IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 05, Issue 1, January 2015, ||V-4|| PP 74-82

Experimental Analysis of Solar Energy Based Agricutural Sprayer

K.Shanmugasundaram, [2]Vinoth[3]R.Senthil Kumar
[1,2,3] *Department of Mechanical Engineering*
Dhanalakshmisrinivasancolloge of engineering technology
Mahabalipuram, 603104

Solar energy has been used since time immemorial to dry agricultural products, to provide space heat in cold seasons or to create ventilation in homes, applications which are still used in many developing countries. More than two thousand years ago, Heron of Alexandria constructed a simple water pump driven by solar energy and in 214 B.C. Archimedes of Syracuse used concentrating solar mirrors to set fire m Roman ships. The daily work of those complex and elegant solar collectors, the leaves of plants and trees, directly or indirectly provides our food, creates the cooking fuel for millions of households throughout the world, and has created all our fossil fuel reserves in the past. This does not imply that there is nothing new in applying solar energy (solar photovoltaic cells are only a few decades old), but some historical insight helps to put things in perspective. People have been using and are still using solar energy technologies without even knowing the term, simply because it is useful and practical to them

I. LITERATURE REVIEW

Power Sprayers are form. It is Two Stroke Petrol Engine. It need fuel and Oil for its operation. The Mechanical parts of the engine operates with this Fuel Energy. The Two Stroke Petrol Engine mounted on a power used to discharge pesticides and fertilizers in the liquid. To keep the efficiency of the machine, care must be taken in the following areas. Maintenance of air filter must be strictly observed.Through cleaning is necessary after three hour operation of the engine. Carburetor has been adjusted correctly, service and maintenance of the carburetor should be adopted strictly as per the Instruction of the company. The spark plug has to remain clean and always free from oil and deposits. Pipes and Carburetor should always be kept clean.Servicing and repair of the ignition system shall be done by an expert only.If the engine is to be put out of service for a longer time, then the corrosion preventive oil should be added.

To overcome the above difficultiesin the Existing models and to reduce the operatingcost of the Power Sprayer, a modified model has been designed and introduced for effective operation withoutfossil fuel. In this modifiedmodel the two stroke petrol engine is replaced by a single motor. This can be operated by the electrical energy stored in the 12V battery attached in the Unit. The 12V battery can be charged by the Solar Panels. The 12V dischargeable battery can be charged by Solar Panel available on the top of the Sprayers.

A separate charging system using Solar Panels can also be used for charging the battery. The cost of the fuel increases day by day. It should be reduced by the modified model which works on the principle of solar energy. The operating cost of power sprayer for one hour operation is calculated and its value is compared with the operating cost of solar sprayer. Its seems that there is no need of operating cost but, the initial investment towards the charging unit is one time investment with a life period of Twenty years which is almost equal to the unit cost of the power.

The solar-powered sprayer is already praised by poor farmers, due to its monetary advantages. Since fuel prices go through the roof nowadays, affordable solar-powered appliances are considered a gold mine by workers with a low income. If the 12 volt 7 amp battery is fully charged, the device can function for up to 8 hours. Even under these circumstances, if the battery fails to provide enough power, the existing solar panels attached to a helmet worn by workers can be considered a viable source of renewable power .

A major plus is that the improved design makes the sack on the sprayer lighter, therefore easier to be moved from one place to another both by men and women. Moreover, the solar-powered sprayer is considered a precious tool, seeking to improve crop quality by halving the amount of harmful pesticides usually required. The innovative technique increases the profit margins obtained by poor farmers and improves the quality of fresh food we purchase and enjoy on a daily basis.

II. SOLAR ENERGY

Every day, the sun radiates (sends out) an enormous amount of energy called **solar energy**. It radiates more energy in one second than the world has used since time began. This energy comes from within the sun itself. Like most stars, the sun is a big gas ball made up mostly of hydrogen and helium gas. The sun makes

energy in its inner core in a process called nuclear **fusion**. It takes the sun's energy just a little over eight minutes to travel the 93 million miles to Earth. Solar energy travels at a speed of 186,000 miles per second, the speed of light. Only a small part of the **radiant energy** that the sun emits into space ever reaches the Earth, but that is more than enough to supply all our energy needs. Every day enough solar energy reaches the earth to supply our nation's energy needs for a year! Solar energy is considered a **renewable energy** source.

As the world faces an impending dearth of fossil fuels, most immediately oil, alternative sources of energy must be found. 174 PW worth of energy falls onto the top of the Earth's atmosphere in the form of sunlight which is almost 10,000 times the total amount of energy used by humans on Earth, as taken from all sources, oil, coal, natural gas, nuclear and hydroelectric power combined. If even a fraction of this could be harvested efficiently, the energy crunch could in principle be averted. Various means for garnering energy from the Sun are presented, including photovoltaics (PV), thin film solar cells, quantum dot cells, concentrating PV and thermal solar power stations, which are more efficient in practical terms. Finally the prospects of space based (satellite) solar power are considered. The caveat is that even if the entire world electricity budget could be met using solar energy, the remaining 80% of energy which is not used as electricity but thermal power (heat) still needs to be found in the absence of fossil fuels. Most pressingly, the decline of cheap plentiful crude oil (peak oil) will not find a substitution via solar unless a mainly electrified transportation system is devised and it is debatable that there is sufficient time and conventional energy remaining to accomplish this. The inevitable contraction of transportation will default a deconstruction of the globalised world economy into that of a system of localized communities.

Solar energy can be used to generate electricity (photovoltaic) or to generate heat (solar thermal). There are three main technologies to transform energy into usable energy from the sun. The solar panel uses sunlight to heat a liquid with special features, contained in its interior, which transfers heat through a heat exchanger, water contained in a storage tank. Concentrating solar panel uses a series of parabolic mirrors to concentrate the linear structure to sunlight on a receiver tube in which flows a fluid or a series of flat mirrors that focus the beams at the end of a tower in which there is a boiler filled with salts which melt in the heat. In both cases the "receiving apparatus" is heated to very high temperatures (400 ° C ~ 600 ° C).The solar panel uses the special properties of semiconductor elements to produce electrical energy when stimulated by light.

2.1 PRINCIPLE OF SOLAR PANEL

A solar panel is a device that uses energy from the sun and converts it into other forms of energy that humans consume for a variety of purposes. Solar panels utilize solar cells. A famous type of solar panel, also known as the photovoltaic panel, uses light energy from the sun and converts it into electricity. Another kind of solar panel is the solar thermal energy panel which is a form of solar energy storage. And of course, one of the more popular and highly useful forms of solar panels is the solar hot water panel which heats water with energy coming from the sun.

In order to understand how solar panels work, one must be familiar with the composition of a solar panel. For instance, the photovoltaic panel is made up of interconnected photovoltaic or solar cells. Solar cells are devices made from silicon that has the property to convert solar energy into other forms such as electricity and heat energy. When these solar cells are packaged together either through wiring or fastened installation, they become one solid panel. For protection, the panel may be covered with fiberglass, plastic, or even metal.

Solar panels work in a way that may be simplified into to steps: light absorption and energy conversion. Solar cells are light-absorbing materials and they have high energy conversion capabilities. The silicon contained in the solar cells of a solar panel makes light absorption possible. The sun's rays emit photons and these are then absorbed by the silicon atoms.

Silicon has the property to create electricity if it is bonded with another element that will produce the positive charge needed. Naturally, silicon has four electrons. In order to generate electricity, silicon atoms must be paired with an element that can knock off the extra electrons and make room for a positive charge. The photon coming from the sun ensures just that. And so, when the sun's photons are absorbed by the silicon atoms, the atomic composition of the solar panel is arranged in such a way that electricity is generated. This energy is then passed on to installed electrical wiring within the solar panel right down to the power generating device connected there to.

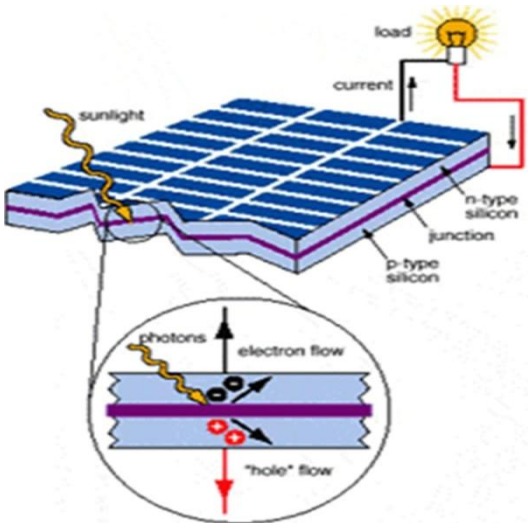


Fig. 1.Solar Panel

In summary, solar panels work in such a way that it acts as connector and energy transformer between the sun and whatever purpose man has for the sun's energy. It acts as a middleman of sorts. The sun gives off its photons through its rays, and the solar panel absorbs these through its solar cells. The light absorbed is then converted into electricity within the solar panel device and it is passed on through a power generating device that makes possible whatever use the solar panel should serve: may it be for solar energy, heat energy, or simple electricity.

2.2 COMPONENTS OF SOLAR PANEL

A solar panel is basically a collection of a large number of solar**cells**. A solar cell is a also called photovoltaic *cell*. Most solar cells are made of a layer of the silicon material. In order to make this a semiconductor of silicon, a layer of phosphorous is added at the top and at the bottom a layer. The whole unit is placed for the protection between two transparent sheets. These were first made of glass, but now also made of various transparent plastics.

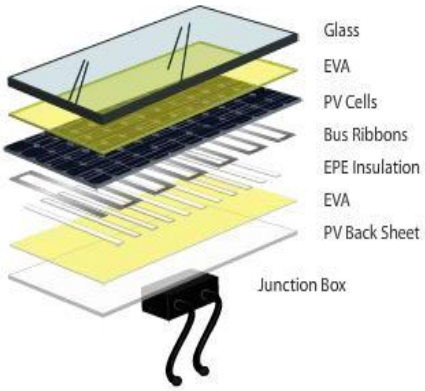


Fig. 2.Components of Solar Panel

Because of the uneven charge distribution creates an electric field at the interface, the electrons can only go one way. The consequence of this is that there is a voltage difference between the top and bottom of the panel is created. Join the top and bottom are to each other, then goes over the wire a power walk.

Since the voltage across the solar cell is very low, are often multiple solar cells in series to each other 'knotted' in a solar*panel*. A modern panel has 60 or even 72 cells. So, the charge of a panel 30 to 36 volts peak amounts. Then will be. A converter placed this ensures that the voltage of a series of solar panels is converted into an alternating current of 230V. Solar panels were originally used almost exclusively in space, but nowadays it is a common practice for the benefit of the whole society. The existing efficient and relatively inexpensive solar panels today are a very cost effective alternative.

III. PESTICIDE SPRAYER USING SOLAR ENERGY

The solar-powered sprayer is already praised by poor farmers, due to its monetary advantages. Since fuel prices go through the roof nowadays, affordable solar-powered appliances are considered a gold mine by workers with a low income. If the 12 volt 7 amp battery is fully charged, the device can function for up to 8 hours. Even under these circumstances, if the battery fails to provide enough power, the existing solar panels attached to a helmet worn by workers can be considered a viable source of renewable power .

Fig. 18. Pesticide Sprayer

A major plus is that the improved design makes the sack on the sprayer lighter, therefore easier to be moved from one place to another both by men and women. Moreover, the solar-powered sprayer is considered a precious tool, seeking to improve crop quality by halving the amount of harmful pesticides usually required. The innovative technique increases the profit margins obtained by poor farmers and improves the quality of fresh food we purchase and enjoy on a daily basis.

A separate charging system using Solar Panels can also be used for charging the battery.The cost of the fuel increases day by day. It should be reduced by the modified model which works on the principle of solar energy. The operating cost of power sprayer for one hour operation is calculated and its value is compared with the operating cost of solar sprayer. Its seems that there is no need of operating cost but, the initial investment towards the charging unit is one time investment with a life period of Twenty years which is almost equal to the unit cost of the power.

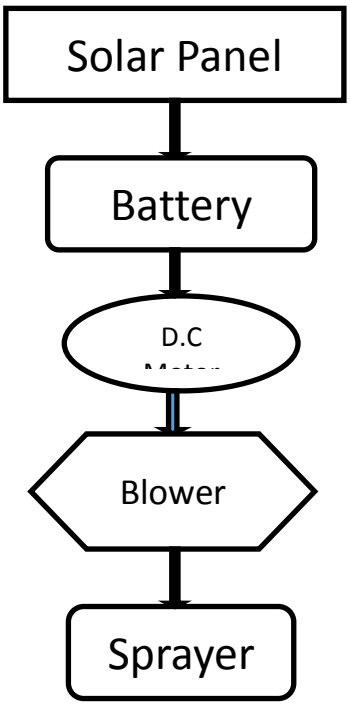
3.1CONSTRUCTION

The construction of the pesticide sprayer consists of solar panel, dc motor, blower, tank, battery, circuit board hose pipe and spraying jet. The solar panel is mounted on the top of the tank to receive energy from the sunlight and the blower is coupled with dc motor to run the blower fan with high speed and pesticide tank is mounted on the blower and the tank is connected to the blower, the one end of hose pipe is connected to blower to increase the flow of liquid and the another end of hose pipe is connected to spraying jet and the rechargeable battery is connected to the solar panel to store the current which is used to run the pesticide sprayer.

Fig. 19. Construction

3.2 WORKING PRINCIPLE

Solar radiation can be converted directly into electricity using semi conductor devices which are known as Photovoltaic cells .whenever sunlight falls upon solar cell a part of the light is absorbed and it is converted into electrical energy by means of electron movements.the solar panel is connected to 12v lead acid battery for storing electrical energy.



12V dc motor is connected to this lead acid battery to convert the electrical energy into mechanical energy. When the blower is coupled with motor its start rotates and passes air into hose.Due to pressure of air the liquid flow rate increases.

3.3DIFFERENT VIEWS

3.3.1 FRONT VIEW

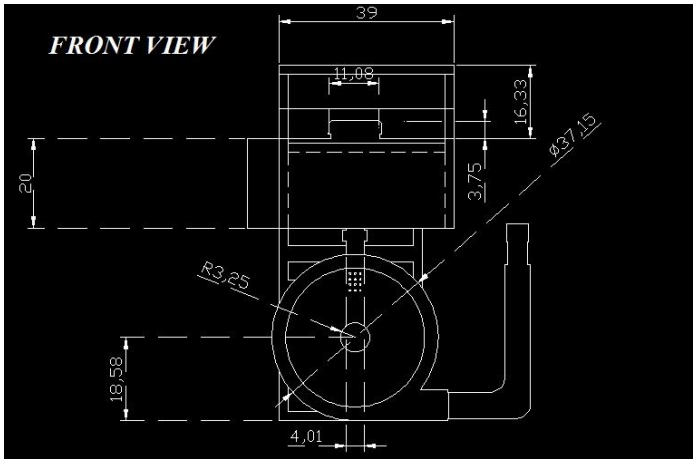


Fig. 20. Front View

3.3.2 TOP VIEW

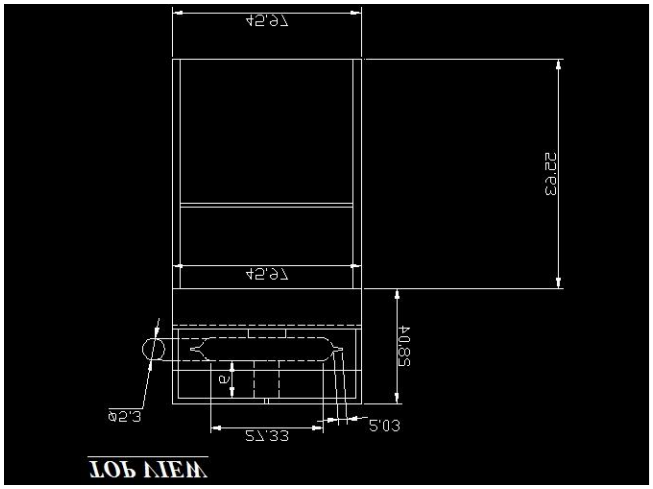


Fig. 21.Top View

3.3.3 SIDE VIEW

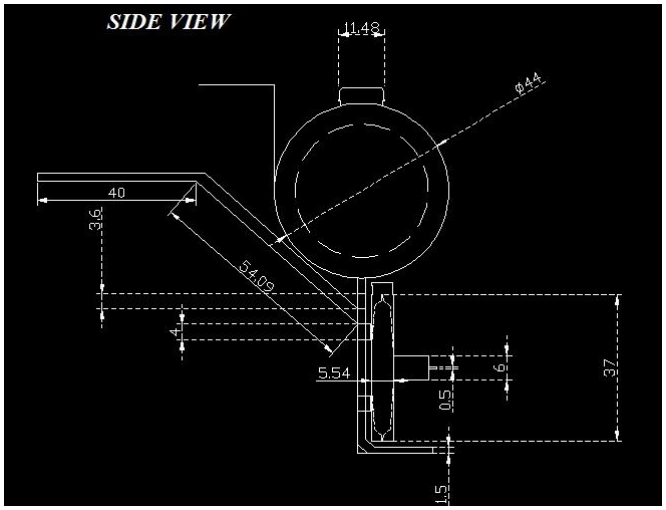


Fig. 22. Side View

3.4 ADVANTAGES AND DISADVANTAGES

ADVANTAGES

- The power source of the sun is easily available.The production of solar energy produces no pollution.
- The technological advancements in solar energy systems have made them extremely cost effective.
- Most systems do not require any maintenance during their lifespan, which means you never have to put money into them

DISADVANTAGES

- Initial cost is high
- Pollution can be a disadvantage to solar panels, as pollution can degrade the efficiency of photovoltaic cells.
- Clouds also provide the same effect, as they can reduce the energy of the sun's rays. This certain disadvantage is more of an issue with solar components.
- The location of solar panels can affect performance, due to possible obstructions from the surrounding buildings or landscape.

3.4 DESIGN CALCULATION

FORMULAE

1. Fill Factor

FF = Imp * Vmp/Ics*Voc

2.Maximum Efficiency

Eff =Imp*Vmp/Is*Ac

CALCULATIONS

Fill factor

FF = Imp * Vmp/Ics*Voc

= 0.295*17/0.33*21.4

=5.015/7.062=0.71

Fill Factor = 0.71

Where

Imp= maximum power at input current

Vmp=The value of voltage at maximum power

Isc=Open Circuit Current at actual power

Voc = The Value of open circuit voltage at maximum power

Maximum Efficiency

Eff Maxi =Imp*Vmp/Is*Ac

Where,

Is = intensity of solar radiation

Ac = Total Area of panel

Eff = 0.295*17/ 700*39

=0.104

Eff=10.5%

Area Calculation

Area of the panel = Length of the panel * Breadth of the panel

= 39 * 17.5

= 682.5 mm^2

= 0.0682 m^2

3.5 PERFORMANCE MEASURE USING MATLAB

The performance measure of the solar panle can be measured using matlab, the voltage values of the panel can be taken at different temperature and its current can be calculated. This can be taken at different temperatures.

Enter the Value of Current at Max Power

Imp =0.295

Enter the Value of Voltage at Max Power

Vmp =17

Enter The Value of open circuit Current at Actual Power

Isc =0.33

Enter The Value of open circuit Voltage at Actual Power

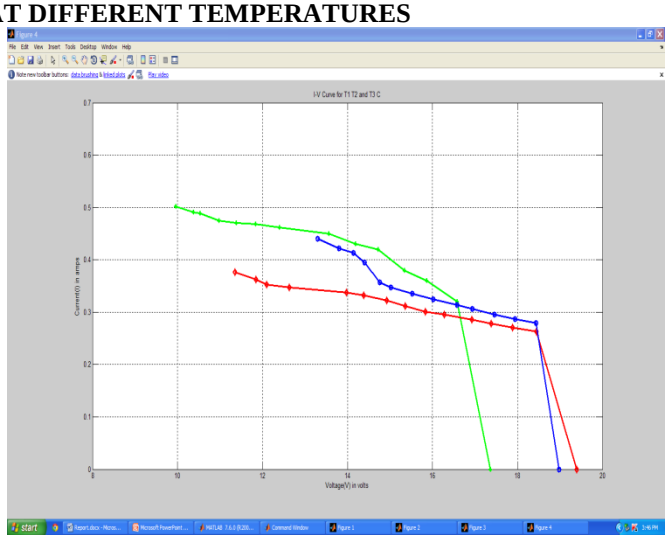
Voc =21.4

Enter The Value of Intensity of solar radiation at Normal sea level clear sky condition

Is =700
Enter The Value of panel Length
L =39
Enter The Value of panel Width
W =17.5

RESULT OBTAINED
Fill Factor = 0.710139
Maximum Efficiency= 0.104971

GRAPH OBTAINED AT DIFFERENT TEMPERATURES



IV. CONCLUSION

- This Technology is most suitable for Energy alternate Device for power sprayers.
- The farming community is more dynamic and they can accept the proved
- technologyfor implementation.
- Moreover the same technique and technology can also be extended for all types of power sprayers.
- Performance measure of solar panel can be easily calculated at different temperature.

REFERENCE

[1]. AbhishekJivrag, VinayakChawre, AdityaBhagwat, SolarOperated Multiple Granulated Pesticide, International Journal on Engineering Research and Development, 3(2),2011, 210-215
[2]. R.JOSHUA, V.VASU & P.VINCENT, Solar Sprayer-An Agriculture Implement, International Journal of Sustainable Agriculture, 2(1),2010,16-19
[3]. B. van Campen, D. Guidi and G. Best,Solarphotovoltaics for sustainable agriculture and rural development Environment and Natural Resources Working International journal on Scientific Research and Development,2(1), 2000, 60-65
[4]. RRajesh, Kumar and O.S. Sastry, Energy Demand,2nd World Conference on Photovoltaic Solar Energy Conversion,2(2), 1998,6-10 [5] J. V. Bhanutej, S. Phani Kumar B. Pradeep Kumar, Working of Sprayers,International Journal of Research in Advent Technology, 3(4), 2015, 160-167
[5]. Solar Cells. chemistryexplained.com
[6]. "Solar cells – performance and use". solarbotic s.net.
[7]. "Technology Roadmap: Solar Photovoltaic Energy" (PDF). IEA. 2014. Archived(PDF) from the original on 7 October 2014. Retrieved 7 October 2014.
[8]. "Photovoltaic System Pricing Trends – Historical, Recent, and Near-Term Projections, 2014 Edition" (PDF). NREL. 22 September 2014. p. 4. Archived (PDF) from the original on 29 March 2015.
[9]. Gevorkian, Peter (2007). Sustainable energy systems engineering: the complete green building design resource. McGraw Hill Professional. ISBN 978-0-07-147359-0.
[10]. "The Nobel Prize in Physics 1921: Albert Einstein", Nobel Prize official page
[11]. Lashkaryov, V. E. (1941) Investigation of a barrier layer by the thermoprobemethodArchived 28 September 2015 at the Wayback Machine, Izv. Akad. Nauk SSSR, Ser. Fiz. **5**, 442–446, English translation: Ukr. J. Phys. **53**, 53–56 (2008)
[12]. "Light sensitive device" U.S. Patent 2,402,662 Issue date: June 1946

[13]. "April 25, 1954: Bell Labs Demonstrates the First Practical Silicon Solar Cell". APS News. American Physical Society. **18** (4). April 2009.
[14]. Tsokos, K. A. (28 January 2010). Physics for the IB Diploma Full Colour. Cambridge University Press. ISBN 978-0-521-13821-5.