Solar Thermal Panels for Generating Electricity

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Abstract:

All over the world, the focus is on using alternative energy instead of fossil fuels because they will be depleted in the coming years and pollute the environment. After all, they produce greenhouse gas emissions. There are many alternative energy sources, but solar energy is the best because it is the basis of all sources. The purpose of this research is to generate electricity from solar energy with its different application there are two main types which divide into photovoltaic panels which depend on the light of the sun, solar heat panels contain: parabolic trough, solar tower, and non-aqueous heating devices which depend on thermal from the sun and each of them contains its specific structure and material. From the previous research, Photovoltaic panels generate electricity from sunlight with high efficiency and high cost but low cost compared to another ordinary way of generating electricity. Photovoltaic divided into other types, for example, CPV which use mirrors with a special type of silicon and there are also thin-film solar panels, Polycrystalline and Mono Monocrystalline which are low efficiency compared to solar heat panel which generates electricity by absorbing the heat from the sun with mirrors which collect heat at a certain point, then heat the liquid and transfer it to the water for steam, this steam converts the turbines connected to the generator that transfers mechanical energy into electrical energy. The cost depends on the cheap materials were used in it, and among the previous research, the best application was the solar thermal power plant as it can overcome its defects. For measuring the output of different panels different devices, laws, and theories to select the parameters focus on the Iv of each PV

Keywords: alternative energy, electricity, heat, Solar thermal power plant.

Introduction:

The world is concerned about the idea of running out of fossil fuels. So, the world is trying to use alternative energy instead of using fossil fuels. as it is currently conceived that produced or recovered without the undesirable consequences inherent in fossil fuel use. There are a lot of types of alternative energy such as wind energy, and solar energy. Energy resources are used to generate electricity. Electricity is a very familiar energy source,that can be renewable or non-renewable recourses that can be generated electricity as it proved in STEM Subjects in Geology 'LO 9'.For an example of this resources -wind energy: is energy describes the process to generate electricity also there is another example: solar energy which is radiant light and heat from the Sun that harnessed using technologies such as solar heating, photovoltaics, solar thermal energy, solar architecture, molten salt power plants, and artificial photosynthesis.

The most common types:

1. Photovoltaic system: the most common way to use solar power as they are also known solar cell systems, which looks like the process photosynthesis in the plant as mentioned in Biology 'LO 10'

2. solar water heating system: it involves heating up of water using the sun's heat. The idea behind this comes from nature: the shallow water of a lake is usually warmer compared to deeper water. in STEM Subjects the reference of Geology mentioned this system. In 'LO 10'

solar thermal collector: collects heat by absorbing sunlight for the heating of water or buildings or the production of electricity this is mentioned in Physics in STEM Subject "LO 10" in the concept Solar heat collector

types of it:1-pool solar power generator:

A swimming pool solar power generator its ground and sides are solar cells that convert sunlight into electricity

2. Parabolic Troughs: they are composed of a long, parabolic shaped reflector that concentrates incident sunlight on a pipe that runs down the trough. These troughs are lined up in rows on a solar field. A heat transfer fluid is heated as it is run through the pipes in the parabolic trough. This fluid then returns to heat exchangers at a central location

where the heat is transferred to water, generating high-pressure superheated steam.

3. Solar Towers: They are large towers that act as a central receiver for solar energy. They stand in the middle of a large array of mirrors that all concentrate sunlight on a point in the tower.

We conclude from researches that solar thermal energy is better than photovoltaics as its drawbacks are less than that of photovoltaics and can overcome. Also, it can work all day unlike photovoltaics can work in the morning only. And for measuring the output of the panel. graphs were used to represent its growth and decay which was learned in Maths "LO 8" and it was needed to store energy and measure the units of the electricity by using what was learned in Chemistry "LO 14"

Analysis:

The problem of solar power is less pronounced than others and its problems considered as efficiency and storing. The capturing sunlight is between 14 percent and 20 percent efficient and nowadays technology is looking forward to making for semiconductors are under development as the sun was concentrated on a large scale in some countries as shown in fig 1.

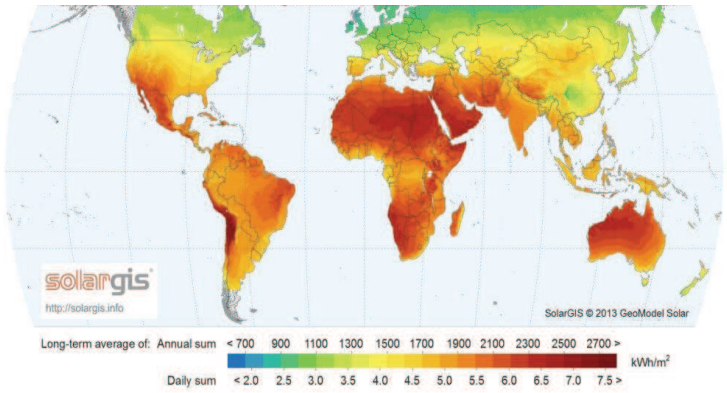


Figure1: showing the global horizontal radiation

In the research which talks about Down-Shifting of the Incident Light for Photovoltaic Applications (Y Jestin,2012) pointed out that an how it affects the different periods along the as shown in fig 2:

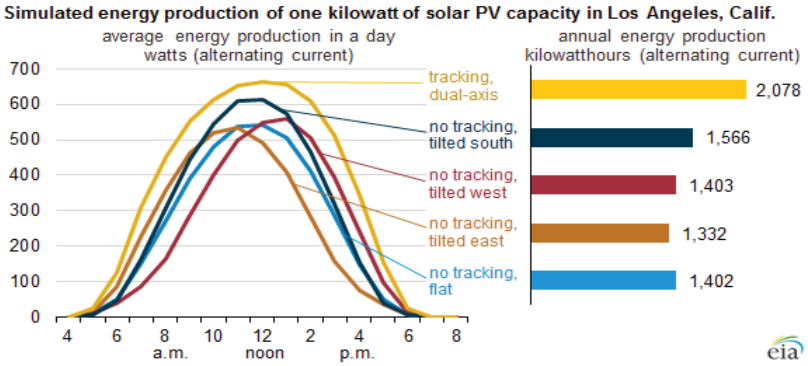


Figure2: solar pv capacity

Strengths: 1-A lot of companies try to solve the problems of photovoltaic cells, scientists have benefited from the down-shifting process and including organic dyes in polymer sheets. And it will increase the efficiency to 16% and with low cost

2-there are relatively simple-principle approaches to achieve efficient utilization of the short-wavelength part of the solar spectrum.

•improvement the electronic properties the devices by using very narrow junctions or low doping levels the method can be effective to enhance the performance of solar cells.

•Later, simulations by Richards and McIntosh predicted that when applied to CDs/CdTe solar cells, organic luminescent down-shifter layers could result in an increase in conversion

efficiency from η = 9.6% to η = 11.2%, which corresponds to an enhancement in t he efficiency of nearly 17%.

Weakness: 1-thermal losses: semiconducting may lose the ability to absorbs the energy of photons

2-improve the electronic properties of existing devices by using very narrow junctions or low doping levels not simple to implement and too expensive for use in production. And there is also paper talked about the CPV which used to generate electricity by using the sun (Arshad, R., Tariq, S., Niaz, M. U., & Jamil, M. (2014))

the strength: 1-it is low cost by using CPV (concentration photovoltaics) has an advantage over non-concentrated photovoltaic, as a smaller number of solar cells are required for the same power output.

2-the efficiency of the solar panel by the use of mirrors and cooling mechanism so is easy, cheap no need for more devices

3-this research paper is strong and makes this idea as simple as it can be understood by anyone.

4-focus on the material which will be used in CPV as Most solar cells are made from silicon—the same semiconductor material, the cells which usually used are expensive to produce as it takes a great deal of energy to purify the silicon.

The weakness:1-The number which of volts which produced by the ordinary panels not depend on trusted theory or rule or experiment if it was that it did not prove or mentioned

2-the effect of the radiation on the solar panel is not specific enough with specific numbers of a watt, so it would be put and the research shows this type is the best but it has weak points and did not show the other types of CPV which are: •Low concentration PV (LCPV)

•Medium concentration PV •High concentration PV (HCPV)

Technology helps to improve the efficiency of this type of panels and this way has Dennis Costello and Paul Rappaport. (1980) pointed out that:

The strength points which are: 1-When semiconductors are particularly treated with these impurities; they can convert sunlight into electrical energy is relatively efficient compared to other solar conversion processes such as photosynthesis.

2-the technology help of lowering the cost very large.

The weakness: 1-Efficiencies of currently available commercial cells range from 10% to 15%. These relatively low efficiencies lead to high balance-of-system costs resulting from the large array areas required for power output.

Third, and most importantly, the processes for producing single crystal silicon cells are currently very expensive.

2-it converts this resource Directly to electricity, the PV systems do not have moving parts Maintenance, costs are slight. The efficiency of the PV independent of its size. There is no critical size as it is with other solar systems. And, Systems be built in separate locations and small sizes with minimal penalties Inefficiency or cost.

3-photovoltaic cells are not flexible in other research about (paper printed photovoltaics cell): an emerged method for PV cell production is that the cost of these cells is much lower at cost than traditional photovoltaic as they need support. Progress commercializing solar-electric power system. In this research, the writer explains how the world uses solar energy to produce electricity in different ways.

He explains especially Solar thermal power plants. by explaining its structure and its work.

Solar thermal: the technology captures the heat energy from the sun and use it for heating or producing electricity.

There are two main types.

Active: requires moving parts like fans or pumps to circulate heat – carrying fluids.

Passive: have no mechanical components and rely on design features only

Advantages and disadvantages of the solar thermal system: Strength:

solar thermal systems are relatively low maintenance because they use simpler technologies and passive systems that have no moving parts Weakness: 1. Low efficiency.

There are two types:

1.Solar Towers: Solar power towers are large towers that act as a central receiver for solar energy. They stand in the middle of a large array of mirrors that all concentrate sunlight on a point in the tower. These large numbers of flat, sun-tracking mirrors are known as heliostats as shown in fig 3. In the tower, there is a mounted heat exchanger where the heat exchange fluid is warmed. The hot fluid is then used to create steam to run a turbine and generator, producing electricity. “Raymond Dracker “November (1996)

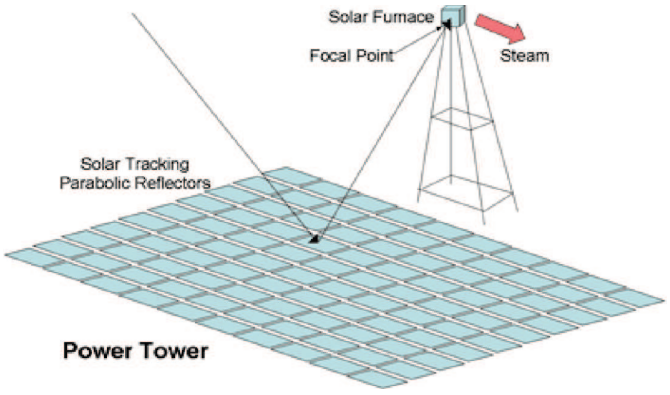


Figure 3: solar thermal tower

2.Parabolic Trough:

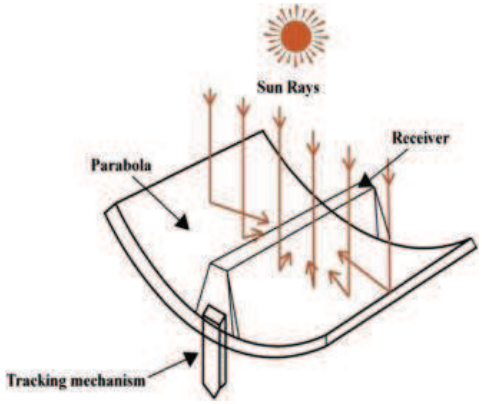
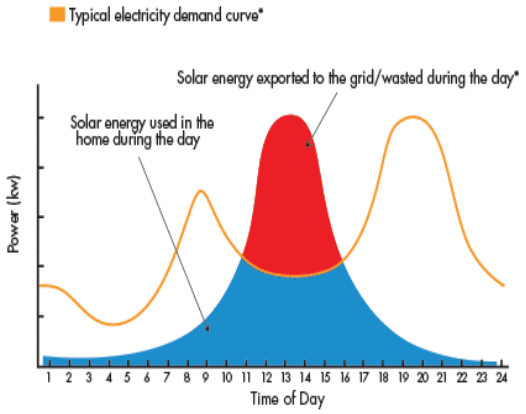


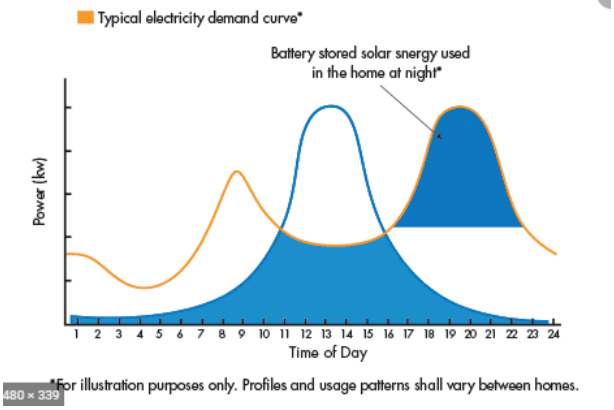
Figure 4: parabolic trough.

The system is curved parabola-shaped reflectors use mirror coating to concentrate sunlight on a tube (Dewar tube) filled with liquid, is usually filled with oil, and carries the heated fluid to an engine similar to a traditional power plant as shown in fig 4. (Philip G. Jordan, in Solar Energy Markets, 2014)

Advantages: 1. The cheapest source at present is solar parabolic troughs, as it uses a cheap material like a mirror 2. Thermal storage in insulated tanks can provide electricity at night as shown

Figure 5: solar energy used daily figure 6: stored solar energy used at night





Disadvantages: 1. Sun tracking is necessary to maintain solar collection by parabolic troughs otherwise the output will reduce; this increases the cost and maintenance associated with maintaining the moving structures. In diffused light, there is an inability to focus sunlight efficiently, and the output decreases. while Solar cells can provide some output even in diffused light, not so the case in the solar parabolic trough and solar PVs can be conveniently placed on rooftops.

3. Molten salts freeze at high temperatures in the range of 120ºC to 220ºC. There is a risk of it freezing at night which affects plant operations.

Solar is a large scale of using this research paper also talked about its use in generating electricity but in pools generator, located in or around a swimming pool in a manner to generate electricity from the sun. solar cell module disposed of in a recess of an inner wall of a swimming pool

strength point:

1-water can transmit visible light (want rules)

2-there is a sensor finding that a person is near the pool

3-The analysis of collecting underwater solar energy from solar energy in an easy way and with numbers

Weak points:

1.this research paper not keen on speaking about the damages that could happen

2. Most homes do not have a pool

3. The short-circuit current density (Jsc) can be 18.1 mA/cm2 for five feet of water and 16.7 mA/cm2 for eight feet of water. Jsc can be 30.1 mA/cm2 in air. Solar panel efficiencies can typically be about 16% in air and scale with the JSC. Hence, 16.7/30.1×16%=9% can be the solar cell efficiency for eight feet of water and 18.1/30.1×16%=9.6% can be the solar cell efficiency for five feet of water these calculations

5.depend on how the solar cells are oriented to the sun, orientation can depend on latitude, longitude, time of year, and time of day.

6.panels on the sides of pools may be more efficient in some instances. 8ft can have about half the power output as a solar cell in air.

So, the measure of the outputs of the panels, this research paper talked about the measure of the module and cells to select the parameter, it focuses on the I v and the different devices, soft wares theories and laws used programs which also used for measuring(Muhammad, F. F., Sangawi, A. W. K., Hashim, S., Ghoshal, S. K., Abdullah, I. K., & Hameed, S. S. Published: May 2, 2019)

the strengths point:

1. it depends on many things like graphs another research papers, laws and theories

2. ACT considered as the best solution for measuring and it was developed from the other device's mistakes

The weak points are:

1. that the different amount of light affects the measure of the output of the device or the way used to measure Maximal sunlight-to-electricity conversion efficiencies for solar cells range Up to 30% (and even higher for some highly complex cell designs), however, the typical efficiency is 10%-15%. Most current work on cells is directed at enhancing efficiency while lowering cost. Certain physical processes limit their output of cells-some are inherent and cannot be changed; some can be improved by proper design.

In Biology lo 12: photosynthesis can also call biological solar panel. Photosynthesis is a complex system of processes consisting of hundreds of parts that work together at the cellular level.

The two major processes of photosynthesis are the so-called light-dependent and dark reactions. By capturing light energy from the sun

and converting it into dense energy molecules, through the process of photosynthesis, these organisms support most of life on our planet.

(6CO2 □□6H2O ------C6H12O6 □□6O2) So, this process is similar to the work of the photovoltaic cell.

In Physic lo 10: in this concept of solar heat collector as it explains how it works that is a device that collects and/or concentrates solar radiation from the sun. these devices are primarily used for active solar heating and allow for the heating of water for personal use and as these collectors are generally on the roof.

In Geology lo 10: There are different forms of solar energy. These include direct and indirect solar radiation and photovoltaics There are three forms of solar energy with the most potential. One is solar thermal. This is direct solar radiation to make electricity. The others are wind power and photovoltaic cells. Solar Heating Home heating is one of the main uses of solar energy. There are two basics
kinds of solar heating systems: active and passive. Water heating is another major use of solar energy. Solar water heating systems for buildings have two main parts. They include a solar collector and a storage tank. Also, PV power is the cheapest form of electricity. The efficiency of PV systems is not high. Yet, it is increasing. New materials are being developed for the conversion of sunlight to electricity. The use of PV systems is growing quickly.

In geology lo 9: the unit of measure for electric power is a watt (W). The rate at which an appliance transforms electric energy is called it's capacity. It helps us, especially in photovoltaics.

In Chemistry lo 14: Most solar cells consist of a semiconductor. we have in mind that the explanation of how the electricity generation exactly works in such solar cells often will have to be skipped and summarized as" electrochemical cell.

In Math lo 8:

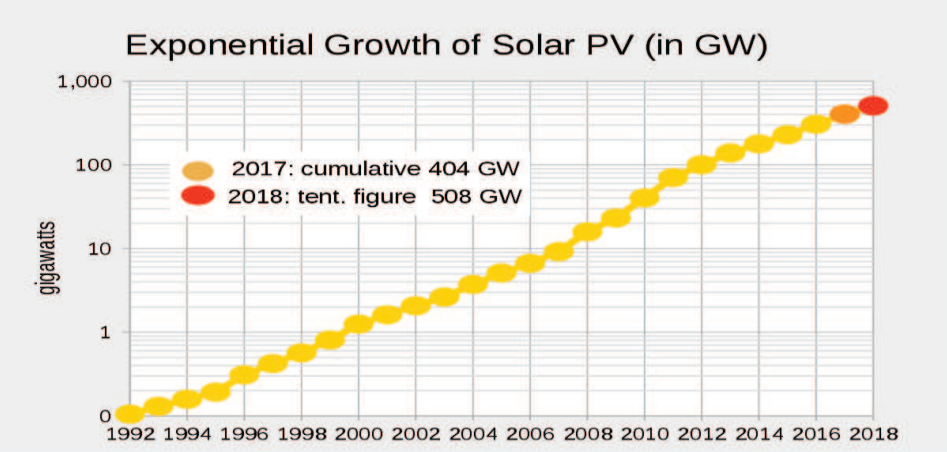


Figure 7: exponential growth of pv

As shown in fig 7 the exponential growth of photovoltaics as we understand the data from that learning outcome.

Conclusion:

After a lot of researches and analysis, we reached that the solar thermal power plant is the best way. because these plants get around the issue of being unable to efficiently store electricity by being able to store heat instead. Photovoltaics is very complex and

expensive than the solar thermal power plant because the solar thermal power plant is better than photovoltaics and easy to use. The storage of heat is more efficient and cost-effective than storing electricity. Additionally, these plants can produce dispatchable

baseload energy, which is important as it means these plants produce a reliable amount of energy and can be turned on or up at will, meeting the energy demands of society. In addition to this, solar thermal power plants

represent a type of electricity generation technology that is cleaner than generating electricity by using fossil fuels. Thus, these are some of the cleanest options for generating electricity. Some of the drawbacks include a large amount of land necessary for these plants to operate efficiently, but Egypt has a large space of empty lands available so that this drawback is not a

problem in Egypt. Egypt is the best place to make solar thermal power plants because the sun rays in it are so hard so that we can take a lot of heat to generate electricity.

Recommendation:

The solar thermal power plant has disadvantages like Birds that fly in the way of the focused rays of the Sun can be incinerated. you should make a lot of researches on that. We recommend making this project in eastern deserts next to the Red sea because of the large amount of land necessary for these plants to operate efficiently. As well, the water demand of these plants can also be seen as an issue, as the production of enough steam requires large volumes of water. the time was not enough to make more researches to find a good solution.

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