

A REPORT ON
REAL TIME ON-GRID SOLAR INVERTERLESS HOME APPLIANCE
SUBMITTED BY
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17IMUH007
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF
THE PROGRAMME
MINIPROJECT



OCTOBER 2019

DEPARTMENT OF MECHANICAL ENGINEERING
PSG INSTITUTE OF ADVANCED STUDIES
COIMBATORE-4

LETTER OF TRANSMITTAL

OCTOBER 2019

TO

Mrs. J. Kanchana

PSG Institute of Advanced Studies

Coimbatore-4

Respected Madam,

The following report entitled “Real Time On-Grid Solar Inverterless Home Appliance” is submitted in the partial fulfilment of the programme MINI PROJECT. The report is based on my model.

Your Faithfully,

(R.S. MRITYUNJAYA AADITYAA)

ACKNOWLEDGEMENTS

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I feel extremely proud and privileged to have worked under the able guidance of our guide **Dr P S Kannan (retd.)**, Former Dean and Head, Department of Electrical and Electronics, Thiagarajar College of Engineering, Madurai. I express my sincere and valuable gratitude for his untiring guidance, patience, suggestions and ready help rendered at every step.

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ABSTRACT

This project is based on the usage of DC from the solar energy and battery which acts as a primary source. There are two types of power sources, that is AC and DC in which we get enormous amount of DC from sunlight. The DC is utilized instead of AC by using a DC – DC converter, a modified circuit box consists of a bridge rectifier, relay for switching between battery and solar power, a LDR. The solar power passes through the battery, in such a way it charges the battery and gives the load. By using LDR, the circuit senses the day and nighttime, depending on which the mode is switched. Though we have inverters for converting from AC – DC its cost are very high, but by using this we can reduce the cost and also utilize the solar energy to the core.

1. INTRODUCTION

Real time on-grid solar inverterless home appliances is one of the finest way in which we can describe that DC can be used for our home appliances but with certain limitations. Now-a-days the home appliances that are available in the market are having capacity to operate both in AC (Alternating Current) and DC (Direct Current) but still there is specification in the manual of the appliance and most of the people are unaware about this. I think in future there will be a solution to make right. But why I am insisting on DC? the answer is that the most abundant source for electricity which is also readily available on earth is “THE SUNLIGHT”, so we all know that by using Solar Panel we can collect and utilize the energy from the SUN light. But the only problem is that the energy received from the SUN is DC so when it is stored in the batteries from the panels, it is stored as DC and there is a need to convert from DC to AC which is very expensive and it is difficult to afford for majority of the people. But our “Boon” is that we have enormous amount of sunlight, which is not getting utilized fully. By using this simple process, we can convert a small amount of power to a larger amount of power, so that we can utilize the current for more home appliances. This project model consists of a DC – DC Converter which is readily available in the market, a modified circuit box, 12V battery, 50 watts solar panel. In future everyone will be able to make use of it at a lower cost than ever.

2. REAL TIME ON-GRID SOLAR INVERTERLESS HOME APPLIANCES

This project’s main motto is to show that latest home appliances that are available in the market can operate in AC as well as in DC. So why only the latest products and not the old products that can consume DC? The answer is that in old products they were using transformers inside their circuit which utilized coils, these coils will burn which the DC flows through them are they constantly flows in one direction only whereas AC alternates its direction periodically. This make a positive point for the AC to be used in old electronic devices. Whereas in latest devices, Switch-Mode Power Supply (SMPS) method is used where it allows DC as they switch between the current sources.

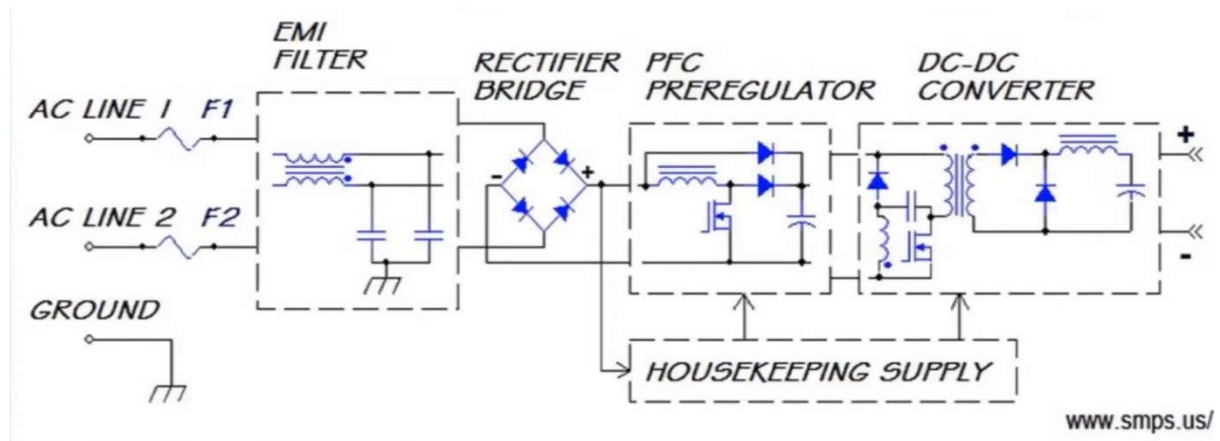


Fig.1 Switch-Mode Power Supply (SMPS)

The working of SMPS in these circuit is when an 230V AC is given as input, it passes through Electromagnetic interference filter then through Rectifier which converts AC to DC, whereas when an DC of 300V is supplied, the EMI filter and rectifier simply by-pass DC. PFC pre-regulator and DC-DC converter is used as switching the circuit for producing required output voltage. The DC is taken from the battery which act as a prime source. The rectifier's job is that whatever maybe the input polarity the output polarity doesn't change. So the latest products available in the market accept dual sources (i.e. electronic usage of AC and DC).

The devices that uses dual sources are,

- CFL lights
- DVD player
- Digital Set-of-box
- Electronic table and ceiling fans
- Fluorescent tube light with electronic ballast
- Mobile Charger
- Personal Computers and Laptops
- Television set
- Induction stove
- Drives with VFD controller

Above mentioned uses dual source and those the appliances uses coil such as a printer, fan etc., cannot be used.

This model makes us to utilize the solar power to its maximum capacity. Here the basic principle used which was derived from Ohm's law. That is,

$$P = I * V$$

Where, P = Power (Watts)
 I = Current (Ampere)
 V = Voltage (Volts)

The picture of the model is displaced below,

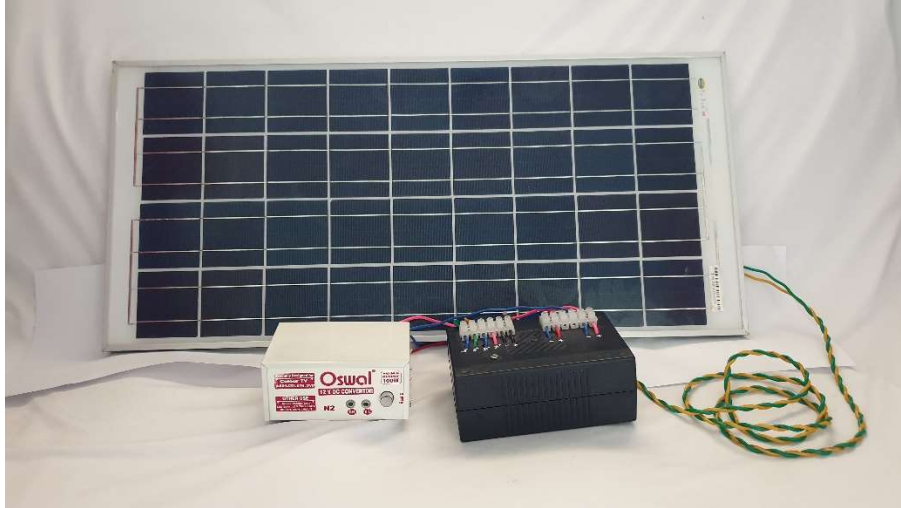


Fig .2 Real time on-grid solar inverterless home appliance – device

The components used as a primary requirement for this model are listed below,

- 35A Bridge Rectifier
- DC – DC Converter
- 50W Solar Panel
- Light Dependent Resistor (LDR)
- Relay

2.1 35A BRIDGE RECTIFIER:

A Bridge rectifier is commonly used circuit is an Alternating Current to Direct Current converter. It rectifies AC input – DC output, if a DC is an input, it simply passes-by the DC as input. whatever the polarity input, the output polarity doesn't change. Here we are using 35A bridge rectifier, i.e., we increase higher value amps (Volume of amperes) so that the designed circuit can handle more wattages, in such a way we can use a greater number of appliances. The DC-DC Converter used here gives us 100 Watts, but after adding this, the watts are increased such that more household appliance can be used.

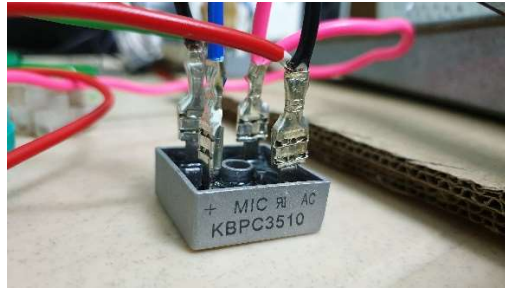


Fig.3 35A BRIDGE RECTIFIER

2.2 LIGHT DEPENDENT RESISTOR:

LDR is based on the principle of photoconductivity. When it conducts light, its resistance decreases which results in having larger flow of current when the circuit is closed and when the LDR is kept in dark, its resistance increases resulting in giving current supply to the external source connected to it.

In case of my project, when the LDR senses darkness surrounded by, the solar panel power source is automatically switched to the battery source which was charged by the solar panel and supplies the power to the appliance connected to it. When it senses the light around it, battery mode is switched to solar source and the power supply for the external power source connected can be cut-off if we don't want that particular appliance to operate in that condition.

2.3 DC – DC CONVERTER:

It is used to amplify from one voltage value (low voltage) to another value (high voltage). Working is that the converter stores input energy temporarily and releases it at different voltage output.

Here it converts the DC power produced from the solar panel from a voltage of 12V – 220V of DC. In the same way it works for battery.



Fig.4 DC – DC CONVERTER

2.4 50W SOLAR PANEL:

Solar panel consist of photovoltaic cells which absorbs energy from the sunlight to produce DC. They are assembled in such a way that they are available in different voltages and wattages. Here the solar panel I have used is of 50 Watts and 17.8 Voltages.

2.5 RELAY:

A relay is utilized as a switch in electrical circuits. The purpose of the relay is to switch between the solar power source to the battery source as per the instruction given by LDR.

2.6 CONSTRUCTION:

In modified circuit box, the 35A bridge rectifier is wired from the solar input and battery input sources, these are then connected to the relay such that it can switch between the mode of power sources. Again, from the bridge rectifier, it is wired to the DC – DC converter from which the output source is taken.



Fig.5 Inside the Modified circuit

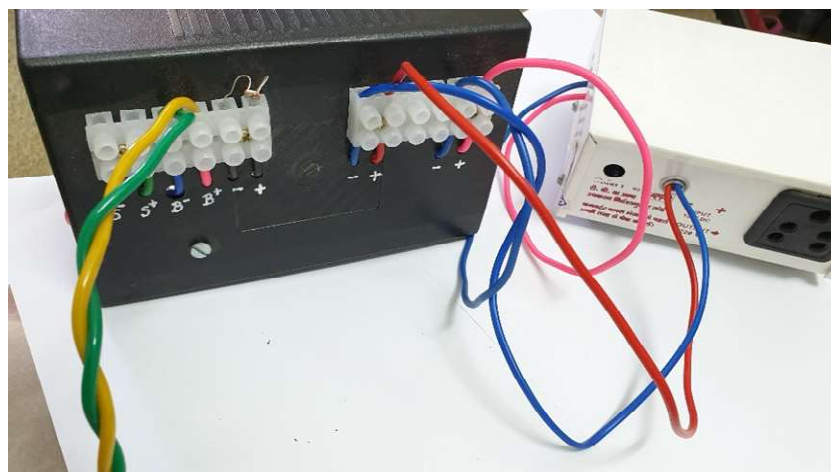


Fig.6 Connection from the Modified circuit to the DC – DC Converter

2.7 WORKING:

All the above are used in this model. It has two sources as input that is a solar power source and a battery source. And here when solar energy enters the modified circuit, first the power source is collected in the battery (charging the battery) and then from battery it is sent to the DC – DC Converter. Otherwise if there is no solar source, then the battery directly supplies it to the DC – DC converter. But there might be a arising question that how we can switch between these when both are connected inline? The answer for this is a relay which act as an electronic switch. It switches between these sources whenever they are in need. The information for switching between the circuit is given by Light Dependent Resistor (LDR). When there is enough light source it switches to solar energy which supplies the energy to it. When it senses darkness it automatically switches to battery in which case it supplies the energy. Then from there these energies are supplied to converter to convert from 12V to 230V DC from which the output is taken. Important thing is that I have increased the wattage, Amperes by using the bridge rectifier. For 35 amperes, we cannot give in a single panel as the single panel ampere used here is 2.8 ampere, so according to our requirement we can add solar panels up to 12 panels. For this accordingly the wattage will also change by using the above said electric power equation as power is directly proportional to current. From this increased power source, we can utilize more home appliances.



Fig.7 Power Source from Solar Panel



Fig.8 The LED Bulb Glows when LDR Senses Darkness

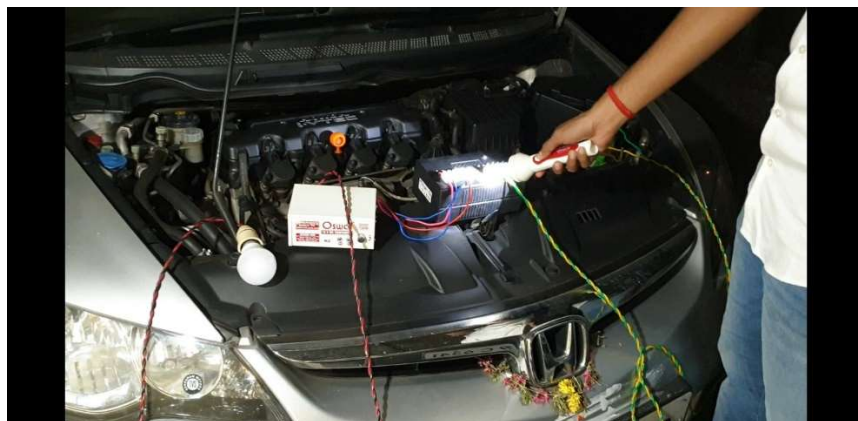


Fig.9 The LED Bulb turns off when LDR Senses Light

2.8 ADVANTAGES:

- Reduced cost.
- Can be utilized without an inverter.
- Can be used without changing any major components in the circuit.
- Compact in size.
- Not only used for DC appliances but can also be used for AC appliances which uses the transformer coil technology.

2.9 DISADVANTAGES:

- The main disadvantage is that since it is a Direct current, when we get electrical shock, it is heavier that people cannot withstand it which is advantage for the Alternating current as its electrical shock is bearable.

3. APPLICATION

This method can be used for the appliances that uses DC as a prime source, as mentioned above those appliances that are not using coil and transformer

technology can be used. The latest circuit which consist of SMPS method can utilize it to the maximum core.

Using the LDR and as per the above circuit it can be efficiently used in streetlight which perfectly fits for it.

4. CONCLUSIONS

Though it has a disadvantage, in future there will be a solution to make it light such they can be used in a feasible way and in a healthier manner by people. This technology about the usage of DC to the home appliance should be made aware to people and soon there should a solution to use it in a safe manner. As it is a abundant source on earth, though we have converters which is costlier, it is a good start to directly use it so that it makes cheap in cost so that people can afford it and use the energy that is naturally available. Hence, I conclude that everything in this world has a solution but finding about that solution takes time, so in future I thing DC can also be used in a healthier manner as AC.

5. REFERENCE

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