International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 05 | May 2020 www.irjet.net p-ISSN: 2395-0072

OFF GRID SOLAR SYSTEM

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Abstract - *This paper aim to implement an off-grid scheme with using of Battery and Capacitors simultaneously and make it hybrid system to urge maximum output in purpose to an existing hybrid Solar Buses in China. A calculation has been allotted to see the system size and style, hence also for improving the system design. The system will consists of solar array together with batteries and Capacitors as an energy storage. The system setup might be operating in automatic mode to change on at midnight and off the system during the day light. During the day the system design are able to perform the energy cycle so main power supply are terminated to consume the capacitors and batteries power first if these two power sources are ok to handle load then we don't require to access main supply this can reduce electricity bill and make it more accessible for daily purpose use. The surplus energy will be accumulated within the battery storage units through superior control. And whenever load is increase then it'll automatically start using stored energy. It's recommended that this technique should be present in rural area due to heavy power bring to a halt in rural area*

Key Words*: *Off-Grid Solar, Flash Charging, Super Capacitors, Photovoltaic System, Bus Stop

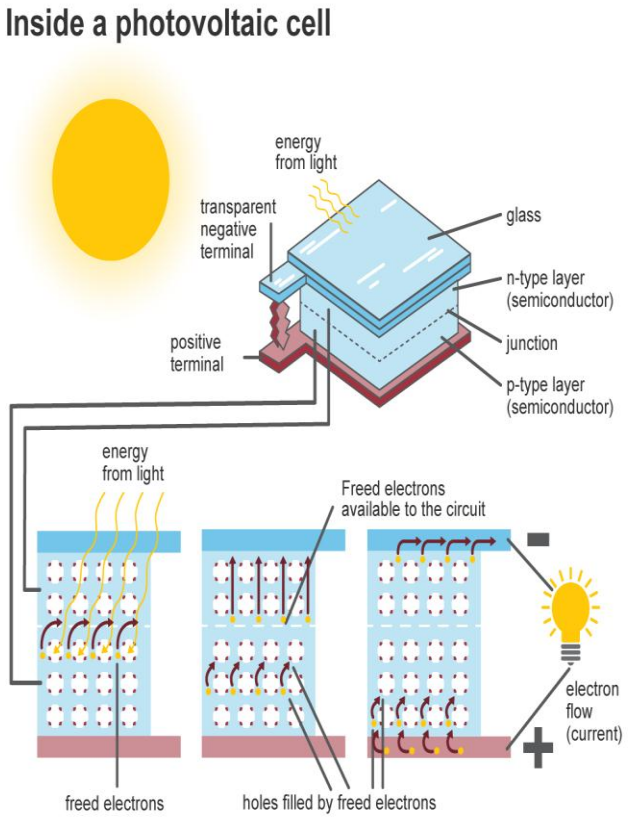
1. INTRODUCTION

As we are Solar energy is generated from sun radiation which is available in very large scale. A study in year 2010 presents that the complete solar energy that can be harness on earth is approx 2.0× 1021 Mega Watt (MW). Hence, the availability of greater amount of solar energy can be used to produced and supply electricity for several years that yet to come. The wide enhancement of PV technology to harness solar energy has shown a great impact on power production using the PV technology. Photovoltaic technology power production is greatly being introduced in previous years as one of the most potential alternative to harness energy. The positive rising reason keeps increasing to generate power using the PV technology is because of this direct conversion of sunlight to electricity. PV technology implementation in energy conversion is one of the most leading attractive power source production method which proven reliability from microwatt to megawatt. Due to the proven reliability output, PV system is being implemented on several applications at various areas which requires from small to high voltage supply. Solar energy is the solar radiation that reaches the earth which is then being converted to electrical Power through several strategies. Solar apartment generally utilize solar Photovoltaic panels to produce electricity. Solar Photovoltaic panels produce Direct current electric power when exposed to sun light, and a DC-AC inverter normally converts this to AC power, which is the conventional form of the electric energy in a typical building. Using Direct Current electric energy directly from solar Photovoltaic panels is a little bit challenging as many of the electric appliances are functioning using an AC energy. To resolve power crises in rural area we are going to introduce this idea to make solar energy more useful. With the help of this we can provide energy in every area of this country.

2. PHOTOVOLTAIC SYSTEM BUS STOP

A PV system is designed based on the recorded information from provided latitude and longitude in the HOMER software. The system composed of solar modules, charge controller, batteries as storage and load power. The system configuration and implementation varies with the recorded location solar radiation information. The system is configured accordingly to the place because the source of harness normally should not be constant for many hours. Thus, energy production to electrification the system can be insufficient, hence proper energy management and configuration is necessary upon system installation. The system power management and configuration will enhance the system electrification for the complete year. A PV system is a system is one of or more solar panels combined together with an inverter and other hardware that use energy from the Sun to generate electricity. PV systems can vary in size from small rooftop or portable systems to bigger utility scale production plants. PV systems can be operated by themselves as off-grid PV systems, this article focuses on systems connected to the utility grid, or grid-tied PV systems The energy from the Sun, made up of packets of energy called photons, falls onto a solar panel which is present on the top of the apparatus and creates an electric current through a process called the photovoltaic effect. Each panel generate a relatively very small amount of energy, but can be attached together with other panels to produce massive amounts of energy as a solar array. The electricity generate from a solar panel is in the form of direct current and many electronic devices use DC electricity, including your phone or laptop etc. They are designed to work using the electrical utility grid which provides alternating current. Therefore, in order for the solar electricity to be useful it must first be converted from Direct Current to AC using an inverter. This AC electricity from the inverter can be used to power

electronics, or can be sent on to the electrical grid for use elsewhere.



2.1 SOLAR PANEL

The system will utilize four solar modules. The dimension of each solar panel is 604mm × 524mm × 33mm and weight 5.3 kilogram. Each solar module produces an output of 44 Watt per hour at 12 VDC input. Based on the load capacity, each solar module is able to produce 178Watt per day. In total, four solar modules will be able to produce 609 Watt per day.

Figure.1 Solar Panel

2.2 CHARGE CONTROLLER

A charge controller is necessary to optimize the batteries power for the installed system. The charge controller will stop over charging the batteries storage bank. To support the characteristics for batteries storage bank, 35 Ah to 40 Ah charge controller is installed for this system. Additionally, the charge controller will be capable to switch on the system automatically during operating hours and switch off the system automatically during non-operation hours.

2.3 BALANCE OF SYSTEM COMPONENTS

Balance of system components is necessary to be explained because the system will be placed at the field site. The balance of system components require complete final design and construction. All the necessaries wiring for the system required to installed clearly and also mount the housing at the undertaken field solidly.

3. FLASH CHARGING

The Flash-Charging power point at selected bus stops, provide a very high-power boost charge that can fully charged up capacitors for further use that can be terminus feeding stations deliver a longer, low power charge to compensate the power required B/W the operating line and depot place. Because of fast charging we can charged up our supercapacitors in very less seconds.

A typical e-bus could required a battery capacity of over 350kWh in order to complete its daily requirement through a city on a single charge. That's a very heavy and expensive "fuel tank," so engineers have found very creative ways to reduce the weight and cost of ebus batteries. And One

method is to use a smaller battery also fully charge it at the depot overnight, and top off the charge at select passenger stops along the route this is the basic procedure.

3.1 SUPER CAPACITORS (SC)

A supercapacitor, also known as ultracapacitor, is a high-capacity capacitor with a capacitance value that much higher than other types of capacitors, but with lower voltage limits, that bridges the gap between electrolytic-capacitors and rechargeable batteries. It stores 10 to 100x times more energy per unit volume that can be accept and delivery of charges much faster than batteries, and can handle many more charge and discharge cycles than the rechargeable batteries.

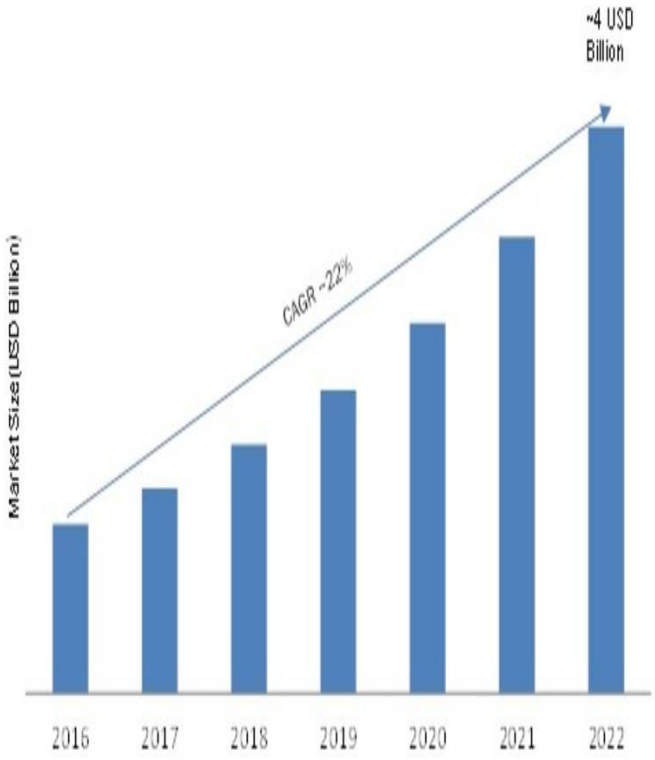


Fig:- Super Capacitor market size

Supercapacitors are generally used in many applications requiring fast charge concept in it and discharge cycles also, rather than very long term compact energy storage — in automobiles, buses, trains and cranes etc. where they are used for the purpose of regenerative braking, short-term power storage, or burst-mode power also delivered . Smaller units are required as energy backup for static random access memory. What about the separator between the plates? In an simple capacitor, the plates are separated by a thick dielectric material made from something different like mica, a thin plastic film, also even simply air. When the capacitor is fully charged, positive charges form on one plate and negative charges on the other plate, generating an electric field between plates. Its molecules line up in the opposite direction to the field and reduce its power. That means that the plates can store more amount of charge at a given voltage. In a supercapacitor, there is no dielectric. Instead, both plates are dip in an electrolyte and separated by thin insulator like carbon, paper and plastic. When the plates are fully charged up. Because of this supercapacitors are often referred to as double-layer capacitors, also known as electric double-layer capacitors. The capacitance of a capacitor increases as the area of the plates are increases and the distance between the plates decreases. Supercapacitors get much larger capacitance from a combination of plates with a larger, effective surface and also less distance between them and very effective double layer is the reason behind this. The first supercapacitors were made in the late 1945s using activated charcoal as the plates. Since then, advances in material science have led to the development of much more effective plates made from such things as carbon nanotubes (small carbon rods built using nanotechnology), graphene, aerogel, and barium titanate and many different material.

4. REGENRATIVE BRAKING

Ever since the first Toyota vehicle rolled off the line over 15 years ago, the concept of regenerative braking has become well-known as a method of rising range in hybrid and electric vehicles. These days, we can find it in everything from electric bicycles and skateboards to any electric vehicles.

5. Grid Impact

Let's look more closely at those flash chargers. While they're delivering only about 5kWh of power—less than the 9 percent of the total battery capacity—drawing that much energy in a few seconds increase a heavy load on the grid, a factor that grid operators call "demand." The innovation behind TOSA is to give each flash-charging power points an energy storage device: a stationary battery also that acts as buffer between the grid and the passenger buses. This battery can slow charge from the grid, reduce the demand, and then deliver high bursts of energy for short durations. The bi-directional connection between grid and charger. This allows the constant battery to support the grid by sending additional power during peak-demand hrs and also providing frequency regulation. Utilities are adding the grid-level battery storage units. The only thing that increase curiosity in me about the TOSA concept is that the terminal feeding power stations, which deliver 410kW, don't have batteries. (The TOSA specification only refers to batteries in 700 kW flash chargers.) Tesla's 3rd generation Supercharger draws only 260kW, and it includes battery to minimize demand on the grid. Grid can be use to generate a high power at a single place where we can use many super capacitors at a single place only. Electric moving vehicles in a present time have an unique challenges and opportunities like for electrical utilities in world wide. There is a technological shift from fuel to electricity that requires an increase in electrical generators.

While increased in production can be manageable for the grid system on a very large scale, localized problems will

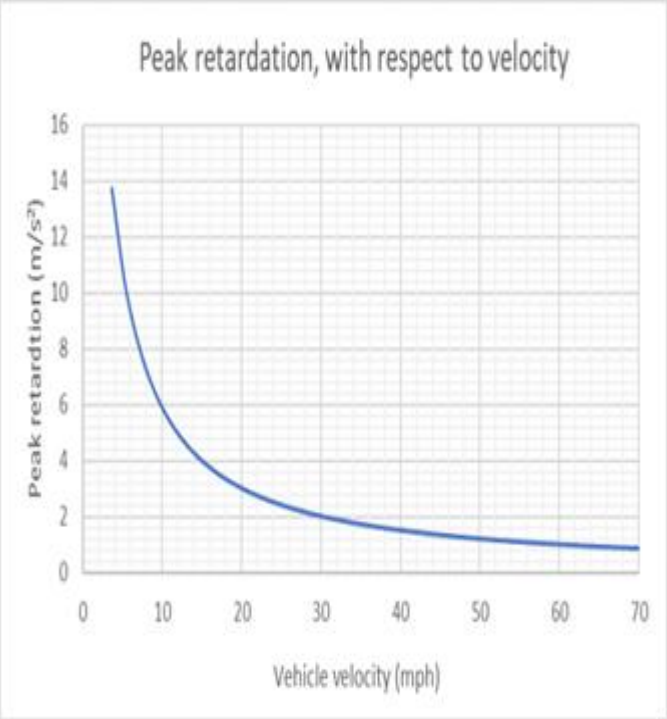
arise and Clustered charging, when several electric moving vehicles charge in the same area, It can be a risk to local infrastructure. That ways of managing a local load such as apartment infrastructure and constent price signals will prove to be less effective than ever before. The changing nature of shifting load act as a result of vehicle charging is more challenging to decide and manage. Electric utilities requires a new solutions to reduce the risk to infrastructure.

6. Efficiency

No machine can be 100 percent efficient (without breaking the laws of physics), as any transfer of energy will inevitably incur some loss as heat, light, noise, etc. Efficiency of the regenerative braking process varies across many vehicles, motors, batteries and controllers, but is often somewhere in the neighbourhood of 60-70 percent efficient. Regen usually loses around 10-20 percent of the energy being captured, and then the car loses another 10-20 percent or so during conversion that energy back into acceleration, according to Tesla motors. This is fairly standard across most electric vehicles including cars, electric bicycles, electric scooters and many more vehicle.

Keep in mind that this 70 percent does not mean that regenerative braking will give an 70 percent range increase. This isn't going to increase your range from 100 miles to 160 miles. This simply means that 70 percent of the KE lost during the act of braking can be turned back into acceleration later.

Because of this only reporting the efficiency of the system doesn't really mean much. Someone can be very efficient when they work, but if they only work an hr a day only, they may not accomplishing a lot. Basically in this we can boost up the power storage capacitors in just few seconds and can use it further. It will also helpful in regenerative braking system where we can store energy of braking system as a power generator. It can also reduce the cost of the electricity and can also reduce human efforts. Whenever we applied a brake because of this the Kinetic energy produce and that K.E will be stored in the form of electric charge in super capacitors and that same energy will be used as a acceleration power.



7. CONCLUSION

The Off-Grid Solar Powered System is developed for installation onto the existing bus stop and houses. There are no serious problems to developed Off-Grid Solar Powered System during the system working hours and days. Generally, the Off-Grid Solar Powered System has worked very well and we added flash charging in electronic vehicle which will reduce the energy and time of the people. Also using of Super capacitors (SC) as battery replacement. This will minimize the use of costly battery. This will minimize the use of costly battery. Through a survey of the literature for the power storage system especially for the Supercapacitors energy storage system for improvement of power quality of the different systems; an overview has been presented. Several aspects of the problem rises, such as to providing ride through, stabilization of power system, to make undispatchable power into dispatchable, to improve power quality of weak transportation system, of aircraft distribution system UPS, elevator and dynamic voltage restorer in the island mode, switching transients mode, grid connected mode, in standalone for the short term outage. Therefore it would prove a best power storage option and mainly power quality maintenance with power conditioning system as the cost reduces down being the life and its efficiency will be very high.

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