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Effects on Panels Performance Submerged in Liquid

Himanshu Senger, Sheo Kumar** and Hare Ram Singh****

ABSTRACT

One of the materials used in the manufacture of solar panels is a semiconductor that is sensitive to the radiation falling on it. Semiconductor materials begin to heat up and lose efficiency over a certain limit, which causes the power output to decrease too low to be practical. The high temperature problem is overcome utilising a variety of cooling approach. It is widely acknowledged that all of humanity's energy needs, both direct and indirect, are met by the Sun and other renewable energy sources. The industrial revolution, which brought about a number of changes and resulted in the widespread adoption of a new energy source, was launched by the invention of the steam engine [3]. The initial error of using fossil fuels—oil and natural gas—was used by biofuels, oil, and natural gas after the development of combustion engines, and electricity was decentralized.

Keywords: *Steam Engine; Semiconductor; Renewable Energy.*

1.0 Introduction

In view of rising concerns about the price and availability of fossil fuels, solar energy has grown significantly in relevance for our future energy supply [1]. You have given us a lot of useful information on how incentives in various countries might help make solar systems more lucrative. Over the previous 10 years, the industry has grown at an incredible 40 percent a year [2]. Photovoltaics generated more than 40 Gigawatts of electricity by the end of 2007. For context, a 20 billion euro microelectronics market [3] would be equivalent in size. The photovoltaic market will surpass the micro market in size by 2020, based on current growth rates. A large amount of money is being spent in solar technology, and it is expected that new innovations and price rises will follow.The human factor may ultimately prove to be the limiting factor in the photovoltaic industry given all of these potential developments Males use commercial resources more frequently, which has improved their quality of life[5], but my issues have also become apparent. The adverse effects on the environment are arguably the worst. Prior to identifying the specific one, the entire word will be examined [6]. This figure will help in determining how long it will take for current energy sources to completely replace the need for sustainable energy, and this solution will be briefly discussed. The financial sector also needs to become familiar with the fundamentals of photovoltaics. The best way to solve the problem is to work together to develop appropriate financial plans [7] with people

**Corresponding author; Project Planner, Andritz Hydro Pvt Ltd (E-mail: himanshu.senger@andritz.com)*
***Professor, Department of Computer Science & Engineering, CMR Engineering College, Medchal, Kandlakoya, Telangana, India (E-mail: sheo2008@gmail.com)*
****Associate Professor, Dr. A. P. J Abdul kalam Technical University, Lucknow, Uttar Pradesh, India (E-mail: hrsingh.2000.2000@gmail.com)*

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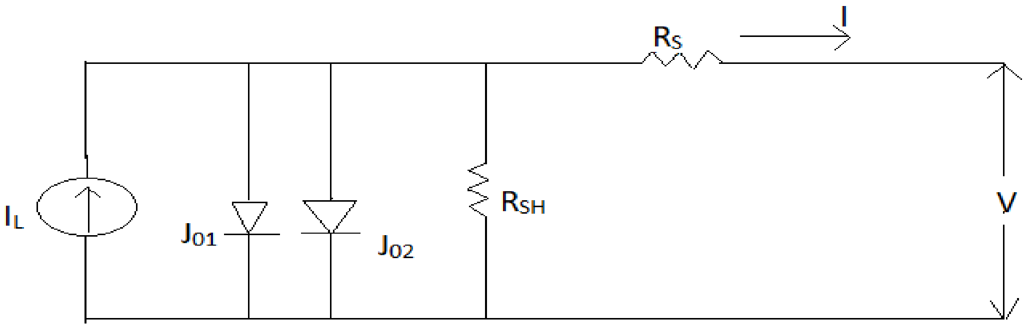
and to invest in energy globally. In order to promote the advancement of solar PV technologies, numerous governments have adopted accounting regulations. The Indian government established the National Solar Mission in 2010 with the objective of [8] installing 20 Gigawatts of solar energy by 2022. The administration in place now has changed the objective and set 2019 as the deadline for achieving 100 Gigawatts of power. Because of this, a highly favourable environment has been created for the advancement of PV technology [9].

Figure 1: Solar Cell Circuitry in its Most Basic Form



$$I_{sh} = \frac{V}{R_{sh}} . \frac{N_p}{N_s} + \frac{I}{R_{sh}} . R_s \qquad ...(1)$$

$$V_t = \frac{k.T}{q} \qquad ...(2)$$

$$I_{sh} = \frac{V}{R_{sh}} . \frac{N_p}{N_s} + \frac{I}{R_{sh}} . R_s \qquad ...(3)$$

$$V_t = \frac{k.T}{q} \qquad ...(4)$$

$$I_{ph} = [I_{sc} + k_i \, (T - 298)] \, \frac{I_r}{1000} \qquad ...(5)$$

$$I_{rs} = \frac{I_{sc}}{e^{\frac{qV_{OC}}{N_s k_n T}} - 1} \qquad ...(6)$$

$$I_o = I_{rs} \left(\frac{T}{T_r^{3}}\right)^{3} e^{\frac{q.E_{go}}{nK}\left[\frac{1}{T} - \frac{1}{T_r}\right]} \qquad ...(7)$$

$$I = N_p \, . I_{ph} - N_p I_o \left[e^{\left(\frac{\frac{V}{N_S} + I \frac{R_S}{N_P}}{n.V_t} - 1\right)} - 1 \right] - I_{sh} \qquad ...(8)$$

$$\eta = \frac{I_{sc} V_{OC} F.F}{P_{in}} \qquad ...(9)$$

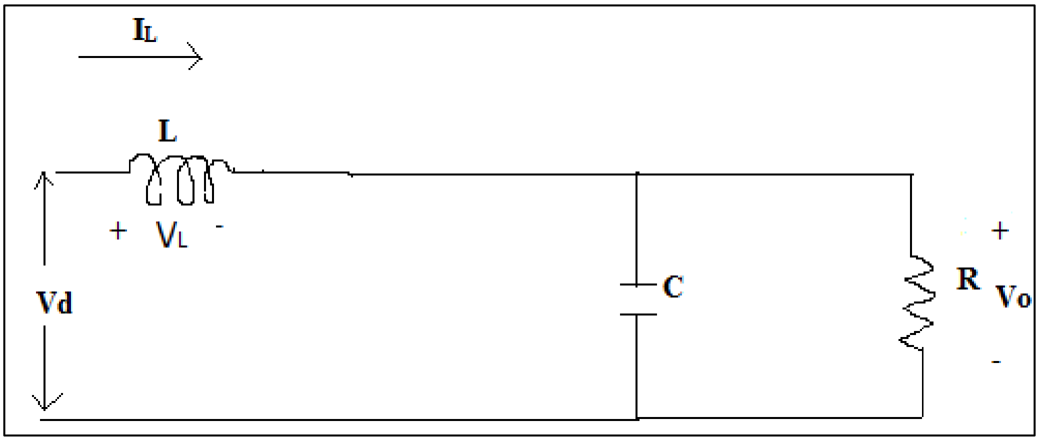
Table 1: Solar Panel Specifications

Sr. No.	Parameter	Value
1	Units	80
2	Maximum generation	215.15 W
3	V_{Pmax}	26 V
4	I_{Pmax}	8.35 A
5	V_{OC}	37.3 V
6	I_{SC}	8.84 A
7	Temperature Coeff. Of Voc	-0.46 % / ^{o}C
8	Temperature Coeff. of Isc	0.112 % / ^{o}C
9	Area of panel	1 m^2

2.0 Boost Converter

A boost converter, also known as a DC-DC converter, produces an output voltage greater than the source voltage The adverse effects on the environment are arguably the worst [10]. Prior to identifying the specific one, the entire word will be examined [11]. This figure will help in determining how long it will take for current energy sources to completely replace the need for sustainable energy, and this solution will be briefly discussed vary between 0 and 1, the output voltage would always be greater than or [12], and would therefore range from the initial voltage to infinity.

Fig.2: Boost Converter Equivalent Circuit Diagram



$$L_{min} = \frac{D\left(1-D^2\right)R}{2f} \qquad \ldots(10)$$

$$C_{min} = \frac{D}{R\left(\frac{\Delta V_O}{V_O}\right)f} \qquad \ldots(11)$$

Table 3: Converter Characteristics

Sr. No.	Parameter	Value
1	D	0.6
2	Freqeuncy	25 KHz
3	R	110 Ω
4	$\frac{\Delta V_O}{V_O}$	0.002
5	Min. value of capacitance	0.000100 F
6	Minimum inductance	0.0043 H
7	Implemented capacitance	0.004 F
8	Implemented inductance	0.4 H

3.0 Liquid Immersion Cooling Technique

The efficiency of a solar thermal system is governed by a number of mechanisms, which in turn depend on how well heat transfer processes work [13]. The solar panel itself needs to be improved, but there is also a chance of increasing solar conversion efficiency. All photons are

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absorbed by the ideal solar panel, which then transforms them into heat and transfers it to a fluid medium [14]. Higher fluid thermal transfer, higher output temperatures, and higher temperatures lead to increased power cycle energy conversion

$$C_{PV}\frac{dT_{PV}}{dt} = I_{reff} - Q_R - P_E - Q_{CV} - Q_H \quad \ldots(12)$$

$$I_{reff} = \varphi * \alpha \quad \ldots(13)$$

$$Q_R = \varepsilon_P\, \sigma \left[T_{PV}{}^2 + T_S{}^2\right]\left[T_{PV} + T_S\right] \quad \ldots(14)$$

$$T_S = 0.037536 \left[T_{amb}{}^{1.5}\right] + 0.32 \left[T_{amb}\right] \quad \ldots(15)$$

$$P_E = C_{FF}\left\{\frac{\varphi \ln[K_1\, \varphi]}{T_{PV}}\right\} \quad \ldots(16)$$

$$Q_{CV} = \left[h_{front,natural} + h_{front,forced} + h_{rear}\right]\left[T_{PV} - T_{amb}\right] \quad \ldots(17)$$

$$h_{front,forced} = 2.84 + 3\, v_w \quad \ldots(18)$$

$$h_{front,natural} = 1.78 \left[\left[T_{PV} - T_{amb}\right]^{\frac{1}{3}}\right] \quad \ldots(19)$$

$$h_{rear} = 1.31 \left\{\left[T_{PV} - T_{amb}\right]^{\frac{1}{3}}\right\} \quad \ldots(20)$$

$$\text{Conduction} = 2\, K\, X\left[T_{PV} - T_{amb}\right] + K.X.H\left[T_{PV} - T_m\right] \quad \ldots(21)$$

$$C_{PV} = 0.1694e^{\left(2.375 * 10^{-4} * T_{PV}\right)} \quad \ldots(22)$$

Table 4: Characteristics of Panel

Sr. No.	I_R (w/m^2)	T_{PV}	T_{PV}	P_{max}	P_{max}
1	1200	24	24	210.68	207.78
2	840	75	42.7	145.2	158.6
3	840	67	44.4	149.0	160.88
4	820	57.25	35.2	154.3	164.81
5	888	62	38.25	162.3	170.98

The temperature change before and after the application of the cooling technique is shown in the above table, along with the increase in power output. The PV panel's operating temperature has decreased by about 26 oC, and the power output has increased by about 10 watts.

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Table 5: Characteristics after Application of Strategy of Cells

Sr.No	I_R	T_P	V_{pmax}	I_{pmax}	P_{max}	V_{oc}	I_{sc}	F. F	η
1	1200	24	29.39	8.39	211.68W	38.14	7.87	0.85	0.222
2	840	58	25.76	6.9	155.66W	32.61	6.54	0.72	0.19
3	820	51.61	25.38	6.19	157.98W	34.28	6.42	0.72	0.189
4	810	42.35	32.4	6.11	161.71W	35.4 V	6.52A	0.72	0.195
5	878	48	32.05	6.61	172 W	34 V	7.4 A	0.75	0.154

4.0 Conclusion

The open circuit voltage decreases as the temperature increases. As the plate temperature rises and the output tension linearly decreases, as can be seen from the tests above, the current gradually increases. By using nanofluids as a refrigeration technology to lower the working temperature of PV panels, we were able to increase efficiency and fill factor by 2.3 percent and about 23 °C, respectively. Using a cooling technique known as nanofluid, we may be able to increase power by more than 15 W in comparison to the power generated prior to cell cooling.

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