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Review on Solar Energy Application

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ABSTRAC

Solar energy technology is one of the important sources for developing heating for many countries to tolerate their energy needs. The geographic location plays an important role in collecting the energy, it is be one of the promising type of renewable energy. It has been reported in some review papers, it can spotlight for made on solar energy in fresh water got after arrival distillation high efficiency by using Solar Energy System the integration between solar energy for electricity and water Production, due to this fact that exchange efficiency from solar energy is much higher for process heating than for electricity generation. As result to share of industrial energy consumption. The incorporation of renewable energy and the transportation system can be significantly beneficial for the economy and environment. can use the main energy source for vehicles are the natural gas and fuel However, due to the rapid depletion of the gas reserve, soaring gas prices and global warming, alongside the environmental pollution caused by burning fuel, this raises concerns about these energy sources. Renewable energy offers a plausible solution to these problems.

Keywords: solar energy, water distillation, solar collectors, thermal energy storage, thermal Energy storage, phase change materials, electric vehicles, green transportation, solar electric (photovoltaic).

1 INTRODUCTION

Energy is defined as capacity to produce an effect to do work. Energy has been an important component to meet the day to day needs of human beings. Human society requires increasing amount of energy for industrial, commercial, domestic, agriculture, and transport uses. Different forms of energy are defined as primary and secondary energy, commercial and noncommercial energy, renewable and nonrenewable energy.

1.1 Primary and Secondary energy- Primary energy refers to all types of energy extracted or captured directly from natural resources. Primary energy can be further divided into two parts namely renewable and nonrenewable energy. Primary energy is transformed into more convenient form of energy such as electricity, steam etc. these forms of energy are called secondary energy.

1.2 Commercial and Noncommercial energy- Energy that is available in the market for a definite price is known as commercial energy. The most important forms of commercial energy are electricity, coal, refined petroleum products and natural gas. Any kind of energy which is sourced within a community and its surrounding area, and which is not normally treated in the commercial market is termed as noncommercial energy such as firewood, cattle dung, agriculture waste etc(Sinton, J. E., & Fridley, D. G, 2000).

1.3 Renewable and nonrenewable energy- Renewable energy is obtained from natural sources. These resources can be used to produce sustainable energy eg, solar energy, wind energy, tidal energy etc. Nonrenewable resources cannot be replaced once they are used eg. Coal, oil, gas etc. these energy resources are limited and would be exhausted within prescribed period of time (Mathew, S, 2006).

1.4 Solar energy Applications -The earth receives the solar energy in the form of solar radiation. These radiations comprising of ultra-violet, visible and infrared radiation. The amount of solar radiation that reaches any given location is dependent on several factors like geographic location, time of day, season, land scope and local weather. Because the earth is round, the sun rays strike the earth surface at different angles (ranging from 0° to 90°). When sun rays are vertical, the earth's surface gets maximum possible energy (Campbell, J. B., & Wynne, R. H, 2011).

Many countries to inquire into and change to environmental friendly alternatives that are renewable to sustain the increasing energy demand. Solar energy is one of the best renewable energy sources with least negative impacts on the environment. Different countries have formulated solar energy policies to reduce dependence on fossil fuel and increase domestic energy production by solar energy. This paper discusses a review on the different solar energy policies implemented on the different countries of the world.

According to the 2010 BP Statistical Energy Survey, the world cumulative installed solar energy capacity was 22928.9 MW in 2009, a change of 46.9% compared to 2008. Also this paper discussed the existing successful solar energy policies of few selected countries. Based on literatures, it has been found that FIT (Feed in Tariff), RPS (Renewable Portfolio Standard) and incentives are the most beneficial energy policies implemented by many countries around the world. These policies provide significant motivation and interest for the development and use of renewable energy technologies (Solangi, K. H., Islam, M. R., Saidur, R., Rahim, N. A., & Fayaz, H, 2011).

In this study we review solar energy applications. A study by Garg(1975), to design a water distillation system that can purify water from nearly any source, from he was the results of project calculations a truthful estimate was made to prototype the most effective geometries of the distiller and trough concentration system, one that will maximize evaporation/condensation and re capture waste heat to minimize thermal losses. To achieve this goal, a system was designed incorporating a parabolic solar trough coupled with a custom designed distillation device (Al-Hayeka, I., & Badran, O. O, 2004). The incoming solar radiation from the sun is focused and concentrated onto a receiver pipe using a parabolic trough, heating the incoming impure water, at which point it is sprayed into our custom designed distillation device where it evaporates and is re-condensed into pure potable water even though a study Mehta, Alpesh, used different method he found that.water is in a fresh, liquid state, and nearly all of this is polluted by both diseases and toxic chemicals. For this reason, purification of water supplies is extremely important. Keeping these things in mind, we have devised a model which will convert the dirty/saline water into pure/potable water using the renewable source of energy (i.e. solar energy) (Kalogirou, S. A, 2005).

Study by Garg, fresh water obtained after arrival distillation efficiency of the still is 99.64% as compared to the theoretical analysis. Future goals for this project include calculation refinement, material research/testing, and fabrication. PV, Solar Radiation. However, we found Mehta, Alpesh obtained results by evaporation of the dirty/saline water and fetching it out as pure/drinkable water. The designed model produces 1.5 liters of pure water from 14 liters of dirty water during six hours (Bouchekima, B. 2003). The efficiency of

plant is 64.37%. The TDS (Total Dissolved Solids) in the pure water is 81ppm.

The research done by Al-Hamadani study focus on discussions stats, and author Water Distillation Using Solar Energy System with Lauric Acid as Storage Medium. They found the result an experimental investigation on a solar still with lauric acid as phase change material (PCM) is carried out to examine the effect of both the mass of PCM and basin water on the daily distillate productivity and efficiency of the system under outdoor condition. Basic energy balance equations are written to predict the water and glass temperatures, daily distillate productivity and instantaneous efficiency of the single slope solar distillation system with PCM (Ofili, I., Ugwuoke, E. C., Eng, M., Eze, N. N., Eng, B., Ukwuani, S. T., & Ogunjobi, S. A, 2016). It is found that the higher mass of PCM with lower mass of water in solar still basin significantly increases the daily productivity and the efficiency. Therefore, the distillate productivity at night and on day for solar still with PCM increased by 127% and 30-35% respectively than without PCM one. Shukla et al. approach of the use of inner glass cover temperature for productivity prediction which has also been investigated, and the prediction shows relatively better agreement with the experimental data than outer glass cover temperature (Garg, H. P, 1975).

Solar energy can be used for Electricity and Water Production, in study Moser,Massimo got this result, Several studies carried out at DLR such as [AQUA-CSP 2007], [MED-CSD 2010] and [MENAWATER 2011] have shown that the current water supply of several countries of the Middle East and North Africa (MENA) relies to a large extent on fossil groundwater extractions. Such extractions are characterized by continuously increasing energetic and economic efforts, which causes depletion of precious water resources and negative impact on the environment.

The main objective the development of a flexible model for the integrated techno-economic assessment of seawater desalination plants using renewable energy. A number of simulation models have already been implemented for the design and the simulation of renewable plants or desalination units. However, so far no established tool exists for the simulation of such integrated systems. The simulation tool INSEL has been selected for the analysis. This commercially available tool combines a modular structure with simple handling and low computational effort. The core of the present doctoral thesis consists in the extension of the currently available INSEL library with new models for a number of desalination technologies, i.e. multi-effect distillation (MED) and reverse osmosis (RO) as well as CSP components such as solar field, thermal energy storage and power block (Benli, H, 2016).

The INSEL library has been further extended by a number of CSP components, which include parabolic trough, linear Fresnel and central receiver. The solar field models base on a steady

state thermal energy balance between incoming radiation, geometrical and optical losses, heat gains of the heat transfer fluid (HTF) and heat losses to the environment. The model takes into account layout and losses of the HTF system. In addition, transient effects are considered by means of a simplified approach. This is an important improvement which is not considered by the majority of the existing system analysis simulation tools. A two-tank molten salt storage has been selected as reference thermal energy storage, while the power block consists of a detailed thermodynamic model of a conventional Rankine cycle. Inlet steam quality, number and pressure level of steam extractions, and type of cooling (once through, evaporative, dry) can be flexibly adapted. The INSEL CSP models have been developed with information from the DLR groups of the Institute of Solar Research and of the Department of Thermal Process Technology (Ma, Q., & Lu, H, 2011).

A potential application of the implemented INSEL models is shown in a final case study, which assesses the feasibility of combined power and water production plants. The analysis has been carried out for Marsa Alam, a remote touristic location in the South-East of Egypt. The governorate of Marsa Alam is not connected to the national networks, which makes it attractive for the development of renewable desalination plants. Under these assumptions RO provides slightly lower water production cost than MED; however, due to its robustness and simplicity of operation, MED could still be a competitive option wherever feed water pre-treatment is particularly challenging and RO plants would be prone to frequent fouling problems (e.g. Arabian Gulf). The molten-salt-based central receiver with a 14-16 hours thermal storage performs lowest levelized electricity (Moser, M, 2015).

Analysis of multi-purpose plants has been performed as a function of local requirements (electricity, water), available resources (solar irradiation, wind speed, air temperature, water quality) and techno-economic parameters (plant configuration, investment and operation cost, back-up fuel cost etc.) by means of annual yield simulations with hourly time steps. Different plant configurations need to be compared based on common boundary conditions. This implies e.g. that the same demand curves (i.e. electricity and water) have to be covered by all analyzed configurations, which allows also considering external costs such as the impact of fluctuating renewable power on fossil power plants´ performance. One of the main findings is that moving in due time towards an electricity supply system based on a mix of renewable and conventional technologies is not only convenient in the case of high fossil fuel price, but it also includes strategic advantages such as the reduction of the dependence on scarce resources and the stability of the supply cost. A cost-optimal power park consists of a mix of all available renewable technologies and fossil backup. Thereby, electricity generation by relatively cheap but variable renewable power plants is balanced by slightly more expensive power generation on-demand, which is

provided by CSP (Lovegrove, K., Wyder, J., Agrawal, A., Boruah, D., McDonald, J., & Urkalan, K, 2011).

As for water heating to can review in Soloha, Raimonda studied, significant increase in the use of solar energy can be observed. Solar energy is not, however,widely used in Latvia. The aim of this paper is to devise an algorithm to evaluate the possibility of integrating solar energy into the district heating system (DHS) of Latvia for both space heating and the supply of domestic hot water. The methodology was tested on a district heating system in a municipality in Latvia with 20,000 inhabitants. The existing DHS operation data were processed for the analysis and optimization of the system. Optimization of the system includes energy efficiency measures (EEM). Results show the possible energy production from solar energy depends on the area of different solar collector fields and thermal water storage tank volumes, as well as the probable costs of the system. It would be necessary to install solar collection fields of 9,000 m^2 to 72,900 m^2 with a properly sized TES in order to produce from 6,000 MWh/year up to 23,700 MWh/year. With this system it would be possible to supply 10 % to 78% of the total heat demand with solar energy in any given DHS. If EEM have also been implemented, solar energy share can be increased (Al-Hamadani, A. A. F., & Shukla, S. K, 2011).

Another study for water heating at Benli, Hüseyin, Potential application of solar water heaters for hot water production in Turkey. Turkey has become one of the fastest growing energy markets in the world in parallel to its economic growth registered in the last 10 years and is rapidly gaining a competitive structure. Turkey is increasingly turning to renewable energy sources as a means to improve its energy security and curb dependence on imported gas from Russia and Iran. Turkey is a country which has the highest hydropower, wind and solar energy potential among European countries. Current energy policy of Turkey primarily aims to maximize solar, geothermal, wind and hydropower potential of the country until 2023(Benli, H, 2016). In this study, solar energy potentials of country and solar water heaters were investigated using meteorological and geographical data from six cities in Turkey. Two different collector types were compared in terms of absorber material (galvanized sheet and vacuum tube). The energy requirements for water heating, collector performances, and economic indicators were calculated using climate data. Results showed that galvanized sheet absorbers were the most appropriate in terms of coverage rate of the energy requirements for water-heating across Turkey. The prices of a galvanized absorber type and a vacuum tube heating systems in Turkey are 950 and 1250 USD on average (including installation), respectively. Copper and selective absorber type collectors did not appear to be appropriate based on economic conditions. Six provinces in Turkey were chosen, which were ideally located to take advantage of solar thermal energy and technologies. The data also show that most of the solar water heaters are

mainly used by the domestic sector for hot water production (about 96%). The regional popularization analysis indicates that the limited installation of solar water heaters in the Eastern and the Northern district. In these districts, the problem of climatic conditions and lack of purchasing power are addressed (Moser, M, 2015). Although we note that in the State of India different results for the reason of climate variability and thus the results of the Suresh, N. S study, the annual consumption of petroleum products in India was about 221 million metric tons in 2015. Of this, 84% was imported. The Indian industrial sector accounts for about 16%–20% of the total fuel consumption for thermal energy for different heating applications in the temperature range of 50°C–250°C. Solar collectors can meet these temperature requirements and offer the possibility to mitigate the consumption of oil. This study highlights the fact that conversion efficiency from solar energy is much higher for process heating than for electricity generation and that process heating applications constitute a significant share of industrial energy consumption. In this paper, a methodology has been developed to estimate the potential for integration of solar collectors for process heating. The methodology employs process operating temperatures to select the type of solar collectors. The size of the solar field is estimated taking into account the thermal heat loads, working fluid and temperatures of these processes, the efficiency of the chosen solar collectors, location-based solar irradiance and capacity utilization of the solar collectors (Kumar, A., Sootha, G. D., & Chaturvadi, P, 989). The proposed methodology has been validated with a software tool called System Advisor Model (SAM). The techno-economic analysis will indicate the viability of solar systems for integration in industries. Therefore, the consociated parameters on economic (capital cost, fuel oil savings, monetary benefits), financial (Payback periods, Rates of Returns) and environmental (Carbon savings) are estimated. Further, the methodology has been applied to select Indian industries to verify its potential quantitatively. The industries selected include Textile, Pulp & Paper, Dairy, Leather and Automobile. Process wise energy demands are considered while estimating the potential as the fuel requirement offset by solar energy in terms of absolute fuel oil savings, monetary benefits and carbon savings. The other economic and financial parameters mentioned above were estimated to verify the capability and present the market position of solar systems. Further, sensitivity analyses have been performed with respect to solar energy penetration and fuel oil prices to address the viability of integration of solar energy for process heating (Suresh, N. S., & Rao, B. S, 2017).

Reviews the application of solar industrial process heating industry in M.Gajendiran study. This focuses of solar thermal technology is required in those industries which use large quantities of low temperature hot water for the economic operation. With the rise in fuel cost, there is a significant research, development and

application in solar industrial process heating. Due to the unavailability of solar energy during non-sunny days and diurnal changes throughout the day, storage of thermal energy is inevitable. Recent developments nationally and internationally may rekindle new applications of solar thermal energy use by industry (Gajendiran, M., & Nallusamy, N, 2014).

Review on Integration of Solar Air Heaters with Thermal Energy Storage in Saini study Solar radiation on the earth's surface is abundant and truly a zero-carbon energy source. The solar energy needs to be harnessed using various efficient equipment, which has a very low carbon footprint. Various solar thermal energy harvesting techniques have been used which employ solar radiation incident on the optimal area with the help of concentrators (Saini, P., Patil, D. V., & Powar, S, 2018). The solar air heater is one of the solar thermal harvesting techniques, which has gained tremendous popularity in recent times. In this chapter, design and operations of various solar air heaters are detailed. Further, due to the intermittent nature of the solar energy, energy storage becomes an integral part of the solar energy harvesting and the solar energy may be stored using latent or sensible heat thermal energy storage. A discussion on various thermal energy storage technologies is then followed. Here, integration of a solar air heater along with low cost or efficient, sensible heat thermal energy storage system is given (Gupta, S., & Sharma, A, 2018).

Another study used solar energy in Iraq is a country located near the solar belt, which makes it characterized by high solar radiation intensity and high brightness period throughout the year. These properties make the use of renewable energy, especially solar energy, possible and have a clear effect. In this review, solar applications are studied for the production of heat and electricity and the possibility of using them in Iraq (Kazem, H. A., & Chaichan, M. T, 2012). From reviewing the many references that have worked in this field, it is clear that Iraq is ready to use solar energy in applications of heating water for domestic use. Solar heating in the winter of Iraq is also possible and clearly reduces the electricity required for this application in the winter. The use of thermal storage, whether in the Trombe wall or in the solar pool, is very successful in Iraq, thanks to high solar radiation. As for the production of electricity whether by concentrated power station (CPS) or using solar cells, the studies proved its successfulness, with the need for further research to increase the productivity of photovoltaic cells, which is currently done through photovoltaic thermal systems (PVT) (Jacobson, M. Z., & Delucchi, M. A, 2011).

Another study Richardson, for solar energy use in electric for example electric vehicles. While other countries have some problems, it has become an important problem for our country if it is thought that we are mostly foreign dependent and the energy demand is a problem. Our country especially works on the policies about energy efficiency besides energy resource

search. It is the sign of how it is important that we are mostly foreign dependent on energy (Richardson, D. B, 2013). The most important energy problem is energy for efficiency. When changing and developing automotive industry is handled, an important part of energy consumption consists of automobiles. The movements of the vehicles are accomplished with petrol consumption which is a fossil fuel resource today. The researchers seek different energy resources for long years because fossil fuel resources are limited, exhaustible and results in environmental pollution. In this concept, the thought of electrical vehicles is present for long years (Takeno, M., Chiba, A., Hoshi, N., Ogasawara, S., Takemoto, M., & Rahman, M. A, 2012). So, it is clear that even small scale efficiency studies can save energy when thought in general basis (all automobiles). Practical solutions about efficiency increase in present vehicles, electrical efficiency and structure of vehicles working with energy taken from the sun is analyzed. Additionally, we try to determine a way for possible new designs for new cars. As the infrastructure of cars running by converting the energy taken from sun into electricity cannot reach desired levels, it is quiet costly today. Saving which can be done with small changes in present cars should not be ignored. Practical approaches should be developed by making detailed researches on these approaches.

Can use solar energy in optimization of solar energy system for the electric vehicle at University Campus in Dhaka in Chowdhury study, Bangladesh the incorporation of renewable energy and the transportation system can be significantly beneficial for the economy and environment of Bangladesh (Chowdhury, N., Hossain, C., Longo, M., & Yaïci, W, 2018).The main energy source for vehicles in Bangladesh are the country's natural gas and fuel. However, due to the rapid depletion of the gas reserve, soaring gas prices and global warming, alongside the environmental pollution caused by burning fuel, this raises concerns about these energy sources. Renewable energy offers a plausible solution to these problems. This paper's objective is to focus on the maximum usages of a solar photovoltaic (PV) system in electrical vehicles and to minimize the environmental impact in terms of CO2 emission (Longo, M., Hossain, C. A., & Roscia, M, 2013). This system may be partially used to power up the electric vehicle with a charging facility and contribute excess power to the national grid. The modeling, with its optimal analysis of the green transportation system, the goal of this work is to offer an alternative use of RETs to provide a new transport system, which can reduce the operating cost and minimize the CO2 emissions. The modeling with its optimal analysis is simulated using HOMER software (Energy, H. O. M. E. R, 2011), is simulated using the Hybrid Optimization of Multiple Energy Renewables (HOMER) software. This is a general problem-solving method that consists of systematically enumerating all possible combinations for the solution and checking whether each combination satisfies the problem's statement. The energy produced by

the PV system can provide up to 13,792 kWh/year. Approximately 21% of the total production can be used in the charging station for charging the electrical vehicles and the rest of the energy can contribute to the national grid. Moreover, using the proposed concept of green transport will ultimately reduce greenhouse gas emissions by 52,944 kg/year (García-Olivares, A., Solé, J., & Osychenko, O, 2018, Chowdhury, N., Hossain, C., Longo, M., & Yaïci, W, 2018).

This study Oji, utilization of solar energy for power generation in Nigeria, solar-thermal and photovoltaic options were discussed (Oisamoje, M. D., & Oisamoje, E. E, 2013). It highlights the basic science for the design and selection of components for successfully harnessing solar power. Requirements for solar panel placement and orientation were also highlighted. Solar panels are made up of solar cells which are an array of photovoltaic cells (PV) (Oji, J. O., Idusuyi, N., Aliu, T. O., Petinrin, M. O., Odejobi, O. A., & Adetunji, A. R, 2012). Any type of equipment used to convert sunlight into energy is considered solar cell or panels. The technology behind Solar panels has varied widely throughout the five or six decades and while solar cells were the true origin of modern solar panels. It emphasizes that the knowledge and experience gained in solar energy as an abundant and convenient energy source, can play a role in steering the nation toward a permanent and sustainable development. The energy demand in Nigeria far outweighs the supply which is epileptic in nature, today researchers are shifting to new platform and approaches to gathering energy from sunlight which including crafting solar cells from silicon semiconductor configured to trap and convert sun energy which are coated in an antireflective coating and contained under a glass cover plate to protect the cell from the elements (Agbetuyi, A. F., Akinbulire, T., Abdulkareem, A., & Awosope, C. O. A, 2012).The acute electricity supply hinders the country's development notwithstanding the availability of vast natural resources in the country. Our ability to continue the trend for affordable energy will be severely tested in the coming decades, as evidenced by the widening trade imbalance, collapse of big manufacturing companies, sharp increase in the cost of doing business just to mention but a few. It is the issue of utilizing the sun's silent, inexhaustible, and non-polluting resource for power generation in Nigeria that this work addresses, hence it is the long-range review of the energy problem (Zsiborács, H., Bai, A., Popp, J., Gabnai, Z., Pályi, B., Farkas, I., ... & Pintér, G,2018).

2 CONCLUSIONS

Energy are the basic necessity for all of us to lead a normal life on earth. Solar energy technology and its usage are very important and useful for the developing, heating and more application under developed countries to sustain their energy needs it is one of the best applications of renewable energy. The solar is user friendly to the human being in the nature. Local climatic condition and application are to be considered while selection of solar still. All these are covered in review paper. Focus is

made on solar energy in fresh water obtained after arrival distillation high efficiency Using Solar Energy System .Can use solar energy used for Electricity and Water Production, relies to a large extent on fossil groundwater extractions. Such extractions are characterized by continuously increasing energetic and economic efforts. As for water heating to can review in significant increase in the use of solar energy. Highlights the fact that conversion efficiency from solar energy is much higher for process heating than for electricity generation and that process heating applications constitute a significant share of industrial energy consumption from application solar energy in the winter, the use of thermal storage by high solar radiation. As for the production of electricity whether by power stations or using solar cells, the studies proved its successfulness, with the need for further research to increase the productivity of photovoltaic cells, which is currently done through photovoltaic thermal systems (PVT). The incorporation of renewable energy and the transportation system can be significantly beneficial for the economy and environment. can use the main energy source for vehicles are the natural gas and fuel However, due to the rapid depletion of the gas reserve, soaring gas prices and global warming, alongside the environmental pollution caused by burning fuel, this raises concerns about these energy sources. Renewable energy offers a plausible solution to these problems

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