



COMMUNICATION STRATEGIES ON THE USE OF ELECTRIC POWER AND PHOTOVOLTAIC DISTRIBUTED GENERATION AT THE FEDERAL UNIVERSITY OF ABC

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ABSTRACT

The institution's Sustainable Logistics Management Plan (SLMP) determines the good practices and recommendations on sustainability criteria at High Education Institutions (HEI). The SLMP might contemplate seven main themes, whereas in this paper, only the second theme, Electricity, will be discussed. Thus, this paper intends to present a methodology to implement behavioral-based actions aimed with suitable communication objects to publicize the energy efficiency actions carried out by the R&D Priority Project and public call 001/2016. Therefore, it can be noticed that effective gains have been made at the Federal University of ABC (UFABC) and that the appropriate communication strategies have been used to make the actions comprehensive to the entire community.

Keywords: Sustainability, Electric Power, Sustainable Logistics Management Plan (SLMP).

Introduction

In the last few years, public institutions have fetched the introduction of photovoltaic (PV) distributed mini-generation at their campi aiming for money savings and also adding to sustainable initiatives following guidelines disseminated by organizations such as the United Nations through the Sustainable Development Goals (SDGs) and the Sustainable Logistics Management Plan [1][2]. To broaden the discussion at the universities campi, it is understood that sustainability must be treated as knowledge and technology production through the scholarship of sustainable development seeking to get inside the different mottos of the university. An institutional authority must run coordinated actions reinforcing good practices that run through the execution of successful new projects and suitable communication arrangements targeting to embrace all the institution's party members, either on extension projects, research, or teaching. It has been noticed that disseminating technological innovations aligned with sustainability has instant acceptance and encourages new projects and behavioral changes.

When seeking ways of saving in the public sector, PV has demonstrated itself as an efficient resource because, besides reducing public costs, this cleaner energy model contributes to the diffusion of sustainable elements, promoting the development of an economic, environmental, and socially conscious society [3].

In this sense, in 2016, the National Agency for Electric Power (ANEEL) presented a call notice for a Priority Energy Efficiency Project (PEE) and Strategic Research and Development (R&D) to select strategic projects in public HEIs, which will serve as models for a portfolio of joint actions in several public institutions of the country. A pilot for the installation of two PV plants was elaborated following the specifications when UFABC's project was accepted, including the energy efficiency actions (awareness campaigns and replacement of inefficient equipment), laboratory training, and human training on PV generation. Additionally, the project enables the development of coupled

systems for operation, such as SCADA and automatic interlock [4]. For the selected project, one PV plant was installed in Santo Andre, adding up to 1080 PV modules with a maximum production capacity of 388.8 kWp, and the other one was installed in Sao Bernardo do Campo, adding up to 762 PV modules with a maximum production capacity of 280.08 kWp. These two combined systems have a total capacity of 668.88 kWp and 1842 modules, which can generate up to 66 thousands kWh/month. Figure 1 presents pictures of the installed PV and their electric potencies:



Figure 1 - PV system in Santo Andre (left) and in Sao Bernardo do Campo (right).

The systems are connected to the grid (SFCR) as shown on Figure 2:

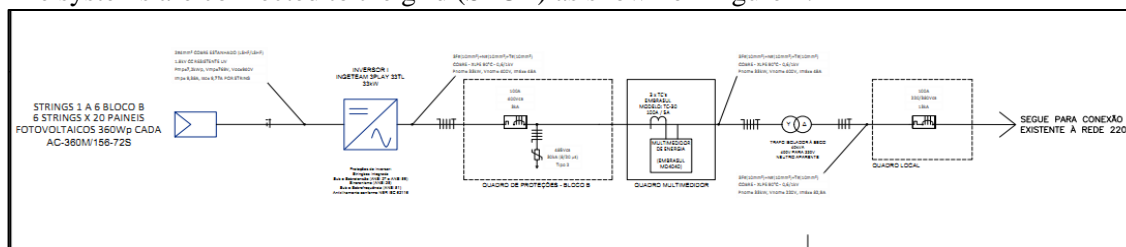


Figure 2 – PV generator connected to the grid.

UFABC's PV plants were installed in 2021 and started operating in 2022 and, nowadays they allow the university to save electric power and money from power bills. This action is aligned with the Sustainable Logistics Management Plan (SLMP) [5], although it was not foreseen when the plan was written. The system's inauguration was widely disclosed by the internal media and local newspapers.

During this paper's development, it was possible to identify the changes at UFABC caused by the PV distributed mini-generation, such as improvements and other matters that need to be improved or revised, to show how solar power affects public costs. As a solution, it is recommended to publicize the data on technical reports, institutional announcements, and media. The data can be used on research projects, energy management, and budget planning.

Finally, the introduction of a successful new technology means a new way of handling the prior scenario, and promoting better energy planning and management by raising the use demands.

Problem Statement

UFABC's electric power expenses represent up to 10% of the annual budget. Considering the essentiality of electric power to the university, efficient actions to save power are mandatory. The SLMP forecasted the saving needs and the electricity consumption disclosure to awareness of the academic community. From this need arose a PV system installation on top of the UFABC's buildings, as a way to reduce the electricity bill.

In August 2021, the PV system was installed at UFABC. The occasion was covered by the local newspaper "Diario do Grande ABC" [6] which published an article speaking about the partnership between UFABC, ENEL, and ANEEL. The next month, UFABC's press released another article on the same subject [7].



The SLMP didn't foresee or suggest the use of solar energy as an alternative source or economic option. Originally, the SLMP suggested the substitution of the diesel generator for a natural gas generator. Although, it suggests "the seek for energy cogeneration", without pointing to a source for it. Therefore, the PV system can be considered a more efficient and advantageous way than those indicated at first.

Methodology

UFABC's SLMP foresees that the University City Hall (PU) is responsible for disclosing electric power consumption data for both campi, however does not stipulate how or where. Thereby, PU chose its website to disclose the data and created a specific section for "Energy", where electric power consumption and its financial correspondent can be found [8].

The power generation data comes from the PV system management website, which allows real-time and history follow-up. The data were compiled for analysis and disclosed in form of graphics. This way, PU is practicing active transparency while data is monthly updated.

The information disclosed on PU's website referred to the bills' values in Brazilian currency (R\$) and the power consumption and generation in megawatt-hour (MWh).

A. Savings Calculation

The first step to know how much was saved is to calculate the MWh's value. It is highly recommended that this calculation be made monthly and per campus separately because it is noticed that there is a variation. Thereby, divide the invoice's total (a) by the amount of consumed MWh at that term (b):

$$\frac{a}{b} = c \quad (1)$$

The result is MWh's cost by that particular term (c). To find how much was saved (e), multiply MWh's cost (c) by the total produced MWh by the PV system during the same term (d):

$$c \times d = e \quad (2)$$

B. Saving Power Campaign

Early in 2023, PU started sending e-mails before holidays as a manner of reminding people of the importance of shutting down lights and computers by the end of the shift, because they would be wasting power for longer periods without usage. These messages asked for air conditioners (AC), computers, and lights to be turned off by the end of the day. The recommendation to turn off the printers was omitted when an IT professional explained they could lose configuration, so it is better to keep them on 24/7.

Farther, during the undergraduate discipline "Introducing to Engineering", students were asked to create a campaign to raise awareness of the benefits of using the stairs instead of the elevator. They made some posters and put them next to elevators saying "Choose the stairs" because people are more likely to accept instructions that make them believe that it is their choice and not an imposition, like when it is used the words "Go by the stairs" or "Don't use the elevator".



Figure 3 - campaign posters made by students.

Figure 3 shows some posters made by the "Introducing to Engineering" students using graphic resources and strategies to make a friendly message. The choice of words is fundamental to the campaign's success in saving electric power.

Results

PV electricity production is something that UFABC did not need to buy from the power distribution company. That's why we considered it a saving. The charts below show this point:

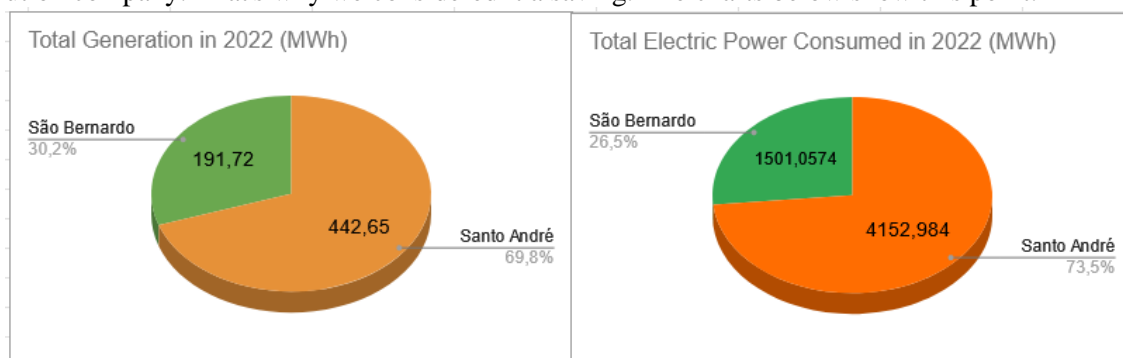


Figure 4 - Total electric power generated (left) and the total electric power consumed (right) by the year of 2022.

On the left of Figure 4 is the electricity produced on both campi, up to 192 MWh in SBC and 443 MWh in SA. The second chart illustrates the electricity consumed by both campi: 1501 in SBC and 4153 in SA.

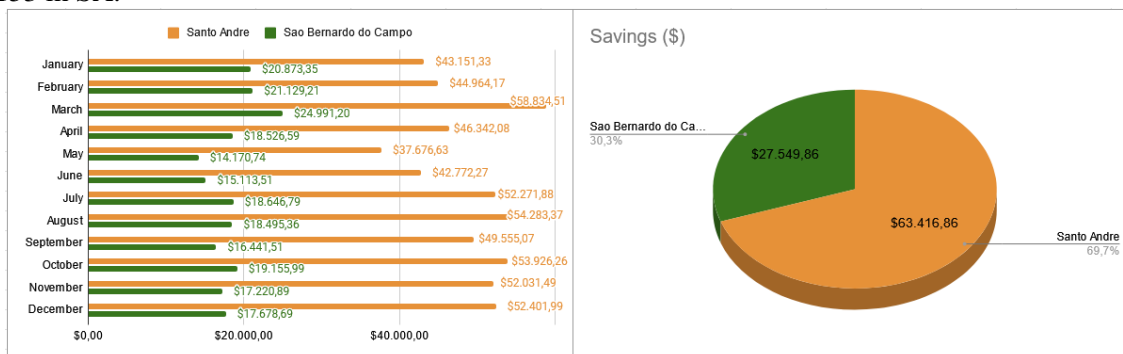


Figura 5 – Electric bills value per month (left) and the amount saved (right).

Applying section A equations, it is possible to calculate how much UFABC avoided paying on electric bills. These significant savings demonstrate the effectiveness of PV electricity production in reducing UFABC's reliance on the power distribution company and the subsequent financial benefits for the institution.



The student's campaign showed that tone and word choice are a major part of engaging the academic community. People need to feel part of the campaign, however, also need to feel that it is their choice to turn off the lights or use the stairs instead of the elevator. It is their choice and not someone else's imposition.

Conclusion

The data presented in this report clearly shows the positive impact of implementing PV electricity production at UFABC. The charts and figures demonstrate the significant reduction in electricity consumption and the substantial savings in electric bills. This not only showcases the effectiveness of renewable energy in reducing reliance on traditional power sources but also highlights the financial benefits for the institution. Moving forward, it is evident that further investment and expansion in PV electricity production would be a wise decision for UFABC, both environmentally and economically. The success of the student's campaign highlights the importance of empowering individuals within the academic community to make sustainable choices. By giving people a sense of ownership and agency over their actions, the campaign effectively fosters a culture of environmental responsibility.

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