Rural community "Santa Maria del Loreto". 20 years with photovoltaic solar energy

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Abstract

The work exposes the most significant and relevant aspects, in the 20 years of the start-up of the Autonomous Photovoltaic Solar Power Plant of the Rural Community "Santa Maria del Loreto" which constitutes, in our opinion, challenge and the greatest lesson learned, taking into account that it demonstrated at this time the technical, economic, social and sustainability viability, from a specialized follow-up by specialists in the subject and community participation.

Keywords: Autonomous photovoltaic system; sustainability

I. Introduction

The installation of the photovoltaic (PV) plant "Santa Maria del Loreto" is without doubt a success of photovoltaic technologies in Cuba [1], because of their demonstrative character, which has allowed its successful operation for 20 years, Figure 1.

Figure 1. Photovoltaic plant "Santa Maria del Loreto"

All of the above supported by proper management of community leaders and support of local social organizations allows their sustainability over time.

Also, its configurable nature which makes it practically adaptable to any situation that may arise technical highlights. Stable operation of the PV plant has demonstrated technical feasibility in conditions Cuban rural environment [2]. Social and economic development of the community was causing a slight gradual increase in energy consumption, improving utilization rate in accordance with the provisions of the design.

The PV plant, benefits the local population with access to electricity high quality allows substantial improvement of living conditions with increased nighttime entertainment and cultural impact on raising the quality of life and the cultural heritage of the population, have made significant achievements in health, education and rising economic development has slowed the flow of migration to cities [3].

From the point of view of research, installation of the PV plant has served as a basis for management studies in Cuban rural context and the influence of climatic conditions (temperature, relative humidity and solar irradiance) on the main parameters operating the PV plant and its most important [4,5] components.

II. Development

Electricity is a key element of revaluation of the rural environment. Agenda 21 called for Promoting the "transition of the rural energy problem" to fulfill in a sustainable manner, the electricity supply must be energy efficient, economically feasible, socially fair and ecologically clean.

An option for the rural electrification of some settlements in Cuba has-been the use of Generating Group, however the environmental damages That cause gas emissions and the spills

of fuel and lubricants in fragile ecosystems, as in the case of the abundant cays, watersheds, coastal and mountain areas, are evident, also face the problem of high fuel costs and the difficulties of transportation and stable distribution of it, all this imposes the need for generation only for a few hours a day, not fully satisfying the needs of the users, in Addition reinforces the needs of expensive maintenance.

An example of this is the Rural Community "Santa Maria del Loreto" which is located in the mountain range of the Sierra Maestra, Songo-La Maya Municipality, Santiago de Cuba Province. It is located approximately 60 Km from the provincial capital. Access is through a difficult mountain path of approximately 11 Km to the Santiago-Guantánamo highway, passes through the National Electric Power System (NEPS).

With a population center around 30 homes composed of approximately 121 people where lived. Its basic activity was reduced to agricultural production, its main line being coffee.

The contemporary demands for the Increase of the quality of life of the citizens of "Santa Maria del Loreto" related to the electric service in front of the population's problems, having a 32 kVA diesel generating set that worked 4 hours a day and sometimes due to the problems of the "special period", bad state of the communication channels, conditions of very rugged relief, lack of fuel, led to an irregular service, making it impossible to incorporate social other and economic activities, having amply demonstrated its unsustainability.

Among the main problems of having an inefficient and unstable electricity service were:
- The gradual decrease in the quality of life in the community.
- Poor training and retention of human resources.
- Problems of environmental contamination by emissions of CO_2 into the atmosphere, from the generating group.
- Uncertainty, discontent in the population and, consequently, migrations.
- Hygienic conditions unfavorable.

III. Description of the result

In 1997, a multidisciplinary group from the Solar Energy Research Center (SERC), identified the main difficulties of the community, providing different ways for Renewable Energy Sources Electrification. At the same time, training was given to the residents on the advantages and disadvantages of centralized photovoltaic systems for electrification, community obtaining approval.

To guarantee the appropriation of centralized photovoltaic technology, the social participation of the entire community was used in the project from the very beginning, for the purpose the installation of PV plant guaranteed the incorporation of the neighbors to the construction works and assembly, as well as the contribution to the logistics service to the technician team in charge of the installation, in the same way a neighbor was trained from the beginning to fulfill the functions of technician in operation and primary maintenance, who fulfills the functions of past Local Management.

The start-up of the PV plant in the rural community "Santa Maria del Loreto", meant for the residents the guarantee of high quality, uninterrupted and stable electric service. As a result, access to community information was increased through TV and radio, new activities Were incorporated as a collective laundry service, a 24-hour collective telephone communication service, contributing very favorably to community development and Improving quality of life of men and especially of women (given that in the community they are responsible for carrying out mostly domestic tasks).

The improvement of the quality of life of the inhabitants, also allowed to increase the production of root vegetables, fruits and vegetables for community self-consumption in the strengthened Cooperative "Antonio Guiteras" besides the production of milk and the coffee harvest of the community enterprise.

This stimulated the construction of a Social Circle, the repair of the houses and a remarkable improvement of the conditions of the medical post and the school, as well as an Increase of the social nocturnal and Cultural activities, Besides a considerable Increase in the productivity of the work (cultivation of coffee of superior quality), Figure 2.

Figure 2. Economic and social objectives

Operation, maintenance and repair of the PV plant has been accompanied by researchers, specialists and technicians SERC, supported by national and international projects.

A new feature of the project is the fact That there are no documented projects of this type of system in Latin America and the Caribbean, or reference to them in the last 20 years, taking into account the influence of technological factors, social and nature together, so this result has shown when taking into consideration that all the above factors can achieve sustainable technology.

Project Contributions are those described below:

Scientific contribution

The installation and rural community of "Santa Maria del Loreto" have demonstrated the social and technical-economic viability of these facilities in the socio-cultural and environmental conditions of Cuba, has contributed to raise the scientific-technical knowledge of the Technology for national and international specialists in relation to the functioning of the autonomous photovoltaic systems and has allowed the formation of a Doctor in sciences, two masters in Sciences and a thesis of undergraduate. It has been shown that it is possible to generalize other communities and that it can achieve socio-technological and economic.

Economic contribution

The installation of the CFV, generates 22 MWh/year equivalent to 5.1 tons of oil, which has allowed in the 20 years of exploitation generate 440 MWh, equivalent to 102 tons of oil the country has been able to save an amount of 118,800.00 CUC, based on the cost of L KWh produced is quoted at 0.27 CUC.

Environmental contribution

From the environmental point of view in the analyzed period has stopped emitting 308 t of CO_2 to the atmosphere, the installation ceases to emit 15.400 kg of CO_2 per year, which represents an approximate saving of 117 T. of diesel that would have been consumed if necessary the I Installation of a generator set, these indicators show a positive environmental impact and prove the sustainability of obtaining electrical energy from solar energy.

Social contribution

In the social order, they have achieved the following benefits:

- 100% of households maintain high quality lighting, fluorescent lighting or to Have energy-saving bulbs, Improving the quality of the home atmosphere for non-use of kerosene burners for night illumination.
- 100% of the houses maintain high quality lighting, with fluorescent lighting or saving bulbs, which improves the quality of the domestic atmosphere by the nonuse of kerosene lighters for night lighting.
- 27.5% of households have household refrigerators for food preservation.
- 62.5% of the houses have TV for the distraction and information of the population.
- 25% of the houses use blenders for the elaboration of milkshakes and juices.
- The stability of the workforce of the community has been achieved, since by raising its standard of living, the population has significantly decreased migration to the city.

CONCLUSIONS

The photovoltaic power station "Santa Maria del Loreto" has demonstrated the technical, economic and social viability and long term sustainability for the electrification of rural communities in Cuba.

This facility is the first medium-scale experience in climatic conditions of Cuba, with photovoltaic solar energy electrifying 46 economic and social objectives.

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