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Socio-economic Importance of Solar Desalination of Local Water Bodies: A Case Study of Uburu and Okposi Lakes, Ebonyi State, Nigeria

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Abstract

Purpose: Access to clean and potable water supply is the priority of many nations including the government of Nigeria towards socio-economic emancipation of the people. Due to increasing population expansion and water pollution, shortage of freshwater has become very common to many nations, particularly to the developing countries. To overcome the growing freshwater shortage, desalination has been proven to be the best alternative option towards freshwater provision for domestic and industrial applications. Desalination could be either thermal or electric methods which include multi-stage flash distillation (MSFD), multiple-effect distillation (MED), reverse osmosis (RO), or solar desalination. The innovation of solar still technology in recovery of fresh water from saline waters makes solar desalination simple and economical. A survey of socio-economic importance of solar energy desalination of saline lake waters at Uburu and Okposi communities, Ebonyi State, South eastern, Nigeria was conducted.

Methodology: A survey research design was adopted for the study in order to address an age long tradition of fuel wood utilization in salt processing activity by the local women folk of Uburu and Okposi communities using saline water from the local lakes.

Results: The survey showed that about 1,200 women were involved in the salt production activity utilizing about 26,000 tons of fuel wood per year. Translating this into monetary terms amounts to about US$$1.5 million per year. Socio-economic lives of people in the communities were negatively affected because fuel wood utilization in salt production adversely results to deforestation, environmental pollution and high cost of fuel wood in the communities. The quality and quantity (output) of salt recovering process were not commiserating to time, energy and monetary input in the process. It was observed that the distillate (freshwater portion) of the salt recovery from the saline water was not considered as an important component of the salt extraction process. This is because the salt producers were only interested on the salt extract as the only useful output of the extraction process. Recovery of freshwater component of the process could be an additional valuable income if considered.

Unique Contribution to Theory, Policy and Practice: For sustainable salt production and freshwater recovery from the process solar desalination method was recommended for salt processing in the communities. The incorporation of solar desalination system into the age long traditional known method of salt processing will enhance salt production and boast socio-economic activities in the communities. A study of this kind is likely to help solve a major problem of acute water shortage in some communities whose water bodies are salty. The study could be a useful tool for policy makers in making rational policy that would improve and enhance salt and fresh water production as an enterprise.

Keywords: *Socio-economic, Solar, Desalination, Study*

INTRODUCTION

Water is one of the most important components of the Earth and life activities. Due to rapid increasing population and water pollution, shortage of freshwater has become very common to many nations, mainly to arid and semi-arid regions of the world where about 25% of the world population lives, with total lack of good quality water supply. The Earth on its own is covered with about 75% of brackish and brine water which renders it inadequate for drinking and therefore not potable unless when treated or processed further. About 1.76 billion people live in areas already facing a high degree of water stress (Vorosmarty et al, 2001). While ‘‘Water stress’’ is at the top of the international agenda of critical problems, at least as firmly as climate change (Vaknin, 2005). Because of this, the need for desalination is increasing, even in regions where water supply is currently adequate. According to UN report, the world is facing an imminent water crisis. Global fresh water demand will outstrip supply by 40% by 2030. Population growth, lifestyle changes, development and agricultural practices will contribute to an increasing demand for water during the next decades to come. By 2050 one in five developing countries will face water shortages according to UN Food and Agriculture Organization (https://www.seametrics.com).

Recent studies showed that solar energy can be used for sustainable production with high profit margins. In a long-term frame, considering energy and carbon payback times, solar-based interventions, even for energy retrofit, proved to be profitable. Solar energy can provide at least 76% of primary energy demand of a residential building with a short payback period (Serghides and Georgakis 2012). Thus, to improve and increase the quantity of freshwater production in communities short of freshwater supply in developing countries requires concerted effort. Various desalination methods and technologies have been reported (Bruggen, 2003 and Sharma et al., 2016).

To overcome the growing issue of freshwater shortage, saline water could be subjected and processed through solar desalination application to obtain freshwater. Solar desalination has become one of the major sources of water supply in several countries of the world today especially in the Middle East and North Africa region. Desalination technique removes excess salts from sea

water or brackish water by separation into safe potable or usable water. Desalination methods are categorized into thermal processes and membrane processes. Water purification by desalination has been proved as one of the best ways in solving freshwater shortage confronting many nations. Recent studies showed that solar energy can be useful for sustainable production with high profit margins (Chukwuemeka et al, 2021, Okonkwo and Akubuo, 2007). Solar energy can provide at least 76% of primary energy demand of a residential building with a short payback period (Okonkwo et al, 2022) including desalination. Various desalination methods and technologies have been reported (Bruggen, 2003, Sharma et al, 2016 and Abada et al, 2018). There is a great potential in fresh water provision using solar desalination technologies especially for regions where solar resource is in abundant supply, for instance in Nigeria. Most studies employed the solar still concept. According to Abada et al 2018, the economic potential of using solar still for extraction of salt from saltwater of high-level total dissolved solid (TDS) triggered the idea of looking for ways of modifying and improving the already existing single basin double slope solar still. At the present time, various researches have continued to improve on its thermal efficiency. Many design changes are being made in solar still to make it applicable at large scale. Solar still design method was employed at Uburu and Okposi in Ebonyi State, Nigeria for the purpose of salt production to enhance and boast the economic activities of the local people more especially the women folk. This was through the effort of the United Nations Industrial Organization (UNIDO) in an effort to impact positively and sustains continuity of salt production in Uburu and Okposi communities. By UNIDO's initiated action plan, solar crystallization technique for salt manufacturing was introduced in the communities in order to improve and maintain the age long profession of the community women. The study involved the survey of Uburu and Okposi salt manufacturing communities to identify, ascertain and proffer intervene in order to make salt manufacturing process easy in the communities.

Desalination is a process of extracting salts and minerals from a target substance. However, Desalination is an energy intensive venture. In thermal plants about 14 kilowatt-hours of energy is required to produce 1,000 gallons of desalinated seawater. Cost of distillation is high because a notable large amount of electricity is needed to heat water that can generate high pressure.

Solar desalination on the other hand, is a technique that produces potable water from saline water through direct or indirect methods, yet powered by solar energy. This is an alternative source of freshwater provision for areas where there is scarcity of water. Through this process, dissolved salts are separated from brackish or seawater.

Countries such as Australia, Italy and Egypt have adopted this system as an alternative source of water for their population.

PROBLEMS ADDRESSED BY THE STUDY

Studies (Okonkwo, 2005) showed that salt processing was the major income generating activity among women of both Uburu and Okposi communities. Whereas the drudgery of salt making in

Uburu and Okposi communities was noted, the utilization of fire wood as a major source of energy input was observed to have affected the salt production in the Uburu and Okposi communities of Ebonyi State, Nigeria. While many women had forsaken the age-old vocation of salt manufacturing, some continued to do so on a part-time basis, firewood being viewed as a rare resource with no equivalent at the time. Retailers have also reported that supply has become more expensive as a result of its competitive consumption in communities. Apart from its use in salt production, firewood is the primary source of household energy consumption for domestic cooking, boiling, and frying. According to Okonkwo (2005), over 1200 women in the settlements of Uburu and Okposi are active in salt production. The villages' salt production is seasonal. Only during the dry season, when the environment is dryer and brighter than during the rainy season, is salt generated.

The major input in the salt processing activities is fuel wood as energy source for heating the salt solution to crystallization. On the average, each woman produces about 23kg of salt per week under intensive heating using firewood. This results to a total of 5,160 tons of salt per year. Each woman utilizes an average of 112kg of fuel wood to produce this quantity of salt. This costs about US$7/day an average of US$0.057/kg. In a year about 26,000 tons of fuel wood costing approximately US$1.5 million is used for salt production alone in the communities.

In order to remove the drudgery associated in salt production while improving the current system, an alternate choice for the profession's sustainability and an environmentally friendly system is required. This served as the foundation for the research for this study.

THE SURVEY AREA

The study area included the autonomous villages of Uburu and Okposi in Ebonyi State, Nigeria. The salt lakes and ponds are the most well-known features of the community. Due to the fact that the available water bodies are saline, individuals must travel long distances to find freshwater for domestic and industrial purposes. The two communities share dialects and hence communicate similarly, despite their cultural differences. Farming is the predominant occupation of the population due to the fertile soil. Approximately 90% of the population is involved in agricultural output, with peasant households performing the majority of farming activities utilizing indigenous farm implements. During the rainy season, vegetation is thick and verdant, but as the dry season approaches, it becomes sparse. The terrain is undulating in places. The soil type varies from fertile clayloam to lateritic clay, causing water to pool on the earth's surface. The average annual rainfall is 750mm, and the temperature ranges from 25 to 33 degrees Celsius throughout the year, with an average solar radiation intensity of 550W/m2. Throughout the year, solar radiation is available. The minimum and maximum solar radiation intensities ranged from 370 to 780W/m2. The villages are located in the world's tropical zone in latitude 8o 30'E and longitude 6o 2'N. These conditions allow for more productive farming operations in the communities. Commercial quantities of crops such as yam, cassava, and rice are grown.

Apart from agriculture, the Uburu and Okposi communities are endowed with natural saline (salty) ponds and lakes, which are referred to among the communities as "Mmahi" (salt lakes). In general, Ebonyi State has three significant salt ponds, lakes, or springs: Uburu (20%), Okposi (50%), and Enyigba (27%). Other smaller ones can be found in Ukawu, Idembia, Onicha, and Inyaba.

The Uburu and Okposi saline lakes (Fig. 1) are gifts from nature to the women in the communities. In these areas saline waters are not only noticed in lakes and ponds but also in hand dug wells and most often reflects on the test of crops planted and harvested in the areas. The source of the brine is not yet known. It is believed that it is due to entrapped marine waters and sediments in the sub terrain of the locality. Some other version had it as due to some salt dome underground which on coming in contact with water dissolves and issues out through fractures and springs. However, the presence of the ponds and or lakes in the communities makes it possible for the women to manufacture local salt themselves and generate income for their families. Because the available water bodies are salty the people trek several distances in order to get freshwater for domestic and other applications.

Fig. 1: Uburu (left) and Okposi salty lakes of Ebonyi State, Nigeria

Salt extraction and production is a hereditary skill and a major profession only known to the women folk in the communities. Traditionally, the salt water taken from the lakes is boiled over hours, with fuelwood being the only energy source of heating, which has adversely affected the communities not in small measures but with the great consequence of deforestation, air and environmental pollution.

However, due to the time-consuming nature of the process, crude traditional techniques, ever-increasing cost of firewood, time and energy expended, modern development, and poor income generation, many women left the age-old hereditary profession for other professions such as

trading on articles, farming, teaching, and so on. Only a few women are currently employed in salt manufacture in the areas. The bulk of these people combine salt manufacturing with other economic pursuits to earn a living and provide for their family. This necessitates an intervention to promote sustainability, profitability, and poverty alleviation among the people of Uburu and Okposi areas, particularly women.

UNITED NATIONS INDUSTRIAL ORGANIZATION (UNIDO) INVOLVEMENT

In response to the aforementioned needs, the United Nations Industrial Organization (UNIDO) initiated an action plan to introduce solar crystallization technique for salt manufacturing in Uburu and Okposi communities, Ebonyi State, in order to improve and sustain the age-old profession of the community women. The study included a survey of salt producing areas to determine the amount of energy input (fuelwood) used in salt making. This was done in order to determine the best technologies to introduce to assist women in the manufacturing process. The survey's major goal was to promote solar desalination as a technique of salt manufacture in the communities.

Other objectives include to:

1. To improve on the traditional methods of salt manufacturing in Uburu and Okposi Communities of Ebonyi State.
2. To eliminate firewood utilization in salt manufacturing in the communities.
3. To enhance profitability and efficiency in salt manufacturing
4. To reduce environmental degradation due to fuelwood utilization and deforestation in the communities.

METHODOLOGY

For this study, a survey research design was used. According to Busher and Harter (1980), a survey research design allows specific issues to be explored by obtaining information on people's attitudes and beliefs across a large population. This technique is applicable to this study because it entailed sampling stakeholder perspectives (women, community leaders, etc.) on the art of salt manufacture in communities.

A survey instrument (questionnaire) devised for the purpose was utilized to collect sufficient information about the salt manufacturing communities of Uburu and Okposi in Ebonyi State. The questionnaires were given to women (respondents) who are directly involved in salt processing in their communities. This was accomplished with the support of members of a non-governmental organization (NGO) - the Centre for Small Industry Research and Training (CENSIRT), as well as members of state and local committees formed for the purpose.

ADMINISTRATION OF QUESTIONNAIRE

Based on the population of women working in salt production, a total of seventy (70) women were chosen at random for the two villages, with 40 and 30 women picked at random for Uburu and Okposi, respectively, and the questionnaire was administered to the women respondents).

Sections A-F of the questionnaire address general information about the respondents, social and occupational information, salt production, energy input, community information, and salt making technology in the communities. As a realistic representation of people active in salt making, the survey was limited to elderly (married) women aged 23 and up. The questionnaire was administered in groups. Women in each community were gathered together in the Village Square and the questionnaires were administered to the respondents who filled them there and returned them thereby. This was to make sure that accurate information was collated and also to avoid any possible manipulation and non-return of survey questionnaires by the respondents. Oral interview was used to extract information where possible. Members of CENSIRT and committee members were on hand to help the women who could not read nor write to fill the questionnaire (see Fig. 1). The completed copies of the questionnaire were analyzed using simple statistics such as frequency counts and percentages, and tables were provided where necessary.

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Fig. 2: Facilitators gathering information from local women salt manufacturers at Okposi

SURVEY INSTRUMENT

The instrument used for data collection was questionnaire. A 43 items structured questionnaire was designed. The questionnaire was divided into 2 sections. Section 'A' sought for information

on personal (Demographic) data of the respondents. Section "B" sought for information on the use of water from the local Salt Lake to produce salt.

VALIDATION OF THE INSTRUMENT:

To verify the validity of the questionnaire, ten (10) salt producers from both villages participated in a research pretest. This allowed the researcher to determine whether the questions asked would provide the necessary data. However, the findings of the instrument validation demonstrated that all of the items in the questionnaire were capable of eliciting the desired response. As a result, the device was capable of measuring the variables in the study.

DATA ANALYSIS

SURVEY DATA AND DATA REDUCTION PROCEDURES

Raw data obtained from the survey questionnaire were compiled and computed in order to get reduced data as presented in the Tabular form.

Social and Occupational indicators

The social and occupational indicators were obtained by taking the statistics of the respondents on the questionnaires as administered. Information gathered from the respondents were used for the analysis. The indication by some respondents as engaged in other occupations in addition to salt production was taken into account in the evaluation. The General formula used to estimate the percentage of each set of respondents on each question was given by

$$Y = \frac{Y_1}{X} X\,100\%$$

Where;

Y = information sort for

Y1 = number of respondents in the group

X = Total number of respondents, for Uburu = 40, and Okposi = 30

Detailed analysis of the study is as given below.

General Information

The survey was restricted to women who are directly involved in salt production in their communities. Although the respondents were mostly women, emphasis was made to age distribution, as ages 0 to 15 were considered children, and ages 16 and up were considered adults; however, the results showed that 100% of the women respondents were residents of the villages. According to the findings, all of the respondents were between the ages of 23 and 85. This emphasizes that salt manufacture in the communities is a job for elderly women. Out of 40 women respondents in Uburu 4(10%) were below 30 years, 15(37.5%) fell within the age range of 31 – 45

years, 14(35%) were within the age range of 46 – 65 years old while 7(17.5%) were above 65 years old.

In Okposi out of 30 women respondents 3(10%) were below 30 years old, 12(40%) were within the age bracket of 31 – 45 years old, 10(33.3%) were between 46 – 65 years old and only 5(17.7%) were above 65 years old. It was observed that the majority of the respondents were within the age range of 31 – 65 years old demonstrating the age of active participation of women in the art of salt manufacturing.

The marital status of the respondents showed that 100% were married and none was single. While the general level of education/literacy was such that in Uburu community, of the 40 respondents about 60% were literate in vernacular. About 30% were found to have completed or attended primary education, 10% attended secondary education while none was found to have attended tertiary education.

With regards to education of the respondents in Okposi community, about 43.3% out of the 30 respondents were illiterates. They can neither read nor write. Only 46.7% have attended or completed primary education, while only 3% completed secondary education and none had tertiary education.

It was believed that women in towns with higher education, such as those in teaching, the civil service, or the commercial sector, found better careers outside of salt manufacturing, as well as inside local government. If improved salt production is to be achieved in the two communities, a conscious effort should be made to take the interests of the women into account based on their level of education and the sort of intervention needed.

ECONOMIC ACTIVITIES

Statistics indicated that salt processing was the major income-generating activity among women of both Uburu and Okposi communities. However, because of development and prolonged periods coupled with cost of energy input and crude method of salt manufacturing, the women either are engaged in some other activities in order to meet with the family demands. A woman may be found to be manufacturing salt while at the same time involved in one or more other economic activities. Such economic activities could be found in farming, trading, tailoring or civil service.

In Uburu and Okposi communities, 80% and 70% of the respondents showed that salt production was their main occupation while 20% and 30% respectively stated other profession as their major occupation but doing salt production part-time as an economic activity. In Uburu and Okposi, respectively, 65% and 66.7% of salt production is combined with agricultural work, and in Uburu, 12.5%, farming is the primary activity. While 32.0% of respondents in Uburu combine salt manufacture with tailoring and only 2.5% are in the civil service, 10% of respondents in Okposi were involved in commerce and 3.3% were employed in government.

According to the data above, women in the Uburu and Okposi communities mostly engage in the manufacture of salt. Any additional work is done on the side or in conjunction with the production of salt. Their male counterpart has no bearing on this situation. Only the elderly (married) women help bring salt water from the lake, with perhaps one or two young girls. And only pots built according to tradition (earthenware) are permitted to be used to draw water from lakes.

PRICE OF CAKE OF SALT

Salt is made in a solid state and is sized through molding. The salt cake's market price is determined by the size of the salt. A cake of salt in a mould can weigh anywhere from 3.2 kg to 23 kg, and it can be purchased for between N100 and N1,000. According to 2010 prices, salt might bring in anything from N500 to N4,000 per month.

All of the female respondents (100%) in Uburu and Okposi, respectively, said they sell the salt they produce in the local markets, but they weren't happy with the price they receive in comparison to the energy input and time consumed. It was noted that the majority of the women were processing the salt for little or no profit. In this regard, it was adopted broadly an increment in price.

FIREWOOD USAGE IN DESALINATION OF THE SALINE WATER

Fuelwood constitutes the only source of energy input in salt production in both Uburu and Okposi communities. It takes about 112kg bundle of firewood to produce 23kg of salt. In a year 21.67 tons of firewood is what it takes a woman salt producer to continue in the business. Comparatively, 26,000 tons of firewood is utilized by 1200 women in the business for salt production annually. This when translated in monetary value gives a total sum of 188,490,000 million naira per year just about $1.5 million per year at N125 per dollar exchange rate. This is the amount that could be saved if there is an alternative to fire wood input.

Apart from the indication that fire wood was the most difficult and expensive aspect of salt production in the communities, all or 100% of the respondents indicated the use of fire wood only as the energy input in boiling the salt solution. 95% of the sample survey in Uburu showed that between 3 – 5 bundles of fire wood were utilized in salt production while 5% indicated using 6 and above bundles of fire wood or trip of fire wood.

On the other hand, the 30-sample survey in Okposi 80% used 3 to 5 bundles of fire wood while 6.7 % indicated between 6 to 10 bundles, 3.3% used 10 bundles and above, and 10% of the respondents bought the fire wood in trips.

APPLICATION OF SOLAR DESALINATION METHOD IN DISTILLING AND SALT PRODUCTION

Solar energy radiation and the availability in Uburu and Okposi communities was estimated to be at an average of 4.5kW/m2/day. This is available for about 6.5hours on a daily basis and all the year round. There was evidence that solar energy is being used in the communities in such areas

as crop, cloth, fish and meat drying activities. However, there was no trace of use of solar energy either to boil or evaporate salt solution in both communities. The technology of solar still/distillation technology is not a common knowledge among the community members. The 40 and 30 survey sample respondents in Uburu and Okposi communities 30(75%) and 26(86.7%) indicated no knowledge of solar still or desalination technology while only 10(25%) and 4(13.3%) respectively indicated knowledge of solar still or desalination technology. All or 100% of the respondents in both communities indicated the willingness to accept solar technology that can save them fuelwood utilization in salt production. 95% and 80% of the respondents also indicated their willingness to pay for such technology if made available to them while 5% and 20% of the sample survey indicated no willingness to pay for such technology.

Potable water supply was one of the major problems identified facing both Uburu and Okposi communities. This is because water from the lakes is very salty and therefore unfit for drinking and other domestic purposes. Major sources of water supply in the communities include manually operated borehole, streams/rivers, lakes and rainfall.

Report showed that 47.5% and 23.3% of sample survey respondents in Uburu and Opkosi respectively indicated getting their water supply from manually operated bore hole, while 47.5% and 50% indicated rain harvest as one of the sources of getting their water supply. Only 2.5% in Uburu indicated lake as source of water supply and buying freshwater from tanker supplies. However, all the respondents in both communities indicated streams/rivers as one of the sources of getting water supply. The streams are between ½ - 3km radius depending on the location of the household.

Apart from water supply problem other problems identified were environmentally related. While deforestation was evident as result of falling of trees for fuelwood, bush burning and air pollution from fuelwood usage in salt manufacturing, waste dumping was observed to constitute a threat to the environment. Out of the 40 and 30 sample respondents from Uburu and Okposi communities 42.5% and 70% indicated deforestation as problem in the community, 10% and 33.3% responded bush burning to be a problem, 72.5% and 72.5% also showed air pollution resulting by fuelwood usage producing smokes to be a major problem while 17.5% and 3.3% indicated waste dump.

In regards to community plan to boost salt manufacturing, 35% and 13.3% of Uburu and Okposi survey samples indicated there was no plan, while 65% and 60% of the respondents indicated that they are waiting for government to come and help them, 32.5% and 33.3% were of the opinion that there was no financial support from anybody to encourage them, and 47.5% and 46.7% said they are doing the salt production on individual basis respectively.

However, one thing that was common to all was the neglect of the water component of the traditional method in use that allows the steam of the boiling saline water to evaporate into the air. The steam could constitute freshwater if properly channeled and collected. This could save some amount of money, time, and energy of trekking long distance in search of water.

It is accepted that it takes a long time for a new ideas, concepts or technologies to have an impact on an environment but salt manufacturers in Uburu and Okposi communities of Ebonyi State are already aware of the drudgery involved in the current method of salt production in their communities. This results to the manufacturers' indication of innovative technology into the salt manufacturing process. Majority is aware of the potential of solar energy resources in the locality. Indication from survey shows that it takes about a week for a salt manufacturer in Uburu or Okposi to produce about 23 kg of salt using the traditional method of salt processing.

However, it is recommended that a solar crystallization salt processing system that can produce at least the same quantity of salt (23 kg) within the same period was to be designed and developed as an intervention eliminate the drudgery involved in salt production in the communities. Solar crystallization method has the potential of replacing age long fuel wood utilization in the salt manufacturing process. This represents alternative that could be more economical, environmentally friendly and sustainable.

CONCLUSION

This study showed that salt processing was the major income generating activity among women folk of both Uburu and Okposi communities of Ebonyi State, Nigeria. Whereas the drudgery of salt making in Uburu and Okposi communities was noted, the utilization of fire wood as a major source of energy input was observed to have affected the salt production and the Uburu and Okposi communities at large adversely. While many women had left the age long profession of salt making and some doing it on part-time basses, firewood supply was regarded as a scarce resource, which has no substitute at the present. Supply by retailers has been confirmed as very costly with its utilization in the communities also very competitive. Firewood is the major household energy consumption for domestic cooking, boiling and frying apart from the utilization in salt making. Okonkwo (2005) showed that about 1200 women in the communities comprising Uburu and Okposi are involved in salt production. Salt production in the communities is seasonal. Salt is produced only during the dry season when the environment is dry and brighter than the rainy season.

The major input in the salt processing activities is fuel wood as energy source for heating the salt solution to crystallization. On the average each woman produces about 23kg of salt per week under intensive heating using firewood. This results to a total of 5,160 tons of salt per year. Each woman utilizes an average of 112kg of fuel wood to produce this quantity of salt. This costs about US$7/day an average of US$0.057/kg. In a year about 26,000 tons of fuel wood costing approximately US$1.5 million is used for salt production alone in the communities.

In order to eliminate the drudgery involved in salt making as well as improves on the current method the local salt producers use solar desalination method was recommended. Solar desalination is eco-friendly and could help harness the distillate (fresh water) otherwise a waste by

the present method the women salt producers use. Its introduction would improve socio economic life in Uburu and Okposi communities respectively.

RECOMMENDATIONS AND CAPACITY BUILDING INTERVENTIONS

In view of the conclusions derived and presented in section above the following recommendations and capacity building related interventions were made for Uburu and Okposi salt manufacturing communities of Ebonyi State, Nigeria.

1. Introduction and popularization of solar desalination system for salt manufacturing in Uburu and Okposi communities will reduce the fast rate of deforestation and environmental degradation around the communities.
2. Establishment of solar equipment manufacturing centre that will take the responsibility of developing and manufacturing solar still for salt extraction in Nigeria.
3. Installation of six (6) and four (4) pilot solar crystallization plants in Uburu and Okposi communities close to the saline lakes respectively.
4. Training of local people on the technology, fabrication and installation of solar still.
5. Provision of micro credit for the purchase and fabrication of solar stills.
6. Empowerment of the local salt producers economically.

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