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Vest Heated With Solar Energy

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ABSTRACT: *In this study, the design and practice of resistant vest heated by using solar energy both to be protected during winter months and to be able to charge cell phones, tablet PC, Mp3, Mp4, digital cameras, and cameras were conducted. For this purpose, forty solar panels and batteries with 0.63W, 0.5V, 1,26A, 52x78 mm dimension, 5 gr weight and multicrystal characteristics were used. The system created both heats the vest and charges the battery. The resistant vest heated with solar energy can be used for military purposes, mountaineers, and shepherds. The charged battery can heat the vest in for approximately three hours at night during the experiments conducted. This is especially ideal for the soldiers standing sentry to be protected from cold during winter months. Resistance vest has windproof and waterproof features that can heat up to 30W, 12V and 40/45^{0}C. The solar panels of the vest can charge the battery in approximately 7.7 hours.*

Keywords: *Resistant vest, Solar panel, Battery*

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I. INTRODUCTION

It is clear how important the energy, especially electrical energy is for our country which is in the industry development area. On the other hand, in addition to meeting the need for electrical energy increasing year by year in our country with new investments, the use of current resources in the most efficient way is an indisputable fact[1]. The solar energy arriving at our world in a year is equivalent to approximately 15-20 times of the energy to be obtained from all fossil fuel resource reserves[2]. The energy indicated in Table 1.1 and which is as much as to be considered as infinite in terms of human life in respect of the resources are called renewable energy [2].

According to the study conducted by *EIE (General Directorate of Electrical Power Resources Survey and Development Administration),* it was determined that the average annual total sunshine duration in Turkey is 2640 hours (7,2 hours in total per day), and the average total radiation intensity is 1311 kWh / m²-year (3.6 kWh / m² in total per day). The solar energy potential and sunshine duration values of Turkey by month are indicated in Table 2.2. As a result of ongoing measurement studies, it is expected that the solar energy potential of Turkey will be 20-25% more than the previous values[3]. The system can be brought into a state that can meet the increasing need for power with the addition of new ones to the current modules [4]. It especially appropriate for the villages, television stations and satellites far from the electric network[5]. Photovoltaic systems can be considered as more economical when compared to the systems based on fossil[6].

Table 1. Alternative energy sources

	Alternative Energy Type	Welding or fuel
1	Nuclear energy	Heavy elements such as uranium
2	Solar Energy	Solar
3	Wind Energy	Atmospheric movements
4	Wave Energy	Ocean and seas
5	Natural gas	Underground sources
6	Geothermal Energy	Underground Water
7	Hydraulic Potential	Rivers
8	Hydrogen	Water and hydroxides
9	Bio-mass, bio-diesel	Biological residues, oils

When millions of silicon atom are enriched with boron, there will be a 1-electron of the hole in the structure. Thus, there will be a positive type in this structure[7]. The sun consists of hot gas with 1,39 x 106 km diameter, 2,2 x 1026 ton weight and 1,41 g/cm3 density, and it is 75% hydrogen, 24% helium and 1% other elements[8]. The first solar battery was created by D.M. Capim, C.Fuller and G.L. Person in 1954. Depending on the requirements, parallel and series connection methods can be used to obtain battery banks with different voltage values[8,9]. The solar energy made itself accepted as an environmentally clean energy source. Thus, it is required to use the sun in the most efficient way [10]. According to the study conducted by *EIE (General Directorate of Electrical Power Resources Survey and Development Administration)*; average annual total sunshine duration of Turkey is 2640 hours, and this equals to 7.2 hours per day (2) [11]. The productivity values of the solar panels are approximately 15%.

Table 2. Monthly average solar energy potential of Turkey

Aylar	Aylık Toplam Güneş Enerjisi		Güneşlenme Süresi
	(Kcal/cm^2-ay)	(kWh/m^2-ay)	(Saat/ay)
January	4.45	51.75	103.0
February	5.44	63.27	115.0
March	8.31	96.65	165.0
April	10.51	122.23	197.0
May	13.23	153.86	273.0
June	14.51	168.75	325.0
July	15.08	175.38	365.0
August	13.62	158.40	343.0
September	10.60	123.28	2S0.0
October	7.73	89.90	214.0
November	5.23	60.S2	157.0
December	4.03	46.S7	103.0
Total	112.74	1311	2640
Average	308,0 cal/cm^2-gün	3,6 kWh/m^2-gün	7.2 saat/gün

II. METHODS AND MATERIALS

2.1. Boundary Diagram of the System Developed

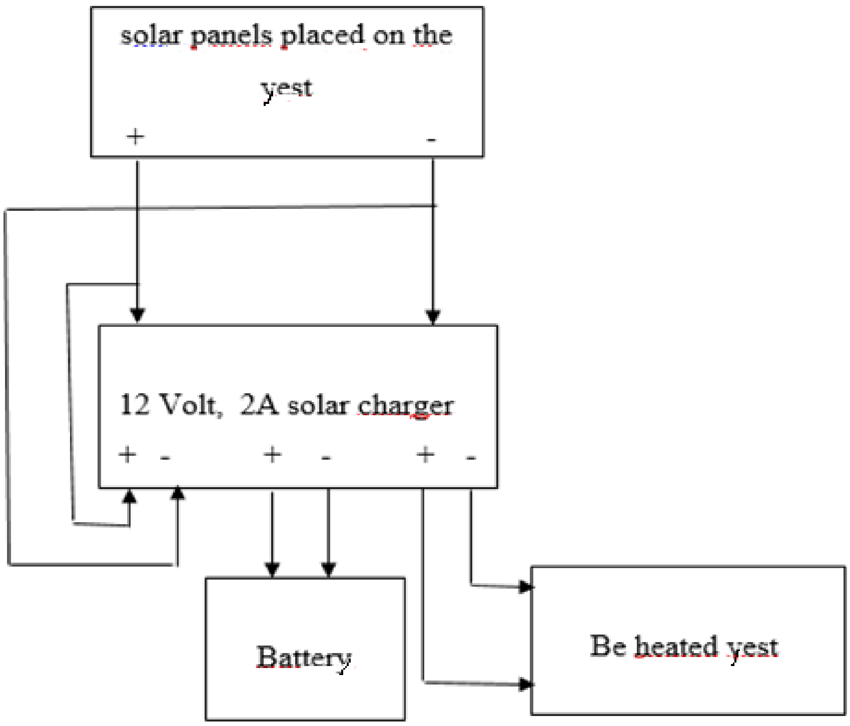

Figure 2.1. Boundary Diagram of the System

12-Volt DC tension and 2A current obtained from the solar panels mounted on the shirt are applied to the positive and negative entries of the solar charger. One of the remaining positive and negative outputs of the solar charger is applied to the battery, and the other one is applied to the resistants of the vest to be heated. Both the battery is charged, and the vest is heated.

2.2. Technical characteristics of the solar panels used

Table 2.2.1 Technical characteristics of the solar panels

Average Power	0.63 Watt
Production Tolerance	5%
Average Voltage	0.5Vmax
Average Current	1.26 Imax
Panel Dimensions	52x78mm
Number of Cells	1
Weight	5gr
Feature	Multi kristal

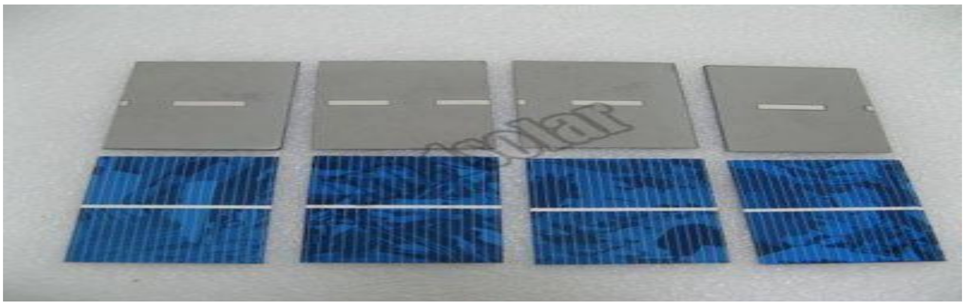

Figure 2.2.1. Structure of the solar panel

2.3. Resistant vest used

Table 2.2.2. Feature of the resistant vest used

Voltage	12V
Power	30W
Heating Feature	40/45°C
Feature	Wind and Waterproof Fabric

a) b)

Figure 2.3.1. a) Before, b) after the solar panels are attached to the resistant vest

As indicated in Figure 2.2.1, 40 small solar panels are integrated on the vest. Since the weight of each piece is 5 gr, total weight is 200 gr. Thus, it is an insignificant weight for the person who wears it.

2.4. Technical characteristics of the battery used

Table 2.4.1. Technical feature of the battery

Voltage	6 V
Current	2.8Ah
species	Dry Battery
size	66mm*33mm*98mm

Figure 2.4.1. Outlook of the battery

Table 2.4.2. Feature of the regulator circuit

Input voltage	4-35V
Output voltage	1.23-30V
Output Current	0-3A
Operating temperature	-40°C ila 85 °C
Operating frequency	150KHz
Conversion yield	% 92

2.5. SPC 122 Solar Panel Charger Control Device

It provides the accumulators from 12 volts to 12 amperes to be charged with the solar panels. Thanks to the microprocessor in it, it protects your battery by keeping battery float voltage at the optimal level and prolongs its life. Battery voltage, charger condition and fill rate can be visually observed on the led screen on the device.

Figure 2.5.1. Charge controller card

Figure 2.5.2. 12V, 2A solar charger

III. CONCLUSION AND SUGGESTIONS

In this study, resistant vest working with solar energy was practiced for people having aproblem with heating during winter months. The resistant vest heating with solar energy can be especially used for military purposes, mountaineers and shepherds pasturing their animals at mountains. Resistance vest has windproof and waterproof features that can heat up to 30W, 12V and 40/45^{0}C. It was concluded as a result of the experiment we conducted on the power source battery that the solar panels on the vest can be charged in approximately 7.7 hours. Cell phones and appropriate electronic devices can be charged with the batteries charged. Since there will be no sun at night, charged batteries will heat the resistant vest in approximately two hours.

Figure 3.1. Montage of the solar panels to the vest

40 solar panels, each with a capacity of 0.63W and providing 24V at maximum solar energy were used to charge the batteries. These panels were connected in series to each other and connected to the battery working with 14V through a regulator. An amperometre was connected to measure the current the vest drew while it was charged with solar energy. The values obtained are indicated in Table 3.1.

Table 3.1: Current and tensions drew from the solar panels while being charged with solar energy.

Current	Voltage
0A	22V
0.5A	19.5V
0.8A	18.8V
1A	16.8V
1.2A	14.8V

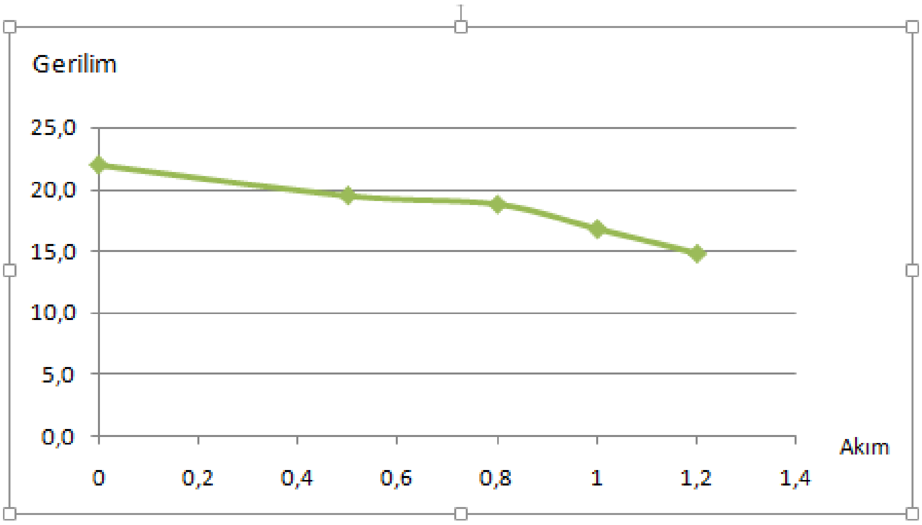

Figure 3.2. Voltage-current diagram

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