# ANNUAL REPORT 2023

BASE YEAR 2022

eAmazônia
Energia Sustentável e Inovação

Cover Image: Photo of Alamanda Roxa (*Allamanda blachetti*)
in the eAmazônia headquarters building

## eAmazônia - Energia Sustentável e Inovação

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# 2023 Annual Report
Base Year 2022


## Elaboration
Rafael Meirelles David

## Team
Aline Santana Gallina
Caroline Luiza Vieira
Hermann R. Duarte Mendes
Isabelle M. Santiago
Jersileide Rufino da Silva
Lucas Matheus de Sousa Lima
Nadine da F. A. dos Santos
Patrícia Juliana Oliveira

## Graphic Design and Layout
Nadine da F. A. dos Santos

## Photos/Images
eAmazonia collection

## Support and Collaboration
Carlos Eduardo V. de M. Lopes
Fernanda Ladeira de Medeiros
Gleyson de Sousa Oliveira
Marcio Szechtman
Moacyr Pereira dos Santos
Marco Aurelio A. Epifani Filho
Ricardo de Oliveira

Since its creation, eAmazônia has played an important role in collaborating with the sustainable development of the Legal Amazon. And despite the young history, the Institute can already be proud of the positive impacts that its actions have brought to this region.

In the last 5 years alone, research and energy efficiency projects carried out by eAmazônia have brought more than 7 millions reais in investments to the Amazon Region. As a result, around 5.2 GWh of energy was saved from the energy efficiency actions carried out by the Institute in Acre institutions.

Also it is worth mentioning the use of professionals from local higher education institutions in the eAmazônia Projects and the qualification of around 270 people from the Amazon region, through courses and workshops held by the institution's technical team.

***2022 was another remarkable year for eAmazônia!***

This year we successfully concluded all activities related to the R&D project “Automated Planning of Distribution Networks” carried out together with Copel. As a result of the project, we developed a computational tool that innovates by automating several processes and by incorporating a model for projecting the growth of Distributed Photovoltaic Generation (DPG) in medium voltage networks as a characterization attribute and that has potential for replicability.

That same year, we managed to complete the works and acquired the equipment and furniture to compose the Neipa Public Lighting laboratory, developed in partnership with Procel.

Also together with Procel, work plans were drawn up for two new initiatives.

One of these new initiatives is the result of the work that has been developed by Neipa and aims to design and implement a Web platform for the elaboration of proposals for public lighting retrofit projects, following the methodologies used by Procel Reluz, in addition to promoting the development of innovative technologies in the field of energy efficiency in public lighting.

The other initiative aims to elaborate an energy panorama of public school buildings in the North Region, in addition to implementing a pilot project in a school to develop an energy management model, based on ISO 50001.

Continuing with the structuring of the Institute's headquarters building, work was completed on a landscaping project directed at promoting better integration of the building with its surroundings, since the headquarters was built in the middle of an

environmental reserve of great plant and animals diversity. It should be noted that all plants that make up this landscaping are from species present in the Amazon region, such as, for example, the “Alamanda Roxa”, a plant with long, purplish branches and oval leaves, which can reach up to 3 meters height, that illustrates the cover of this Report.

We also need to highlight the publications made by eAmazônia and the Institute's participation in important congresses, fairs and seminars, such as Rio Innovation Week, the largest technology, innovation and business meeting in Latin America, demonstrating the Institute's commitment to disseminating information and knowledge technical and scientific aspects relevant to Brazilian society.

I conclude by expressing my most sincere thanks to all the Institute's partners and the members of the eAmazônia team. Without them, these achievements would not be possible. I wish you a good read.

**Rafael Meirelles David**
Director of Technological Development

## The eAmazônia

It is an independent, non-profit institution that aims to produce and disseminate information and technical and scientific knowledge, collaborating for the sustainable development of the Legal Amazon.

Developed through a partnership between Eletrobras and the Federal University of Acre - Ufac, its foundation occurs in parallel with the creation of Bachelor's Degree courses in Electrical Engineering in the region, and also with the construction of HPS on the Rio Madeira.

The eAmazônia headquarters is located within the Ufac campus, promoting synergy with the academic environment, resulting in an ecosystem capable of innovating in products and processes, in addition to collaborating to train the local workforce.

The three main lines of eAmazônia research are:

**I - Energy Extractivism:**

acting so that communities in the Legal Amazon can supply their energy demand in a sustainable and low-cost way, collaborating for the development of the region, as well as local skills and vocations.

**II - Sustainable Development:**

carrying out studies and activities that collaborate with the development of local communities, always considering the minimization of environmental impacts and the entire life cycle of the project, from the beginning of its implementation process to its decommissioning.

**III - Energy Efficiency:**

developing studies, activities and disseminating concepts to generate the same amount of energy with less natural resources or obtain the same service with less energy, adhering to the regional environment.

Although it has priority action in the three lines mentioned, eAmazônia also includes, given the characteristics of the Legal Amazon, inevitable aspects of social development.

In order to fulfill its objectives, it has partnerships with several institutions, functioning in an organic network, where all members can contribute to its development, through a strong compliance structure and, above all, transparency in processes and expenses.

In addition, it has remarkable technical capacity in its field of activity and collaborates with the public and private sectors in general, acting as a technical and advisory body, in the study and solution of scientific, technological, environmental and regulatory problems.

Observing the priority lines of action and also other themes that may be included in the institution's technical capacity, eAmazônia can accomplish energy efficiency projects, either through Aneel resources or as consultancy for external institutions, in addition to research and development projects of interest of the electricity sector and the North Region, as it has been doing and is shown in this report.

# ANNUAL REPORT

This Report is intended to present, in summary form, the main activities carried out by eAmazônia during the year 2022, serving as a rendering of accounts to the Institution's associates and to the community in general.

To facilitate reading, this document was divided into 4 (four) chapters, namely: Institutional Activities & Infrastructure, Finalized Project, Projects in Execution and Prospects.

# SUMMARY

# INSTITUTIONAL ACTIVITIES & INFRASTRUCTURE | 1

*Cape Flower: Evolvulus Glomeratus (Azulzinha)*

Administratively, eAmazônia continues in the constant search for improving its internal processes and valuing the transparency of its actions, with the disclosure of annual reports, newsletters and supply of data on the projects that are carried out by the Institute.

This Chapter presents eAmazônia's advances at the institutional level, as well as advances in the physical infrastructure of its headquarters building. For a better reading, the subjects were separated into 6 (six) topics, presented below.

## 1.1 2022 BUDGET

Figure 1, at the top, shows a consolidation of the revenues and expenses that occurred in eAmazônia in 2022. At the bottom, the Percentage of these Revenues and Expenses by item is shown.

eAmazônia's Total Revenue in 2022 was made up of Contributions by Eletrobras, made in March and August (25%), by R&D projects, carried out in partnership with Copel and CEB/Neoenergia (42%) and by the Neipa carried out in partnership with Procel (33%), where the remaining balance for the year 2021 of the project is also considered.

The Total Expense of eAmazônia, for the year 2022, was constituted of project costs (77%) and institutional expenses (23%), which guarantee the proper functioning of eAmazônia on a day-to-day basis.

The remaining balance for 2022 was allocated to the 2023 budget, and may be used to conclude activities that had been planned but could not be carried out, such as the execution of works and building renovations, among others.

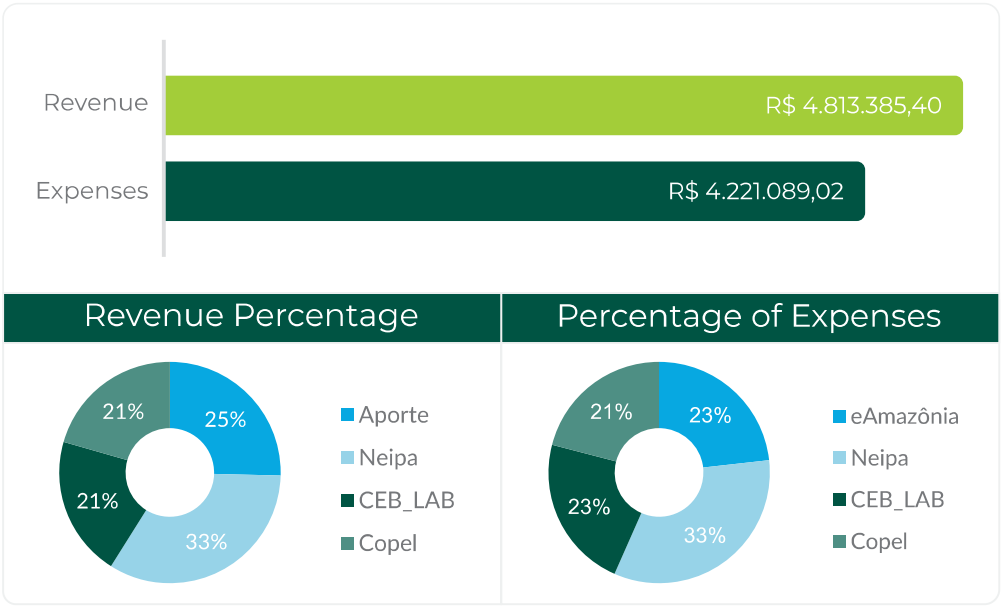


**Figure 1: Revenues and Expenses of eAmazônia in 2022**

## 1.2 EXTERNAL AUDIT

In order to provide more security and transparency to its investors and society in general, the accounting information presented annually by eAmazônia is submitted for evaluation by an external auditing company. This evaluation is intended to prove that the equity position, the financial result of its operations, the evolution of its equity and the origin and application of funds, informed by the Institute, were correctly presented in its financial statements.

In the year 2022, the accounting audit of eAmazônia was carried out by the company LBRK Consultoria Auditoria e Assessoria, which presented the following conclusion in its report:

> ***"Based on our review, we are not aware of any fact that leads us to believe that the aforementioned financial statements do not adequately present, in all material respects, the equity and financial position of eAmazônia Energia Sustentável e Inovação as of December 31, 2022, and the performance of its operations and cash flows for the year ended on that date, in accordance with accounting practices adopted in Brazil."***

The audit report is available on our website at the Transparency Portal, or directly by clicking here.

## 1.3 ORGANIZATIONAL FRAMEWORKS

### 1.3.1 eAmazônia trademark registration

After completing the branding study and having defined the new brand (Figure 2) for eAmazônia, the process of registering this brand with the competent body was started.

**Figure 2 - eAmazônia new brand.**

Registering a trademark is the only way to legally protect it against potential copycats. This registration is done through the National Institute of Industrial Property (INPI), making the request that will be examined in accordance with the Industrial Property Law and other administrative resolutions of the responsible organ.

The brand is the means of identification of the company by its customers and over time it comes to be understood as the benchmark for the quality of its products or services.

The brand assessment request was made in the second half of 2022, with the INPI. The process has already gone through the period for filing an opposition and is currently listed as “Awaiting examination on the merits”, that is, it indicates that the trademark registration application is in the institute’s examination queue, awaiting judgment to def ne whether the trademark complies with the criteria for obtaining official registration.

The average time for examining a mark without opposition is close to 10 months and after the INPI judgment, the most common orders are “Awaiting payment of the concession (within the ordinary period)” and “Awaiting the presentation and examination of an appeal against the rejection” . Thus, it is up to eAmazônia to wait for the order status change and carry out the necessary steps to finalize the registration.

### 1.3.2 Qualification in Siscomex & Import Tax Exemption

Considering that eAmazônia is a Research Institute that has as one of its objectives to produce and disseminate information and technical and scientific knowledge, it is natural that it is necessary to acquire equipment with cutting-edge technology, whether for the development of projects or for composition of research laboratories. Considering that most cutting-edge research equipment is not manufactured in the national territory, there is a need to acquire it outside the country, carrying out its imports.

In Brazil, anyone who wants to carry out a foreign commercial operation, whether import or export, must qualify for Radar (Registration and Tracking of the Performance of Customs Interveners). This qualification guarantees that the importer or exporter performs operations according to legal parameters and allows the use of the Siscomex Portal.

> ***eAmazônia is enabled in the unlimited modality, with exemption from import taxes, subject to the limit of the annual quota approved by the CNPQ[1].***

[1] Conselho Nacional de Desenvolvimento Científico e Tecnológico.

After Qualifying the Radar, eAmazônia filed a lawsuit with the CNPQ to claim the benefits provided for in Law No. 8010 of March 29, 1990, which guarantees exemption from import taxes for scientific and technological research. The claim was accepted and eAmazônia received a certificate (Figure 3) valid for 5 (five) years.


Ministério da Fazenda

Receita Federal

SECRETARIA DA RECEITA FEDERAL DO BRASIL

INTERESSADO

RAZÃO SOCIAL: EAMAZONIA - ENERGIA SUSTENTAVEL E INOVACAO

CNPJ: 15.691.624/0001-70

REQUERENTE: MOACYR PEREIRA DOS SANTOS

ASSUNTO: HABILITAÇÃO NO SISCOMEX

TERMO DE DEFERIMENTO

Da competência da Secretaria da Receita Federal do Brasil, fundamentada nas disposições acerca dos impostos sobre o Comércio Exterior previstos nos artigos 19 a 28 da Lei nº 5.172 de 25 de outubro de 1966 (Código Tributário Nacional), bem

**Figure 3: Term of Deferment with CNPQ**

### 1.3.3 Exemption from ISS

Since eAmazônia is a non-economic legal entity, its public utility, as well as the actions reversed in favor of society, it was requested, with the Municipality of Rio Branco, the tax immunity of the Institute. After a process in which eAmazônia proved its relevance to society, tax immunity was granted to the Institute. This recognition will make a very important contribution to maintaining the Institute's financial sustainability over the years.

## 1.4 INTEGRITY PROGRAM

Continuing its institutional strengthening, eAmazônia implemented the Integrity Program, which is a structured set of institutional measures aimed at the prevention, detection, punishment and remediation of corrupt practices, fraud, irregularities and ethical and conduct deviations.


eAmazônia's Integrity Program has a Code of Ethics, which sets out the ethical foundations and conduct necessary for the good and honest development of its institutional activities, in addition to a Transparency Portal, which makes available financial statements, Council minutes, statute and norms; and Reporting Channels.

To access all information on the Integrity Program, visit eamazonia.org/integridade or click here.

## 1.5 INFRASTRUCTURE

Continuing the efforts to improve the infrastructure of the eAmazônia headquarters building, in 2022 the renovation of Block D3 was completed, a space reserved for the implementation of the Public Lighting laboratory (IP) of the Neipa Project (Nucleus of Excellence in Public Lighting in the Amazon). Furniture was also purchased for Block A and work on the landscaping project began.

### 1.6.1 Bloco D3 - Neipa

At the beginning of the year, the readjustment of Block D3 (Figures 05 and 06) was completed, used for the installation of the Neipa IP Laboratory, which aims to train students in training courses, within the scope of the Agreement ECV-PRFP-001/ 2021. The space has an exclusive area for the practical classes of the training courses, in addition to the possibility of carrying out tests/rehearsals of receiving IP equipment, as well as carrying out scientific research on the subject. More details on the reform will be presented in Chapter 3 of this report.


**Figure 05 - Neipa Public Lighting Laboratory Entrance**

**Figure 06 - Interior of Neipa's Public Lighting Laboratory**

### 1.6.2 Bloco A

Also in the first semester, furniture was purchased to compose the external area of Block A (Figure 07), following what was defined in the architectural project for the building, such as tables, stools, benches and flower boxes. In addition, furniture was purchased, with resources from the Agreement ECV-PRFP-001/2021, to equip a classroom, an important environment to enable the realization of courses and training that will be made available in the next and current projects.

**Figure 07 - (a) and (b) Bloco A exterior, (c) Bloco A classroom**

### 1.6.3 Renovation & Landscaping

In the second half of 2022, a major work was started to carry out the landscaping project for the eAmazônia headquarters building. The developed project highlights a square (Figure 08) in front of the auditorium, which can be used as a living and resting area, generating pleasant and functional social interaction. In addition, the planting of grass and trees was promoted across the front of the building (Figure 09).

The landscaping plays an essential role in integrating the building with the surrounding environmental reserve. Therefore, careful planning was carried out, considering the use of only plants usually from the Amazon region. In this way, it is composed of trees, such as Flamboiã and Ipê, açaí palms, açaí touceiro and popunha. The landscaping also features small plants that flower throughout the year, such as the forasteira azulzinha, alamanda bush and Indian cane.

**Figure 08 - Square in front of the auditorium (eAmazônia Headquarters)**

**Figure 09 - Front of eAmazônia**

It was also noted the need to carry out some retouching of the building's painting, to add to the sensory stimulation of the corporate environment and the incorporation of the eAmazônia brand through the use of the colors of its logo (Figure 10). In this same sense, and to improve the identification of the building, an acrylic sign was installed, with the eAmazônia logo (Figure 10), on the wall of the entrance hall.


**Figure 10 - Wall Painting and eAmazônia Logo**

Likewise, understanding the need for integration and following the external architecture project, benches were made available along the entire length of the deck, along with benches with flower boxes fixed close to the auditorium. Also, to refine the aesthetics, the Institute's building was ornamented with decoration vases, obtained from local artisans, who house regional palm trees, donated by the Ufac Park (Figure 11).

**Figure 11 - eAmazônia Pots and Flower Pots**

With the increase in the number of people frequenting the internal and external spaces of eAmazônia, care for the well-being and safety of all was expanded. In this sense, people began to control the access of people in the building, even in the basement, as it houses materials and machinery with high added value, such as air conditioning condensers and construction materials, such as the metal profiles necessary for the construction. construction of building ramps.

Security measures had already been adopted, such as the installation of an alarm and cameras, now they have been complemented with the installation of a gate at the entrance to the building and the closing of the basements, which previously allowed access to the internal areas of the building (see Figure 12) .

**Figure 12 - Basement Gate and Closing**

Finally, still on the structural side, the Atmospheric Discharge Protection System (ADPS) was renovated to ensure better security in the building's installations, with regard to lightning actions.

### 1.6.4 Power generation

Composing the building's infrastructure, eAmazônia also has two photovoltaic plants, which together have an installed capacity of 120 kWp.

Figure 13 shows a graph of generation and consumption, month by month. The installed plants generated a total of 43,545 kWh in energy in 2022, which corresponds to a monthly average of 3,600 kWh. The annual consumption was 10,580 kWh, which corresponds to a monthly average of 880 kWh in energy.

In this scenario, eAmazônia generated 32,965 kWh in energy credits in the year 2022, which would be enough to power 15 homes[2] for 1 (one) year.

Adding to the balance of previous years, eAmazônia now has 158,496 kWh of accumulated energy, which can be used in up to 60 months.

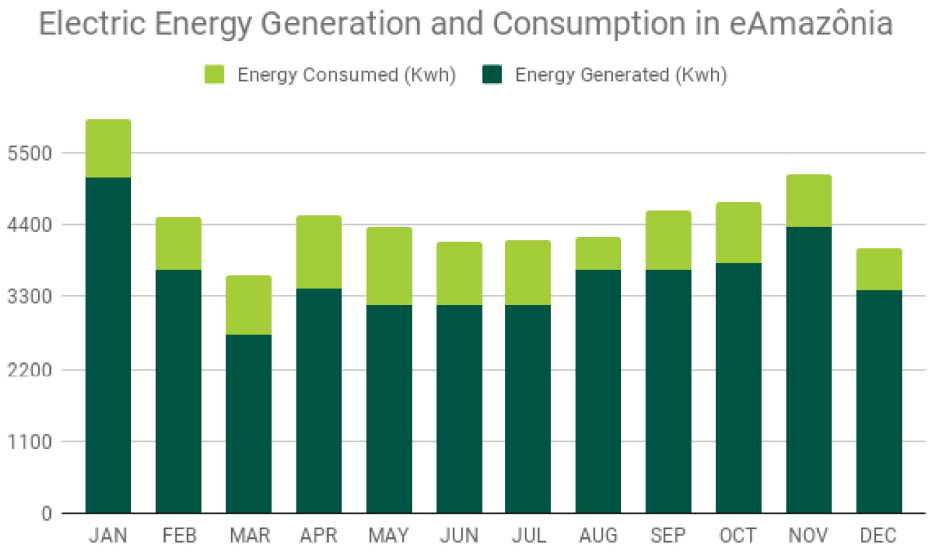


**Figure 13 - Graph of Electricity Generation and Consumption of the eAmazônia headquarters building**

## 1.6 DIVULGATION

In order to share information and technical and scientific knowledge and, in this way, collaborate for the sustainable development of the Legal Amazon, eAmazônia has been making a series of efforts to increase the reach of the dissemination of the

[2] The average Brazilian residential consumption in the North region, published by the Energy Research Company in its Statistical Yearbook of Electric Energy 2022 - Base Year 2021, was taken into account. Available here.

results of the works and projects that it has been carrying out in the region. The Institute has actively participated in important events in the area of innovation and technology, in addition to coordinating work for the creation and dissemination of digital content. The following topics present some of the dissemination actions carried out by eAmazônia in 2022.

### 1.6.1 Participation in events

Actively participating in events is essential for the work carried out by the Institute to be even better known by society, in addition to being a great opportunity to learn about new trends and technologies, as well as attract new partners and potential investors. Among the events that eAmazônia participated in in 2022, Rio Innovation Week, Anpei Conference 2022, Viver Ciência and the training course on energy efficiency promoted by the Vanzolini Foundation stand out.

Rio Innovation Week, the largest technology, innovation and business meeting in Latin America, brought together more than 125 thousand visitors, 2000 startups and more than 1700 speakers from different areas, with the proposal to share new knowledge and technological innovations.


**Figure 14 - Participation in Rio Innovation Week**

eAmazônia was present, exposing the theme "Operational challenges of an ESG center in the Amazon"


**Figure 15 - Participation in ANPEI**

At the ANPEI Conference (National Association for Research and Development of Innovative Companies), eAmazônia presented a case study that demonstrates the repositioning that the institute has been going through since 2020, to become a Global and Sustainable Platform for Research and Innovation. The Conference had more than 3,000 people registered, 58 panels, five simultaneous stages, eight technical visits and three days of many exchanges and learning.

Founded in 1984, ANPEI is the only Brazilian association that is multisectoral and financially independent of the innovation ecosystem.

eAmazônia was invited to exhibit the projects it has been developing in the Amazon Region at the Acre Science and Technology Education Exhibition (Viver Ciência),

organized by the State Secretariat for Education, Culture and Sports of Acre, being the main Science and Technology event aimed at for the young audience of schools from elementary to high school (see Figure 16).

One of the projects presented at the exhibition was the Structuring of the Nucleus of Excellence in Public Lighting in the Amazon - Neipa, developed in partnership with Procel/Eletrobras.


**Figure 16 - eAmazônia stand at Viver Ciência**

As part of the dissemination of the results that are being obtained within the scope of the Neipa project, two researchers from eAmazônia made a presentation in the Training on Energy Efficiency and Energy Saving in Public Power, promoted by Procel/Eletrobras, through the Vanzolini Foundation, which took place in Manaus/AM.

**Figure 17 - Presentation of eAmazônia in Manaus/AM**

### 1.6.2 Publications

Another important form of dissemination adopted by eAmazônia is the production of scientific papers. During the year, four articles and four expanded abstracts were presented, as indicated below:

- In the 26th edition of the most traditional event in the electricity sector, the National Seminar on Production and Transmission of Electric Energy (SNPTEE), the article entitled "Simulation of the PBE-EDIFICA Labeling of Buildings at the Federal University of Acre" was presented, produced by Aline Santana Gallina, Lucas Matheus de Sousa Lima, Thiago Melo De Lima, Nadine Da Fonseca Araujo Dos Santos, Rafael David and Vinicius Oliveira. In which the possible energy efficiency rating of 42 buildings and actions that can improve the overall rating were presented.

- Also at the SNPTEE, the article "Planning based on representative networks of the distribution system considering the penetration of distributed energy resources" was presented, arising from the Project detailed in Chapter 2 of this report.

- The article "Estimative of the Reduction of CO2 Emissions by the Insertion of UFV in Isolated Cities in the Amazon", elaborated by the researchers, Aline Santana Gallina, Lucas Matheus de Sousa Lima, Isabelle Moreira Santiago and Gustavo Moreira Oliveira de Castro, was accepted for publication and presented at the IX Brazilian Symposium on Electrical Systems (SBSE 2022), a scientific, technical and industrial event promoted by the Brazilian Society of Automatics (SBA) in the city of Santa Maria/RS. The work presents the technical calculations for the reduction of CO2 emissions, if the generation of thermal plants that supply electrically isolated municipalities in the interior of Acre were replaced by photovoltaic generation.

- At the event organized by the SBA, the article entitled "Optimization of standards for Public Lighting projects using Python" was published, conceived by researchers Gustavo Moreira Oliveira de Castro, Aline Santana Gallina, Joshua Barroso Martins, Lucas Matheus de Sousa Lima and Nadine da Fonseca Araújo dos Santos, accepted for publication and presented at the XXIV Brazilian Congress of Automatics (CBA), which took place in the city of Fortaleza/CE. The work dealt with a proposal for an algorithm in Python language to carry out the automatic generation of IP project standards according to the guidelines of the electronic f le of Procel Reluz calls, it was tested in a case study with data from the streets of a neighborhood in the city of Rio Branco/AC.

- At the II Interdisciplinary Seminar on Energy (SINERG), an event organized by the University of São Paulo (USP), four expanded abstracts were accepted. Of the works generated by the Neipa project, the following abstracts are cited:
    - Development of an algorithm for determining lighting standards for public roads to meet the Procel Reluz guidelines, which dealt with the application of an algorithm to form project standards;
    - Enabling the use of dimming in public lighting at UFAC, which studied the economic impacts of dimming promoted by a public lighting telemanagement system applied to the retrofit performed on the campus;
    - Application of the Procel Reluz methodology in the retrofit of Public Lighting parks, which analyzed the retrofit of the UFAC campus through lighting and energy saving aspects.
    - Analysis of the databases of the Brazilian Electric System: A case study of the isolated systems that exposed the divergences of the databases of several entities in relation to the isolated systems of the Amazon.

In addition to what has already been submitted and presented, the scientific productions shown in Table 1 are being prepared.

Table 1 - List of articles under development.

**PUBLICATIONS**

| Work Label | Area |
|---|---|
| Retrofit of UFAC's Public Lighting Park: Technical and Economic Feasibility of Implementing Telemanagement | Street lighting |
| Retrofit of UFAC Public Lighting Park: Challenges of Implementing Telemanagement | Street lighting |
| eAmazônia: ESG Center in the Western Amazon | ESG |
| Color temperature as a key factor in the process of improving the luminance of public roads | Street lighting |
| Isolated Systems x-ray: compilation and analysis of open data. | Isolated Systems |

### 1.6.3 Newsletter

Continuing to strengthen ties with its partners, through reports with the main highlights/achievements achieved by the Institute, two Newsletters were published (Figure 18). These newsletters are forwarded by e-mail to partners, customers, associates and collaborators of eAmazônia.

In addition, to reinforce dissemination, the Newsletters are always made available and disseminated to the general public through the eAmazônia social networks and on the Institute's off cial website, in its News tab.


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Edição Especial
Este Boletim Especial traz informações e destaques das recentes participações do eAmazônia em fóruns e congressos de reconhecimento nacional e internacional.
RIO INNOVATION WEEK
Sendo o maior encontro de tecnologia, inovação e negócios da América Latina, a Rio Innovation Week reuniu mais de 125 mil visitantes, 2000 startups e mais de 1700 palestrantes de diversas áreas, com a proposta de compartilhar novos conhecimentos e inovações tecnológicas.
O eAmazônia se fez presente expondo o tema"Desafios operacionais de um centro ESG na Amazônia".
CONFERÊNCIA ANPEI 2022
A Conferência ANPEI de Inovação 2022 teve 3 mil pessoas inscritas, 58 painéis, cinco palcos simultâneos, oito visitas técnicas e três dias de muitas trocas e aprendizados.
O eAmazônia apresentou um estudo de caso que demonstra o reposicionamento que o instituto vem passando desde 2020, para tornar-se uma Plataforma Global e Sustentável de Pesquisa e Inovação.
Fundada em 1984, a ANPEI (Associação Nacional de Pesquisa e Desenvolvimento das Empresas Inovadoras) é a única associação brasileira multisetorial e independente financeiramente do ecossistema de inovação.

**Figure 18 - Newsletters**

# FINALIZED PROJECT: AUTOMATED PLANNING DISTRIBUTION NETWORKS | 2

*Flower Cape: Canna Indica (Cana da Índia)*

The P&D project, carried out in partnership with COPEL-DIS, lasted 24 months, ending with an online workshop in August 2022. The general objective of the project was to develop a methodology and an automated system for proposing and evaluating works to the medium voltage power grid throughout the distributor's concession area. This planning takes into account the technical, regulatory and economic criteria in the prioritization of works, being flexible to evaluate or not the possibility of expanding distributed generation in the network, as well as evaluating the effects of an expansion of Distributed Generation (GD) for the concessionaire .

The main objectives achieved by the project were the elaboration of a methodology for this new planning paradigm, whose product was a computational tool for the automated proposition of works in the planning of medium voltage electrical networks, with evaluation and prioritization. The tool includes:

- The automation of the current electrical network diagnosis process using RPA (Robotic Process Automation) and AI (Artif cial Intelligence) techniques;
- Diagnosis of electrical networks with specif c criteria for characterizing the capacity of the network to support distributed generation;
- The proposition of works done automatically through algorithms, which are trained and conf gured according to the current planning parameters;
- Automated prioritization of works through multi-criteria methods, able to meet both charging, voltage, expansion and network quality standards, in order to guarantee an electrical network that meets the expectations of society and COPEL.

Figure 19 illustrates the developed tool, whose interaction with users is done through a web application.


**Figure 19 - Technical losses report**

The project innovates by automating several processes and by incorporating a projection model of the growth of Distributed Photovoltaic Generation (GDFV) in medium voltage networks as a characterization attribute. It is also noteworthy that although the tool adds a set of advanced machine learning techniques, diffusion models, task automation and prioritization methods, the user interface remains intuitive and friendly, facilitating the adoption of the solution by planners.

Finally, the presentation of the results obtained in a case study applied to the COPEL-DIS base allowed the validation of each of the stages developed, conf rming the potential of the proposed solution, which may even be replicated to other distributors in the country.

# PROJECTS IN EXECUTION | 3

*Flower Cape: Lantana Camara (Lantana Amarela)*

eAmazônia is currently executing 2 projects, namely: the “Nucleus of Excellence in Public Lighting in the Amazon -Neipa” project, instituted through a cooperation agreement with the National Electric Energy Conservation Program (Procel), with a forecast of completion in June 2023 and the project entitled “Integrated Automation Platform for Complete Simulation of Digital Substations with a Focus on Interoperability and Cybernetic Security (Integrated Automation Platform)”, arising from an R&D regulated by Aneel, carried out in partnership with Neoenergia, which is scheduled for completion in November 2023.

The following topics provide more information about these projects.

## 3.1 NEIPA

On July 7, 2021, eAmazônia signed its first technical-financial cooperation agreement with Procel - Eletrobras, for the structuring of Neipa, with the objective of promoting the development of new projects in the SL sector in the Amazon region, providing technical instructions , through theoretical courses and the practical development of a pilot project with improvements in the Public Lighting system of the Rio Branco Campus of the Federal University of Acre - UFAC, with smart functionalities, to reduce energy consumption and improve the functioning of the system and the perception of campus users.

***The Nucleus of Excellence in Public Lighting of the Amazon, aims to be a reference in the Region as a promoter for the elaboration of new projects in the field***

To achieve this objective, the project was divided into four main activities and after a year and six months of signing the agreement, the retrofit of Ufac's SL park was carried out, the structuring of the SL Laboratory and Neipa's Training was completed, a the first edition of the Training course for municipalities in the North region, and finally, the project is being disseminated through the production of scientific articles and social media. The following topics detail each activity that has already been carried out and those that are in progress.

### 3.1.1 Ufac SL Pilot Project

During the first semester, the necessary materials and equipment were specif ed and purchased for carrying out the retrofit of Ufac's SL park. It should be noted that the technical specif cations adopted in the Term of Reference of projects financed by Procel Reluz, such as color temperature, durability and minimum energy efficiency,

served as a reference for the luminaires that were acquired within the scope of this project.

Figure 20a shows a comparison of the old and new lighting fixtures with LED technology. Note that the new luminaires, in addition to being more efficient, are smaller and much lighter than those previously installed. In addition, the old light fixtures were in poor condition (Figures 20b and 20c), most of them very dirty, broken and some even with bird nests. All these factors contributed negatively to the lighting of the roads, as they prevented the correct diffusion of light.

**Figure 20a - Comparison of old luminaire vs LED luminaire**

**Figure 20b - Old broken light fixtures**

**Figure 20c - Dirty old light fixtures**

Together with the light fixtures, the telemanagement system was installed, which until then no SL park in the North Region had. This system makes it possible to control the luminaries via software, so that it is possible to turn them on, off, schedule, configure the time map and dim. The combination of the last two functionalities makes it possible to dim the lights at specific times, such as reducing street lighting after the end of night activities, this dimming has a direct impact on reducing the electricity consumed.

The retrofit was accompanied by the eAmazônia team (Figure 21) and a total of 142 SL points were updated, providing adequate lighting for the roads on the University campus. Figures 22 and 23 show the before and after retrofit of the University's main road and the access road to the library, respectively. It is noted that the project was implemented with competence, as the lighting was extended to the gardens with the safety of the academic community in mind. In addition, it is possible to notice that there is no occurrence of Zebramentos (brighter and darker bands), since the uniformity of the new lighting is adequate to the norm.

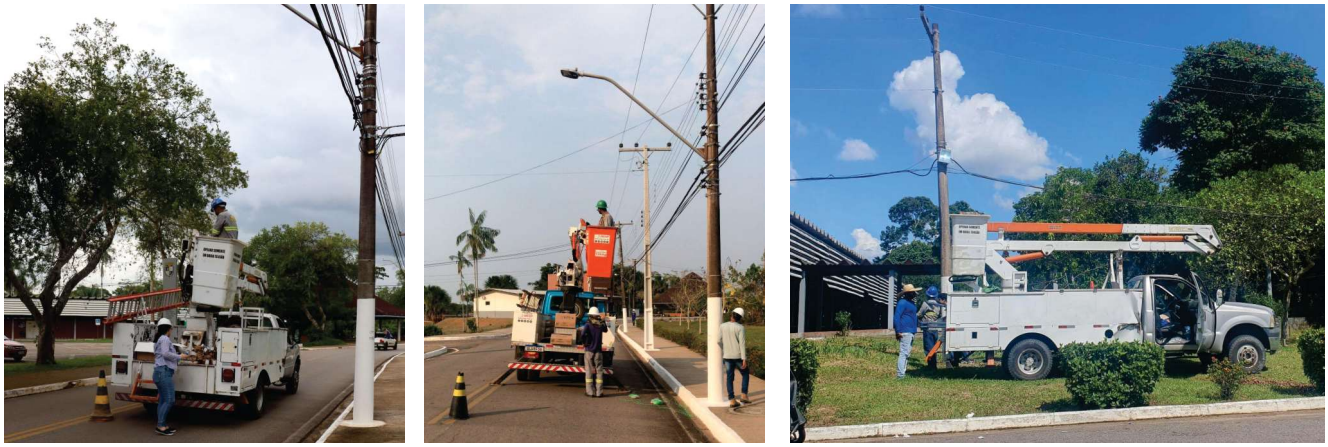

Figure 21 - Tracking the Retrofit of Ufac Campus roads

Figure 22a - BEFORE (Via UFAC)

Figure 22b – AFTER (Via UFAC)

Figure 23a - BEFORE (Via Library)

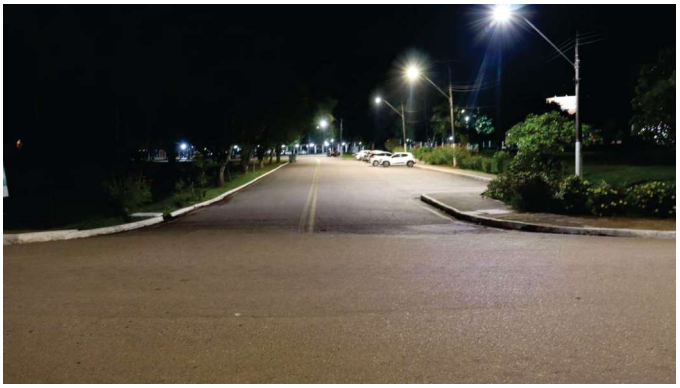

Figure 23b – AFTER (Via Library)

In Figures 24a and 24b, there are images of before and after the retrofit of the access road to Utal. Previously, lighting was carried out using LED reflectors, with 200 W of power, which did not allow for good lighting on the road. Thus, 80 W arms and lamps were installed, thus adapting the lighting and reducing the energy consumed by 80%.

Figure 24a - BEFORE (Utal Route)

Figure 24b - AFTER (Utal Route)

However, the next steps in this activity are carrying out photometric measurements and accounting for energy consumption, in order to analytically demonstrate the gains that the SL Pilot Project brought to the University, in addition to the possibility of demonstrating in training courses how important is the promotion of energy efficiency and adequate lighting on public roads.

### 3.1.2 Neipa IP and Training Laboratory

The implementation of the Neipa Public Lighting Laboratory aims to support the measurement and verif cation activities of Public Lighting projects, in addition to constituting an important didactic instrument for research, teaching and learning for students of the training courses in Public Lighting developed and provided by eAmazônia.

The ground floor of Block D3 was chosen for the implementation of the Laboratory, as it offers better physical and safety conditions for the equipment and activities carried out there, requiring only a small internal renovation to enable the wide use of the environment.

In August 2021, the Term of Reference and the Base Budget for the Renovation Work were published on the eAmazônia website, and in December 2021 the company had already been hired to carry out the renovation. Figure 25 shows the conditions of the block prior to the renovation.

Figure 25a – Entrance to the Laboratory Before the Renovation.

Figure 25b – Internal Environment of the Laboratory Before the Renovation.

As can be seen, the environment had all the necessary structure and space for laboratory use, however, it lacked internal finishing compatible with this purpose. After the refurbishment, the environment had ample capacity for use, as shown in Figure 26.


Figure 26 – Neipa Public Lighting Laboratory.

The large span of 13.5m x 21m was divided into 5 rooms comprising the computer room, meeting room, storage room, equipment room and the hall for the development of group activities. The entire physical space received porcelain flooring, painting, electrical installation and internal lighting. It has an internal air conditioning system and has been fully equipped with a modern alarm and camera security system, ensuring ample security for the environment against theft or theft. It is important to note that all equipment that consumes electricity used in the Laboratory is Class A in the National Energy Conservation Label - NECL, which guarantees the highest energy efficiency in the category.

In addition to works, the environments of the physical space mentioned were equipped with furniture such as tables, chairs, cabinets and stools.

As foreseen in the Agreement, equipment was purchased (Figures 27 to 30) to be used in the measurements of public roads and in training courses.

***The luminance and glare meter (Figure 28) is the first of its kind in the country and will be used to measure the luminance of lives in compliance with the proposal of the new NBR 5101 standard.***


**Figure 27 – From left to right: Bench multimeter, power analyzer**


**Figure 28 - Luminance and glare meter**

**Figure 29 – From left to right: digital multimeter, high precision luxmeter**

**Figure 30 – From left to right: simple luxmeter, portable wattmeter**

### 3.1.3 Training and Assistance Course for Municipalities in the North Region

The Training Course in Public Lighting (TCPL) is aimed at professionals in the area and employees of city halls in the North Region and aims to present aspects of Public Lighting, such as basic concepts, standards, existing equipment and all the necessary processes for preparing of the proposals for participation in the Procel Reluz Public Call, such as the preparation of the lighting project, the electronic f le, survey of the luminaire catalogs, among others.

The Agreement provides for the execution of two editions of the course. The first edition had 42 participants and took place from May 30 to July 15, in the EAD (Distance Learning) modality, using Google Classroom as a teaching platform, in addition to the occurrence of synchronous meetings (Figure 31). In order to convey different types of visions and perceptions to the students, the course had the participation of professionals external to eAmazônia, such as representatives of Procel and Energisa (local energy distribution concessionaire), and Liteleds[3].

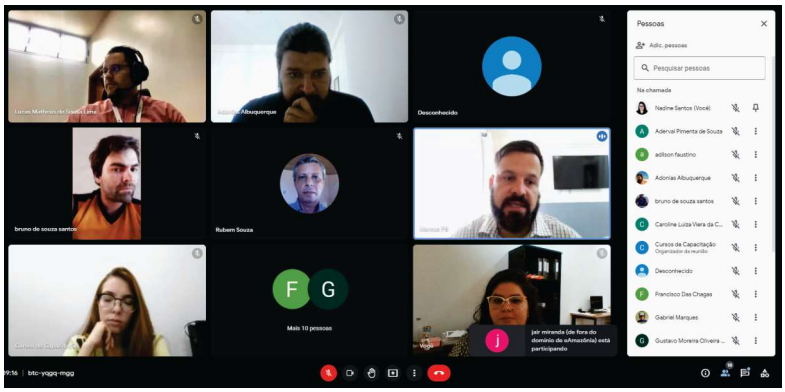


**Figure 31 – Synchronous Meeting of the Public Lighting Training Course**

[3] One of the companies contracted to supply retrofit equipment for Public Lighting at the Federal University of Acre.

***The first edition of the Training Course in Public Lighting had 42 applicants from across the North Region, including employees from city halls and private companies, students and university professors.***

The course was supported by a booklet (Figure 31), prepared by the eAmazônia researchers, which is made up of 12 modules that cover everything from the basics of Public Lighting to the treatment of regulatory matters.


**Figure 31 - Cover of Chapters 1, 2 and 12 of the CCIP booklet**

At the end of the first edition, a course evaluation form was made available, with the aim of verifying the receptivity of the professionals regarding the course, with regard to the methodology, the content taught, the mastery of the professors on the subject and the interest in participating. in Procel public calls. As a suggestion, it was requested that the support material be produced in book form and made available to city halls. The suggestion was accepted and is being revised and elaborated material for publishing a book on Public Lighting. In general, there was a positive reception to the CCIP, with several compliments and congratulations being received for the initiative.

With the end of the course, a certif cate (Figure 32) was made available to those who carried out a minimum of 70% of the activities and sent the course evaluation form.

CERTIFICADO

O eAmazônia - Energia Sustentável e Inovação, no uso de suas atribuições, certifica que o(a) aluno(a) <Nome>, inscrito(a) sob Cadastro de Pessoa Física de nº<000.000.000-00>, concluiu com sucesso o "CURSO DE CAPACITAÇÃO EM ILUMINAÇÃO PÚBLICA", realizado pelo Núcleo de Excelência em Iluminação Pública da Amazônia - Neipa, no âmbito do convênio ECV-PRFP-001/2021 firmado entre eAmazônia, Procel e Eletrobras, no período de 30 de maio até 15 de julho de 2022.

Rio Branco/AC, 29 de julho de 2022

Rafael Meirelles David
Diretor de Desenvolvimento Tecnológico do eAmazônia

REALIZAÇÃO: eAmazônia Energia Sustentável e Inovação

APOIO: PROCEL Eletrobras

Conteúdo Programático:

Módulo 01 - Introdução à Iluminação Pública:
- Evolução histórica de sistemas de IP
- Sistemas de IP
- Novas tecnologias
- Vantagens de um parque moderno

Módulo 02 - Conceitos Básicos de Iluminação Pública:
- Aspectos Elétricos e Fotométricos
- Conceitos básicos de eletricidade
- Conceitos básicos de luz e visão

Módulo 03 - Gestão e Manutenção de Parques de Iluminação Pública:
- Responsabilidade pela gestão
- Como é feita a gestão?
- Custos de gestão e manutenção
- Legislação

Módulo 04 - Recursos Técnicos e Financeiros para Apoio à Projetos de Eficiência Energética em Iluminação Pública
- Procel Reluz
- PEE
- Modelos de negócios

Módulo 05 - Aspectos Regulatórios e Normativos
- ABNT NBR 5101
- Portaria Nº 20 do INMETRO
- RN Aneel Nº 1000
- Tarifação

Módulo 06 - Etiqueta de Eficiência do Inmetro e Selo Procel
- Etiqueta ENCE do INMETRO
- Selo Procel
- Como etiquetar um produto

Módulo 07 - Equipamentos de IP
- Lâmpadas
- Equipamentos auxiliares
- Luminárias
- Curvas fotométricas e classificação
- Equipamentos de sustentação

Módulo 08 - Novas Tecnologias: Luminárias LED e Telegestão
- Luminárias LED
- Sistemas de telegestão

Módulo 09 -Elaboração de Projeto para a Chamada Pública do Procel Reluz
- Requisitos do Procel Reluz
- Modelagem da proposta
- Documentos exigidos ao município
- Condição adicional de habilitação

Módulo 10 - Medição e Verificação - M&V no âmbito do Procel Reluz
- O que é M&V
- PIMVP
- M&V na Iluminação Pública
- M&V no âmbito do Procel Reluz"

Módulo 11 - Elaboração de Plano Diretor em IP (PDIP)
- Plano diretor
- Principais requisitos do PDIP
- Vantagens de possuir o PDIP
- Política reversa de descarte de equipamentos

Módulo 12 - Práticas em Campo de Projeto IP
- Equipamentos de medição
- Estudo de caso do retrofit da UFAC

Para validar o certificado, acesse o QR Code acima.

**Figure 32 - CCIP Certif cate Model (front and back)**

The second edition of the course is scheduled for April 2023 in the face-to-face modality and will take place at the eAmazônia headquarters building, in the space prepared for this, as presented in item 3.1.2 of this report.

Soon after the completion of the first edition of the course, assistance to municipalities was initiated. So far, two municipalities have shown interest in participating, they are: the municipality of Brasiléia in the state of Acre and Espigão D'Oeste, in Rondônia.

The assistance will include the preparation of a retrofit project for at least 500 (f ve hundred) IP points and assistance in the preparation of all necessary documentation for presentation in the Procel Resource Application Plan.

It is still necessary for the manifestation of another 3 (three) municipalities to meet the requirements of the Neipa Agreement. However, contact with city halls is diff cult, since contact details (phone, email and website) are out of date, in addition to the lack of interest on the part of some municipalities.

### 3.1.4 Neipa Divulgation

For a better dissemination of the concepts advocated by the project, whenever possible, research in progress is converted into articles and published in congresses and/or events related to the subject, as presented in item 1.6.2 of this report.

In addition to scientific dissemination, social networks have been used to disseminate the project, its activities and its main results, Figure 33 exemplif es this dissemination.


**Figure 33 – Disclosure of the Neipa Project on social networks**

Another strategy adopted for dissemination is the creation of an exclusive Site for the project, which will contain the competences to serve the public with services and consultancies related to Public Lighting. Figure 34 presents a first draft of the Home page that is being developed for the site.


**Figure 34 – Sketch of the Homepage of the Neipa Hotsite.**

## 3.2 INTEGRATED AUTOMATION PLATFORM FOR COMPLETE SIMULATION OF DIGITAL SUBSTATIONS FOCUSED ON INTEROPERABILITY AND CYBER SECURITY

The search for improvement in the efficiency of the processes involved and in the reliability of the energy supply, has led, over the years, to great advances in the automation and digitalization of substations, with the replacement of electromechanical equipment and copper wiring by intelligent electronic devices (IED) and f ber optic communication structure.

With the considerable increase in the amount of data that travels through the substation equipment and systems, problems and uncertainties arise related to the performance of the SAS in situations of high information traff c. In addition, interoperability problems arise, arising from the large number of equipment from different manufacturers communicating through non-standard protocols.

Finally, the possibility of remotely controlling and accessing substation information entails problems related to the facilities' cybersecurity. In recent years, several cyber attacks on distribution concessionaires in Brazil and worldwide have been observed.

In this scenario, this project, developed in partnership between Neoenergia Brasília and eAmazônia, proposes the development of an automation platform that allows testing involving the various equipment and systems that make up the automation system of a substation.

Within the project, methodologies were developed for tests related to cybersecurity and the implementation of process buses, whose research levels are still incipient in the energy distribution sector. The results of the project will allow Neoenergia Brasília to implement digital substation technologies satisfactorily in the future, considering the different realities existing in the company's concession area.

In 2022, the negotiation and acquisition of various equipment and systems with suppliers was carried out. Among them is the acquisition of servers, gateways, f rewall and station switches for the substation supervisory system, to be simulated on the platform. In addition to the acquisition of IEDs and Merging Units from different manufacturers, to enable interoperability tests according to the IEC 61850 series. And f nally, the acquisition of a test case for signal injection.

After the acquisition process, the assembly and conf guration of the equipment in the laboratory where the project tests will be carried out, which are still running, began.

Finally, based on the methodology reports prepared in previous stages, test notebooks were designed, which detail each of the tests designed in the methodology stage. The test notebook describes the architecture to be applied, the equipment used, the conf guration to be performed on each equipment, in addition to the tables to be f lled in with the test results.

The project's f nal execution date is November 2023.

# PROSPECTS | 4

*Flower Cape: Portulaca Grandiflora (Onze Horas)*

In the constant search for institutional development and reaffirmation of the importance of eAmazônia for the North Region as well as for the national energy research sector, one of the ways considered essential deals with the construction of a network of researchers and partner institutions around the world, in order to to facilitate access to the latest knowledge and research in different parts of the world.

Thus, the highlights carried out in 2022 related to this topic are presented below.

## 4.1 DISTRIBUTED ENERGY RESOURCES

Distributed generation of electricity has become an invariable component in conventional energy distribution systems, being the subject of several studies and discussions on its technical and regulatory aspects. However, when it comes to isolated systems, that is, those not connected to the National Interconnected System - NIS, the application of distributed generators still needs to be evaluated and deepened.

These isolated systems, which have high levels of technical losses and fragility, are usually powered by thermal generators and range from small communities to municipalities with more than 80,000 inhabitants. The variability of scenarios and loads demonstrates the need to develop research projects that focus on distributed generation as a tool for reducing losses and improving energy quality, or even as a characteristic present in new consumers of electricity.

Thus, eAmazônia has been seeking to develop its own structure for carrying out studies on the topic of distributed energy resources with a focus on isolated systems.

Currently, negotiations are being carried out with relevant institutions in the sector to provide consulting services and supply of equipment for laboratory assembly of energy resources distributed in isolated systems.

## 4.2 PAR Procel

In mid-2021, eAmazônia submitted two proposals to Procel's 4th Resource Application Plan (RAP). Which were approved in Public Consultation 005/2022 by Aneel. Are they:

1. Development of a regional overview of energy efficiency for state public school buildings in the northern region of the country and an energy management model;
2. Structuring of the Núcleo Amazônico de Tecnologia em Eficiência Energética (Natee) to develop technology-based applications in energy eff ciency projects with an emphasis on public lighting.

During 2022, together with Procel technicians, the work plans for these two project proposals were developed, detailing all the activities and resources to be allocated.

For the first, the size of the sample that will be evaluated has already been defined, since the universe of schools in the region exceeds 3,000 units. As well as what equipment will be needed for the assessment, such as a drone and a thermographic camera. It should be noted that the physical space at the eAmazônia headquarters (two research rooms with capacity for 14 people) has already been reserved to house the technicians who will be responsible for carrying out the activities of this new project.

The Natee project, on the other hand, aims to develop, through information technology, a Web platform, which will serve as support to city halls and other professionals in the area to prepare proposals for Public Lighting projects with the Procel Reluz methodology, through analysis and processing of technical and financial data. The project also includes a call for projects to encourage ideas in the field of Public Lighting that can lead to the development of innovative technologies for application in IP projects and other areas such as buildings and industries. Also for this new project there is already a physical space reserved at the headquarters of eAmazônia (a research room with capacity for 8 people) to house the technicians who will work in the activities.

Thus, it is expected that in 2023 both projects will start, bringing a range of learning and improvements to the population of the Amazon region, further consolidating the partnership between eAmazônia and Procel.

## 4.3 SEARCH FOR NEW PARTNERS

In the search for institutional maintenance, it is necessary to look for sources of funds and new projects that allow the continuity of current activities and the start of new projects aligned with the axes of action adopted by eAmazônia. In this area, during 2022, meetings and presentations were held for electricity companies, national and international investment funds, BNDES, start-ups and bodies and institutions that operate in the sector, such as Procel and FINEP.

With these institutions, project proposals were discussed that deal with the generation of electricity for isolated communities, the implementation of intelligent distribution networks as an energy security tool, education and technical training, in addition to the development of energy solutions aimed at riverside communities. Conversations are still ongoing and projects are expected to start with some of these partners in 2023.

A more institutional contact was made with state agencies of Acre, especially the Secretariats of Education (SE) and Science and Technology (SEICT). Being the only research institution in the state of Acre to deal with energy issues, eAmazônia reaff rmed its importance as a consultative entity for sustainable development issues and a participant in state forums on the subject. The partnership with SE also seeks to facilitate the execution of energy efficiency projects in schools in Acre, a topic in which eAmazônia has been specializing in recent years.

# TEAMS BY PROJECT

## COPEL

Acacia dos Campos da Terra
Ana Gabriela Benitez
Bruno Hideki Nakata
Carlos Marcio Vieira Tahan
Daniel Perez Duarte
Daniel Szente Fonseca
Felipe Kenndy Matsuzaki
Marcos Fábio Martins
Matheus Guarany de Araújo
Ricardo Petta de Andrade
Sergio Mishima dos Santos Barbosa
Thaís Helena Samed e Sousa
Vinicius Eduardo da Silva Xavier
William Ferreira Peixoto

## LAB

Carlos Marcio Vieira Tahan
Daniel Perez Duarte
Daniel Szente Fonseca
Felipe Kenndy Matsuzaki
Francisco Manuel Pires Neto
Gustavo de Goes Himeno
Henrique Kagan
Marcelo Aparecido Pelegrini
Marcos Roberto Gouvêa
Natasha Akie Yaguiu Knorst
Paulo Rogerio Maschietto
William Backhaus Lopes Moura

## NEIPA

Aline S. Gallina
Ana Thaís da S. Cordeiro
Beatriz Vitorino
Camila Santos
Caroline L Vieira
Gustavo M. O. de Castro
Hermann Duarte
Hanalise L. de Oliveira
Isabelle M. Santiago
Joshua B. Martins
Klaus C. Ludwig
Lucas S Figueiredo
Luiz Bryan Vilela
Naara Carvalho
Mateus da S. Nascimento
Patrícia Juliana Oliveira
Vinicius Oliveira
Vitória Aguiar Monte
Lucas Matheus de Sousa Lima

eAmazônia

Energia Sustentável e Inovação

www.eamazonia.org

@eamazonia_inovacao