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Solar Lighting System for Barangay Abulalas & Barangay Carillo Bridge

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Abstract

The Bulacan State University had an agreement between Local Government Units of Brangays Abulalas & Carillo both in the town of Hagonoy, Bualacan, Philippines to develop and install a much needed Solar Powered Street Lighting system for the bridge that connects the two barangays. The system is composed of two solar powered lighting units capable of illuminating up to 100watts of illumination within a span of 10-12 hours during night time. On the as a result of all these research activities , it was concluded by the researchers that the system is composed with the appropriate components to maximize the peculiarities of the area; the project was deemed by the recipient barangays as highly acceptable, and in terms of the service rendered by the proponents of the project, the recipient barangays rated the service to be very highly acceptable. Qualitative data also indicate that positive progressive developments have occurred due to the installation of the system such as: perceived increased traffic activity during night time and reduced undesirable incidences in the area.

Index Terms

Solar, Lighting, Stand alone, Solar Power,

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I. INTRODUCTION

Solar power has vast potentials for boundless and environmentally friendly energy that if appropriately explored, can provide a limitless energy to power the needs of humankind. Modern society has been predominantly dependent on traditional sources of fuel for its energy requirements. But with the ever growing demand for fuel, the threat of depleting traditional energy sources has become very alarmingly real. In response to the ever growing need for alternative energy sources, the R&D efforts of institutions have been focused on the development & appropriate application of these technologies.

It is lamentable to note that in the fast paced world we live in, there are still areas that where there is a paucity of basic public utility services such as water and electricity. The only way to provide for these needs is through alternative means, such is the case of the recipient of the project at hand.

Within the environs of Hagonoy lies a bridge that connects two barangays namely, Abulalas & Carillo. This bridge is situated near the Bulacan State University Hagonoy Campus and many of the students enrolled in the said campus pass through the bridge everyday. The bridge is not equipped with any sort of illumination, thus during nighttime it poses a potential threat to anyone who uses the bridge.

In response to the ever growing need for alternative energy sources, the R&D efforts of institutions have been focused on the development & appropriate application of these technologies. The College of Industrial Technology humbly offers it modest collection of skills in heeding the call to promote the use of alternative energy sources, particularly solar energy. The study dealt with the construction and installation of an Street Illumination System that is solely powered through solar panels that is used to provide light in some portions of the Barangay Abulalas & Carillo Bridge. To attain the main objective, the following specific objective must be achieved.

1. Design a practical solar lighting system infrastructure appropriate for the Barangay Abulalas & Carillo Bridge.
2. Construct a post that is designed specifically for the environmental features of the vicinity of the Bridge.
3. Preassemble the system prior to installation in order to assess its performance and apply adjustments if necessary.
4. Periodic assessment of the system shall be performed to determine the effectiveness of the system.
5. Conduct an evaluation of the acceptability of the project and the quality of the extension service rendered by the stakeholders of the area.

Based on the philosophy of John Dewey [1] this study asserts the obligation of higher education to engage in providing answers to problems that the community is faced with. Often times professors focus their attention on pedagogical activities and churning out professionals for industry. It is also imperative that higher education institutions must conduct activities for the betterment of the communities within their environs. As argued by Dewey [1], that teaching and learning process entails interaction among individuals, making it a social process, Hence, higher education institutions must not only be a place for knowing but more so, as a place to discover one's humanity. In this context, students are encouraged to learn not only for their own personal benefit but as agents of change for making the world a better place for everyone.

Solar energy has always been harnessed by man. Even during modern times third world countries use it to primarily dry products ranging from food, clothing and building materials. Solar energy provides infinite electrical power. Current systems for solar power requires a solar panel which changes it to electrical energy and either stores it in a battery or transfers it directly to the grid. Presently, the energy sector comprises only a fraction of the sector that uses solar energy. The sun provides vastly more than what we can convert, thus we can still maximize its full potential. [2].

To effect a positive progressive development in isolated communities. It is necessary to assess alternative sources of energy that are available within a certain community that is deprived of grid electricity. There is dichotomy of the utilization of solar energy[3].. Firstly, in some communities solar power is used as heat source for processing food and other necessities. In some cases this heat is used to increase the temperature of fluids this heated fluid can then be used to produce electricity or as a component for refrigeration. Second, photons from the solar rays of sun are collected and converted into electricity by solar cells. These potential energy sources can both be used for business or non-profit purposes.

Solar panels are composed of photovoltaic elements that produce electricity at certain levels when exposed to light sources. The connection of these photovoltaic systems are varied depending on the type of application they will be used for, They may also be utilized along with other power sources in hybrid systems[4]. Photovoltaic systems have varied uses for telecommunications, illumination, power for isolated areas, for monitoring systems and for re-energizing battery cells. There are mainly two kinds of photovoltaic systems, one is independent from main grid connections while the other works in consonance with the main electrical power provider.

An independent system relies on the energy produced through its solar cells and the energy stored in its batteries. This kind of system necessitates the use of a photovoltaic panel(s), an energy storage element and a charge monitoring device. In some systems, inverter elements may be used to change direct current provided by the panels into alternating current.

Mains grid type of photovoltaic systems is coupled to a mains electricity provider. This type of system provides electricity during daytime and reverts back to the grid power system in the evening. At times when the photovoltaic system produces more than is needed by its load the surplus electricity can be readily used by others or may be paid for by the grid electrical provider. This kind of application no longer requires the use of an energy storage element such as a battery.

Different configurations to optimize the utilization of solar power systems. Solar panels produce electricity through individual photovoltaic cells connected in series [5].

There are several designs for photovoltaic power systems. Photovoltaic cells are configured in series connection in order to generate electrical power [5]. This may be adapted in communities where there is an abundance of sunlight, in locations that are deprived of electrical connections or in residences that need to augment or economize their electrical consumption. In order to use solar energy solar cells must be exposed to photons provided by sunlight these cell in turn produce electricity. The procedures and resources used for the manufacture of photovoltaic cells shall ascertain the effectiveness of each system.

Solar cells are made from differentiated substances . Usually, the more expensive materials and processes result in more efficient output.

Certain energy requirement often dictate what elements, such as panel dimensions, controllers, converters and trackers, are needed to result in the desired outputs of the end users.

Converters transform the variable output from solar panels to constant voltages to maximize the continuous supply of usable power for either present needs or stored for future use

To provide a continuous flow of electrical energy it is necessary to have a device that would serve as buffer between the fluctuating power produced by the solar panels. Thus, converters are installed for this reason [6]. Within the duration of the exposure of the solar panel to the sun, several factors may affect the output of the system within this period. Variations within the environment may render the system to become less efficient if certain modifications are not made in order to produce a sufficient desirable output. These constant oscillations are caused by either the weather, the elements used in the manufacture of panel and even the arrangement of the panels with reference to the sun. There is also the consideration of switching the system to off during night time and reconnect its load to either a mains power grid or a local storage unit.

II. METHODOLOGY

Developmental research purports to evaluate existing methods, devices and approaches in varying fields in order to develop knowledge that can be used by academics as well as those who apply them in the world of work. It forms a cycle that serves as a feedback mechanism between these two groups.

The method used in particular for this study was Type 1 developmental research. This sort of study is geared towards the assessment of certain methods, devices or practice. Based on this assessment certain suggestion may be derived either as general or particular indications. This type of approach also aims to evaluate the efficiency of the product or system developed based on standard metrics.

A questionnaire for assessing the acceptability of the project to the community of the target area was utilized. This instrument was developed by the Extension Services Office of the Bulacan State University. It is geared towards determining the quality of service that is rendered to a community. Since the installation of a utilitarian infrastructure is a form of service, the researcher deemed the instrument congenial for this research undertaking.

The acceptability of the device by the beneficiaries of the project was also measured through a standardized instrument ISO 9126.

Purposive sampling was employed in determining the respondents of the study which shall consist

The respondents of the study were chosen on the basis of their expertise and know-how that may be related to solar panel and electrical systems and also from the different community stakeholders who reside within the environs of the Abulalas & Carillo Bridge. Passers-by who are not residents shall also be taken in as respondents.

An appropriate statistical tool for impact assessment was used by the researchers.

III. RESULTS

A. Project Description

To better appreciate the propensity of this research undertaking, this research report is supplemented with photographs of the different activities undertaken. The equipment used for the fabrication and assembly of the lighting system are also presented. Figure 1. presents the vertical clearance arches of the bridge. This is where the lighting

system shall be installed in order to minimize modifications on the current structure of the bridge.

Fig. 1. The Abulalas & Carillo Bridge, Hagonoy, Bulacan.

Presented in Figure 2. Solar Lighting System 1 & 2 each unit was specifically fabricated for a particular vertical clearance arch of each end of the bridge. Clamps fabricated from angle bars will be used to fasten the units safely to the arches. Figure 3 shows Solar battery 26Amps and controller 10 Amps for each unit, this is the power storage unit for the system & they are encased securely in a metal casing with padlocks to deter vandalism and even stealing of the power unit. As seen in Figure 4. LED (Light Emitting Diode) unit for the system for this particular application, 30 watts LED light will be sufficient to illuminate critical parts of the bridge and can be adjusted to desired angles

Fig. 2. Solar Lighting System 1 & 2

Fig. 3. Solar battery 26Amps and controller 10Amps

Fig. 4. LED (Light Emitting Diode)

Figure 5 shows the solar panel, each system is equipped with an 80Watt/ 26 Amps unit which is capable of charging the power storage unit/ battery even in mildly sunny weather. In Figure 6, it depicts actual installation of the solar lighting system on both sides of the Abulalas & Carillo Bridge. Figure 7 shows the installed units undergoing final tests and fastening to the concrete posts. In Figure 8 it shows the actual Monitoring the units at night. Everything's clear and bright

Fig. 5. The Solar panel.

Fig. 6. Actual Installation

Fig.7. Installed units

Fig. 8. Monitoring the units at night

Results of the Project/Product Evaluation

A group of evaluators composed of instructors and students was requested to evaluate the acceptability of the project

Table 1. MEAN SCORES AND VERBAL INTERPRETATION FOR THE EVALUATION OF THE ACCEPTABILITY OF THE PROJECT

CRITERIA	MEAN	INTERPRETATION
Functionality	4.54	Very Highly Acceptable
Reliability	4.56	Very Highly Acceptable
Usability	4.67	Very Highly Acceptable
Maintainability	4.80	Very Highly Acceptable
Portability	4.64	Very Highly Acceptable
Workability	4.65	Very Highly Acceptable
Safety	4.61	Very Highly Acceptable
Overall Mean rating	**4.63**	**Very Highly Acceptable**

As gleaned from the table, the result of the evaluation yielded an overall mean of 4.63, the Solar Lighting System was deemed to be very highly acceptable by the recipient residents of the barangay.

IV. CONCLUSION

Based on the findings derived resulting from he evaluation and observations of the researchers, the following conclusions were made

1. The system is composed with the appropriate components to maximize the peculiarities of the area.
2. The project was deemed by the recipient barangays as highly acceptable.
3. In terms of the service rendered by the proponents of the project, the recipient barangays rated the service to be very highly acceptable.

V. RECOMMENDATIONS

In the light of the findings and conclusions, the following are hereby recommended:

1. The area may be further illuminated by adding more units along the bridge.
2. An impact assessment study may be conducted to after a specified period of time to gauge the long term effects of the project to the community it serves.

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