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SOLAR PUMPS IN AGRICULTURE: PROVIDING SUSTAINABLE & ECOFRIENDLY IRRIGATION INFRASTRUCTURE TO INDIAN FARMERS

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Abstract

Currently, more than 300 million people in India are in deficit of energy, required. Increasing energy access has become an economic opportunity, with companies providing off-grid (*i.e.* solar lanterns or solar home systems) or micro-grid solutions (localized, small-scale generation typically serving residential loads). These options help rural population to move away from burning relatively expensive fuels such as kerosene and can provide basic energy services such as lighting and cell-phone charging, but they do not always provide enough electricity to meet economically productive needs. in the agricultural sector, there is an enormous opportunity to link residential electricity needs with agricultural electricity needs, like the electricity needed to power irrigation pumps, and provide a more comprehensive electrification solution. This research shows the opportunities available for solar pumps along with facilitating the rural energy demand by using the available solar energy.

***Keywords*:** SPV (Solar Photovoltaic), AC (Alternating Current), DC (Direct Current), KUSUM (Kisan Urja Suraksha evam Utthan Mahabhiyan), MNRE (Ministry of New and Renewable Energy), SNA (State Nodal Agency), DSM (Demand Side Management), KW (Kilowatt).

Introduction

India is an agriculture-based country, where more than 50% of population is dependent on agriculture & its allied fields; on the other hand agriculture sector contributes 18% to the country's GDP. From past two decade trends it is evident that Indian agricultural sector needs proper irrigation facilities and other amenities to reap maximum benefits. One of the major constraints in agriculture sector is farmers' dependency pump based irrigation solution. Most of Indian farmers use irrigation pumps, some of which are connected to the grid while some pumps run on diesel and other fossil fuels. As Indian agriculture is flourished with seasonal crops, due to which most of the farmers are deprived of regular source of income. Solar energy can be put to good use to address these critical issues of the agriculture sector.

Technology of Solar pump

Solar pumps operate by the electricity generated by mostly by solar PV modules and radiated thermal energy available from solar plate collector as opposed to grid electricity or diesel run water pumps. The economic operation of solar powered pumps is due to the lower operation and maintenance costs& long lifespan. Solar pumps are very useful where grid connected electricity is not available.

Components of Solar pump

There are three following main components of solar pump-

1. **Solar Panel:** This is most expensive component of solar pump, which constitute up to 80% of the total cost. The size of the PV module is directly dependent on the size of the pump and the solar radiance available over the respective land.
2. **The controller:** It serves the two fold uses out of which first, it matches the output power that the pump receives with the input power available from the solar panels and secondly, a controller usually provides a low voltage protection, whereby the system is switched off, if the voltage is too low or too high for the operating voltage range of the pump. This increases the lifespan of the pump, due to which the need for maintenance will be reduced.
3. **Motors:** The motors of solar pump can be AC (Alternating current) or DC (Direct current). DC motors are used for small to medium applications up to about 4 kW rating, and are suitable for applications such as garden fountains, landscaping, drinking water for livestock, or small irrigation projects. Since DC systems tend to have overall higher efficiency levels than AC pumps of a similar size, the costs are reduced as smaller solar panels can be used. If an AC solar pump is used, there will be inverter requirement, which is necessary to change the DC received from the solar panels into AC for the pump. The supported power range of inverters extends from 0.15 to 55 kW and can also be used for larger irrigation systems. However, the panel and inverters must be sized

accordingly to accommodate the inrush characteristic of an AC motor. In India majority of the solar pumps are fitted with a 2 - 3.7 kW motor that receives energy from a 4.8 kW_p PV array. The 3.7 kW systems can deliver about 124,000 liters of water/day from a total of 50 meters setoff head and 70 meters dynamic head. Energy storage in the form of water storage is better than energy storage in the form of batteries for solar water pumps because there is no intermediary transformation of one form of energy to another. The most common pump mechanics used are centrifugal pumps, multistage pumps, borehole pumps, and helical pumps.

Types of solar pump used in India for irrigation

S. No	Types of Solar Pumping System	Discharge (in Liter/day)
1	1 Hp DC Submersible	For 30 m, 45600, Shut off dynamic head 45 m
2	2 Hp DC Surface	For 10 m, 198000, Shut off dynamic head 12 m
3	2 Hp DC Submersible	For 30 m, 68400, Shut off dynamic head 45 m
4	3 Hp DC Submersible	For 30 m, 114000, Shut off dynamic head 45 m
		For 50 m, 69000, Shut off dynamic head 70 m
		For 70 m, 45000,Shut off dynamic head 100 m
5	5 Hp DC Submersible	For 50 m, 110400, Shut off dynamic head 70 m
		For 70 m, 72000, Shut off dynamic head 100 m
		For 100 m, 504 00, Shut off dynamic head 150m
6	7.5 Hp DC Submersible	For 50 m, 155250, Shut off dynamic head 70 m
		For 70 m, 1012 50, Shut off dynamic head 100m
		For 100 m, 708 75, Shut off dynamic head 150m
7	7.5 Hp AC Submersible	For 50 m, 141750, Shut off dynamic head 70 m
		For 70 m, 94500, Shut off dynamic head 100 m
		For 100 m, 607 50, Shut off dynamic head 150m

Government initiatives for the usage of solar pumps in agriculture in India

For promoting solar based agricultural pump for irrigation, Govt. of India launched KUSUM (Kishan Urja Suraksha and Utthan Maha-abhiyan) yojana. Kusum Yojana is promoted and established by the professional group for socio-economic and livelihoods enhancement of poor in country. Another focus is led on the mobilization, organisation and collective actions for local communities and natural, ethnic groups. Service centers also approach to the far-flung hamlets for the capacity building and mainstreaming the unreached poor women and men community members. Predominantly the project area is schedule tribal, mainly bhils and bhillas and majority population lives of the project area below poverty line with very limited options for livelihoods. Moreover, the livelihoods depend upon the migrant based farming system. In India, most of rural families migrate to urban areas for cash economy and remain away for 5-6 month every year.

Key points of KUSUM Yojana

- KUSUM Yojana is launched under MNRE for facilitating the Indian farmers a solar based irrigation system. State Nodal Agencies (SNAs) of MNRE will coordinate with States/UTs, power distribution utilities, and farmers for implementation of the scheme.
- Components A, i.e. Commissioning of 1000 MW capacity of ground/ stilt mounted solar or other renewable energy source based power projects and component C *i.e.* Solarization of 1,00,000 grid connected agriculture pumps of the Scheme will be implemented in Pilot mode till 31st December 2019. On successful implementation of pilot run of Components A and C of the Scheme, these components would be scaled-up, after getting necessary approval.
- The Component B, which is a ongoing sub-programme, will be implemented in entirety without going through pilot mode.

Conclusion

Since solar powered pumps present a clean, simple and energy-efficient alternative to traditional electric and fuel-driven pump sets. They are part of an environment friendly approach in agriculture sector and can be used to exploit every region, whether it's developed or poor. It is an eco-friendly concept that gets rid of any power grids or fossil fuels used to pump water out of the ground. Another important thing to note when it comes to solar pumps and irrigation systems, it is the fact that their costs have dropped significantly in the past few years & the economic feasibility of these systems varies for different regions and areas, mostly depending on site conditions, crops and markets. As a way of sustainable development of farmers, GoI has also outlined various initiatives like KUSUM yojana which are focusing on solar base irrigation system.

References

www.powermin.nic.in/
www.mnre.gov.in/
www.niti.gov.in/
www.solarmagazine.com
www.upneda.org.in