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A Novel Tool for Low Power Photovoltaıc Systems

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Abstract **– Nowadays, there are many commercial software's used in the installation of photovoltaic systems. This software's have been designed to respond the great power systems. In this study, software that is provided for users are interested in solar power systems has been developed. The software consists of two parts. In the first part; selection and design options to determine the daily energy needs of the living area are submitted for users. In the other part, appropriate system requirements are determined by load calculations. In addition instant system efficiency can be dynamically tested by using measurement data. By using software are designed for a photovoltaic system with the low power, model application was made with data of Tokat city for requirement of a standard house.**

Keywords **– Photovoltaic Systems, Software Design, Energy Requirement.**

I. INTRODUCTION

Today, demand for energy is increasing in connection with globalization, the rapidly increasing population and industrialization. The International Energy Agency (IEA) projections, according to energy policy and energy supply of choice for defending the current status in the world primary energy demand between 2007 and 2030 an increase of 40% would be expected [1]. It is running out of available energy resources and environmental pollution from fossil fuels, making mandatory the use of renewable energy sources [2].

Renewable energy sources are environmentally friendly because it is damaging the Earth's atmosphere and ecosystems and protect the environment. In 1997, the Kyoto Protocol, the United Nations Framework Convention on Climate Change aimed to reduce the amount of carbon released into fossil fuels into the atmosphere in 2005, which came into force this treaty has tried to reduce dependence on fossil fuels [3]. Countries, the depletion of fossil fuels and increased energy costs with renewable energy sources by considering the potential energy production is accelerated.

Solar energy on the earth, 10.000 times fossil energy sources and nuclear energy used by human beings. The solar energy reaching earth in a year, is close to 1.2 x 1017 watts. In this case, the world can respond to 0,003% of the total electricity demand. This situation clearly shows the importance of established solar system solar energy with us [4].

Emrah KIYANÇİÇEK, in 2013 has created the software package (PVS^2) for the sizing of photovoltaic systems. He has done that for a household in the sample application the application program with the province of Konya has realized. Turkish menu with this program by providing general information to users in general also shaped to the needs in this direction when setting up a system of program designers aimed to reduce costs with PVS^2 [6].

Dursun AYDÖNER, In 2010, the building integrated photovoltaic system in the Istanbul area, by applying to the installation of photovoltaic systems in the region in order to analyze the potential of solar energy to reduce costs and energy producing their own model building has been carried out. This design performing "Sunny Design" is ready package is used [7].

Huan-Liang and friends, relaized PV cell, module and photovoltaik model application with MATLAB Simulink. Although the model has been designed with ease of use a dialog box such as Simulink block libraries [8].

Reich and friends has simulated photovoltaik model with CAD application. The output data of the simulation, compared to the possibility of being installed on the model is high, it has been revealed [9].

The needs analysis may be performed for the use of photovoltaic systems in homes with application program. In addition, photovoltaic system design can be realized. By using software are designed for a photovoltaic system with the low power, model application was made with data of Tokat city for requirement of a standard house [10].

The average sunshine duration of all provinces into our application program has been registered in the program. User everything necessary to design systems from a single screen energy needs can be seen on a single screen. Applications can be designed in the program calculated the amount of energy required by the system and a simple model of the system to be installed is created. Our application software provides ease of use to users due to the Turkish menu. To prevent problems resulting from incorrect calculations, our program can be made continuous revisions to the data, calculations and system design can be done again and again. C # programming language application with our program can be improved due to the effectiveness of the programming language and easily updatable.

II. PHOTOVOLTAIC SYSTEMS

Photovoltaic systems consist of batteries, inverters, battery charger a variety of electronic control devices, and support circuitry. These systems, in the past only where there is no electricity grid from remote residential areas, difficult to transport fuel to the generator was being used and when it is expensive. Today, the use of the network in connection with settlements in the roof of the house in connection with the network and large-scale power plant application has become widespread. In addition, it is also possible to use as diesel generators or hybrid combination with other power systems.

The independent system network, a sufficient number of photovoltaic modules, used as an energy source with

battery group. Photovoltaic modules, generating electrical energy during the day are stored in the energy battery and provides the necessary energy from the battery. Charging control unit is used to prevent damage to the battery. Where it is necessary network compliant alternating current, an inverter is added to the system. C voltage in the battery, 220 V-50 Hz is converted to a sine wave. Similarly, support electronic circuits can participate in the system according to the form of the application. In some systems, it has a maximum power point on tracker device that allows the operation of the maximum power point of photovoltaic modules. Figure 1 illustrates a diagram of a photovoltaic grid independent system.

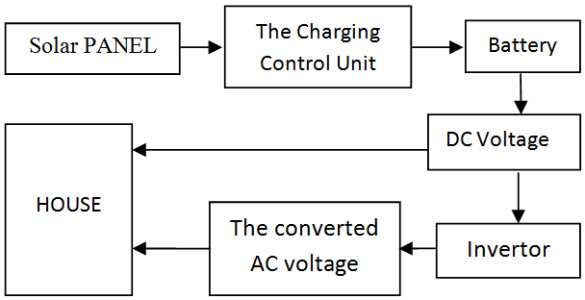

Fig. 1. The closed scheme for household photovoltaic design

III. PHOTOVOLTAIK SYSTEM ANALYSIS AND DESIGN

In the first part of application program, the power of the devices can be used at home working time is selected, energy needs are determined with the help of the necessary calculations [11]. In addition, the power has already spent all the items that need a home are calculated in the program. “Listele” button is clicked, the amount of energy needed by the device are listed at the bottom of the program. “Textbox” were used for not having restrictions in the program. As a result of the calculation data, it is provided with the units. “Temizle” button will reset all values calculated in the program design in conjunction with re-making facilities. Examples of application in, a house - week average 43135 watthours (Wh), is calculated that require energy. The total power of the devices was found to be 965 watts.

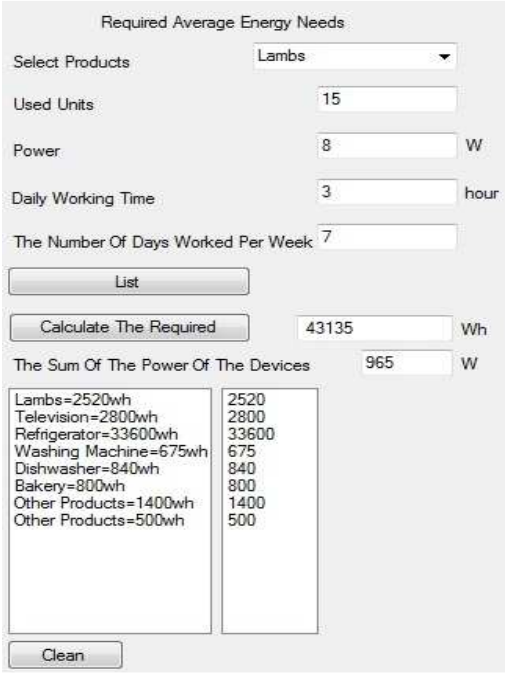

Fig. 2. The weekly energy used in homes

In the second part of the program, AC-DC loads and considering the productivity of PV module, the amount of energy required PV module has been found to be 53253 Wh. information nominal voltage of the system as 12V is entered. Clicking on "Ort. Günlük Enerji İhtiyacını Hesapla" button, the average daily energy needs is calculated to be 7607,58 Watt/day and of the average load current is calculated to be 184.94A (Figure 4).

The average sunshine duration of the provinces in accordance with the data received from GEPA has been registered in the program. Our sample application, has been carried out in the province of Tokat was found to be 6.75 hours of average sunshine duration per day [10].

For calculating of the pv module current, Selection of the appropriate modules is performed with "Kullanılacak Modül Türünü Seçiniz" combobox. PV module current of the selected OST80(80Wp) is 10A.

The needed number of series panels with buttons on the bottom of the program 1 pieces, the number of parallel panels 146 pieces and 146 pieces of the total number of panels, total panel power were determined 11687,92 Wp (watt peak). A general layout of the module shown in Figure 3.

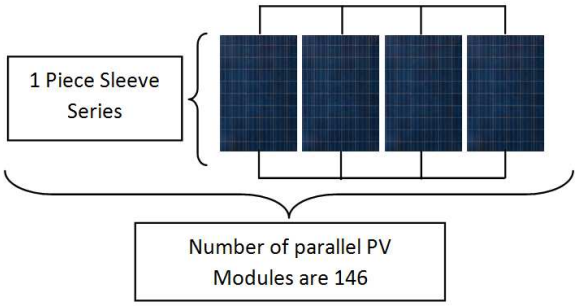

Fig. 3. Panel layout

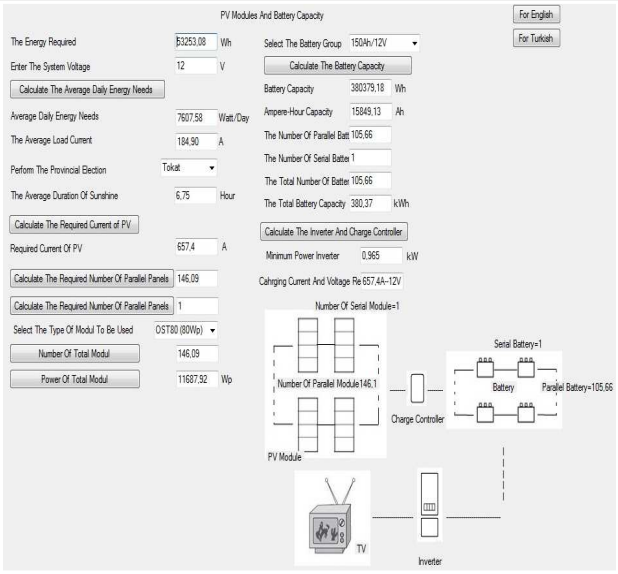

Fig. 4. PV Modules and Battery Capacity

The battery needs of the system is calculated taking into account the last number of days off in a row. In Figure 4 with "Batarya kapasitesini Hesapla" button has been calculated as a minimum of 380.379 kWh of the required battery capacity. In addition, to be used numbers of parallel battery 105, number of serial battery 1 pieces and total number of battery was found to be 105*1=105.

Considering the efficiency loss of the required inverter has been calculated minimum power of inverter that will be used. With The " İnvetör ve Şarj Regülatörü Hesapla " button has been determined to be the 0,965 kw of minimum inverter power to be used. The current of charging regulator has 657A and the voltage of charging regulator has been calculated 12V.

In the light of the information given above is shown in Figure 5 a screenshot of the application program. In this context, photovoltaic systems, which will be held for a house in Tokat application is shown in Figure 5 in our program.

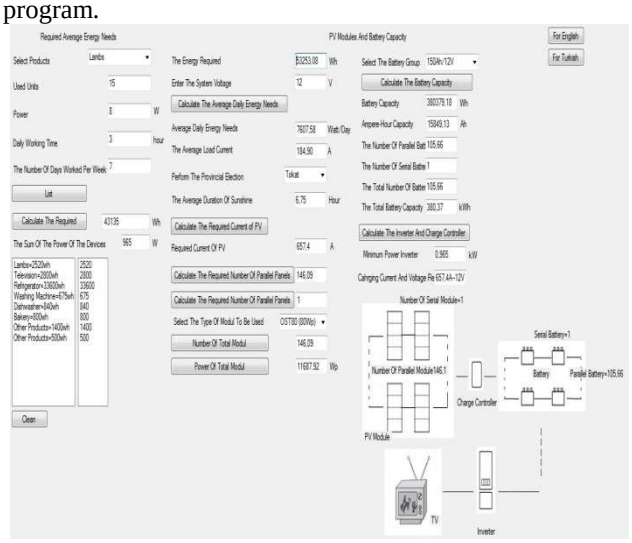
Fig. 5. Overview of Application Program

IV. Conclusion

The application program consists of two main parts. In the first part, the power of the device can be used at home and working time is determined using energy needs by selecting the necessary calculations. The second part, the number of photovoltaic modules and batteries required by the system are calculated. Users are given clues to the router. With the realized interface is provided ease of use for users. The first portion and second portion is operatively connected to each other. Data changes are occurring in the first part, the second part of the calculations are updated.

GEPA data, allows to calculate potential PV system requirements for the establishment of a home in Turkey. In Tokat province, to meet of the requirement electricity energy of a house, samples of PV systems implementation on application program. With enhancements to the program will be set up only for homes is intended to be used for making factories and other businesses, except for photovoltaic systems. In addition, it is aimed to overcome the lack of native software. Again with revisions made to the system cost and the depreciation period determining the application of hybrid systems it is planned to be in the sample.

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