

OFF-GRID SOLAR PUMPING MARKET IN SOUTH-ASIAN REGION

QUANTIFICATION AND ACTORS

Countries covered: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka

1 - Macro Economical view

Southern Asia is the largest market for water pumps followed by Western Asia-Pacific, Europe and North America. Water pumps are mainly used for agricultural purpose. This micro-study analyzes installation capacity and potential of solar water pumps in this region, focusing on the 2 best countries: India and Bangladesh.

Southern Region: solar water pump Eldorado

- Southern Asia is one the biggest consumers of agricultural water, behind Northern Africa and Middle-east: 90%¹ of its water is used for agricultural purposed.
- Plus, Southern Asia represents one third¹ of the world irrigated land. Those irrigated lands are mainly used for rice crop (90%² of the rice production and consumption occurs in all Asia), which are significant loads in power systems due to the large amount of electrical energy required by the irrigation system. Solar PV water pumping systems is one of the best solutions for irrigation.

	Pop. 2014	Rural pop.	% rural access drinking water	% rural elec. rate	GDP (PPP) 2013	% agric. 2013	Irrigated land Kkm ²	Freshwater withdrawal m ³ km/yr
India	1 236 M	879 M	91 %	67 %	4 990 B\$	17 %	663 340	761
Pakistan	196 M	125 M	89 %	88 %	574 B\$	25 %	199 900	184
Bangladesh	166 M	19 M	84 %	43 %	324 B\$	17 %	50 500	36
Afghanistan	31 M	24 M	56 %	29 %	46 B\$	20 %	32 080	20
Nepal	31 M	26 M	88 %	72 %	42 B\$	37 %	11 680	10
Sri Lanka	22 M	19 M	93 %	83 %	134 B\$	11 %	5 700	13
Bhutan	0.7 M	0.5 M	97 %	39 %	5 B\$	14 %	319	0.3

Source: World Fact Book¹

2 - Technology

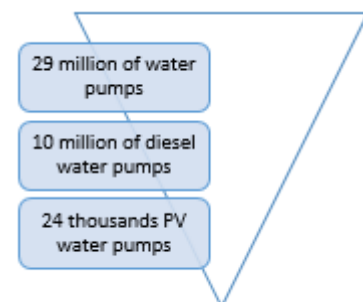
A water pump can be a hand pump or a motorized pump. The latter can be powered by grid electricity, diesel generator or renewable energy. Motorized pump can be submersible (installed below the water surface) or installed at the surface. 2 types of pumps are used in Southern Asia: AC pumps and DC pumps. AC pumps are mainly manufactures in Southern Asia whereas DC pumps are mostly imported³.

Main component are pump units, controllers, solar panels, diesel generators (option solar trackers). The majority of the pumps in Asia are flited with 1HP to 5HP motor and powered with 1.8kW to 11kW PV array. Usage defines the system mainly via depth of the well and water yield in m3/day.

3. Solar water pumps potential for irrigation

There are 29 millions of water pumps in activity in Southern Asia. 90% of the installation is concentrated in India. More than 65% of the pump are powered by grid electricity, but without problem: unequal subsidized, low quality of supply, etc... The remaining 34% are mainly diesel powered, and farmers have to face huge cost of diesel. Less than 0.1% are solar powered. The low rate of solar installation can be explained by 3 points:

- Before 2010's, government did not push solar power equipment (no subsidize, failed program).
- High price of solar equipment (panels, battery, pumps) and maintenance. It was more economical to store water than store electricity in 2000's⁴.
- Lack of knowledge on solar products and poor quality of product: too many local manufacturers, low quality, no standardization



a) 1st market: India

The market for solar water pumps in India has primarily been driven by both national and state level government schemes addressing irrigation and rural drinking water needs. There is an estimated potential of 26 million of water pumps in India^{5,6}. Due to subsidies mentioned in the previous section⁷, India had to face a huge jumps in electric pump use to 1 million in 1980 to more than 18 million in 2014⁷. But, there are still 7.5^{5,6} million of pumps running on diesel generators due to lack of electricity in rural areas. In 2014, only 19 thousands of solar water pumps were installed, concentrated in 4 States: Punjab, Rajasthan, Haryana and Bihar. More than 200 000 diesel water pumps will turn to solar in the coming years⁸.

Current installations⁸:

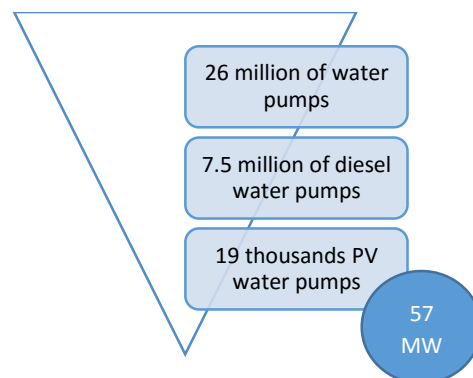
- In 90's, MNRE aimed to deploy 50 000 solar water pumps.
- *MNRE*: in 2010, > **7 000 PV water pumps** have been installed (IREDA).
- New program: "Jawaharlal Nehru National Solar Mission" (JNNSM), including solar subsidized. In 2014, > **11 626 PV water pumps** have been installed.

Future programs & potential⁸:

- *MNRE*: JNNSM: plans to replace the 1st 200 000 diesel water pumps by PV water pumps. For 2014/2016: **17 500 PV water pumps** will be installed. Average size: **3kW/system (potential of 52.5MW)**.

Private companies' references in 2014^{9,10}:

- *Grundfos*: 9 000 pumps sold from 2010 to 2014. Target 500 000 solar pumps for 2014/2015 in Maharashtra.
- *SunEdison*: solar water pumps sold in 500 locations from 2012 to 2014. Customer: MNRE for JNNSM program.
- *ABB*: 2044, 3 000 solar pumps



b) 2nd market: Bangladesh

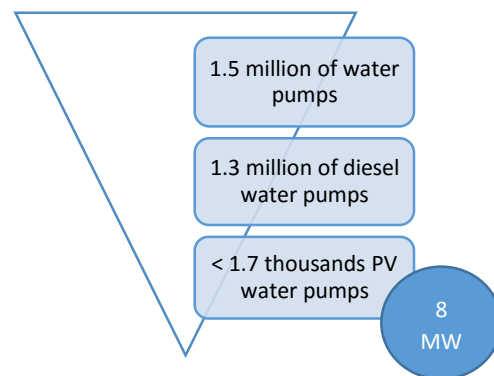
The development of solar water pumps in Bangladesh is sponsored by the Ministry of Power, Energy & mineral Resources Implementing Agency: IDCOL. They buy and install the majority of the solar pumps in the territory. More than 20 000 solar water pumps will be deployed in the coming years.

Current installations¹³:

- *Government*: in 2011, implementation of a new program to install 18 750 PV water pumps (\$800 million) targeting a **total capacity of 150 MW** (8kW/pumps). **In 2014, <350 PV water pumps** were installed.
- *World Bank*: in 2013, a \$10 million grant was signed for solar irrigation to install **1 300 solar water pumps** (4kW/pump). Approx.: **5.2MW**.

Future programs^{14,15}:

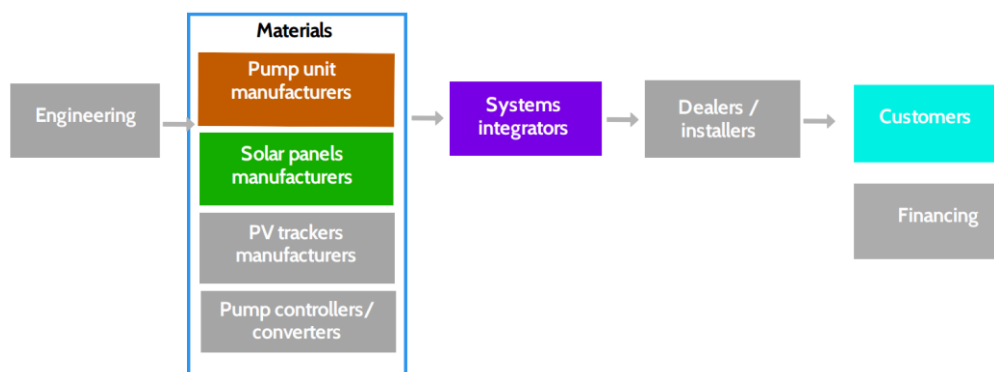
- *Government of Bangladesh*: still need to install 7 500 PV water pumps under the national program up to 2016. *IDCOLS*: Targets 1 500 solar water pumps by 2016 (from 5 to 15kW) for irrigation mainly (12MW)



4. Value Chain and main actors

More than 95% of the equipment are manufactured in Southern Asia region and less than 5% are imported³. This market is highly fragmented, with small manufacturers in unorganized segment. This framework leads to a lack of standardization and quality assurance.

Pump manufacturers work directly with solar panel manufacturers or can act as system integrators like Kirlokar Brothers, Grundfos, Shakti pumps etc. They mainly address domestic, agricultural or small industrial segment. Big Industrial pumps for paper production, hydroelectric production, construction industry etc. are less solar powered, due to the lack of technical offer (several hundreds of kW to MW). The main issue remain the lack of localized services infrastructure to install and maintain solar power equipment on site.



Zoom on INDIA: more than 800³ water pumps/equipment manufacturers are active and only 50 solar water pumps suppliers are registered for the solar water pumping program¹¹. Main actors are mentioned below:

- Major systems integrators: [SunEdison](#), [Jain Irrigation Systems](#), [WAAREE Energies Limited](#), [Bright Solar Water pumps](#)
- Major pump unit manufacturers: [KSB](#), [Grundfos](#), [Shakti Pumps](#), [Jyoti Ltd](#), [Kirloskar Brothers](#), [Mahendra Pumps](#)
- Major solar panels manufacturers: [Tata Power Systems](#), [JJPV solar Pvt](#), [Lanco Solar Pvt](#), [Topsun Energy limited](#)

Conclusion

Energy crisis, government regulation and rising diesel cost are motivating water pump manufacturers to develop energy efficient product in Southern Asia. Solar water pumping systems seem to constitute a cost effective alternative to irrigation pump sets that run on grid electricity or diesel. Beside, regulatory (subsidized, national program, etc.) and market related framework conditions are in the way to be improved to incentivize private investors to provide access to clean energy in rural areas. The potential for PV is significant, and growth prospects in the long-term are still good.

Sources:

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