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Electrically Savvy or Not? Tentative Portrait of the Romanian Student as a Consumer of Electric Devices and Utilities

Mariana Cernicova-Buca [1,*], Vasile Gherheș [1], Gabriel-Mugurel Dragomir [2] and Roxana-Mihaela Sirbu [3]

[1] Department of Communication and Foreign Languages, Interdisciplinary Research Center for Communication and Sustainability (PoliCom), Politehnica University of Timisoara, 300006 Timisoara, Romania; vasile.gherhes@upt.ro
[2] Department of Teaching Training, Interdisciplinary Research Center for Communication and Sustainability (PoliCom), Politehnica University of Timisoara, 300006 Timisoara, Romania; mugur.dragomir@upt.ro
[3] Entrepreneurship Department, Politehnica University of Timisoara, 300006 Timisoara, Romania; roxana.sirbu@upt.ro
* Correspondence: mariana.cernicova@upt.ro

Abstract: The understanding of student profiles is critical in educational processes, providing valuable information on the learner's knowledge, aspirations, expectations, and behaviors. The research aims to profile students' relationship with electric energy resources across three issues: the use of energy-efficient devices, interactions with available devices and utilities, and the display of adaptive behaviors to environmental conditions and exploitation of resources. The research is undertaken in the oldest university in the western part of Romania, schooling 13,000 students. The methodology consists of monitoring energy consumption on the university campus hosting around 6000 students in 16 dormitories, and of a survey mapping of their energy-related consumption behavior. A total of 1023 participants participated in the study, with responses indicating significant differences in the studied population, which cannot be viewed as a homogenous group. Gender and place of residence influence the results. While the respondents display a relatively high overall awareness and responsible energy-saving behaviors, women and on-campus students seem to be more inclined to adopt energy-saving, sustainable behaviors. The findings of the research are useful for developing data-driven strategies to enhance and consolidate student energy saving behaviors and to plan for nudging messages to induce sustainable choices in the student body.

Keywords: energy saving; student campus; energy consumption; behavior; high/low energy user; environmental awareness

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1. Introduction

Modern life depends on the supply of energy because technological advances produce more and more appliances and devices powered by electricity. In its 2030 Sustainable Development Agenda, the United Nations (UN) has identified the pursuit of affordable and clean energy (SDG7) as a distinctive goal, stating that by 2030, electricity must be universally accessible, and calling on governments to accelerate electrification, invest in renewable energy, improve energy efficiency, and develop policies and regulatory frameworks to facilitate access to energy [1]. Although Europe has a strong position on access to electricity, with 99% of the population enjoying access to energy, UN reports show that prioritizing energy efficiency in policy and increasing investment are needed to achieve energy and climate targets; otherwise "the 2030 Agenda will become an epitaph for a world that might have been" as António Guterres, UN Secretary-General remarked [1]. Recent research shows that residential sector energy consumption has grown yearly by 1% since 2000, representing almost a quarter of global energy consumption and represents a major contribution to climate change and global warming [2]. The increasing demand for energy

services counterbalances efforts to keep this growth under control, the diversification of energy-powered devices, and the sophistication of comfort levels.

Studies highlight that human behavior plays a decisive role in overall energy demand since technical solutions are available to control physical factors, such as energy production, ensuring energy efficiency of buildings, or using energy-efficient devices and appliances [2–5]. Individuals tend to make satisfactory decisions rather than spend time and effort searching for the optimal decision, and reevaluating consumption decisions is not an easy task [6]. Elisabeth Shove, for example, in an influential analysis of modern lifestyle, draws attention to the fact that modernity allows one to "play God with indoor climate" and that people move away from behaviors that adapted them to climate conditions toward adopting solutions that lead to increased energy consumption in private homes, especially in western societies [7] (p. 26). However, she also states that in pursuit of changing behaviors, societies are limited by the features of the built environment since buildings "contain within them important scripts for the future" and they help build "what will become the traditions and conventions of tomorrow" [7] (p. 76). Understanding that energy use is widely diverse between countries and lifestyles [7,8], researchers, politicians, governments, and international organizations are looking for solutions to promote energy efficiency and avoid irreversible environmental damage [2]. Ensuring a stable future relies "not only on qualified technical, scientific, and professional expertise but also on the ability of the average citizen to make appropriate energy related choices", as DeWaters and Powers so vividly argues [9].

A special case is represented by residential living that harbors future independent individuals that will perpetuate or not the current energy consumption habits: university campuses. According to Irmak et al., there is a lack of research on issues related to the shaping of energy-saving behavior at the school and university levels [10]. Educational buildings and their electricity consumption seem to be a topic that has not been thoroughly investigated [11]. This is partly due to the fact that improvements in electricity consumption did not have a direct economic impact on users, unlike private industries or residential customers, and partly because interventions depend largely on policies and budgets both at institutional and national levels. However, the current energy crisis, the constant increase in electricity prices, and the commitment of educational institutions to pursue sustainability goals, in addition to educational and research tasks, have altered the forecast electricity plans and budgets of university campuses, which, at least in Europe, represent almost 50% of the total building demand [11]. Many universities ensure student housing on campuses [12], residential living resembling domestic homes, but also bearing specific features: seasonal occupancy, shared access to bathrooms, kitchens, study rooms, etc. [13]. Universities can intervene in the architecture and amenities provided for student dormitories but can also use the housing facilities as vectors of education, encouraging the development of behaviors in students, and sharing a proper energy culture. Studies show that energy culture positively influences the impact of human activity on climate and the environment [11,14–16]. In this light, it becomes critical to investigate students' awareness regarding environmental issues, their willingness to adjust their behaviors to sustainability principles, and their interactions with the available resources to ensure a future independent life. Only a complex approach to the issue can overcome the limits displayed by a technical-only or human-related-only approach [17]. Educational research tackles the issue of student profiles either in terms of recruitment processes or linked to learning theories [18]. Student profiling is often debated as the key to treating the learner as a consumer of a variety of services, including educational ones; an angle that is viewed critically by authors who defend academia against marketization discourses [19,20]. However, students are multi-faceted, being simultaneously learners, consumers, future professionals, and family members [21]. The novelty of the present research is that, based on a human-centered approach, it investigates the energy consumption of Romanian students based on monitoring their energy use, that places the young person into one of the categories of low, medium, or high users, not based on the perception of their own use of energy [22], but in an objective manner, based on data obtained through monitoring student residential

living on campus. Metered consumption is further interpreted as being produced by the consumption of a wide range of utilities and devices. Students were asked to self-report energy-related behaviors leading to energy saving or energy wasting in campus life. As Cotton et al. remark, most energy-saving activities are of "the low-effort, low impact variety" and even individuals with a high energy literacy can be at a loss if asked to assess the amount of energy saved by human action [22]. The purpose of this study is to determine the profile of the Romanian student as a consumer of electricity and to highlight the actionable characteristics that can influence the young person's choices towards an attitude of care for the resources that ensure a modern, comfortable, but energy-efficient lifestyle.

2. Framing the Debate on Energy Consumption in University Campuses

Researchers struggle with the question "what (and how) to assess" [23] in evaluating the universities' progress in working towards their sustainability goals. Energy is a major recurrent factor reported as part of the commitment to incorporate sustainability in university life, as shown by the numerous assessment and reporting tools developed in the last decades [24–27]. Improving the energy efficiency of campus buildings is a concern shared by many universities around the world. Reports and studies show that a variety of measures are taken, in the form of surveys, competitions, information, and awareness campaigns to address the issue. Schools and higher education universities share, as a common feature, the irregular footprint (pattern) of electrical consumption due to the seasonal distribution of operating times, to electrical equipment and systems used for educational and residential purposes, and to the availability of buildings for education, administration, residential life in dormitories and canteens [28]. Most recently, Quevedo et al. argued that addressing the space usage type in university buildings and working towards future benchmark development can result in improving energy management and, ultimately, in developing more sustainable universities [29]. This position is also embraced by researchers advocating that universities implementing concepts such as the Sustainable Campus better respond to the needs and expectations of their stakeholders (mainly faculty and students) than the non-implementing ones [24,30], helping, alongside, reach energy conservation and efficiency. Also, emphasis is placed upon the fact that despite global interest in campus greening and energy-saving measures at the university level, less attention is dedicated to presenting students' practical actions, such as personal energy-saving behaviors as part of the institutional effort to pursue sustainability goals [22]. Among the recommended paths of action, the enhancement of energy literacy of students (during their study years, but also as future experts and sustainable citizens) is highlighted. With the current trend toward microgrids and smart solutions, from the point of view of technical solutions, a change in energy consumption is expected [28]. Therefore, the behavior of the occupants of the buildings remains a vivid topic of debate and action. When it comes to the drivers of sustainable residential energy use, research shows that information campaigns, policies, economic measures, and incentives to induce behavioral change must integrate practical solutions with the expectations and perceptions of the modern consumer and with images of what residential living can provide to ensure comfort and security [2–5,7,8]. While for private residential living, financial incentives and personal choices for energy providers can influence consumption [2,3], for students living in campus dormitories, such drivers are not applicable. The choice of energy provision depends on the building administrator, while the payment of utilities is usually flat, whether students are "relatively frugal or profligate" in their use of resources [31,32]. Therefore, campus residents do not have an immediate economic incentive to conserve energy, other than their personal beliefs. There are researchers whose findings point to the fact that students exhibit a continuum type of attitude at home and on campus [33] (p. 348), in the sense that behaviors that manifest at their homes in terms of energy saving, for instance, are perpetuated in the university environment. However, other studies show that students who live on campus have more environmentally conscious behavior than those who live in the city [12]. Actual behavior depends on the type of energy culture that students embrace. Ishak et al. [14] make the case

that "high" energy users do not show concern about practicing energy-saving behaviors, while "low" energy users are open to changing their consumption habits, as actions that prevent environmental deterioration [8,14,34].

Against this background, Romanian universities are rarely presented as objects of study or instances in higher education practice. As Zanellato et al. point out, overviews highlight that Romanian universities have a low commitment to sustainability issues compared to universities in other countries [35]. Their analysis presents the case of the one Romanian university that succeeded in implementing sustainability reports as current practice and achieved international recognition of the pursuit of sustainability goals, by inclusion in three prestigious global rankings on sustainability. While understanding that there is no consensus on where to begin implementing sustainability goals in a university [36], Zanellato et al. [35] explain, based on extracting information from official documents and reports, that the first Romanian university (out of the 89 Romanian accredited higher education institutions) went from the "opportunistic" stage of collecting information on isolated initiatives throughout the institution to the organizational stage and, finally, to the assessment and recognition stage. Education for the environment was formally introduced in Romania in 2023, as described in the National Strategy on Education for the Environment and Climate Change [37], but only for the primary and secondary school levels. At the time of writing this study, universities are still experimenting with the topic. Only five universities are mentioned in a UNESCO communication on Romanian educational sustainability-related programs. Not many universities include in their strategic documents sustainability goals [38], even if students' sustainable (or unsustainable) beliefs and behaviors receive attention, in the context of generational features [39,40]. Narrowing the sustainability topic to energy, it is important to note that for Romania, educational institutions, out of which 5% are universities, represent significant consumers of electricity, contributing 10% of the final amount of energy used by the public sector [22]. Given the lack of consideration for stakeholders and/or public engagement during the establishment of sustainable campuses identified in research by Dawodu et al. [41], this research focuses on the human dimension of energy consumption in campus residencies, exploring students' energy-related behaviors. This leads to the formulation of the first research objective:

RO1. *What type of electric energy profile is typical of the Romanian student residing on campus premises?*

Research efforts often go toward measuring the actual electric energy consumption of electrical energy of buildings [11,32,42–44] or on the perceptions and beliefs of the occupants—in this case, students—regarding the use of a variety of electrically powered appliances and devices [45]. An important guide for the inventory of such devices is developed by the World Health Organization in collaboration with the World Bank, which proposes a set of core questions on household energy use [46] related to cooking, heating, and lighting. Data are collected using a survey that provides quality information used to support decisions or contains evidence supporting calls to action. Ishak et al. used a series of surveys to investigate both the awareness of the occupants of educational buildings about the necessity of pro-environmental actions and the habitual use of appliances by students that underlie energy consumption [14]. These results encouraged the formulation of the second research objective for the current study:

RO2. *What electrical devices are used by students on campus and what is the underpinning of electric consumption?*

A third consistent direction of research goes toward identifying the drivers for energy-saving behavior in the investigated population. Studies highlight the effects of competitions [47,48], data visualizations and other sources of information delivery, or individual and sociodemographic factors that affect the energy-saving behavior of student communities [10,31,49,50]. These studies inspired the third research objective:

RO3. *What are the actionable energy consumption behaviors of students that can lead to energy-saving in everyday life?*

Being aware that consumption habits and energy consumption depend on the natural environment and climate conditions, such factors are also considered in the study.

3. Materials and Methods

The methodology of this research is data-driven, combining data collection resulting from monitoring energy consumption in student residences with data obtained from a questionnaire survey on students at the same university. The monitoring method was non-intrusive, relying on the technology already installed in the buildings included in the sample. The information is limited, however, because meters offer whole-building data, not allowing for breakdown analysis on individual consumption. Additionally, a questionnaire-based sociological survey was applied. On the one hand, the survey highlighted the students' consumption behaviors on a list of domestic appliances from the point of view of availability and frequency, and on the other hand, the survey aimed to identify student energy-saving or energy-wasting behavior. The combination of monitoring and survey data can help overcome the limits of a single-angle approach [17,44,50]. To obtain the desired profile of students as consumers of electrical utilities and devices, the analysis was carried out along the following variables: sociodemographic and tools [51]. In the sociodemographic set, the participants are of similar ages and level of education, two features having the potential of influencing the results: gender and place of residence [12]. The tools variable refers to the use of the amenities in homes or on campus, including the use of electrical equipment (type, availability, frequency) and the acknowledged energy-related behavior.

The overall concept of the research design is presented in Figure 1.

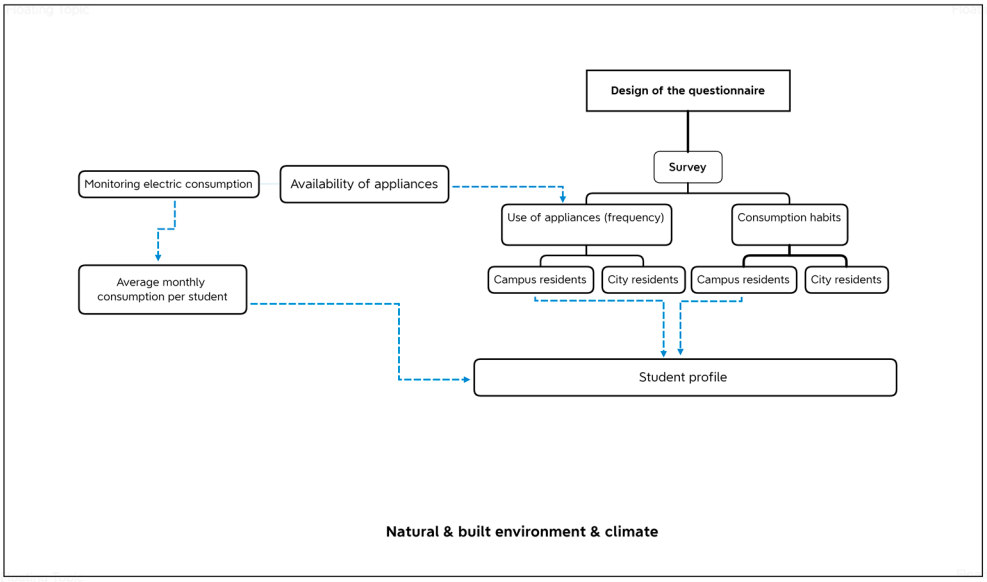


Figure 1. Conceptual design of the research.

3.1. The Campus and Local Climate

The study investigates the student campus of Politehnica University in Timisoara, Romania (official acronym UPT), the oldest higher education institution in the region. Timisoara is situated in the western part of Romania, close to the Serbian and Hungarian borders. It has a continental temperate climate, with cold winters and hot summers. In the last two decades extreme records reached −24 °C in January 2003 for cold and 41 °C, set in July 2007 for heat. Such a variation in outdoor temperature creates pressure on adjusting indoor climate, influencing energy consumption.

According to Romanian practices, most universities build and administrate campuses with student residences to facilitate young people's access to education. Students pay flat rates, irrespective of their consumption of utilities, at a discounted rate. Housing costs may be subsidized if the financial conditions of the students require it. The selected campus consists of 16 residences located close to the city center and in the immediate vicinity of the university. Approximately 6000 students out of the total 13,000 chose to live on campus. Electricity is used for lighting, cooking, and laundry washing. The heating cost is not reflected directly in the consumption calculations but is reported in a separate utility billing. Electric appliances of the student residences are uniformly configured by the university's logistics department. The residences are equipped with washing machines, electric hobs, and refrigerators of the same power and brand in all residences. Students bring along portable appliances and devices such as laptops, chargers, hair dryers, irons, water heaters, fans, etc. Utilities are provided by municipal services (water supply and management, waste management), with electricity being provided by a supplier selected from a list of designated producers, according to Romanian regulations [52]. The housing on campus is managed by Student Social Services at the university level. However, student representatives are involved in the lease signing between campus residents and the university. Out of the total of 16 residencies, two were excluded from the monitoring process because they were reserved for teaching staff and doctoral students. These occupants display different features from the majority of campus residents by age, professional and financial status, space occupancy, and duration of lease.

3.2. Electricity Consumption

The monthly electricity consumption for the selected dormitories was obtained from the Student Social Services. Since metering is recorded per building, datasets were collected for the whole lot of dormitories from 1 January to 30 November 2023. The building administrators report the self-read meters to the electric energy supplier, but there is a two- to three-month delay in the billing, which consolidates the data after their verification by the supplier. Therefore, to have an objective, verifiable set of electricity consumption calculations were made for the period 1 January to 31 July 2023, which took into consideration both the data collected from the electricity meters of the monitored buildings and the data reflected on electricity bills issued by the supplier, thus ensuring the objectivity of the data. For August, zero consumption was recorded since the students' leases ended on 31 July, and the new ones were signed in September.

3.3. Questionnaire Survey

Questionnaires are a frequently used tool to collect data pertaining to energy consumption, as shown by Deme Belafi et al. [17]. In designing the questions, the research team drew inspiration from consulted scientific literature but also from the set of core questions developed by the World Bank and WHO [46]. It looked for the appliance-related behavior (in terms of availability and frequency) and for the energy-related behaviors, leading to energy saving or energy-wasting, display of adaptive behaviors to environmental conditions, and exploitation of resources. The questionnaire was built online, on a platform specialized for sociological inquiry and distributed in Romanian, but for the presentation of the data, an English version was provided in the present study. It included a set of questions inquiring about the frequency of household appliances use measured on a 7-point scale from "never" (quantified with 1) to "daily" (quantified with 6). The 7th variant, allowing for non-responses, was quantified with 0. The environment-related behavior was measured through the set of 5-point Likert-scale questions, from 1 corresponding to "never", up to 5 corresponding to "always". A set of sociodemographic questions (age, gender, residence status) concludes the questionnaire form. The validation of the questionnaire, from a quantitative point of view, was carried out on a sample of 380 on-campus and off-campus residents. Cronbach's alpha coefficient was calculated on the verification sample to assess the reliability and internal consistency of the questionnaire [53,54]. Cronbach's Alpha

coefficients can take values between 0 and 1 [55]. A value above 0.7 is generally considered acceptable for research purposes [54]. In the present case, the coefficient had the value 0.932 (Table 1), which ensured the comfort of the internal consistency of the chosen items and allowed for carrying out factorial analyses.

Table 1. Cronbach's Alpha fidelity estimation value.

Cronbach's Alpha	N of Items
0.932	13

The resulting adjusted questionnaire was applied to elicit responses presented in this research.

3.4. Recruitment of Participants

A total of 1023 participants from all years of study at the Politehnica University of Timisoara participated in the study. Compared to the total number of approximately 13,000 Politehnica students, the margin error was estimated at ±3.3%. The sample was randomly stratified, and stratified by gender and place of residence—data that proved to bear weight in determining student behaviors [12]. Two balanced comparable groups were obtained, the final sample including 511 women and 512 men, with an average age of 22.92 years, and a distribution of 511 people living off-campus and 512 in on-campus residences. The inclusion criteria referred to the status of students at Politehnica university. For the group of students residing on campus an exclusion criterion was the occupancy of a dorm in one of the two buildings excluded from the study. Out of the 6000 students residing on campus, 512 responded to the questionnaire, on average 30 to 40 respondents per residential building. The sample of students living off-campus was calibrated to ensure the possibility of comparison along the residency criterion. Participation was voluntary, and measures were undertaken to prevent responses from being traced back to the respondents. The distribution of the questionnaire was done through mobile apps, as suggested by researchers who tested various routes of recruiting students for environment-related surveys [48]. Also, in face-to-face interactions, the research team distributed links for the survey to students present at various mass-attended events organized by the university in the period May–June 2023.

3.5. Data Processing and Analysis

Statistical methods were used for data processing and analysis. The data collected for electricity consumption were interpreted in a key relating consumption to students, obtaining an average that can be used to place the student profile in the high, medium, or low energy consumption category [14]. SPSS Statistics 27.0.1.0 software was used to analyze the responses to the questionnaire.

4. Results

The findings are presented below, indicating the energy consumption data, the frequency of the use of electrical devices, and the recognized energy-saving behaviors shared by students. Differences between on-campus residents and students who live in the city, as well as between genders, are highlighted when statistically relevant.

4.1. Electric Energy Consumption Data for Campus Residents

The monitoring of electric energy consumption showed that, on average, a campus resident student used up to 48.07 Kwh/month, with the lowest consumption in the oldest residence, amounting to 15.84 Kwh/month, and the highest consumption in the largest residence, rising up to 66.68 Kwh/month. Compared to the average household consumption, estimated at 283 Kwh/month [52], the data place campus residents in the low energy consumers' category, allowing for an optimistic approach to the possibility of influencing

their behavior towards energy-saving habits. The variation between the lowest and the highest consumptions can be interpreted in connection with the specific features of each residence in terms of orientation, exposure to the sun, insulation, and footage of the floors, but also depending on the consumption habits of the residents themselves. Future research should analyze, in-depth, these features, to identify potential areas of intervention in the pursuit of a strategy to green the campus [12].

4.2. Use of Electrical Devices Influencing the Energy Consumption

A more in-depth analysis of the behavior of electricity consumption among students allows for an exploration of the various habits and preferences that influence overall energy consumption. Such an analysis not only creates the possibility of forecasting their implications for energy efficiency and sustainability, but also explains the consumption patterns for the investigated population (Figure 2). It is also useful to determine potential areas of intervention on the part of the university administration, either in the form of investing in new equipment or in improving energy management in residential buildings.

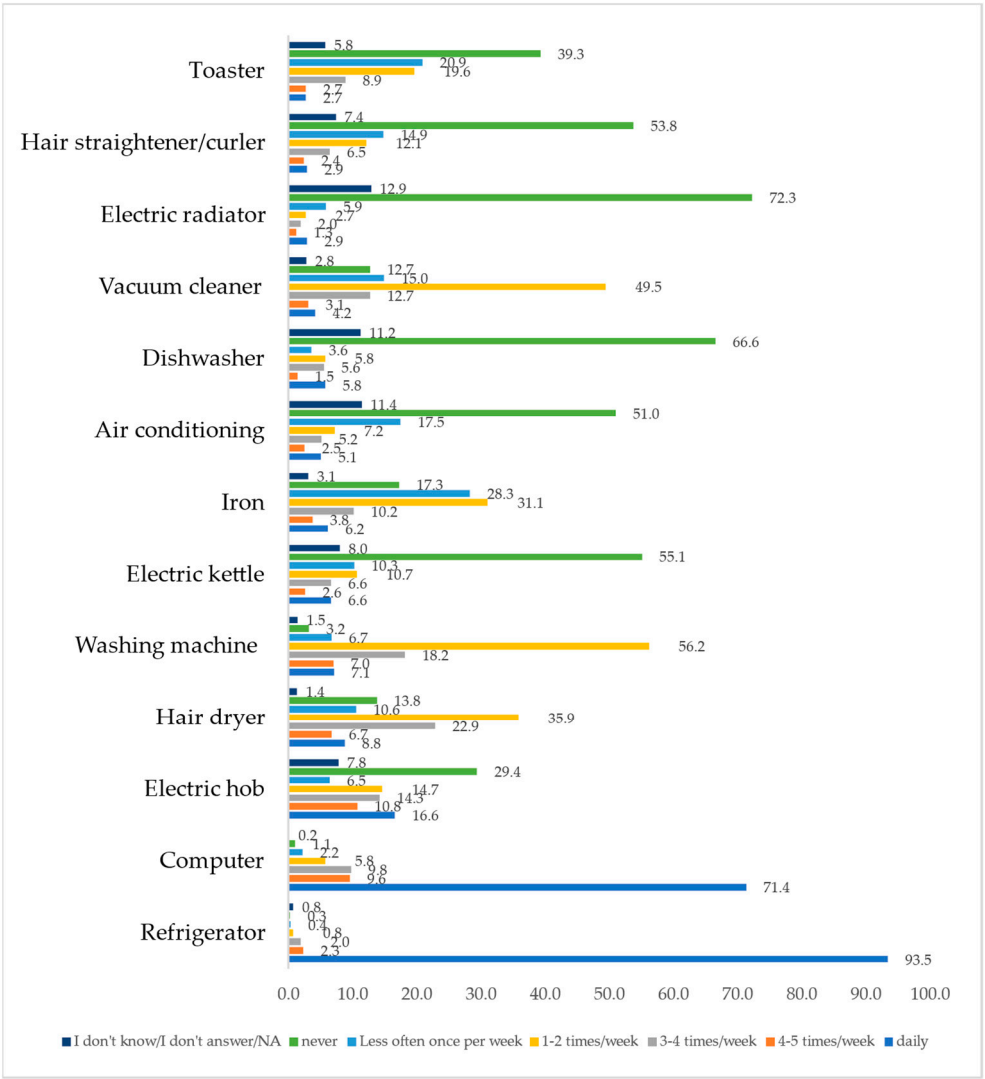


Figure 2. Frequency of use of domestic electrically powered devices.

The analysis indicated a high use of refrigerators and computers, with daily usage rates of 93.45% and 71.36%, respectively. It is essential to maintain a high energy efficiency for appliances that operate continuously and consume electricity around the clock, such as refrigerators. In the case of computers, applying energy-saving strategies and turning

them off when not in use can greatly reduce energy consumption and the carbon footprint, as demonstrated by researchers who measured such an effect of the IT equipment used by the student population [28]. Furthermore, the frequent use of electric hobs, with a rate of 16.62%, indicated a preference for home cooking, which also presented opportunities to improve energy efficiency by adopting more efficient cooking technologies.

Hair dryers (8.80%) and electric kettles (6.65%) were used less frequently but consumed a significant amount of energy over short periods of time. Awareness campaigns on efficient use and low-consumption alternatives could optimize consumption.

The low frequency of use of air conditioners, electric radiators, toasters, vacuum cleaners, and hair straighteners can be attributed to the limited access of students to such devices or to the adoption of alternative solutions for their use. The use of air conditioners (5.08%) and electric radiators (2.93%) can be influenced by weather conditions and can vary significantly between seasons.

In refining the data by the residential status regarding the use of electrical devices, the analysis showed that significant differences can be traced (Table 2).

Table 2. Differences in the use of electric devices between on-campus and off-campus residents.

		N	Mean	t	df	Sig. (Two-Tailed)
2. Washing machine	off-campus residents	473	2.74	4.537	904	<0.001
	on-campus residents	433	2.46			
3. Electric hob	off-campus residents	233	3.82	5.099	574	<0.001
	on-campus residents	343	3.32			
5. Hair dryer	off-campus residents	373	2.73	−3.179	758	0.002
	on-campus residents	387	2.96			
9. Dishwasher	off-campus residents	124	3.54	2.440	145	0.016
	on-campus residents	66	3.11			
12. Electric kettle	off-campus residents	511	2.31	−4.058	1015	<0.001
	on-campus residents	512	2.85			
13. Toaster	off-campus residents	511	3.17	3.109	1021	0.002
	on-campus residents	512	2.75			

The study used the *t*-test to assess differences in the frequency of use of different equipment between residents on-campus and off-campus. The findings indicated that the differences between the on-campus and off-campus students depended mainly on the availability of devices or equipment listed in Table 2 above. Electric hobs, for instance, were less popular in private homes, while dishwashing machines were less frequent on campus.

The results indicated significant differences in the use of certain equipment as follows.

4.2.1. Washing Machines by Place of Residence

Population studied: residents off-campus (n = 473, mean = 2.74) and residents on-campus (n = 433, mean = 2.46).

Statistics: t = 4.537, df = 904, $p < 0.001$.

Conclusion: There was a significant difference in the frequency of washing machines used, in that off-campus residents declared that they usedthem more frequently.

4.2.2. Electric Hob by Place of Residence

Population studied: residents off-campus (n = 233, mean = 3.82) and on-campus residents (n = 343, mean = 3.32).

Statistics: t = 5.099, df = 574, $p < 0.001$.

Bottom line: there was a significant difference in the use of electric hobs, in that off-campus residents used them more often.

4.2.3. Hairdryer by Place of Residence

Population studied: residents outside of campus (n = 373, mean = 2.73) and on-campus residents (n = 373, mean = 2.73) and residents (n = 387, mean = 2.96).

Statistics: t = −3.179, df = 758, $p = 0.002$.

Bottom line: On-campus residents used hair dryers more often than off-campus residents, with a statistically significant difference.

4.2.4. Dishwasher by Place of Residence

Population studied: on-campus residents (n = 124, mean = 3.54) and residents outside the campus (n = 66, mean = 3.11).

Statistics: t = 2.440, df = 145, $p = 0.016$.

Bottom line: off-campus residents useD dishwashers more frequently than on-campus residents, with a significant difference.

Therefore, we can say that there were significant differences in the use of household equipment between residents on campus and residents off campus. These differences point to inconsistency in consumption behaviors, possibly influenced by factors such as access to facilities, lifestyle, and individual needs. Understanding these differences can be crucial to developing more effective resource management strategies and promoting sustainable practices on campus and in surrounding communities.

We also used the t-test to assess differences in the frequency of use of different devices between men and women. The results indicate significant differences in the use of certain equipment (Table 3).

Table 3. Gendered differences in the use of household devices.

	Lot	N	Mean	t	df	Sig. (Two-Tailed)
5. Hairdryer	Men	352	3.24	10.478	602	<0.001
	Women	408	2.50			
6. Computer/laptop/printer	Men	497	4.65	4.646	922	<0.001
	Women	490	4.39			
11. Hair stretcher/curling plate	Men	38	3.26	2.766	243	0.006
	Women	207	2.76			
12. Electric kettle	Men	511	2.38	−2.935	1017	0.003
	Women	512	2.78			
13. Toaster	Men	511	2.79	−2.440	1021	0.015
	Women	512	3.12			

4.2.5. Hairdryer by Gender

Study population: men (n = 352, mean = 3.24) and women (n = 408, mean = 2.50).

Statistics: t = 10.478, df = 602, $p < 0.001$.

Bottom line: there was a significant difference in the use of hair dryers between men and women, with women using this equipment more frequently.

4.2.6. Computer/Laptop/Printer

Study population: men (n = 497, mean = 4.65) and women (n = 490, mean = 4.39).

Statistics: t = 4.646, df = 922, $p < 0.001$.

Bottom line: men used computers, laptops, and printers more frequently than women, with a statistically significant difference.

4.2.7. Hair Straightener/Curling Plate by Gender

Study population: men (n = 38, mean = 3.26) and women (n = 207, mean = 2.76).
Statistics: t = 2.766, df = 243, $p = 0.0006$.
Bottom line: women used hair straighteners more often than men, with a statistically significant difference.

4.2.8. Electric Kettle by Gender

Study population: men (n = 511, mean = 2.38) and women (n = 512, mean = 2.78).
Statistics: t = −2.935, df = 1017, $p = 0.0003$.
Bottom line: women used the electric kettle to heat water more often than men, with a statistically significant difference.

4.2.9. Toaster by Gender

Study population: men (n = 511, mean = 2.79) and women (n = 512, mean = 3.12).
Statistics: t = −2.440, df = 1021, $p = 0.0015$.
Bottom line: women used toasters more often than men, with a statistically significant difference.

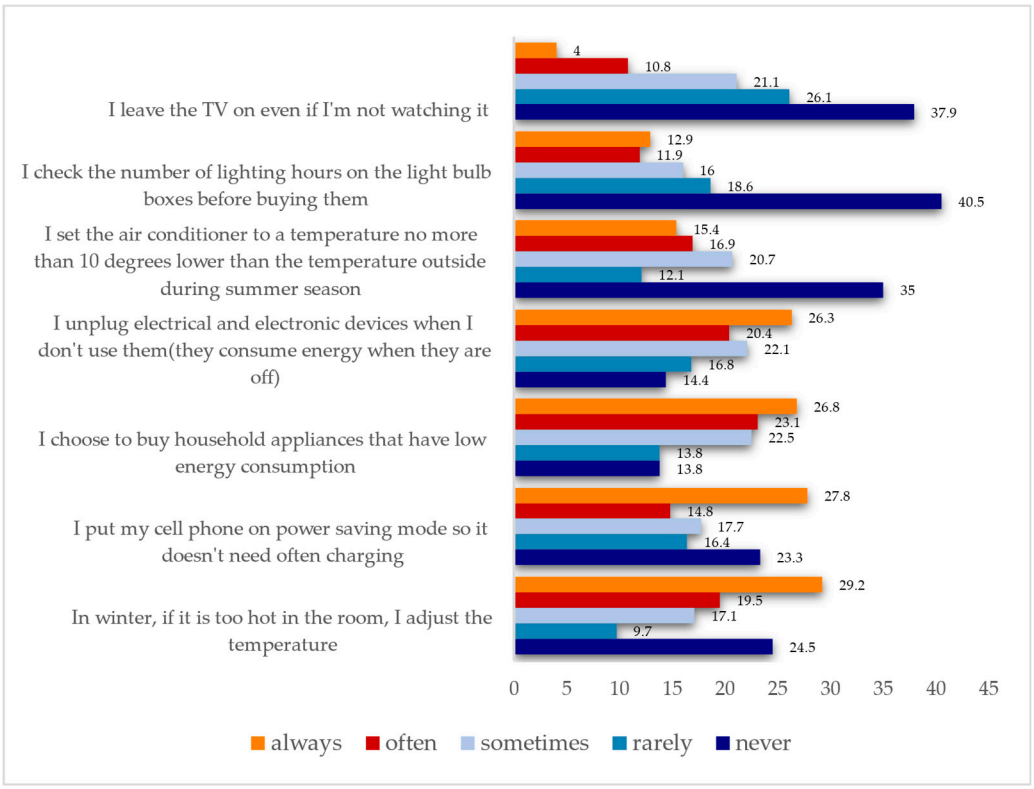
These differences reflect variations in gender-related behavior and their needs in the use of technological and household equipment. Promoting the use of energy-efficient equipment adapted to the specific needs and behaviors of each gender can contribute to reducing the carbon footprint. These results differ from the findings of Cotton et al., who compared students from Portugal and the United Kingdom and concluded that there are no significant differences between male and female students regarding their perception of their own energy usage [22].

4.3. Energy-Related Behaviors, Leading to Saving/Wasting Resources

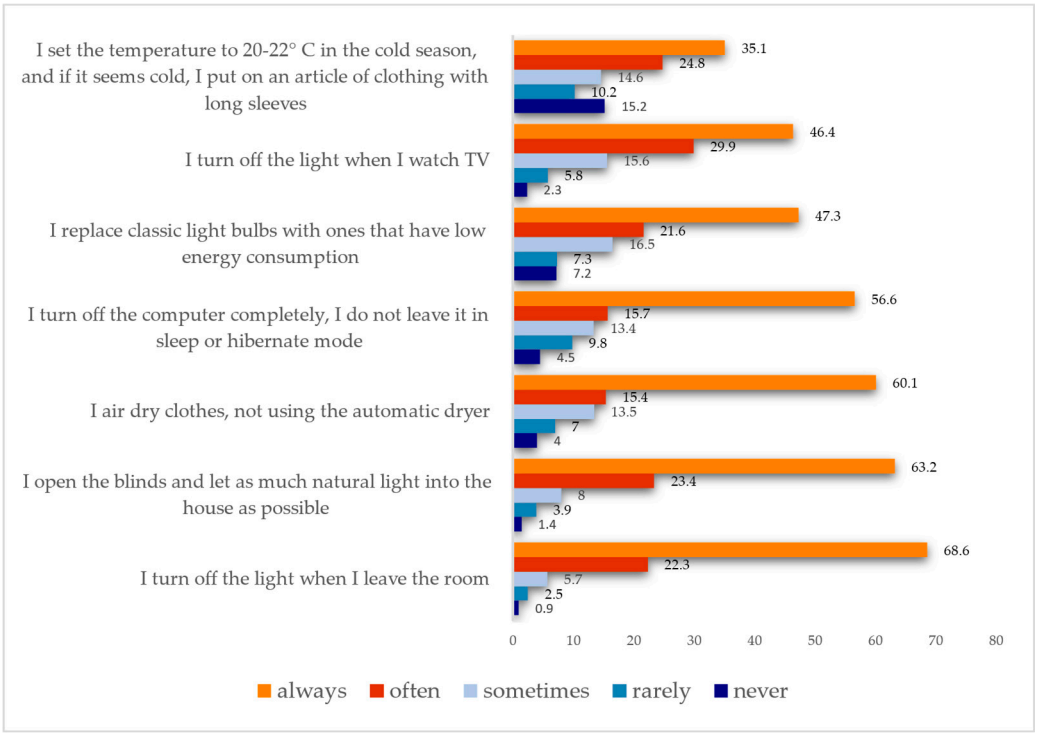
The investigation concerning students' consciously adopted behaviors towards sparing electrical energy resources led to the results summed up in Figure 3. The findings can serve to develop tailored strategies to nudge sustainable behaviors in campus life. Studies on the campus greening processes highlight such possibilities, although in international perspectives, the cases showed different levels of students' sensitivity to one or another of the topics in the list [22,29,39].

4.3.1. I Turn off the Light When I Leave the Room

Most of the students at Politehnica University of Timisoara manifested a conscious attitude towards the need to save energy, 68.6% of them indicating that they made a habit of turning off the light when leaving a room. This practice emphasizes a high level of energy efficiency awareness and a commitment to sustainable living principles. Another group, representing 22.3% of the sample, admited that it turned off lights "often", which showed a general awareness of energy consumption, although there was room for improvement. However, there was also a smaller segment of students who were not as consistent in turning off the lights, which could indicate a lack of habituation or awareness of the impact of this action on resources (5.7%—"sometimes", 2.5%—"rarely", 0.9%—"never"). In our analysis, we observed a significant difference between the behavior of campus residents and off-campus students, with a t-score of −4.172 and a p-value of 0.000 ($p < 0.01$). Analyzing the averages of the answers obtained on a scale from 1 to 5 (where 1 indicates a very low degree of involvement and 5 a very high degree), we find that on-campus students demonstrated a higher level of responsibility in this aspect (the average for residents in dormitories is 4.66, while for off-campus students it was 4.45).



(**a**)



(**b**)

Figure 3. Energy-relatated behaviors (**a**,**b**).

4.3.2. I Open the Blinds and Let as Much Natural Light in as Possible

Efficient management of energy resources is a crucial aspect in the current context of climate change, and the need to promote sustainable practices is emphasized over and over. In this respect, individual behavior regarding the use of artificial light becomes an area

of major interest. The results of the study highlighted a positive trend among the studied population to adopt sustainable behaviors in the management of artificial lighting. A significant majority of students (63.2%) preferred to use natural light over artificial light, in that they "always" choose to "open the blinds and let as much natural light in as possible", which is an excellent practice for saving energy. To these can be added the category of those who said they adopt this behavior "often" (23.4%). A smaller number of students were less inclined to take advantage of natural light, which could indicate the need for greater awareness about the benefits of using natural light (the answer options chosen being "sometimes"—8%, "rarely"—3.9%, "never"—1.4%). In this situation, we found a statistically significant difference by gender, noting that women show a higher level of responsibility towards energy consumption compared to men, especially when it came to opening blinds to let as much natural light into the house as possible. This was underlined by a t-score of -5.053 and a p-value of 0.000 ($p < 0.01$), with an average of 4.57 among women and 4.29 among men.

4.3.3. I Air Dry Clothes, Not Using the Automatic Dryer

More than 60% of the students (60.1%) respond to the statement that they air-dry their laundry by choosing the option "always", indicating that they avoid the use of the tumble dryer. This indicates that students at Politehnica University of Timișoara showed a strong trend towards environmentally friendly and energy-efficient drying methods. A smaller percentage of students, 15.4%, adopt this practice "often". However, there is a significant segment of students who "rarely" (7%) or "never" (4%) resorted to natural laundry drying, which could signal a lack of adequate space or resources. In this context, we identified a significant difference in laundry behavior between students who lived on campus and those who do not. This discrepancy was evident from a t-score of 5.461 and a p-value of 0.000 ($p < 0.01$). Following the analysis of the average results obtained on a scale from 1 to 5 (where 1 represents a very low level of involvement, and 5 indicates a very high level), we found that students who do not live in UPT dormitories demonstrate greater responsibility regarding the drying process of clothes. The average for dorm residents is 4.01, while for those who live in the city, it is 4.40. As stated above, this result could be due to a lack of space or adequate resources for those who live on campus. We also identified significant gender differences, noting that women show a higher level of responsibility for energy consumption, preferring to air dry laundry more often than using the automatic tumble dryer ($t = -2.018$, $p = 0.044$ that is, $p < 0.01$, with an average value of 4.28 for women and 4.13 for men).

4.3.4. I Completely Turn off the Computer; I Do Not Leave It on Standby Mode

Most students (56.6% chose the "always" answer option) had a habit of completely turning off their computers when they were not using them. This is a positive indicator because turning off the computer completely saved energy. Another segment of the 15.7% of respondents indicated that they 'often' resort to this practice, which is also a positive sign. However, there is also a considerable number of students who leave computers on standby mode or do not turn them off at all. This group could benefit from more education and nudging to adopt more sustainable behaviors (13.4%—"sometimes", 9.8%—"rarely", 4.5%—"never").

4.3.5. I Replace Classic (Incandescent) Light Bulbs with Ones That Have Low Energy Consumption

The behavior of replacing traditional light bulbs with energy-efficient bulbs was observed among the study population. Specifically, 47.3% of Politehnica University of Timișoara students indicated that they "always" replace classic incandescent bulbs with ones that consume less energy, according to the statement, "I replace classic (incandescent) light bulbs with ones that have low energy consumption". This reflects the adoption of efficient practices to reduce energy consumption. A significant proportion of students,

21.6%, chose the "often" option for the same statement, which shows that this segment is also involved in energy-saving practices. On the other hand, there are students who either did not adopt this practice at all (7.2%—"never") or apply it "less often" (7.3%). These percentages indicate that there is room for improvement, and an increase in the adoption of these environmentally beneficial behaviors can be encountered should target methods be in use. In this situation, we found that there was a significant difference in the behavior of replacing incandescent bulbs with energy-efficient bulbs between on-campus students and off-campus ones. This difference was evidenced by a t-score of 2.853 and a p-value of 0.004 ($p < 0.01$). Analyzing the average results obtained on a scale of 1 to 5 (where 1 indicates a very low level of participation and 5 is a very high level), we found that students who do not live in UPT dormitories show greater responsibility in terms of replacing traditional bulbs with efficient ones. The average for on-campus residents was 3.83, while for off-campus students, it was 4.06.

4.3.6. I Turn off the Light When I Watch TV

We encountered a predominantly positive trend among students to turn off lights while watching television, with 46.4% of respondents stating that they "always" practice this behavior. However, there is still room for improvement and awareness of the benefits of this simple but effective action to reduce energy consumption. We notice that 15.6% of students do not consistently adopt this behavior, opting for the answer variant "sometimes", while a smaller percentage of students admit that they do not turn off the lights while watching TV (5.8%—"rarely" and 2.3%—"never"). When comparing on-campus students with the off-campus ones, we identified a significant difference between the two groups, as evidenced by a t-score of -2.365 and a p-value of 0.018 ($p < 0.01$). Analyzing the averages of the answers obtained on a scale from 1 to 5 (where 1 indicates a very low degree of behavior adoption and 5 is a very high degree), we notice that students in dormitories demonstrated a higher level of responsibility in this regard (the average for residents in dormitories was 4.20, while for off-campus students it was 4.05).

4.3.7. I Set the Temperature at 20–22 °C in the Cold Season and If It Seems Cold, I Wear Long Sleeves

More than a third of the students (35.1%) consistently opted for this behavior, showing a commitment to sustainable practices and an understanding of the need to reduce energy consumption. Approximately a quarter of students (24.8%) adopted this practice regularly, preferring to put on warmer clothes rather than to raise the temperature, helping to save energy. However, there is a significant percentage of students who did not follow this practice (15.2%—"never") or "rarely" do so (10.2%). Analyzing the data of on-campus students compared to off-campus ones, we find a significant difference between these two categories. This difference is underlined by a t-score of 4.716 and a p-value of 0.000 ($p < 0.01$). Examining the average of the answers obtained on a scale of 1 to 5, where 1 represents a very low degree of commitment, and 5 represents a very high degree, we notice that students in residing dormitories show a lower level of responsibility regarding setting the temperature of the heater at 20–22 °C in the cold season and choosing to wear a long-sleeved garment if they feel cool. The average response for on-campus students is 3.30, while for the off-campus ones, the average is 3.76. This situation can be justified by the fact that on-campus students do not have their own heating systems and, consequently, do not have the possibility to adjust the temperature in their living spaces.

4.3.8. In Winter, If It Is Too Hot in the Room, I Adjust the Temperature

Analyzing the responses to the statement, "In winter, if it is too hot in the room, I adjust the temperature", we notice that a significant percentage of students, 29.2%, say they "always" adjust the temperature when it is too hot in the room, thus demonstrating a conscious and responsible behavior towards energy consumption. This is a positive sign that indicates that these students are aware of their thermal comfort and are willing to

take steps to reduce their energy consumption. 19.5% of the students chose the "often" option, suggesting that they are involved enough in managing the temperature in their living space to ensure a comfortable and energy-efficient environment. A proportion of 17.1% of students "sometimes" adjusted the temperature. This group could benefit from more information and encouragement to adopt more sustainable practices consistently. A smaller segment of respondents chooses to adjust the temperature "rarely" (9.7%) or "never" (24.5%). These percentages indicate that there is a significant number of students who are not actively involved in the effective management of energy in their living space, either due to a lack of habit or a lack of awareness of the importance of this behavior.

4.3.9. I Put My Cell Phone on Power Saving Mode, So That It Does Not Need Often Charging

For the statement, "I put my cell phone on power saving mode, so it does not need often charging", the data collected reflects that a significant number of participants, 27.8%, say they always adopt this practice, indicating an awareness and active application of energy saving measures for their mobile devices. 14.8% of the respondents opt for the "often" variant, suggesting that some users are regularly engaged in energy-saving practices, although there is room for improvement. A close proportion, 17.7%, opted for the "sometimes" answer, indicating an inconsistency in adopting this energy-saving behavior. A smaller but still significant segment of participants reported that they "rarely" (16.4%) or "never" (23.3%) put their phone on power-saving mode. These percentages may suggest that there is a considerable group of users who are not aware of the benefits of this practice or who choose not to adopt it. In this case, we identified a statistically significant difference between the genders, noting that women adopt more responsible energy practices than men, especially when it comes to setting their mobile phone on energy-saving mode to reduce charging frequency. This difference is evident in the t-score of -5.893 and a p-value of 0.000 ($p < 0.01$), with averages of 3.36 for women and 2.80 for men.

4.3.10. I Choose to Buy Household Appliances That Have Low Energy Consumption

When analyzing data on the purchase of low-energy household appliances, we notice various trends among the respondents. A significant segment of participants, 26.8%, chose "always" for the statement, "I choose to buy household appliances that have low energy consumption", thus, showing a strong commitment to sustainable practices and reducing energy consumption. Another category, 23.1% of the total sample, responded that they adopt this practice "often", suggesting that there is significant awareness of the importance of choosing energy-efficient appliances. However, 22.5% of the respondents indicated that they adopted this practice "sometimes", which could indicate a lack of information or access to low-energy products. Interestingly, the percentages of those who answered "never" and "rarely" are equal, both being 13.8%. This shows that there is still a significant segment of people who are not yet fully engaged in purchasing energy-efficient appliances, indicating a clear opportunity for improvement and awareness raising in this direction.

4.3.11. I Unplug Electrical and Electronic Devices When I Do Not Use Them (They Consume Energy When They Are Off)

More than a quarter of the participants in the survey, 26.3%, chose the "always" option, indicating that they have consistently adopted this energy-efficient behavior. This group of students is aware of phantom energy consumption and takes steps to reduce this type of energy loss. 20.4% of the participants responded that they "often" disconnect their devices, suggesting that this practice is relatively well established, although there is room for improvement. 22.1% chose the "sometimes" option, indicating inconsistent behavior when disconnecting devices. This group could benefit from more information and encouragement to improve their behavior and reduce energy consumption. 16.8% responded "rarely" and 14.4% "never", indicating that these students are unaware of power consumption when devices are turned off or do not consider it important to adopt such behaviors. When comparing on-campus and off-campus students, we see a significant difference between

these two categories, illustrated by a t-score of −2.957 and a *p*-value of 0.003 ($p < 0.01$). Evaluating the averages of the answers obtained on a scale from 1 to 5, where 1 signifies a very low level of commitment and 5 is a very high one, we find that on-campus students show a higher degree of responsibility regarding the action of disconnecting electrical and electronic devices when they are not using them. The average response for on-campus students in dormitories was 3.40 and for off-campus students it was 3.15. Furthermore, we found significant gender differences, noting that women demonstrated a higher level of responsibility for energy consumption compared to men by unplugging electrical and electronic appliances when not in use (understanding that even when turned off, they consume energy). This was reflected in a t-score of −5.190 and a *p*-value of 0.000 ($p < 0.01$), with an average of 3.50 for women and 3.05 for men.

4.3.12. I Set the Air Conditioner to a Temperature Not Higher than 10 Degrees Lower than the Outside Temperature during the Summer Season

A significant 35% of students chose the "never" option, indicating that this practice is not very widespread among the studied population. This behavior can lead to higher energy consumption, as large temperature differences between indoors and outdoors require more energy to maintain the selected level of temperature comfort. In total, 12.1% of the respondents chose the "rarely" option, suggesting that there is a segment of students who adopt this practice but not regularly. Some 20.7% of the students chose the "sometimes" option, indicating an occasional adoption of this practice. This behavior shows that there is awareness of the importance of setting the air conditioning, but this is not yet a consistent practice. 16.9% of the respondents chose the variant "often", indicating that a significant number of students adopt this energy-saving practice on a regular basis. 15.4% of the students chose the 'always' option, showing a constant commitment to this sustainable practice. When comparing on-campus students with those living off-campus, we see a significant difference between these two groups, evidenced by a t-score of 2.977 and a *p*-value of 0.003 ($p < 0.01$). By analyzing the averages of the answers given on a scale of 1 to 5, where 1 indicates a very low level of engagement and 5 is a very high level, we find that off-campus students show a greater level of responsibility about setting the air conditioning to a temperature no more than 10 degrees lower than the outside temperature during the summer season. The average response for off-campus students was 2.81, while for the on-campus ones, it was 2.48.

4.3.13. I Check the Number of Life Hours on the Light Bulb Packages before Buying Them

A significant percentage of students, 40.5%, indicated that they never checked the number of hours of operation on the packaging of light bulbs before purchasing them. This suggests that there was a lack of awareness or interest in the life of the bulb, an important aspect of saving energy and choosing sustainable products. Another 18.6% of the respondents chose the "rarely" option, indicating that they only occasionally consider this aspect when purchasing light bulbs. Together with those who answered "never", these percentages show that there was a significant opportunity for education and awareness raising among students about the importance of checking the life of light bulbs for better resource management and reduction of energy consumption. The "sometimes" option was selected by 16% of students, indicating that there is some awareness of the issue, but this is not consistently applied. The categories "often" and "always", with percentages of 11.9% and 12.9%, respectively, reflect a group of students who are more attentive and aware of the useful life of light bulbs, therefore adopting a more responsible and sustainable behavior when choosing their products.

4.3.14. I Leave the TV on Even If I Do Not Watch It

A significant percentage of students, nearly 38%, say they "never" left the TV on when they were not watching it. This indicated a high level of awareness of the importance of energy saving and environmentally responsible behavior. More than a quarter of students

(26.1%) indicated that they only leave the television on in their absence "rarely". Although this behavior is uncommon, there is still room for improvement and awareness of the impact of this habit on energy expenditure. More than 21% of the respondents admit that they "sometimes" leave the television on when they are not watching it. This behavior indicates that there are opportunities for education and awareness to encourage more energy-efficient practices. A lower percentage of study subjects, almost 11%, "often" left the TV on in their absence, and 4% indicated that they "always" left the TV on even when they were not watching it. This behavior was the least energy efficient and shows a lack of awareness of the impact this habit can have on energy resources.

The findings are useful primarily to the university leaders and administrative staff, to improve energy management in the residential buildings, either as stand-alone initiatives or in a future effort to launch greening campus processes and/or sustainability-led initiatives [29,56]. However, influencing student behaviors towards more sustainable practices has the potential to positively influence not only the university's finances and use of resources but also on society as a whole, which encourages environmental citizenship and sustainable lifestyles [12,24,25,41].

4.4. Tentative Profile of the Romanian Student

The overall findings lead to the idea that students at Politehnica University of Timisoara are reasonably interested in energy-related behaviors and fall in the category of low energy consumers. The monitoring of electrical meters offered a data-based image of energy consumption and allowed for calculations that placed students residing on campus in a category of reasonable use, below the average registered for private home consumption. However, the sociological survey granulated the data. A closer analysis of the responses offered by the respondents highlights the fact that the student body is nonlinear and nonhomogeneous [21]. A distinctive part can be categorized as "electrically savvy", in the sense that students in this group interact knowledgeably with the available electrical devices and utilities, spare resources, adapt as much as possible to environmental conditions by choosing to use natural light as much as possible, air-dry clothes, wear warmer clothes when feeling cold and adjusting temperature if it is too hot in the room. Around 30–40% of the students fall into this category, although for some of the energy-saving behaviors, the numbers are even more promising, for instance, more than 60% of the respondents are careful to turn off the lights when leaving a room and turn off completely electric and electronic equipment when not in use. At the other end of the spectrum, there are the indifferent students who do not seem concerned about environmental issues or energy-wasting behaviors. Again, even in this group, there are variations between 11% and 30% in the display of behaviors, such as leaving the TV on irrespective of whether they are watching it or not, or letting the computers run continuously. Inconsistent students, forming the middle group, adopted behaviors depending on the situation and the availability of choices, being the most susceptible to responding to educational interventions towards energy-saving solutions. Their responses indicate valuable information that can be used for tailored educational interventions. The three objectives pursued by the research open the possibility to imagine that campus greening, for instance, on sustainability-led initiatives, can be planned and launched as participatory processes, involving students as major stakeholders whose beliefs and behaviors can be properly addressed at the level of the investigated university [22,23].

5. Conclusions

The presented results show that students at the Politehnica University of Timisoara have a high general level of awareness and display responsible energy-saving behaviors. Positive trends are evident in behaviors such as turning off lights when leaving a room, preferring natural light, and turning off computers completely when not in use. Similar commitments are evident in the habit of purchasing energy-efficient light bulbs and low-energy household appliances, as well as in practices such as air-drying clothes and un-

plugging electrical and electronic devices when not in use. The results indicate significant differences between the behavior of on-campus students and those living off-campus, with the former generally showing a higher level of responsibility in terms of saving energy. Consumption habits are also gendered in the sense that women tend to acknowledge a higher level of responsibility for energy consumption than their male colleagues. The results also indicate actionable practices, where educational and persuasive measures can lead to an improved level of sustainability-oriented actions. For example, a considerable percentage of students do not adjust the indoor temperature by regulating the thermostat or the setting of the air conditioning and do not verify the lighting life on the packaging of light bulbs before purchasing. Therefore, it is essential to incorporate educational strategies and awareness-raising activities to develop and consolidate responsible energy-saving practices in students, along with providing resources and facilities to support these behaviors on- and off-campus. Such goals can be achieved by developing and implementing education programs to raise students' awareness of the benefits of energy saving and the impact of their behaviors on the environment. Besides developing a data-based strategy to enhance new knowledge among students regarding their energy use, and engage them through persuasive techniques to adopt sustainable behaviors, the university administration should also investigate energy management practices and provide, for instance, regulators for the heating systems, to improve students' possibilities to engage in energy-saving behaviors. The tentative student profile, proposed by the research findings, can serve as a starting point for tailoring appropriate information and awareness-raising campaigns to sustain the university community in pursuing sustainability goals, among which energy saving plays an important part. Such campaigns can lead to the improvement of energy management in the university setting but also can prepare students for a future autonomous life as citizens ready to adopt and implement sustainability principles in their professional and personal lives. As Amaral et al. warn [56], the scientific literature does not fully grasp why sustainability on campus is "so hard to achieve, set goals are still difficult to materialize, and some actions commonly perceived as good practices reveal to be unsuccessful". To secure that a major stakeholder, the student body, is engaged in the transformational process leading to a sustainable campus data obtained in this research should be placed at the foundation, and backcasting sustainability can be planned [12].

6. Limits and Further Directions

The present study gathered valuable electricity consumption data from the monitoring of energy consumption in student dormitories and from a survey applied to students at the Politehnica University of Timisoara, Romania. However, the authors of this study acknowledge that while the findings are interesting and useful for immediate use in developing sustainability strategies at the Romanian university level, additional research needs to be undertaken for the assessment of existing and new policies based on empirical evidence collected in this project, for an ex-ante and ex-post evaluation of persuasive campaigns on the student population, for a closer look into the factors determining the variations in the energy consumption among the campus buildings. Another important limitation is representativeness. The study focuses on students from a single university, which may limit the applicability and generalization of results to other contexts or demographic groups. Student behaviors and preferences can vary significantly by region, culture, and socioeconomic conditions. Another aspect worth mentioning is the dependence on self-reporting of energy consumption by the building administration, which can introduce errors or inaccuracies in consumption data. Therefore, the results must be interpreted with caution, bearing in mind these limitations. Future studies could seek to address these issues through more diversified data collection methods and by extending research to more higher education institutions. While lessons drawn from this research contribute to the literature on university life and strategic choices, a long-term verification of results can add to global knowledge on the contribution of higher education to the pursuit of sustainability goals.

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