



Energy Efficiency and the Link with Society



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Abstract

The results obtained in the linking process are shown with society as one of the substantive activities, in the period 2021-2022 carried out by students of the Electrical Engineering career. The project encouraged students to train a group of people through practical methodologies to have minimum knowledge related to energy efficiency and renewable energy sources. The qualitative and quantitative method was used, which allowed describing the results of the survey without altering their respective variables. The population was made up of 45 people belonging to various cantons of the province of Manabí, such as Flavio Alfaro, Bahía de Caráquez, el Carmen, 24 de Mayo, Chone, Santa Ana, Rocafuerte and different places in the canton of Portoviejo, and province of Orellana, which were selected at random, the preparation of the didactic material was carried out. Among the results, it was highlighted that the participants did not know how energy can help the environment, but nevertheless, they were aware that energy is related to the environment and dependence on society. The result was that the students were able to bring the knowledge acquired in the teaching process to society, in addition to being able to compare how they behaved before and after the link.

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1 Introduction

Among the substantive activities of the university are teaching, research, and community outreach, the latter being an issue that contributes to transforming society's way of thinking about issues that are imperative in social processes, economic and environmental (Rodríguez et al., 2019). The purpose of this work is to present the processes that were carried out to train a group of people from some cantons of the province of Manabí, in which issues such as energy efficiency, the use of renewable energy, and the associated environmental impacts were addressed. The participating subjects were students of the electricity career.

In the first place, a group of people who lived near the community where the students who carried out the research lived was contacted, they were gathered in an establishment where the reason for the training was detailed, where it was explained that the objective was the strengthening of the knowledge acquired by the students in the teaching processes to transmit them to society. This process lasted two hours, distributed one hour per day. For the beginning of the linking process, the issue of energy efficiency was addressed, defined by some authors as the ratio between the energy needed to develop a specific activity and the amount of primary energy used for the process (Sánchez & Fuquen, 2014).

Energy efficiency is commemorated every March 5, the world day of this concept that emerged on an emblematic day, "at the international conference on Energy Efficiency, it was developed for the first time in 1998 in Austria, as a measure against the possibility of a depletion of fossil energy sources in the short term" (Ministry of the Environment, Water and Ecological Transition, 2022). If we consider this issue of energy efficiency, it can be considered as a commitment to protect natural resources, carry out efficient and rational consumption of energy through specific activities that impact daily life, such as controlling the use of energy without sacrificing daily activities" (Industry of Heat Exchangers – Inditer, 2020).

Energy, like water, are an essential element in improving the quality of life, the dependence of current society on electrical energy leads to greater consumption, the consequences of which affect not only the environment, but also health (Díaz et al., 2008), by consuming the non-renewable energy resource (coal, gas, oil, or uranium), although if it were generated with renewable energy sources, this decreases (Rey et al., 2018). Electricity helps improve the quality of life, where many tasks are performed by electrical devices (Díaz et al., 2008). In addition, the influence of energy use on environmental, economic, and social aspects has resulted in the creation of an international standard in Energy Management Systems_ SGE, ISO 50001 plan, do, verify, and act (Rey et al., 2018).

Energy efficiency measures have increased worldwide, and many countries are making a transition to renewable energy sources, this has exceeded all expectations, it has been increasing steadily, as has energy consumption. (United Nations, 2016). Fossil fuels for energy generation, despite the fact that there are still countries with great resources such as Russia, Mexico, and Venezuela, among others, the future is inexhaustible clean sources on a human scale, this would help to transition to a sustainable planet (Technological Institute of Petroleum and Energy (ITPE), 2020), considering that the energy resources available to humanity come directly or indirectly from the sun (Vivanco, 2020).

Renewable energy sources are mostly of solar origin, they are resources that are renewed through natural processes at a rate equal to or greater than their rate of use, this allows obtaining continuous or repetitive flows of energy that are produced in the natural environment and It includes low-carbon technologies, such as solar, hydroelectric, wind, tidal and ocean thermal energy, as well as renewable fuels such as biomass (Inter-American Institute for Cooperation on Agriculture (IICA), 2015)

Global warming, in addition to causing the melting of glaciers and the rise in sea level, causes other climatic changes such as desertification and the increase in extreme phenomena such as hurricanes, floods, and fires: the alteration of the climate could cause incalculable damage. For this, it is necessary to implement the main tool which is the energy transition. That is, to change from an energy system based on fossil fuels to one with low or no carbon emissions, based on renewable sources. Awareness of climate change has led governments and international institutions to generate the incorporation of new energies of the renewable origin or clean energies.

2 Materials and Methods

The main tool used in the linkage project with society was motivation, allowing knowledge to be provided on a topic in the social environment through the linkage process. Learning and self-learning can lead the student to a social

structure where people are selected for training. Here the student transmits what has been learned in this sense, new knowledge related to renewable energy sources and energy efficiency was implemented. The qualitative and quantitative method was applied, the structure of the survey was based on a questionnaire with closed questions, the design was non-experimental. In the training, use was made of technological resources such as the internet, laptop, projector, cell phone and other materials such as books, which were of great help to provide better information and understanding to citizens.

3 Results and Discussions

The process of linking with society involved a group of students distributed in different cities of the province of Manabí and Orellana, all belonging to the electricity career of the Faculty of Mathematical, Physical and Chemical Sciences (FCMFQ) for the period 2021-2022. In the training there were several participants such as teachers, university students, and the study population, allowing to carry out the linkage program for the well-being of the population, promoting the advances that exist in renewable energies, energy efficiency, and the benefit that it has. in the territory to improve the quality of life of the inhabitants of a community (Akella et al., 2009; Ramos et al., 2018; Santosa & Yusuf, 2017).

With respect to the study population, it was made up of several cantons in the province of Manabí, such as Flavio Alfaro, Bahía de Caráquez, El Carmen, 24 de Mayo, Chone, Rocafuerte, and different sites in the Portoviejo canton, which were selected based on a non-probabilistic convenience sampling, which consisted of choosing forty-five (45) people who were willing and interested in receiving the training. In the training, use was made of technological resources such as the internet, laptop, projector, cell phone, and other materials such as books, which were of great help to provide better information and understanding to citizens.

Linking with society is a process that has been carried out for several years as one of the substantive activities of the academy, where students transmit the knowledge they acquire in the classroom to the people of the communities and it is a way of training Ciudadanos is a direct university-society form, as a substantive process of shared responsibility that reaffirms a basic principle of higher education (Barreno Salinas et al., 2018). It is good to mean that the training was virtual because it was in the pandemic stages. Figure 1 shows some representations of the students teaching their relationship with society.



Figure 1. Some presentations of the students in the connection

As you can see, each student presents their training in a personalized way according to the person they train, promoting their style as future professionals. To meet the proposed objective, a methodology was prepared which allowed the students to prepare a program designed to develop the training of the people in charge. Figure 2 shows the steps that were followed for the linking process.

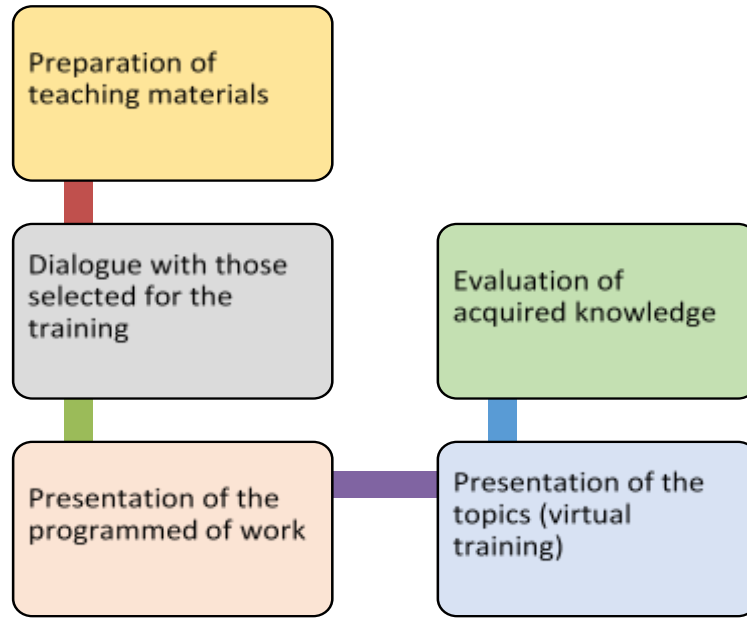


Figure 2. Methodology for the process of linking with society

The figure details the stages to comply with the linking activity, here planning, execution, and evaluation are involved. The appropriate material was prepared for the respective training so that the participants acquired knowledge in an easy and enjoyable way from the experiences and teaching shown by the students who took the training (Herring, 2006; Koroneos et al., 2003; Panwar et al., 2011). From the organization of the race, nine students were responsible for training the 45 people of the community, fully complying with the steps established in the activities of the linking program, each student selected the areas and people who received the preparation in cantons such as Bahía de Caráquez, Portoviejo, el Carmen, Flavio Alfaro, Rocafuerte, Santa Ana, 24 de Mayo, Chone and Orellana Province. Next, Figure 3 will present the number of presentations for the respective training carried out by each of the members of the linkage project.

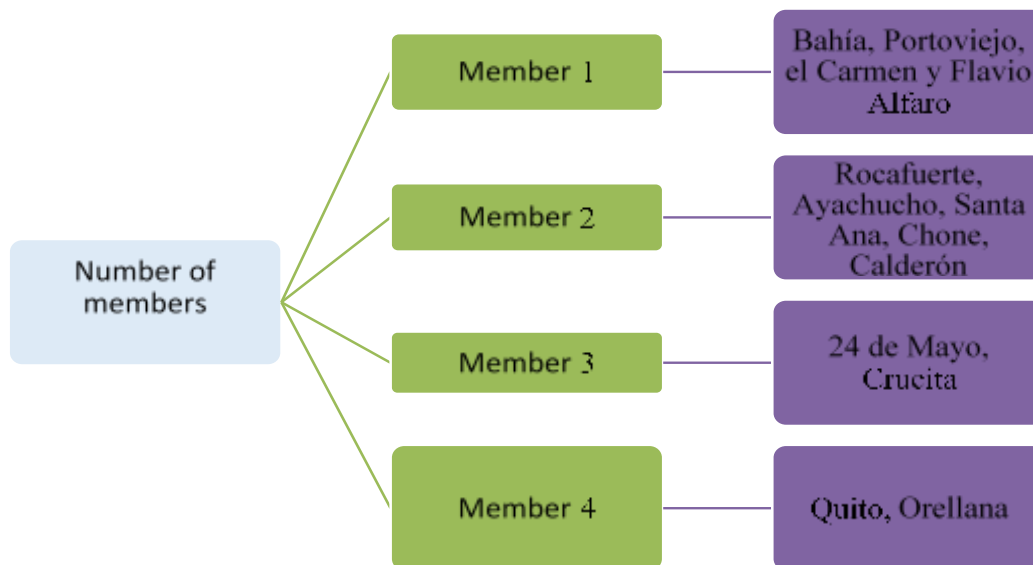


Figure 3. Number of people by canton who received the linkage

More than eleven cantons and three provinces, this shows how it is possible to work in the diversity of regions showing knowledge acquired by students in the subject that allows local development, based on the improvement of energy efficiency. The survey questionnaire addressed indicators about the importance of saving energy and its benefit to the environment, which was made known to the participants who were unaware of how energy can favor the environment, but nevertheless were aware that This is related to the environment where they live and develop (Geller et al., 2004; Ghaffour et al., 2014; Zografakis et al., 2008). To have a comparison of the knowledge acquired by the trained personnel, a survey was carried out at the beginning of the program and the same survey was repeated at the end of the training, obtaining as a result what is shown in figure 4.

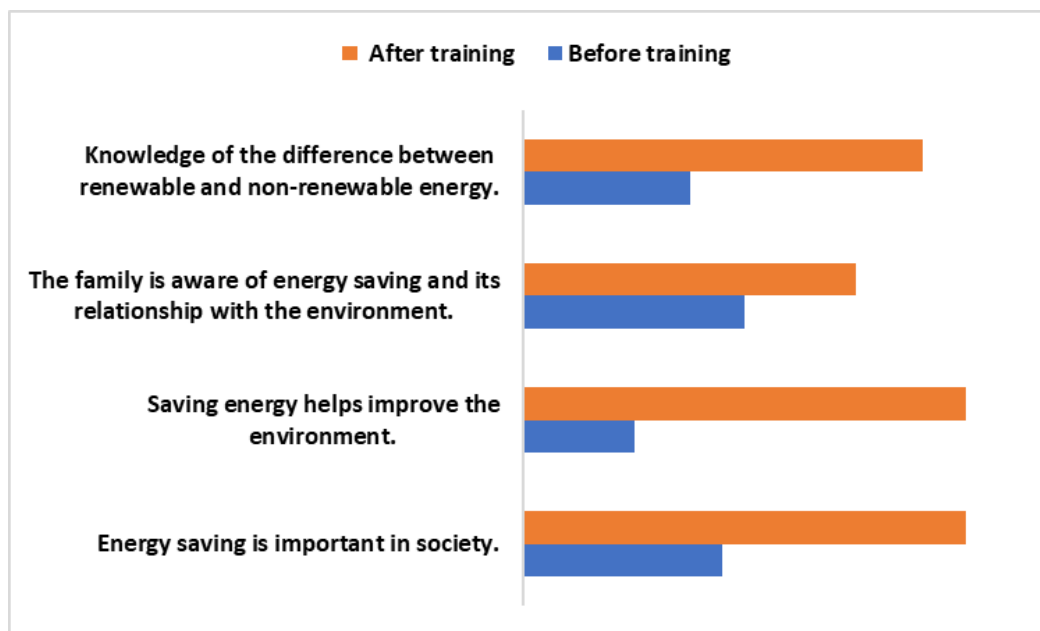


Figure 4. Results before and after the survey

As can be seen in figure 4 with respect to the survey carried out before the training, it is observed that most of the study population did not know the difference between renewable and non-renewable energy. They also insisted that family members were not completely clear about the benefits of saving energy in relation to the environment, and other issues such as the importance of saving energy in society. Through this diagnosis, it was possible to identify the figures of the people who knew and were unaware of any element that involves renewable energy sources, which made it easier for the members of this project to capture the issues to expose and explain to society.

With this, the fulfillment of the first objective related to the proposal of the types of renewable energies that exist and that can be developed locally if there is potential was obtained. Among the aspects mentioned in the training, topics on the difference between renewable and non-renewable energies stand out, in addition to the elements that make them up, where it was diagnosed that the majority of the trained population knew the difference, although it should be noted that there were small Doubts about renewable energies (which do not run out) and non-renewable energies (which run out), because there was confusion where the study population mentioned that renewable energies are not renewed and non-renewable energies regenerate quickly, an aspect that is not the case because renewable energy, as its name indicates, in a relatively short time and non-renewable energy involves a much slower regeneration. Emphasis was also placed on the benefits of energy-saving, where the respondents reported that energy saving helps reduce bill costs, environmental impact, and global warming, having less energy dependence on other countries (Lo, 2014; Oró et al., 2015; Garrett-Peltier, 2017).

Through the result of the survey, after the training, it was revealed that the people selected for this project to link with society successfully managed to acquire the necessary knowledge about renewable energies, although there was a small percentage that did not. fully master this subject. It was possible to transmit by the students the knowledge acquired in the teaching process to different people who were dispersed by different cantons of the province of Manabí and Orellana, fulfilling the processes and objectives proposed in the project. Currently, the link helps to bring to society the results of scientists and professionals who continue to investigate and investigate how they could improve

renewable energy sources because in the future it will be an essential source to achieve sustainability in life on the planet. where the human being and the quality of life are present as essential entities, which would avoid extinction itself. That is why, for the improvement of natural energy resources, it should be taken into consideration to maintain the linking processes in such a way that new ideas are developed from society.

4 Conclusion

At the provincial level, it was possible to contact 45 people, but it was discovered that these people lacked knowledge about efficiency and renewable energy sources, however, with the training provided online, knowledge about the information on the subject of study was improved because an exhaustive explanation was made related to the proposed topic, the types of existing energies, their advantages, and disadvantages that they present, in addition, the technological alternatives available for the use of this electrical energy were emphasized. It was possible to train people who were in other provinces, demonstrating that it is not only the radius of action of the province of Manabí, that the Technical University affects the linking processes in other regions such as the mountains and the Amazon.

Conflict of interest statement

The authors declared that they have no competing interests.

Statement of authorship

The authors have a responsibility for the conception and design of the study. The authors have approved the final article.

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References

- Akella, A. K., Saini, R. P., & Sharma, M. P. (2009). Social, economical and environmental impacts of renewable energy systems. *Renewable Energy*, 34(2), 390-396. <https://doi.org/10.1016/j.renene.2008.05.002>
- Barreno Salinas, M., Barreno Salinas, Z., & Olmedo Valencia, A. C. (2018). Higher Education And Its Relationship With Society: Essential References For A Change. *REVISTA UNIVERSIDAD Y SOCIEDAD*, 10(3), 40-45.
- Díaz, M., Schallenberg, J., & Hernández, C. (2008). Renewable energy. *Instituto Tecnológico de Canarias, SA* Retrieved from <https://www.cienciacanaria.es/files/Libro-de-energias-renovables-y-egencia-energetica.pdf>
- Garrett-Peltier, H. (2017). Green versus brown: Comparing the employment impacts of energy efficiency, renewable energy, and fossil fuels using an input-output model. *Economic Modelling*, 61, 439-447. <https://doi.org/10.1016/j.econmod.2016.11.012>
- Geller, H., Schaeffer, R., Szklo, A., & Tolmasquim, M. (2004). Policies for advancing energy efficiency and renewable energy use in Brazil. *Energy Policy*, 32(12), 1437-1450. [https://doi.org/10.1016/S0301-4215\(03\)00122-8](https://doi.org/10.1016/S0301-4215(03)00122-8)
- Ghaffour, N., Lattemann, S., Missimer, T., Ng, K. C., Sinha, S., & Amy, G. (2014). Renewable energy-driven innovative energy-efficient desalination technologies. *Applied Energy*, 136, 1155-1165. <https://doi.org/10.1016/j.apenergy.2014.03.033>
- Herring, H. (2006). Energy efficiency—a critical view. *Energy*, 31(1), 10-20. <https://doi.org/10.1016/j.energy.2004.04.055>
- Koroneos, C., Spachos, T., & Moussiopoulos, N. (2003). Exergy analysis of renewable energy sources. *Renewable energy*, 28(2), 295-310. [https://doi.org/10.1016/S0960-1481\(01\)00125-2](https://doi.org/10.1016/S0960-1481(01)00125-2)
- Lo, K. (2014). A critical review of China's rapidly developing renewable energy and energy efficiency policies. *Renewable and Sustainable Energy Reviews*, 29, 508-516. <https://doi.org/10.1016/j.rser.2013.09.006>
- Oró, E., Depoorter, V., Garcia, A., & Salom, J. (2015). Energy efficiency and renewable energy integration in data centres. Strategies and modelling review. *Renewable and Sustainable Energy Reviews*, 42, 429-445. <https://doi.org/10.1016/j.rser.2014.10.035>
- Panwar, N. L., Kaushik, S. C., & Kothari, S. (2011). Role of renewable energy sources in environmental protection: A review. *Renewable and sustainable energy reviews*, 15(3), 1513-1524. <https://doi.org/10.1016/j.rser.2010.11.037>
- Ramos, J. L. M., Pérez, A. V., Gámez, M. R., & Zambrano, R. V. H. (2018). Renewable energy sources on the change of energy matrix in Manabí province. *International research journal of engineering, IT & scientific research*, 4(4), 17-29.
- Rey, J., Velasco, E., & Hernández, J. (2018). *ISO 50001 Energy Management System*. Spain: Ediciones Paraninfo SA
- Rodríguez, M., Vázquez, A., & Cuenca, LA (2019). University work as a guarantee of sustainable development. Practical experiences. *Educare*, 23(2), 56-76. Retrieved from <http://www.revistas.upel.edu.ve/index.php/educare/article/view/8061>
- Sánchez, C., & Fuquen, H. (2014). Energy efficiency. *Colombian Innovation Company - Colinnovacion*. Obtained from file:///C:/Users/59396/AppData/Local/Temp/Articulo-EFICIENCIA-Edicion-3-Volumen-1.pdf
- Santosa, I. G., & Yusuf, M. (2017). The application of a dryer solar energy hybrid to decrease workload and increase dodol production in Bali. *International Research Journal of Engineering, IT and Scientific Research*, 3(6), 99-106.
- Vivanco, E. (2020). Renewable and non-renewable energies. *Library of the National Congress of Chile*.
- Zografakis, N., Menegaki, A. N., & Tsagarakis, K. P. (2008). Effective education for energy efficiency. *Energy Policy*, 36(8), 3226-3232. <https://doi.org/10.1016/j.enpol.2008.04.021>