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Energy efficiency actions at a Brazilian university and their contribution to sustainable development Goal 7

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Abstract

Purpose – The purpose of this paper is to analyse recent actions of energy efficiency implemented by University of Passo Fundo, a higher education institution located in the south of Brazil, and their contributions to Goal 7.

Design/methodology/approach – The analysis is based on collected energy data and information of energy efficiency actions applied at the university.

Findings – The paper shows the progress related to the energy practices and discusses opportunities, threats, strengths and weaknesses of applying energy efficiency at universities and its contributions towards sustainable development goal (SDG) 7.

Practical implications – The findings of this study can inform readers about University of Passo Fundo's initiatives towards energy efficiency focussed in lightening, photovoltaic solar power generation and free energy market. Readers are able to improve their knowledge with the discussion of internal and external factors related to the initiatives.

Originality/value – The originality of this paper is connected to the idea of sharing the experiences from University of Passo Fundo, connecting energy efficiency practices at universities to SDG 7 and also exploring opportunities, threats, strengths and weaknesses of applying these practices in the context of a higher education institution.

Keywords Universities, Energy efficiency, SWOT analysis, Sustainable development goals, Energy sustainability

Paper type Case study

1. Introduction

Energy efficiency is the practice to reduce energy consumption and its costs, and it is also related to the efforts to increase clean energy production. The gains associated with it, including cost savings and resource efficiency, are critical considering that the global resource costs are rising and countries need to become economically efficient (Maistry and Annegarn, 2016). In addition, the high levels of energy consumption increase emissions of carbon dioxide and other air pollutants, impacting people's health and global climate.

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The definition of sustainable development is based on three pillars: economic, social and environmental (Giddings *et al.*, 2002). The integration of these in Lozano's (2006) point of view, starts with a change process, in which the quality of life is improved by societies and reaches a dynamic equilibrium between the economic and social aspects, while protecting, caring for and improving the natural environment. According to Shahsavari and Akbari (2018), the widespread use of renewable energy sources could help to avoid the negative environmental and social impacts related to fossil fuel energies, also it could create extra socio-economic benefits – reducing local air pollution and safety risks, increasing energy access and improving security of energy supply.

The sustainable development goals (SDGs) are part of the 2030 Agenda that aims to build a more equal, prosperous and secure world. The seventh goal is "Affordable and clean energy" with the aim to ensure access to affordable, reliable, sustainable and modern energy for all. To achieve that, it is necessary to reduce, control and monitor energy consumption and energy efficiency.

According to Salvia and Brandli (2019), in one way or another universities have been contributing to the targets of SDG 7. Through research, extension, curriculum greening and campus operations, these higher education institutions (HEIs) are acting towards improving access to electricity and clean fuels, increasing the use of renewable energy, promoting energy efficiency, besides seeking to enhance international cooperation, expanding energy infrastructure and upgrading the technology used.

HEIs are an important key to help develop a better society by educating and training new leaders, managers, and entrepreneurs and by providing future conscious for new generations (Silva *et al.*, 2018). The university campus can be considered a living lab (Evans *et al.*, 2015), a laboratory for experimentation, to test and implement new strategies that make a transformation and to establish new standards to its education, organizational structure, operation and infrastructure based on sustainable development. UNESCO (2015) suggests that when Education for Sustainable Development is part of universities curriculum and actions, it shows people how to lead a life more engaged with social and environmental causes.

A green campus can serve as a model for students to improve their sustainable behaviour and continue doing that after university life. According to Leal Filho *et al.* (2015), another role of campus greening is its visibility and documentation, providing ways to record the implemented practices and tracking performance to help define and redefine targets. In addition, reports with this information increase the visibility of the university for internal academic members and also for the external community.

Leal Filho *et al.* (2015) suggest that there are two popular areas related to campus greening activities considered easy to implement and starting points for a sustainable process: solid waste and energy management. The high consumption of energy and environmental impact caused by universities through activities and operations as well as in support services can be considerably reduced by organizational, technological and energy optimization measures (Kolokotsa *et al.*, 2016). Research from the Lawrence Berkeley National Laboratory (2013) demonstrates that the most abundant and cheapest way to reduce greenhouse emissions is to improve energy efficiency.

Many authors have been presenting the experiences of their universities when it comes to topics of energy conservation, efficiency and education on campus. Pearce and Miller (2006) quantify and analyse a guaranteed energy savings programme by using the technical and financial expertise of an energy service company, concluding how important it was to catalyse university administration to support sustainability initiatives. On the other hand, Allen and Marquart-Pyatt (2018), Boulton *et al.* (2017) and Cotton *et al.* (2015) present initiatives related to behaviour change and energy education on campus. Energy

conservation practices at universities and energy challenges may only succeed with full support and awareness from the academic community.

Other authors focus on the use of renovation plans, more energy-efficient buildings and the importance of aligning sustainability planning to energy conservation (Fonseca *et al.*, 2018; Soares *et al.*, 2015; Petratos and Damaskou, 2015). It is worth highlighting how universities have been using different approaches to reach energy sustainability, and more recently, to meet the SDGs (Albareda-Tiana *et al.*, 2018).

Although there are many studies focussed on energy issues at universities, less is discussed about the connection among actions from HEIs, energy efficiency and the SDGs; therefore, this paper aims to present a case study of a university in the South of Brazil and use it to explore how energy-efficiency actions implemented by HEIs are contributing to SDG 7. This paper is divided in five sections which encompass introduction, methodology, data presentation, discussion and final considerations.

2. Methodology

The object of the case study is the University of Passo Fundo (UPF), a multi-campus university, located in Southern Brazil. The main campus occupies a peripheral zone of the city, with a built-up area of more than 110 thousand square metres, receiving a population of approximately 16,000 users (including students, professors and staff) with several impacts on the neighbourhood context and mobility (Frandoloso and Brandli, 2015).

UPF is the focus of this research due to recent approaches towards a more sustainable university and some energy efficiency actions implemented in the main campus to promote environmental development and to transform it into a "green campus". In addition, its University Social Responsibility Policy is a document that officializes and guides the institution's commitment to the social development of the region and country that is located.

The energy data and information on energy efficiency practices were provided by the UPF Electric System Sector. According to this sector, UPF's electrical system has an important infrastructure, containing 22 internal substations of retraction and elevation of energy; 14 consumer unities part of energy concessionaries of electric power; power grid in more than 95 buildings; own generation of electrical power during peak hours and emergencies; 880 power poles in medium and low tension; more than 1,800 exterior lighting points; and more than 30,000 interior lighting points in buildings.

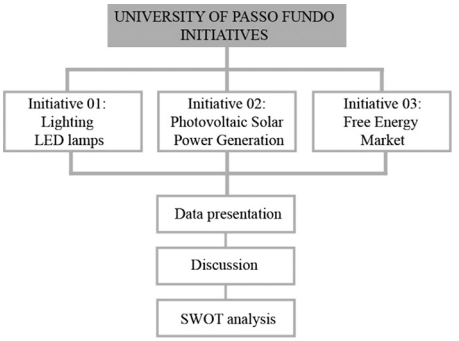
The development of the methodology starts with the description of three initiatives towards energy efficiency applied by UPF. Following the data presentation, a discussion is described as well as a SWOT analysis (Figure 1).

Table I presents a summary of the actions on sustainability that UPF has been implementing or plans to implement in a short-term period, contributing to energy efficiency on campus.

This article focussed on analysing three of these initiatives, as presented below:

2.1 Initiative 01: lighting – LED lamps

The first initiative implemented at the university main campus is the Lighting – LED Lamps Project, in the year of 2017. The aim of it is to improve the energy efficiency of the Library campus and main campus avenue through the change of fluorescent lamps to LED lamps. Besides the energy consumption reduction and the less environment damages, another proposal is to contribute to student's academic development.



Source: Authors (2019)

Figure 1.
Methodology stages

Initiatives	Year	Results
University Social Responsibility Policy	2013	It is considered the guideline to implement sustainability actions aiming economic, social and environmental aspects
Institutional Development Plan	2013	It defines goals to economic balance; energy self-sufficiency and efficient consumption at UPF
Photovoltaic Solar Power Generation	2018	Besides the own energy generation, it contributes to energy efficiency due to immediate consumption without losses. The generated power is instantly consumed for electric charges connected to generation
Free energy market	2018	UPF's electrical energy consumption at Campus I comes directly from clean and renewable sources with reduced costs
Lighting – LED lamps	2017	The change of lamps in the library and main avenue for LED lamps improved energy savings and lighting efficiency
Sustainable Pergola	In progress	It allows the culture of sustainability to be inserted in University of Passo Fundo's environment through a structure that has lighting and energy points powered by photovoltaic generation system. In addition, the structure was prepared with reused woods
Electrical vehicle on campus	Future	This action aims to make the entire fleet of vehicles of the University of Passo Fundo electric, where the energy is supplied by the Photovoltaic Solar Generation Park, concluding a sustainable cycle with a significant reduction in the emission of fossil fuels throughout the process
Sustainable Auditorium Project	Future	Auditorium project designed with reused containers to use rainwater, light and natural ventilation and electric energy coming from solar generation
Moving Campus	Future	This initiative is going to happen once a month, called "Day E" to promote and improve a change in the academic community's behavior, including conscious use, reduction of energy consumption and waste generation

Table I.
University of Passo Fundo's initiatives on sustainability

2.2 Initiative 02: photovoltaic solar power generation

The solar energy is a source of clean energy that can be easily produced by photovoltaic panels. The Photovoltaic Solar Power Generation's initiative includes the production of solar power energy by a structure of 54 photovoltaic panels facing north direction to obtain the

better solar incidence, implemented in May 2018. It is the first initiative involving solar generation in the University and can be an example for future buildings on campus to use its roofing structure to install photovoltaic panels.

2.3 Initiative 03: free energy market

Although in Brazil the electrical power production usually comes from renewable and clean sources (mainly hydroelectric), during peak hours the production can be from thermoelectric or nuclear sources. Furthermore, the UPF also used a non-renewable source from a diesel generator during peak hours due to the necessity to reduce electrical bill costs, resulting on emissions of toxic gases. In 2018, UPF started to be part of the free energy market, reducing its ecological footprint to the complete use of clean and renewable energy source.

The SWOT method (strengths, weaknesses, opportunities and threats) is also used in this paper to analyse the current state of UPF's energy-efficiency initiatives and its needs regarding economic viability, environmental impact and social development. Also, it helps identify internal and external factors that are important to achieving the main objective. The internal factors can be considered the strengths and weakness internal to the organization or project. On the other hand, external factors are the opportunities and threats presented by the external environment.

In this way, this article presents the UPF initiatives towards their contribution to SDG 7.

3. Data presentation

In this section, the results of the case study about energy-efficiency initiatives and their contribution to SDG 7 are presented. From the data collected, three initiatives were analysed and are described in the following discussion:

3.1 Initiative 01: lighting – LED lamps

To reduce consumption and, consequently, cost, the institution replaced the old fluorescent lamps (100 W) for LED ones (40 W), which were installed in the central library and at the main avenue of the campus. The new lamps are more energy efficient and less harmful to the environment.

Figure 2 describes the significant change in power consumption of the central library of campus I. Two models of 18 W and 40 W LED lamps were installed in the library. The installation began in August 2017 and caused a monthly reduction in consumption of

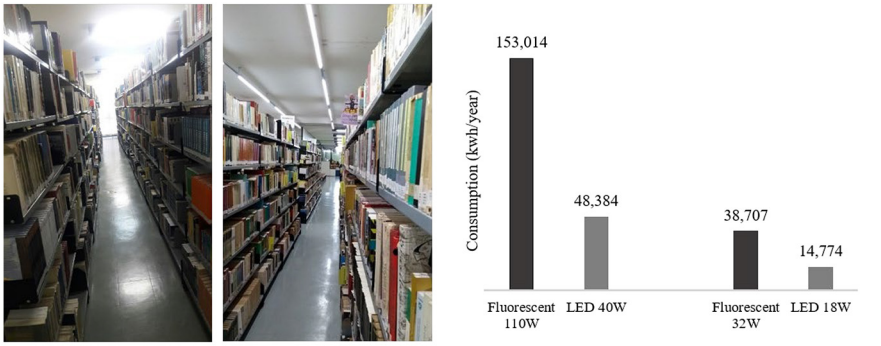


Figure 2.
Data analysis of lamps at the Central library

Source: Authors (2019)

approximately 3 per cent. The old type of fluorescent lamps used to consume approximately three times more than the new LED lamps.

The main avenue of Campus I also had the old lamps replaced by new LED ones. According to the graphic of Figure 3, the replaced 250 W sodium lamps consumed about 49,680 kWh per year, whilst the installed 150 W LED lamps consume 19,872 kWh/year, resulting in a considerable reduction of energy consumption in approximately 60 per cent.

3.2 Initiative 02: photovoltaic solar power generation

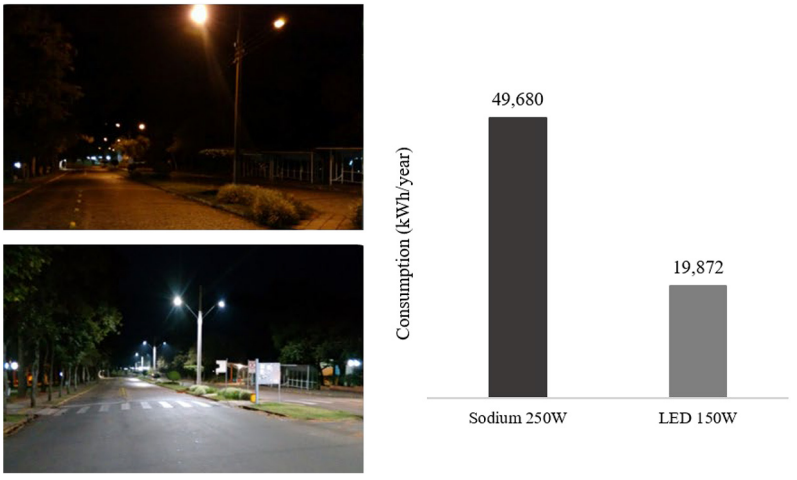
A recent action of the University is the construction of a Solar Photovoltaic Generation Park, with a structure of 750 m^2 with 54 photovoltaic panels and a total power of 17.55 kWp. Its catchment area is 108 m^2, and the panels are expected to generate 2,300 kWh/month (UPF, 2018).

Figure 4 illustrates the amount of renewable energy generated after the implementation of the solar park. According to the graphic, in the first five months after implementation, it has been generating an average of 1,713 kWh/month. Also, there is a gradual increase in the generation of energy, as it depends on the intensity of the solar radiation, according to the season, which is higher in the spring and summer, from September to March.

3.3 Initiative 03: free energy market

Until September 2018, the university used to purchase electrical power from a captive market energy provider, using also a diesel generator for peak and emergency hours, to reduce costs. However, the use of this source causes environmental damage due to carbon emissions. Since October 2018, the University changed the main source of electrical power to a free energy market, looking for sustainability in the three aspects: economic, social and environmental.

According to a Brazilian national legislation (Brasil, 1995), there are two types of energy consumers: regulated and free. Regulated consumers purchase electricity straight from local



Source: Authors (2019)

Figure 3.
Data analysis of lamps at the Main avenue

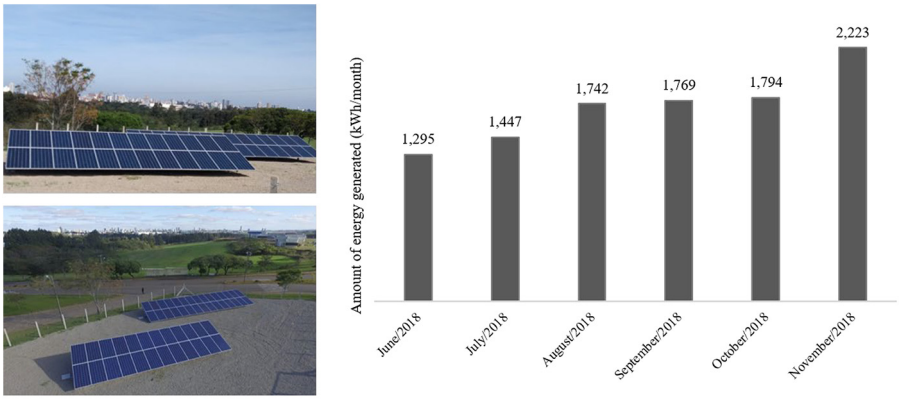


Figure 4.
Data analysis of the Solar Photovoltaic Generation Park

Source: Authors (2019)

distribution companies (captive energy market) and are not able to negotiate prices. On the other hand, free consumers choose their electricity supplier, negotiating conditions and prices.

Another positive impact of the free market is the possibility to choose suppliers that can guarantee that the electricity comes from renewable sources. In addition, the free market also proposes a constant electricity price, without the need to increase prices when the country is going through a period of high demand, or rains are scarce and there is a need to supply energy through non-renewable source.

Additionally, UPF could turn off the diesel generator for peak and emergency times, as the free market allows the free use of energy without exceeding the costs in moments of high energy demand, decreasing environmental impacts.

Concomitant to the generator's shutdown, a smart campus project was launched at UPF, with the aim to monitor campus air quality. Entitled "How clean is the air you breathe?", the project monitored the air quality on campus for about four months, using three sensors, distributed at specific points. All the data collected by the sensors was uploaded to an online platform, in which all campus users and local community could access and check the results in real time (Mazutti, 2018).

4. Discussion

Lighting is responsible for approximately 15 per cent of the global electricity consumption and about 5 per cent of greenhouse gas emissions (The World Bank, 2018). However, in this decade, the use of LED lamps has occasioned an energy revolution, because of energy savings of up to 80 per cent compared to conventional lamps (Department of Energy, 2017). In addition, LED lighting delivers a high level of brightness, long lifespan and reliability (Garrido *et al.*, 2018). Light or its absence has a fundamental effect in learning environments (Wu and Ng, 2003), and it can influence student's performance and academic achievement. Next steps can be guided by the experiences shared through the case study of Fonseca *et al.* (2018), as the authors present similar energy actions (such as the LED replacement and the use of a photovoltaic system) but guided by a renovation plan aiming to achieve nearly zero energy goals.

Solar energy is becoming a popular choice among countries because of the intense growth of greenhouse gas emissions (Shahsavari and Akbari, 2018). This choice, according to the authors, occurs because of the great abundance of solar energy available worldwide, which can be converted into two types of energy: thermal and electric. Photovoltaic solar power generation, from UPF's main campus, is responsible for converting sunlight into electricity, which is used by some buildings and laboratories of engineering and related courses. This initiative supplies the university with renewable energy from a local source, contributing to the reduction of greenhouse gas emissions.

According to The World Bank (2018), the share of renewable energy represents 22.8 per cent of the total electricity in the world. Data from ANEEL (2018) show that renewable energy accounts for 85.2 per cent of total electricity generated in Brazil, and photovoltaic solar energy accounts for about 3.2 per cent of it. At UPF, the solar power generation accounts for approximately 1 per cent of the total electricity consumption on campus so far. Therefore, the most important aspect is from the educational point of view. The park current purpose is to be used in classes of all courses, which can learn more about technical and sustainable aspects, and also for the local community as it is open for visits. This is aligned with the importance of developing energy literacy, as suggested by Cotton *et al.* (2015).

The free energy market was created to develop and stimulate the consumption of renewable energy sources. In Brazil, the free market seeks energy from renewable sources, mostly from hydroelectric, followed by solar and wind power. The energy at UPF that is supplied through the free energy market comes entirely from renewable energy sources (being provided by hydroelectric and wind power generation parks). In addition, data from October 2018 shows financial savings of 22 per cent in the energy cost due to the use of free energy market at UPF's main campus. This practice was a result of many months of planning and discussions with the administrative sector of the university, confirming the importance of sustainability planning efforts to their positive effects on energy conservation (Petratos and Damaskou, 2015).

Table II presents a summary of how the energy initiatives at UPF have been contributing to SDG 7. The first target of this goal is to ensure universal access to affordable, reliable and modern energy services. With indicators related to access to electricity and reliance on clean fuels and energy, the initiative of using the Energy Free Market contributes directly to this target, as the access to energy is now more reliable and affordable, besides having the guarantee of coming from renewable sources. Also, in connection with renewable energy, the initiative of implementing a Photovoltaic Solar Generation Park at UPF contributes the most to the second target of SDG 7, which is to increase substantially the share of renewable energy in the global energy mix by 2030. Even though it is a small system, it is working towards more clean energy on campus, and it is also important for the students, who have now practical classes using the system, and for the local community to raise awareness on sustainability and

Initiatives	Goal 7 Targets
Free energy market	Ensure universal access to affordable, reliable and modern energy services
Photovoltaic Solar Generation Park	Increase substantially the share of renewable energy in the global energy mix
LED Lamps	Double the global rate of improvement in energy efficiency

Table II.
Contributions of the initiatives at UPF towards SDG 7

renewable energy. Finally, the initiative related to the use of LED Lamps is connected to improving energy efficiency, another important target of Goal 7. It is clear that the initiatives have an approach limited to the campus or to the region where the university is located; however, the idea of acting local aiming a global contribution is even more important considering the goals of 2030 Agenda.

4.1 SWOT analysis

The SWOT analysis demonstrates the opportunities and threats in the global external environment, and the strengths and weakness inherent to the initiatives. The results are presented on Figure 5.

4.1.1 Strengths. A university internal factor of strength is to have policies related to energy efficiency or a plan with goals and guidelines to implement initiatives during the coming years. Besides, planning initiatives contributes to financial economy, and to categorize what is an immediate priority and what can be done over time. This approach places a higher value to facilitate the process of applying energy efficiency initiatives. To better achieve the goals, it is necessary to define a sector inside the organization to be responsible for the implementation and monitoring the plan or policy. In addition, the administration engagement in energy-efficiency approach is essential to implement plan and initiatives at universities. This can help the academic community understand and discuss the needs for energy efficiency process, identifying objectives and promoting new perspectives.

At UPF, the electric system sector represents an important role in the development of the three initiatives analysed in this article. The engagement of people who care about environmental causes helped to develop ideas for its implementation. Also, this sector is responsible for collecting energy consumption data, verifying the energy system distribution and developing new projects related to this subject.

4.1.2 Weaknesses. Capital funds can be considered a barrier to energy efficiency initiatives when related to the insufficient of it, due to the possibility of no implementation. Energy-efficiency investments may be inhibited by internal capital budgeting procedures, investment appraisal rules or by managers choosing other strategic projects over energy management initiatives. Referring to limited budget, the hidden cost in implementing energy efficiency initiatives – namely energy technology, costs of disruptions or inconvenience in systems – sometimes make organizations fail to invest in it. The risk and uncertainty to invest for example in energy-efficiency technology is a rational response that individuals can consider before making decisions. This economic risk is caused by the business cycle, fluctuation of exchange rates and energy prices (Maiorano and Savan, 2015).

To achieve an energy-efficient status or at least to implement initiatives related to it, individuals need to make good decisions. The limited vision or ability to process information

Internal factors	**Strengths** Internal policy Energy efficiency plan Environmental management system Electric System Sector Administration engagement	**Weaknesses** Limited budget Bounded rationality
External factors	**Opportunities** Visibility Partnerships between universities and market Electric power bill price reduction	**Threats** Free market external legislations condition Cuts of public funding

Figure 5.
SWOT analysis: internal and external factors

can be considered a weakness in the process of energy management initiatives. Maiorano and Savan (2015) describe that individuals do not make decisions considering economic models even when given good information and appropriate incentives, explained by constraints on time, attention and the ability to process information. The author describes this individual characteristic as bounded rationality: reliance on routines and unwillingness to consider change. Another limit could be the lack of influence of an energy manager or a person in charge of energy sector information, which can transform the energy efficiency initiative in low priority given to energy management performance.

4.1.3 Opportunities. The development of energy efficiency initiatives brings to organizations the visibility of environmental action. In some countries, depending on the initiatives taken, there are types of certification to label an Institution/Organization or a building according to energy efficiency parameters or levels. This visibility can draw attention to the university (and for its country as well) and indirectly benefit it for being an example towards sustainable development.

The partnership between market and university is not just a key to develop students' professional skills and abilities, it also helps universities achieve their goals. According to Stăiculescu *et al.* (2015), educational partnership regulates the university openness to the social and economic environment related to the context they work. It is a possibility for long-term research, use of technology and a way to fund projects.

The participation of UPF in a free energy market can be analysed also as an economic approach considering the Brazilian electrical power bills, due to a contract of established prices per month for a certain period. With the fixed price, the electrical sector can have financial savings and therefore invest in other issues.

4.1.4 Threats. Energy efficiency in Brazil has been advancing when related to energy efficiency legislation, funding, and regulation; however, there are certain administrative, bureaucratic and legal barriers needed to be overcome for the consumption of electricity may no longer be related with low levels of efficiency (Oliveira *et al.*, 2013). Brazil is going through an economic period in which funding for energy efficiency may not be available, resulting in the probability of future difficulties to implement initiatives on this subject at universities level.

The free energy market legislations are an external condition of threat due to the possibility of change. Nowadays, it is a way to consume 100 per cent renewable energy in Brazil, mainly with energy from hydroelectric power. However, when organizations sign a contract with the free energy market company, it lasts a specific period; therefore, after this period, the electricity bill and the conditions for having renewable energy may be dubious.

5. Research limitations and implications

The limitation of this research is mainly due to the focussed approach in only three initiatives towards energy efficiency applied at UPF. In general, universities have the necessity to reduce operational costs, leading to the choice to improve their environmental stewardship. To accomplish it, internal barriers such as capital funds, internal capital budgeting procedures and energy managers' choices need to be overcome. In this case study, the results of the three energy-efficiency initiatives represent an example to show how it is possible to save energy and to invest in a clean energy source. Given its focus, this study did not include another important variable, which is the occupants' behaviour, especially because people can have different views concerning energy efficiency and actions not always focussed on energy-saving habits. This approach can be a topic for future research.

This study shows how initiatives on energy efficiency can contribute to a more sustainable campus and to an important SDG. In addition, it is possible to identify that some

actions can be considered opportunities or potential lessons to other institutions towards embedding sustainability in their campuses. Although the SWOT analysis suggests that internal and external factors can have influence on university's management decisions, the database confirms the investments' payback over a certain period.

6. Conclusion

The main goal of this study was to analyse UPF's initiatives towards energy efficiency and the seventh SDG. As a result, among the initiatives, this article focussed on three: Lighting – use of LED lamps; Photovoltaic Solar Power Generation; and the Free Energy Market. The first initiative is the replacement of fluorescent lamps for LED lamps in the library, causing a monthly reduction in consumption of approximately 3 per cent. In the main avenue, the replacement resulted in approximately 60 per cent of reduced energy consumption. The second initiative, regarding the Solar Photovoltaic Generation Park, has generated an average of 1,431 kWh/month in five months and can be higher depending on the season and intensity of solar radiation. The third initiative, concerning the use of Free Energy Market, is also an economic approach comparing to regular electric power bill prices, with financial savings of 22 per cent in October 2018. Besides the financial economy, the three initiatives contribute to the development of a more sustainable campus, with less greenhouse gas emissions and as an example for the academic community's environmental awareness.

In a whole perspective, the three initiatives follow specific targets of SDG 7. The Free Energy Market is related to the access of reliable and affordable energy; the Solar Photovoltaic Generation Park increases the share of renewable energy in the global mix; and the use of LED lamps is connected to doubling the global rate of improvement in energy efficiency. Although these initiatives are related to local actions, the aim of contributing to global causes is important considering the goals of 2030 Agenda.

The SWOT analysis suggests that there are important internal and external factors to consider to achieve the main goal of energy efficiency on university campuses. As strengths, energy efficiency internal policies and a plan with goals and guidelines to implement initiatives on this subject during coming years are described. In addition, the importance of administration engagement to implement initiatives and discuss the needs of the university is highlighted. Another internal factor mentioned is the weakness related to limited budget and bounded rationality. The funds to invest in energy efficiency sometimes are insufficient, and it can be risky or uncertain to invest in some types of technology. Also, there is the concern that decisions related to this subject need to be made by individuals, which may feel under pressure due to economic risks. The external factors are both opportunities and threats. The first one brings to the university the visibility of environmental actions and the opportunity of partnership between market and institution as tools to develop students' sustainable consciousness and achieve its goals. The threats are local legislations due to the possibility of change and the specific time the contracts tend to last.

At this point, by sharing the case study of UPF and its experiences, this paper may provide lessons for other universities with a similar stage of sustainability implementation, promoting energy efficiency initiatives and generating innovation, learning and knowledge sharing, besides empowering the academic community to engage with the university and its initiatives. The originality of this paper is connected to the idea of sharing the experiences from UPF, connecting energy-efficiency practices at universities to SDG 7 and also exploring opportunities, threats, strengths and weaknesses of applying these practices in the context of a HEI.

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