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A NOVEL BASIC METHODOLOGY TO COMBAT UNBEARABLE POWER CUT PROBLEMS AT SOUTHEREN PART OF INDIAN SUBCONTINENT VIA TAPPING OF MOST PROMISING OF SOLAR ENERGY AND SUPERCAPACITOR

N.S.MURTHI SARMA, A.PRAVIN, K.CHAITANYA, T.V.JANARDHAN RAO, N.S.N.LAKSHMIPATHI RAJU, B.V.V.SATYANARAYANA AND M.S.MADAN MOHAN

Bonam Venkata chalamayya Engineering College, Odalarevu, 533210, India

ABSTRACT

This paper aims at proposal of attempt applied at Andhra Pradesh, one of the states of southeren part of Indian sub continent. The combat is made against regular inconvenience to the common man. The serious problem is proposed in a optimal way. The novelty lies in linking sun to the electric load of a common man. The solution found more benefited with the support devices that includes super capacitor. The idea is encouraged by management of this institution and all the concept verification is with its sponsoring.

Key words: Regular inconvenience, electric load, super capacitor.

Introduction

In the present scenario, the utilization of electric power is ever increasing. This is of technological advancement at every gadget and home appliances. Thie even competes with industries Many customers in the southern india such as Andhra Pradesh, are highly dissatisfied during last few years. Even conventional invertors decreased their support rapidly. There are incidents where several people spent sleepless nights due to mal functioning of the gadgets. This awoke to search non conventional energy sources.

Table 1: Some features of the planet sun relavant to the context

Sl.NO	Feature	Value
1.	Mean distance from earth	149 600 000 km
2.	Energy radiation	$38x10^{20}$MW
3.	Receivable power by earth	$17x10^{10}$MW
4.	Average Availability	12 Hours of the day.

The super energy emitter i:e SUN (Table1) in general ,will ample of energy all round the year especially during March to September of any year with reference to Indian conditions . As an attempt to draw some energy from dawn to dusk of his presence is made. This is a direct and highly benefitable on comparison with wind energy. The utilization of wind and sun as renewable sources causes uncontrollable fluctuations in power generation. Though this is in practice at large scale customer such as satellite power, Economic solution for a normal house hold customer is the novelty in this paper. India ranks fifth in the world in use of non conventional energy resources such as Wind. Among its states, Tamilnadu ranks first .Gujart occupies the prority place where it initiated maximum of solar use. Also, the Government of Andhrapradesh is also encouraging towards inviting solar solutions

Furthermore, the ratio between peak power and average power is high for systems with a limited number of households. In small autonomous renewable energy systems (ARES)[3], energy storage is needed. However, when one designs a small storage system inverters that supply power by storing the energy in batteries having different capacities and delivering the power in the absence of the main power source generator. The use of Lead-acid batteries as energy buffers is problematic, since it is not possible to cover fast power fluctuations without dramatically reducing the batteries'[6] life-time.

Super Capacitors[2] applied relieve fast changes in the battery storage system. Batteries are used to meet the energy requirements while the Super Capacitors combats the instantaneous power demand.

The Solar Photo Voltaic (SPV) technology which enables the direct Conversion of sun light into electricity can be used to run pumps, lights, refrigerators, TV sets, etc., and it has several distinct advantages, since it does not have moving parts, produces no noise or pollution, requires very little maintenances and can be installed anywhere. These advantages make them an ideal power source for use especially in remote and isolated areas which are not served by conventional electricity making use of ample sunshine available in India, for nearly 300 days in a year Solar

Thermal Device on the other hand captures and transfers the heat energy available in solar radiation. The energy generated can be used for thermal applications in different temperature ranges. The heat can be used directly or further converted into mechanical or electrical energy. .

A. An outline on Solar Panel

A solar panel (also solar module, photovoltaic module or photovoltaic panel[1]) is a packaged, connected assembly of photo voltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. (Fig.1 and 2) Each panel is rated by its DC output power under standard test conditions, and typically ranges from 100 to 320 watts. The efficiency of a panel determines the area of a panel given the same rated output - an 8% efficient 230 watt panel will have twice the area of a 16% efficient 230 watt panel. Because a single solar panel can produce only a limited amount of power, most installations contain multiple panels.

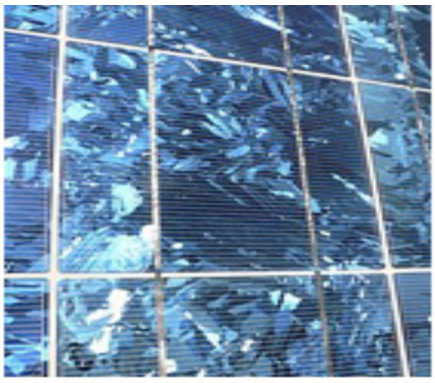

Figure.1: Poly crystal Solar panel

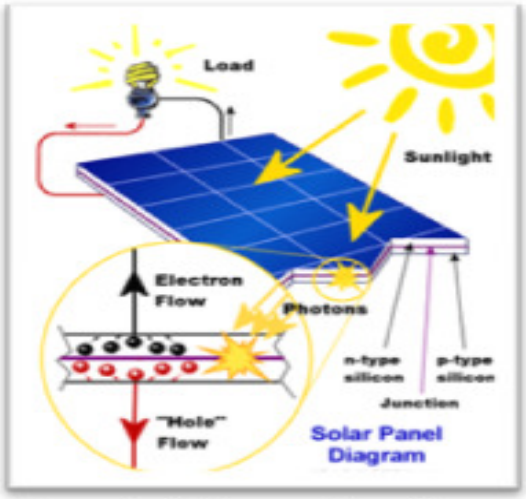

Figure 2: Solar panel working

The roots of panel ranges from Edmund Bequerel in (1839) to Anderson (2001). Externally, popular terrestrial usage photovoltaic panels use MC3(older) or MC4 connectors[4]to facilitate easy weatherproof connections to the rest of the system Fig.3 The concept of the connection is shown in Fig4 .

B. *Efficiency*

Depending on construction, photovoltaic panels can produce electricity from a range of frequencies of light, but usually cannot cover the entire solar range (specifically, ultraviolet, infrared and low or diffused light). Hence much of the incident sunlight energy is wasted by solar panels, and they can give far higher efficiencies if illuminated with monochromatic light. Therefore, another design concept is to split the light into different wavelength ranges and direct the beams onto different cells tuned to those ranges. This has been projected to be capable of raising efficiency by 50%.

Figure 3: MC4 Type connecter

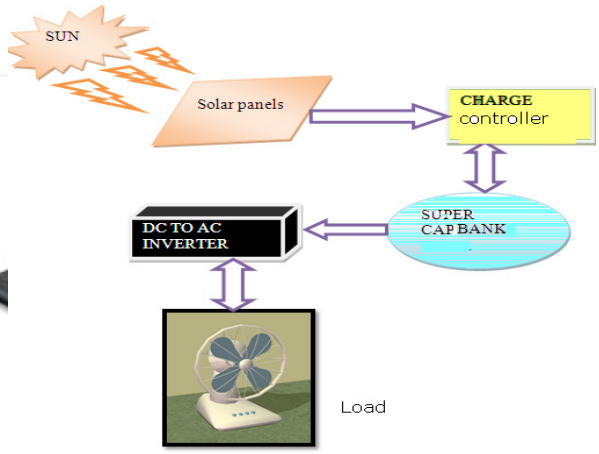

Figure 4 : Concept of the solar solution

Currently the best achieved sunlight conversion rate (solar panel efficiency) is around 17.4% in new commercial products typically lower than the efficiencies of their cells in isolation. The most efficient mass-produced solar panels have energy density values of up to 16.22 W/ft^2 (175 W/m^2).

C. *Connectors* and Output

The MC4 connector is UL rated at 20A and 600V maximum, depending on the conductor size used. While small solar panels used for example for battery charging may not require special connectors, larger terrestrial arrays for power generation involve higher currents and voltages, and place special demands on both cables and connectors for safe operation. The MC4 connector incorporates a flexible watertight seal and is supplied as 'male' and 'female' type to minimise the chance of wrong connections.

Solar panels most often produce a 'nominal' 12v DC output or multiples there of (i.e. 12 volt solar panels, 24 volt solar panels, etc) - the actual stated peak voltage will be about 40% higher than this at peak watt power output - assuming ideal solar conditions. Such a varying voltage depending on the solar conditions is not that useful for today's devices that often require a precise AC supply at much high voltages, usually either 240 volt or 120 volt.. Now you can put solar panels together in series to get to around this voltage, but it would be in DC and highly unstable as to the exact voltage at any given time.

2.Requirements For Realization Of Concept

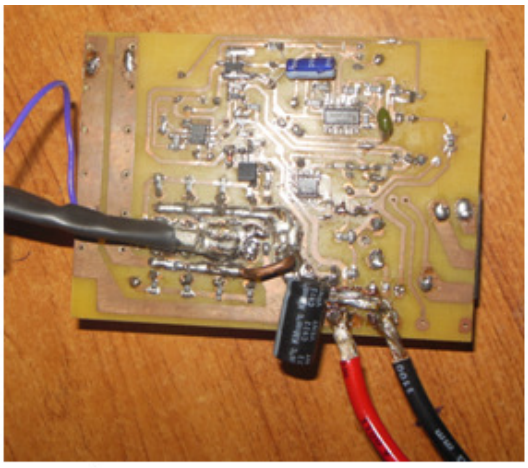

Figure5 Back view of charge controller

Most solar powered systems consist of up to three main parts: a solar collector (i.e. the solar panels), an inverter and optionally a charge controller and battery set if you are operating 'off the grid'; i.e. without mains power supply. The diagrammatic form of this is shown below The solar collector, usually photovoltaic (PV),otherwise known as solar panels ,convert the solar energy from the sun into electricity. The solar panels are related by peak power output measured in watts

Inverter

Inverter is a type of electronic power generator which convert low voltage direct current(DC) from a battery to a high voltage alternating current(AC).Power failures can be really very frustrating at times, especially during the night time. Inverters will help you to cope up with the blackout and do away with your problems. Backup time of Inverter is as follows BT= Ahx12VxPFx0.9/Load VA hours. (1) Where, Ah is the ampere-hour capacity of the battery, PF stands for the power factor of the inverter and load is the sum of VA ratings of the electrical loads connected to the inverter.

3. Implementation And Working

Implementation of concept has phases such as, Installation of solar panels, Designing of charge controller, Super capacitors, DC to AC inverter and Load distribution. This starts with installation of solar panels.. The solar panels that has the capacity of 800watt.As we require constant voltage to be obtained at the input of the charge controller the solar panels are connected in parallel so the constant amount of voltage is obtained with required current level. The solar panels are arranged in a way such that maximum amount sunlight falls on the panels. When sunlight falls on the panels the voltage that is obtained throgh the panels will be19v DC. This 19v DC is applied as input to solar charge controller

A. Design and working charge controller

Charge controller is to control the voltage that is feed to storage system and to the inverter. The input to the solar charge controller is 19v DC.

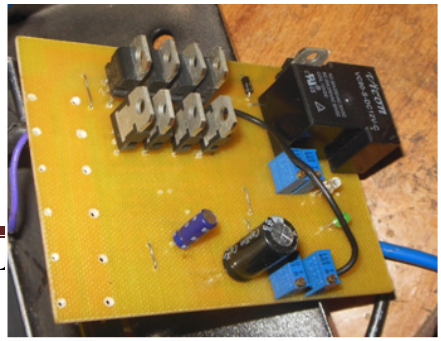

Figure 5 Front view of charge controller

Solar charge controller is a combination of many components that are connected in particular topology based on our requirement. Initially charge controller verifies the

amount charge that is present in the storage system. If the charge stored in the storage system is reduced to 0V,then the amount of voltage that is present at the input of the charge controller is feed to the super capacitor bank that are connected in series. And this super capacitors get charged slowly. The minimum cutoff of this super capacitors is 6V.If the voltage at the input crosses

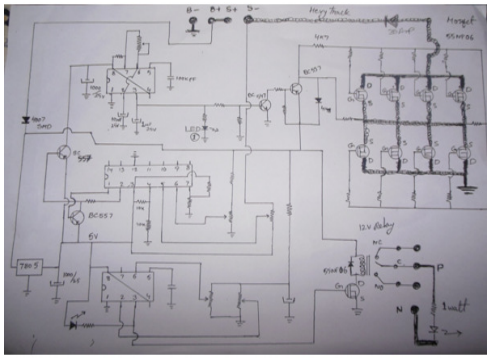

Figure7: Practical charge controller circuit

the minimum voltage the capacitors get speed up incrementing the voltage rapidly till the maximum amount of the voltage is reached i.e 13.5v DC. Now the DC voltage is given as input to the DC to AC inverter.

The solar panel positive is connected to the positive terminal of the capacitor bank and the negative terminal is connected through diode to the source of the MOSFET section and the drain of the MOSFET section is connected to the negative terminal of the capacitor bank. Now the voltage coming from the solar panel is 19 volts DC.

The main section in this charge controller is MOSFET section. This MOSFET section controls the charging of the capacitor bank. When the capacitor voltage reduced to 12 volts the gate of the MOSET section is excited by oscillator and the MOSFET section comes in to on state and charges the capacitor bank. As the output of the solar is not constant and varies automatically so a voltage comparator is required to generate constant amount of voltage required for verifying the operation and control of charge of capacitor. The comparator used is 7805 that generates only 5V as the output whenever the input is greater than 5V this is fed by the positive terminal of the solar panel. Now the output of the 7805 IC is connected to the comparator. This comparator generates the output based on the input compared value. To the positive terminal we connect voltage divider resistors and so the voltage 5V is divided equally whatever the resistor value but both should be in equalized manner. Now by adjusting the preset the second resistor of the comparator we will fix the voltage reference to 2.5 volts if the voltage at this node is greater than 2.5 volts it generates output as 5 volts else output is zero volts only.

Now to make the MOSFET section to switch continuously we use this output voltage of the comparator fed to the another comparator then it compares the voltage of the capacitor bank and if this is less than the required amount then it ejects a pulse so the MOSFET section gets on and the bank charges, after the required amount of charge is filled then the voltage coming from the solar is feed to the inverter through capacitor bank only by parallely charging and discharging only.

B Super capacitor bank

All the five super capacitors having each voltage of 2.7volt and 1000F,are connected in series. We have designed the circuit in a way that when the voltage in the capacitors reached to13.2V then the charge controller transfers the remaining Dc voltage to the inverter. Before giving the DC voltage as input to capacitors we convert it into pulsating DC. We do such a conversion because as the capacitors are connected in series if DC is given directly this results the charging of end capacitors so that the capacitors that are present at the middle cannot be charged so to avoid it pulsating DC is given as input to the capacitor bank. Due to this they get charged quickly.[2]. The inverter used is DC to AC inverter. The input given to this inverter is the Direct current that is arriving from solar panels. The minimum input of the inverter is 12 volts. The 12 volts Dc signal is given and as the conversion should be from lower value to higher value we use two stage transformer. Transformer operates on AC

Table2: A case study of Solar application and APSEB application

S.NO	Description	Common House	Engineering College
1	Duration of power supply by APSEB in a day	Average of less than 4 hours From 8Am to 12AM	Average of 2 hours in a day from 8Am to 5Pm.
2.	Promised power supply with support of solar panels and APSEB	More than 10 hours through out the day.	More than 15 Hours through out the day.
3.	Bill without solar and with inconvinenice	INR 1500	INR 10000
4.	Bill with Proposed set up.	INR800	INR6000

Input section

This has two section Firstly,The input DC is given to the inverter. The conversion of low constant voltage should be converted to a high alternating voltage that is having high frequency. When the DC is given as input then to operate the ferrite core two stage transformer it should be converted to pulsating AC. So there is a presence of n-channel Power MOSETS at the primary of the transformer. This crystal oscillator generates a frequency of 38KHZ in the form o a square continuous pulse. With the help of this square pulse the two NMOSETS gets operated and the output voltage obtained at the primary of the transformer is linked up with the secondary windings o the transformer in opposite wit primary voltage. Second secton is as follows.

The remaining section, i:e after ferrite core transformer the usage of ultra fast switching diodes comes in to existence. These diodes are connected in a bridge manner .The usage of ultra fast switching is important as because we are dealing with high frequencies we use these diodes. The switching capacity of these diodes is 38K times per second so we use this for conversion of such a high frequencies in to a limited frequency and the input voltage is raised in amplitude and is converted to 230V AC. Now this 230V AC is given to the loads through sockets. From the sockets the current goes through the links and the loads are made to be operated. The obtained AC i:e 230V AC is given to the home appliances according to our equirement

4. Result and Discussion

The attempt found advantageous towards Reduction in space occupancy by inverter, Reduction in the usage of power supplied by Government, Minimization of power bills, Cost reduced and zero maintenance. Also, life span of the system and components increased up to 40 years. A case study report is as per Tab.2. A common house is assumed with normal load of 4tubes and 2fans. Engineering college load is on par with any standard college. But, the college is located at village of southern India. The installation of our proposal relieves much inconvience as examination work is highly electric dependent. One may proudly say that an all time assured and economic solution.

The challenge of this is Installation box should be kept in proper place such that the capacitors can with stand up to 70degree centigrade.The proposed practice is attempted at various departments of our college. The panels are installed on terrace of the buildings. Currently 1MW of energy is backed up by Solar energy.

5 Conclusion

Thus with the help of super capacitors we have eliminated the usage of batteries and generated the power for the home appliances by using solar panels that will generate the power from dawn to dusk of the sun .Due to this the usage of payable power had been eliminated during the presence of sunlight.

The next advancement of this is while operation of the entire system there will be some lose of current while coming from the panels and also there will be lose in current while the MOSETS are switching fastly. So this lose can be reduced by making connection with another capacitor. This capacitors stores the energy and compensates the lose that had occurred and provides the energy to the components. This paper aims at proposal of attempt applied at Andhra Pradesh, one of the states of southeren part of Indian sub continent. The combat is made against regular inconvenience to the common man. The serious problem is proposed in a optimal way. The novelty lies in linking sun to the electric load of a common man. The solution found more benefited with the support devices that includes super capacitor

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