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SOLAR WATER PUMPING SYSTEM

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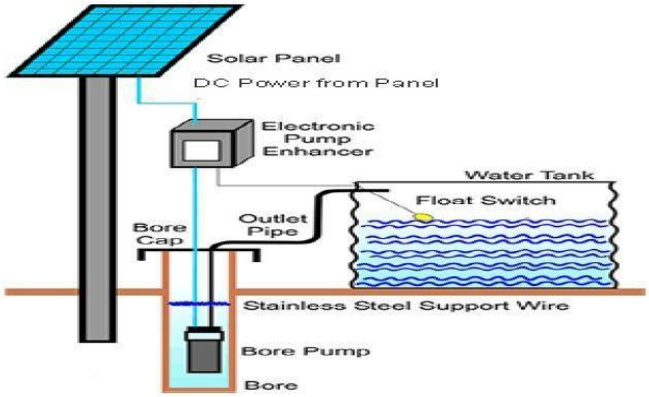
Abstract: This paper proposes highly economical, low price photovoltaic water pumping system incorporating a boost converter and a diode clamped multilevel inverter employing photovoltaic panel is initiated without batteries. This system is used in areas where electrical power is not accessible. Using photovoltaic energy is one of the solution to this problem. The converter boosts the voltage of the panel and inverter drives the Induction Motor by using Sinusoidal Pulse Width Modulation (SPWM) control. At the given irradiance level MPPT technique pushes the photovoltaic panel to obtain peak power. The performance of a solar water pumping system is discussed in this paper the system consists of a photovoltaic (PV) array, a permanent magnet (PM) DC motor and a helical rotor pump. The operation of the PV array is analysed using PSPICE. The efficiency of the system is improved with a maximum power point tracker (MPPT) and a sun-tracker. Simulation and field test results are presented.

I. INTRODUCTION

Energy is a key ingredient for the overall development of an economy. India has been endowed with abundant renewable solar energy resource. India is large country and the rate of electrification has not kept pace with the expanding population, urbanization and industrialization and has resulted in the increasingdeficit between demand and supply of electricity. This has not only resulted inunder electrification but also put heavy pressure on the governments to keep pace with demand for electricity. People not served by the power grid have to rely on fossil fuels like kerosene and diesel for their energy needs and also incur heavy recurring expenditure for the poor people in rural areas. Wherever the rural areas have been brought under power grid the erractic and unreliable power supply has not helped the farmers and the need for an uninterrupted power supply especially during the critical farming period has been has been amajor area of concern. India receives a solar energy equivalent of 5,000 trillionkWh/year with a daily average solar energy incidence of 4-7 kWh/m2 . This isconsiderably more than the total energy consumption of the country. Further,most parts of the country experience 250-300 sunny days in a year, which makes solar energy a viable option in these areas.

DECENTRALIZED RENEWABLE ENERGY SYSTEMS:

which rely on locally available resources, could provide the solution to the rural energy problem, particularly in remote areas where grid extension is not a viable proposition Solar energy, with its virtually infinite potential and free availability, represents a nonpolluting and inexhaustible energy source which can be developed to meet the energy needs of mankind in a major way. The high cost, fast depleting fossil fuels and the public concern about the eco- friendly power generation of power have led to a surge of interest in the utilization of solar energy.power have led to a surge of interest in the



utilizationof solar energy. To evaluate the energy potential at particular place, detailed information on its availability is

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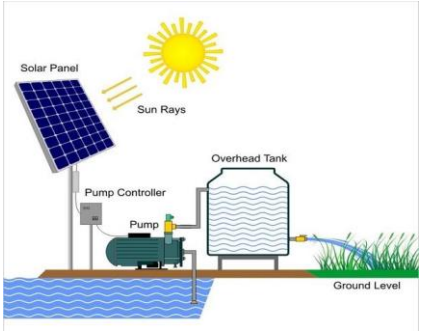
essential. These include data on solar intensity,spectrum, incident angle and cloudiness as a function of time.

II. USE OF SOLAR ENERGY

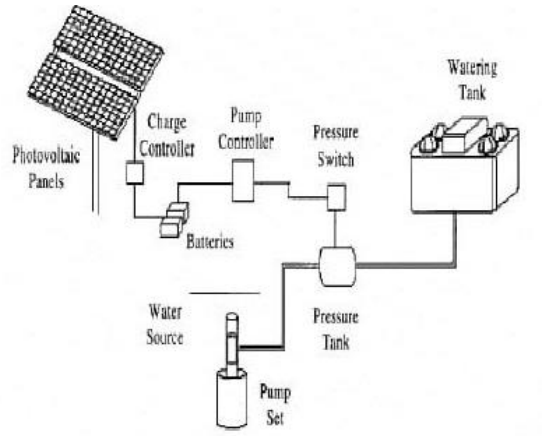
Solar Thermal (ST) technologies where the heat produced are used to operate devices for heating, cooling, drying, water purification and power generation. The devices suitable for use by village communities include solar hot water heaters, solar cookers and solar driers.

Solar Photovoltaic (SPV) systems which convert sunlight into electricity foruse applications such as lighting, pumping, communication and refrigeration. The Solar Energy Programme is prominent among the technology-basedrenewable energy programmes of the MNES. Areas covered under thisprogramme include solar thermal technology (hot water systems, cookers,dryers, solar passive architecture etc.), solar photovoltaic technology (lanterns,fixed systems, pumpsets) as well as information dissemination, marketing,standardisation of products and R&D. The support to the programme is mainlyin the form of subsidies and technical support



EXPERIMENTAL PROGRAM

Block Diagram:



Model Photo

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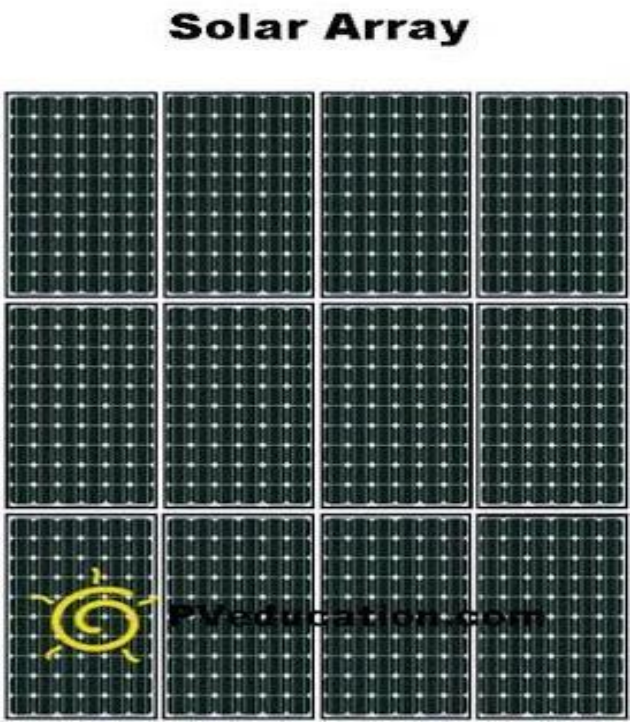
Electric Motor:

Submersible pumps are installed completely underwater, including the motor. The pump consists of an electric motor and pump combined in a single unit. Typically the pump will be shaped like a long cylinder so that it can fit down inside of a well casing. Although most submersible pumps are designed to be installed in a well, many can also be laid on their side on the bottom of a lake or stream. Another common installation method for lakes and rivers is to mountthe submersible pump underwater to the side of a pier pile (post).

pumps don't need to be primed since they are already under water. They also tend to be more efficient because they only push the water, they don't need to suck water into them. Most submersible pumps must be installed in a special sleeve if they are not installed in a well, and sometimes they need a sleeve evenwhen installed in a well. The sleeve forces water coming into the pump to flowover the surface of the pump motor to keep the motor cool. Without the sleevethe pump will burn up. Because the power cord runs down to the pump throughthe water it is very important that it be protected from accidental damage. Youwouldn't want a boat tangled up in the cord or a snapping turtle or alligator to bite through it.

Solar Array:



A solar cell behaves like a low voltage battery whose charge is continuously replenished at a rate proportional to the incident solar radiation. Connecting such cells into series parallel configuration results in photovoltaic modules or solar arrays with high current andvoltages. The power developed by a solar array ranges from 80 to 120 watts per square meter of the panel. The photovoltaic power canbe utilized to operate conventional electrical appliances, including. DC electric motors. The solar array is mounted on a simple framewhich has provision for adjusting the array manually against the position of the sun.

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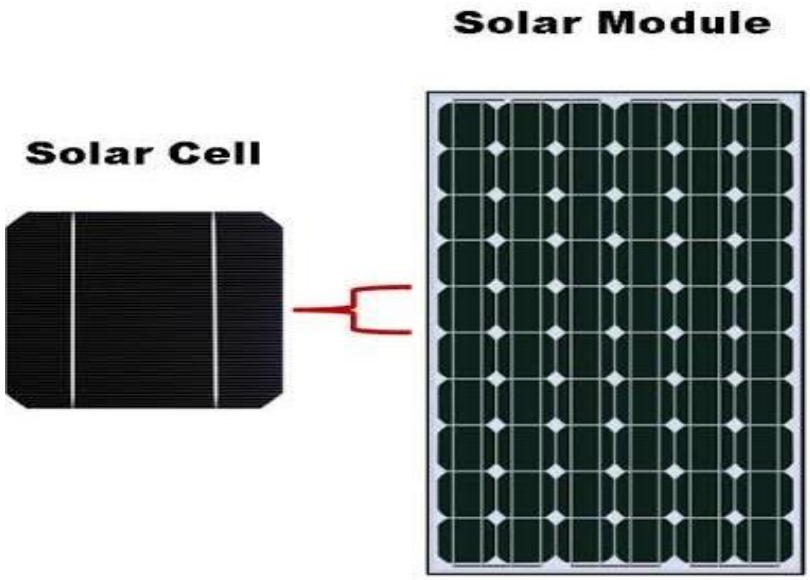
Solar Cell:



The solar cell operates on the principle of the photovoltaic effect - the creation of charge carrier with in a material by the absorption of energy from the incident solar radiation. The efficiency of solar cells in converting incidentsolar energy into electrical energy depends on the illumination spectrum intensity, materials of construction and design of the cell, atmospheric temperature and dustiness of the sky.

Solar cell used in running DC electric motors have efficiencies ranging from 10 to 12 percent. Silicon is the most commonly used material for makingsolar cells. Other materials include cadmium sulfide and gallium arsenate. The fabrication of the solar cell involves a large number of processes. Wafer form,followed by junction formation, contact fabrication and anti-reflection coatingon the active surface of the cell. The outer surface of the panel is protected by a special tempered glass which provides high transmittance of sunlight.

Advantages:

- No fuel cost - as it uses available free sun light.
- The SPV is more reliable, consistent and predictable power option as compared to conventional power systemin rural areas
- Sunlight, the fuel source of SPV system is a widely available, inexhaustible, and reliable and free energy source.Hence the SPV system has no monthly fuel bills
- The system operates on little servicing and no refueling,making them popular for remote rural areas, hence the operation and maintenance is very low. The suppliers provide maintenance at a very low annual maintenance contract rates
- As SPV systems are modular in nature they can easily betransported in pieces/components and are easily expandable to enhance the capacity
- Solar energy is clearly one of the most effective energy conservation programs and provides a means for decentrailized PVgenerated power in rural areas.Solar pump is energy efficient and a decentralized system avoids any unnecessary expenditure on T & D networks

Disadvantages:

- Maximum system voltage 600 VDC U.S.
- Capital costs typically higher than equivalent dieselsolutions
- Most of application need water storage typically largerthan for equivalent diesel systems.
- Risk of theft of panels, that are still seen as a valuablecommodity in some locations.
- System is dependent on solar radiation levels.

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Application:

- Water for crop irrigation.
- Drinking and cooking water supply.
- Water for live stock.
- Domestic portable water for remote homes,camp grounds.
- Pond water management and water transfer.
- Water supply for villages in developing world .
- Agriculture live stock watering.
- Home gardens and drip irrigation system.
- For commercial use

III. CONCLUSION

1) Potentially high initial system cost But it gives morebenefit in long time.
2) Low labor and maintenance costs.
3) No fuel costs
4) Easy to remove, transport, and store.
5) Produces water during sunny weather when it's neededmost.
6) Reliable and long life.
7) Non-polluting.

IV. FUTURE SCOPE

In the coming years, technology improvements will ensure that solar becomes even cheaper. It could well be that by 2030, solar will have become the most important source of energy for electricity production in a large part of the world.This will also have a positive impact on the environment and climate change.

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