South American Publishing

SAP Multidisciplinary Open. 2025; 3:24
doi: 10.62486/mo202524

ORIGINAL

Self-sustaining energy as an alternative to power outages in the Pueblo Unido sector in 2024

Energía autosustentable como alternativa a los cortes de energía eléctrica en el sector de Pueblo Unido en el año 2024

Yilena Montero Reyes[1] ✉, Anthony Villacis[1], Yandri Garces[1], Roberth Loachamin[1]

[1]Universidad de las Fuerzas Armadas. Ecuador.

Cite as
Montero Reyes Y, Villacis A, Garces Y, Loachamin R. Self-sustaining energy as an alternative to power outages in the Pueblo Unido sector in 2024. SAP Multidisciplinary Open. 2025; 3:24. https://doi.org/10.62486/mo202524

Publication History
Submitted: 01-03-2024
Revised: 06-06-2024
Accepted: 25-10-2024
Published: 01-01-2025

Corresponding Author
Yilena Montero Reyes ✉

ABSTRACT

Introduction: power outages are a common problem in many parts of the world due to various reasons, it is important to consider self-sustaining energy as a viable alternative.
Objective: to determine the knowledge in the Pueblo Unido sector about self-sustaining energy as an alternative to power outages.
Method: an observational, descriptive, and cross-sectional study was conducted to assess knowledge related to self-sustaining energy as an alternative to power outages in the Pueblo Unido sector in 2024.
Results: 52,1 % are female, 43,8 % have power outages every month, 60,4 % usually have power outages for one hour, 52,1 % have problems with delays in household and work activities during the year, 54,2 % have ever considered installing self-sustaining energy systems, 87,5 % believe that the implementation of self-sustaining energy could reduce the frequency of power outages.
Conclusions: the potential of self-sustaining energy systems based on motor and bicycle generators to address the challenges related to power outages is highlighted, while promoting sustainability, resilience, and community well-being.

Keywords: Self-sustaining Energy; Power Outages; Mechanical Energy; Electrical Energy; Power Generator.

RESUMEN

Introducción: los cortes de energía eléctrica son un problema común en muchas partes del mundo debido a diversas razones, es importante considerar la energía autosustentable como una alternativa viable.
Objetivo: determinar los conocimientos en el sector de Pueblo Unido sobre energía autosustentable como alternativa para los cortes de electricidad.
Método: se realizó un estudio observacional, descriptivo y trasversal para evaluar conocimientos relacionados con la energía autosustentable como alternativa para los cortes de energía eléctrica en el sector de Pueblo Unido en el año 2024.
Resultados: el 52,1 % son del género femenino, el 43,8 % presentan cada mes los cortes de energía, el 60,4 % suele tener los cortes de energía durante una hora, el 52,1 % presentan afectaciones en lo que se refiere a retrasos en las actividades del hogar y laborales durante, el 54,2 % si ha considerado alguna vez instalar sistemas de energía autosustentable, el 87,5 % cree que la implementación de energía autosustentable podría reducir la frecuencia de los cortes de energía eléctrica.
Conclusiones: se resalta el potencial de los sistemas de energía autosustentable basados en generadores de motor y bicicleta para abordar los desafíos relacionados con los cortes de energía eléctrica, al tiempo que promueven la sostenibilidad, la resiliencia y el bienestar comunitario.

Palabras clave: Energía Autosustentable; Cortes de Energía Eléctrica; Energía Mecánica; Energía Eléctrica; Generador de Energía.

© 2025; The Authors. This Open access article is distributed under the Creative Commons Attribution 4.0 license (https://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Power outages are a common problem in many parts of the world due to various reasons, such as extreme weather conditions, electrical infrastructure failures, or excessive demand, which can have serious consequences, such as the interruption of medical services, the paralysis of industrial and agricultural production, among others. Having self-sustaining energy systems can mitigate the impact of these outages by providing an alternative and continuous energy source.[1]

Currently, the issue of self-sustaining energy is highly relevant, as there are various problems caused by excessive electricity use, and it contributes to reducing greenhouse gas emissions and mitigating climate change. Using energy generated by human movement, like a bicycle connected to a generator, is a way to harness clean and renewable energy.[2]

Several authors agree that with the haste and determination to achieve profits only as demanded by economic models, two elements that are interrelated with the economy have been neglected: society and the environment. This is why the overexploitation of resources has failed to respect this generation and to consider and reflect on tomorrow's generations, generating socio-environmental conflicts.[3,4,5,6,7]

It is, therefore, essential to consider self-sustainable energy as a viable alternative to mitigate the risks of power outages. Self-sustainable energy is the ability to produce energy independently and sustainably using renewable energy sources such as solar, wind, and hydraulic energy, among others. In addition to reducing dependence on fossil fuels, self-sustainable energy reduces greenhouse gas emissions, promoting a healthier environment.

Current technological advances and growing awareness of the importance of environmental sustainability have driven the development of innovative projects in self-sustainable energy. These advances undoubtedly promise to contribute positively to the care of the planet shortly. In this context, using a power generator powered by a treadmill motor as part of energy generation systems has become a viable option and solution for regions currently lacking access to electricity.[8]

Developing self-sustainable energy systems can provide a reliable and continuous energy source, reducing dependence on the traditional power grid and increasing resilience to power outages. Generating energy from renewable and self-sustaining sources, such as mechanical energy harnessed by direct current motors, is essential for reducing greenhouse gas emissions and mitigating climate change. Researching and developing direct current motor-based systems encourages the adoption of more sustainable and environmentally friendly practices.[9]

The need for policies and programs that promote the adoption of self-sustainable energy and address identified barriers is highlighted. Furthermore, successfully implementing these technologies could improve energy resilience and enhance residents' quality of life in the Pueblo Unido sector.

Based on the above, this article aims to determine the level of knowledge in the Pueblo Unido sector about self-sustainable energy as an alternative to power outages.

METHOD

An observational, descriptive, cross-sectional study was conducted in 2024 to assess knowledge related to self-sustainable energy as an alternative to power outages in the Pueblo Unido sector.

There are approximately 10 102 people in the Pueblo Unido neighborhood in the city of Quito. Of these, 50 families were surveyed about the self-sustainable energy project as an alternative to power outages, thus constituting the study sample.

The survey is a research technique used to collect data from a representative population sample to understand attitudes, opinions, behaviors, or specific characteristics of interest.

RESULTS

The survey conducted in the Pueblo Unido neighborhood of Quito on the self-sustainable energy project as an alternative to power outages in the Pueblo Unido sector in 2024 shows that 52,1 % of respondents were female and 47,9 % were male, concluding that females completed the majority of the survey. Of the total sample, 43,8 % experience power outages every month, 25 % almost never experience power outages, 12,5 % experience power outages once a week, and 18,8 % experience occasional power outages. In conclusion, the Pueblo Unido neighborhood experiences power outages every month.

Figure 1 shows that 60,4 % usually experience power cuts for one hour, while 33,3 % usually experience power cuts for five hours.

It can be seen that 52,1 % report problems related to delays in household and work activities during power outages, 43,8 % report problems such as damage to electrical appliances, and 4,2 % experience stress or anxiety during power outages. In conclusion, power outages cause household and work activities delays for people in the neighborhood. In addition, 47,9 % are unfamiliar with self-sustaining energy sources such as solar or wind power, 37,5 % are unfamiliar with self-sustaining energy sources such as solar or wind power, and 14,6 % are familiar with self-sustaining energy sources such as solar or wind power. In conclusion, the neighborhood is unfamiliar with self-sustainable energy sources such as solar or wind power. Figure 2 shows that 54,2 % have considered installing self-sustainable energy systems in their homes.

50 % believe that the main obstacle to adopting self-sustainable energy technologies in the sector is insufficient economic resources. In comparison, 33,3 % believe that a lack of knowledge about self-sustainable energy generation prevents them from embracing this new technology in the sector, and 16,7 % believe that the climatic conditions in the industry are preventing them from adopting self-sustainable energy. In conclusion, this sector does not adopt self-sustainable energy technology due to insufficient budget. In addition, 43,8 % agree to invest in self-sustainable energy systems for their homes, 20,8 % are neutral about investing in self-sustainable energy systems for their homes, 20,8 % strongly agree to invest in self-sustainable energy systems for their homes,

12,5 % disagree to invest in self-sustainable energy systems for their homes, and 2,1 % strongly disagree to invest in self-sustainable energy systems for their homes. Figure 3 shows that 87,5 % believe that the implementation of self-sustainable energy could reduce the frequency of power outages in the area.

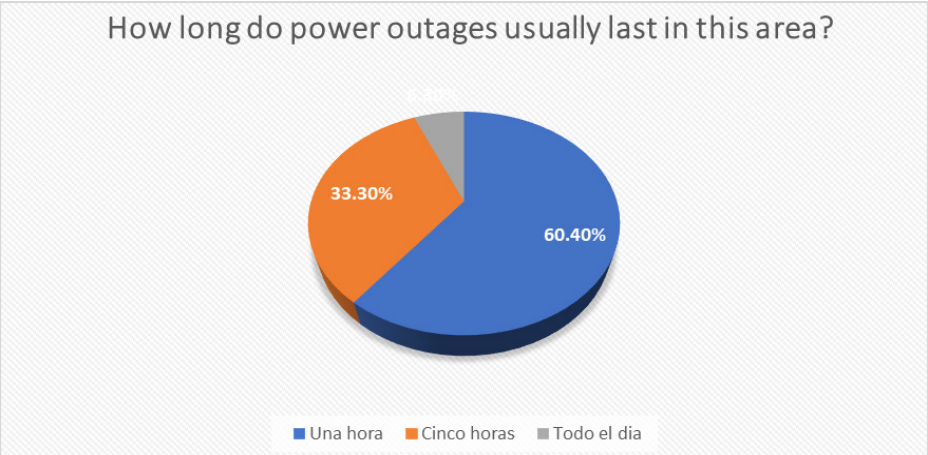


Figure 1. Distribution according to the duration of power cuts in each area

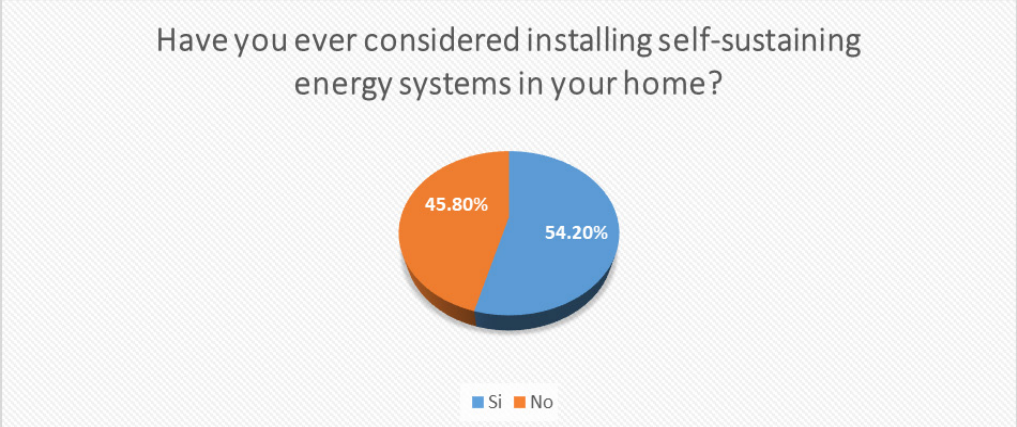


Figure 2. Distribution according to whether they have ever considered installing self-sustainable energy systems in their homes

31,3 % strongly agree that adopting self-sustainable energy could benefit the community economically, 60,4 % agree that adopting self-sustainable energy could benefit the community economically, 4,2 % disagree that adopting self-sustainable energy could benefit the community economically, and 4,2 % strongly disagree that adopting self-sustainable energy could benefit the community economically. It can be seen that 85,4 % would like to receive information about financing programs for the installation of self-sustainable energy systems, while 14,6 % would not like to receive information about financing programs for the installation of self-sustainable energy systems. Figure 4 shows that 52,1 % agree that education and awareness are key to promoting the adoption of self-sustainable energy in the community.

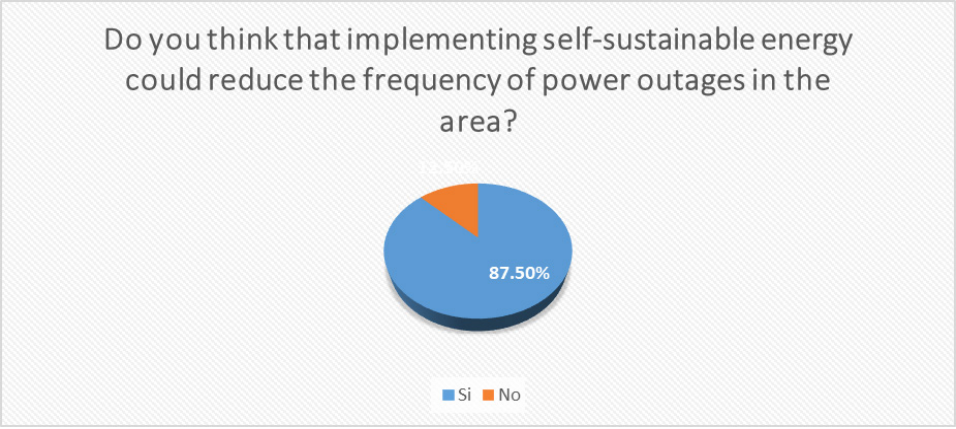


Figure 3. Distribution according to whether self-sustainable energy implementation could reduce the frequency of power outages in the area

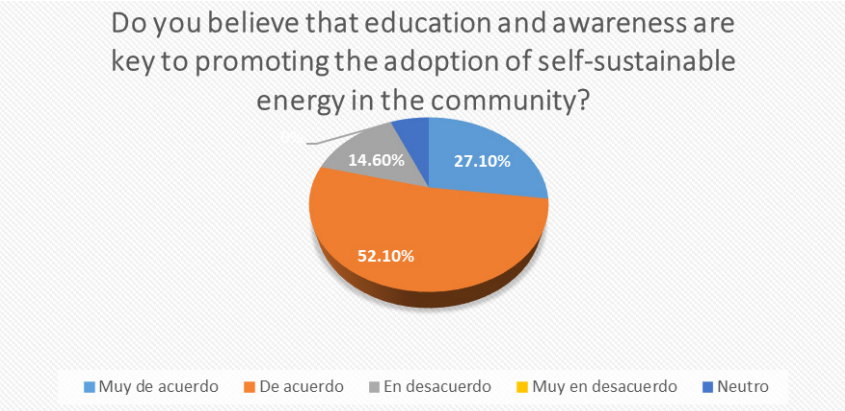


Figure 4. Distribution according to whether education and awareness are considered key to promoting the adoption of self-sustainable energy in the community

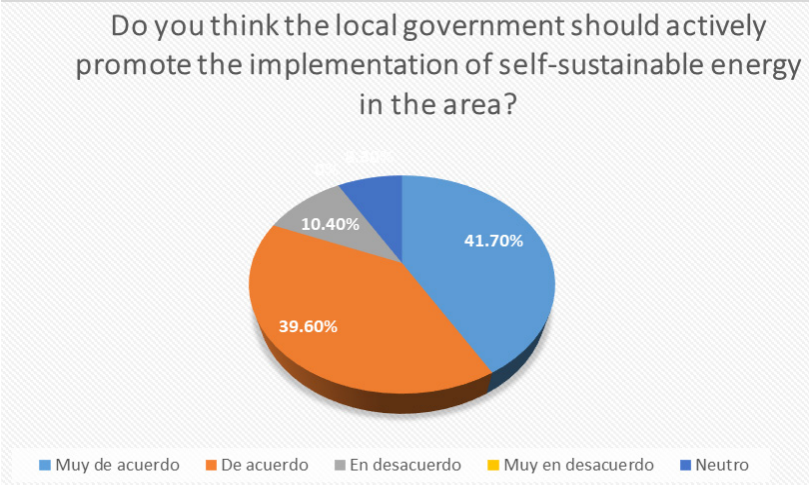


Figure 5. Distribution according to whether the local government should actively promote the implementation of self-sustainable energy in the area

29,20 % are aware of projects or initiatives related to self-sustainable energy in the sector. In comparison, 70,80 % are unaware of any projects or initiatives related to self-sustainable energy in the industry. Furthermore, 51,1 % believe that self-sustainable energy is highly reliable compared to traditional electrical energy, 19,1 % believe that self-sustainable energy is less reliable than conventional electrical energy, 21,3 % believe that self-sustainable energy is moderately reliable compared to traditional electrical energy, and 8,5 % think that they cannot express an opinion on the reliability of self-sustainable energy compared to conventional electrical energy. Figure 5 shows that 41,7 % strongly agree that the local government should actively promote the implementation of self-sustainable energy in the area.

Figure 6 shows that 85,4 % would consider participating in community programs for the installation of self-sustaining energy systems

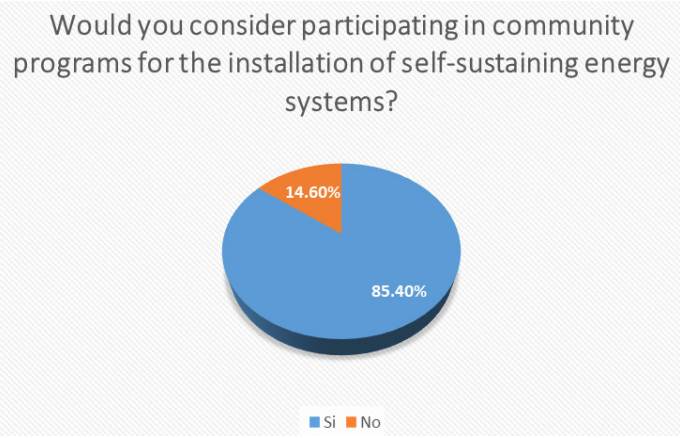


Figure 6. Distribution according to whether respondents consider participating in community programs for the installation of self-sustaining energy systems?

DISCUSSION

The small-scale power generation approach involves decentralized energy production on a local scale rather than relying exclusively on large power plants. Motor and bicycle generators provide a form of small-scale power generation that can be implemented in homes, communities, or remote locations to increase energy autonomy.

Energy efficiency is the ratio between the amount of sound energy produced by a system and the amount consumed to make it. Motor and bicycle generators can be designed to be relatively efficient at converting kinetic energy into electrical energy, maximizing their ability to mitigate power outages.

Energy sustainability refers to the ability to meet present energy needs without compromising the ability of future generations to meet their own needs. Self-sustaining energy from renewable sources, such as that generated by a motor and bicycle generator, is considered a more sustainable alternative to fossil fuels, as it uses naturally available resources in a renewable manner.[9]

Renewable energy refers to energy sources that are naturally replenished and are virtually inexhaustible on a human scale. Energy generated by human movements, such as pedaling a bicycle connected to a generator, is considered a form of renewable energy as it does not deplete finite resources or produce harmful emissions during its generation.[5]

Self-sustaining energy is presented as a viable alternative to solve the problem of power outages, as it allows communities to generate their energy using natural and renewable resources. For example, installing solar panels or wind turbines can provide sustainable and reliable energy throughout the day, even at times of high demand or during power outages.[9]

Community resilience refers to a community's ability to withstand, adapt to, and recover from disruptions, such as power outages. Implementing self-sustaining energy systems through motor and bicycle generators can strengthen community resilience by providing a local and reliable energy source during emergencies.[10]

The active participation of community members in the planning, implementation, and maintenance of self-sustaining energy systems can be critical to their long-term success. Creating educational and training programs can encourage community participation and empowerment in managing their energy.

These conceptual foundations and theories provide a solid framework for understanding self-sustaining energy as an alternative to power outages in the sector through a motor and bicycle power generator. By considering these principles, effective strategies can be designed and implemented to improve energy resilience and promote community sustainability.

In addition, self-sustainable energy can also contribute to reducing greenhouse gas emissions, which helps mitigate climate change and its negative impacts on the environment and human health. It is important to note that the transition to a self-sustaining energy-based economy requires significant investment in technology, infrastructure, and training as well as appropriate policies and regulations for its development and expansion. However, the potential long-term benefits of economic, environmental, and social sustainability may outweigh the initial costs.[11]

Power outages are a global challenge, and self-sustaining energy presents itself as a viable and necessary alternative. Implementing sustainable and reliable solutions can improve people's quality of life and reduce negative environmental and public health impacts.

Power outages, also known as blackouts or blackouts, are temporary interruptions in the electricity supply that affect a specific geographical area or an entire electrical system. These outages can be caused by a variety of reasons, including:[11]

Power grid failures: technical problems with transmission lines, electrical substations, or distribution equipment can cause power outages.

Adverse weather conditions: storms, hurricanes, heavy snowfall, strong winds, or extreme temperatures can damage electrical infrastructure and cause power outages.

Scheduled maintenance: sometimes, electric companies must perform maintenance or upgrades on the electrical grid, which may require a temporary interruption in service.

Grid overloads: excessive energy consumption, especially during periods of high demand, can overload the power grid and cause power outages.

Power generator failures: technical problems at power plants or distributed generation systems can cause power outages in specific areas.

The self-sustaining power system should be designed to focus on resilience and security. Measures should be taken to ensure system reliability and minimize the risk of power outages, such as implementing backup systems and safety protocols. Regulatory and legal issues related to implementing a neighborhood-level self-sustaining energy system should be considered. This may include building permits, environmental regulations, and electrical safety standards.

Currently, the global trend is toward using renewable energies, which are environmentally friendly and harness natural resources to generate power. Renewable energy sources have become a priority on the energy agenda in industrialized countries and many developing economies, thanks to their beneficial effects in the economic, social, and environmental spheres. Thus, the importance of having alternative energy sources to meet the demand of large nations by providing for the expansion of growth in alternative sources is highlighted.[10]

Self-sustainable energy is energy obtained from renewable sources that are not depleted by use. It is based on continuously renewed natural resources like solar, wind, hydroelectric, geothermal, and biomass energy. This type of energy is considered sustainable because it does not compromise resources for future generations and has a lower environmental impact than non-renewable energy sources, such as fossil fuels. Self-sustainable energy promotes energy independence, reduces greenhouse gas emissions, and mitigates climate change.[9]

Energy sources are natural resources from which humanity can obtain usable energy for its activities. In turn, these energy sources originate from non-renewable and renewable sources, depending on the energy consumption required by humans. However,

some problems related to global economic development are currently concerning the energy capacity of each country. There are different sources of energy, which can be classified into two main groups:[12]

Non-renewable sources: these are available in limited quantities and are depleted by use, such as fossil fuels (coal, oil, natural gas). These have the characteristic that they cannot be reused once used for energy generation.

Renewable sources: renewable energy sources are those that, due to their characteristics, are inexhaustible, even if their availability is intermittent, and their use does not cause profound environmental alterations. This type of energy is defined as that, when appropriately managed, can be exploited indefinitely, i.e., its available quantity does not decrease as it is used.

Given the great importance of this issue, the energy policies of different countries have focused on gradually increasing the supply of renewable energy. To this end, a development strategy has been drawn up in which various regions, such as the European Union, South America, and Central America, seek ways to harness natural resources for energy production that minimize the environmental impact of human activity on the natural environment.[7]

Implementing self-sustaining energy systems based on a motor and bicycle generator can significantly contribute to the sustainability and energy autonomy of communities by reducing their dependence on the conventional electricity grid and fossil fuels.

These systems provide a localized and reliable energy source that can operate independently of power outages, increasing the resilience of communities to emergencies and natural disasters. The energy generated from human movement on a bicycle harnesses a local and renewable resource, which can be especially beneficial in remote or developing areas where access to electricity is limited or non-existent. Although the initial investment in installing these systems can be significant, they can generate substantial savings in operating costs and reduce economic losses associated with power outages in the long term. Using a bicycle as an energy source promotes healthy and active lifestyles by encouraging physical activity among users, which can have additional benefits for the health and well-being of the community.

CONCLUSIONS

The potential of self-sustaining energy systems based on motor and bicycle generators to address challenges related to power outages while promoting sustainability, resilience, and community well-being is highlighted. However, further research and feasibility studies are needed to evaluate their effectiveness and applicability in different contexts.

FINANCING

The authors did not receive funding for the development of this research.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION

Conceptualization: Yilena Montero Reyes, Anthony Villacis, Yandri Garces, Roberth Loachamin.
Data curation: Yilena Montero Reyes, Anthony Villacis, Yandri Garces, Roberth Loachamin.
Formal analysis: Yilena Montero Reyes, Anthony Villacis, Yandri Garces, Roberth Loachamin.
Research: Yilena Montero Reyes, Anthony Villacis, Yandri Garces, Roberth Loachamin.
Methodology: Yilena Montero Reyes, Anthony Villacis, Yandri Garces, Roberth Loachamin.
Project management: Yilena Montero Reyes, Anthony Villacis, Yandri Garces, Roberth Loachamin.
Resources: Yilena Montero Reyes, Anthony Villacis, Yandri Garces, Roberth Loachamin.
Software: Yilena Montero Reyes, Anthony Villacis, Yandri Garces, Roberth Loachamin.
Supervision: Yilena Montero Reyes, Anthony Villacis, Yandri Garces, Roberth Loachamin.
Validation: Yilena Montero Reyes, Anthony Villacis, Yandri Garces, Roberth Loachamin.
Visualization: Yilena Montero Reyes, Anthony Villacis, Yandri Garces, Roberth Loachamin.
Writing – original draft: Yilena Montero Reyes, Anthony Villacis, Yandri Garces, Roberth Loachamin.
Writing – review and editing: Yilena Montero Reyes, Anthony Villacis, Yandri Garces, Roberth Loachamin.

BIBLIOGRAPHIC REFERENCES

1. Garcia Delgadillo D, Marulanda Espinosa J. Desarrollar un prototipo piloto de generación eléctrica, autosustentable, basado en el ensamble y control de máquinas eléctricas. UNAD 2020. https://repository.unad.edu.co/handle/10596/705/browse?rpp=60&offset=272&etal=25&sort_by=1&type=title&starts_with=P&order=ASC&locale-attribute=fr.

2. Ramos Gonzales R. Generación de energía eléctrica autosustentable para el sistema de iluminación de una familia rural de Cajamarca. UPN 2020. https://repositorio.upn.edu.pe/handle/11537/23884.

3. Sun H, Caluyo F, De Ocampo A, Hernandez R. Sistema de gestión de energía urbana basado en enlazador inteligente. Salud Ciencia y Tecnología 2024. https://doi.org/10.56294/saludcyt2024.915.

4. Muñoz-Vilela A, Lioo-Jordan F, Baldeos-Ardian L, Neri-Ayala A. Design of an eco-efficiency system for sustainable

development in the university context. Salud Ciencia y Tecnología 2023. https://doi.org/10.56294/saludcyt2023393.

5. García Juárez H, Ticona Machaca A, Cahuana Pacco D. Importancia de los elementos involucrados en los programas de seguridad y salud en el trabajo. Salud Ciencia y Tecnología 2024. https://doi.org/10.56294/saludcyt2024718.

6. Anticona Valderrama D, Caballero Cantu J, Chavez Ramirez E, Rivas Moreano A, Rojas Delgado L. Salud ambiental, Gestión ambiental, ecoeficiencia y su relación con la optimización de los residuos sólidos. Salud Ciencia y Tecnología 2023. https://doi.org/10.56294/saludcyt2023333.

7. Zambrano Acosta D, Quishpe Jara G. Experiencias de vida de familias hacinadas en la Comunidad Tingo Grande. Salud Ciencia y Tecnología 2022. https://doi.org/10.56294/saludcyt2022160.

8. Pérez Barrionuevo F. Diseño de un sistema de abastecimiento de energía eléctrica con el uso de energías renovables como la eólica en viviendas unifamiliares en la parroquia Ambatillo cantón Ambato, provincia de Tungurahua. UTA 2020. https://repositorio.uta.edu.ec:8443/handle/123456789/31495.

9. González González R. Diseño e implementación de un prototipo híbrido para la generación y almacenaje de energía eléctrica a través del uso de una bicicleta. USAC 2022. http://www.repositorio.usac.edu.gt/16588/.

10. Vilela A. Requerimientos para un sistema de transformación de energía continua a energía eléctrica mediante el uso de una bicicleta estática en los centros de acondicionamiento físico para el autoconsumo en sus instalaciones. Uniminuto 2006. https://repository.uniminuto.edu/server/api/core/bitstreams/5b254519-b0ed-441c-8b38-ee529c118c55/content.

11. Meléndez M. Desarrollo para estrategias para el consumo energético mediante el aprovechamiento de recursos y utilización de energías alternativas en la Universidad Libre sede Bosque Popular. Unilibre 2008. https://repository.unilibre.edu.co/handle/10901/10597.

12. Hermosillo J. Evaluación de la reducción de costos de energía eléctrica en la Unidad Central del Valle del Cauca a partir de la elaboración de un prototipo de energía autosustentable diseñado con motor. UCEVA 1995. https://repositorio.uceva.edu.co/handle/20.500.12993/2682?show=full.