DIGITAL PORTFOLIO

SOLAR ENERGY

IACOC
Compromisso com o desenvolvimento socioeconômico do Semiárido paraibano
PaqTcPB Fundação Parque Tecnológico da Paraíba
UFCG Universidade Federal de Campina Grande
INSA Instituto Nacional do Semiárido
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E INOVAÇÕES
PÁTRIA AMADA BRASIL GOVERNO FEDERAL
JL FIDA Investindo nas populações rurais

Solar Energy is an alternative, sustainable and renewable energy, having the Sun as its source and can be used mainly as photovoltaic and thermal electric energy. Photovoltaic energy is the direct conversion of the sun's rays into electricity. Thermal energy makes use of the sun's heat to heat water or to transform it into electrical energy.

The main investments made by IFAD are aimed at the implantation of photovoltaic systems in agro-industries and communities in the Brazilian semiarid region. Photovoltaic systems are composed of photovoltaic solar panels, which are basically devices used to convert sunlight into electrical energy in photovoltaic cells. Solar or photovoltaic cells are responsible for capturing and converting the sun's rays into electrical energy. The systems also provide a photovoltaic module that is the component responsible for generating energy, being basically a plate protected by glass where the solar cells are placed and connected to each other by wires, completing the assembly of a module. For the assembly of an autonomous photovoltaic system for the purpose of irrigation in agricultural areas, in addition to the equipment mentioned above, a charge regulator, a battery or battery bank and a direct current inverter for alternating current are required in order to attend the pump set and the possible electrical equipment of the irrigation automation system fed with alternating current.

In some cases no battery is used. When connected to the electrical network, there is a need for a solar inverter to promote the inversion of the electrical energy generated by the solar panel from direct current (DC) to alternating current (AC), required by most electrical equipment. This happen in addition to a light board which receives the energy that comes out of the solar inverter and distributes it to your home or business, as well as a clock that calculates and causes the excess electricity produced when there is too much sun or too little consumption to return to the power grid. This additional electrical energy is inserted into the distributor's network, becoming "energy credits" that can be used at night, on cloudy days or in the coming months. In addition, this clock also measures the input of public energy that is consumed when there is no sun, calculating in these cases the balance due to energy to the distributor. Unlike conventional means in the production of electricity that use the principle of electromagnetic induction to generate an alternating current in the circuit, photovoltaic conversion takes place directly, in which the photons coming from the Sun interact directly with the electrons of the cells of the semiconductor material, generating a one-way current, that is, a direct current.

What is the justification for it to fit into this project and examples of products / prototypes under development or installed (based on FIDA experiences)

The Brazilian semiarid region has great potential for the production of photovoltaic solar energy, which can be better exploited to transform this potential into real opportunities, capable of generating employment and income, with the greatest solar radiation in Brazil being in areas of low economic development, mainly those found in this region. Another important factor is linked to the reduction of environmental impacts when compared to conventional means of producing electric energy, since in the production of photovoltaic energy there is no emission of CO_2 and other gases, not even liquid pollutants or during the generation of electricity. With the large availability of solar energy sources in the semiarid region, IFAD has encouraged the use of photovoltaic energy in the region through various projects with the States.

The implementation of solar panels in agro-industrial systems and in rural communities has been impacting on the reduction in the cost of electricity, increasing the competitiveness of rural businesses and increasing the income and sustainability of the projects. 33 investments were identified involving photovoltaic systems in the states of Paraíba, Piauí and Sergipe, encompassing 14 associations / cooperatives and benefiting 5,676 families, all of which are financed by IFAD and in partnership with other public agencies.

FACTORS THAT PROMOTE OR LIMIT TECHNOLOGY ADOPTION

Solar energy is an inexhaustible source with a low environmental impact, and it can satisfactorily complement the supply of energy generated from hydroelectric plants, whose supply is diminished by the recurring low water levels in the reservoirs, negatively impacting the generation of energy and requiring the activation and use of thermoelectric plants, which increases the release of greenhouse gases. The costs for the deployment of systems with solar energy are relatively high; however, the savings generated can be up to 5 times in relation to the conventional system, making its implementation be economically interesting over time, despite the existing obstacle to the acquisition of solar systems. In this way, the savings generated can be equivalent to the value of the investment made with amortization that occurs over the months of use, and with high durability and low maintenance cost.

Even so, in addition to the fact that there is no emission of CO_2 and other gases, not even liquid or solid pollutants during the generation of electricity, the emission volumes in the manufacturing stages of the equipment used in the photovoltaic sector are low and the amount of energy generated by the lifespan of photovoltaic systems is 8 to 17 times greater than the energy consumed in their manufacture, and is therefore a viable alternative in this segment. It is also important to highlight that, at the end of the life cycle of a photovoltaic system, about 85% of its components can be recycled and reused, so that the environmental impacts tend to become even smaller in the long run, already quite reduced.

COST BENEFITIC ANALISYS

Instalacion costs (Amount in R$):

RESIDENTIAL

The cost of a residential photovoltaic solar energy system (including installation and materials) is approximately R$ 19,520.05, considering the use of a 3.46 kWp generator installed in a residence with an average monthly consumption of 372.6 kWh.

COMMERCIAL

With an investment of around R$ 187,495.07 photovoltaic solar system, it is possible to obtain a commercial system with expected energy generation of 585,000 kWh per month.

Maintenance costs (Amount in R$):

This system has a maintenance (after 25 years) equivalent to R$ 5,000.00.

There is the maintenance cost, represented by the replacement of inverters in the 15th year, in the amount of R $ 22,131.40 and the depreciation of 1.5% in the first year and 0.7% of the acquisition cost in the others.

Technology lifetime (value in years): about 25 years.

SOCIAL IMPACT

In IFAD investments, priority is given to productive groups with a focus on women, youth, quilombolas, indigenous people, the black and brown population. With this focus, any investments that considers improving income generation, gender equity, increasing quality of life and improving working conditions are prioritized as a public policy. Solar energy is seen as a technology that goes beyond the environmental issue, as it is capable of reducing production costs with the potential to increase self-investment in other group needs. Such action has a positive impact on the income generation capacity of these priority groups, improving social welfare to all the community.

ADAPTATION TO THE REALITY OF FAMILY FARMING

The available technology allows several uses for family farming, either to reduce production costs or to completely replace the energy source. Practical examples include the installation of photovoltaic panels for pumping water for various uses, including the irrigation of production fields. Its use for capturing water has the advantage of being able to be installed in places where there is no conventional power grid. The presence of agro-industries making use of this energy source has been expanding in the country, improving competitiveness and better insertion in all the markets. It consists of a technology of simple management and requires basic maintenance to function and with great potential for use in family agriculture and emphasis on the semi-arid region, with a large supply of the main raw material - the sun.

CO_2 EMISSION ANALISYS

The reduction of CO_2 emissions with the use of photovoltaic panels was calculated considering the indirect emissions from the alternative purchase of electric energy, in the approach to the choice of purchase. Without considering the life cycle of the manufacture of photovoltaic panels, there was a 99.9% reduction in CO_2 emissions compared to the consumption of electricity from the conventional electricity grid.

The calculation was made by comparing the electricity consumption before and after the use of photovoltaic solar energy in a Picuí-PB Cooperative. The emission factors used were based on the Brazilian energy matrix.

Mês	Consumo (MWh)	Fator Médio de Emissão	Total de emissões (tCO_2e)
Agosto/2019	2206	0,1070	236
Agosto/2020	0,165	0,1070	0,018

TOTAL QUANTITY INSTALLED AND NUMBER OF BENEFICIARIES

Installed Quantity (total value): 2722

Number of beneficiaries (total value): 8,461 families

Municipalities (total value): 24 municipalities

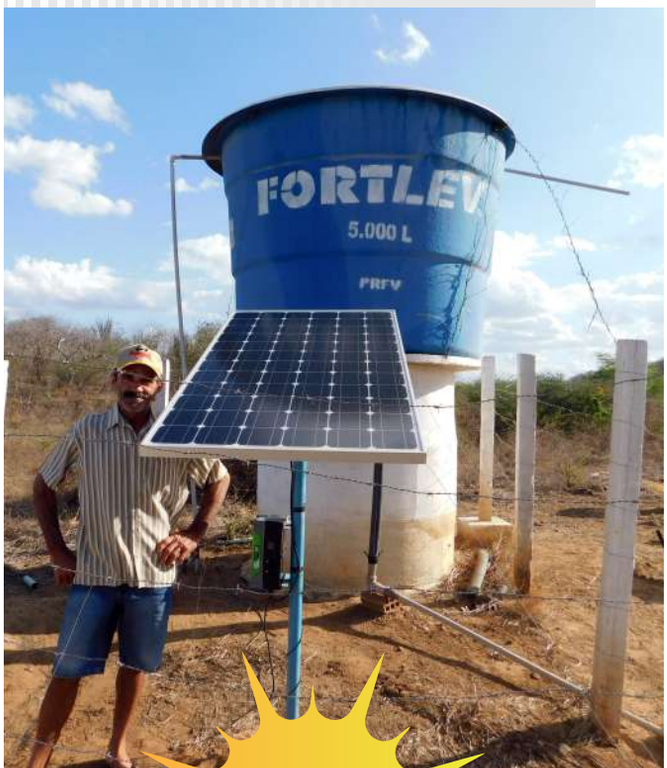
SOCIAL TECHNOLOGY TRL

The photovoltaic panels fit into TRL 9 since they have already been tested, as well as they are already commercialized and used by the community successfully. All this, considering that this level is reached when the technologies in question are applied in systems that are successful in a actual operation. It is also noteworthy that the fundamental difference between TRL 8 and 9 is related to the operation of the system, being a basic example that the construction of a new aircraft fits into a TRL 8, but flying it the first time in a real way is TRL 9.

TRL : 9

LOCATION

We went to Picuí and Nova palmeira to see the actions carried out with IFAD financing. In Picuí, we visited the Cooperativa Agroindustrial do Seridó and Curimataú Paraibano - COOASC, both of which benefited from the installation of a photovoltaic solar system to reduce costs in the processing of fruit pulps. In Nova palmeira, we visited the property of Mr. Euclides and family, both in the Saquinho community, who were benefited with a solar photovoltaic kit for the purposes of irrigating their property. All families benefited from the experiences were satisfied and grateful for the concession of the technologies.



We visited a cooperative aimed at the production of pulps and a rural property that received solar photovoltaic systems, using resources from Procase / PB and IFAD. The cooperative located in Picuí has reduced production costs thanks to the reduction in expenses with electricity from now on, which is aided by the photovoltaic system. While the rural property has part of its production irrigated with water pumped by the photovoltaic system. The images portray well the experiences and the current situation of the systems in the localities.

DID YOU KNOW...?

That photovoltaic energy has been around since 1839?

Alexandre Edmond Becquerel discovered the photovoltaic effect in 1939, while conducting electrochemical experiments in his father's workshop. In 1873 the first photovoltaic cell that was made of selenium was created. Currently almost 80% of solar panels are made up of some variation of silicon thanks to Calvin Fuller who, in 1954, developed silicon photovoltaic cells. In 1973, the first house powered by solar energy was built, a fact performed by the University of Delaware in the USA. But it was in 2004 that millions of cells were produced worldwide with an efficiency of 16%, surpassing for the first time the barrier of 1 gigawatt of annual electrical power.

That besides to solar energy other devices are used to harness energy from the sun?

"Aqualuz": technology aimed at the treatment of cisterns, using only the sun, without the need to use chemical substances, sophisticated filters, or interventions in the cistern. Its assembly takes just 10 minutes, with daily use for 20 years, and its low maintenance is done only with soap and water. The technology consists of a stainless steel box covered with glass and a simple pipe connected to the cistern.

Solar distiller: it is a low cost and easy to operate robotic prototype (DSR), with a solar tracking system, aimed at residential, laboratory and industrial applications, for water distillation. The equipment consists of four fundamental parts: receiving chute; absorber tube; robotic antenna mobility system and condenser cooling system.

Solar desalinizer: the technology promotes solar distillation by completely eliminating all salts, heavy metals, bacteria and microbes present in polluted waters, as well as the removal of various pesticides, due to high temperatures and ultraviolet radiation. At the end of the process, a simple reconstitution of salts is made easily for use as drinking water.

Solar dryer: composed of a piece that simultaneously performs the function of collecting solar energy and serving as a drying chamber, where solar radiation affects directly the product placed in the dryer. The air is heated and the circulation is made by natural convection, being a quick and inexpensive drying.

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