Hybrid Solar Generating Module By Cooling

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Abstract- *"Faster, mightier & smaller" is still the keyword for every invention and development. In day-to-day world we concentrate on the compactness and efficiency of every product. Keeping this in our thought we have designed and fabricated an economical and reliable unit known as "Water Cum Room Cooler"."Human comfort is that condition of mind, which expresses itself with the thermal environment". In our project two rival properties of cool water and cool air are obtained. This system can be used continuously. By using our system there is no need of going for a separate air conditioner or air cooler and water cooler. As both purposes are served by a single system, the cost is also lowered to a considerable level.*

Keywords- Silicon solar cells, Working temperature, Efficiency, Diode and output parameters, Cooling system, Concentration.

I. INTRODUCTION

Now by increasing the efficiency of industrial production monocrystalline silicon solar cells (Si-SC) up to 17-18 % while significantly reducing their cost Chinese manufacturers were the largest exporters of photovoltaic products in the world. A significant part of the manufacturers engaged in industrial production of solarmodules, using Chinese-made solar cells. In addition, the largest segment of the market of imported solar modules also is occupied by Chinese manufacturers. For selling solar cells Chinese manufacturers in addition to efficiency and output parameters indicate the open circuit voltage (UOC), short-circuit current density (JSC), the fill factor (FF) of the illuminated current-voltage characteristic increase of Si-SC working temperature, which reduces their efficiency. In a significant amount of research works have been analyzed the influence of temperature on the efficiency of monocrystalline Si-SC, which are produced in European countries and Russia (see,Thus, established physical mechanisms lead to lower efficiency. At the same time, similar studies of Chinese production Si-SC with a few exceptions was not carried out Now a popular option for increasing a power of solar energy stations is the equipment of solar generating module (SGM) by low solar concentration system. Using low-concentration of solar radiation is economically justified. The equipment of photovoltaic modules, by concentrators single or double-sided flat focline type with the degree of concentration up to 2, which is optimal for solar cells of conventional design based on single-crystal silicon allows to twice reduce the number of used solar cells.

II. WORKING PRIENCIPAL

According to the equivalent Si-SC circuit quantitative characteristics of photovoltaic processes that occur in such device structures are diode characteristics: density of the photocurrent (Jph), the diode saturation current density (Jo), the coefficient of diode ideality (A), series resistance (Rs) and shunt resistance (Rsh), calculated per unit area of SC. By the analyzing the literature, it can be shown that with increasing Jf, Rsh, and with decreasing Jo, A, Rs increases the efficiency of solar cells. The photocurrent density, which quantifies the effectiveness of nonequilibrium charge carriers generation and diffusion processes, determined by the number of photons arriving to the base layer, a quantum yield of the photoelectric effect and the of nonequilibrium charge carriers lifetime in the base layer. The values of the ideality coefficient and density of diode saturation current, which quantitatively characterize the efficiency of the of nonequilibrium charge carriers separation in Si-SC, controlled by the recombination speed in the spacecharge area and the energy structure of the separation barrier. Shunt resistance is included in the equivalent circuit of solar cells in order to take into account the influence on the efficiency photovoltaic processes of low resistivity local parts of the device structure and the end surfaces. The series resistance of solar cells, the amount of which determines the nonequilibrium charge carriers collection efficiency depends on the electrical conductivity of the base Si-SC layer, the contact resistance and the recombination speed of nonequilibrium charge carriers on the back and front contacts. In this work calculation of output and diode parameters For investigated SC was carried out using the developed analytical processing program based on an approximation of the experimental illuminated CVC by the theoretical expression from. Illuminated CVC Si-SC measured by the loaded method during Illumination SC by the solar radiation simulator for terrestrial conditions with the light power up to 100 mW/cm2 . Measuring scheme, which has shown in Fig. 1a, as a source of simulating solar radiation includes LED Illuminator with

microcontroller control. The variable load resistance having six decades with the corresponding resistance values, which allows precisely vary value when measuring the CVC in the range from 0.01 up to 1000 Ohm. Registering of voltage value on load resistance has carried out by digital multimeter Mastech MS8226 DMM. Measuring scheme for investigated loaded currentvoltage characteristics and the appearance of the LED illuminator (b), the inset shows the location of the LEDs on the radiating element. 1 – LED Illuminator; 2 – investigated Si-SC; 3 – variable load resistance; 4 – multimeter to measure the voltage on the load resistance standard Si-SC having a known value of the shortcircuit current, and place it near the investigated SiSC. By changing, the distance between the Si-SC and LED illuminator emitting element achieved the compliance with the actual value of Isc for standard Si-SC to its value at 100 mW/cm2 irradiance power, after that investigated Si-SC has been connected to the measuring circuit.

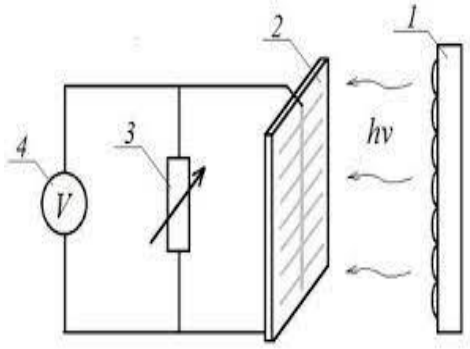

Fig1. Hybrid solar module

Determining Your Efficiency

The best way to determine your panel's tolerance to heat is by looking at the manufacturer's data sheet. There, you'll see a term called the "temperature coefficient (Pmax.)" This is the maximum power temperature coefficient. It tells you how much power the panel will lose when the temperature rises by 1°C above 25°C. @ STC (STC is the Standard Test Condition temperature where the module's nameplate power is determined).

For example, the temperature coefficient of a solar panel might be -.258% per 1 degree Celsius. So, for every degree above 25°C, the maximum power of the solar panel falls by .258%, for every degree below, it increases by .258%.

What this means no matter where you are, your panel may be affected by seasonal variations. However, the temperature coefficient also tells you that efficiency increases in temperatures lower than 25°C. So, in most climates, the efficiency will balance out over the long run.

For a geographic region where temperatures higher than 25 degrees C. are the norm, one can consider alternatives to Mono or Polycrystalline modules, which have the highest efficiency (At 1:1 concentration), but also the highest temperature coefficient at PMAX. Project designers may want to consider a thin film or CdTe module – or in the case of a very large project, High Concentration PV, which is designed for hot climates, but not applicable for small projects.

How to Reduce the Effects of Heat

After the module technology is selected for installation, there are several ways to minimize the negative effects of high temperatures:

- Install panels a few inches above the roof so convective air flow can cool the panels.
- Ensure that panels are constructed with light-colored materials, to reduce heat absorption.
- Move components like inverters and combiners into the shaded area behind the array.

III. RESULT

The study of working temperature influence on the efficiency of Chinese production silicon solar cells is shown that with increasing working temperature reduction of efficiency is 0,07 %/°C, that is significantly higher than in the device structures of European and Russian production and a due to the unconventional decrease of short circuit current density. By the computer modeling of the quantitative influence of diode parameters on efficiency has been shown that Chinese production Si-SC efficiency decrease is due to not only by the growth of the traditional diode saturation current density, but also a decrease of shunt resistance. Identified temperature dependence of efficiency shows the feasibility of using Chinese production Si-SC in the construction of photovoltaic thermal system, which together with the heat pump is part of a bined system for hot water supply, heating and air conditioning. Based on a detailed analysis of the working temperature influence on the efficiency of photovoltaic processes that determine the solar cells work, it was proposed the optimal construction and technological solution hybrid solar generated module, the main feature of which is the heat exchange block, designed to reduce the HSGM working temperature.

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