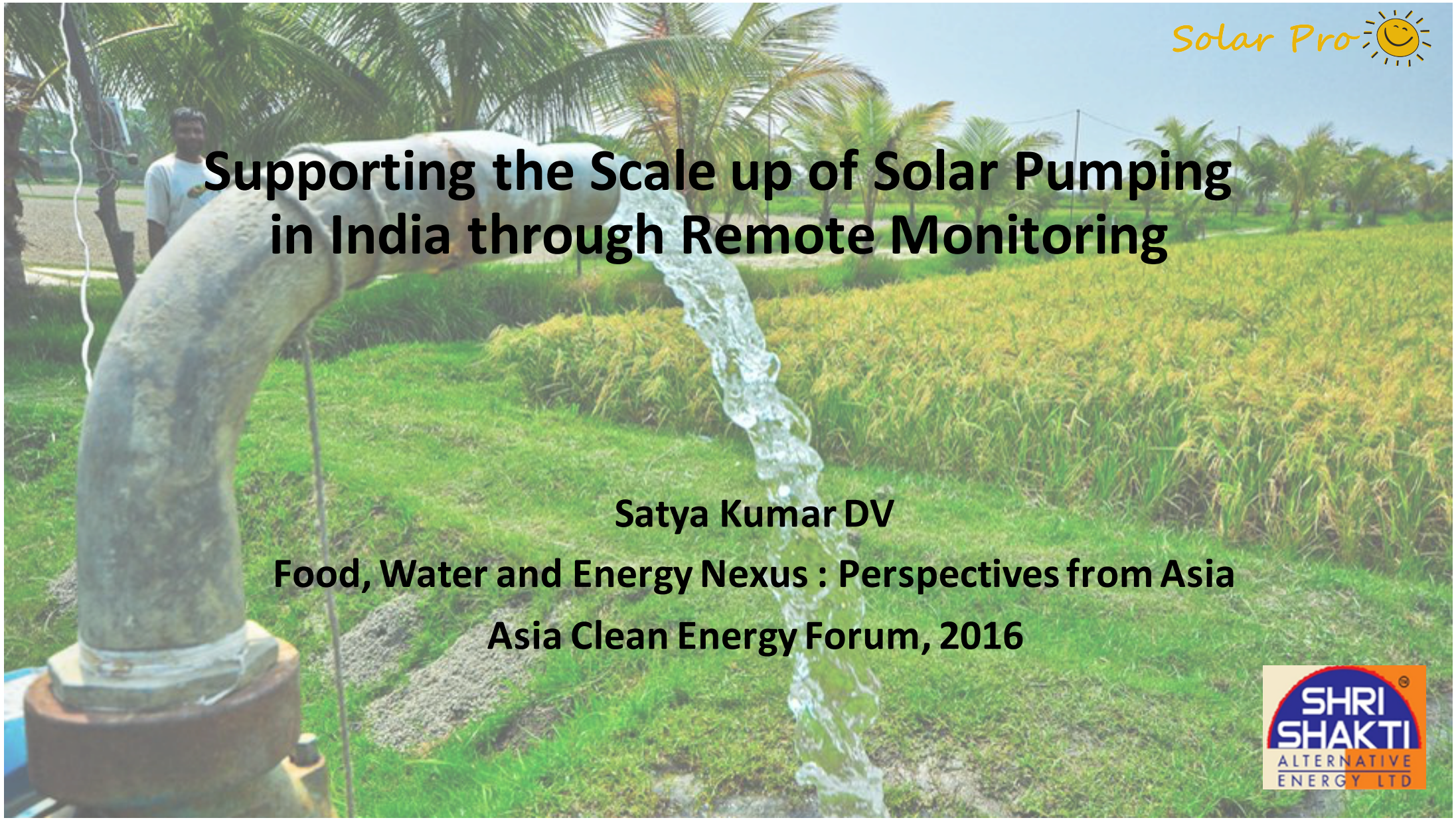


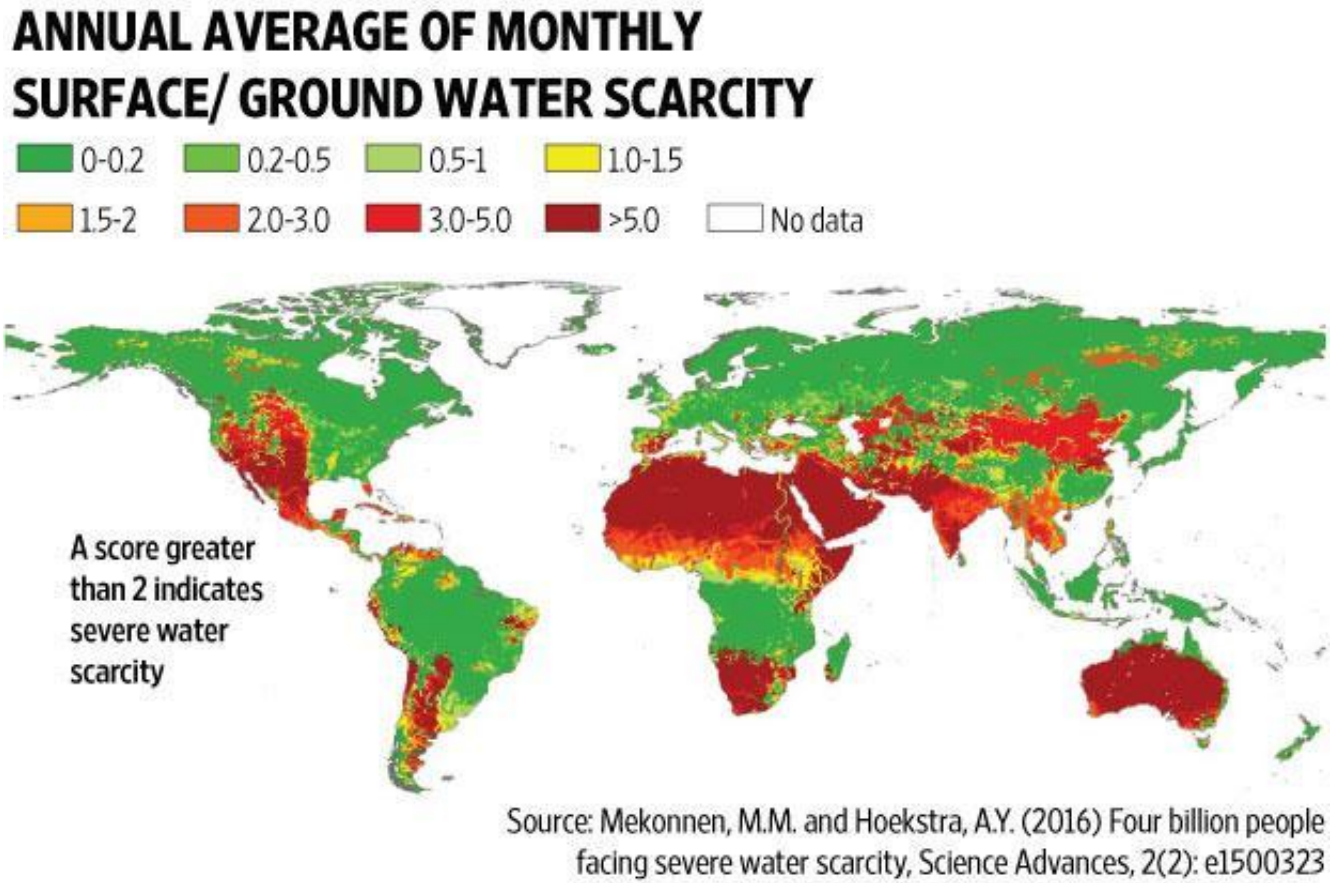
Supporting the Scale up of Solar Pumping in India through Remote Monitoring

Satya Kumar DV

Food, Water and Energy Nexus : Perspectives from Asia

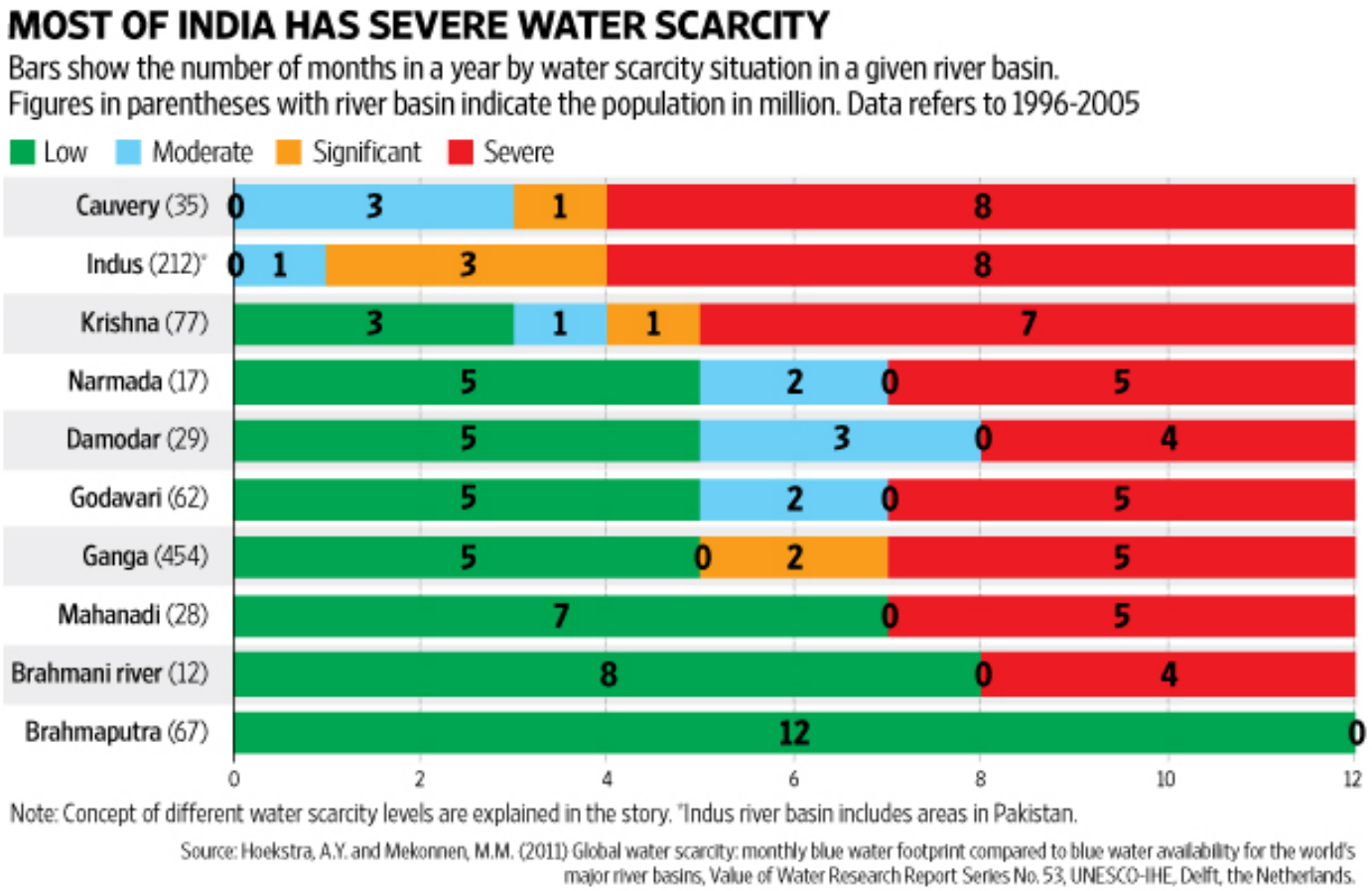
Asia Clean Energy Forum, 2016

Most of India is facing acute water scarcity



Source: Mekonnen, M.M. and Hoekstra, A.Y. (2016) Four billion people facing severe water scarcity, Science Advances, 2(2): e1500323

Water scarcity in River basins



Choice of Food impacts Water and Energy use

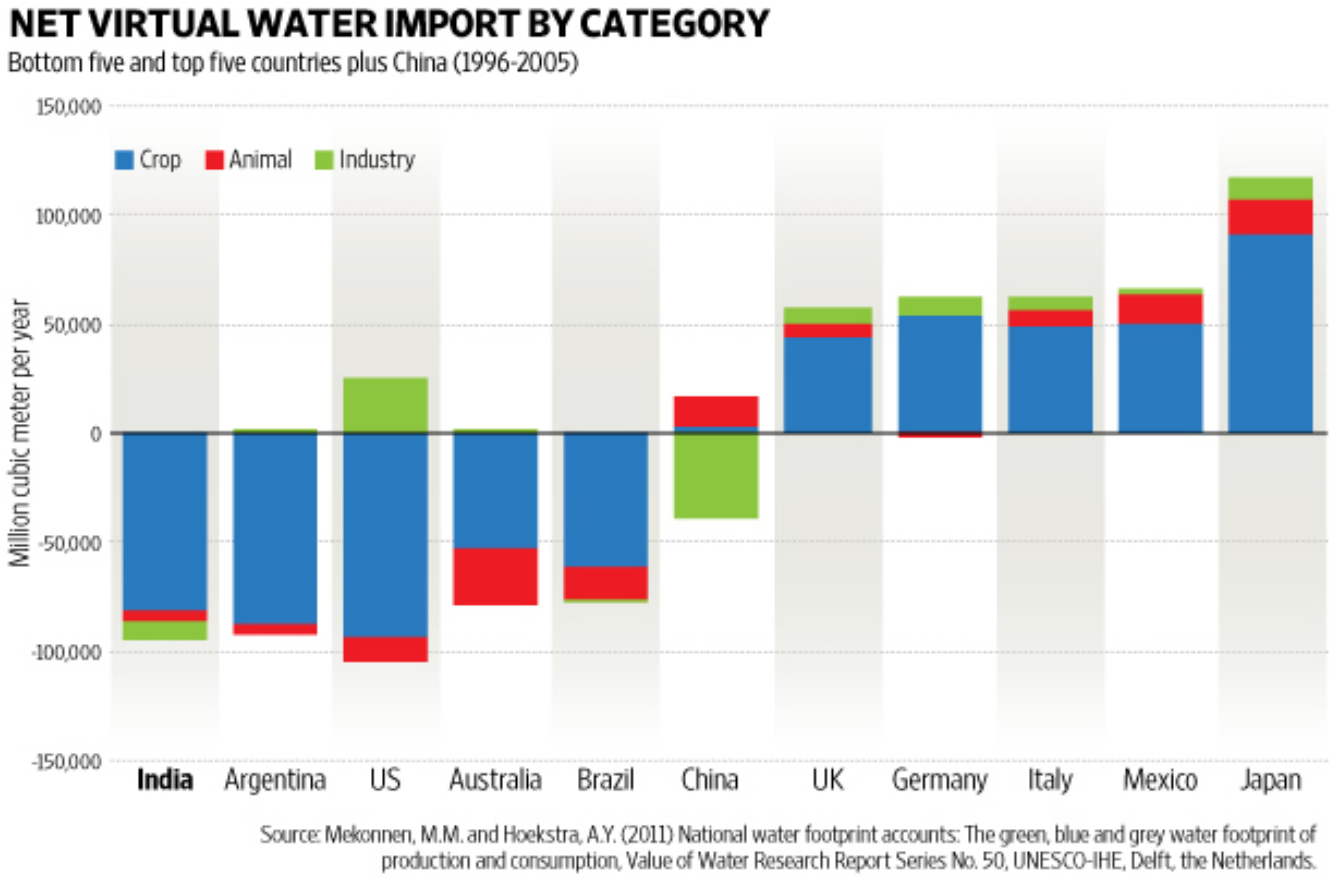
EMBEDDED WATER CONTENT BY WEIGHT AND NUTRITIONAL VALUE

	Production water footprint (cubic metre/tonne)				Nutrition water footprint		
Crop	Green	Blue	Grey	Total	litre/kcal	litre/gram of protein	litre/gram of fat
Sugar crops	130	52	15	197	0.69	0	0
Vegetables	194	43	85	322	1.34	26	154
Starchy roots	327	16	43	387	0.47	31	226
Fruits	726	147	89	962	2.09	180	348
Cereals	1,232	228	184	1,644	0.51	21	112
Oil crops	2,023	220	121	2,364	0.81	16	11
Pulses	3,180	141	734	4,055	1.19	19	180
Nuts	7,016	1,367	680	9,063	3.63	139	47
Milk	863	86	72	1,020	1.82	31	33
Eggs	2,592	244	429	3,265	2.29	29	33
Chicken meat	3,545	313	467	4,325	3	34	43
Butter	4,695	465	393	5,553	0.72	0	6.4
Pig meat	4,907	459	622	5,988	2.15	57	23
Sheep/goat meat	8,253	457	53	8,763	4.25	63	54
Beef	14,414	550	451	15,415	10.19	112	153

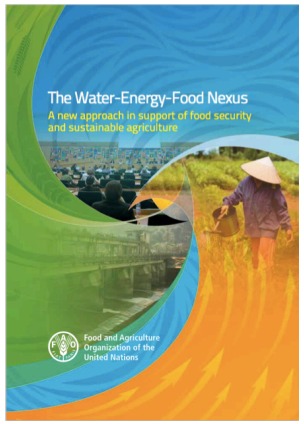
Green: rainwater; Blue: surface and ground water; Grey: Water required to carry off pollutants

Source: Mesfin M. Mekonnen and Arjen Y. Hoekstra (2012), A global assessment of water footprint of farm animal products

India is a net exporter of water



The Food, Water and Energy Nexus

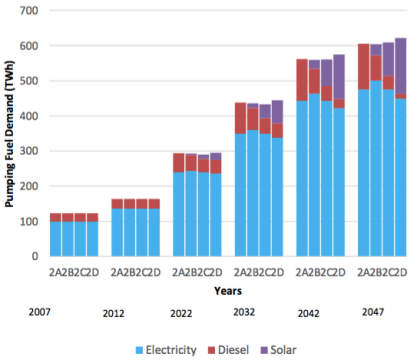


Food production and supply chain consumes about 30 percent of total energy consumed globally (FAO 2011b). India consumes ~ 27% energy only for irrigation

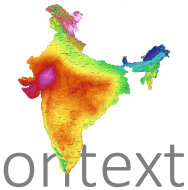
Agriculture accounts for 70 % of global freshwater withdrawals. In India it's 82% !

60% more food will be needed in order to feed the world population in 2050.

Number of agri pumpsets in India over 16 million (2012) with ~20% using diesel; consumed 136TWh of energy (2012)



Solarizing India



– Provides the context for an holistic approach to Agriculture

India is considering an ambitious target of 1 to 3 million solar irrigation pumps by 2022 that is estimated to cost US$ 30bn.

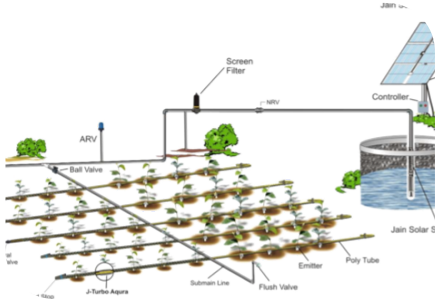
This massive scale up is based on the success of an innovative scheme in Rajasthan State which combined the stand-alone federal and state government schemes and offered a packaged solution for the livelihood of farmers.

The 'Solar water pumping program in Rajasthan' introduced a composite irrigation package through creation of water harvesting structures, recharging ground water, pumping with solar pumps and irrigating through drip.

Some farmers' income levels increased four-fold and even young MBA graduates were inspired to take up farming.

The Rajasthan Solar Pumping Program

Solar Pumping and Drip Irrigation in Gurha Kumavatan Village, Jaipur District



Drip irrigation schematic

Remote Monitoring of Solar Pumps and off grid Solar PV Plants

via Data Loggers
& GSM-SMS technology

Online Web Portal

- Real time Performance Monitoring
- MIS Reporting
- Outsourced Service Management
- Asset Management

A Project implemented by Shri Shakti Alternative Energy Ltd and funded by PACEsetter Fund, a joint initiative of MNRE, Govt of India and the US State Department

PACEsetter Fund Grant Award 27th May 2016

Prototype testing on AC and DC Pumps in Rajasthan

User Summary

Name : Mr. Khema Ram

Address : Village: Gurha Kumavatan, Jaipur (+919782781438)

Pump Type : DC 3HP lorentz Make (Head: 160 meter)

***Day Summary* 2016-05-24**

Total ON Time (H:M:S): 0:0:0

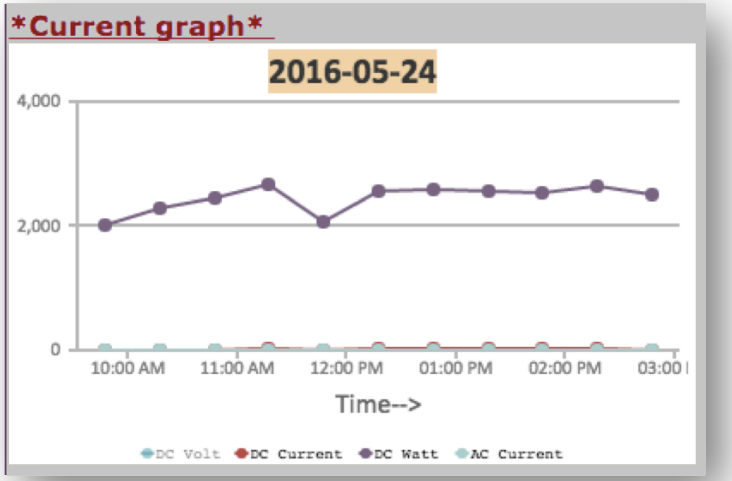
Generated DC Energy (kWh): 12.75

Estimated Avg. DC Power for Total ON Time (kW/hr): 0.00

Estimated Avg. Flow (m^3/hr): 0.00

For Source Document: Click Here

Estimated Water Quantity in a day (m^3): 14.66



RMS: Logged Events

Report Genrated Date: 24/May/2016 and Time: 06:19:59 PM

S. No.	Site_Name	Date and time stam	Signal_ Strengt	DC Watts	DC Volts	DC Amps	DC kWh
1	Khema Ram	2016-05-24 14:47:	20	2496.17	198.71	12.56	692
2	Khema Ram	2016-05-24 14:17:	20	2632.2	188.89	13.94	690.7
3	Khema Ram	2016-05-24 13:47:	20	2529.02	176.3	14.34	689.38
4	Khema Ram	2016-05-24 13:17:	20	2567.56	178.21	14.41	688.09
5	Khema Ram	2016-05-24 12:47:	20	2573.77	178.7	14.4	686.79
6	Khema Ram	2016-05-24 12:17:	20	2547.16	176.85	14.4	685.49
7	Khema Ram	2016-05-24 11:47:	20	2078.7	176.58	11.77	684.24
8	Khema Ram	2016-05-24 11:17:	20	2671.49	193.9	13.78	682.88
9	Khema Ram	2016-05-24 10:47:	20	2454.71	189.54	12.95	681.56
10	Khema Ram	2016-05-24 10:17:	20	2285.4	204.43	11.18	680.35
11	Khema Ram	2016-05-24 09:47:	20	2021.5	203.71	9.92	679.25

Key Features of the Project

Online Web Platform to monitor all solar pumps and off-grid solar PV power plants

Potential to monitor cultivation, crop yields and ground water levels.

Linkage planned to GIS, Aadhar Card (Social Security) and Soil Health Card

Prototypes tested in Rajasthan. Roll out of pilot projects in Rajasthan and Chhattisgarh in Q4 2016

Facilitating prompt service to farmers through a common pool of trained technicians

Intended Outcomes

Performance monitoring and O&M – Key enablers to help MNRE achieve its target of 1 million pumps by 2022

Real time data and performance reports to various stakeholders

Establish prompt service to farmers

Reduced T&D losses for State Discoms

Impacts

Employment generation, Skill development of local technicians

Monitoring and control of resources, leading to energy and water conservation

Better irrigation leads to better farming output, better rural economy

Reduction in GHG emissions

Multiple bottom line Impacts

Going beyond the PACEsetter Project

Develop new financing models for solar pumps based on potential for increased farmer's income through crop selection, drip irrigation, horticulture, fertigation etc.

Reduce dependency on subsidies on solar pumps from 85% to 50% or less. Additional income generation from the unused power of solar array.

Test new financing models through a pilot to install 100 pumps at a cost of US$ 500,000. Leverage debt from NABARD or IREDA.

Holistic approach to solar pumping has great alignment with policies under Prime Minister's Farm Irrigation scheme (PMKSY) – outlay of $8bn over 5 yrs

NABARD

Good fit with PM's goal to double farmers' income by 2022. New Krishi Kalyan Cess will garner $1 bn / yr for funding agri development initiatives.

Thank You

DV Satya Kumar
dvsk@ssael.co.in

SHRI SHAKTI ALTERNATIVE ENERGY LTD

Solar Pro