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DESSALINIZAÇÃO DE ÁGUA SALOBRA POR CONVERSÃO DE EM ENERGIA SOLAR EM TÉRMICA: UMA POSSÍVEL SAÍDA

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RESUMO: O principal objetivo deste trabalho é o estudo da viabilidade técnica e económica da dessalinização da água do mar e salobra utilizando a energia solar, tomando como caso de aplicação uma pequena comunidade rural na Cidade de Itarema-CE. A destilação solar passiva foi a tecnologia de dessalinização estudada neste trabalho e que se pode vir a tornar uma alternativa promissora para um fornecimento regular de água.
Palavras-chave: Destilação. Solar. Seca

DESALINIZATION OF BROKEN WATER BY CONVERSION OF SOLAR ENERGY INTO THERMAL: A POSSIBLE OUTPUT

ABSTRACT: The main objective of this work is the study of the technical and economic viability of the desalination of brackish water using solar energy, taking as a case of application a small rural community in the city of Itarema-CE. Passive solar distillation was the desalination technology studied in this and can become a promising alternative to a regular supply of water.
Keywords: Distillation. Solar. Dry

INTRODUCTION

The semi-arid region of the Brazilian Northeast is characterized, from the climatic point of view, by the high spatial and temporal variability of rainfall and drought cycles, which usually occur at intervals that can vary from a few years to decades. In this context, the consequences of this climate variability on the hydrological cycle are drastic, causing an increase in water deficit, resulting in an increase in areas with high climate risk in the region, as shown by Lacerda & Nobre, (2010). The Brazilian climate scenario follows the same global trend, in which the most significant changes are, in addition to the increase in temperatures, changes in rainfall distribution patterns and changes in the distribution of climatic extremes, such as droughts.

In our country, despite the great existing water potential, all regions have suffered from the problem of scarcity caused by climate change. According to Formoso (2010), one of the biggest problems in the Brazilian semi-arid region is the scarcity of water during periods of drought, a fact aggravated by the presence of large amounts of dissolved salts in the available springs, coming naturally from rocks that make up the soil of the region and the

aridity characteristics of the climate. This salinity often makes the available water unsuitable for human consumption, agriculture and even animal consumption.

About 50% of the soils in the Northeast Region are represented by crystalline basement rocks (granites, gneisses, schists, etc.), with low water potential, this area corresponding to the location of the most arid zones in the States of Ceará, Rio Grande do North, Paraíba, Pernambuco, north of Bahia and east of Piauí (MME, 2009). These crystalline rocks have low values of porosity and primary permeability, which causes a slow circulation of fluids and, consequently, a longer permanence time of the percolated waters in the aquifers, with a greater salinization of the same.

When addressing the drought context, two aspects have to be analyzed: the socioeconomic issue and the natural phenomenon. As a natural problem, drought represents a phenomenon of a climatic nature, corresponding to a considerable deficit of rainfall. The drought then appears as an aggravating factor of the socioeconomic issue through a lack of economic structure that generates employment and income. Thus, the drought phenomenon exists as a natural fact, possible to be predicted, but impossible to be prevented from occurring, however its social and economic effects are greatly aggravated by the lack of more efficient public policies. (SILVA, 2013).

Currently, the main solution to meet future consumption is found in the seas, since the largest amount of water is found in the oceans, that is, in the form of salt water, which corresponds to 97%. Since the scarcity of fresh water is becoming an obstacle for the future of humanity, the use of the oceans can be a solution to overcome the lack of fresh water. Man's desire to transform salt water into fresh water dates back to antiquity. Aristotle, concerned with the problem 2300 years ago, used to explain to his students that “salt water, when it becomes steam, becomes sweet and the steam does not produce salt water after condensing” The desalination of sea or saline water it consists of removing dissolved salts from water at levels or concentrations that allow its use for both human consumption and other activities performed by fresh water. This technique is very common in countries or coastal areas with scarcity of freshwater sources, such as Cape Verde, with the only alternative being the use of seawater as a source of freshwater. Sea water has a salinity of 3500 – 4200 mg/l while fresh water salinity is less than 500 mg/l.

The practice of desalination is booming and it is estimated that there are approximately 15000 water desalination stations in more than 120 countries and this number is expected to increase. Most of these stations are located mainly in Middle Eastern countries, the United States of America and Spain.

MAIN GOAL

To offer families an alternative to overcome the problem of water scarcity in rural communities, using solar energy as a source, developing alternative desalination plants and a prototype that is based on capturing solar energy, converting it into electricity and later into thermal .

SPECIFIC OBJECTIVES

• Identify and study the necessary and suitable materials for the manufacture of a solar desalinator;

• Design a prototype of the Alternative solar desalinator built in masonry and offering;

• Evaluate the performance of the prototype, under operating conditions;

• Survey the production costs of the developed desalinator;

• Carry out physical-chemical analyzes of desalinated water.

• Construction, in a process of social participation together with local families, of solar desalinators to provide drinking water;

• Analyze the potential (liters per day) of potable water produced by desalinators;

• Diagnose the quality of the water coming from the desalination plants;

• Identify the socio-economic and environmental benefits deriving from sola desalinators

METHODOLOGY

The solar desalinator is a social technology for coexisting with long periods of drought, providing families with good quality water. The Alternative model of solar desalinator that will be built consists of a box built with pre-molded concrete plates, totaling an area of 4 m^2. The cover is made of glass or plastic, which allows the passage of solar radiation (short waves), but inhibits the output of long waves out of the solar desalinator. As a result, the

temperature inside the desalinator increases, causing the evaporation of the water stored in a “truck tarpaulin” placed as the floor of the desalinator. In summary, what happens is that the high temperatures evaporate the water on the truck canvas; so the water vapor comes into contact with the glass surface (which is at a lower temperature than the steam) which causes the condensation of the water vapor, and with this, quality water for human consumption is produced. The desalinators not only promote the removal of salts dissolved in the water, but also eliminate pathogenic microorganisms, especially bacteria that cause diseases, such as Escherichia Coli. In this sense, the high temperatures (up to 70°C) inside the solar desalinator eliminate pathogens, making the water meet the drinking requirements.

About the prototype assembly, it will be done by the elaboration of a project where, through solar energy, it will be converted into electricity that will later be transformed into a resistance that will serve to heat the water deposited inside the brackish water storage system, where through a solar plate it will capture solar energy and, through a converter, transform it into electrical energy, being stored in two batteries, later this energy will be used as resistance; The second stage will take place with the process of desalination of the water based on the technology of chemical engineering, where a cauldron of salt water that feeds the system applying the energy/resistance in the form of heat in the water, making this water undergo boiling, where this vapor will pass through a condenser depositing the distillate in the container.

Finally, the solar desalinator is a social technology that uses solar energy (renewable and with great potential in Brazil) for the desalination and disinfection of water, which has contributed to meeting the water needs of rural families in the semi-arid region of Paraíba.

RESULTS

With the implementation of 4 alternative solar desalinators in the Rural Settlement of Itarema-CE together with the prototype, I expected to obtain the following results:

1. An average production of 40 liters per day, where each Alternative desalinator will produce an average of 10 liters of drinking water per day;

2. The water that will be produced daily must be sufficient to meet the drinking water needs of 20 people distributed in the beneficiary families, in terms of what the UN determines: each individual must consume 2 liters of water per day;

3. Carry out laboratory analyzes of the water collected from the desalination plants, showing that they will meet the physical-chemical and microbiological parameters described by National Laws and by ANVISA regarding water potability;

4. Enable numerous socio-economic and environmental benefits: produce enough potable water to improve water security conditions; have a low cost of implementation and maintenance; facilitate access to water due to the proximity of desalination plants to homes; can be for individual or collective use; and is an easy-to-learn social technology.

5. With the application of the PROTOTYPE, make its use on a small scale, but as a means of testing for future social investments, since it requires a greater investment., but allows a greater benefit, since it can be used even without having sun with your batteries charged.

In view of the above, the main objective/result will be: to use solar energy to provide drinking water and thus meet the water needs of rural families who live with a shortage of drinking water.

SOCIAL DISCLAIMER OF THE PROPOSAL

Solve or alleviate problems of access to quality water in the Brazilian semi-arid region, adopting the technique of solar distillation, which serves both for desalination and disinfection, from a renewable energy source and that can be carried out at the family and family level. decentralized way; taking as an initial problem the lack of water and economic disadvantage of the local population. Many works have been published by several researchers on desalination methods, in order to reduce the costs of desalination plants and increase access to potable water in regions where the water has an average salt content above that allowed for consumption.

This being a very old thermal desalination process, it mimics the natural cycle of water on the planet. The simplest of them, as described by Soares (2004) and used in hot places, is characterized by the construction of large tanks covered with glass or other transparent material. The sunlight that passes through the glass causes the water to heat up, generating vapors that, when condensing on the inside of the glass, return to a liquid state, flowing into a collection and storage system. In this solar desalination process, water heating appears as one of the simplest and most practical applications for the use of solar energy, especially in Brazil, which has a high incidence of solar radiation, especially in the Northeast region.

The dimensions of the equipment can be easily adapted to the minimum needs of desalinated water per day for a family, providing better quality water, avoiding diseases normally transmitted by water in the region.

IMPACT ON THE DISSEMINATION OF KNOWLEDGE AT SCHOOL

The project as a whole has very relevant aspects when it comes to knowledge at school, since it encompasses chemical, physical and biological knowledge; thus being a project with a very pedagogical bias, being able to be linked as field classes for the students in its diffusion, thus gaining the classes more attractive diversities and a contextualization as well as being able to see the interdisciplinarity in its body. Thus working solar distillation and water cycle, energy conversion and its physicochemical processes involved, chemical/analytical processes of analysis of water salts as well as biological analysis of bacteria and others that can contaminate the water.

FINAL CONSIDERATIONS

Finally, the solar desalinator placed in the present study, seeks to use alternative materials and construction techniques, of lower cost, presenting similar results in its performance to other passive equipments, and, therefore, being evidenced gains by the solar use, as a source of initiative. to eradicate this problem, when compared with other models described in the literature, showing ergonomic and functional in terms of its proper handling, thus transforming the reality of the semiarid region under study, and showing itself as a means that can be disseminated on a large scale.

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