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Convert the fuel operating system as free energy operating system for agriculture implementation

■ **ANISA AND GEETA**

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■ **ABSTRACT :** Based on the experimentation, it is found in this project that the Solar panel provides 17V, 1A during day time between 9.30 AM to 4.30 PM. Since the pesticide sprayers are used in this duration, testing is as carried out in this time. The 12V, 8Ah battery can be charged fully in 7 hours during this time at 1.3A. Hence, this module can be operated to spray continuously 7 to 8 hour which is not possible with electrical pesticide sprayer. The model cost will not exceed Rs. 7000. Hence, the proposed model is cost effective and compatible with other models available commercially.

■ **KEY WORDS :** Sprayer, Solar sprayer, Energy alternate devices, Free energy sprayer, Hand sprayer

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Solar spray are the ultimate cost effective solution at the locations where spraying is required. This solar-powered spray pump system uses solar energy as source. Solar energy is first used to charge a storage battery. The solar energy stored in the battery is utilized to operate motor which functions as pump as the name of the paper suggests, it deals with the constant discharge of pesticide, compress air control system, solar power, battery charging, monitoring as well as timer and non-conventional power controlling techniques. As far as controlling is concerned, it include the parameters such as pressure, pesticide level, battery voltage, current, solar cell and discharge condition. In this paper we are trying to make unique equipment for cultivation users. Mostly in the forming process pesticide spray is taking a critical role due to poison properties of chemical. So, in this paper committed to do something unique and useful equipment with non-conventional source technique. Also reduce the weight of unique solar spray jet as compare to diesel spray jet.

The results of performance measurements of field-aged crystalline silicon photovoltaic modules arturskoczek, tony sample and ewan d. Dunlop, progress in photovoltaics: research and applications, volume 17 issue 4, 2009, pages 227 – 240. Large-scale solar pv investment models, tools, and analysis: the ontario case, wajidmuneer, kankarbhattacharya, claudio a. Cañizares, ieee transactions on power systems, vol. 26, no. 4, november 2011. Landau, Elaine. *The History of Energy*. Minneapolis: Twenty-First Century, 2006. Print. "Solar Power Energy Information, Solar Power Energy Facts - National Geographic." *Environment Facts, Environment Science, Global Warming, Natural Disasters, Ecosystems, Green Living - National*

Geographic. Web. 15 Oct. 2011. <http://environment.nationalgeographic.com/environment/global-warming/solar-power-profile. Many people are using solar power these day. Many of these uses are for every day thing such as charging your I-pod, laptop, and cell phone because many of those manufactures have come out with many solar power chargers. There are many different varieties in which you can use solar such as holiday lights, fountains, and floodlights are just some of the many things that can be powered by solar energy. You may be using solar power but you don't even know it. In many cities today they use at bus stops they place the solar panels on top of the roof it is collecting solar energy. Many states have adopted a government programme that was introduced to the united states in 1997 called the Million solar Roof initiative this programme was set up to have more solar in the United states (Sobha, 2008) Landau, Elaine. *The History of Energy*. Minneapolis: Twenty-First Century, 2006. Print. Bristow and Campbell, 1984. On the relationship between incoming solar radiation and daily maximum and minimum temperature. Agricultural and Forest Meteorology. 31: 159-166. Galdabini *et al.*, 1992.

METHODOLOGY

Construction procedure :

Requirement of good spray:

According to enquiry from 20 different farmers about spraying capacity of spray. Middle range of delivery spraying capacity that is 12 feet to 15 feet and discharge capacity of spray is 10 to 12 lit/min. According to requirement of spray, following motor is selected for this spray model.

Sr. No.	Specification	Capacity
1.	Motor speed	3000
2.	Delivery capacity	15 to 16 feet
3.	Discharge capacity	0 to 12 lit/min
4.	Operating power required	84 watt
5.	Operating voltage	12 volt
6.	Operating current	7 amp

Battery charging time calculation :

Instrument used to measure sun radiation : Sun meter:

When the Solar radiation is between 200 to 300 MW/cm^2 : 3 to 4 hrs.

When the Solar radiation is between 300 to 400 MW/ cm^2 : 2 to 3 hrs.

When the Solar radiation is between 400 to 600 MW/ cm^2 : 1 hrs

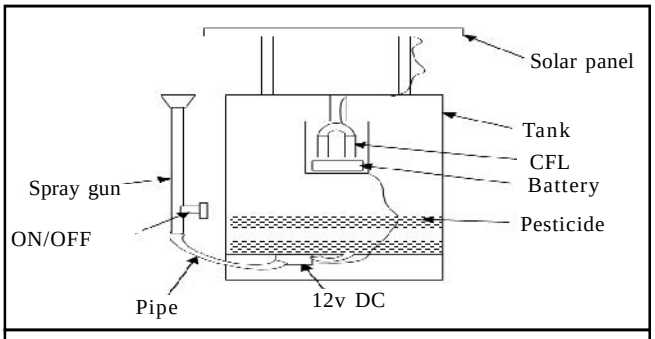

Fig. A : Line diagram solar sprayer figures assembly of different parts

Basic component of solar sprayer :

- Nozzle
- Swirl plate
- Nozzle screen
- Over flow pipe
- Solar panel
- Battery
- Tank
- Pump
- Spray gun

Fig. B : Nozzle

Swirl plate :

It is the part of a cone nozzle which imparts rotation to the liquid passing through it (Fig. C).

Nozzle selection and sizing example:

The recommended nozzle spacing is 20 inches. Calculate the required nozzle discharge:

$$\text{Nozzle discharge} = \frac{(5\text{ mph} \times 20\text{ in} \times 15\text{ GPA})}{5940} = 0.25\text{ GPM}$$

The nozzle you select must have a flow discharge

Fig. C : Swirl plate

Fig. D : Screen

of 0.25 GPM when operated within the recommended pressure range from 15 to 60 psi (preferably under 40 psi). Nozzle performance tables in manufacturer's catalogue will show the discharge rates at various pressures for several nozzle sizes. Select the nozzle which will give you the most flexibility with a wide pressure range for "fine-tuning."A change in pressure does not cause an equal change in flow discharge. In some examples, in order to double the spray output, the pressure would have to be quadrupled. If you do not find the discharge rate in the catalogue calculate the operating pressure using known catalogue conditions:

$$psi_1 = psi_2 \times \left(\frac{GPM_1}{GPM_2}\right)^2$$

where:

Subscript "1" is the desired condition and subscript "2" is the known catalogue condition.

Although some nozzles such as cone types require high operating pressures, try to avoid pressures above 40 psi. Pressures over 40 psi increase the drift potential and put strain on the sprayer components. Conversely, avoid pressures less than the recommended minimum pressure because spray patterns begin to distort and cause poor spray uniformity.

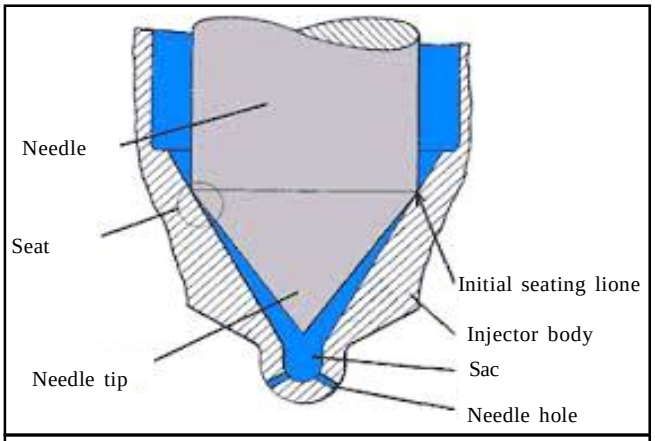

Fig. E : Selection nozzle

Power rating:

Voltage : 15 volt
Current : 5 Amp.
Power : 15 x 5 = 75 watt

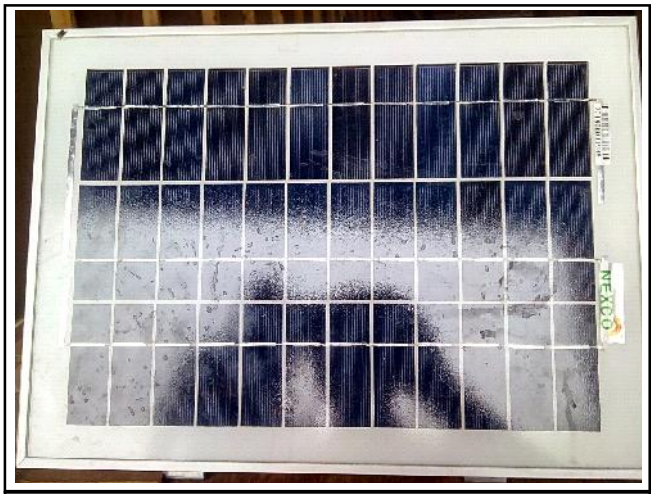

Fig. F : Solar panel

Power conversion efficiency:

The solar cell power conversion efficiency can be calculated by using the relation

$$\frac{\text{Output power}}{\text{Input power}}$$

Fig. G : Side view

Working of solar sprayer :

Working of this pump is simple. Solar panel collects the solar energy into electricity and supplies it to battery. Battery uses this electricity to charge itself. This battery next is used to operate motor and lighting system. Motor attached at the bottom of tank sucks the liquid from tank and deliver it. The 'ON' and 'OFF' of motor is controlled with handle attached to spray gun. A switch is given there to operate its function. As the handle is pushed, the valve of gun is released and at the same time the switch is pushed which supplies the current to motor. Thus motor sucks liquid and deliver it through delivery pipe. The home lighting system is also available with this unit. The CFL light also operates through battery. An inverter circuit is used with battery to convert the DC supply into AC supply to 'ON' the CFL. A switch is used to 'ON' or 'OFF' the light. Sprayers are mechanical devices that are specifically designed to spray liquids quickly and easily. They come in a number of different varieties. In this project we'll take a look at solar operated mechanical sprayers. A sprayer of this type is a great way to use solar energy. Solar based pesticides sprayer pump is one of the improved version of petrol engine pesticide sprayer pump. It is vastly used in the agriculture field and also used for many purposes.

Working of solar cell :

A solar panel is a device that collects and converts solar energy into electricity or heat. It transfers energy from the sun into electricity or heat which can be used by (for example) nearby buildings. Solar panels can be made so that the sun's energy excites the atoms a silicon layer between two protector panels. The atoms split up and the electrons travel down wires into the home for electricity. Solar panels were in use over one hundred years ago for hot water heating in homes. Solar panels can also be made with a specially shaped mirror that concentrates light onto a tube of oil. The oil then heats up and travels through a vat of water, instantly boiling it. The steam created turns a turbine for power.

Photovoltaic panels, used to generate renewable electricity directly from sunlight. Solar thermal energy collection systems, used to generate electricity through a system of mirrors and fluid-filled tubes. Solar hot water panel, used to heat water, often in homes and other private housing estates.

Operating principle:

In this device, the solar cells present on the panel are used to convert the received solar radiation directly into electrical energy by means of a PV principle. The electrical energy received from the solar cell is stored in a storage battery unit for application. This stored electrical energy can be converted in to mechanical energy by rotating the motor. For this mechanical operation there is no need of conventional fuel like petrol and oil.

■ RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Experimental analysis :

The discharging time depends on the intensity of solar radiation. The performance of the solar agro

Table 1 : Performance of the solar agro sprayer

Average solar radiation (W/M)	Charging time in min.	Testing hours
500	130	09.00am-11.30am
		03.30pm-06.00pm
600	110	10.00am-12.00am
		03.30pm-05.30pm
700	95	11.00am-12.30pm
800	85	12.00am-01.30pm
900	70	01.30pm-03.00pm

sprayer were studied with different ranges of solar radiation and were reported in the Table 1. The maximum time requirement to charge the storage battery was found to be two hours and the minimum time requirement is one hour.

Equations and design calculation :

Requirement of good spray :

According to enquiry from 20 different farmers about spraying capacity of spray. Middle range of delivery spraying capacity that is 12 feet to 15 feet and discharge capacity of spray is 10 to 12 lit/min. According to requirement of spray, following motor is selected for this spray model:

Specification of motor :

- Motor Speed :2500-3000 rpm
- Delivery capacity :15 to 16 feet
- Discharge capacity :0 to 12 lit/min
- Operating power required :84 watt
- Operating voltage : 12 volt
- Operating current :7 amp

Performance analysis :

– To assess the performance of the solar agro sprayer the following experimental observations were made and its characteristics have been made.

- The power conversion efficiency of the solar cell.
- The charging time of the storage battery.
- The discharge time of the storage battery.
- The discharge capacity of the chemical tank.
- The operational cost effectiveness with the existing model.

Conclusion :

It does not compromise the performance of a petrol based pesticide sprayer. In addition, the model is designed to be eco friendly and lower cost, and thus will prove to be more efficient when compared to petrol based pesticide sprayer. A minor modification to the form factor, the module can be brought out as a commercial product. In order to verify the performance we mounted an attachment on the frame and carried out the testing. We are happy to find that 8Ah battery can run the pump for 3 hours; one fully charged battery can be used to spray 2 Acres, while 1litre of petrol can cover 1 Acre. Thus, cost of 1 litre petrol is Rs. 80 and cost for charging the battery is negligible. So no operating cost is required in solar based pesticide sprayer." As we know 70 per cent of population of our country lives in villages and their main occupation is agriculture. My prominent aim of this paper is to fulfill the tasks like hand spraying, IC engine spraying, and leg pump spraying etc. using non-conventional energy sources. Thus solar operated spray pump will help the farmers of those remote areas of country where fuel is not available easily. They can perform their regular work as well as saves fuel upto large extent. At the same time they reduce environment pollution.

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REFERENCES

Ahrensapril, J.F. (1982). Weed control in landscape plantings. *J. Arboriculture*, **7** (4) : 85-88.

Ajayi, Oluyede Clifford and Akinnifesi, Festus K. (2007). Farmers understanding of pesticides safety labels and field spraying practices. *Scentific Res. & Essay*, **2** (6) : 204-210.

Al-Mohamad, A. (2004). Efficiency improvements of photo-voltaic panels using a sun-tracking system. *Appl. Energy,* **79**

: 345-354.

Bristow, K.L. and Campbell, G.S. (1984). On the relationship between incoming solar radiation and daily maximum and minimum temperature. *Agric. & Forest Meteorol.*, **31** : 159- 166.

Galdabini, S., Giuliani, G. and Robotti, N. (1992). Photoelectricity within classical physics: from the photocurrents of Edmund Becquerel to the first measure of the electron charge. Proceedings of the Conference on 'History of Physics in Europe in the 19th and 20th Centuries'. Como, Italy. 149 - 156.

Joshua, R., Vasu, V. and Vincent, P. (2010). Solar sprayer - an agriculture implement, *Internat. J. Sustainable Agric.*, **2** (1): 16-19.

Kale, Bhojraj N., Prayagi, S.V. and Nimkar, M.P. (2013). Solar energy availability and utilization in Nagpur, Maharashtra, *Internat. J. Engg. & Innovative Technol.*, **2** (12) : 81-84

Kumar, Rajesh and Sastry, O.S. (1998). Proceedings of 2nd World Conference on Photovoltaic Solar Energy Conversion held at Vienna, Austria, pp: 6-10. Performance, evaluation and development of Solar Photovoltaic Lighting Systems in India.

Rai, G.D. (2009). *Non-Conventional Energy Sources* (Khanna Publishers, 2009)

Ravis Bradford (2006). *Solar Revolution: The Economic Transformation of the Global Energy Industry* (MIT Press, 2006)

Sastry, O.S., Kumar, Rajesh and Pant, P.C. (1999). Photovoltaic test facility at solar energy centre, Indo-Japan Co-operation on Science & Technology Seminar "Photovoltaic Technology in India & Japan", 2 New Delhi.

Sobha, Geeta (2008). *Green Technology: Earth - friendly Innovations*. Rosen Pub.,New York.

Sootha, G.D. and Gupta, S.K. (1991). Jugal Kishor (Ed.); Solar Energy Centre. Proceedings of the Workshop on Technology Transfer.

Sukhatme, S.P. (1996). *Solar Energy : Principle of Thermal Collection and Storage*, 3rd Ed., McGraw –Hill Publication, New Delhi, Page No. 37-287.

Tyler G. Hicks (2001). Pumps Operation and maintenance (Tata McGraw Hill edition, 2001).

Wilson, John S. and Tsunehiro Otsuki (2002). To spray or not to spray? Pesticides, Banana Exports, and Food Safety. Policy Research Working Paper, No.2805. World Bank, Washington, D.C. © World Bank.

WEBLOGRAPHY

<http://environment. nationalgeographic.com/environment/global-warming/solar-power-profile