AERC REPORT 173

Solarisation of Agricultural Water Pumps in Rajasthan

S. S. Kalamkar and Hemant Sharma

Study Coordinated by

Agro-Economic Research Centre,
Sardar Patel University, Vallabh Vidyanagar, Gujarat (India)

Agro-Economic Research Centre
For the states of Gujarat and Rajasthan
(Ministry of Agriculture and Farmers Welfare, Govt. of India)
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Report submitted to the
Directorate of Economics & Statistics
Department of Agriculture, Cooperation & Farmers Welfare
Ministry of Agriculture & Farmers Welfare,
Government of India, New Delhi

Agro-Economic Research Centre
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January 2019

AERC Report No. 173

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Draft Report Submitted in December 2018
Final Report Submitted in January 2019

Citation: Kalamkar, S.S. and H. Sharma (2019), Solarisation of Agricultural Water Pumps in Rajasthan, AERC Report No. 173, Agro-Economic Research Centre, Sardar Patel University, Vallabh Vidyanagar, Anand, Gujarat.

Foreword

A complex set of factors including global warming, competitive land use and lack of basic infrastructure is creating new challenges for India's vast agrarian population. The ever increasing mismatch between the demand and supply of energy in general and electricity in particular, is posing challenges to farmers located in remote areas and makes them vulnerable to risks, especially the small and marginal farmers. Indian farmers and the national and sub-national government both face several challenges with regard to irrigation. Electricity in India is provided at highly subsidized low tariffs, mostly at flat rates, and this has led to widespread adoption of inefficient pumps. Farmers have little incentive to save either the electricity, which is either free or highly subsidized, or the water being pumped, resulting in a wastage of both. Although the government heavily subsidizes agricultural grid connections; grid electricity in rural India is usually intermittent; fraught with voltage fluctuations; and the waiting time for an initial connection can be quite long. Besides, the power shortages, coal shortages and increasing trade deficit, put food security of nation at the risk. Currently, India has 26 million groundwater pump sets, which run mainly on electricity that is primarily generated in coal-fired power plants; or by diesel generators. Irrigation pumps used in agriculture account for about 25 per cent of India's total electricity use, consuming 85 million tons of coal annually, and 12 per cent of India's total diesel consumption, i.e. more than 4 billion liters of diesel. The scarcity of electricity coupled with the perpetual unreliability of monsoon is forcing farmers to look at alternate fuels such as diesel for running irrigation pump sets. However, the costs of using diesel for powering irrigation pump sets are often beyond the means of small and marginal farmers. Consequently, the lack of water often leads to damaging of the crop, thereby, reducing yields and income. In this scenario, environment-friendly, low-maintenance, solar photovoltaic (SPV) pumping systems provide new possibilities for pumping irrigation water. Solar powered pumps are emerging as an alternative solution to those powered by grid electricity and diesel. Diesel and electric pumps have low capital costs, but their operation depends on the availability of diesel fuel or a reliable supply of electricity. It is estimated that saving of 9.4 billion liters of diesel over the life cycle of solar pumps is possible if 1 million diesel pumps are replaced with Solar Pumps.

The Ministry of New & Renewable Energy (MNRE) has been promoting the Solar-Off Grid Programme since two decades. The programme size has increased many folds with the advent of Solar Mission, giving much impetus to various components of the programme in which solar pumping is one of the major component. Solar Pumping Programme was first started by MNRE in the year 1992. From the year 1992 to 2015, 34941 solar pumps have been installed in the country. This number is minuscule, if we compare this with the total number of pumps in agricultural sector. High costs of solar modules during these years resulted in low penetration of solar pumps. However, in recent times the module costs have started decreasing and are presently hovering around one fourth of the price in those days. As a result, the programme has become more viable and

scalable. Therefore, there was a need to study the important issues concerning large scale adoption of solar irrigation pumps, its economics/feasibility and problems in adoption of same. In view of above, the present study was entrusted to us by the Ministry of Agriculture and Farmers Welfare, Government of India. The results of the study provide useful insights to understand the socio-economic profile of adopter households. The study came out with suitable policies.

I am thankful to authors and their research team for putting in a lot of efforts to complete this excellent piece of work. I also thank the Directorate of Economics and Statistics, Ministry of Agriculture, Government of India for the unstinted cooperation and support. I hope this report will be useful for policy makers and researchers.

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Acknowledgements

The study on "Solarisation of Agricultural Water Pumps in Rajasthan" has been carried out at the Agro-Economic Research Centre, Sardar Patel University, Vallabh Vidyanagar, Anand, Gujarat, as suggested and sponsored by the Ministry of Agriculture and Farmers Welfare, Government of India, New Delhi.

We have benefitted immensely from various scholars and officials from different government departments while carrying out this study. At the outset, we would like to thank **Prof. Shirish Kulkarni**, Vice Chancellor of our University and Chairman, AERC Governing Body as well as **Dr. Mahesh Pathak**, Honorary Advisor of our Centre for their constant encouragement and support for undertaking such research activity at the Centre. We are grateful to **Shri P.C. Bodh** (Advisor) and **Mr. Rakesh Kumar** (Assistant Director), AER Division of Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, Government of India for their support and guidance in completing the study.

We thank **Dr. Dhruv Raj Godara,** Director, Institute of Solar Energy Management & Project Officer, Solar Radiation Resources Assessment, National Institute of Wind Energy, Ministry of New and Renewal Energy, Government of India for providing us the data on coverage of solar irrigation pumps in selected States (Gujarat and Rajasthan). We also thank the **Commissioner of Agriculture**; the **Director of Horticulture**, Department of Agriculture and Cooperation, Govt. of Rajasthan, **Pant Krishi Bhavan, Jaipur** for providing the secondary information and necessary support for said field work.

We are grateful to the **Dr. Vijay Pal Singh**, Mission Director/Director of Horticulture, Department of Agriculture and Cooperation, Government of Rajasthan; **Shri Rashid Khan**, Deputy Director Horticulture, Kota; **Shri Laxman Singh**, Assistant Director Horticulture, Tonk; **Shri Danveer Verma**, Deputy Director Horticulture, Jaipur and **Shri Nand Bihari Malv**, Assistant Director Horticulture, Jhalawar (Rajasthan) for providing the necessary data and support in data collection. We would like to record our sincere thanks to staff of all these organizations for their invaluable help and support.

The study would not have reached to this stage without the active co-operation of the respondent households who provided all the required data for the study without any hesitation and expectation. We thank each one of them for their invaluable support.

Thanks to **Dr. Sangeeta Shroff,** Professor and In-charge of Agro-Economic Research Centre, Gokhale Institute of Politics and Economics, Deemed to be a University, Pune for her valuable and constructive comments on draft report.

We have also received support and encouragements from our colleagues in the Centre and PG Department of Economics of our University while carrying out the study. We would specifically thank all my colleagues at our Centre for their inputs and assistance in publication of the report.

Thank to Shri Deep Patel for designing the cover page of report and making necessary arrangements for printing and circulation of the report.

Lastly but not least, we thank the all other AERC and CCS staff for their direct and indirect support. Needless to say, all the errors and omissions are solely our own.

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Team Leader

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List of Abbreviations

AD	Accelerated Depreciation
Approx.	Approximately
Av.	Average
BEN	Beneficiary farmer households
C.I.	Cropping Intensity
CEEW	Council on Energy, Environment and Water
CFA	Central Financial Assistance
CII	Confederation of Indian Industry
DC	Direct Current
DISCOMs	Distribution Company (In India)
FGD	Focus Group Discussion
GCA	Gross Cropped Area
GCF	Green Climate Fund
GDP	Gross Domestic Product
GIA	Gross Irrigated Area
GOR	Government of Rajasthan
GOI	Government of India
GTNfW	Grassroot Trading Network for Women
GVA	Gross Value Added
GW	Giga Watt
ha	hectare
HH/hh	Household

HP	Horsepower
I.I.	Irrigation Intensity
INR	Indian Rupees
IREDA	Indian Renewable Energy Development Agency
IRENA	The International Renewable Energy Agency
IWMI	International Water Management Institute
JNNSM	Jawaharlal Nehru National Solar Mission
kg	kilograms
KUSUM	Kisan Urja Suraksha Evam Utthan Mahaabhiyan
kW	kilowatt
kWh	kilowatt-hour
kWp	kilowatts peak
LEDS GP	Low Emission Development Strategies Global Partnership
m	meter
mha	Million hectares
MIS	Micro Irrigation System
MNRE	Ministry of New and Renewable Energy
MOA & FW	Ministry of Agriculture & Farmers Welfare
MOP	Ministry of Power
MoWR	Ministry of Water Resources, River Development & Ganga Rejuvenation
MPCE	Monthly Per Capita Expenditure
mt	Metric Tonnes
MW	Megawatt
NABARD	National Bank for Agriculture and Rural Development, India

NCA	Net Cropped Area
NGO	Non Government Organisation
NIA	Net Irrigated Area
NITI	National Institution for Transforming India
NONBEN	Non-beneficiary Farmer Households
NRREP	National Rural and Renewable Energy Programme
NSA	Net Sown Area
NSSO	National Sample Survey Organisation
NSUSER	Non-Solar User Household
NTPC	National Thermal Power Corporation
O&M	Operation & Maintenance
OBC	Other Backward Classes
PPA	Power Purchase Agreement
RBI	Reserve Bank of India
REC	Renewable Energy Certificates
RKVY	Rashtriya Krishi Vikas Yojana
SEWA	Self-Employed Women's Association
SIP	Solr Irrigation Pump
SKY	Surya Shakti Kisan Yojana
SLDC	State Load Dispatch Centre
SPaRC	Solar Power as Remunerative Crop
SPDI	Solar Powered Drip Irrigation
SPIS	Solar Powered Irrigation Systems
SPV	Solar Photo Voltaic
SREA	State Renewable Energy Agencies

ST	Solar Thermal
SWP	Solar water pump
UNFCCC	United Nations Framework Convention on Climate Change
V	Volt
VGF	Viability Gap Funding
Wp	Watt Peak Capacity
Y	Yield

Solarisation of Agricultural Water Pumps in Rajasthan

S. S. Kalamkar and H. Sharma[1]

India relies heavily on agriculture and irrigation is used in about 49 per cent of India's cultivated area, while the rest relies on monsoon rain. Thus, sound and expanded irrigation is critical for improving crop production and raising yields. For over 50 years until 2010, India ranked first with the largest irrigated area in the world. Irrigation in India today is almost entirely reliant on electric and diesel pumps. Irrigation pumps used in agriculture account for about 25 per cent of India's total electricity use, consuming 85 million tons of coal annually, and 12 per cent of India's total diesel consumption, more than 4 billion liters of diesel. Of the nearly 30 million irrigation pumps in use throughout the country, about 70 per cent run on grid electricity, 30 per cent are powered by diesel, and only 0.4 per cent are solar. The annual fossil fuel use associated with diesel and electric pumps amounts to more than four billion litres of diesel, and 85 million tonnes of coal for electricity generation. The demand for irrigation far exceeds the available pumping capacity. Rapidly growing population, coupled with unreliable precipitation patterns and extreme temperatures wrought by climate change impose additional pressure on agricultural productivity in the country. Therefore, improving access to irrigation, while reducing greenhouse gas emissions, has become our national priority

A complex set of factors including global warming, competitive land use and lack of basic infrastructure is creating new challenges for India's vast agrarian population. The ever increasing mismatch between the demand and supply of energy in general and electricity in particular, is posing challenges to farmers located in remote areas and makes them vulnerable to risks, especially the small and marginal farmers. Indian farmers and the national government both face several challenges with regard to irrigation. Electricity in India is provided at highly subsidized low tariffs, mostly at flat rates, and this has led to widespread adoption of inefficient pumps. Farmers have little incentive to save either the electricity, which is either free or highly subsidized, or the water being pumped, resulting in wasting both. Although the government heavily subsidies agricultural grid connections, grid electricity in rural India is usually intermittent, fraught with voltage fluctuations, and the waiting time for an initial connection can be quite long. Despite the power shortages, coal shortages and increasing trade deficit, put food security of nation at the risk.

The generation of solar energy and irrigation for agriculture could be intricately related to each other. This is because India is a country that is fret with an irregular and ill-spread monsoon. Hence, irrigation is a pre-requisite for sustaining and increasing agricultural output. This is particularly true for the western states of India and especially Gujarat and Rajasthan, where rainfall is

[1] *Agro-Economic Research Centre, Sardar Patel University, Vallabh Vidyanagar, Gujarat*

often scanty, uneven and irregular; whereas perennial rivers are absent. The role of canal irrigation becomes very crucial in this scenario. However, in the absence of sufficient and reliable canal water supply, the only other option that remains with the farmers is that they irrigate their fields with the help of ground water withdrawn through either electricity or diesel-driven pumps. Provision of power for irrigation and other farm operations therefore, is a high priority area for the States. However, providing farmers reliable energy for pumping is as much of a challenge as is making the availability of water, sufficient. The high operational cost of diesel pump sets forces farmers to practice deficit irrigation of crops, considerably reducing their yield as well as income.

Currently, India has 26 million groundwater pump sets, which run mainly on electricity that is primarily generated in coal-fired power plants, or run by diesel generators. Scarcity of electricity coupled with the increasing unreliability of monsoon forces the reliance on costly diesel-based pumping systems for irrigation. The scarcity of electricity coupled with the perpetual unreliability of monsoon is forcing farmers to look at alternate fuels such as diesel for running irrigation pump sets. However, the costs of using diesel for powering irrigation pump sets are often beyond the means of small and marginal farmers. Consequently, the lack of water often leads to damaging of the crop, thereby, reducing yields and income. In this scenario, environment-friendly, low-maintenance, solar photovoltaic (SPV) pumping systems provide new possibilities for pumping irrigation water. Solar powered pumps are emerging as an alternative solution to those powered by grid electricity and diesel. Diesel and electric pumps have low capital costs, but their operation depends on the availability of diesel fuel or a reliable supply of electricity. Saving of 9.4 billion liters of diesel over the life cycle of solar pumps is possible if 1 million diesel pumps are replaced with Solar Pumps. Using solar power for irrigation pumps can cut a carbon footprint of Indian agriculture and bolster the country's role in the war against climate change.

Solar power could be an answer to India's energy woes in irrigated agriculture. Solar power generation on the farm itself through installation of solar PV (photovoltaic) panels; and using it to extract groundwater could just be the solution for the above concerns. Solar pumps come with a user-friendly technology and are economically viable. They are easy to use, require little or no maintenance, and run on near-zero marginal cost. Solar power is more reliable, devoid of voltage fluctuations and available during the convenient day-time. India is blessed with more than 300 sunny days in the year, which is ideal for solar energy generation, aptly supported by promotional policies of the Government of India.

The Ministry of New & Renewable Energy (MNRE) has been promoting the Solar-Off Grid Programme since two decades. The programme size has increased many folds with the advent of Solar Mission, giving much impetus to various components of the programme in which solar pumping is one of the major component. Solar Pumping Programme was first started by MNRE in the year 1992. From 1992 to 2015, 34941 number of solar pumps have been installed in the country. This number is minuscule, if we compare with the pumps in agricultural sector. High costs of solar modules during these years resulted in low

penetration of solar pumps. However, in recent times the module costs have started decreasing and are presently hovering around one fourth of the price in those days. As a result, the programme has become more viable and scalable. Therefore, present study was undertaken with aim to study the important issues concerning large scale adoption of solar irrigation pumps, its economics/feasibility and problems in adoption of same.

Literature suggests that application of solar energy in irrigation could have myriad benefits. The primary benefit is that it is 'free'. However, the generating apparatus comes with high initial fixed costs like that of capital equipment, costs of installation, depreciation, interest, protection from theft, vandalism etc. Nevertheless, the marginal costs are indeed 'near zero' (operation, maintenance, repairs). The costs of expansion in irrigated area like that of hose pipes for transporting water across fields is also much lesser compared to operating a diesel pump or getting another electricity connection. Hence, solar pumps could not only provide cheaper irrigation but also expand irrigated area and thus increase the returns on agriculture. It could also extend the farming beyond the kharif season (monsoon); by harnessing ground water and thus aid the diversification of crops. Solarization could also unshackle the farmers from the shortage of electricity supply and its inconvenient timings. They would be able to irrigate not only their own land, but also become irrigation service providers to their neighbouring farmers and also supplementing their own incomes in the process. Solarized pumps could promote conjunctive irrigation by promoting ground water extraction in flood-prone regions like north Bihar, coastal Orissa, north Bengal, Assam and eastern Uttar Pradesh. The government has acted positively in this matter and during the last five years, considerable progress ha s been made in installation of Solar Pumps.

In light of the above, this study attempts to study the status and prospects of solarisation of agricultural pumps in selected districts of Rajasthan. The data were collected from three distinct groups of farmers, viz. farmers who had adopted SIPs with the help of subsidy by the government, farmers who had adopted SIPs without any support in the form of subsidy by the government, and the farmers who had not adopted SIPs. The first group was of 100 sample farmers (25 from each of the four districts under study, i.e. Jaipur, Bikaner, Udaipur and Sriganganagar) who had installed Solar Irrigation Pumps (SIP) with the support of subsidy from the government (beneficiary farmer households). The second group consisted of 5 sample farmers from four districts who had installed SIPs on their own without any support in the form of subsidy (non-beneficiary farmers). The third group included 20 sample farmers (5 each from the four districts under study) who had not yet adopted solarized irrigation (non-adopters). They were still using other conventional fuels for powering their irrigation pumps when they were visited by the researchers. Thus, the total sample consisted of 125 selected farmers (Table 1).

Table 1: Sampling Framework in Rajasthan State

Sr. No.	Selected District	Beneficiary farmers	Non-solar adopter	Non-beneficiary farmers	Total
1	Jaipur	25	05	01	31
2	Bikaner	25	05	01	31
3	Udaipur	25	05	01	31
4	Sriganganagar	25	05	02	32
	Total	100	20	05	125

Policies supporting Solar Power Irrigation in Rajasthan

The state of Rajasthan has 10 per cent of India's land, 5 per cent of its population and only 1 per cent of its water resources, a disadvantage by a factor of the for supply of irrigation water vis-a-vis agriculture area. Acute water shortage, erratic rainfall and recurring droughts in every district have exacerbated the situation. Over 60 per cent of the population depends for livelihood on agriculture or horticulture, often marred by low productivity due to unreliable, inadequate or non availability of irrigation. About 70 per cent irrigation is done through wells or tube-wells energized mainly by grid-power or diesel generators. Approximately 60,000 farmers are waiting for grid-based electricity connections for irrigation. Extension of electric-grid is not feasible in far-flung areas; almost 70 per cent area in the State is classified as desert. Moreover, ground water has deteriorated rapidly in the last two decades. Out of 249 blocks, nearly 200 are in the highly critical zone. Almost 90 per cent of groundwater withdrawal in the State is utilized through flood or furrow-irrigation methods with mere 35 to 45 per cent water-use-efficiency.

Rajasthan is blessed with one of the best solar insolation on earth (6-7 kWh/m2/day) combined with maximum sunny days in a year, about 325, which makes it one of the most attractive destinations for harnessing solar energy for various purposes, especially irrigation. It was thus envisaged that an integrated solar water pump scheme formulated by combining various stand-alone government schemes would be indeed beneficial for the region as well as its farmers. Subsidies available under various programs were clubbed and the State committed to grant the total subsidy up to 86 per cent of the capital cost. The departments of agriculture, finance and energy of the State, and Union government's Ministries for Agriculture (MoA) and New and Renewable Energy (MNRE) worked in tandem along with various stakeholders to make it is seamless and successful project.

Rajasthan has been pioneer in promoting solar water pumps by adopting suitable policies with an aim to increase solar pump coverage in the state. The solar pump scheme for irrigation began in Rajasthan in 2010 – a combination of the Jawaharlal Nehru National Solar Mission (JNNSM), Rashtriya Krishi Vikas Yojana (RKVY), the water harvesting structure (WHS) scheme under the National

Horticulture Mission (NHM), and various other State resources. Under the scheme, farmers are provided with subsidies from RKVY and the Ministry of New and Renewable Energy (MNRE). In the inception year, a subsidy figure of 86% was arrived at (30% from MNRE and 56% from RKVY), through calculations of a base price for the manufacturing and installation of a solar water pump set. The remaining 14 per cent, equivalent to the cost of just the pump set, was to be paid by the farmer, which would amount to about Rs. 56000-63000. In 2010-11, 50 farmers were targeted, which was scaled up to 500 in 2011-12, and 10,000 in 2012-13, eventually covering all 33 districts of the State. There are three, very transparent eligibility criteria for the subsidy –(1) the farmer should own at least 0.5 Ha of land; (2) the land should have a diggi/farm pond or other water storage structure; (3) drip irrigation system should be installed in a portion of the farm. Progressively, the scheme was amended to include the usage of mini-sprinklers as criteria for areas where land holdings are relatively smaller and diggi construction is unfeasible or impractical. This inclusion widened the scope for the popularization of efficient irrigation methods, increasing the water use efficiency in many regions significantly. On the other hand, the subsidy figure was reduced from 86 per cent to 70 per cent to an even lower 60 per cent over the years, and this reduction in the subsidy amount is presently the major cause for farmers backing out from the scheme. Farmers who already have electric connections for irrigation shall be provided with a smaller figure of subsidy, amounting to about 30% of the total cost of the solar pump set. This calls for a study of the efficacy of the scheme and a detailed evaluation of the impact that these solar water pumps have actually had on farmers already using them, to enable us to ascertain why we should be moving towards this green, efficient, cheap, and emission-free energy source, and/or explaining how the scheme may be further improved for a much wider acceptance and preference among those that require such alternative solutions desperately.

In the year 2008-09, Government of Rajasthan had started scheme of 100 per cent subsidy on solar water pump for government farm then after in 2010-11, pilot project was started and covered only 6 districts to installed solar water pump. To harness the vast amount of energy, the Rajasthan government subsidized 86 percent solar-powered irrigation in 2011-12 and introduced 3 HP DC submersible pumps. MNRE and the Ministry of Agriculture through the financial assistance of the state government had supported. Jawaharlal Nehru National Solar Mission (JNNSM) provides 30 percent of the state government, Rashtriya Krishi Vikas Yojana (RKVY) and the Ministry of New and Renewable Energy offers a 56 per cent subsidy. The solar water pump scheme was scaled up from a mere target of 50 in 2010-11 to 500 (900 per cent increase) in 2011-12; to 2,200 (over 340 per cent increase) for 2012-13; and, to 10,000 (354 per cent increase) for 2013-14. Implementation at large scale was initiated in year 2011-12 when out of 33 districts, 14 districts were covered. Next year i.e. 2012-13 the scheme covered all the 33 districts in the State. In the year 2014-15, all 33 districts were also included, but this time only 2900 solar water pump was kept in the target as the subsidy rate had been reduced, but still achieved a lot of achievement and 242 percent more solar pumps installed than targeted. The good achievement in the next year 2015-16 and 31 percent more installed than the targeted solar pump.

After year 2013-14, Rajasthan has also begun targeting high ROI beneficiaries by prioritizing farmers without electric connections. The state has three subsidy slabs—75 per cent for those willing to give up their place in the queue for electric connections, 60 per cent for farmers without an electric connection, and only the 30 per cent MNRE subsidy for those unwilling to give up their electric connection/place in the queue.

Despite water scarcity, Rajasthan is actively pushing for solar pumps. Its horticulture department provides 86 per cent subsidy on pumps, while the rest is borne by the farmer (Table 2). Government of Rajasthan brought a new momentum in the space of solar irrigation pumps by introducing 3 HP DC submersible pumps in an 86 percent subsidy scheme launched in 2011-12. There was also a 2 HP DC submersible pump option, but there have been few takers for it. The initial estimates of costs at the Rajasthan level 3 were Rs.6.16 lakh for 3 HP pump and almost Rs. 18-20 lakh for a 10 HP pump. Government of Rajasthan's aggressive policy of subsidizing solar pumps is helping to increase the numbers but there is some evidence that the current subsidy is discouraging cost reduction. Farmers are viewing solar pumps as an all purpose solution to their energy needs and government has came out the suitable policy towards same (Table 3). The top five districts having highest coverage of solar pumps are Bikaner, Jaipur, Sri Ganganagar, Hanumangarh and Sikar.

Table 2: Achievements of Solar Irrigation Pump in Rajasthan

Year	Project	No. of District Covered	Target	Achieve-ment	Pump Capacity (WP)	Subsidy (%)	Funding Source
2008-09	Government Farms	7	14	14	1800	100	RKVY
2010-11	Pilot Project	6	50	34	2200/ 3000	86	JNNSM, RKVY
2011-12	First major jump	14	500	1649	2200/ 3000	86	JNNSM, RKVY
2012-13	Second major jump	33	2200	4280	2200/ 3000	86	JNNSM, RKVY State
2013-14	Third major jump	33	10000	10000	2200/ 3000	86	JNNSM, RKVY, State
2014-15	fourth major jump	33	2900	9919	2200/ 3000	30, 60, 75	JNNSM, NCEF, STATE
2015-16	Fifth major jump	33	4702	6170	2200/ 3000	30,60, 75	JNNSM, NCEF, STATE
2016-17	Six major jump	33	7500	n.a.	n.a.	30,60, 75	JNNSM, NCEF, STATE
2017-18	major jump	33	500	n.a.	n.a.	50, 55, 65, 70	JNNSM, NCEF, STATE
2018-19	major jump	33	7500	n.a.	n.a.	50, 55, 65, 70	JNNSM, NCEF, STATE

Note: n.a. Not available.

The solar pump subsidy was only available to farmers who had farm ponds (diggi), did horticulture in at least 0.5 hectare (ha) land and used drip irrigation. The farmer also had to own a minimum of 0.5 ha of land. Further the farmers who owned up to 2 ha of land could apply for 2200 Wp pump and those who had more than 2 ha of land could apply for 3000 Wp pump. The eligibility criterion for solar power pump has been changing every year.

Table 3: Base Rate for SPV Solar Pump Project in Rajasthan (2017-18 and 2018-19)

Sr. No.	Details	DC/ AC Mounting	Head (mtr.)	Base Rate (in Rs. Per set)			
				3 Hp	5 Hp	7.5 Hp	10 Hp
1	2	3	4	5	6	7	8
1	SPV Surface pump	DC Static	20	236250	0	0	0
2		AC Static	20	230492	307999	0	0
3	SPV submersible pump	DC Static	20	252266	344000	509839	650090
4		AC Static	20	230265	306390	465560	593250
5	Additional Cost	Head Over 20 m	50	5412	5412	5412	5412
6			75	9020	9020	9020	9020
7			100	12000	12000	12000	12000
7		Manual Tracker		2706	2706	2706	2706
8		Auto Tracker		8118	8118	8118	8118
9	SPV Domestic Lighting System 37 Wp/ 40 Ah Battery / 9 W x 2 fixture			4681	4681	4681	4681
10	Fencing			6765	9020	11275	13530

Source: GOR, Jaipur.

Farmers have to apply to the Horticulture department along with a demand draft for Rs.10000, land ownership record, a tri-partite agreement among the farmer, preferred empanelled supplier and the horticulture department, a quotation from the selected empanelled firm, and a technical drawing of the structure. Once all the applications are collected at Tehsil level, these are verified for compliance with the eligibility criteria. If the applications are more than the quota, a lottery is conducted in the presence of District Collector. A seniority/waiting list is created. If a farmer's name features in the lottery list, he/she has to deposit his 14 percent share minus Rs.10000 with the select firm. Based on the confirmation of the receipt of farmer's share work orders are issued by the Horticulture Department of the state government.

Findings from Field Survey Data

- Data were collected from 125 sample households comprised of 100 households those who have installed solar irrigation pump with support of subsidy (beneficiary farmer household), 5 sample households who have installed solarizied irrigation pump on their own (without any subsidy non-beneficiary farmer household) and 20 sample households who have not yet got subsidy nor installed solar irrigation pumps on their farm (non adopters-control group).
- It was observed that except few respondents from beneficiary category, all other selected households from all groups (beneficiary, non-beneficiary and non-adopter category respondents) were male. This indicates farming decisions

and adoption of new technology on farm related decision were taken by the male, thus dominance of male could be seen despite of the fact that female contribution is highly significant in the farming and dairying.

- The average age of all the respondents of selected respondents was around 50 years while average family size of household was relatively larger in case of beneficiary households (6.91 person), than non-beneficiary and non adopters households (5.4 and 5.3 members respectively). Out of total adult family members in the family, more than 70 per cent were actively participating in the farming.
- The education status of selected respondents indicate the average education level up to 8 years, while non beneficiary households were relatively more educated (around 11 years) than other groups. The figures on average level of education of respondents indicate that lower level of education among selected respondents.
- The religion-wise distribution of selected respondents indicate that out of total selected households, about 94 per cent households belongs to hindu religion while remaining were from Muslim and Sikh religions. Among the three groups of respondents, same trend was observed except relative high share of Sikh religion among non-beneficiary households as about one fifth of non-beneficiary households were from Sikh religion. In case of social caste distribution, on an average, dominance of other backward class category households was observed followed by households from general category and scheduled caste category. The other backward caste followed by open category comprised beneficiary household group, while opposite composition of households was observed in case of non beneficiary households. Besides, Open and OBC category households, scheduled caste households were also among selected households under non-adopters group. Thus, at overall level, backward class category respondent dominated the sample followed by general category and then scheduled caste, while very meager share was of Scheduled Tribe respondents
- The details on economic characteristics of the selected households indicate that more than 90 per cent of total beneficiary and non-adopter households were having farming as their principal occupation while three fourth of total non-beneficiary households had service as their principal occupation. Animal husbandry and dairying followed by agriculture labour was subsidiary occupation of beneficiary and non-adopters, while crop cultivation followed by agriculture labour was subsidiary occupation of non-beneficiary households. The main occupation of the selected households was agriculture comprised of cultivation of land as a farmer along with supportive allied activity of animal husbandry and dairying.
- The average years of farming experience of the respondents was around 29 years, which shows that most of the respondents were in farming business since their young age. The income level of both beneficiary and non-beneficiary households as around 98 percent and 50 per cent non-adopter of households are categorized above poverty line. The trend was observed in case of dwelling

structure where about 98 per cent households of beneficiary member have pucca structure while in non- beneficiary and non adopter category only 60 per cent and 45 per cent household has pacca house structure.

- On an average, land holding size of selected beneficiary households was 1.21 ha categorizing them as small land holders' group, while non-adopters had much lesser land holing of 0.91 ha as marginal land holders, While corresponding figure for non-beneficiary households was 6.10 ha, indicating larger size of holdings as medium size land holders. Moreover, we also found that the who were having solar water pump had taken land on leasing-in while none of them leasing out the land. Non-beneficiary farmer households had taken larger size of land on leased-in (0.75 hectare) as compared to beneficiary households (0.01 ha), this might be because the non beneficiary farmers are comparatively wealthy farmers and have more capital than the other two groups.
- Out of the total operational land holdings with selected households, almost all land under operation of non-beneficiary household was under irrigation, while in case of beneficiary households, about 80 per cent land was under irrigation coverage. The non-adopter households could irrigated their three fifth of total operational holdings with available sources of irrigation. Thus, despite of having the large size of land holdings, non-beneficiary had sufficient water and sources of irrigation to irrigate the crop. Due to such sound background of having all land coverage with irrigation, the assured returns must have pushed the farmers to invest in installation of solar pumps on their farm with their own expenditure, i.e. without any subsidy.
- After solarisation, changes in cropped and irrigated area were observed in case of selected beneficiary households. Area under cropped as well as irrigated area was increased by around 17 percent, despite of same cropping intensity was constant. The share of area sown to gross cropped area during kharif and summer season has shown meager increase. Area under irrigation by type of irrigation method has shown some changes after solarisation as compared to situation prevailed during pre-solarisation period of beneficiary farms. The area irrigated by flood method of irrigation has declined by about 30 per cent which must have due to adoption of sprinker and drip method of irrigations. The area under rainfed condition has also shown declined trend. Overall the total gross cropped area has increased about 17 per cent after solarisation. The transformational impact of irrigation is evident in solar water pump Scheme, where solar pumps were used to expand the coverage of the scheme from 40 to 50 hectares. More than 50 per cent beneficiary household area transformation from gravity-fed irrigation to sprinkler and drip irrigation with additional solar booster pumps have been deployed to pump water into a storage reservoir.
- The changes in net sown area, gross cropped area and cropping intensity of sample non-beneficiary households indicate that after solarisation, after solarisation, significant growth in gross irrigated area and gross cropped area was recorded, that to increase in irrigated area was more than cropped area. Due to which cropping intensity has changed by around 13 per cent points

after solarisation as compared to before solarisation year. The increase in area under irrigation may be due to assured and quality power supply through solar during convenient timings during day time for irrigation.

- In case of non-beneficiary households, area irrigated by flood method of irrigation has declined by about 28 per cent. Also rainfed area has declined by 43 per cent after solarisation. While area irrigated through the use of micro irrigation equipments such as sprinkler and drip has recorded significant increase. Overall the total gross cropped area has increased about by 26.04 per cent after solarisation. As increase in gross cropped area was higher for non-beneficiary than the beneficiary may to due to the fact that non beneficiary farmers are economically strong and diesel pump owners, had shifted to solar pumps to avail benefits such as zero operational costs, ease of use throughout the day and cost savings on diesel.
- In case of non-adopter, cropping intensify was 166 per cent mainly because of more than four fifth of total cropped area having irrigation coverage.
- Before solarisation of irrigation pumps, out of selected solar water pumps users, only 37 percent of beneficiary household had grid connection facility available on their farm while all the non-beneficiary farmers had grid connectivity to their irrigation pumps on farm. In case of rate charged towards use of electricity, almost two third pumps of beneficiary households were metered and remaining were charge in flat rate basis. While in case of non-beneficiary households, all irrigation pump had meter and were charged on meter use basis. Average irrigation expenditure per household per year was estimated to be between Rs. 3200-3500/-. Despite of the fact that agriculture require more hours of electricity supply to carry out agricultural operations (irrigation, threshing, etc), selected respondents households reported that they used to get hardly 6 hours of power supply in a day, which indicate the pressure built on respondents to make use of new technology of solar energy.
- The selected households had multiple sources of water available for irrigation and also used multiple method of irrigations such drip and sprinkler irrigation. The average water depth was estimated to around 200 feet and water was lifted through making use of diesel and electric pumps. The average distance of canal/river water was about 1 kms from the field. Around two third of the selected households had water storage facility on the farm, while no one has made attempt to recharge the groundwater through adoption of any innovative technique or practice. The main problem was observed with the availability of electricity to farm connection which is hardly made available though grid for eight hours in a day that to at inconvenient times, irrespective of season. Thus, in order to irrigate the crop during day time with uninterrupted power supply, the solar irrigation pump is the most suitable option available which selected households have installed on their farm.
- Changes in cropping pattern of sample beneficiary households indicate that due to about 17 per cent increase in gross cropped area after solarisation, area under fruits and vegetables, wheat and maize crop has significantly increased during rabi and summer season. The change in cropping pattern was

relatively in favor of irrigated crops. During kharif season, major crops grown were paddy, maize, groundnut, cotton, soybean while wheat and gram were sown during rabi season. Due to availability of irrigation facility, crops such as maize, moong, vegetables and fruits were grown during summer season.

- Most of the households, who were previously growing little more than subsistence crops of bajra, maize, soybean in kharif and wheat, gram and mustard in rabi, could grow feed crops, earn income and benefit. After solarisation, the numbers of crops grown have also increased. During survey, respondents have reported that farm yields have increased to an average of 2 to 4 quintal per hectare. Irrigation enables farmers to grow three crops per annum and rotate crops to grow a diversity of nutritious and cash crops, such as vegetables and fruit crops and flowers also. This indicates that solarisation helps to increase the area under cultivation during the summer season or under the perennial with commercial crops like vegetables.
- While in case of non-beneficiary households, kharif season was the major season. Crops were grown in all three seasons (kharif, rabi and summer) before solarisation as well because of the fact that they are economically sound and thus can make full use of water through diesel and electricity pump. While after solarisation, the share in area of traditional crops such as jowar, moong, moth, guar and bajra has decreased and area under other horticulture crops like vegetables and fruits crops has increased. After solarisation, gross cropped area of the non-beneficiary households has increased by 25 percent. It was also observed that after solarisation, the numbers of crops grown during year has been increased, as seen in case of beneficiary households. In kharif season, the major crops grown were cotton, soybean and bajra while during rabi season, wheat, gram and rapeseed & mustard crops were grown. The fodder and vegetables crops were grown by the non beneficiary farmers during summer season. The increase in share of the area under commercial crops, fruits and vegetables and perennial crops indicate the benefit of solar energy availability with selected non beneficiary households for irrigating the crops.
- In case of non-adopters (control group) households, major crops grown during Kharif season were bajra, moong, moth, groundnut, guar and other minor crops while wheat, gram, rapeseed and mustard were major crops grown during rabi season. It was very pleasant to note here is that significant area during summer season was allotted under fodder crops indicates the scarcity of fodder in the selected area. The distribution of area under irrigation by type of irrigation method used by all non adopter farmers adopted flood irrigation system.
- The details on possession of irrigation pumps of selected households indicate that Solar pumps essentially are a collection of solar PV panels, AC or DC pumps and the associated electronics that have been optimized for high efficiency operations. All non-beneficiary households have used submersible DC pumps while in case of beneficiary households, 54 per cent households had DC pumps on their farm. As a technology, while AC technology is now catching up, DC technology is considered to be more suitable given the wider operating range and higher efficiencies reported by beneficiary.

- The details about the installation of solar panels and availability of power with selected beneficiary and non-beneficiary households indicate that land area covered by the solar pump installed was around 4.8 ha in case of beneficiary households while same was 4.4 ha in case of non-beneficiary households. All the selected households had solar panels on farm. About two third of installed solar PV panels were with automatic rotation system while remaining were with manually rotation system. On an average 4-6 poles are were installed with mean number of stand poles between 12-15, having average size of panel of 3 feet by 5 feet. Mean area covered by the each stand pole was around 5 feet by 5 feet. No installed solar panel have meter to record the power generated and used. About 37 percent solar plants of beneficiary households and 5 percent of non beneficiary households were connected to grid. None of farmers has installed the solar power storage cell. The solar power generated mostly been sued for agriculture purpose while few of beneficiary households used for household purposes as well. None of the selected households had use solar power to sell irrigation water to neighboring farmer, thus no additional income through sale of water was reported.
- Rajasthan comprises about 10.4 percent of India's landmass in which 60 per cent area are is desert and 5.5 percent of the total population but has only one percent of the nation's water resources. Groundwater is either saline or declining at a fast rate. The grid power supply available for only 5 to 6 hour for form field and its very expensive. In such a scenario, selected households were asked about the reasons for adoption of solar power generation unit on their farm. The selected households have cited multiple reasons for choosing solar on their farm.
- About two third of beneficiary households mentioned that to avoid hassle of irrigating crop irrigation during night hours was the major reason for adoption of solar irrigation pump. More than 50 percent of selected households strongly reported that they adopted the solar water pump due to costly diesel, followed by non-availability of electricity connection, unreliability of electricity supply/ inconvenient grid supply timings, high electric bill. Few of the beneficiary households wanted to try renewable technology as it is environment-friendly while few wanted to take advantage of subsidy being offered for installation of solar pumps on farm. While in case of non-beneficiary households, major three reasons quoted were saving electric bill followed by costly to run electric pumps and inconvenient time of electric supply/costly diesel. Thus, findings about the reasons for adoption of the solar water irrigation pump under different category suggests that high cost of electricity along with inconvenient hours of electricity supply and high cost of diesel has pushed the farmers to adopt pollution free power generation thorugh solar.
- Government of Rajasthan brought a new momentum in the space of solar irrigation pumps by introducing 3 HP DC submersible pumps with 86 percent subsidy scheme launched in 2011-12. There was also a 2 HP DC submersible pump option, but there have been few takers for it. The State government leveraged central financial assistance coming from MNRE and Agriculture Ministry for the same. The state government provides 56 percent subsidy

under Rashtriya Krishi Vikas Yojana (RKVY) and the New and Renewable Energy Ministry of Government of India provides the balance 30 percent under Jawaharlal Nehru National Solar Mission (JNNSM). The project was implemented through the Horticulture Society under the Agriculture department of Government of Rajasthan. The beneficiaries had to pay 30 to 32 per cent of the system cost. The agriculture department of Rajasthan provided 68-72 per cent of total cost as subsidy through JNNMS and RKVY scheme. The cost of 5 HP solar pumps was about 30 to 33 per cent higher than 3 HP solar. It may be noted that, the major sources of institutional credit was commercial banks followed by cooperative banks, for both beneficiary and non-beneficiary farmers. About 50 to 80 per cent amount had taken loan by beneficiary while corresponding figure for non beneficiary household was 45 to 55 with interest rate ranges between to 7 per cent. The cost of documentation incurred by selected households was about Rs. 1111/- per households while in case of non beneficiary households same was Rs. 1848/-. The expenditure of Rs. 1584/- was incurred towards installation by the beneficiary while corresponding figure for non-beneficiary household was Rs. 1848/-.

- The process of installation of solar pump took almost 6-7 days while average number of visits of representative of agency was more in case of non-beneficiary (about 5 visits) compared to beneficiary households (about 3 visits). The company-wise distribution of solar panels indicates that Jain Irrigation Company had supplied major share of pumps (as solar pump supplier) in both groups. The other major suppliers were Shakti, Lubi, Tata Solar, Waaree, etc. More than 95 per cent of selected respondents had received training/ demonstration about operating solar pump from solar water pump through supplier agency while about more than 98 per cent of beneficiary and non beneficiary household had satisfied with support services provided by agency and quality of solar panels. More than 90 per cent responded are insured the solar pump.
- Government of Rajasthan had many times improved the policy and eligibility criteria of receiving subsidy on solar water pump. The solar pump subsidy was only available to the farmers who fulfill the basic criteria fixed for same such as farmer should have farm ponds (diggi), had land at least 0.5 hectare (ha) land and availability of micro irrigation instruments or ready to take solar with micro irrigation and no grid connection. It can be seen in table 3.19 that more than 80 per cent beneficiary had fulfilled these conditions.
- Storage tanks in different sizes are used to store the water that is pumped. The water that is stored in the tank can be used for irrigation when needed. There are different types of agricultural irrigation method used.. More than 90 percent beneficiary households had used solar with MIS while 100 per cent non-beneficiary households have used MIS and Solar pump without subsidy. All solar water pump users advise to others to adopt solarisation of irrigation pumps with the information of the government policies in the solar irrigation sector, particularly solar subsidies regard and economic benefit of solar irrigation pump.

- To supplement the intermittent and inadequate canal supply, many farmers have also dug tubewells. It can be seen in table that the depth of water level is was around 210 feet in case of beneficiary households during both the periods, while same has slightly increased to about 235 feet in case of non-beneficiary users. The depth of groundwater was stagnant possibly may be due to farm pond as recharger for ground water on beneficiary farm.
- Diesel was used as fuel to drive the water pump during rabi season. On an average about 4 litre of diesel was used per bigha watering of land by the selected respondents and approximate expenditure of repair of diesel pump was estimated to be between Rs. 8500-10000/- was incurred. Some of the beneficiary and non beneficiary farmers had to incurred expenditure to the tune of amount of Rs. 4581-/ and Rs. 6847/- towards repair of their electric pumps. On an average, about more than two hours time was spent on procuring diesel/petrol per week to fetch diesel from about 10-12 kms away from village/farm. But after solarisation, not only large reduction in operational and maintenance cost was observed but also complete removal of reliance on fuel has been observed. It was surprising to note here is that no selected respondent have commented on the excessive water withdrawal for long run as well as on steps taken to curtail water withdrawal for self use as no one had reported sale of water. Besides, no efforts were made by anyone respondents to recharge water.
- About 20 to 25 per cent respondent have realized that the crop productivity have increased and about 40 to 45 per cent respondent have adopted the crop diversity after adoption of solar which help them to increase the numbers of crops in a season. They are now growing commercial crops and also reported that the after solar, the productivity of traditional crop increased. None of farmers of beneficiary and non-beneficiary has sold the water but the exchange and borrow water from each other. Due to increase in availability of power during convenient timings, farmers have diversified their cropping pattern towards high value crops as well as some of them have noticed positive increase in productivity of crops grown.
- Solar panels are generally self cleaning, but in particularly dry areas or where panel tilt is minimal, dust and other substances such as bird droppings can build up over time and impact on the amount electricity generated by a module. Grime and bird poop doesn't need to cover an entire panel to have an effect. This is where cleaning solar panels may have to be done. As solar electricity generation is depend on the exposure of solar panel surface area which may over time get dusty and with other substances such as bird droppings can build up over time may impact on the amount electricity generated by a module. Therefore, regular cleaning of solar panels need to be carried out by the farmers. It was observed that different time schedules are adopted by the households for cleaning of solar panel surface and no similar pattern observed. Two third of beneficiary households and one fourth of non-beneficiary households has been cleaning the same twice in a week, half of the non-beneficiary households and one tenth of beneficiary households clean solar panel once in a week. The approximate time for cleaning the solar panel

surface is estimated to about 20-22 minutes. On average, 45 per cent of the solar panels users clean the panels in once a week and 25 percent of the respondents are cleaned twice in a week. The estimated time for the cleaning of solar panels is 28 to 30 minutes.

- The experiences with solarized irrigation of selected households indicate that ease of opinion and maintenance along with convenience time for irrigation with output of water were major positive aspect of solarisation. The other supportive factors of solarisations noted by the selected households were reduction in use of fertilizers, use of micro-irrigation method.
- More than 90 per cent beneficiary and non beneficiary farmers had great experience of solar i.e. ease of operation, ease to maintenance, less labour and supervision required and the timing for irrigation are very convenience, used of fertilizer decrease with increase of micro irrigation after solarisation. Some of the selected respondents using electric pumps were dissatisfied with use of electric pump due to its unreliable power supply, depleting water tables and high expenditure on diesel.
- Solar pumping systems allow vital water resources to be accessed in remote rural locations. Solar water pumps require no fuel and minimal maintenance. All selected respondents reported the advantage of no cost of fuel followed by no maintenance cost and quality of power supply. The other advantages reported by respondents were no harassment of irrigating crop in night, saving on labour cost, almost no monthly cost of operation and no harassment of fetching diesel.
- Most of the selected households mentioned the two prominent disadvantages of solar panels such as it require a huge initial investment and only can be used during sunny days. As installation of solar panel requires usually around Rs. 4.5 lakhs to 6.5 lakhs depending on the size of the panel and horse power of solar panel. This is the main reason that discourages people to install solar panels. Unfortunately, sun doesn't shine 24 hours, and solar power relies on it. Since solar electricity storage is not yet fully developed, so it can be used during sunny days.
- About 79 per cent of farmers had given first preference to lack of fund for non adopting water pump followed by hesitation to invest/ lack of confidence/ risk averse (66.05%), less land, unviable for investment on solar pump (57.40%), opposition from family members (56.55%). unviable for investment on solar pump, Subsidy is insufficient, ground water is at great depth, unsuitable for solar and came to know about it much later.
- About 70 per cent non-adopter HH has suggested that the criteria of subsidy should be relaxed and need to increase subsidy rate. About 40 per cent respondents had suggested that the portability of grid connectivity to solar irrigation pumps should be made and awareness about solar irrigation pump Scheme need to be increased.

Policy Implications:

- Both the central and state governments have policies and incentives place to grow the use of solar pumps in the irrigation sector. However there is a felt need for raising awareness among farming community and for putting project delivery mechanism in place.
- Presently, cost of solar pump appears to be high for individual farmer. Large scale adoption and production will lead to cost cutting. Community based projects can reach out to marginal farmers and other low-income group individuals.
- Feasible costing and assistance from state/ central government will encourage more farmers to opt for the technology. With partnership of state energy departments, Vidyut Vitaran Nigams, and private partners, technology can be disseminated at large scale.
- Portability of grid connectivity to solar irrigation pumps should be made and awareness about solar irrigation pump scheme need to be increased.
- Majority of the beneficiary farmers suggested that solarized irrigation could be expanded if the SIPs were made more user-friendly in terms of their requirement of space, technical features as well as financing; including that for insurance.
- Solar cooperative need to established and individual SIPs in group under cooperative structure can be connected with the grid in order to evacuate the surplus power generated there from into the grid, it could not only prevent the wastage of solar power but also provide the farmers with a supplementary source of income by way of selling solar power.
- The farmers were also in need of awareness about insurance and its coverage against risks of damage of SIPs or theft of their solar panels.
- Also, the procedure for availing subsidy should be simplified and the criteria for eligibility should be relaxed so as to include more farmers as beneficiaries
- Clearly, more needs to be done in the direction of convincing the farmers about the advantages of solarized irrigation per se, so that they would come forward to adopt in large numbers, regardless of the subsidy on offer or the initial capital costs thereof.
- There is a need of innovative policies for governing ground water level in a sustainable way. There is a need for metering agriculture water use and total water extraction by farmers using solar, electric or diesel pump.

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Chapter I

Introduction

1.1 Introduction

Energy is a primary driver of economic growth and welfare. Provision of good quality energy is a means to improve the standard of living of the people. India has come a long way since independence in building the capacity to produce quality energy and in making it reach the rural areas as well. Power production is considered to be a core industry as it facilitates growth across various sectors of the Indian economy such as manufacturing, agriculture, commercial enterprises and railways. Thus, it is a key enabler for India's economic growth, and has historically shown growth trends in tandem with the overall growth of the economy, which is also reflected in the strong correlation between the growth rate of GDP/GVA and the growth rate of power generation capacity in the economy.

In spite of recording significant growth over the years, the Indian power sector is facing challenges such as shortages and supply constraints of inputs as well as power supply. Power scenario in the country which had worsened over the years with the deficit at 10.1 per cent and the peak deficit at 12.7 per cent during 2009-10 has now improved somewhat, with a recorded deficit of 0.7 and peak deficit of 2.0 percent in 2017-18[1]. However, it is still not enough, because considering the growth outlook of the economy, it is expected that the demand for electricity would grow in future. Moreover, India imports over 70 per cent of her crude oil needs and demand routinely outstrips supply. All of these, along with the growing concerns about the environmental consequences of fossil-fuel based power-generation; call for an effective and thorough system of energy production, distribution and regulation in India. While power-generation in India is predominantly done with the help of conventional sources such as thermal, hydro and nuclear plants, the country is also emerging as one of the leaders in

[1] See Annexure I (https://powermin.nic.in/en/content/power-sector-glance-all-india).

renewable energy production (MSSRF, 2007). Efforts are being made to achieve fuel security though renewable fuels. Harnessing clean and green sources of energy on a large scale in the country is a necessity to ensure sustainable economic development without seriously damaging the environment while also addressing the need for energy security (SPRERI, 2014).

1.2 Renewable Energy Resources at Global Level:

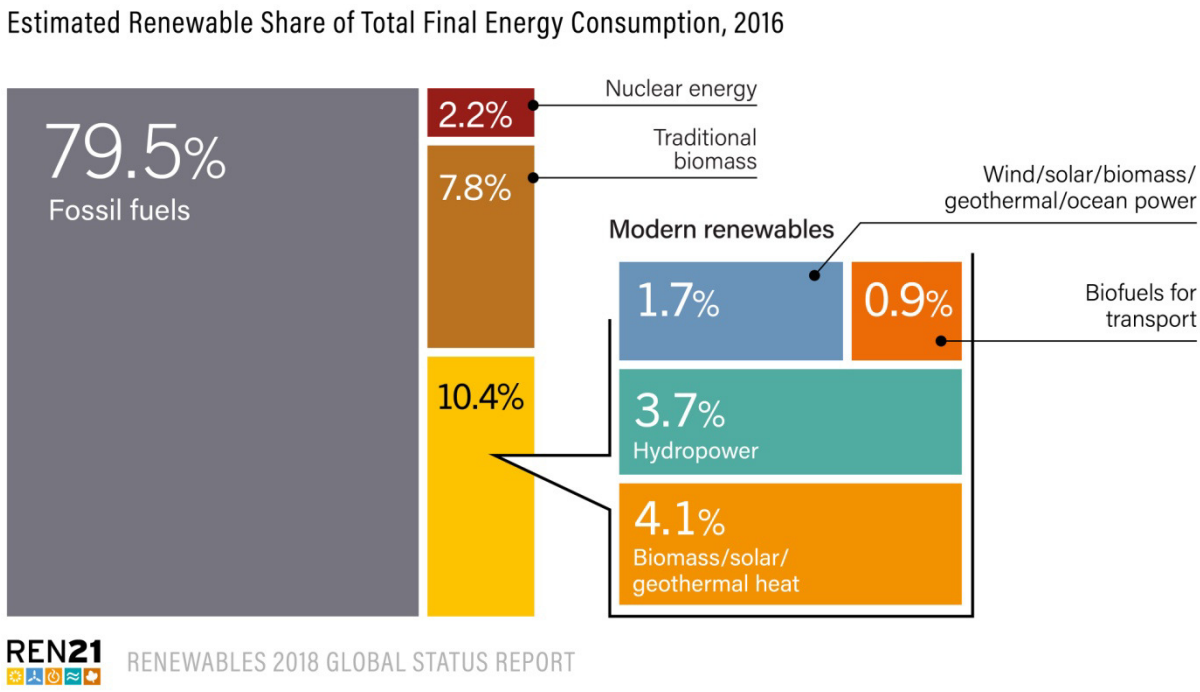
Rising international fuel prices, growing demand for energy and concerns about global warming are the key factors driving the increasing interest in renewable[2] energy sources (Rosegrant et al., 2006). Renewable technologies for power generation, heating and cooling, as well as transportation are considered the key tools for advancing multiple policy objectives including boosting of national energy security and economic growth; creating jobs; developing new industries; reducing pollution from carbon emissions; and providing affordable and reliable energy for all citizens instead of having to rely on costly and ever-depleting fossil fuels (REN21, 2018). Renewable energy is defined as energy that comes from resources which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, waves and geothermal heat (Omar et al., 2014). The shifting to renewable energy can help us meet the dual goals of reducing greenhouse gas emissions, thereby limiting future extreme weather and climate impacts; and ensuring reliable, timely, and cost-efficient delivery of energy. Investing in renewable energy can have significant dividends for our energy security (Omar, et.al, 2014). Therefore, there is considerable interest within the international community in the socio-economic implications of moving society towards a more widespread use of renewable energy resources. Renewable energy replaces conventional fuels in four distinct areas: electricity generation, hot water/space heating, motor fuels, and rural (off-grid) energy services (REN21, 2010).

The world over, renewable energy sources are beginning to be accepted not only for their easier availability compared to fossil fuels, but also their positive impact on global warming and climate change. Renewable technologies for power

[2] Renewable energy is generally defined as energy that comes from resources which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, waves and geothermal heat (Omar et al., 2014).

generation, heating and cooling, and transport are considered key tools for advancing multiple policy objectives of countries going through various stages of economic development. Renewable energy markets have been growing rapidly over the last few years. The deployment of established technologies, such as hydro-power turbines as well as newer technologies such as wind and solar photovoltaic (SPV) plates has spread quickly, which has increased confidence of the users in these technologies; reduced the costs of production of equipment by bringing in the economies of scale; and opened up opportunities for new entrepreneurs in the market. It is estimated that global electricity generation from renewable energy sources could grow by 2.7 times between 2010 and 2035 (Omar et al, 2014).

Fig 1.1: Energy Resources of the World (2016)

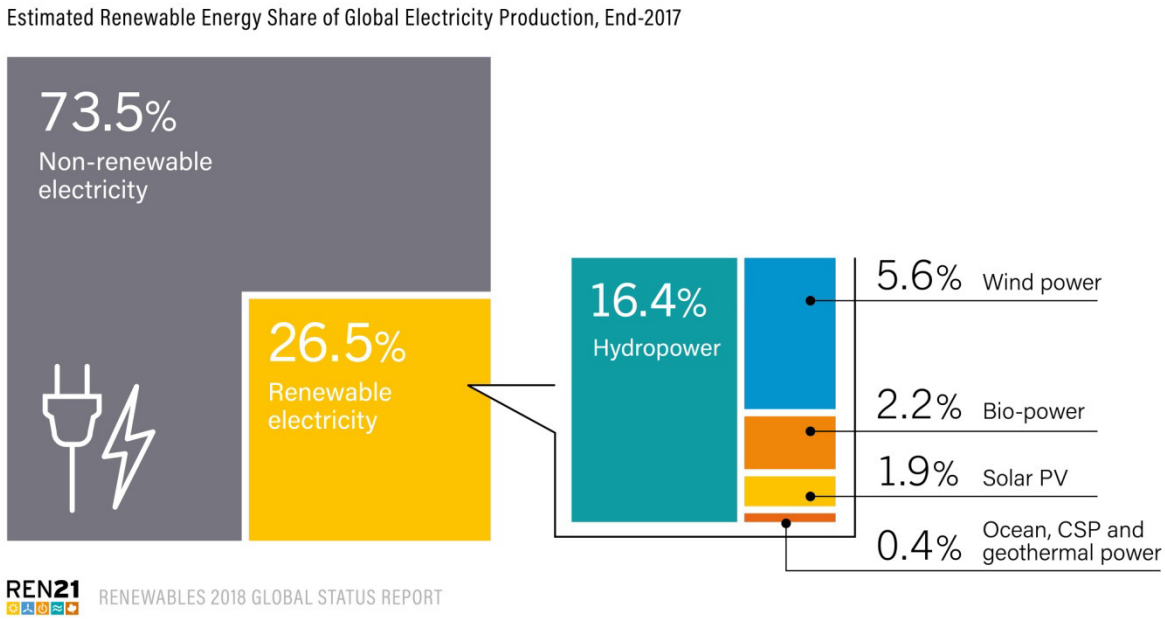


Source: REN21 (2018).

Renewable energy resources are innovative options for electricity generation. Their potential is enormous as they can, in principle, meet the world's energy demand many times over. Despite rapid expansion of capacity for renewable energy generation as well as the output of equipment such as solar photovoltaic (PV) panels as well as wind turbines, fossil fuels continue to supply an

overwhelming proportion of total consumption of energy in the world (REN21, 2018). On the other hand, renewable energy produced from traditional renewable sources of energy such as burning of biomass and large hydropower plants; as well as 'new' renewable sources such as small hydro-power plants, modern 'biomass', wind, solar, geothermal, and biofuels; together supplies only about 11 percent of the total energy consumed in the world (see, Fig. 1.1) while renewable energy share of global electricity production was 26.5 per cent (Fig. 1.2).

Fig 1.2: Renewable Energy share of Global Electricity Production, 2017



Source: REN21 (2018).

1.3 Renewable Energy Scenario in India

Way back in 1980, India was the first country in the world to set up a Ministry of Non-conventional Energy Resources. Over the years, renewable energy sector in India has emerged as a significant player in enhancing the grid-connected power generation capacity. In doing so, it also supports the government's agenda of sustainable growth, while, emerging as an integral part of the solution to meet the nation's energy needs an agent for improving the access to energy for a vast section of the population and the economy. It is evident that renewable energy would have to play a much deeper role in achieving energy security in the coming years as an integral part of the process of planning to fulfill energy needs.

The core drivers[3] for development and deployment of new and renewable energy in India have been as follows:

(a) ***Energy Security*:** At present around 69.5 per cent of India's power generation capacity is based on coal. Besides, it faces an increasing dependence on imported oil, which amounts to around 33 per cent of India's total energy needs.

(b) ***Electricity Shortages*:** Despite an increase in installed capacity by more than 113 times in the sixty five years since independence, India is still not in a position to meet its peak electricity demand as well as energy requirements.

(c) ***Energy Access*:** India faces a challenge to ensure availability of reliable and convenient and good quality of energy supply for all its citizens. Almost 85 per cent of rural households depend on burning of bio-mas for their cooking needs and only 55 per cent of all rural households have access to electricity. However, even with this low access, most rural households face issues with quality and consistency of energy supply. Shortage of supply of electricity gives rise to large-scale use of kerosene which in turn leads to a continuously increasing burden of subsidies on imported crude oil; dependence on imports for the same and consequently, a constant pressure on foreign exchange reserves.

(d) ***Climate Change:*** India has undertaken a voluntary commitment of reducing carbon emissions up to that which prevailed in year 2005 by the year 2030 (a reduction of about 30-35 per cent). In the recently concluded 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) held at Paris, India committed to achieve a target of installing 40 per cent of its capacity of cumulative electricity generation from non-fossil fuel based energy resources by the year 2030 with the help of transfer of technology and low cost international finance; including that from the Green Climate Fund (GCF).

One of India's major advantages today and going forward is that its renewable energy (RE) potential is vast and largely untapped. India has an estimated renewable energy potential of about 900 GW from commercially

[3] https://mnre.gov.in/file-manager/annual-report/2015-2016/EN/Chapter%201/chapter_1.htm

exploitable sources viz. Wind – 102 GW (at 80 meter mast height); Small Hydro – 20 GW; Bio-energy – 25 GW; and Solar power-750 GW, assuming that 3 per cent of wasteland would be made available for this purpose (see, Annexure II).

India is geographically, a very diverse country. Renewable energy sources in India are not equally well distributed. While solar and biomass are distributed more or less evenly and could be harnessed in almost all Indian states; wind energy sources, although abundant, are concentrated only in a few states in southern and western India. Even for solar energy generation and supply of biomass for the generation of power, the availability of land might be a cause of concern for a few states, though not so much for the others.

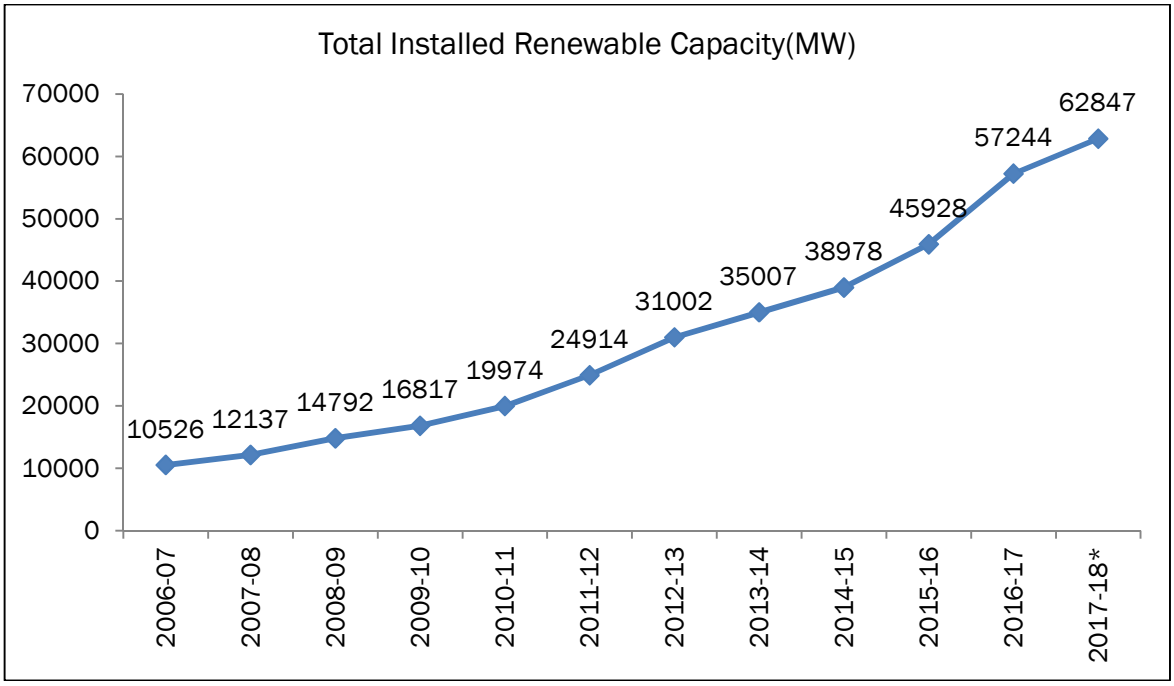
Recent estimates show that India's solar potential is greater than 750 GW and its announced wind potential is 302 GW (the actual could be higher than 1000 GW). The potential of biomass and small-hydro power projects is also significant. India Energy Security Scenarios 2047 show a possibility of achieving a high of 410 GW of wind and 479 GW of solar PV by 2047[4]. Thus, renewable energy has the potential to anchor the development of India's electricity sector. The Ministry of New and Renewable Energy (MNRE), Government of India (GOI) is in-charge of developing sources of renewable energy in India. The Ministry has been facilitating the implementation of broad spectrum programs including harnessing renewable power; promoting the use of renewable energy in rural areas for lighting, cooking and transportation; use of renewable energy in urban, industrial and commercial applications; as well as development of alternate fuels and applications. It has targeted for increasing solar power capacity to almost fifteen times the level of 2016 by year 2022. India is a major participant in the International Solar Alliance of 120 countries of the world that aim to develop solarization in power sector (GoI, 2015-16, "Annual Report, MNRE).

The growth in solar power capacity achieved during 1999-200 to 2015-16 is presented in Figure 1.3. As of October 31, 2018, India's overall installed capacity for power generation has reached 346.048 Giga Watt (GW); of which, renewable energy sources account for 72.013 GW i.e. (20.8 %)[5]. Out of the total

[4] https://niti.gov.in/writereaddata/files/writereaddata/files/document_publication/report-175-GW-RE.pdf
[5] See Annexure III (https://powermin.nic.in/en/content/power-sector-glance-all-india).

power generated through renewable sources, around 49 per cent came from wind, while around 32 per cent was generated through solar energy. It is worth noting that hydro-electricity generation is treated separately and falls under the purview of the Ministry of Power (MOP) and not under the MNRE. In keeping with the stress laid on harnessing and development of renewable energy sources, the Ministry of Power, GoI, has also announced that no new coal-based capacity addition is required after the year 2027. The figures presented in Table 1.1 refer to newer and fast developing renewable energy sources and are managed by the Ministry for New and Renewable Energy (MNRE). In addition, as of 31st March 2018 India had 45.29 GW of installed large hydro capacity which comes under the ambit of Ministry of Power. As mentioned earlier, government of India intends to achieve 40 per cent cumulative electric power capacity from non-fossil fuel sources by 2030 (MNRE, 2017).

Fig. 1.3: Total Installed Renewable Capacity (MW), 2006-07 to 2017-18



With electricity being a concurrent subject, power sector planning occurs at both the Central level and State levels, not always in a cohesive manner. Apart from this, the power distribution utilities (DISCOMS) in various States are already grappling with issues such as power theft and mounting losses, so as to have little

inclination for managing the variations associated with the intermittent output of wind and solar power. Renewable energy can offer enormous benefits to the nation as a whole, eventually benefiting the States as well. Sharing of energy resources between States could make things easy, quick and cost-effective for them. It has been well-established internationally, that a smooth integration and management of energy supply reduces to some extent, the overall variability of power supply from renewables. Hence, the energy policy needs to be designed in a manner such that it empowers the States so that they could leverage their investments in the energy sector by multiple times by way of quick, large-scale and planned deployment of renewable energy generation. National Institution for Transforming India (NITI, 2015) in its report highlighted some of the challenges and possible policy interventions (Box 1.1).

Table 1.1: Installed Grid Interactive Renewable Power Capacity (excluding large hydropower) in India as of 31st March 2018 (RES MNRE)

Sr. No.	Source	Total Installed Capacity (MW)	2022 target (MW)
1	Wind power	34,046	60,000
2	Solar power	21,651	100,000
3	Biomass power	8,701	
4	Biomass & Gasification and Bagasse Cogeneration	114.08	*10,000
5	Waste-to-Power	138	
6	Small hydropower	4,486	5,000
	Total	69,022	175,000

Note: * The target is given for "bio-power" which includes biomass power and waste to power generation.
Source: Renewable energy in India - Wikipedia.html accessed on December 20, 2018.

1.3.1 Solar Energy in India

Of all the sources of renewable energy, the most suitable in the Indian context is solar energy. Situated close to the Tropic of Cancer and enjoying sunny days for close to about 300 days in a year in most regions, India could have an obvious opportunity to become the hot-bed of solar energy. With about 300 clear and sunny days in a year, the calculated solar energy incidence on India's land area is about 5000 trillion (kWh) per year (or 5 EWh/yr). The solar energy available

in a single year exceeds the possible energy output of all of the fossil fuel energy reserves in India. The daily average solar power plant generation capacity in India is 0.20 kWh per m^2 of used land area, equivalent to 1400–1800 peak (rated) capacity operating hours in a year with available technology that is also commercially viable. The Indian government is aggressively promoting solar energy generation. It had announced an allocation of ₹1,000 crore (US$160 million) for the Jawaharlal Nehru National Solar Mission (JNNSM) and a clean-energy fund for the 2010-11 fiscal year, an increase of ₹ 380 crore (US$60 million) from the previous budget. The budget 2010-11 had encouraged private solar companies by reducing the import duty on solar PV panels by five percent which is expected to further reduce the cost of a rooftop solar-panel installation by 15 to 20 percent. The Union government had reduced the solar PV panel purchase price from the maximum allowed ₹4.43 (6.9¢ US) per KWh to ₹4.00 (6.3¢ US) per KWh, reflecting the steep fall in the cost of solar power-generation equipment. The applicable tariff is offered after applying viability gap funding (VGF) or accelerated depreciation (AD) incentives. At the end of July 2015, the major incentives offered were as follows: i) Scheme of accelerated depreciation under which, if an enterprise installs a rooftop solar power generation system, 40 percent of the total investment could be claimed as depreciation in the first year itself. This would reduce the total tax liability of the firm; ii) Provision of subsidy (initially 30% and subsequently reduced to 15%) on capital expenditure for installing rooftop solar-power plants up to a maximum of 500 kW and iii) Tradeable RECs (Renewable Energy Certificates) provided for every unit of green power generated by the firms as a supplementary source of income for them.

Financial incentives are based on the measurement of power produced by way of installed meters on the premises. Besides, the government provides a guarantee of assured Power Purchase Agreement (PPA) to the firms producing solar power. This is done via the power-distribution and purchase companies owned by State and Central governments. The PPAs offer a price equal to that of the peaking power on demand for the solar power. It also has an added advantage of an intermittent yet more reliable source of power supply to the producer firm itself for its own use on a daily basis.

Box 1.1: Major barriers to Mainstreaming Renewables

Despite the obvious benefits, several factors have prevented the mainstreaming of renewable energy.

- Firstly, India lacks a comprehensive national policy and legislative framework for renewable energy. Existing policies and programmes are technology-specific and vary across states restricting strategic intent.
- Secondly, there is an acute shortage of willing and credit-worthy buyers of RE-based electricity. Most of our financially distressed power distribution companies (Discoms) and also the bulk purchasers of power have held back from buying expensive power (whether conventional or renewable-based) thus confining power markets. Market risks, clubbed with other economic factors, have led to high interest rates in Indian financial markets up to around 10% - 14% per annum; which is almost three times higher than that in developed economies. These high rates impact RE more than other conventional power or infrastructure. The lack of financing for RE projects is also a result of risks at multiple stages, for example buyers not paying or grid operators curtailing their operations which results in reduced enthusiasm amongst investors in these projects.
- Third major factor, also adding to the risks, is the unplanned and non-facilitated project development environment.
- Finally, inadequate and outdated grid infrastructure and operations have affected not just the renewable energy sector but the overall reliability of power supply. Placing renewables at the center of India's power system will therefore require a paradigm shift in planning and governance practices.

Source: NITI (2015).

India's solar energy insolation is about 5,000 T kWh per year (i.e. ~ 600 TW), far more than its current total primary energy consumption. In fact, India's long-term solar potential could be unparalleled in the world because it has the ideal combination of a geographical location that affords a high solar insolation as well a vast consumer base of power-deprived population. With a major section of its citizens still surviving off-grid, India's grid system is considerably under-developed. Availability of cheap solar power can bring electricity to these people almost with a minimum time-lag and bypass the need and costs of installation of expensive grid networks. Also, a major factor influencing a region's energy-use intensity is the cost of the energy consumed for controlling high temperatures

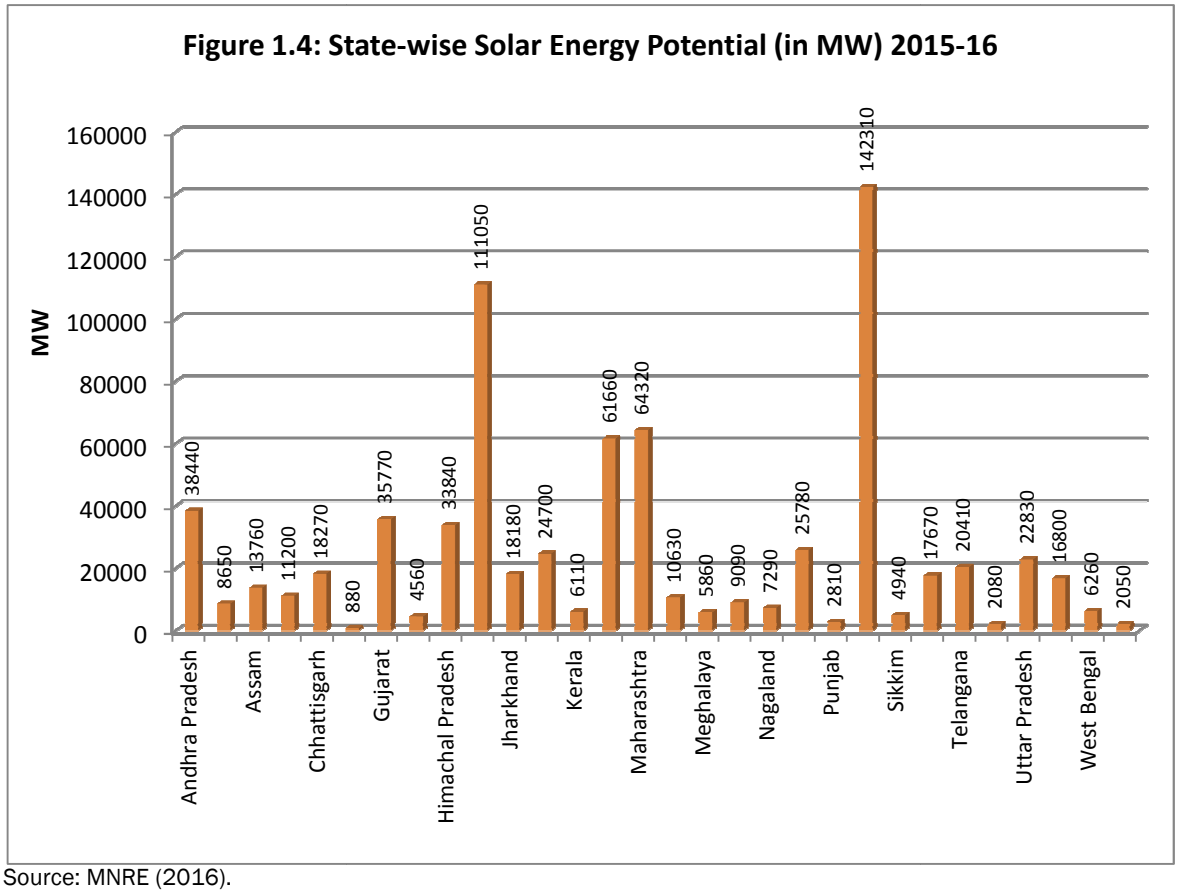
during the extremely harsh summers. However, this energy use could be turned around for free, if solar power generated during high temperature in the day time itself, could be utilized for cooling load requirements during the same period. Since the harshness of the summer coincides with the generation of solar power and in turn, the requirement of power for cooling; using solar energy for the purpose of cooling could make perfect energy-economic sense.

Installation of solar PV plants requires nearly 2.0 hectares (5 acres) land per MW capacity. This is comparable to coal-fired power plants if one considers the entire life-cycle including land for coal mining, consumptive water storage and area for ash disposal. It is also akin to the requirement of a hydro power plant if the area that is submerged under the water reservoir created on a the site is also accounted for. Solar plants of the capacity of about 1.6 million MW could be installed in India on its 1 per cent land (32,000 square km). There are vast tracts of land suitable for solar power generation in all parts of India exceeding 8 per cent of its total area which is unproductive, barren and devoid of vegetation. Part of waste lands (32,000 square km) when installed with solar power plants can produce 2400 billion kWh of electricity (two times the total generation in 2013-14) with land productivity/yield of Rs. 0.9 million per acre (3 Rs/kWh price) which is at par with many industrial areas and many times more than the best of the productive and irrigated agriculture lands. Moreover, these solar power units are not dependent on supply of any raw material and are self-sustaining. There is unlimited scope for solar electricity to replace all fossil fuel energy requirements (natural gas, coal, lignite and crude oil) if all the marginally productive lands are occupied by solar power plants in future. Thus the solar power potential of India promises to meet perennially, the requirements of its population.

As mentioned earlier, India has an estimated solar energy potential of about 750 GW, the state-wise estimated solar energy potential and installed solar capacity in the country as on 31.12.2016 presented in Figure 1.4 and Table 1.2. It indicates that Rajasthan accounted for the highest potential of 142 GW which is 19 percent of the total national potential followed by Jammu and Kashmir (15 per cent), Maharashtra and Madhya Pradesh (8-9 per cent each), Andhra Pradesh and

Gujarat (around 5 per cent each). These six states together accounted for 60 percent of total solar energy potential of the country.

Figure 1.4: State-wise Solar Energy Potential (in MW) 2015-16



Source: MNRE (2016).

The installed capacity of commercial solar thermal power plants which do not have a facility to store power; totals at about 227.5 MW in India; with 50 MW in Andhra Pradesh and 177.5 MW in Rajasthan. However, solar thermal plants with thermal storage are emerging as cheaper (US 6.1 ¢/kWh or Rs 3.97/KWh) and having a clean load, which also bring in more advantage, as they can supply electricity round the clock. They can cater the load demand perfectly and work as base load power plants when the generated solar energy is excessive on a particular day. Hence, a proper combination of solar thermal (storage type) as well as solar photo-voltaic type, could be appropriate to cater to fluctuations in load requirements throughout the day as well as in different seasons; thus limiting the need for procuring batteries for storage of power which are costlier options.

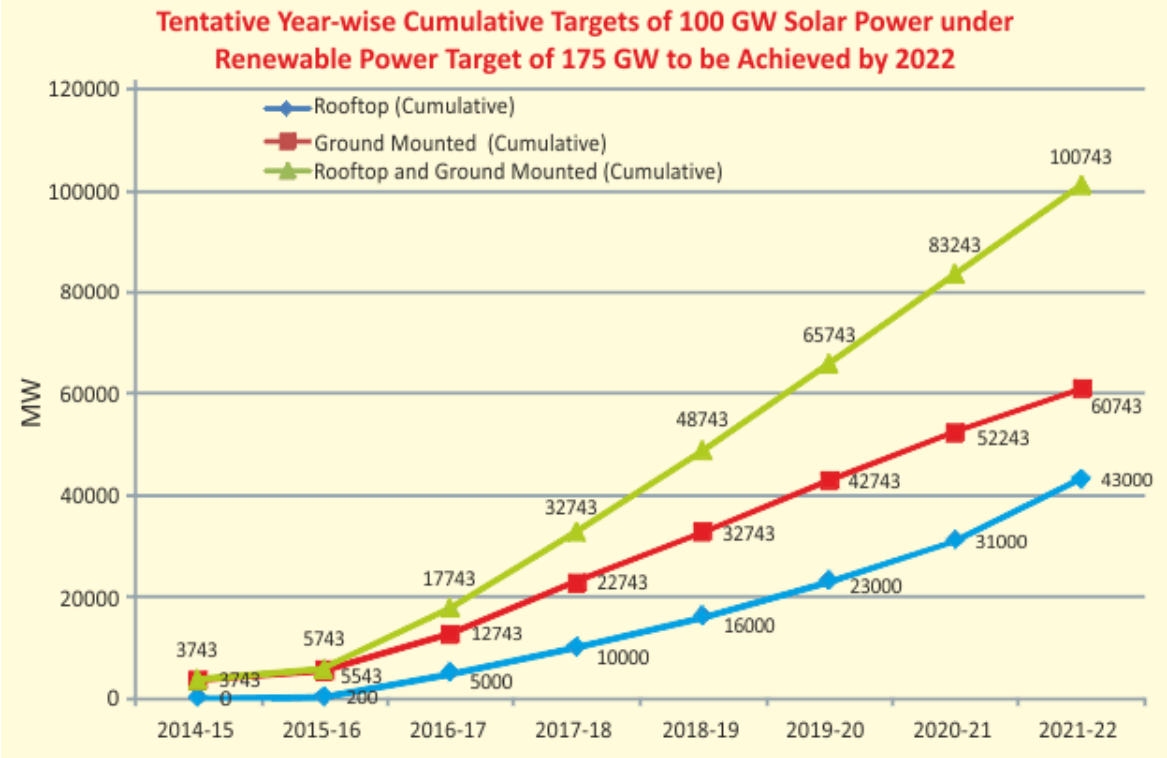
Table 1.2: State-wise estimated Solar Energy Potential vs. installed solar capacity in the Country as on 31.12.2016

Sr. No.	State/UT	Solar Potential (GWp) #		Installed Capacity (MW) as on 31.12.2016		Install capacity to Potential
		GW	% to total	MW	% to total	
1	Andhra Pradesh	38	5.1	979.65	10.9	2.58
2	Arunachal Pradesh	9	1.2	0.27	0.0	0.00
3	Assam	14	1.9	11.18	0.1	0.08
4	Bihar	11	1.5	95.91	1.1	0.87
5	Chhattisgarh	18	2.4	135.19	1.5	0.75
6	Goa	1	0.1	0.05	0.0	0.01
7	Gujarat	36	4.8	1158.5	12.9	3.22
8	Haryana	5	0.7	53.27	0.6	1.07
9	Himachal Pradesh	34	4.5	0.33	0.0	0.00
10	Jammu & Kashmir	111	14.8	1	0.0	0.00
11	Jharkhand	18	2.4	17.51	0.2	0.10
12	Karnataka	25	3.3	327.53	3.6	1.31
13	Kerala	6	0.8	15.86	0.2	0.26
14	Madhya Pradesh	62	8.3	840.35	9.3	1.36
15	Maharashtra	64	8.5	430.46	4.8	0.67
16	Manipur	11	1.5	0.01	0.0	0.00
17	Meghalaya	6	0.8	0.01	0.0	0.00
18	Mizoram	9	1.2	0.1	0.0	0.00
19	Nagaland	7	0.9	0.5	0.0	0.01
20	Odisha	26	3.5	77.64	0.9	0.30
21	Punjab	3	0.4	545.43	6.1	18.18
22	Rajasthan	142	18.9	1317.64	14.6	0.93
23	Sikkim	5	0.7	0.01	0.0	0.00
24	Tamil Nadu	18	2.4	1590.97	17.7	8.84
25	Telangana	20	2.7	973.41	10.8	4.87
26	Tripura	2	0.3	5.02	0.1	0.25
27	Uttar Pradesh	23	3.1	239.26	2.7	1.04
28	Uttarakhand	17	2.3	45.1	0.5	0.27
29	West Bengal	6	0.8	23.07	0.3	0.38
30	Delhi	2	0.3	38.78	0.4	1.94
31	UTs & Others	1	0.1	88.68	1.0	8.87
	TOTAL	750	100.0	9012.69	100.0	1.20

Notes: # Assessed by National Institute of Solar Energy; * includes 100.92 MW from other rooftop systems.
Source: http://mnre.gov.in/file-manager/annual-report/2016-2017/EN/pdf/4.pdf

The Government has up-scaled the target of renewable energy capacity to 175 GW by the year 2022 which includes 100 GW from solar, 60 GW from wind, 10 GW from bio-power and 5 GW from small hydro-power. The capacity target of 100 GW set under the National Solar Mission[6] (JNNSM) will principally comprise of 40 GW Rooftop and 60 GW through Large and Medium Scale Grid Connected Solar Power Projects (See, Figure 1.5 and Annexure IV). With this ambitious target, India will become one of the largest Green Energy producers in the world, surpassing several developed countries. The total investment in setting up 100 GW will be around Rs.6,00,000 crore. The existing solar thermal power plants (non-storage type) in India which are generating costly intermittent power on a daily basis, can be converted into storage type solar thermal plants to generate three to four times more base load power at cheaper cost without the need to depend upon government subsidies. Fig. 1.6 presents the tentative state-wise breakup of sector-wise renewable power target of 175 GW by 2022.

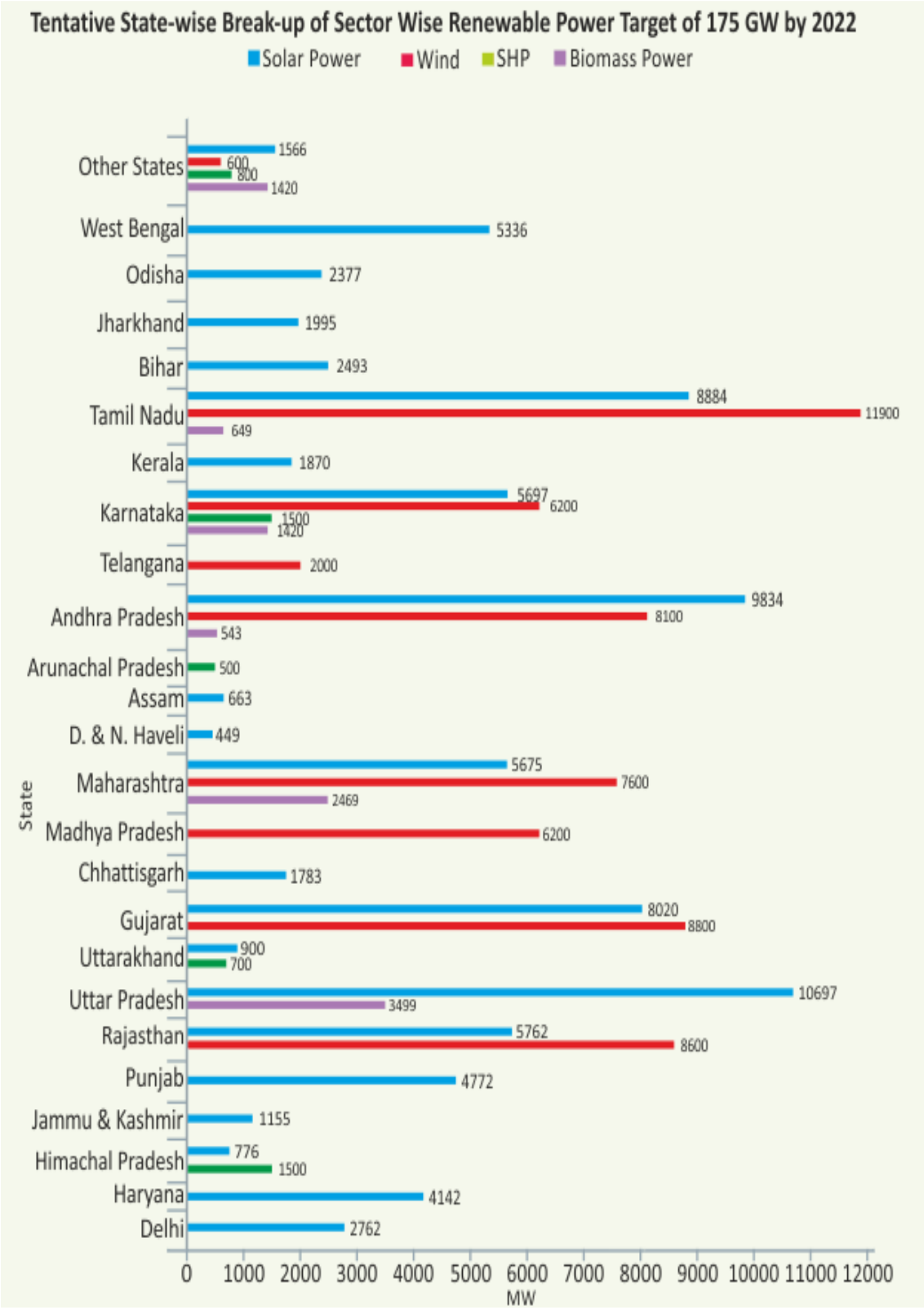
Fig. 1.5: Targeted 100 GW Solar Power under RE 175 GW by 2022



Source: https://mnre.gov.in

[6] https://mnre.gov.in/file-manager/grid-solar/100000MW-Grid-Connected-Solar-Power-Projects-by-2021-22.pdf

Fig. 1.6: Tentative State-wise Breakup of Sector-wise Renewable Power Target of 175 GW by 2022



Source: https://mnre.gov.in

1.3.2. Challenges and Possibilities

There are many challenges to the harnessing of solar energy in India as well. The per-capita land availability is low. Dedication of land for the installation of solar arrays must compete with other needs. The amount of land required for utility-scale solar power plants is about 1 km^2 (250 acres) for every 40–60 MW generated. It would be prudent to use the water-surface area on water-bodies such as canals, lakes, reservoirs, farm ponds and the sea for large solar-power plants. These water bodies could also be a ready source of water in order to clean the solar panels. Similarly, highways and railways may also avoid the cost of land nearer to load centers, thereby minimizing the cost of transmission-lines by deploying solar panels at about 10 meters above the roads or rail tracks. Solar power generated in the area covered by the roads may also be used for in-motion charging of electric vehicles or even trains, which could not only reduce their fuel costs but also waiting time for refueling and congestion on refueling stations as well as rail and road junctions. Solar panels installed on top of highways could also protect them against damage from rain and the summer heat, in turn increasing their life-span and also increasing comfort for the commuters by providing a shaded space to traverse on.

The architecture best suited to most parts of India would be a set of rooftop power-generation systems connected via a local grid. Such an infrastructure, which does not have the economy of scale of mass, utility-scale solar-panel deployment, needs a lower deployment price to attract individuals and family-sized households. Photovoltaic panels are projected to continue their cost reductions, enabling them to compete with the price of fossil fuels.

Greenpeace recommends that India should adopt a policy of developing solar power as a dominant component of its renewable-energy mix. In one scenario India could make renewable resources the backbone of its economy by 2030, curtailing carbon emissions without compromising its economic-growth potential. A study suggested that 100 GW of solar power could be generated through a mix of utility-scale and rooftop solar PV panels, with the realizable potential for rooftop solar PV panels between 57 and 76 GW by 2024. During the 2015-16 fiscal year the National Thermal Power Corporation (NTPC); with 110 MW solar power

installations, generated 160.8 million kWh at a capacity utilization of 16.64 percent (1,458 kWh per kW)—more than 20 percent below the claimed norms of the solar-power industry. It is considered prudent to encourage solar-plant installations up to a threshold (such as 7,000 MW) by offering incentives. Otherwise, substandard equipment with overrated capacity may tarnish the image of the industry as well as the resource. Alarmed by the low quality of equipment, India issued draft quality guide lines in May 2017 to be followed by the solar plant equipment suppliers which are confirming to the Indian standards.

1.4 The Energy-Irrigation Nexus & Need of Solarization of Pumps:

India relies heavily on agriculture and irrigation is used in about 48.78 per cent of India's cultivated area, while the rest relies on monsoon rain (GOI, 2018). Thus, sound and expanded irrigation is critical for improving crop production and raising yields. For over 50 years until 2010, India ranked first with the largest irrigated area in the world (Renner 2012; www.fao.org[7]). Currently, India has 26 million groundwater pump sets, which run mainly on electricity that is primarily generated in coal-fired power plants, or run by diesel generators (Pearson and Nagarajan, 2014). Irrigation pumps used in agriculture account for about 25 per cent of India's total electricity use, consuming 85 million tons of coal annually, and 12 per cent of India's total diesel consumption, more than 4 billion liters of diesel (Upadhyay 2014; SSEF, 2014).

Indian farmers and the national and sub-national government both face several challenges with regard to irrigation. Electricity in India is provided at highly subsidized low tariffs, mostly at flat rates, and this has led to widespread adoption of inefficient pumps (Desai, 2012). Farmers have little incentive to save either the electricity, which is either free or highly subsidized, or the water being pumped, resulting in wasting both. To meet the dual objective, solar powered pumps are emerging as an alternative solution to those powered by grid electricity and diesel. Diesel and electric pumps have low capital costs, but their operation depends on the availability of diesel fuel or a reliable supply of electricity. Although the government heavily subsidies agricultural grid connections, grid electricity in rural

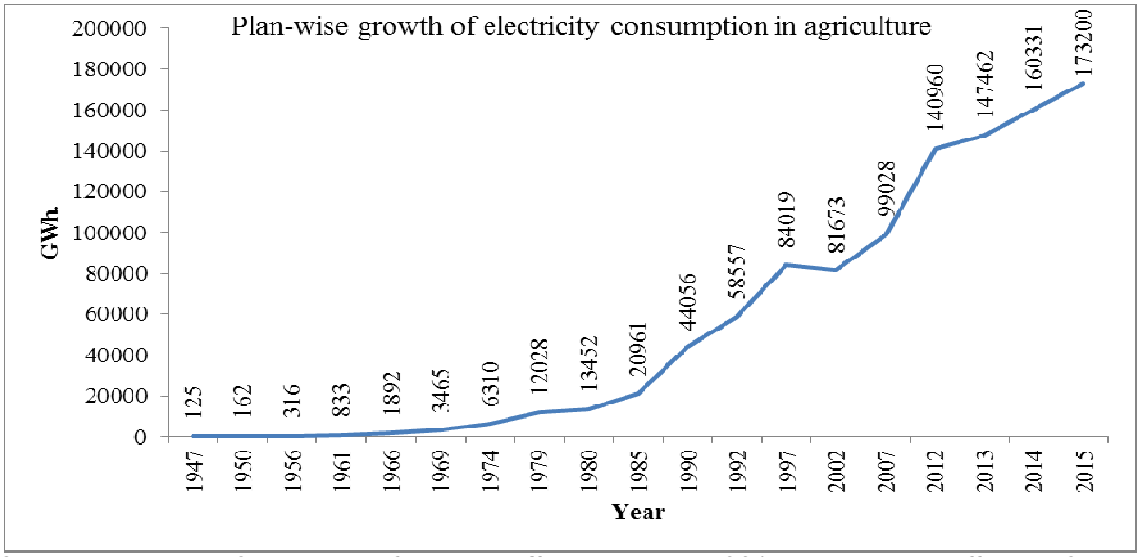
[7] http://www.fao.org/nr/water/aquastat/didyouknow/index3.stm

India is usually intermittent, fraught with voltage fluctuations, and the waiting time for an initial connection can be quite long (Banerjee *et.al*. 2015). Solar pumps provide freedom to farmers from these constraints, by giving a reliable access to irrigation on most occasions. However, some of the recent field studies have indicated that solar pumps have not been able to replace the electric or diesel pumps entirely (SKEF, 2018). For a few days in a year, farmers complement other pumps with solar pumps. Looking at the economics, the capital cost of solar pumps is high, but on a life-time cost basis, solar pumps may offer savings for farmers due to their low operating expenses.

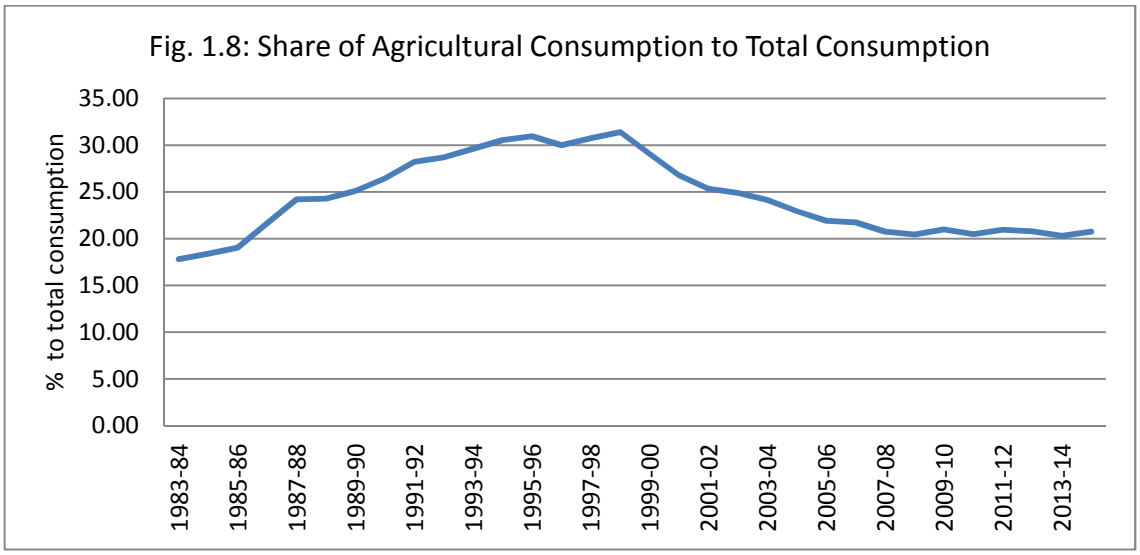
The generation of solar energy and irrigation for agriculture could be intricately related to each other. This is because India is a country that is fret with an irregular and ill-spread monsoon. Hence, irrigation is a pre-requisite for sustaining and increasing agricultural output. This is particularly true for the western states of India and especially Gujarat and Rajasthan, where rainfall is often scanty, uneven and irregular; whereas perennial rivers are few. The role of canal irrigation becomes very crucial in this scenario. However, in the absence of sufficient and reliable canal water supply, the only other option that remains with the farmers is that they irrigate their fields with the help of ground water withdrawn through either electricity or diesel-driven pumps. Provision of power for irrigation and other farm operations therefore, is a high priority area for the States. Agriculture is a State subject in India whereas water and power are on the concurrent list. Hence, along with the scarcity of water, the scarcity of power is another major issue plaguing Indian agriculture. The use of electricity in agriculture has increased significantly over the period of time from about 3 per cent of total electricity consumption in the country at the time of independence to more than 18 per cent in the year 2018 (see, Fig. 1.7 and Annexure V & VI), as availability of electricity has increased. Though share of electricity consumption had increased the highest level of 26.65 percent of total electricity consumption in 1997, it declined thereafter to around 18 per cent which may be due to low availability of electricity in relation to its demand (Fig 1.8). There is a growing demand for electrical energy for irrigation requirements in India. Electricity DISCOMS of many states have been facing acute power shortage which led to unrest among the

farmers in many states (Murthy and Raju, 2009). The highest share of use of electricity in agriculture to total consumption during 2013-14 was recorded in the state of Rajasthan (40 per cent), followed by Karnataka and Madhya Pradesh (around 33 per cent), Andhra Pradesh and Haryana (around 30 per cent), while corresponding figure for Gujarat was 22 per cent (Annexure VII).

Figure 1.7: Growth of Electricity Consumption in Agriculture



Source: High Impact Opportunities for Energy Efficiency in India (2017), India Energy Efficiency Series



Source: GOI (2018).

A complex set of factors including global warming, competitive land use and lack of basic infrastructure is creating new challenges for India's vast agrarian population. The ever increasing mismatch between the demand and supply of energy in general and electricity in particular, is posing challenges to farmers located in remote areas and makes them vulnerable to risks, especially the small

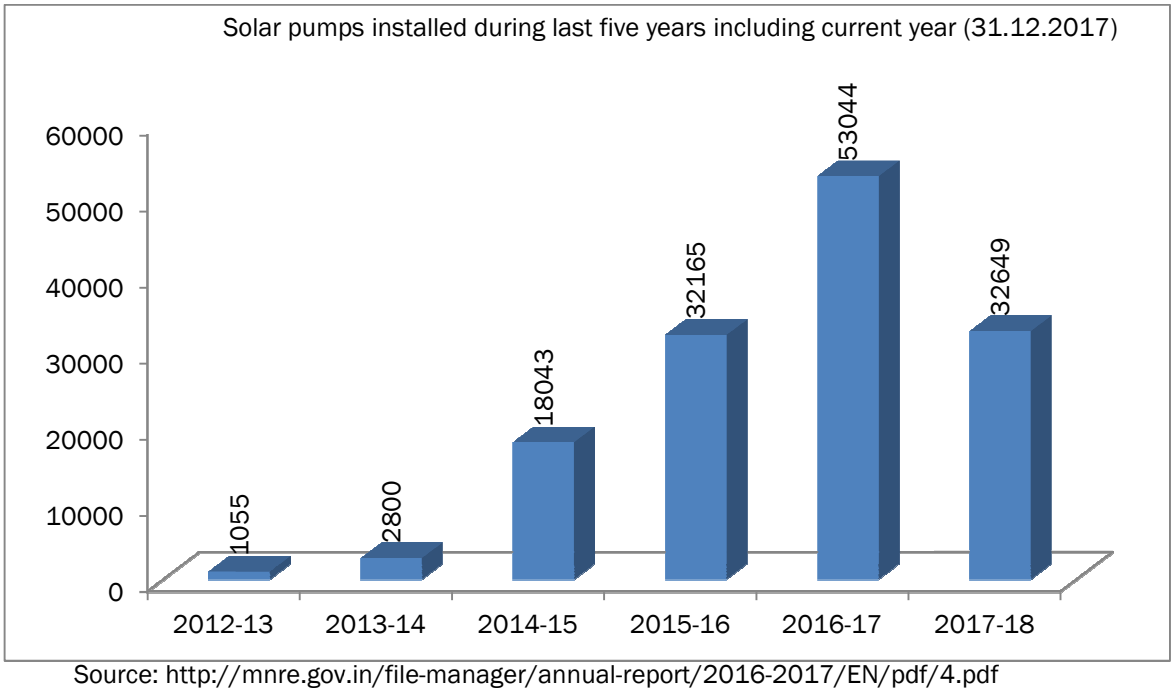
and marginal farmers. The scarcity of electricity coupled with the perpetual unreliability of monsoon is forcing farmers to look at alternate fuels such as diesel for running irrigation pump sets. However, the costs of using diesel for powering irrigation pump sets are often beyond the means of small and marginal farmers. Consequently, the lack of water often leads to damaging of the crop, thereby, reducing yields and income. In this scenario, environment-friendly, low-maintenance, solar photovoltaic (SPV) pumping systems provide new possibilities for pumping irrigation water. However, they constitute a rather unknown technical option, especially in the agricultural sector. Up till now, they have not been seriously considered in agricultural planning in the country. Despite inheriting the world's largest canal irrigation network in 1947, India today has become the world's biggest groundwater irrigation economy. However, providing farmers reliable energy for pumping is as much of a challenge as is making the availability of sufficient water. However, the high operational cost of diesel pump sets forces farmers to practice deficit irrigation of crops, considerably reducing their yield as well as income.

India currently has about 15 million electrified irrigation tube wells, with an estimated power subsidies on irrigation of about 70,000 crores (Shah *et al.,* 2016) that are responsible for the financial mess in our DISCOMs (Shah, et al., 2016). State governments dare not cut these subsidies owing to their political compulsions. Besides, the existing electricity supply is not far from sufficient, non-reliable, inferior and fluctuating in voltage and available at inconvenient hours. New electricity connections are hard to get, with a waiting list running into lakhs. In eastern India also, in spite of the abundance of ground water, the shortage of electricity supply hampers its harnessing for irrigation. As a result, a large proportion of irrigation is done through diesel-run pumps. About 9 million diesel pumps were currently being used for irrigation in India (Chawla and Agrawal, 2016). This burdens the exchequer with huge subsidies given on diesel; and also generates environmental pollution. In this scenario, solar power could be an answer to India's energy woes in irrigated agriculture. Solar power generation on the farm itself through installation of solar PV (photovoltaic) panels; and using it to extract groundwater could just be the solution for the above concerns. Solar

pumps come with a user-friendly technology and are economically viable. They are easy to use, require little or no maintenance, and run on near-zero marginal cost. Solar power is more reliable, devoid of voltage fluctuations and available during the convenient day-time. India is blessed with more than 300 sunny days in the year, which is ideal for solar energy generation, aptly supported by promotional policies of the Government of India (Chawla and Agarwal, 2016).

Solar energy, long considered ideal for home lighting uses, has suddenly become attractive for pumping irrigation water (Shah, et al., 2014). India has already some 20,000 solar irrigation pumps in fields and famers everywhere seem happy with their performance and potential (Kishore et al, 2014; Tewary 2012). Solar water pumping systems constitute a cost-effective alternative to irrigation pump sets that run on grid electricity or diesel. Solar Photovoltaic (SPV) sets constitute an environment-friendly and low-maintenance possibility for pumping irrigation water. Studies estimate India's potential for Solar PV water pumping infrastructure to be between 9 to 70 million solar PV pump sets, corresponding to at least 255 billion liters/year of savings of diesel (HWWI, 2005). The government has acted positively in this matter and during the period 2012-13 to 2016-17 considerable progress ha s been made in installation of Solar Pumps (Fig 1.9).

Figure 1.9: Solar Pumps installation during 2012-13 to 2017-18



Source: http://mnre.gov.in/file-manager/annual-report/2016-2017/EN/pdf/4.pdf

1.4.1 Understanding the Economics of Solar Pumping[8]

The comparison between the solution offered by way of solarized irrigation vis-à-vis the conventional solutions depends on a number of factors, including

1. Initial capital costs (type and size of system, cost of shipping and installation);
2. Recurring costs (e.g. costs relating to operation and maintenance, labour and fuel);
3. Assurance of economic benefits (e.g. fuel savings, yield increase) to the users; and
4. Current expenditure on the provision of energy

A number of studies have assessed the economics of solar irrigation. The comparability of results is limited due to differing contexts, methodologies and cost assumptions. However, across the literature, there is an emerging consensus that solar based irrigation offers substantial economic benefits. In India, several studies point out the competitiveness of solarized irrigation compared to diesel-powered irrigation under a variety of conditions. Similar evidence is also available from Bangladesh, Benin, Chile, Egypt, Kenya, Zambia and Zimbabwe of the about the competitive costs of solarized irrigation as compared to irrigation through conventional sources. Indeed, subsidies offered for electricity and fuel affects their price in such as way that their cost to the consumer is affected, if comparable amount of subsidy were to be offered in solarized irrigation as well. The cost calculations stand to change drastically. While analyzing the economics of solar irrigation, two key aspects need to be examined:

1. Costs and benefits of solarized irrigation vis-à-vis irrigation from other sources should be considered; not only for the farmers but also to the government exchequer (Box 1.2). In the case of grid-connected pumps in particular, non-cost-reflective power tariffs distort the attractiveness of solar pumping solutions for farmers, although governments are increasingly recognizing the long-term economic benefits that can be gained from switching over the existing or new grid-connections for agricultural pumps into solarized irrigation pumps.

[8] Based on *www.energetica-india.net/download.php?seccion=articles&archivo...pdf*

Box 1.2: Cost Benefits of Solar Pumping

Farmers	*Governments*
• Supply of energy and improved access to water for irrigation • Improved crop yields and increased incomes • Reduced manual work and saving of time which could be used more productively • Enhanced crop resilience and food security • More income generating opportunities by combining crops of staple foods with high-value crops • Self-sufficiency in the matter of electricity for household use • Additional benefits for health, education and poverty alleviation; especially with respect to women	• Reduction in electricity and fuel use • Savings of payment of subsidies • Reduced fuel imports; savings of foreign exchange • Creation and development of employment in small or medium land-holdings, trade and businesses across the value chain • Improved reliability of power systems • Increased agricultural output for the population • Reduction in carbon emissions • A step towards resisting climate change

2. Different scales of farming (commercial, smallholder and subsistence) as well as existing irrigation practices (grid-connected, fuel-based and rainfed) need to be considered. The competitiveness of solarized irrigation could vary as farmers with smaller landholdings may adopt smaller, less capital-intensive irrigation options, such as petrol-diesel based pumps or they may also opt to pay for irrigation services purchased from others instead of investing to create the same on their own.

1.4.2 Recognizing the Environmental Impact

India uses more than 4 billion litres of diesel and around 85 million tons of coal per annum to support water pumping for irrigation. Solar irrigation has a substantially lower environmental footprint compared to traditional options. The potential environmental advantages from solar pumping, compared to conventional methods, is impressive. In India, it is estimated that 5 million solar pumps can save 23 billion kilowatt-hours of electricity, or 10 billion litres of diesel. This translates into an emissions reduction of nearly 26 million tonnes of carbon dioxide. Installing 50,000 solar irrigation pumps in Bangladesh could save the country 450 million litres of diesel and reduce emissions by 1 million tonnes of CO

per annum. Thus, solarized irrigation offers an opportunity to achieve sustainable development through a reduction in carbon emissions a resilience against climate change (see, Box 1.3). This makes it a preferred contender for financing under the theme of meeting the challenges of climate change. For instance, the solar irrigation programme of Bangladesh IDCOL is supported by the World Bank under the Bangladesh Climate Change Resilience Fund. Similarly, the Nordic Climate Facility has provided funding for solar powered irrigation to farmers in Benin (Nordic Development Fund NDF and Nordic Environment Finance Corporation).

Box 1.3: Summary of Benefits and Impacts of Replacing Conventional Pumps with Solar

Benefits from replacing 1 million diesel pumps with solar pimps		**Impacts**
Reduction of diesel use	9.4 billion liters of diesel use over life cycle of solar pumps	Environmental
Subsidy savings	USD 1.26 billion (INR 84 billion) in diesel subsidy savings[9] over life cycle of solar pumps	Economic
Emission reduction	25.3 million tons of CO_2 emission abatement over life cycle of solar pumps	Environmental
Foreign exchange savings and relief of current account deficit	By reducing diesel imports, USD 300 million savings annually, USD 4.5 billion over pump life	Economic
Benefits from replacing 1 million electric pumps with solar pumps		impacts
Reduction of electricity use	Up to 2,600 million units of electricity, to relieve the overburdened old power grid	Economic and Environmental
Subsidy saving	USD 450-525 million (INR 30-35 billion) savings in farm power subsidies[10]	Economic
Emission reductions	2.5 million tons of CO_2 emission abatement	Environmental
Benefit agricultural output from installing 1 million solar pumps		**Impacts**
Improvement in crop yields[11]	10% increase in crop yields or USD 300 million (INR 20 billion) annually, USD 4.5 billion (INR 300 billion) over the pump lifetimes	Economic
Other Impacts of solar pumps		
Boosting relevant industry	Development of solar pump market and technology advancement	Economic
Job creation	Creation of small businesses/ employment across the value chain	Economic

Source: Shim (2017), Global Green Growth Institute, Seoul.

Looking forward, the global market for solar pumps is expected to reach over 1.5 million units by 2022 compared to approximately just 1,20,000 units in 2014. This means an increase of nearly twelve-fold in the market size. Reaching such a scale of deployment will require substantial efforts in order to develop an enabling environment in terms of policy support as well as fiscal measures that enable the strengthening of forward and backward linkages in the market.

1.5 Brief Review of Literature

Literature suggests that application of solar energy in irrigation could have myriad benefits. The primary benefit is that it is 'free'. However, the generating apparatus comes with high initial fixed costs like that of capital equipment, costs of installation, depreciation, interest, protection from theft, vandalism etc. Nevertheless, the marginal costs are indeed 'near zero' (operation, maintenance, repairs). The costs of expansion in irrigated area like that of hose pipes for transporting water across fields is also much lesser compared to operating a diesel pump or getting another electricity connection. Hence, solar pumps could not only provide cheaper irrigation but also expand irrigated area and thus increase the returns on agriculture. It could also extend the farming beyond the kharif season (monsoon); by harnessing ground water and thus aid the diversification of crops.

Solarization could also unshackle the farmers from the shortage of electricity supply and its inconvenient timings. They would be able to irrigate not only their own land, but also become irrigation service providers to their neighbouring farmers and also supplementing their own incomes in the process. Solarized pumps could promote conjunctive irrigation by promoting ground water extraction in flood-prone regions like north Bihar, coastal Orissa, north Bengal, Assam and eastern Uttar Pradesh (Shah and Kishore, 2012).

The Government of Rajasthan (GoR) began an aggressive promotion of solar irrigation pumps, offering a subsidy of as much as 86 per cent for the adopters. Governments of Bihar and West Bengal also rendered active support for supplying solar pumps to small farmers (Shah and Kishore, 2012).

Solar pumps enable the farmers to make immediate and visible savings on diesel costs (Tewari, 2012). Besides, solar pumps require less monitoring than diesel pump-sets, which makes the former a labour-saving option too. Tewari (2012) attributed the success of solar pumps in northern Rajasthan to the presence of the well-developed canal network, due to which there was already a prevalence of *diggies* (farm ponds) in the area; from which, low-lift pumping could be effectively done through solar pumps.

Shah et al., (2014) studied Karnataka's *Surya Raitha* policy that offers a guaranteed buy-back of surplus solar power from solar irrigation pump (SIP) owners at an attractive price, on the lines of Germany, Japan, Italy and California. Rooftop solar power generation for self-consumption as well as evacuation of the surplus power to the grid is rapidly emerging as a solution for providing electricity for irrigation as done in India (Gambhir et al., 2012). Surya Raitha scheme of Karnataka is to target several goals at one go i.e. improving agrarian livelihoods by providing farmers with a supplementary source of cash incomes for "growing" solar energy much in the same way as any other cash crop; and at the same time conserving the environment through a built-in incentive to conserve groundwater and energy use in pumping. Most importantly, it would enhance the quality of irrigation by providing farmers with a reliable and uninterrupted power supply during the convenient daytimes. It would also have a long term and much larger impact of reducing the carbon footprint of ground water irrigation done with the help of electricity or diesel-run pumps. As a positive side-effect, it could also improve strained finances of the state-run power distribution companies by reducing the burden of agricultural power subsidies. Thus Surya Raitha was expected to produce win-win outcomes for all the stakeholders of the ground water socio-ecology and farm economy. The present policy incentivises farmer against wastage of solar power or overuse of groundwater. The Surya Raitha scheme would pay them for the power produced by them and thus lead to the conservation of both solar power as well as the ground water pumped with it. With a net-metered SIP along with a guaranteed buy-back of surplus solar power, the farmer owning the SIP would now tend to use ground water sparingly, for which he would be encouraged to opt for micro-irrigation technology, At the same time, in order to

meet the high costs of installation of SIP as well as micro irrigation system, he would be compelled to choose a crop-mix that brings high returns, i.e, highly productive or high-value crops.

In parts of western and southern India which are not only electricity-scarce but also water-scarce, Shah and Kishore (2012) advocate small farmers to form decentralized cooperative networks of solar power producers. These cooperatives could enable the farmers to not only fulfill their own energy needs through solarized irrigation but also gain supplementary income by selling their surplus in a joint manner. They could become economically viable if the state-owned electricity discom were to guarantee a buy-back of solar power from them. Mishra *et al.,* (2016) also concluded that the off-grid power production in India could be successful only if it is accompanied by policy support, local accountability mechanisms, proper selection of technology and scale of intervention, and capacity building among the communities to subvert local-level conflicts and elite capture.

Apart from the implicit and realized advantages of solarized irrigation, there are concerns also. Bassi (2015) vehemently argued that solar pumps are economically unviable because they are less efficient than diesel pumps and also do not bring any net environmental gain. He also feared an increase in ground water extraction. This is due to the fact that the marginal cost of solarized irrigation is near-zero, with no incentive for farmers to save power and in turn, economize on the use of groundwater. Shah and Kishore (2012) also flag the dangers of solarized irrigation pumps that could encourage completely unrestrained ground water extraction, leading to unprecedented harmful impact on ground water tables and worsen the situation in northern and western India. They advocate the prior formation of an effective demand management regime for ground water before promoting the replacement of diesel pumps with solar pumps. They suggest that instead of allowing the farmers to generate and use solar power freely, they should be organized for collectively evacuating their surplus power into the grid of the power distribution companies. The supplementary income that accrues to them in this manner could incentivize them to economize on their own power use as well

as ground water extraction through that solar power. It could also insure them against a failed agricultural season.

Tewari (2012) observed that farmers in Rajasthan did not bother about the possible impact of solar pumps on ground water extraction because energy for irrigation and household needs was their crucial need. Kishore *et al.,* (2014) believe that solar pumps improve productivity of water only by 5-10 per cent; and also do not decrease the total volume of water use. They found that farmers were happy with the performance of solar pumps and the fact that they could get free energy for their domestic needs.

Kishore *et al.,* (2014) found that solar pumps mainly replaced diesel pumps and not electrical ones, with were accompanied by heavily subsidized or often free supply of electricity. Therefore, consumption of state-supplied electricity may not fall with the spread of solar pumps, particularly in those areas where agricultural power was non-metered (carrying a flat charge regardless of the quantum of use) and highly subsidized.

The promotion of solar powered irrigation based on a huge state-supported subsidy regime for the required capital expenditure practiced in states such as Rajasthan has been widely criticized. The Government of Rajasthan had tried to address the possible harmful impact of SIPs on ground water extraction by mandating that the subsidy on the cost of installation of SIPs could be given only to a farmer possessing a drip irrigation system as well as a farm-pond on his land. Kishore *et al.,* (2014) argued against this subsidy regime in Rajasthan by saying that the offer of a huge subsidy to the extent of 86 per cent on solar pumps was inefficient and misdirected. Bassi (2015) also raised a concern against this measure by arguing that the gains from this subsidy would accrue mainly to resource rich farmers who could meet its eligibility conditions with regard to micro-irrigation and possession of a farm-pond. Quite naturally, this would exclude those farmers who did not have the means to meet these eligibility conditions but may still be in dire need of irrigation facility. Besides, the welfare gains of this subsidy would be too little compared to the burden it would entail on the tax payers of Rajasthan State.

Kishore *et al.,* (2014) recommended that pro rata subsidy on purchase of solar pumps from a state-empanelled supplier should be discontinued. With pro-rata subsidy, neither the farmer nor the supplier had any incentive to negotiate the price or cut the costs of production. Hence, the price tended to remain sticky. Instead, if the farmer were given a lump sum subsidy, he would be free to purchase the solar pump-set from the market on the best terms that he could negotiate. There would also ensue a competition amongst supplier firms which could bring down the market price. This could also reduce the transaction costs for the State which would in turn, cut down on the total expenditure on the devolution of the amount of subsidy.

Tewari (2012) notes that empanelled firms charged prices higher than the market, while unregistered suppliers charged much lesser. In fact, if farmers purchased non-subsidized pumps on their own, they would be installed without the need to wait in a queue, go through the cumbersome formalities or bow down to corrupt practices. Moreover, the speedy installation of the SIP would bring an almost instantaneous savings on the costs of diesel costs; compensating for the subsidy that was foregone. Kishore *et al.,* (2014) suggests that if the farmers were given remunerative prices for selling the surplus power to the grid, self-investment on solar pump-sets would increase, resulting in lesser dependence on subsidies in the long run. Shah and Kishore (2012) rightly pointed out that subsidies in solar pumps would be meaningless and contradictory if they enriched supplier firms rather than farmers.

Shah, et.al (2015) estimated that one-hectare farm can generate annual gross revenue of R50,000 from field crops and Rs. 150,000 as an orchard. But if put under solar PV arrays, one hectare can generate over R1 crore/year from solar power. This revenue is free of risk from droughts, floods, pests and diseases. Moreover, growing solar power does not need seeds, fertiliser, pesticides, irrigation and backbreaking labour. All it needs is land, and farmers own half of India's land.

Gupta (2017) estimated the causal effect of solar water pumping program on water consumption, energy consumption, cropping intensity and cropping patterns of farmers in Rajasthan by conducting survey of 430 farmers from 6

districts-Jaipur, Sikar, Jaisalmer, Sriganganagar, Bikaner and Chittorgarh covering the period from 2011-12 to 2015-16. Author found that the solar pump subsidy program has increased energy and water access for solar pump adopters in Rajasthan. This has led to increase in cropping intensity, gross cropped area under fruits and vegetables, and annual profits of solar pump adopters in Rajasthan. Overall, this seems to be a good policy for enhancing food security and incomes of farmers, and reducing fossil fuel consumption of diesel and electricity consumption, which are associated with high degree of carbon emissions. Interestingly, author find that in all diesel using districts (except Chittorgarh) farmers are primarily dependent on canal irrigation and using solar pumps for distribution of water from diggi (water tank which stores canal and rain water). This implies promoting solar pumps in these areas provide win-win solution as farmer profits expand and fossil fuel consumption falls with no impact on ground water extraction. However, there is a evidence of increasing ground water extraction by small and medium farmers who have electric pumps (up to 11-13 HP) or no electric pumps in Jaipur and Sikar. Access to solar pumps enabled them to extract more groundwater and meet some amount of previously unmet irrigation water demand leading to expansion in area under cultivation and area under fruits and vegatables. Almost all solar pumps were of the size 3 HP, which is relatively small compared to the existing average electic capacity of 15 HP in Jaipur and 8 HP in Sikar. However, the extension of subsidy to larger solar pumps such as 5-10 HP could result in over exploitation of ground water in the long run in the ground water using districts as solar is free and farmers have no incentive to save water. Author advocate need innovative policies for governing ground water level in a sustainable way. There is a need for metering agriculture water use and total water extraction by farmers using solar, electric or diesel pump.

Raymond and Jain (2018) opined that connecting solar pumps to the electric grid is expensive for the government and benefits farmers lesser than subsidies for the purchase of solar pumps. The cost to the government to subsidise a 3HP stand-alone solar pump at 60 per cent, or to provide a grid connection to an existing solar pump and pay the farmer a feed-in tariff for surplus energy over 15 years is approximately equal. However, the farmer's cost under the

capital subsidy scenario is 53 per cent lesser than that in the grid-connected case, despite revenues from the feed-in tariff. Connecting solar pumps to the grid may provide some additional revenue to solar pump owners. However, they would prefer selling water using surplus energy, should there be a local demand. Equivalent revenue that a farmer can gain for such pumping service is INR 20 per kWh, which is much higher than the feasible feed-in-tariff. However, not all the surplus energy can be utilised for selling water locally, as the demand is also seasonal and intermittent. Water-as-a-service using solar pumps by village level entrepreneurs is a promising model to improve both the utilisation of solar pumps, and provide irrigation access to marginal farmers. The viability of solar pump sharing and the significance of the revenue from it remain sensitive to the timing of local irrigation needs. In areas with a dominance of diesel pumps for renting or selling water, solar-based water-as-a-service model could have a payback of two to four years. Encouraging pump sharing could be an opportunity for the government to increase the utilisation of solar pumps. It would increase the impact of government support while creating a market-based solution for efficient and judicious use of the ground water.

In light of the above, this study attempts to study the status of solarisation of agricultural pumps in selected districts of Rajasthan.

1.6 Objectives of the study:

- To study the coverage of solar irrigation pump in selected districts of Rajasthan
- To study the features and relative economics of the use of solar irrigation pumps
- To study the problems faced by the farmer in installation of solar pump
- To suggest suitable policy measures to expand solarization of irrigation.

1.7 Data and Methodology:

The study is based on both, the secondary and primary data. The secondary data pertaining to the data on coverage of solar irrigation pumps across the States and regions, details of implementing agency/cies and various schemes in

operation for the promotion of solar irrigation pumps, district-wise coverage of solar irrigation pumps, list of beneficiary farmer households under solar irrigation pump subsidy programme were collected from the nodal agency of State Government, published sources and related websites.

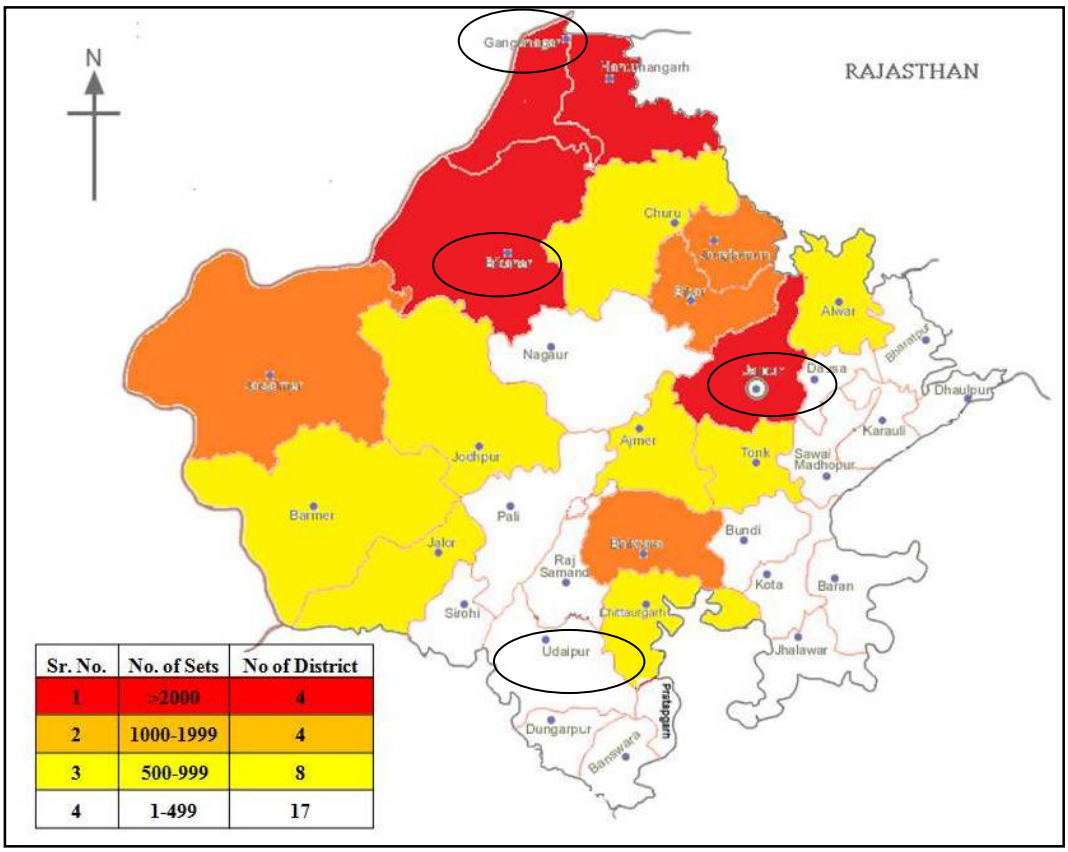
For the study, primary data were collected from randomly selected farmers from four districts from different regions of Rajasthan State with the help of structured and pre-tested schedules/questionnaires from the following categories of respondents:

- Beneficiary farmer households (BEN- farmers who had adopted SIPs with the help of subsidy by the government),
- Non-beneficiary farmer households (NONBEN- farmers who had adopted SIPs without any support in the form of subsidy by the government),
- Non-Solar user household (NSUSER- farmers who had not adopted SIPs)

1.7.1 Area of Study

The area of study was the State of Rajasthan. The four districts have been chosen from four regions of the state as they represent the characteristics of that region and are also relevant to research problem under study, i.e. solarisation of irrigation pumps (Map 1.1). Therefore, these four distinct districts in Rajasthan in the study area could capture a holistic picture of problem under study at state level. The districts were chosen as the study area as they exhibit a variety of challenges such as a scarcity of electricity connections, falling ground water tables, scarcity of rainfall and surface water structures as well as economic and social backwardness to an extent. On the positive side, these districts also present an interesting opportunity of studying the problem under consideration, since the penetration of solar irrigation technology has reached promising figures and could throw in some important lessons with regard to how could the further expansion of solarised irrigation in Rajasthan be done and what could be the constraints for the same. The selected districts were Jaipur, Bikaner, Udaipur and Sriganganagar.

Map 1.1: Solar Map of Rajasthan and Location Map of Study Districts



Sr. No.	No. of Sets	No of District
1	>2000	4
2	1000-1999	4
3	500-999	8
4	1-499	17

1.7.2 Selection of Sample Respondents

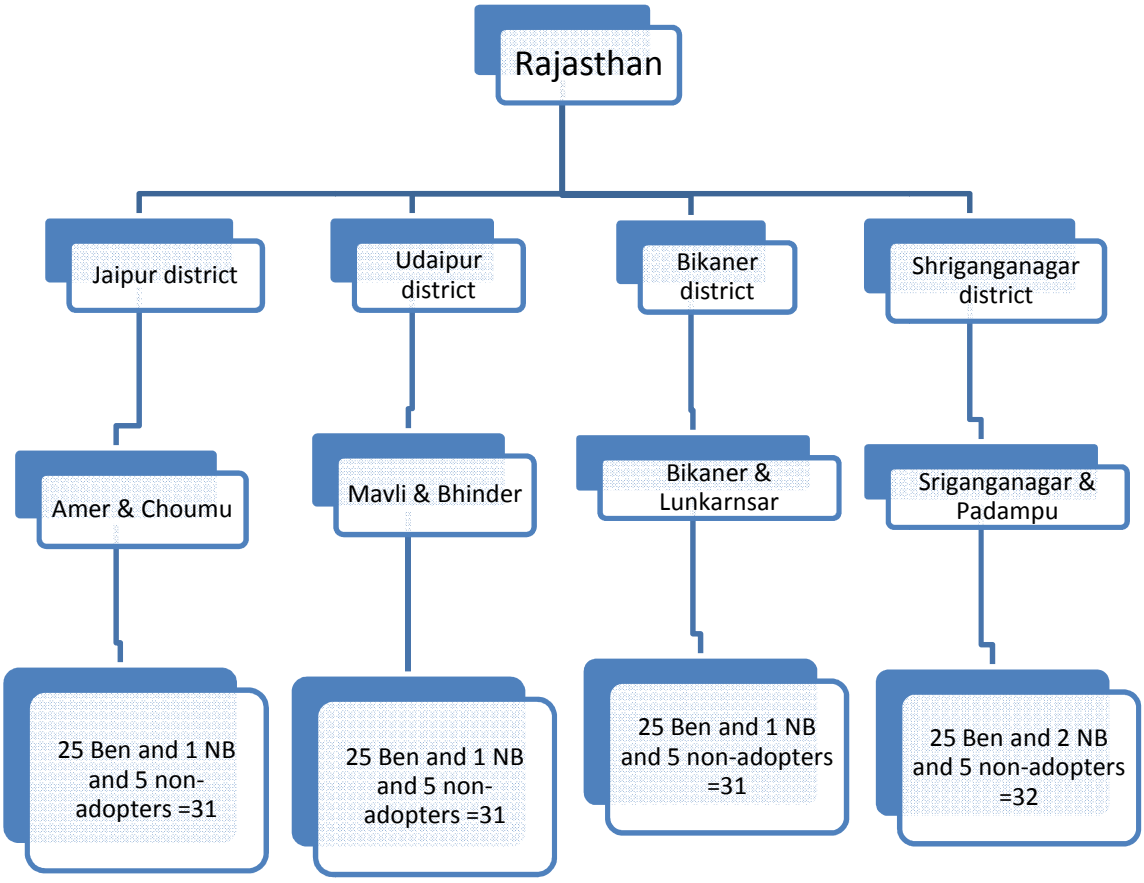
All the farmers using solarised irrigation in the selected districts were treated as the universe for this study. There exists a wide variety in the farmers using solarised irrigation in Rajasthan. Firstly, there are the obvious differences unequal land ownership and caste. Further, farmers differ in terms of source of irrigation, i.e. ground water or surface water, method of irrigation i.e. micro, lift or flood irrigation, electric-powered, diesel-powered or purchased irrigation service also, farmers in different regions exhibit different practices. Then there is a variation in terms of the cropping pattern also, across different agro-ecological zones of Rajasthan. Similarly, there is a wide variety amongst adopters of solarised irrigation in Rajasthan as they could use either AC or DC powered solar pumps, submersible or surface pumps; and also use solar pumps in conjunction with or

without micro-irrigation on their farms (see, Annexure VIII). With respect to financial costs of SIPs, many farmers have adopted subsidized solar pumps while there are also those who have purchased them at market rates without availing of government subsidy. From each of the selected region and district, villages having highest number of solar pump installations done by the most dominant service provider were selected.

Sampling Framework

As mentioned earlier, primary data were collected from the selected sample households from selected regions and districts on the basis of the sampling design described below as presented in Fig. 1.10 and Tables 1.3 & 1.4.

Fig. 1.10: Sampling Framework in Rajasthan



- Four districts from four regions of the states were selected.
- Four districts were selected from different regions/zones in order to capture holistic macro picture at the state level.
- Accordingly, Jaipur, Bikaner, Udaipur and Sriganganagar districts were selected.
- Department of Horticulture, Government of Rajasthan is nodal agency to implement the solar scheme in Rajasthan thorough JNNSM and State Recourses.
- From each district, 25 sample beneficiary households, 5 non-solar adopters were selected (every district-30 households).
- From all four districts, 5 sample households were selected who had not availed subsidy and have installed pump at own cost.
- Total sample size for the study was 125 comprised of 100 beneficiary households, 5 non-beneficiary households and 20 non-solar adopters from four districts of Rajasthan.

Table 1.3: Details on Selected Sample Households in Rajasthan state

Sr. No.	Selected District	Beneficiary farmers	Non-solar adopter	Non-beneficiary farmers	Total
1	Jaipur	25	05	01	31
2	Bikaner	25	05	01	31
3	Udaipur	25	05	01	31
4	Sriganganagar	25	05	02	32
	Total	100	20	05	125

Table 1.4: Selected Sample Villages in Rajasthan

Sr. No	District	Tehsil/Taluka	Village
1	Bikaner	Bikaner	Himatsar Hosangsar Jahanglu Pemasar Ridamlsor Purohitan Udasar Hussainsar Gairsar Nal Badi
2	Jaipur	Chomu	Anantpura Chimanpura Bhute Chomu Sandarsar Nangal Bhurda Khetroli Ghoni Bhuteda Kusalpura Chomu B Chimanpura Kacholiya Singotkala
		Govindgarh	Dodhsar
		Jhotwara	Basedi Bassi Jajda Begas Balolai Sheosinghpura
3	Sri Ganganagar	Sri Ganganagar	9Q 10Q 11Q 12Q 10QA RACP-9Z 14Z 15Z 4C Chhoti 9Z 10A
4	Udaipur	Bhinder	Kodach Bhinder Intali
		Mavli	
		Vallabh Nagar	Khokharwas Ronakui Kalipahadi Kharsan Dubhok Morjai Bansda Navania
		Badgav	Madar

1.8 Data Collection and Analysis

Personal visits were undertaken in each village and information from sample farmers was collected with the help of a structured questionnaire. The data was coded, cleaned, edited and tabulated for the purpose of further analysis. The data was analysed with the help of simple statistical measures like calculating the mean, median and mode as well as advanced tools like ANOVA as and where it was found suitable. Conclusions were drawn from the study on the basis of the research findings which were used to make policy recommendations for expanding and the area under solarised irrigation in Rajasthan state and enhancing its efficiency in terms of energy use, water use, agricultural production and productivity as well as and farmer welfare in Rajasthan; in addition to the wellbeing of the society at large through the spread of this renewable technology.

Garrett's ranking technique:

To find out the most significant factor which influences the decision of respondent, Garrett's ranking technique was used. As per this method, respondents have been asked to assign the rank for all factors and the outcome of such ranking have been converted into score value with the help of the following formula:

Percent position = 100 (Rij – 0.5) / Nj

Where Rij = Rank given for the ith variable by jth respondents

Nj = Number of variable ranked by jth respondents

With the help of Garrett's Table, the percent position estimated is converted into scores. Then for each factor, the scores of each individual are added and then total value of scores and mean values of score is calculated. The factors having highest mean value is considered to be the most important factor.

1.9 Limitations of the Study

The primary data were collected from the respondent of beneficiary, non-beneficiary and control group households. As none of the solar pumps has fitted

with meter to record solar power generation and uses system, thus exact amount of energy generated and used for irrigation could not be estimated.

1.10 Structure of the report

The present study report is divided into four chapters including this introductory chapter. Chapter I discuss in brief about the renewable energy resources at global level, renewable and solar energy scenario in India, energy-irrigation nexus & need of solarization of pumps, brief review of literature, data and methodology, limitations of the study and organsiation of report. The second chapter presents the status of solar irrigation pumps in Rajasthan highlighting the policies adopted by the government towards same. Chapter III presents the findings from the field survey data and last chapter presents summary and conclusions of the study.

The next chapter presents status of solarisation in Rajasthan.

Chapter II

Policies Supporting Solar-Powered Irrigation in Rajasthan

2.1 Introduction:

Among the various renewable energy resources, solar energy potential is the highest in the country. In most parts of India, clear sunny weather is experienced 250 to 300 days a year. The annual radiation varies from 1600 to 2200 kWh/m2, which is comparable with radiation received in the tropical and sub-tropical regions. The equivalent energy potential is about 6,000 million GWh of energy per year.[1] The National Action Plan on Climate Change also points out: "India is a tropical country, where sunshine is available for longer hours per day and in great intensity. Solar energy, therefore, has great potential as future energy source. It also has the advantage of permitting the decentralized distribution of energy, thereby empowering people at the grassroots level". With the objective to establish India as a global leader in solar energy, by creating the policy conditions for its diffusion across the country as quickly as possible Government of India launched National Solar Mission. The National Tariff Policy was amended in January 2011 to prescribe solar-specific RPO be increased from a minimum of 0.25 per cent in 2012 to 3 per cent by 2022. CERC and SERCs have issued various regulations including solar RPOs, REC framework, tariff, grid connectivity, forecasting etc. for promoting solar energy. Many States have come up with up their own Solar Policy and among all the states, Rajasthan was at forefront to adopt the supportive policy for solar power adoption.

In view of the ongoing efforts of Central and State Governments and various agencies for promoting solar energy, Ministry of New and Renewable Energy has undertaken an exercise to track and analyze the issues in fulfillment of Solar Power Purchase Obligation and implementation of Solar REC framework in India. This would help various stakeholders to understand the challenges and opportunities in the development of solar power. It would also include monitoring

[1] https://mnre.gov.in/solar-rpo

of Solar RPO compliance; analyzing key issues related to the regulatory framework for solar in various states of India.

2.2 Policies Supporting Solar-Powered Irrigation in India

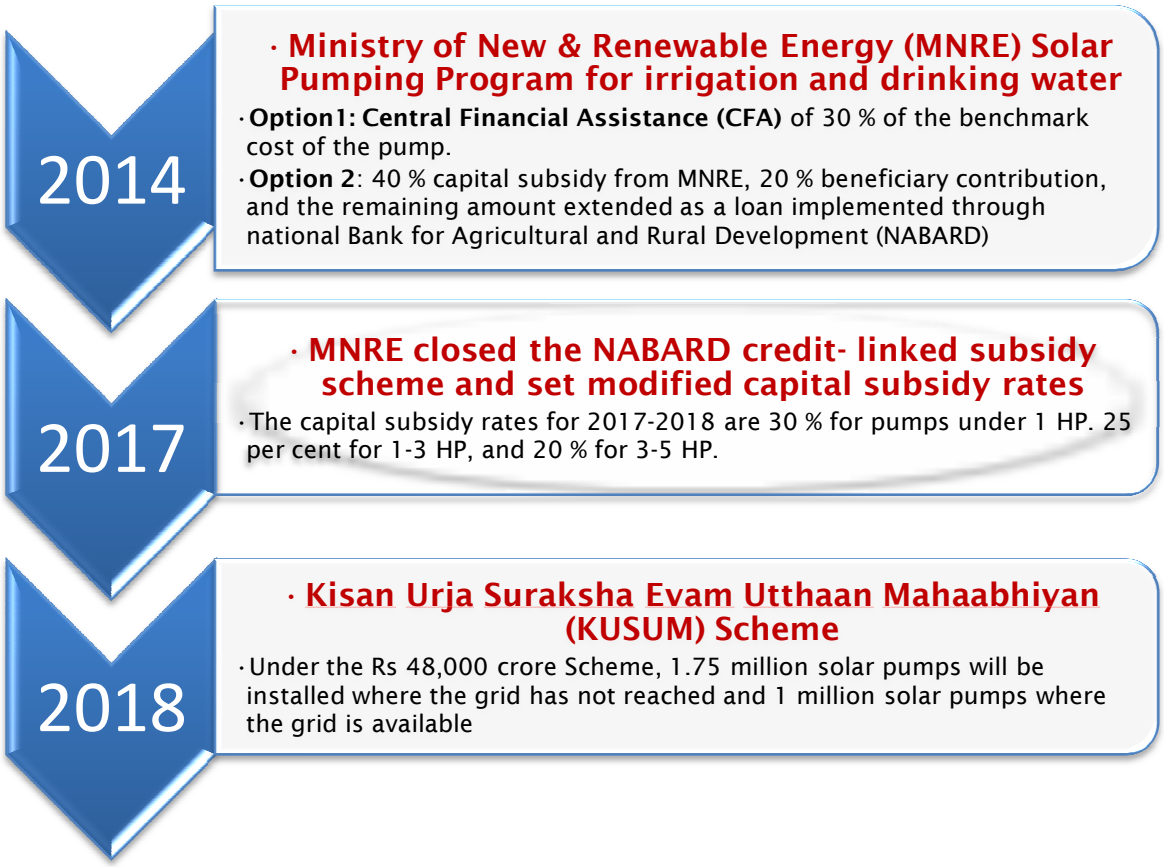
The Government of India has set ambitious targets for expanding the country's renewable energy generating capacity, and in 2010 launched the Jawaharlal Nehru National (JNN) Solar Mission. In 2014, as part of this mission, the Ministry of New and Renewable Energy (MNRE) outlined the Solar Pumping Programme for Irrigation and Drinking Water, which sought to promote the adoption of solar pumps over five years (MNRE, 2014b). Implementation of the programme involved two financing schemes.

- First, farmers received a central financial assistance (CFA) of 30 per cent of the benchmark cost of the pump, and possible additional subsidies at the state level.
- The second, credit-linked scheme, involved 40 per cent capital subsidy from MNRE, 20 per cent beneficiary contribution, and the remaining amount extended as a loan implemented through the National Bank for Agriculture and Rural Development (NABARD) (MNRE, 2014a).

The initial capital subsidy scheme aimed at supporting 100,000 pumps in 2014, and one million by 2020, and the credit-linked scheme through NABARD targeted an additional 10,000 irrigation pumps by 2016. The number of solar pumps in India is increasing, with about 130,000 pumps installed since 2014 when the scheme started, though progress is well below the goals of the subsidy programme (MNRE, 2017a). In March 2017, MNRE closed the NABARD credit-linked subsidy scheme and set modified capital subsidy rates (MNRE, 2017b). It remains to be seen whether the capital subsidy programme will prove effective in encouraging farmers to buy and use solar pumps in the long run. Demand for sustainable irrigation far exceeds current available pumping capacity, and while the Indian government has announced various initiatives to boost deployment of solar irrigation pumps (Figure 2.1), uptake has been slow. The government, to its credit, is making efforts to encourage farmers to install stand-alone solar-powered

off-grid pumps to not only meet their irrigation needs but also to provide an extra source of income from selling surplus power to distribution companies (DISCOMs).

Figure 2.1: Policies Supporting Solar-Powered Irrigation in India



Source: Ministry of New and Renewable Energy, GOI.

2.2.1 Kisan Urja Suraksha Evam Utthaan Mahaabhiyan Scheme (KUSUM)

The start of year 2018 saw the announcement of the new solar water pump scheme *Kisan Urja Suraksha Utthaan Mahaabhiyan* (KUSUM) aimed at the betterment of farmers. Under this arrangement, the central government desires to assist as many farmers as possible to install new and improved solar pumps on their farms. The farmers need not pay a hefty fee for this benefit as it comes with government subsidy. The main aim of this scheme is to provide the farmers with advanced technology to generate power. The solar pumps will not only assist to irrigate the farmers, but will also allow each farmer to generate safe energy. Due to the presence of the energy power grid, the agricultural labors can sell the extra power directly to the government. It attempts to provide them with extra income as

well. So, this scheme brings double benefits. The features of the scheme are as follows:

1. ***For the betterment of the farmers*** – The successful operation of this program will be able to help the farmers not only in meeting their power related requirements, but will also be able to earn some extra cash by selling excess energy.
2. ***Construction of plants on infertile lands only –*** The government has also announced that it will take initiative to construct plants, which will generate solar power. As per the draft, these plants will only be erected on infertile areas, capable of generating a total of 28, 250 MW power.
3. ***Distribution of solar powered pumps*** – One of the primary aims of this program is to provide interested farmers with solar pumps. The government states that 17.5 lakh solar powered pumps will be provided to agricultural labors.
4. ***Power production on small scale*** – Apart from the solar power plants, government will work towards the installation of new solar pumps in farms, which have diesel pumps. The capacity of these pumps will be 720 MW.
5. ***Power generation from tube-wells*** – The government will also work toward the installation of unique tube-wells. Each of these pumps will be able to generate power of 8250 MW
6. ***Sale of excess power*** – Apart from distribution, the scheme also provides all farmers with the chance to earn more money by installing the solar pumps. The excess amount of energy that the farmers generate can be sold to the grid.
7. ***Duration of the scheme*** – Current estimates state that for the successful completion of this elaborate scheme, the central government will have to work for at least 10 years.
8. ***Subsidy structure of the scheme*** – As per the draft, each farmer will get huge subsidy on new and improved solar powered pumps. The agricultural labors will have to tolerate only 10 per cent of the total expenditure to acquire an install a solar pump. The central government will provide 60 per

cent cost while the remaining 30 per cent will be taken care of by bank as credit.

9. ***Good for the overall environment*** – The increased use of solar power and electricity generated from the solar plants, will lower the level of pupation in the area. Dependence on fossil fuel will go down considerably as well.

The components of the scheme are as follows:

1. ***Solar pump distribution*** – During the first phase of the program, the power department, in association with other wings of the government will work towards the successful distribution of solar powered pumps.
2. ***Construction of solar power factory*** – The next component will include the construction of solar power plants, which will have the capacity to produce a significant amount of power.
3. ***Setting up tube-wells*** – The third component of this scheme deals with the setting up of unique tube-wells, under the watchful eyes of the central government, which will also a certain amount of power.
4. ***Modernization of present pumps*** – Only production of powers is not the aim of the scheme. The final component of this program deals with the modernization of pumps, which are in use, as of now. Old pumps will be replaced by developed solar pumps.

The scheme was elaborated with additional funding for successful implementation. As per the announcement of this program, the Finance Minister and the Power department announced that it will require around Rs. 48, 000 crores. The allocation of funds will be done in four separate segments.

- During the initial stage that involves the solar pump distribution, the central government will dispatch an amount of Rs. 22,000 crores.
- During the second phase of this program, Rs. 4, 875 crores will be provided by the respective department.
- The third phase, wherein all ordinary pumps will be converted into solar powered pumps, the central government will have to tolerate an expense of Rs. 15, 750 crores.

- Lastly, for the successful completion of the fourth phase, the central government will have to spend Rs. 5000 crores.
- The scheme is not only aimed at providing better benefits and added income for the agricultural labors, but will also lower the level of pollution. As the solar pumps take over electricity driven or diesel pumps, it will provide better utilization of resources.

2.3 Policies for Solar Pump Irrigation in Rajasthan

The state of Rajasthan has 10 per cent of India's land, 5 per cent of its population and only 1 per cent of its water resources, a disadvantage by a factor of tHn for supply of irrigation water vis-a-vis agriculture area. Acute water shortage, erratic rainfall and recurring droughts in every district have exacerbated the situation. Over 60 per cent of the population depends for livelihood on agriculture or horticulture, often marred by low productivity due to unreliable, inadequate or non availability of irrigation. About 70 per cent irrigation is done through wells or tube-wells energized mainly by grid-power or diesel generators. Approximately 60,000 farmers are waiting for grid-based electricity connections for irrigation. Extension of electric-grid is not feasible in far-flung areas; almost 70 per cent area in the State is classified as desert. Moreover, ground water has deteriorated rapidly in the last two decades. Out of 249 blocks, nearly 200 are in the highly critical zone. Almost 90 per cent of groundwater withdrawal in the State is utilized through flood or furrow-irrigation methods with mere 35 to 45 per cent water-use-efficiency.

Rajasthan is blessed with one of the best solar insolation on earth (6-7 kWh/m2/day) combined with maximum sunny days in a year, about 325, which makes it one of the most attractive destinations for harnessing solar energy for various purposes, especially irrigation. It was thus envisaged that an integrated solar water pump scheme formulated by combining various stand-alone government schemes would be indeed beneficial for the region as well as its farmers. Subsidies available under various programs were clubbed and the State committed to grant the total subsidy up to 86 per cent of the capital cost. The departments of agriculture, finance and energy of the State, and Union

government's Ministries for Agriculture (MoA) and New and Renewable Energy (MNRE) worked in tandem along with various stakeholders to make it is seamless and successful project. The project goals are as follows:

- Enhancing irrigated area in the State
- Increasing productivity of the irrigated area
- Enabling farmers to diversify to remunerative high-value horticulture crops
- Conserving water by utilization of efficient irrigation methods
- Narrowing the gap between grid-power demand and supply in the State Reducing the queue of aspirant farmers for grid connection for irrigation
- Harnessing solar-energy resources available in abundance in the State
- Replacing the expensive and polluting diesel pump-sets
- Providing irrigation facility to farmers living in remote locations where grid is less likely to be extended in near future
- Saving farmers from the drudgery of night or erratic irrigation schedule
- Making environment sustainable and reducing the State's carbon footprint

The solar pump scheme for irrigation began in Rajasthan in 2010 – a combination of the Jawaharlal Nehru National Solar Mission (JNNSM), Rashtriya Krishi Vikas Yojana (RKVY), the water harvesting structure (WHS) scheme under the National Horticulture Mission (NHM), and various other State resources. Under the scheme, farmers are provided with subsidies from RKVY and the Ministry of New and Renewable Energy (MNRE). In the inception year, a subsidy figure of 86 per cent was arrived at (30% from MNRE and 56% from RKVY), through calculations of a base price for the manufacturing and installation of a solar water pump set. The remaining 14 per cent, equivalent to the cost of just the pump set, was to be paid by the farmer, which would amount to about Rs. 56000-63000/-. There are three, very transparent eligibility criteria for the subsidy;

(a) the farmer should own at least 0.5 Ha of land;

(b) the land should have a diggi/farm pond or other water storage structure;

(c) drip irrigation system should be installed in a portion of the farm.

Progressively, the scheme was amended to include the usage of mini-sprinklers as criteria for areas where land holdings are relatively smaller and diggi construction is unfeasible or impractical. This inclusion widened the scope for the popularization of efficient irrigation methods, increasing the water use efficiency in many regions significantly. On the other hand, 3 the subsidy figure was reduced from 86 per cent to 70 per cent to an even lower 60 per cent over the years, and this reduction in the subsidy amount is presently the major cause for farmers backing out from the scheme. Farmers who already have electric connections for irrigation shall be provided with a smaller figure of subsidy, amounting to about 30 per cent of the total cost of the solar pump set. This calls for a study of the efficacy of the scheme and a detailed evaluation of the impact that these solar water pumps have actually had on farmers already using them, to enable us to ascertain why we should be moving towards this green, efficient, cheap, and emission-free energy source, and/or explaining how the scheme may be further improved for a much wider acceptance and preference among those that require such alternative solutions desperately.

In the year 2008-09, Government of Rajasthan had started scheme of 100 per cent subsidy on solar water pump for government farm then after in 2010-11, pilot project was started and covered only 6 districts to installed solar water pump. In 2010-11, 50 farmers were targeted, which was scaled up to 500 in 2011-12, and 10,000 in 2012-13, eventually covering all 33 districts of the State. To harness the vast amount of energy, the Rajasthan government subsidized 86 percent solar-powered irrigation in 2011-12 and introduced 3 HP DC submersible pumps. MNRE and the Ministry of Agriculture through the financial assistance of the state government had supported. Jawaharlal Nehru National Solar Mission (JNNSM) provides 30 percent of the state government, Rashtriya Krishi Vikas Yojana (RKVY) and the Ministry of New and Renewable Energy offers a 56 per cent subsidy. The solar water pump scheme was scaled up from a mere target of 50 in 2010-11 to 500 (900 per cent increase) in 2011-12; to 2,200 (over 340 per cent increase) for 2012-13; and, to 10,000 (354 per cent increase) for 2013-14. Implementation at large scale was initiated in year 2011-12 when out of 33 districts, 14 districts were covered. Next year i.e. 2012-13 the scheme covered all

the 33 districts in the State. In the year 2014-15, all 33 districts were also included, but this time only 2900 solar water pump was kept in the target as the subsidy rate had been reduced, but still achieved a lot of achievement and 242 percent more solar pumps installed than targeted. The good achievement in the next year 2015-16 and 31 percent more installed than the targeted solar pump. After year 2013-14, Rajasthan has also begun targeting high ROI beneficiaries by prioritizing farmers without electric connections. The now state has three subsidy slabs, as follows:

(a) 75 per cent for those willing to give up their place in the queue for electric connections,

(b) 60 per cent for farmers without an electric connection, and

(c) only the 30 per cent MNRE subsidy for those unwilling to give up their electric connection/place in the queue.

The district wise solar irrigation pumps installed in Rajasthan during 2011-12 to 2015-16 are given in Table 2.1 and Fig. 2.2 and year-wise target, achievement of solar irrigation pump, etc., are depicted in Table 2.2. The top five districts having highest coverage of solar pumps are Bikaner, Jaipur, Sri Ganganagar, Hanumangarh and Sikar.

Fig. 2.2: Districtwise Solar Water Pump Installed in Rajasthan (2011-12 to 2015-16)

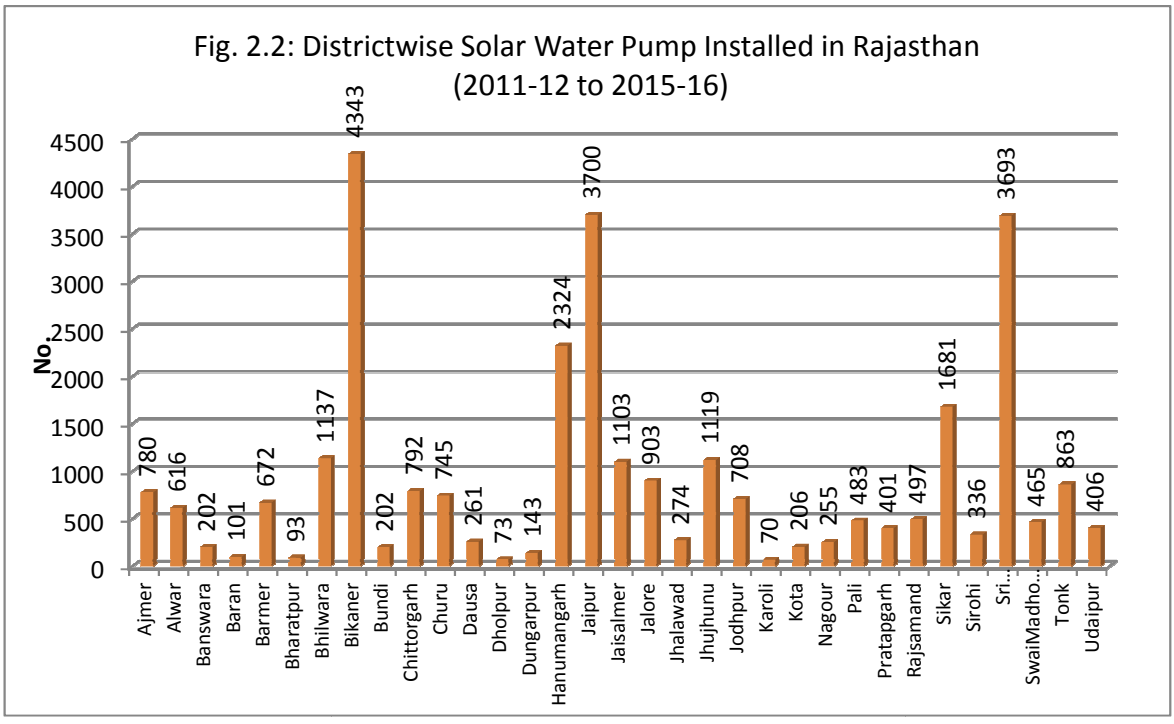


Table 2.1: Year Wise Solar Water Pump Installed in Rajasthan

Sr. No.	District	Solar water Pump Installed in Rajasthan					
		2011-12	2013-12	2013-14	2014-15	2015-16	Total
1	Ajmer	0	90	251	211	228	780
2	Alwar	14	188	246	53	115	616
3	Banswara	0	44	76	44	38	202
4	Baran	0	21	62	14	4	101
5	Barmer	0	42	99	193	338	672
6	Bharatpur	0	11	61	8	13	93
7	Bhilwara	34	241	516	212	134	1137
8	Bikaner	381	556	1360	1314	732	4343
9	Bundi	0	34	63	54	51	202
10	Chittorgarh	24	118	289	232	129	792
11	Churu		31	100	243	371	745
12	Dausa	0	83	114	37	27	261
13	Dholpur	0	21	33	17	2	73
14	Dungarpur	0	14	67	35	27	143
15	Hanumangarh	260	247	792	678	347	2324
16	Jaipur	80	439	1489	894	798	3700
17	Jaisalmer	31	109	334	485	144	1103
18	Jalore	0	51	149	233	470	903
19	Jhalawad	0	161	96	3	14	274
20	Jhujhunu	27	139	310	366	277	1119
21	Jodhpur	51	118	201	190	148	708
22	Karoli	0	37	26	4	3	70
23	Kota	20	54	90	18	24	206
24	Nagour	34	35	95	60	31	255
25	Pali	0	61	194	157	71	483
26	Pratapgarh	0	41	224	64	72	401
27	Rajsamand	0	91	259	94	53	497
28	Sikar	44	272	1028	264	73	1681
29	Sirohi	0	27	95	122	92	336
30	Sri Ganganagar	612	658	1032	911	480	3693
31	SwaiMadhopur	37	97	19	31	281	465
32	Tonk	0	102	122	195	444	863
33	Udaipur	0	47	108	112	139	406
	Grand Total	1649	4280	10000	7548	6170	29647

Source: Office of the Department of Horticulture, GOR, Jaipur.

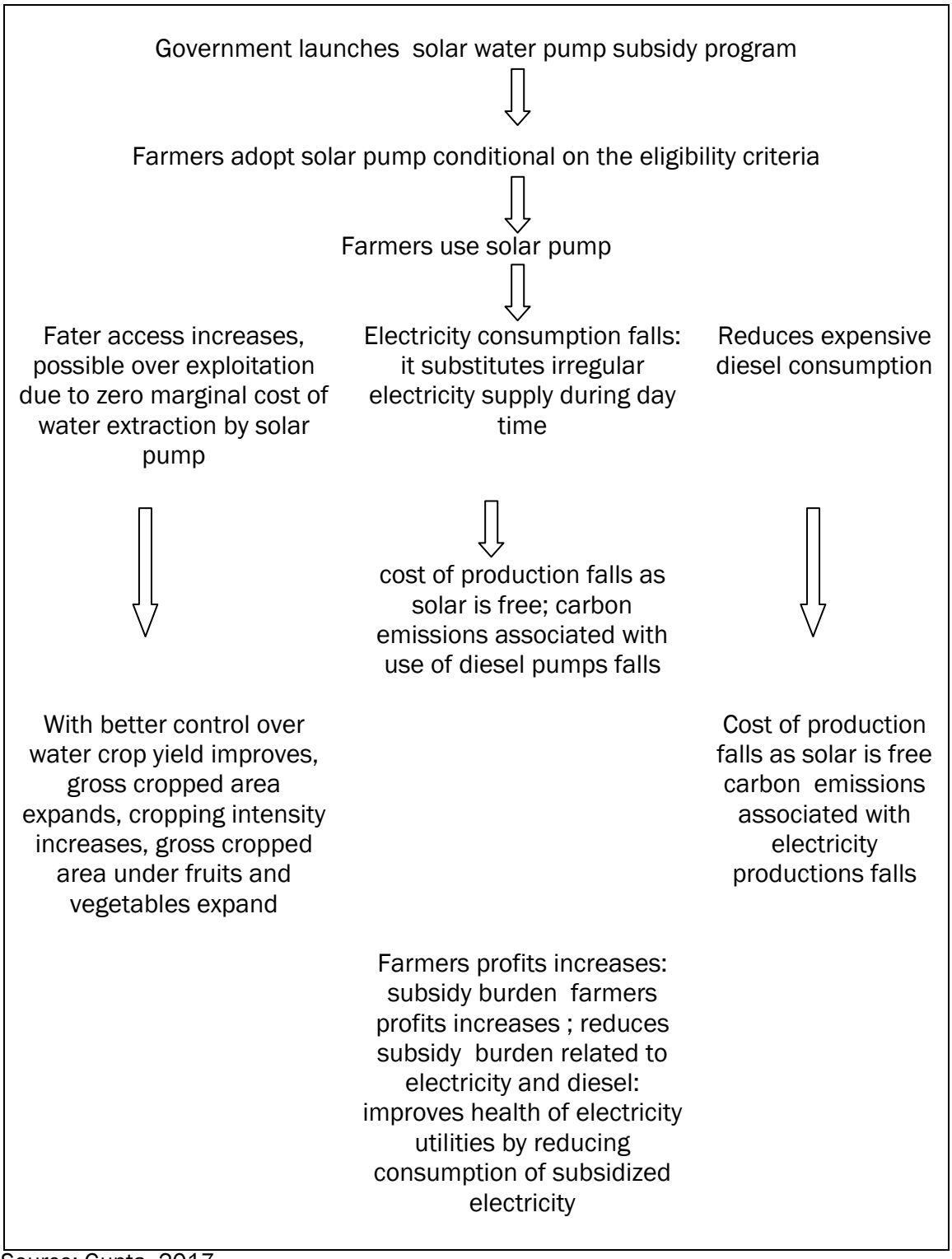
Table 2.2: Year wise target and Achievements of Solar irrigation pump in Rajasthan

Year	Project	No. of District Covered	Target	Achieve-ment	Pump Capacity (WP)	Subsidy (%)	Funding Source
2008-09	Government Farms	7	14	14	1800	100	RKVY
2010-11	Pilot Project	6	50	34	2200/ 3000	86	JNNSM, RKVY
2011-12	First major jump	14	500	1649	2200/ 3000	86	JNNSM, RKVY
2012-13	Second major jump	33	2200	4280	2200/ 3000	86	JNNSM, RKVY State
2013-14	Third major jump	33	10000	10000	2200/ 3000	86	JNNSM, RKVY, State
2014-15	fourth major jump	33	2900	9919	2200/ 3000	30, 60, 75	JNNSM, NCEF, STATE
2015-16	Fifth major jump	33	4702	6170	2200/ 3000	30,60, 75	JNNSM, NCEF, STATE
2016-17	Six major jump	33	7500	n.a.	n.a.	30,60, 75	JNNSM, NCEF, STATE
2017-18	major jump	33	500	n.a.	n.a.	50, 55, 65, 70	JNNSM, NCEF, STATE
2018-19	major jump	33	7500	n.a.	n.a.	50, 55, 65, 70	JNNSM, NCEF, STATE

Note: n.a. Not Available
Source: Goyal (2013) and GOR.

The main motivation of the policy makers for promoting Solar Water Pumping Program, in water constrained and solar abundant Rajasthan, is to increase water and energy access of farmers to improve agricultural output and income of farmers. Figure 2.3 explains underlying theory of change associated with the adoption of solar water pumps.

Fig. 2.3: Theory of Change of Solar Water Pump Subsidy Program in Rajasthan



Source: Gupta, 2017.

2.3.1 Solar Power Pump Subsidy

Tables 2.3 to 2.6 provide an indication of the cost for different solar pump alternatives in Rajasthan during 2011-12 to 2013-14. Despite water scarcity, Rajasthan is actively pushing for solar pumps. Its horticulture department provides 86 per cent subsidy on pumps, while the rest is borne by the farmer. Government of Rajasthan brought a new momentum in the space of solar irrigation pumps by introducing 3 HP DC submersible pumps in an 86 percent subsidy scheme launched in 2011-12. There was also a 2 HP DC submersible pump option, but there have been few takers for it. The initial estimates of costs at the Rajasthan level 3 were Rs.6.16 lakh for 3 HP pump and almost Rs.18-20 lakh for a 10 HP pump. Government of Rajasthan's aggressive policy of subsidizing solar pumps is helping to increase the numbers but there is some evidence that the current subsidy is discouraging cost reduction. Farmers are viewing solar pumps as an all purpose solution to their energy needs.

Table 2.3: Rate for SPV Solar Pump Project in Rajasthan (2011-12 to 2013-14)

Type of pump	Mounting Structure	Head (meter)	2011-12 (Rs./set)		2012-13(Rs./set)		2013-14 (Rs. Per set)			
							DC Pump		AC Pump	
			2200Wp	3000Wp	2200Wp	3000Wp	2200Wp	3000Wp	2200Wp	3000Wp
SPV Surface pump	Static	20			3,28,000	4,25,700	3,25,788	4,00,000	3,21,790	4,10,000
	Manual	20	3,76,500	5,37,000	3,36,000	4,48,800	3,29,838	4,04,050	3,25,840	4,14,050
	Auto Tracker	20	4,14,500	5,70,000	3,86,500	4,62,000	3,43,288	4,17,500	3,39,290	4,27,500
SPV Sub-mersible pump	Static	20			3,60,000	4,29,000	3,55,000	4,68,000	3,54,910	4,25,000
		50			3,61,100	4,38,900	3,61,500	4,74,500	3,61,410	4,31,500
		75			3,63,300	4,48,800	3,66,000	4,79,000	3,65,910	4,36,000
	Manual	20	3,89,900	5,60,300	3,74,300	4,48,800	3,59,050	4,72,050	3,58,960	4,29,050
		50	3,95,800	5,62,300	3,80,000	4,65,300	3,65,550	4,78,550	3,65,460	4,35,550
		75			3,95,100	4,75,200	3,70,050	4,83,050	3,69,960	4,40,050
	Auto Tracker	20	4,18,000	5,70,000	3,99,300	4,68,600	3,72,500	4,85,500	3,72,410	4,42,500
		50	4,18,000	5,70,000	4,05,000	4,81,800	3,79,000	4,92,000	3,78,910	4,49,000
		75			4,11,300	4,85,100	3,83,500	4,96,500	3,83,410	4,53,500
SPV Domestic Lighting System 37 Wp/40Ah Battery/9W×2 Fixture						8,090				8,000

Source: GOR, Jaipur.

Table 2.4: Base Rate, Subsidy rate & Farmer Share on Solar Water Pump in Rajasthan 2016-17

S.N.	Details	DC/ AC Mounting Structure	Head (meter)	Base Rate (in Rs. Per set)		Subsidy (in Rs. Per set)						Farmer Share (in Rs. Per set)	
				3 Hp	5 Hp	MNRE	SP	3 Hp	MNRE	SP	5 Hp	3 Hp	5 Hp
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	**Farmer Category having agriculture electric connection (As per the guideline of 2015-16)**												
1	SPV Surface pump with Fencing	DC Manual	20	339950	527050	121500	0	121500	202500	0	202500	218450	324550
2		DC Auto Tracker	20	353400	540500	121500	0	121500	202500	0	202500	231900	338000
3		AC Manual	20	351050	538050	97200	0	97200	162000	0	162000	253850	376050
4		AC Auto Tracker	20	364500	551500	97200	0	97200	162000	0	162000	267300	389500
5	SPV Submersible pump with Fencing	DC Manual	20	386050	527050	121500	0	121500	202500	0	202500	264550	324550
6			50	392550	533550	121500	0	121500	202500	0	202500	271050	331050
7			75	397050	538050	121500	0	121500	202500	0	202500	275550	335550
8		DC Auto Tracker	20	399500	540500	121500	0	121500	202500	0	202500	278000	338000
9			50	406000	547000	121500	0	121500	202500	0	202500	284500	344500
10			75	410500	551500	121500	0	121500	202500	0	202500	289000	349000
11	SPV Submersible pump with Fencing	AC Manual	20	354050	502050	97200	0	97200	162000	0	162000	256850	340050
12			50	360550	508550	97200	0	97200	162000	0	162000	263350	346550
13			75	365050	513050	97200	0	97200	162000	0	162000	267850	351050
14		AC Auto Tracker	20	367500	515500	97200	0	97200	162000	0	162000	270300	353500
15			50	374000	522000	97200	0	97200	162000	0	162000	276800	360000
16			75	378500	526500	97200	0	97200	162000	0	162000	281300	364500
17	SPV Surface pump with DLS & fencing	DC Manual	20	347949	535049	121500	0	121500	202500	0	202500	226449	332549
18		DC Auto Tracker	20	361399	548499	121500	0	121500	202500	0	202500	239899	345999
19		AC Manual	20	359049	546049	97200	0	97200	162000	0	162000	261849	384049
20		AC Auto Tracker	20	372499	559499	97200	0	97200	162000	0	162000	275299	397499
21	SPV Submersible pump with DLS & fencing	DC Manual	20	394049	535049	121500	0	121500	202500	0	202500	272549	332549
22			50	400549	541549	121500	0	121500	202500	0	202500	279049	339049
23			75	405049	546049	121500	0	121500	202500	0	202500	283549	343549
24		DC Auto Tracker	20	407499	548499	121500	0	121500	202500	0	202500	285999	345999
25			50	413999	554999	121500	0	121500	202500	0	202500	292499	352499
26			75	418499	559499	121500	0	121500	202500	0	202500	296999	356999
27	SPV Submersible pump with DLS & fencing	AC Manual	20	362049	510049	97200	0	97200	162000	0	162000	264849	348049
28			50	368549	516549	97200	0	97200	162000	0	162000	271349	354549
29			75	373049	521049	97200	0	97200	162000	0	162000	275849	359049
30		AC Auto Tracker	20	375499	523499	97200	0	97200	162000	0	162000	278299	361499
31			50	381999	529999	97200	0	97200	162000	0	162000	284799	367999
32			75	386499	534499	97200	0	97200	162000	0	162000	289299	372499

Table 2.4 continues.....

S.No.	Details	DC/ AC Mounting Structure	Head meter)	Base Rate (in Rs. Per set)		Subsidy (in Rs. Per set)						Farmer Share (in Rs. Per set)	
				3 Hp	5 Hp	MNRE	SP	3 Hp	MNRE	SP	5 Hp	3 Hp	5 Hp
1	2	3	4	5	6	7	8	9	10	11	12	13	14
2	Farmer Category not having agriculture electric connection (As per the guideline of 2015-16)												
1	SPV Surface pump with Fencing	DC Manual	20	339950	527050	121500	101985	223485	202500	158115	360615	116465	166435
2		DC Auto Tracker	20	353400	540500	121500	106020	227520	202500	162150	364650	125880	175850
3		AC Manual	20	351050	538050	97200	105315	202515	162000	161415	323415	148535	214635
4		AC Auto Tracker	20	364500	551500	97200	109350	206550	162000	165450	327450	157950	224050
5	SPV Submersible pump with Fencing	DC Manual	20	386050	527050	121500	115815	237315	202500	158115	360615	148735	166435
6			50	392550	533550	121500	117765	239265	202500	160065	362565	153285	170985
7			75	397050	538050	121500	119115	240615	202500	161415	363915	156435	174135
8		DC Auto Tracker	20	399500	540500	121500	119850	241350	202500	162150	364650	158150	175850
9			50	406000	547000	121500	121800	243300	202500	164100	366600	162700	180400
10			75	410500	551500	121500	123150	244650	202500	165450	367950	165850	183550
11	SPV Submersible pump with Fencing	AC Manual	20	354050	502050	97200	106215	203415	162000	150615	312615	150635	189435
12			50	360550	508550	97200	108165	205365	162000	152565	314565	155185	193985
13			75	365050	513050	97200	109515	206715	162000	153915	315915	158335	197135
14		AC Auto Tracker	20	367500	515500	97200	110250	207450	162000	154650	316650	160050	198850
15			50	374000	522000	97200	112200	209400	162000	156600	318600	164600	203400
16			75	378500	526500	97200	113550	210750	162000	157950	319950	167750	206550
17	SPV Surface pump with DLS & fencing	DC Manual	20	347949	535049	121500	104385	225885	202500	160515	363015	122064	172034
18		DC Auto Tracker	20	361399	548499	121500	108420	229920	202500	164550	367050	131479	181449
19		AC Manual	20	359049	546049	97200	107715	204915	162000	163815	325815	154134	220234
20		AC Auto Tracker	20	372499	559499	97200	111750	208950	162000	167850	329850	163549	229649
21	SPV Submersible pump with DLS & fencing	DC Manual	20	394049	535049	121500	118215	239715	202500	160515	363015	154334	172034
22			50	400549	541549	121500	120165	241665	202500	162465	364965	158884	176584
23			75	405049	546049	121500	121515	243015	202500	163815	366315	162034	179734
24		DC Auto Tracker	20	407499	548499	121500	122250	243750	202500	164550	367050	163749	181449
25			50	413999	554999	121500	124200	245700	202500	166500	369000	168299	185999
26			75	418499	559499	121500	125550	247050	202500	167850	370350	171449	189149
27	SPV Submersible pump with DLS & fencing	AC Manual	20	362049	510049	97200	108615	205815	162000	153015	315015	156234	195034
28			50	368549	516549	97200	110565	207765	162000	154965	316965	160784	199584
29			75	373049	521049	97200	111915	209115	162000	156315	318315	163934	202734
30		AC Auto Tracker	20	375499	523499	97200	112650	209850	162000	157050	319050	165649	204449
31			50	381999	529999	97200	114600	211800	162000	159000	321000	170199	208999
32			75	386499	534499	97200	115950	213150	162000	160350	322350	173349	212149
3	**Farmer Category applied for agriculture electric connection and wants to surrender their application in lieu of solar pumps subsidy (As per the guideline of 2015-16)**												
1	SPV Surface pump with Fencing	DC Manual	20	339950	527050	121500	152978	274478	202500	237173	439673	65472	87377
2		DC Auto Tracker	20	353400	540500	121500	159030	280530	202500	243225	445725	72870	94775
3		AC Manual	20	351050	538050	97200	157973	255173	162000	242123	404123	95877	133927
4		AC Auto Tracker	20	364500	551500	97200	164025	261225	162000	248175	410175	103275	141325
5	SPV Submersible pump with Fencing	DC Manual	20	386050	527050	121500	173723	295223	202500	237173	439673	90827	87377
6			50	392550	533550	121500	176648	298148	202500	240098	442598	94402	90952
7			75	397050	538050	121500	178673	300173	202500	242123	444623	96877	93427
8		DC Auto Tracker	20	399500	540500	121500	179775	301275	202500	243225	445725	98225	94775
9			50	406000	547000	121500	182700	304200	202500	246150	448650	101800	98350
10			75	410500	551500	121500	184725	306225	202500	248175	450675	104275	100825
11	SPV Submersible pump with Fencing	AC Manual	20	354050	502050	97200	159323	256523	162000	225923	387923	97527	114127
12			50	360550	508550	97200	162248	259448	162000	228848	390848	101102	117702
13			75	365050	513050	97200	164273	261473	162000	230873	392873	103577	120177
14		AC Auto Tracker	20	367500	515500	97200	165375	262575	162000	231975	393975	104925	121525
15			50	374000	522000	97200	168300	265500	162000	234900	396900	108500	125100
16			75	378500	526500	97200	170325	267525	162000	236925	398925	110975	127575
17	SPV Surface pump with DLS & fencing	DC Manual	20	347949	535049	121500	156577	278077	202500	240772	443272	69872	91777
18		DC Auto Tracker	20	361399	548499	121500	162630	284130	202500	246825	449325	77269	99174
19		AC Manual	20	359049	546049	97200	161572	258772	162000	245722	407722	100277	138327
20		AC Auto Tracker	20	372499	559499	97200	167625	264825	162000	251775	413775	107674	145724

Table 2.4 continues.....

S.N.	Details	DC/ AC Mounting Structure	Head (meter)	Base Rate (in Rs. Per set)		Subsidy (in Rs. Per set)						Farmer Share (in Rs. Per set)	
				3 Hp	5 Hp	MNRE	SP	3 Hp	MNRE	SP	5 Hp	3 Hp	5 Hp
1	2	3	4	5	6	7	8	9	10	11	12	13	14
21	SPV Submersible pump with DLS & fencing	DC Manual	20	394049	535049	121500	177322	298822	202500	240772	443272	95227	91777
22			50	400549	541549	121500	180247	301747	202500	243697	446197	98802	95352
23			75	405049	546049	121500	182272	303772	202500	245722	448222	101277	97827
24		DC Auto Tracker	20	407499	548499	121500	183375	304875	202500	246825	449325	102624	99174
25			50	413999	554999	121500	186300	307800	202500	249750	452250	106199	102749
26			75	418499	559499	121500	188325	309825	202500	251775	454275	108674	105224
27	SPV Submersible pump with DLS & fencing	AC Manual	20	362049	510049	97200	162922	260122	162000	229522	391522	101927	118527
28			50	368549	516549	97200	165847	263047	162000	232447	394447	105502	122102
29			75	373049	521049	97200	167872	265072	162000	234472	396472	107977	124577
30		AC Auto Tracker	20	375499	523499	97200	168975	266175	162000	235575	397575	109324	125924
31			50	381999	529999	97200	171900	269100	162000	238500	400500	112899	129499
32			75	386499	534499	97200	173925	271125	162000	240525	402525	115374	131974

Notes :

- Basis of MNRE subsidy calculation is Rs. 32400/- per HP for AC pumps and Rs. 40500/- for DC pumps.
- In addition to above State Plan subsidy is 30% of Base rate for farmers not having agriculture electric connection & 45% for farmers who have applied for agriculture electric connection and wants to surrender their application in lieu of solar pumps subsidy.
- As per MNRE guidelines subsidy will be allowed only on manual & auto tracking enabled SPV pumps along with remote monitoring mechanism (RMM).
- The subsidy would be payable on the supply of the solar pumping system by the empanelled firm only. In case of any complaints regarding sub standard/ defective supplies, Directorate of Horticulture must be informed with full details of the case so that necessary action can be taken against the defaulter.

Source: GOR, Jaipur.

Table 2.5: Base Rate for SPV Solar Pump Project in Rajasthan 2017-18 and 2018-19

Sr. No.	Details	DC/ AC Mounting Structure	Head (mtr.)	Base Rate (in Rs. Per set)			
				3 Hp	5 Hp	7.5 Hp	10 Hp
1	2	3	4	5	6	7	8
1	SPV Surface pump	DC Static	20	236250	0	0	0
2		AC Static	20	230492	307999	0	0
3	SPV submersible pump	DC Static	20	252266	344000	509839	650090
4		AC Static	20	230265	306390	465560	593250
5	Additional Cost	Head Over 20 m	50	5412	5412	5412	5412
6			75	9020	9020	9020	9020
7			100	12000	12000	12000	12000
7		Manual Tracker		2706	2706	2706	2706
8		Auto Tracker		8118	8118	8118	8118
9	SPV Domestic Lighting System 37 Wp/ 40 Ah Battery / 9 W x 2 fixture			4681	4681	4681	4681
10	Fencing			6765	9020	11275	13530

Source: GOR, Jaipur.

Table 2.6: Base Rate, Subsidy rate and Farmer Share on Solar Water Pump in Rajasthan 2018-19

SN	Details	DC/ AC Mounting Structure	Head (mtr.)	Base Rate (in Rs. Per set)				Subsidy Amount (in Rs. Per set)					
				3 Hp	5 Hp	7.5 Hp	10 Hp	MNRE	SP	3 Hp	MNRE	SP	5 Hp
1	2	3	4	5	6	7	8	9	10	11 (9+10)	12	13	14 (12+13)
	Subsidy - 3 & 5 HP 60%												
1	SPV Surface pump with Fencing	DC Manual	20	245721	0	0	0	61430	86002	147432	0	0	0
2		DC Auto Tracker	20	251133	0	0	0	62783	87897	150680	0	0	0
3		AC Manual	20	239963	319725	0	0	59991	83987	143978	63945	127890	191835
4		AC Auto Tracker	20	245375	325137	0	0	61344	85881	147225	65027	130055	195082
5	SPV Submersible pump with Fencing	DC Manual	20	261737	355726	523820	666326	65434	91608	157042	71145	142290	213435
6			50	267149	361138	529232	671738	66787	93502	160289	72228	144455	216683
7			75	270757	364746	532840	675346	67689	94765	162454	72949	145898	218847
8			100	273737	367726	535820	678326	68434	95808	164242	73545	147090	220635
9		DC Auto Tracker	20	267149	361138	529232	671738	66787	93502	160289	72228	144455	216683
10			50	272561	366550	534644	677150	68140	95396	163536	73310	146620	219930
11			75	276169	370158	538252	680758	69042	96659	165701	74032	148063	222095
12			100	279149	373138	541232	683738	69787	97702	167489	74628	149255	223883
13	SPV Submersible pump with Fencing	AC Manual	20	239736	318116	479541	609486	59934	83908	143842	63623	127246	190869
14			50	245148	323528	484953	614898	61287	85802	147089	64706	129411	194117
15			75	248756	327136	488561	618506	62189	87065	149254	65427	130854	196281
16			100	251736	330116	491541	621486	62934	88108	151042	66023	132046	198069
17		AC Auto Tracker	20	245148	323528	484953	614898	61287	85802	147089	64706	129411	194117
18			50	250560	328940	490365	620310	62640	87696	150336	65788	131576	197364
19			75	254168	332548	493973	623918	63542	88959	152501	66510	133019	199529
20			100	257148	335528	496953	626898	64287	90002	154289	67106	134211	201317
21	SPV Surface pump with DLS & fencing	DC Manual	20	250402	0	0	0	62601	87641	150242	0	0	0
22		DC Auto Tracker	20	255814	0	0	0	63954	89535	153489	0	0	0
23		AC Manual	20	244644	324406	0	0	61161	85625	146786	64881	129762	194643
24		AC Auto Tracker	20	250056	329818	0	0	62514	87520	150034	65964	131927	197891
25	SPV Submersible pump with DLS & fencing	DC Manual	20	266418	360407	528501	671007	66605	93246	159851	72081	144163	216244
26			50	271830	365819	533913	676419	67958	95141	163099	73164	146328	219492
27			75	275438	369427	537521	680027	68860	96403	165263	73885	147771	221656
28			100	278418	372407	540501	683007	69605	97446	167051	74481	148963	223444
29		DC Auto Tracker	20	271830	365819	533913	676419	67958	95141	163099	73164	146328	219492
30			50	277242	371231	539325	681831	69311	97035	166346	74246	148492	222738
31			75	280850	374839	542933	685439	70213	98298	168511	74968	149936	224904
32			100	283830	377819	545913	688419	70958	99341	170299	75564	151128	226692
33	SPV Submersible pump with DLS & fencing	AC Manual	20	244417	322797	484222	614167	61104	85546	146650	64559	129119	193678
34			50	249829	328209	489634	619579	62457	87440	149897	65642	131284	196926
35			75	253437	331817	493242	623187	63359	88703	152062	66363	132727	199090
36			100	256417	334797	496222	626167	64104	89746	153850	66959	133919	200878
37		AC Auto Tracker	20	249829	328209	489634	619579	62457	87440	149897	65642	131284	196926
38			50	255241	333621	495046	624991	63810	89334	153144	66724	133448	200172
39			75	258849	337229	498654	628599	64712	90597	155309	67446	134892	202338
40			100	261829	340209	501634	631579	65457	91640	157097	68042	136084	204126

Source: GOR, Jaipur.

Table 2.6 coninues…

SN	Details	DC/ AC Mounting Structure	Head (mtr.)	Farmer Share (in Rs. Per set)						
				3 Hp	5 Hp	3 / 5 Hp	3 / 7.5 Hp	3 / 10 Hp	5 / 7.5 Hp	5 / 10 Hp
1	2	3	4	15	16	17 (6-11)	18 (7-11)	19 (8-11)	20 (7-14)	21 (8-14)
	Subsidy - 3 & 5 HP 60%									
1	SPV Surface pump with Fencing	DC Manual	20	98289	0	0	0	0	0	0
2		DC Auto Tracker	20	100453	0	0	0	0	0	0
3		AC Manual	20	95985	127890	175747	0	0	0	0
4		AC Auto Tracker	20	98150	130055	177912	0	0	0	0
5	SPV Submersible pump with Fencing	DC Manual	20	104695	142291	198684	366778	509284	310385	452891
6			50	106860	144455	200849	368943	511449	312549	455055
7			75	108303	145899	202292	370386	512892	313993	456499
8			100	109495	147091	203484	371578	514084	315185	457691
9		DC Auto Tracker	20	106860	144455	200849	368943	511449	312549	455055
10			50	109025	146620	203014	371108	513614	314714	457220
11			75	110468	148063	204457	372551	515057	316157	458663
12			100	111660	149255	205649	373743	516249	317349	459855
13	SPV Submersible pump with Fencing	AC Manual	20	95894	127247	174274	335699	465644	288672	418617
14			50	98059	129411	176439	337864	467809	290836	420781
15			75	99502	130855	177882	339307	469252	292280	422225
16			100	100694	132047	179074	340499	470444	293472	423417
17		AC Auto Tracker	20	98059	129411	176439	337864	467809	290836	420781
18			50	100224	131576	178604	340029	469974	293001	422946
19			75	101667	133019	180047	341472	471417	294444	424389
20			100	102859	134211	181239	342664	472609	295636	425581
21	SPV Surface pump with DLS & fencing	DC Manual	20	100160	0	0	0	0	0	0
22		DC Auto Tracker	20	102325	0	0	0	0	0	0
23		AC Manual	20	97858	129763	177620	0	0	0	0
24		AC Auto Tracker	20	100022	131927	179784	0	0	0	0
25	SPV Submersible pump with DLS & fencing	DC Manual	20	106567	144163	200556	368650	511156	312257	454763
26			50	108731	146327	202720	370814	513320	314421	456927
27			75	110175	147771	204164	372258	514764	315865	458371
28			100	111367	148963	205356	373450	515956	317057	459563
29		DC Auto Tracker	20	108731	146327	202720	370814	513320	314421	456927
30			50	110896	148493	204885	372979	515485	316587	459093
31			75	112339	149935	206328	374422	516928	318029	460535
32			100	113531	151127	207520	375614	518120	319221	461727
33	SPV Submersible pump with DLS & fencing	AC Manual	20	97767	129119	176147	337572	467517	290544	420489
34			50	99932	131283	178312	339737	469682	292708	422653
35			75	101375	132727	179755	341180	471125	294152	424097
36			100	102567	133919	180947	342372	472317	295344	425289
37		AC Auto Tracker	20	99932	131283	178312	339737	469682	292708	422653
38			50	102097	133449	180477	341902	471847	294874	424819
39			75	103540	134891	181920	343345	473290	296316	426261
40			100	104732	136083	183112	344537	474482	297508	427453

Source: GOR, Jaipur.

Table 2.6 coninues…

SN	Details	DC/ AC Mounting Structure	Head (mtr.)	Base Rate (in Rs. Per set)				Subsidy Amount (in Rs. Per set)					
				3 Hp	5 Hp	7.5 Hp	10 Hp	MNRE	SP	3 Hp	MNRE	SP	5 Hp
1	2	3	4	5	6	7	8	9	10	11 (9+10)	12	13	14 (12+13)
2	Subsidy - 3 & 5 HP 75%												
1	SPV Surface pump with Fencing	DC Manual	20	245721	0	0	0	61430	122861	184291	0	0	0
2		DC Auto Tracker	20	251133	0	0	0	62783	125567	188350	0	0	0
3		AC Manual	20	239963	319725	0	0	59991	119982	179973	63945	175849	239794
4		AC Auto Tracker	20	245375	325137	0	0	61344	122688	184032	65027	178825	243852
5	SPV Submersible pump with Fencing	DC Manual	20	261737	355726	523820	666326	65434	130869	196303	71145	195649	266794
6			50	267149	361138	529232	671738	66787	133575	200362	72228	198626	270854
7			75	270757	364746	532840	675346	67689	135379	203068	72949	200610	273559
8			100	273737	367726	535820	678326	68434	136869	205303	73545	202249	275794
9		DC Auto Tracker	20	267149	361138	529232	671738	66787	133575	200362	72228	198626	270854
10			50	272561	366550	534644	677150	68140	136281	204421	73310	201603	274913
11			75	276169	370158	538252	680758	69042	138085	207127	74032	203587	277619
12			100	279149	373138	541232	683738	69787	139575	209362	74628	205226	279854
13	SPV Submersible pump with Fencing	AC Manual	20	239736	318116	479541	609486	59934	119868	179802	63623	174964	238587
14			50	245148	323528	484953	614898	61287	122574	183861	64706	177940	242646
15			75	248756	327136	488561	618506	62189	124378	186567	65427	179925	245352
16			100	251736	330116	491541	621486	62934	125868	188802	66023	181564	247587
17		AC Auto Tracker	20	245148	323528	484953	614898	61287	122574	183861	64706	177940	242646
18			50	250560	328940	490365	620310	62640	125280	187920	65788	180917	246705
19			75	254168	332548	493973	623918	63542	127084	190626	66510	182901	249411
20			100	257148	335528	496953	626898	64287	128574	192861	67106	184540	251646
21	SPV Surface pump with DLS & fencing	DC Manual	20	250402	0	0	0	62601	125201	187802	0	0	0
22		DC Auto Tracker	20	255814	0	0	0	63954	127907	191861	0	0	0
23		AC Manual	20	244644	324406	0	0	61161	122322	183483	64881	178423	243304
24		AC Auto Tracker	20	250056	329818	0	0	62514	125028	187542	65964	181400	247364
25	SPV Submersible pump with DLS & fencing	DC Manual	20	266418	360407	528501	671007	66605	133209	199814	72081	198224	270305
26			50	271830	365819	533913	676419	67958	135915	203873	73164	201200	274364
27			75	275438	369427	537521	680027	68860	137719	206579	73885	203185	277070
28			100	278418	372407	540501	683007	69605	139209	208814	74481	204824	279305
29		DC Auto Tracker	20	271830	365819	533913	676419	67958	135915	203873	73164	201200	274364
30			50	277242	371231	539325	681831	69311	138621	207932	74246	204177	278423
31			75	280850	374839	542933	685439	70213	140425	210638	74968	206161	281129
32			100	283830	377819	545913	688419	70958	141915	212873	75564	207800	283364
33	SPV Submersible pump with DLS & fencing	AC Manual	20	244417	322797	484222	614167	61104	122209	183313	64559	177538	242097
34			50	249829	328209	489634	619579	62457	124915	187372	65642	180515	246157
35			75	253437	331817	493242	623187	63359	126719	190078	66363	182499	248862
36			100	256417	334797	496222	626167	64104	128209	192313	66959	184138	251097
37		AC Auto Tracker	20	249829	328209	489634	619579	62457	124915	187372	65642	180515	246157
38			50	255241	333621	495046	624991	63810	127621	191431	66724	183492	250216
39			75	258849	337229	498654	628599	64712	129425	194137	67446	185476	252922
40			100	261829	340209	501634	631579	65457	130915	196372	68042	187115	255157

Source: GOR, Jaipur.

Table 2.6 continues…

SN	Details	DC/ AC Mounting Structure	Head (mtr.)	Farmer Share (in Rs. Per set)						
				3 Hp	5 Hp	3 / 5 Hp	3 / 7.5 Hp	3 / 10 Hp	5 / 7.5 Hp	5 / 10 Hp
1	2	3	4	15	16	17 (6-11)	18 (7-11)	19 (8-11)	20 (7-14)	21 (8-14)
2	Subsidy - 3 & 5 HP 75%									
1	SPV Surface pump with Fencing	DC Manual	20	61430	0	0	0	0	0	0
2		DC Auto Tracker	20	62783	0	0	0	0	0	0
3		AC Manual	20	59990	79931	139752	0	0	0	0
4		AC Auto Tracker	20	61343	81285	141105	0	0	0	0
5	SPV Submersible pump with Fencing	DC Manual	20	65434	88932	159423	327517	470023	257026	399532
6			50	66787	90284	160776	328870	471376	258378	400884
7			75	67689	91187	161678	329772	472278	259281	401787
8			100	68434	91932	162423	330517	473023	260026	402532
9		DC Auto Tracker	20	66787	90284	160776	328870	471376	258378	400884
10			50	68140	91637	162129	330223	472729	259731	402237
11			75	69042	92539	163031	331125	473631	260633	403139
12			100	69787	93284	163776	331870	474376	261378	403884
13	SPV Submersible pump with Fencing	AC Manual	20	59934	79529	138314	299739	429684	240954	370899
14			50	61287	80882	139667	301092	431037	242307	372252
15			75	62189	81784	140569	301994	431939	243209	373154
16			100	62934	82529	141314	302739	432684	243954	373899
17		AC Auto Tracker	20	61287	80882	139667	301092	431037	242307	372252
18			50	62640	82235	141020	302445	432390	243660	373605
19			75	63542	83137	141922	303347	433292	244562	374507
20			100	64287	83882	142667	304092	434037	245307	375252
21	SPV Surface pump with DLS & fencing	DC Manual	20	62600	0	0	0	0	0	0
22		DC Auto Tracker	20	63953	0	0	0	0	0	0
23		AC Manual	20	61161	81102	140923	0	0	0	0
24		AC Auto Tracker	20	62514	82454	142276	0	0	0	0
25	SPV Submersible pump with DLS & fencing	DC Manual	20	66604	90102	160593	328687	471193	258196	400702
26			50	67957	91455	161946	330040	472546	259549	402055
27			75	68859	92357	162848	330942	473448	260451	402957
28			100	69604	93102	163593	331687	474193	261196	403702
29		DC Auto Tracker	20	67957	91455	161946	330040	472546	259549	402055
30			50	69310	92808	163299	331393	473899	260902	403408
31			75	70212	93710	164201	332295	474801	261804	404310
32			100	70957	94455	164946	333040	475546	262549	405055
33	SPV Submersible pump with DLS & fencing	AC Manual	20	61104	80700	139484	300909	430854	242125	372070
34			50	62457	82052	140837	302262	432207	243477	373422
35			75	63359	82955	141739	303164	433109	244380	374325
36			100	64104	83700	142484	303909	433854	245125	375070
37		AC Auto Tracker	20	62457	82052	140837	302262	432207	243477	373422
38			50	63810	83405	142190	303615	433560	244830	374775
39			75	64712	84307	143092	304517	434462	245732	375677
40			100	65457	85052	143837	305262	435207	246477	376422

Source: GOR, Jaipur.

2.3.2 Eligibility Criteria

The solar pump subsidy was only available to farmers who had farm ponds (diggi), did horticulture in at least 0.5 hectare (ha) land and used drip irrigation. The farmer also had to own a minimum of 0.5 ha of land. Further the farmers who owned up to 2 ha of land could apply for 2200 Wp pump and those who had more than 2 ha of land could apply for 3000 Wp pump. The eligibility criterion for solar power pump has been changing every year. The eligibility criteria specified during the year 2017-18 is presented in Box 2.1 and details are discussed below:

Box 2.1: Eligibility Criteria for Solar Power Pump Subsidy

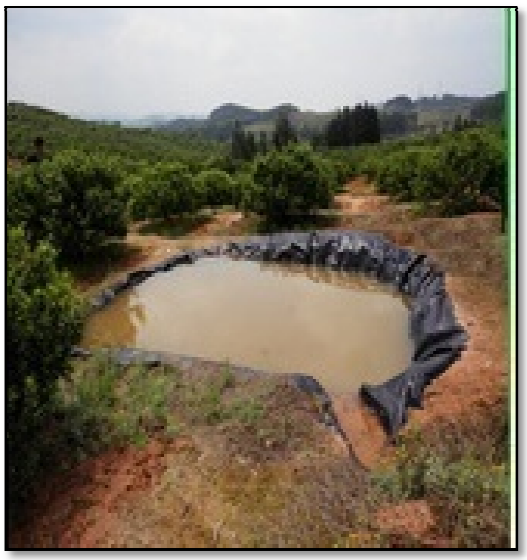
Eligibility		Farmer's Eligibility for 3 HP Solar Power Pump Plant	Farmer's Eligibility for 5 HP solar power pump plant
Land tenure		Minimum 0.5 hectare	Minimum 1.0 hectare
Green House, Shade Net		1000 Meters	2000 Meters
Lo-Tunnel		0.5 hectare	0.75 hectares
Water Storage Structure	Surface water source	1000 cubic meters	1500 cubic meters
Diggi		400 cubic meters	800 cubic meters
Farm pond		1000 cubic meters	1500 cubic meters
Underground Water Source		Maximum 100m Depth	Maximum 100m Depth

Source: Dept of Horticulture, GOR.

Farmers have to apply to the Horticulture department along with a demand draft for Rs.10000, land ownership record, a tri-partite agreement among the farmer, preferred empanelled supplier and the horticulture department, a quotation from the selected empanelled firm, and a technical drawing of the structure. Once all the applications are collected at Tehsil level, these are verified for compliance with the eligibility criteria. If the applications are more than the quota, a lottery is conducted in the presence of District Collector. A seniority/waiting list is created. If a farmer's name features in the lottery list, he/she has to deposit his 14 percent share minus Rs.10000 with the select firm.

Based on the confirmation of the receipt of farmer's share work orders are issued by the Horticulture Department of the state government.

2.3.1.1 Farm Pond (Khet talai) (Rashtriya Krishi Vikas Yojana)



Construction farm pond is a very important and useful activity for harvesting rain water.

Subsidy: To all category of farmers 50% of cost or maximum Rs 52500/- for earthen farm pond and Rs 75000/- for Farm pond with plastic lining (300 Micron on per BIS Standards), whichever is less Subsidy will be payable for individual beneficiary.

Eligibility: Farmer should have ownership of minimum 0.5 hectare cultivable land.

2.3.1.2 Diggi

Construction of Diggi is very useful activity in Canal Command area to restore surplus water for field crops and other agriculture activity.

Subsidy :-A subsidy 50% of unit cost or Rs 350 per quvic meter Storage capacity for Pakki Diggi(Masonary work) or Rs 100 per quvic meter Storage capacity with plastic lining Diggi or maximum Rs 2.0 lac. Whichever is less, will be payable to all category of farmers with minimum capacity of four lac liter Storage capacity as an individual beneficiary.

Eligibility: - Farmer should have ownership on minimum 1.0 ha cultivable land.

2.3.1.3 Water Tank (Rashtriya Krishi Vikas Yojana)

Jalhauz construction is a very important and useful activity to store water for timely irrigation as and when required in areas where ground water level is very deep and electric supply is uncertain.

Subsidy:-To all category of farmers for construction of Jalhauz with minimum one lac liter capacity, 50% of cost or Rs 350 per quvic meter Storage capacity and maximum Rs 75000/- whichever is less subsidy will be payable for individual beneficiary.

Eligibility: - Farmer should have ownership on minimum 0.5 ha cultivable land.

2.3.1.4 Irrigation Pipeline (RKVY, NFSM, NMOOP)

Use of Irrigation Pipeline facility is an important activity for promoting efficient use of irrigation water.

Subsidy:-A subsidy 50% of unit cost or Rs 50/- per meter HDPE pipe or Rs 35/- per meter PVC pipe or Rs 20/- per meter HDPE laminated lay-flat tube pipe or maximum Rs. 15000/- whichever is less, will be payable to all category of farmers as an individual beneficiary.

Eligibility:- Farmer should have ownership on cultivable land, electric / diesel / tractor operated Pumpset. Individual farmer is eligible for separate subsidy having joint and / or separate Pumpset on joint irrigation source. Individual farmer will be eligible for separate subsidy on long distance conveyance pipeline from a common water source.

2.3.1.5 Sprinkler irrigation and Mobile Raingun (NFSM, NMOOP)

Sprinkler irrigation and Mobile Raingun facility is provided to farmers for promoting efficient use of irrigation water.

Subsidy:- Individual beneficiary programme.

(A) Sprinkler irrigation Programme:-

- NFSM – Pulses and Wheat: - Subsidy 50% of unit cost or maximum Rs 10000/- per hectare whichever is less, will be payable.
- NMOOP:- Eligibility:-

Unit cost as per GOI	Area	Farmer Category	Subsidy Payable in %
19600/- per Hectare	DPAP/DDP	Small/ Marginal	60
		Other	45
	Non DPAP/ Non DDP	Small/ Marginal	45
		Other	35

2.3.3 Supportive Programs for Efficient Use of Water

Due to irregular and inadequate rainfall in the state, continuous famine situation remains in some area and water is available for irrigation in limited quantity. Due to rising population and industrialization, increasing demand for water is increasing. In such a situation, it is necessary to preserve this valuable resource, to provide more irrigation in efficient use and to get more profit from the per unit water. Therefore, the following programs are being implemented by the Agriculture Department for proper use of water to attract the attention of the farmers to the protection and efficient use of this limited and valuable resource: -

a) Diggy-Fountain Program
b) Farm Pond (Field Tailieri) Program
c) Water Hog Program
d) Synchy pipeline program

2.3.3.1 Diggy Fountain Program:

This scheme is quite beneficial in the rural areas for the proper use of water and for irrigation in the irrigated area. When the canal is started, the extra water available in the digestion can be used for irrigation by fountain and drip method. This program is being implemented in the districts of Sriganganagar, Hanumangarh, Jaisalmer, Bikaner, Kota, Baran and Bundi districts. About 50 per cent of the cost or maximum of Rs 3.00 lakh whichever is less, grant is given for the construction of four million liters and a heightened capacity of the dignitaries by the farmers.

National Agriculture Development Plan:

- Financial goals of Rs.50.00 crores are proposed for the physical targets of 5000 Diggy constructions and Rupees 150.00 crores in the year 2012-13.
- In the year 2013-14, grants-in-aid of 101.02 crores has been provided to the farmers for the construction of 3453 Digies.
- In the year 2014-15, the financial target of 5000 digit construction and Rs. 100.00 crore financial provision is proposed.

2.3.3.2 Farm Pond (Farm Tailieri) Program:

This program is very effective for the purpose of collecting irrigation water by collecting rain water in heavy soil and harsh lower surface land. The size of the pond for the grant should not be less than 20x20x3 meters (1200 cubic meters). Farmers subsidy is also payable on the form of various sums of forms (such as 30x30x4, 30x30x3, 25x25x4, 25x25x3 meters) which are more than minimum saris. Small, marginal, scheduled caste, scheduled tribes and women farmers will be given 75 percent of the cost or maximum of Rs 60,000 / - whichever is less, on the construction of various sized forms. Growers will be paid to farmers of general category 50 percent of the cost or maximum Rs 60,000 / - whichever is less.

This program is being implemented in all the districts of the state.

- In the year 2013-14, a grant of Rs. 38.42 crores has been provided to farmers for the construction of 6611 farm pond.

- In the year 2014-15, the physical target of 9000 (8000 raw and 1000 lined) form pond constructions and rupees 49.50 crore financial provision is proposed.

2.3.3.3 Water Haul Program:

Jawal Hauj is an important plan to ensure the use of irrigation water as per need. The size of the hawk should not be less than 30g 20g 06ft (3600 cubic feet) or less than 1 lakh liters capacity for the grant. All categories of farmers are given 50 percent of the cost or maximum Rs 60,000 / - whichever is less grant in the year 2013-14. This program is being implemented in the districts of Jaipur, Ajmer, Dausa, Sikar, Jhunjhunu, Bikaner, Churu, Jodhpur, Jaisalmer, Barmer, Nagaur, Jalore, Pali, Sirohi and Bundi districts. Financial target of 1,000 water halls construction and financial provision of rupees 6.00 crores in the financial year 2012-13 under National Agriculture Development Plan.

- In the year 2013-14, a grant of Rs 4.82 crore has been provided to the farmers for the construction of 838 water halls.
- In the year 2014-15, the physical target of 1,000 water-havelic building and rupees 6.00 crore is proposed for financial provision.

2.3.3.4 Synergy Piper Line Program:

By taking raw water available for irrigation through raw drains to the fields, 20 to 25 percent of water is wasted. In order to reduce the wastage and irrigate more area of the water saving area, the farmers of all the categories are asked to take water from the source to the farm on the irrigation pipeline, HDPE / PVC As per their requirement, the farmers will be given subsidy on all types and all-sized pipes to the farmers of 50 percent of the cost or maximum of Rs.15000 / - whichever is less or maximum 25 rupees per meter.

- In the year 2013-14, a grant of Rs 10.21 crore has been made available to farmers for setting up 3729 km pipeline.
- In the year 2014-15, for the Irrigation Pipeline program financial objective of 600 km of NMOP scheme and financial provision of Rs. 150.00 lakh and financial provision of Rs. 4928 crore for the National Food Security Mission and the financial provision of Rs. 1232.00 lakh.

2.4 Cost Analysis and Measurable indicators of Solar Pump Programme

Rajasthan has been pioneer in promoting solar water pumps by adopting suitable policies with an aim to increase solar pump coverage in the state. The important government resolutions of State Government of Rajasthan are given in Box 2.2 and appended as Annexure IX.

Box 2.2: Government Resolutions regarding Solar Irrigation water pumps by, Government of Rajasthan, Jaipur

Date	Resolution No.	Subject
10/15/2014	No.P1() D.H./Solar/GL/2014-15/3255-3479	Guidelines for Solar Energy Operated Irrigation Scheme 2014-15
12/03/2015	No.P1() C.H./Solar/GL/2015-16/4348-4520	Guidelines for Solar Energy Operated Irrigation Scheme 2015-16
07/20/2016	No.P1() D.H./Solar/GL/2016-17/1436-1611	Guidelines for Solar Energy Operated Irrigation Scheme 2016-17
11/1/2017	No.P1() D.H./Solar/GL/2017-18/5401-5526	Guidelines for Solar Energy Operated Irrigation Scheme 2017-18

Source: GOR Office, Jaipur.

The comparative economics of solar pumps and electric system estimated by the State Government in 2013 is presented in Table 2.7. The measurable Indicators - Rajasthan Solar Pump Program up to 2013 is presented in Table 2.8.

Table 2.7: Solar Pump vs Electric System – Cost Analysis

Sr. No.	Details:	Cost input 25 yr	Per ha/yr
1	**Fixed cost**		
(I)	11 kW Sub Station Structure Cost {Structure, GO & DO and LA	90000	
(II)	25 kVA transformer with meter cost	40000	
(III)	11 KV Line per consumer assuming 5 pole average requirement	55000	
(IV)	Sub total	185000	
(V)	Amount being charged from consumer by Discom for 5 HP Connection @ 2500/- per HP	12500	
A	Net Government financial load for connection:	172500	3450
	Established cost for 25 years @10% per year	431250	8625
2	**Calculation of Indirect Electricity tariff subsidy financial load per consumer on Government:**		
(I)	5 HP Load running 6 Hrs per day for 225 days in a years in a year : 3.75 kW×6 Hrs×225 days=50623 units	5063	
(II)	Electricity being charged for 5062 uni billing @ Rs.1.40 per unit	7088	
(III)	Revenue return possible from the same electricity under Commercial tariff plan @ 6.30 per unit	31894	
(IV)	Net Electricity tariff difference indirect subsidy to consumer per year (c-b)	24806	
B	Total Electricity tariff difference indirect subsidy to consumer in 25 years:	620156	12403
3	**Total Government Investment**		
C1	Total subsidy being provided to consumer on connection as well as indirect tariff subsidy in 25 years period: A+B	1223906	24478
C2	Solar subsidy (86% of cost Rs. 7.48 lac)	643280	12866
4	Benefit of Solar over electricity		
D	Saving of subsidy over electricity/ha/year (C1-C2)		11613
	Saving against Potential per year 100000 ha (5000 pumps) Rs. Lac	29031	1161
	Investment for 5000 pumps @ 5.00 lac/-	25000	

Note: Assumption: 5HP pump covers 2 ha area under irrigation
Source: Goyal, 2013.

Table 2.8: Measurable Indicators: Rajasthan Solar Pump Programme

Sr. No.	Item	Unit	Total
1	MNRE approved rate with DC pump	Rs ./Wp	190
2	MNRE approved rate with AC pump (DC rate minus 15%)	Rs ./Wp	161.50
3	Average solar pump capacity	Wp	3,000
4	No .of pumps in 2012-13	No.	4000
5	Equivalent electric power saved (4000x 3000wp)	MWp	12
6	Duration in hours apump runs/day	Hrs.	6
7	No. of units (KWh) saved per day	KWh	18
8	No. of days a pump runs in a year	Days	200
9	No. of electric units saved per pump per year 18 x 200	KWh	3,600
10	Cost per Kwh of electricity	Rs.	5
11	Monthly saved by solar pump per year 3,600 x 5	Rs.	18,000
12	Conventional grid, distribution capital cost saved(not considered)	Rs.	----
13	Diesel cost saved per year (diesel generation is about twice costly than electric)	Rs.	36000
14	Diesel saved per pump per day	litre	3
15	Diesel saved per pump per year	litre	600
16	Diesel saved total, per year (4000 x 600)	Millon Ltr	2.4
17	Foreign exchange saved per year, crude price@ Rs,20/litre	Rs.million	48
18	Diesel subsidy saved by Govt. per year (24,00,000 x Rs.10/liter)	Rs.million	24
19	Diesel subsidy saved by Govt. in 15 years (Rs.2.4Cr x 15 years)	Rs.million	360
20	Area irrigated per pump per crop	Ha	3
21	Area irrigated total, 2 crops a year (4000 pumps x 2 x3)	Ha	24,000
22	Water required for surface irrigation per Ha	Cubic Mtr	5,000
23	Water saved per Ha due to drip irrigation (40% of 500)	Cubic Mtr	2,000
24	Total water saved, 24,000 x 2,000	MCM	48
25	Additional production value due to irrigation through solar pumps	Rs.	1,00,000
26	Total addl production value due to irrigation through solar pumps	Rs. milion	2,400
27	Co2 emission for one 1kwh electricity produced by diesel	Kg	0.29
28	Total co2 generation avoided, 12,000 KWh x 0.29 kg	Kg	3,480
29	Curtailment in farmers' waitlist for electric connection	Nos.	4,000

Source: Goyal, 2013.

2.4 Chapter Summary:

This chapter presented the status of solar irrigation pumps in Rajasthan highlighting the policies adopted by the government towards same. Rajasthan has been pioneer in promoting solar water pumps by adopting suitable policies with an aim to increase solar pump coverage in the state. Its horticulture department provides 86 per cent subsidy on pumps, while the rest is borne by the farmer. Government of Rajasthan brought a new momentum in the space of solar irrigation pumps by introducing 3 HP DC submersible pumps in an 86 percent subsidy scheme launched in 2011-12. The solar pump subsidy was only available to farmers who had farm ponds (diggi), did horticulture in at least 0.5 hectare (ha) land and used drip irrigation. The farmer also had to own a minimum of 0.5 ha of land.

Next chapter presents findings from field survey data.

Chapter III

Findings from Field Survey Data

3.1 Introduction

In order to understand the possible reasons for the adoption of solar technology, information were collected from selected households on various parameters such as their socio-economic profile, operational holdings, sources of irrigation, land holding including leased in and leased out land, source of income and items of expenditure as well as their cropping pattern and returns from cultivation. Further, their reasons for adopting solar technology or otherwise, either with or without subsidy from the government, were also probed. The respondents' experiences with solarized irrigation and their suggestions in order to expand the area under solarized irrigation in Rajasthan were also sought. The collected information is presented in a tabular form and analysed in order to draw meaningful conclusions and bring out policy implications as discussed in the present chapter.

3.2 Social Profile of the Selected Households

As mentioned earlier, data were collected from 125 sample households comprised of 100 households those who have installed solar irrigation pump with support of subsidy (beneficiary farmer household), 5 sample households who have installed solarizied irrigation pump on their own (without any subsidy or support-non-beneficiary farmer household) and 20 sample households who have not yet got subsidy nor installed solar irrigation pumps on their farm (non adopters-control group). The details of social profile of selected households are presented in Table 3.1. It can be seen from the table that except few respondents from beneficiary category, all other selected households from all groups (beneficiary, non-beneficiary and non-adopter category respondents) were male. This indicates farming decisions and adoption of new technology on farm related decision were taken by the male, thus dominance of male could be seen despite of the fact that female contribution is highly significant in the farming and dairying. The average

age of all the respondents of selected respondents was around 50 years while average family size of household was relatively larger in case of beneficiary households (6.91 person), than non-beneficiary and non adopters households (5.4 and 5.3 members respectively). Out of total adult family members in the family, more than 70 per cent were actively participating in the farming. The education status of selected respondents indicate the average education level up to 8 years, while non beneficiary households were relatively more educated (around 11 years) than other groups. The figures on average level of education of respondents indicate that lower level of education among selected respondents.

Table 3.1: Personal Profile of Selected Respondents

Sr. No.	Particulars	Beneficiary Adopters (n=100) BEN	Non-Beneficiary Adopters (n=5) NONBEN	Non-Adopters (n=20) NSUSER	Av. (n=124) ALL
1	Gender of Respondent (%)				
	Male	95.00	100.00	100.00	96.00
	Female	5.00	0.00	0.00	4.00
2	Average Size of household (Nos.)	6.91	5.30	5.40	5.87
3	Average No. of members working in Agriculture	3.67	3.30	3.15	3.37
4	Mean Age of respondent (years)	51.3	50.10	48.3	49.90
5	Mean years of Education of respondent (years)	6.70	11.80	6.60	8.37

Source: Field survey data.

The religion-wise distribution of selected respondents presented in Table 3.2 indicate that out of total selected households, about 94 per cent households belongs to hindu religion while remaining were from Muslim and Sikh religions. Among the three groups of respondents, same trend was observed except relative high share of Sikh religion among non-beneficiary households as about one fifth of non-beneficiary households were from Sikh religion. In case of social caste distribution, on an average, dominance of other backward class category households was observed followed by households from general category and scheduled caste category. The other backward caste followed by open category comprised beneficiary household group, while opposite composition of households

was observed in case of non beneficiary households. Besides, Open and OBC category households, scheduled caste households were also among selected households under non-adopters group. Thus, at overall level, backward class category respondent dominated the sample followed by general category and then scheduled caste, while very meager share was of Scheduled Tribe respondents.

Table 3.2: Social Characteristics of Selected Respondents

Sr. No.	Characteristic	Beneficiary Adopters	Non-Beneficiary Adopters	Non-Adopters	Av.
A	Religion (% to total)				
1	Hindu	94.00	80.00	95.00	93.60
2	Muslim	1.00	0.00	0.00	0.80
3	Christian	0.00	0.00	0.00	0.00
4	Others	5.00	20.00	5.00	5.60
B	Social group (% to total)				
1	Scheduled Tribe	1.00	0.00	0.00	0.80
2	Scheduled Caste	1.00	0.00	35.00	6.40
3	Other Backward Castes	81.00	40.00	55.00	75.20
4	General/Open	17.00	60.00	10.00	17.60

Source: Field survey data.

3.3 Economic Profile of the Selected Respondents

The details on economic characteristics of the selected households are presented in Table 3.2. It can be seen from the table that more than 90 per cent of total beneficiary and non-adopter households were having farming as their principal occupation while three fourth of total non-beneficiary households had service as their principal occupation. Animal husbandry and dairying followed by agriculture labour was subsidiary occupation of beneficiary and non-adopters, while crop cultivation followed by agriculture labour was subsidiary occupation of non-beneficiary households. The main occupation of the selected households was agriculture comprised of cultivation of land as a farmer along with supportive allied activity of animal husbandry and dairying. The average years of farming experience of the respondents was around 29 years, which shows that most of the respondents were in farming business since their young age. The income level of both beneficiary and non-beneficiary households indicate that more than 98 percent of beneficiary and non beneficiary households were better off term sof

income as compared to non-adopters group in which half of the selected respondents were from below poverty line income group. Thus low income status may have kept non adopters away from adoption of this new power generation technology. In case of dwelling structure, it was observed that about 98 per cent households of beneficiary member have pucca structure while in non- beneficiary and non adopter category only 60 per cent and 45 per cent household has pacca house structure.

Table 3.3: Economic Characteristics of Selected Respondents

Sr. No.	Particulars	Beneficiary (N=100)	Non-Beneficiary (n=5)	Non-Adopters (n=20)	Av. (N=125)
A	**Principal Occupation (%)**				
1	Cultivator	92.00	60.00	90.00	90.40
2	AH & Dairying	0.00	0.00	0.00	0.00
3	Agri. Labour	0.00	0.00	0.00	0.00
4	Nonfarm Labour	0.00	0.00	0.00	0.00
5	Own Non-Farm Establishment	2.00	0.00	0.00	1.60
6	Trade	1.00	0.00	0.00	0.80
7	Employee in Service	5.00	40.00	10.00	7.20
8	Other	0.00	0.00	0.00	0.00
B	**Subsidiary Occupation (%)**				
1	Cultivator	8.00	60.00	50.00	16.80
2	AH & Dairying	72.00	40.00	25.00	63.20
3	Agri. Labour	0.00	0.00	0.00	0.00
4	Nonfarm Labour	0.00	0.00	0.00	0.00
5	Own Non-Farm Establishment	10.00	0.00	0.00	8.00
6	Trade	9.00	0.00	0.00	7.20
7	Employee in Service	1.00	0.00	25.00	4.80
8	Other	0.00	0.00	0.00	0.00
C	Av. years of experience in farming	29.60	28.00	30.00	29.20
D	**Income Group (%)**				
1	BPL	2.00	0.00	50.00	9.60
2	APL	98.00	100.00	50.00	89.60
3	AAY	0.00	0.00	0.00	0.00
E	**House Structure Nos. (%)**				
1	Pucca	98.00	60.00	45.00	88.00
2	Semi-Pucca	2.00	20.00	35.00	8.00
3	Kuccha	0.00	20.00	20.00	4.00

Source: Field survey data.

3.4 Size of Land Holdings with Selected Households

Land is the most important and limited factor in agriculture. The details on operational landholding of the selected sample households are presented in Table 3.4. It can be seen from the table that on an average, land holding size of selected beneficiary households was 1.21 ha categorizing them as small land holders' group, while non-adopters had much lesser land holding of 0.91 ha as marginal land holders, while corresponding figure for non-beneficiary households was 6.10 ha, indicating medium size land holders. Moreover, we also found that the who were having solar water pump had taken land on leasing-in while none of them leasing out the land. Non-beneficiary farmer households had taken larger size of land on leased-in (0.75 hectare) as compared to beneficiary households (0.01 ha), this might be because the non beneficiary farmers are comparatively wealthy farmers and have more capital than the other two groups.

Table 3.4: Operational Landholding of the Selected Sample Households

Sr. No	Particulars	Beneficiary	Non-Beneficiary	Non-Adopters	Total
A	Total owned land				
	Rainfed (% to total)	6.12	0.00	25.35	3.65
	Irrigated (% to total)	93.88	100.00	74.65	96.35
	Total (ha)	**2.45**	**5.86**	**0.71**	**3.01**
B	Un-cultivated land				
	Rainfed (% to total)	0	0	0	0
	Irrigated (% to total)	0	0	0	0
	Total (ha)	**0**	**0**	**0**	**0**
C	Cultivated land				
	Rainfed (% to total)	12.50	0.00	19.78	4.42
	Irrigated (% to total)	87.50	100.00	80.22	95.58
	Total (ha)	**1.2**	**5.35**	**0.91**	**2.49**
D	Leased-in land				
	Rainfed (% to total)	0.0	0.0	-	0.0
	Irrigated (% to total)	100.0	100.0	-	100.0
	Total (ha)	**0.01**	**0.75**	**0**	**0.25**
E	Leased –out land				
	Rainfed (% to total)	-	-	-	-
	Irrigated (% to total)	-	-	-	-
	Total (ha)	**0**	**0**	**0**	**0**
G	Total operational land/HHs				
	Rainfed (% to total)	12.40	0.00	19.78	4.01
	Irrigated (% to total)	87.60	100.00	80.22	95.99
	Total (ha)	**1.21**	**6.1**	**0.91**	**2.74**

Out of the total operational land holdings with selected households, almost all land under operation of non-beneficiary household was under irrigation, while in case of beneficiary households, about 80 per cent land had irrigation coverage. The non-adopter households could irrigated their three fifth of total operational holdings with available sources of irrigation. Thus, despite of having the large size of land holdings, non-beneficiary had sufficient water and sources of irrigation to irrigate the crop. Due to such sound background of having all land coverage with irrigation, the assured returns must have build confidence in farmers to invest in installation of solar pumps on their farm with their own expenditure, i.e. without any subsidy.

3.5 Changes in Cropped Area, Cropping Intensity and Irrigation Method:

Changes in cropped area and changes in use of irrigation methods of selected beneficiary households after solarisation are presented in Tables 3.5 and 3.6. It can be seen from these tables that after solarisation, area under cropped as well as irrigated area was increased by around 17 percent while cropping intensity was almost constant. The share of area sown to gross cropped area during kharif and summer season has shown meager increase. It can be seen from table 3.6 that distribution of area under irrigation by type of irrigation method has shown some changes after solarisation as compared to situation prevailed during pre-solarisation period of beneficiary farms. The area irrigated by flood method of irrigation has declined by about 30 per cent which must have due to adoption of sprinker and drip method of irrigations. The area under rainfed condition has also shown declined trend. Overall the total gross cropped area has increased about 17 per cent after solarisation.

The transformational impact of irrigation is evident in solar water pump Scheme, where solar pumps were used to expand the coverage of the scheme from 40 to 50 hectares. More than 50 per cent beneficiary household area transformation from gravity-fed irrigation to sprinkler and drip irrigation with additional solar booster pumps have been deployed to pump water into a storage reservoir.

Table 3.5: Changes in Net Sown Area, Gross Cropped Area and Cropping Intensity of Sample Beneficiary Households

Sr. No	Seasons	Particulars	Before Solarisation (2015-16)	After Solarisation (2016-17)
A	Kharif	Rainfed (% to season total area)	0.83	0.32
		Irrigated (% to season total area)	99.17	99.68
		Total as percentage of GCA	63.07	64.13
B	Rabi	Rainfed (% to season total area)	0.43	1.00
		Irrigated (% to season total area)	99.57	99.00
		Total as percentage of GCA	35.41	33.86
C	Summer	Rainfed (% to season total area)	0.00	0.00
		Irrigated (% to season total area)	100.00	100.00
		Total as percentage of GCA	1.51	2.01
D	Total	Rainfed (% to GCA)	0.67	0.54
		Irrigated (% to GCA)	99.33	99.46
E	Net Area Sown (% to GCA)		63.07	64.13
F	Cropping Intensity (%)		158.55	155.94

Source: Field Survey data.

Table 3.6: Changes in use of Irrigation Methods of Beneficiary Households

Sr. No.	Method of irrigation	Area in ha		Percentage change
		Before solarisation	After Solarisation	
A	**Gross Irrigated Area**	**281.97**	**329.53**	**16.90**
1	Flood	154.96 (54.67)	109.25 (33.09)	-29.50
2	Sprinkler	116.76 (41.19)	200.70 (60.78)	71.89
3	Drip	10.25 (3.62)	19.58 (5.93)	91.02
B	Rainfed	1.48 (0.52)	0.67 (0.20)	-54.73
C	**GCA**	**283.45 (100.00)**	**330.20 (100.00)**	**16.49**

Note: Figures in parenthesis are percentage total.
Source: Field Survey data.

The changes in net sown area, gross cropped area and cropping intensity of and changes in use of irrigation methods of non-beneficiary households after solarisation are presented in Tables 3.7 and 3.8. It can be seen from these tables

that after solarisation, significant growth in gross irrigated area and gross cropped area was recorded, that to increase in irrigated area was more than cropped area. Due to which cropping intensity has changed by around 13 per cent points after solarisation as compared to before solarisation year. The increase in area under irrigation may be due to assured and quality power supply through solar during convenient timings during day time for irrigation.

Table 3.7: Changes in Net Sown Area, Gross Cropped Area and Cropping Intensity of Sample Non-beneficiary Households

Sr. No	Seasons		Changes in area (% to GCA) n=5	
			Before	After
A	Kharif	Rainfed (% to season total area)	11.62	5.76
		Irrigated (% to season total area)	88.38	94.24
		Total as percentage of GCA	63.07	64.13
B	Rabi	Rainfed (% to season total area)	0.00	0.00
		Irrigated (% to season total area)	100.00	100.00
		Total as percentage of GCA	35.41	33.86
C	Summer	Rainfed (% to season total area)	0.00	0.00
		Irrigated (% to season total area)	100.00	100.00
		Total as percentage of GCA	1.51	2.01
D	Total	Rainfed (% to GCA)	7.49	3.42
		Irrigated (% to GCA)	92.51	96.58
E	Net Area Sown (NAS) % to GCA		64.5	59.3
F	Cropping Intensity (%)		155.12	168.49

Source: Field data survey.

It can be seen in the table that the area irrigated by flood method of irrigation has declined by about 28 per cent. Also rainfed area has declined by 43 per cent after solarisation. While area irrigated through the use of micro irrigation equipments such as sprinkler and drip has recorded significant increase. Overall the total gross cropped area has increased about by 26.04 per cent after solarisation. As increase in gross cropped area was higher for non-beneficiary than the beneficiary may to due to the fact that non beneficiary farmers are economically strong and diesel pump owners, had shifted to solar pumps to avail

benefits such as zero operational costs, ease of use throughout the day and cost savings on diesel.

Table 3.8: Changes in use of Irrigation Methods of Non-beneficiary Households

Sr. No.	Irrigation Methods	Area in ha.		Percentage change
		Before solarisation	After Solarisation	
A	Gross Irrigated Area	36.3	47.77	31.60
1	Flood	26 (66.24)	18.85 (38.11)	-27.50
2	Sprinkler	9.18 (23.39)	26.73 (54.04)	191.18
3	Drip	1.13 (2.88)	2.19 (4.43)	93.81
B	Rainfed	2.94 (7.49)	1.69 (3.42)	-42.52
C	GCA	39.24 (100.00)	49.46 (100.00)	26.04

Note: Figures in parenthesis are percentage total.
Source: Field Survey

In case of non-adopters, cropping intensify was 166 per cent (Table 3.9) mainly because of more than four fifth of total cropped area having irrigation coverage.

Table 3.9: Net Sown Area, Gross Cropped Area and Cropping Intensity of Sample Non-adopter households

Sr. No.	Season		Area (% to GCA)
A	Kharif	Rainfed (% to season total area)	12.71
		Irrigated (% to season total area)	87.29
		Total as percentage of GCA	60.16
B	Rabi	Rainfed (% to season total area)	0.00
		Irrigated (% to season total area)	100.00
		Total as percentage of GCA	
C	Summer	Rainfed (% to season total area)	0.00
		Irrigated (% to season total area)	0.00
		Total as percentage of GCA	0.00
D	Total	Rainfed (% to GCA)	7.65
		Irrigated (% to GCA)	92.35
E	Net Area Sown (NAS)		15.73
F	Cropping Intensity (%)		166.21

Source: Field data survey.

3.6 Status of Irrigation before Solarisation

It can be seen from the Table 3.10 that before solarisation of irrigation pumps, out of selected solar water pumps users, only 37 percent of beneficiary households had grid connection facility available on their farm while all the non-beneficiary farmers had grid connectivity to their irrigation pumps. In case of rate charged towards use of electricity, almost two third pumps of beneficiary households were metered and remaining were charge on flat rate basis. While in case of non-beneficiary households, all irrigation pumps had meter and were charged on meter use basis. Average irrigation expenditure per household per year was estimated to be between Rs. 3200-3500/-. Despite of the fact that agriculture require more hours of electricity supply to carry out agricultural operations (irrigation, threshing, etc), selected respondents households reported that they used to get hardly 6 hours of power supply in a day, which indicate the pressure built on respondents to make use of new technology of solar energy.

The selected households had multiple sources of water available for irrigation and also had used multiple method of irrigations such drip and sprinkler irrigation. The average water depth was estimated to be around 200 feet and water was lifted through making use of diesel and electric pumps. The average distance of canal/river water was about 1 kms from the field. Around two third of the selected households had water storage facility on the farm, while no one has made attempt to recharge the groundwater through adoption of any innovative technique or practice. The main problem was observed with the availability of electricity to farm connection which is hardly made available though grid for eight hours in a day mostly at inconvenient times, irrespective of season. Thus, in order to irrigate the crop during day time with uninterrupted power supply, the solar irrigation pump is the most suitable option available which selected households have installed on their farm.

Table 3.10: Details about Grid Connectivity and Irrigation Pumps before Solarisation

Sr. No.	Particulars	Beneficiary (n=100)	Non Beneficiary (n=5)
1	% of HHs having grid supply/ connection on farm	37.00	100.0
	Average Rate		
	Metered (%)	59.46	100.0
	Flat rate (%)	40.54	0.00
2	Average payment Rs./Year	3500.0	3225.0
3	Average Grid power availability (hrs)		
	Rainy	6.00	6.00
	Winter	6.00	6.00
	Summer	6.00	6.00
4	Major source of Irrigation		
	Open well (%)	19.00	0.00
	Tube well (%)	40.00	60.00
	Tank (%)	25.00	40.00
	Canal (%)	36.00	60.00
5	Average Water depth (ft.)	198.31	205.83
6	Nature of irrigation pumps before solar pumps		
	Diesel (%)	50.00	60.00
	Electric (%)	37.00	40.00
	Rented diesel (%)	13.00	0.00
	Rented electric (%)	0.00	0.00
	Floods (%)	100.00	100.00
7	Average Capacity in HP		
	Diesel	3.00	3.00
	Electric	5.00	5.00
8	Method of Irrigation		
	Drip (No.s/ %)	68.00	40.00
	Sprinkler (No.s/ %)	89.00	40.00
	Flood No.s(%)	14.00	60.00
9	Average Distance of Canal/River water (mtrs)	909.47	762.50
10	% of HHS having water storage availability	66.00	60.00
11	% of HHS having ground water recharging facility	0.00	0.00

Source: Field Survey

3.7 Changes in Cropping Pattern

Changes in cropping pattern of sample beneficiary households are presented in Table 3.11. It can be seen from the table that due to about 17 per cent increase in gross cropped as well as irrigated area after solarisation, area under fruits and vegetables, wheat and maize crop was significantly increased during rabi and summer season. The change in cropping pattern was relatively in favor of irrigated crops. During kharif season, major crops grown were paddy,

maize, groundnut, cotton, soybean while wheat and gram were sown during rabi season. Due to availability of irrigation facility, crops such as maize, moong, vegetables and fruits were grown during summer season.

Most of the households, who were previously growing subsistence crops like bajra, maize, soybean in kharif and wheat, gram and mustard in rabi, and feed crops as well to earn income and benefit. After solarisation, not only numbers of crops grown have increased but also farm yields have increased to an average of 2 to 4 quintal per hectare. Irrigation enables farmers to grow three crops per annum and rotate crops to grow a diversity of nutritious and cash crops, such as vegetables and fruit crops and flowers also. This indicates that solarisation helps to increase the area under cultivation during the summer season or under the perennial with commercial crops like vegetables.

While in case of non-beneficiary households, cropping pattern indicate that kharif season was the major season (Table 3.12) for them. However, crops were grown in all three seasons (kharif, rabi and summer) before solarisation as well because of the fact that they are economically sound and thus can make full use of water through the use of diesel and electricity pump. As expected after solarisation, the share in area of traditional crops such as jowar, moong, moth, guar and bajra has declined and area under other horticulture crops like vegetables and fruits crops has increased. After solarisation, gross cropped area of the non-beneficiary households has increased by about 26 percent. It was also observed that after solarisation, the numbers of crops grown during year has been increased, as seen in case of beneficiary households. In kharif season, the major crops grown were cotton, soybean and bajra while during rabi season, wheat, gram and rapeseed & mustard crops were grown. The fodder and vegetables crops were also grown by the non beneficiary farmers during summer season. The increase in share of the area under commercial crops, fruits and vegetables and perennial crops indicate the benefit of solar energy availability with selected non beneficiary households for irrigating the crops.

Table 3.11: Changes in Cropping Pattern of Sample Beneficiary Households

Sr. No.	Crop Name		Before solarisation % GCA	After Solarisation % GCA	% age change Area
1	Kharif				
a	Rainfed	Maize	0.06	0.07	43.75
		Jowar	0.25	0.10	-54.17
		Moth	0.12	0.00	-100
		Guar	0.10	0.03	-59.26
b	Irrigated	Bajra	18.00	16.10	4.21
		Maize	7.51	7.10	10.09
		Jowar	7.18	7.73	25.52
		Moong	4.71	4.37	8.1
		Moth	0.32	0.37	35.16
		Urad	0.03	0.05	100
		Groundnut	5.36	7.73	68.03
		Sesamum	0.03	0.02	0
		Soybean	3.94	4.18	23.55
		Cotton	6.60	5.69	0.53
		Guar	5.22	4.54	1.22
		Tomato	0.02	0.06	233.33
		Ladyfinger	0.02	0.02	0
		Kinnow	3.62	4.43	42.73
		Lemon		0.47	100
		Pomegranate		0.41	100
		Guava		0.50	100
		Chilly		0.06	100
		Brinjal		0.02	100
		Cabbage/Cauliflower		0.04	100
		Rose		0.03	100
2	Rabi				
a	Rain fed	Gram	0.12	0.25	138.24
		Mustard	0.03	0.09	244.44
b	Irrigated	Barley	0.24	0.07	-66.67
		Wheat	18.49	16.75	5.55
		Gram	7.77	7.23	8.4
		Rapeseed & Mustard	8.47	8.60	18.28
		Linseed	0.06	0.08	47.06
		Razka	0.02	0.03	50
		Onion	0.02	0.06	216.67
		Chilly	0.05	0.14	200
		Isabgul	0.06	0.07	37.5
		Tomato	0.08	0.25	281.82
		Cucumber		0.14	100
		Ginger		0.04	100
		Palak & Methi		0.04	100
		Marigold		0.04	100
3	Summer	Jowar Fodder	1.50	1.89	47.06
		Vegetable	0.01	0.01	33.33
		Watermelon	0.00	0.02	600
		Muskmelon		0.02	100
		Tomato		0.02	100
		Aowla		0.04	100
		GCA			16.49

Table 3.12: Cropping Pattern of the Non-Beneficiary Sample Household

Sr. No.	Crop Name	Before solarisation % GCA	After Solarisation % GCA	% age change In area
a	Rainfed			
	Moth	1.91	1.52	0
	Guar	3.97	1.90	-40
	Bajra	1.60	0.00	-100
b	Irrigated	0.00		
	Bajra	9.04	8.51	18.59
	Maize	1.35	1.60	48.58
	Jowar	1.27		-100
	Moong	1.27	2.02	100
	Moth	3.03	1.52	-36.84
	Soybean	15.36	13.91	14.01
	Groundnut		5.94	
	Cotton	14.98	12.78	7.48
	Guar	2.06	0.63	-61.54
	Tomato	2.88	2.87	26.22
	Ladyfinger	0.15	0.53	320
	Chilly	2.70	2.34	9.41
	Kinnow	2.88	3.29	44.44
2	Rabi			
a	Irrigated			
	Wheat	11.84	12.63	23.36
	Gram	5.99	10.37	76.89
	R & Mustard	14.01	11.81	34.22
	Linseed	0.79	0.00	45.45
	Onion	0.64	0.71	87.5
	Cucumber	0.32	0.51	88.5
3	Summer			
	Jowar Fodder	0.97	0.89	16.67
	Vegetable	0.97	2.61	243.33
	Pomegranate		1.13	---
	GCA			24.59

Source: Field Survey

In case of non-adopters (control group) households, major crops grown during Kharif season were bajra, moong, moth, groundnut, guar and other minor crops while wheat, gram, rapeseed and mustard were major crops grown during rabi season (Table 3.13). It was very pleasant to note here is that significant area during summer season was allotted under fodder crops indicates the scarcity of fodder in the selected area. The distribution of area under irrigation by type of irrigation method used by all non adopter farmers adopted flood irrigation system.

Table 3.13: Changes in Cropping Pattern Sample Non-adopters Households

Sr. No.	Crop name	% GCA
1	Kharif	
a	Rainfed	
	Moth	4.78
	Guar	2.87
b	Irrigated	0.00
	Bajra	12.20
	Maize	4.21
	Jowar	5.74
	Moong	5.74
	Moth	4.55
	Groundnut	5.12
	Soybean	3.94
	Cotton	6.46
	Guar	4.05
	Tomato	0.50
2	Rabi	
a	Irrigated	
	Wheat	21.15
	Gram	4.78
	Rapeseed & Mustard	5.74
	Linseed	1.19
	Onion	0.96
	Cucumber	0.48
	Fodder	5.54

Source: Field Survey

3.8 Possession of Irrigation Pumps:

The details on possession of irrigation pumps of selected households presented in table 3.14 indicate that solar pumps essentially are a collection of solar PV panels, AC or DC pumps and the associated electronics that have been optimized for high efficiency operations. All non-beneficiary households have used submersible DC pumps while in case of beneficiary households, 54 per cent households had DC pumps on their farm. As a technology, while AC technology is now catching up, DC technology is considered to be more suitable given the wider operating range and higher efficiencies reported by beneficiary.

Table 3.14: Details on Possession of irrigation Pumps of selected Respondents

Sr. No.	Particulars	Responses (% to total)			
		Beneficiary (N=100)	Non-Beneficiary (n=4)	Non-Adopters (n=20)	Total (N=124)
1	Surface AC	2.00	0.00	0.00	1.60
2	Submersible AC	33.00	0.00	0.00	26.40
3	Surface DC	11.00	0.00	0.00	8.80
4	Submersible DC	54.00	100.00	0.00	47.20

Source: Field Survey

3.9 Installation of Solar Panels and Availability of Power

The details about the installation of solar panels and availability of power with selected beneficiary and non-beneficiary households are presented in Table 3.15. It can be seen from the table that land area covered by the solar pump installed was around 4.8 ha in case of beneficiary households while same was 4.4 ha in case of non-beneficiary households. All the selected households had solar panels on farm. About two third of installed solar PV panels were with automatic rotation system while remaining were with manually rotation system. On an average 4-6 poles are were installed with mean number of stand poles between 12-15, having average size of panel of 3 feet by 5 feet. Mean area covered by the each stand pole was around 5 feet by 5 feet. No installed solar panel have meter to record the power generated and used. About 37 percent solar plants of beneficiary households and 5 percent of non beneficiary households were connected to grid. None of farmers has installed the solar power storage cell. The solar power generated mostly been sued for agriculture purpose while few of beneficiary households used for household purposes as well. None of the selected households had use solar power to sell irrigation water to neighboring farmer, thus no additional income through sale of water was reported.

Table 3.15: Installation of Solar Panels and Availability of Power

Sr. no.	Particulars	Beneficiary (n=100)	Non Beneficiary (n=5)
1	Mean land area on which solar PV panels and pump are installed (ha)	4.8	4.43
2	HHs having solar PV panels (%)		
	on Field	100.0	100
	at home	0	0
3	HHs having device rotated (%)		
	Manual	30.0	40.0
	Automatic	70.0	60.0
4	Mean No. of solar stand poles	4	6
5	Mean No. of rectangular panels in stand poles	12	13
6	Mean Size of each panel (ft*ft)	3x5	3x5
7	Mean power generation capacity (units/day)	NA	NA
8	Average Actual power generated with solar units/day	NA	NA
9	Mean area covered by each stand pole		
	(FT x FT)	5x5	5x5
10	Connection of solar power plant to the grid (No.s/%)	37.00	5.00
11	Mean sale of power to the grid (units/ per month)	NA	NA
12	Selling rate (Rs./unit)	NA	NA
13	HHs that installed solar power storage cells (No.s/%)	NA	NA
14	Approximate cost per unit (range)	NA	NA
15	Type of use of storage cells		
	On own field	NA	NA
	On others' field	NA	NA
16	Renting out for social function	NA	NA
16	Approximate hours of power used per irrigation	NA	NA
17	Prevalent water rates in the district (Rs./bigha/hour of irrigation) (range)		
	i) Through canal flow	NA	NA
	ii) Through canal lift	NA	NA
	iii) Through govt. tube well	NA	NA
	iv) Purchased	NA	NA
18	No. of HHs using solar power		
	(a) for household use		
	(b) for agriculture	98.0	100
	(c) for both	2.0	0

3.10 Reasons for Adopting Solar Pumps

Rajasthan comprises about 10.4 percent of India's landmass in which 60 per cent area are is desert and 5.5 percent of the total population but has only one percent of the nation's water resources. Groundwater is either saline or declining at a fast rate. The grid power supply available for only 5 to 6 hour for field and it is very expensive. In such a scenario, selected households were asked about the reasons for adoption of solar power generation unit on their farm. The selected households have cited multiple reasons for choosing solar on their farm (Table 3.16).

Table 3.16: Reasons for Adopting Solarised Irrigation Pumps

Sr. No	Particulars	Responses (%)	
		Beneficiary (n=100)	Non Beneficiary (n=5)
1	Non-availability of electricity connection	50.00	**60.00**
2	Costly diesel	51.00	60.00
3	Costly to run electric pump	24.00	70.00
4	Unreliability of electricity supply/ Inconvenient grid supply timings	46.00	40.00
5	Inconvenient hours of electricity supply	41.00	60.00
6	Wanted to take advantage of subsidy being offered	36.00	0.00
7	Wanted to try a new technology	3.00	0.00
8	Wanted to try renewable technology as it is environment-friendly	34.00	20.00
9	Personal relations with the person who marketed solar technology	4.00	0.00
10	Recommendation of fellow farmers, friends or relatives	14.00	0.00
11	Savings on the cost of fertilizers and weeding	16.00	20.00
12	Saving electric bill	56.00	80.00
13	To avoid hassle of irrigating crop irrigation during night hours	66.00	30.00

Source: Field survey data.

About two third of beneficiary households mentioned that to avoid hassle of irrigating crop irrigation during night hours was the major reason for adoption of solar irrigation pump. More than 50 percent of selected households strongly

reported that they adopted the solar water pump due to costly diesel, followed by non-availability of electricity connection, unreliability of electricity supply/ inconvenient grid supply timings, high electric bill. Few of the beneficiary households wanted to try renewable technology as it is environment-friendly while few wanted to take advantage of subsidy being offered for installation of solar pumps on farm. While in case of non-beneficiary households, major three reasons quoted were saving electric bill followed by costly to run electric pumps and inconvenient time of electric supply/costly diesel. Thus, findings about the reasons for adoption of the solar water irrigation pump under different category suggests that high cost of electricity along with inconvenient hours of electricity supply and high cost of diesel has pushed the farmers to adopt pollution free power generation thorugh solar.

3.11 Sources of Finance to Purchase Solar Pumps

Government of Rajasthan brought a new momentum in the space of solar irrigation pumps by introducing 3 HP DC submersible pumps with 86 percent subsidy scheme launched in 2011-12. There was also a 2 HP DC submersible pump option, but there have been few takers for it. The State government leveraged central financial assistance coming from MNRE and Agriculture Ministry for the same. The state government provides 56 percent subsidy under Rashtriya Krishi Vikas Yojana (RKVY) and the New and Renewable Energy Ministry of Government of India provides the balance 30 percent under Jawaharlal Nehru National Solar Mission (JNNSM). The project was implemented through the Horticulture Society under the Agriculture department of Government of Rajasthan. The sources of finance for purchasing solar pump are given in the table 3.17. It can be seen in the table that beneficiaries had to pay 30 to 32 per cent of the system cost. The agriculture department of Rajasthan provided 68-72 per cent of total cost as subsidy through JNNMS and RKVY scheme. The cost of 5 HP solar pumps was about 30 to 33 per cent higher than 3 HP solar. It may be noted that, the major sources of institutional credit was commercial banks followed by cooperative banks, for both beneficiary and non-beneficiary farmers. About 50 to 80 per cent amount had taken loan by beneficiary while corresponding figure for

non beneficiary household was 45 to 55 with interest rate ranges between to 7 per cent. The cost of documentation incurred by selected households was about Rs. 1111/- per households while in case of non beneficiary households same was Rs. 1848/- (Table 3.17). The expenditure of Rs. 1584/- was incurred towards installation by the beneficiary while corresponding figure for non-beneficiary household was Rs. 1848/-.

Table 3.17: Sources of Finance for Purchasing Solar Pump

Sr. No.	Particulars	Beneficiary (n=100)	Non Beneficiary (n=5)
1	Av. Cost of solar pump (Rs.)		
	3 HP	480449.0	449281.0
	5 HP	646870.0	606167.0
2	Av. Subsidy on Solar (Rs.)		
	3 HP	323966.8 (67.43)	0.00
	5 HP	456370.0 (70.55)	0.00
3	Own investment (Rs.) Range		
	3 HP	156482.2 (32.57)	449281 (100.00)
	5 HP	190500.0 (29.45)	606167 (100.00)
4	Amount of bank loan (Rs.)		
	3 HP	100750 (55.82)	250000 (55.64)
	5 HP	150500 (79.00)	280333 (46.25)
5	Number of HH taken bank loan (%)	48.00	100.00
6	Bank Interest rate (%)	4.00	4.00
7	Number of Bank Provided Loan	4.75	3.00
8	HHs financed/supported by NGO	-	-
9	Av. Cost of documentation and installation (Range) in Rs.	1111.00	1847.75
10	Av. Cost of installation Rs.	1584.00	3514.00

Source: Field survey data.

3.12 Installation of Solar Pumps & Post installation Service

The process of installation of solar pump took almost 6-7 days (Table 3.18) while average number of visits of representative of agency was more in case of non-beneficiary (about 5 visits) compared to beneficiary households (about 3

visits). The company-wise distribution of solar panels indicates that Jain Irrigation Company had supplied major share of pumps (as solar pump supplier) in both groups. The other major suppliers were Shakti, Lubi, Tata Solar, Waaree, etc. More than 95 per cent of selected respondents had received training/ demonstration about operating solar pump from solar water pump through supplier agency while about more than 98 per cent of beneficiary and non beneficiary household had satisfied with support services provided by agency and quality of solar panels. More than 90 per cent responded are insured the solar pump.

Table 3.18: Process of Installation and Pre and Post-installation Support

Sr. No.	Particulars	Beneficiary (n=100)	Non Beneficiary (n=5)	Total (n=105)
1	No. of times that the representative of the agency visited the respondent (Avg .Days)	2.23	4.5	3.36
2	No. of working days taken to complete installation (Range)	6.32	5.4	6.02
3	Percentage share in funds from the agency that made installation?			
	Jain Irrigation	62.00	60.00	61.90
	LUBI	6.00	0.00	5.71
	Modern Solar	1.00	0.00	0.95
	Shakti	3.00	20.00	3.81
	Tata Solar	4.00	20.00	4.76
	Topsun	5.00	0.00	4.76
	Waaree	10.00	0.00	9.52
	Reel Solar	6.00	0.00	5.71
	SunEdison	2.00	0.00	1.90
	Lanco	1.00	0.00	0.95
4	Respondent who received instructions/ training/demonstration about operating solar pump (%)	98.00	60.00	96.19
5	Satisfaction with support services provided by agency (%)	95.00	100.00	95.24
6	No. of insured solar pumps (%)	92.00	100.00	92.38
7	Satisfaction of respondents with quality of solar panels (%)	98.00	100.00	98.10

Source: Field survey data.

3.13 Conditions of Eligibility for Subsidy

Government of Rajasthan had many times improved the policy and eligibility criteria of receiving subsidy on solar water pump. The solar pump subsidy was only available to the farmers who fulfill the basic criteria fixed for same such as farmer should have farm ponds (diggi), had land at least 0.5 hectare (ha) land and availability of micro irrigation instruments or ready to take solar with micro

irrigation and no grid connection. It can be seen in table 3.19 that more than 80 per cent beneficiary had fulfilled these conditions.

Table 3.19: Conditions of Eligibility of Receiving Subsidy

Sr.	Eligibility conditions	% to total
a	Caste/Category	0.0
b	Gender (Female)	0.0
c	Income group (BPL)	0.0
d	Land ownership (Marginal >1 ha; Small >2 ha)	80.0
e	Backwardness of region/area	0.0
f	No Grid connection	14.0
g	Availability of Diggi=1/Tank=2	80.0
h	Availability of micro irrigations instruments (drip/sprinklers)	83.0
i	Ready to take Solar with micro irrigation	52.0

Source: Field survey data.

Storage tanks in different sizes are used to store the water that is pumped. The water that is stored in the tank can be used for irrigation when needed. There are different types of agricultural irrigation method used (Table 3.20). Characteristics of respondents using solarised irrigation pumps are given table 3.20. More than 90 percent beneficiary households had used solar with MIS while 100 per cent non-beneficiary households have used MIS and Solar pump without subsidy. All solar water pump users advise to others to adopt solarisation of irrigation pumps with the information of the government policies in the solar irrigation sector, particularly solar subsidies regard and economic benefit of solar irrigation pump.

Table 3.20: Characteristics of Respondents Using Solarised Irrigation Pumps

Sr. No.	Characteristic	Responses (%)		
		Beneficiary (n=100)	Non Beneficiary (n=5)	Av. (n=105)
1	Solar pump with MIS	93.0	100.0	93.33
2	Solar pump without MIS	6.0	0.0	5.71
3	Adopted micro-irrigation along with solar pump	93.0	100.0	93.33
4	Solar pump without subsidy	0.0	100.0	4.76
5	Adopted solar irrigation only because bank loan was available	0.0	40.0	1.90
6	Would advise others to adopt solarization of irrigation pumps	100.0	100.0	100.00

Source: Field Survey data.

3.14 Water Use and Sale 'Before' and 'After' Solar Pump

The water use and sale 'before' and 'after' solar pump installed comparative analysis between beneficiary and non beneficiary are given in table 3.21. To supplement the intermittent and inadequate canal supply, many farmers have also dug tubewells. It can be seen in table that the depth of water level is was around 210 feet in case of beneficiary households during both the periods, while same has slightly increased to about 235 feet in case of non-beneficiary users. The depth of groundwater was stagnant possibly may be due to farm pond as recharger for ground water on beneficiary farm. Diesel was used as fuel to drive the water pump during rabi season. On an average about 4 litre of diesel was used per bigha watering of land by the selected respondents and approximate expenditure of repair of diesel pump was estimated to be between Rs. 8500-10000/- was incurred. Some of the beneficiary and non beneficiary farmers had to incurred expenditure to the tune of amount of Rs. 4581-/ and Rs. 6847/- towards repair of their electric pumps. On an average, about more than two hours time was spent on procuring diesel/petrol per week to fetch diesel from about 10-12 kms away from village/farm. But after solarisation, not only large reduction in operational and maintenance cost was observed but also complete removal of reliance on fuel has been observed. It was surprising to note here is that no selected respondent have commented on the excessive water withdrawal for long run as well as on steps taken to curtail water withdrawal for self use as no one had reported sale of water. Besides, no efforts were made by anyone respondents to recharge water.

Table 3.21: Water Use and Sale 'Before' and 'After' solar pump

Sr. No	District	Before Solarisation		After Solarisation	
		BN	NBN	BN	NBN
1	Mean depth of groundwater (ft)	210.14	225.80	210.14	235.8
2	Mean amount of diesel (litres/ watering/bigha) Rabi Summer	3.45	3.93	-	-
3	Approximate mean expenditure on repair of diesel pump (Rs/year)	8520.0	10016.0	-	-
4	Approximate mean expenditure on repair of electric pump (Rs/year)	4581.0	6847.0	-	-
5	Approximate mean distance from sale point of petrol/ diesel (km)	10.09	12.61	-	-
6	Approximate mean time spent on procuring diesel/petrol per week (minutes)	120.0	150.0	-	-
7	(%) Respondents having issues with electricity supply	70.00	80.00	-	-
8	Mean expenditure on irrigation (Rs/bigha/year)				
	Diesel pump	3872	4548	-	-
	Electric pump	13584	15841	-	-
	Solar pump	-	-	-	-
9	Respondents purchasing water/ Selling	N	N	N	N
10	No. of farmers who believe that excessive water withdrawal for sale is harmful in the long run	N	N	N	N
11	No. of farmers who had taken steps to curtail water withdrawal for sale	N	N	N	N
12	No. of farmers who had taken steps for artificial recharge of ground water	N	N	N	N
13	Mean expenditure on water recharging efforts	N	N	N	N

Source: Field Survey data.

About 20 to 25 per cent respondent have realized that the crop productivity increased and about 40 to 45 per cent respondent have adopted the crop diversity after solar and increase the numbers of crops in a season. They were grown commercial crops and also reported that the after solar, the productivity of traditional crop increased. None of farmers of beneficiary and non-beneficiary has sold the water but the exchange and borrow water from each other. Due to increase in availability of power during convenient timings, farmers have

diversified their cropping pattern towards high value crops as well as some of them have noticed positive increase in productivity of crops grown (Table 3.22).

Table 3.22: Crop Diversification after Solarisation

Sr. No.	Particulars	Water use			
		Before Solarisation		After Solarisation	
		BEN	NonBEN	BEN	NonBEN
1	Respondents who adopted crop diversification (%)				
	Kharif	18	5	40.00	80.00
	Rabi	20	5	45.00	100.0
	Summer			40.00	100.0
2	Respondents who reporting increase in crop productivity (%)				
	Kharif	-	-	25.00	80.00
	Rabi	-	-	22.00	80.00
	Summer	-	-	18.00	80.00
3	No. of farmers reporting changes in crop productivity with solar pump (%)				
	Has increased	-	-	40	4
	Has decreased	-	-	-	-
	Remained constant	-	-	60	1

Source: Field Survey data.

3.15 Maintenance of Solar Panel

Solar panels are generally self cleaning, but in particularly dry areas or where panel tilt is minimal, dust and other substances such as bird droppings can build up over time and impact on the amount electricity generated by a module. Grime and bird poop doesn't need to cover an entire panel to have an effect. This is where cleaning solar panels may have to be done. As solar electricity generation is depend on the exposure of solar panel surface area which may over time get dusty and with other substances such as bird droppings can build up over time may impact on the amount electricity generated by a module. Therefore, regular cleaning of solar panels need to be carried out by the farmers. It was observed that different time schedules are adopted by the households for cleaning of solar panel surface and no similar pattern observed (Table 3.23). Two third of beneficiary households and one fourth of non-beneficiary households has been cleaning the same twice in a week, half of the non-beneficiary households and one tenth of beneficiary households clean solar panel once in a week. The approximate time for cleaning the solar panel surface is estimated to about 20-22 minutes. On

average, 45 per cent of the solar panels users clean the panels in once a week and 25 percent of the respondents are cleaned twice in a week. The estimated time for the cleaning of solar panels is 28 to 30 minutes.

Table 3.23: Frequency of Cleaning of solar panels

Sr. No	Time period	Responses (%)		
		Beneficiary	Non-Beneficiary	Av.
1	Every day	25.00	0.00	23.81
2	Alternative day	3.00	0.00	2.86
3	Twice in week	26.00	20.00	25.71
4	one in a week	43.00	80.00	44.76
5	fortnightly	3.00	0.00	2.86
6	Approximate time taken for cleaning (minutes)	28.70	32.10	30.40

Source: Field Survey

3.16 Experiences with Solarized Irrigation

The experiences with solarized irrigation of selected households indicate that ease of opinion and maintenance along with convenience time for irrigation with output of water were major positive aspect of solarisation (Table 3.23). The other supportive factors of solarisations noted by the selected households were reduction in use of fertilizers, use of micro-irrigation method.

More than 90 per cent beneficiary and non beneficiary farmers had great experience of solar i.e. ease of operation, ease to maintenance, less labour and supervision required and the timing for irrigation are very convenience, used of fertilizer decrease with increase of micro irrigation after solarisation. Some of the selected respondents using electric pumps were dissatisfied with use of electric pump due to its unreliable power supply, depleting water tables and high expenditure on diesel.

Table 3.24: Experiences with Solarized Irrigation

Sr. No.	Particulars	Before Solarisation (%)			After Solarisation (%)		
		Beneficiary (n=100)	Non Beneficiary (n=5)	Av (n=105)	Beneficiary (n=100)	Non Beneficiary (n=5)	Total (n=105)
1	Ease of Operation	36.00	40.00	36.19	100.00	100.00	100.00
2	Ease of maintenance	16.00	80.00	19.05	80.00	100.00	81.00
3	Frequency of break-down and repair	94.00	80.00	93.33	40.00	20.00	39.05
4	Labour and supervision required	99.00	100.00	99.05	40.00	40.00	40.00
5	Instances of interruptions due to outages/ shortage of diesel	53.00	80.00	54.29	0.00	0.00	0.00
6	Convenience in timing for irrigation	9.00	20.00	9.52	100.00	100.00	100.00
7	Output of water	68.00	20.00	65.71	90.00	80.00	89.52
8	Use of fertilizers per Bigha	82.00	40.00	80.00	90.00	100.00	90.48
9	Use of micro-irrigation methods	74.00	80.00	74.29	100.00	100.00	100.00

Source: Field Survey

3.17 Experiences of Advantages and Disadvantages of Solar pumps

The advantages of solar pumps realizations by beneficiary and non beneficiary household are presented in table 3.25. Solar pumping systems allow vital water resources to be accessed in remote rural locations. Solar water pumps require no fuel and minimal maintenance. All selected respondents reported the advantage of no cost of fuel followed by no maintenance cost and quality of power supply. The other advantages reported by respondents were no harassment of irrigating crop in night, saving on labour cost, almost no monthly cost of operation and no harassment of fetching diesel.

Table 3.25: Experiences of Advantages of Solar Pumps

Sr. No.	Advantages	Responses (% to total)		
		Beneficiary	Non Beneficiary	All
1	No maintenance cost	99.00	80.00	98.10
2	No cost of fuel	100.00	100.00	100.00
3	No harassment of fetching diesel	29.00	40.00	29.52
4	Almost nil monthly cost of operation	70.00	80.00	70.48
5	Quality supply of power	90.00	100.00	90.48
6	Generate income through sale of water	0.00	0.00	0.00
7	Generate income through renting out of power cells	0.00	0.00	0.00
8	Saving labour cost	86.00	60.00	84.76
9	No harassment of irrigating crop in night	75.00	100.00	76.19

Source: Field survey data.

The disadvantages of solar panel were asked to selected households. Most of the selected households mentioned the two prominent disadvantages of solar panels such as it require a huge initial investment and only can be used during sunny days (Table 3.26). As installation of solar panel requires usually around Rs. 4.5 lakhs to 6.5 lakhs depending on the size of the panel and horse power of solar panel. This is the main reason that discourages people to install solar panels. Unfortunately, sun doesn't shine 24 hours, and solar power relies on it. Since solar electricity storage is not yet fully developed, so it can be used during sunny days.

Table 3.26: Experiences of Disadvantages of Solar Pumps

Sr. No	Disadvantages	Responses (% to total)		
		Beneficiary (n=100)	Non Beneficiary (n=5)	Av (n=105)
1	Only can be used during sunny days	24.00	60.00	25.71
2	High initial cost of installation	84.00	100.00	84.76
3	Heavy depletion of groundwater	0.00	0.00	0.00
4	High cost of batteries/power cell	0.00	0.00	0.00
5	Height of panel is lower thus cannot use space below panel	0.00	0.00	0.00

Source: Field survey data.

3.18 Factors for non-adoption and Perceptions

The few reasons were given by the selected households for non- adopting the solar water pump is given in table. 3.27. It can be seen in the table that the about 79 per cent of farmers had given first preference to lack of fund for non adopting water pump followed by hesitation to invest/ lack of confidence/ risk averse (66.05%), less land, unviable for investment on solar pump (57.40%), opposition from family members (56.55%). unviable for investment on solar pump, Subsidy is insufficient, Ground water is at great depth, unsuitable for solar and Came to know about it much later.

Table 3.27: Ranking of Factors for not Adopting Solar Water Pump

Sr. No.	Description	Responses	
		%	Rank
1	Lack of funds-RANK	79.00	1
2	Hesitation to invest/lack of confidence/risk averse-	66.05	2
4	Less land, unviable for investment on solar pump-	57.40	3
3	Opposition from family members	56.55	4
8	Have flat rate electricity connection	55.95	5
5	Do not have confidence in the NGO/donor agency /Government/external agents-	51.15	6
6	Personal differences with other members of DSIC	48.40	7
7	Land plot is situated at a distance; not found economical to connect to the grid	46.85	8
9	Ground water is at great depth, unsuitable for solar	43.90	9
10	Subsidy is insufficient. I want .....% subsidy	38.15	10
12	No one contacted me persuasively	28.75	11
11	Came to know about it much later.	26.85	12

Source: Field survey data.

3.19 Suggestions

The few suggestions given by the selected non-adopter households to expand solarisation of irrigation and its benefits are presented in Table 3.28. It can be seen from the table that about 70 per cent non adopter HH has suggested that

the criteria of subsidy should be relaxed and need to increase subsidy rate. About 40 per cent respondents had suggested that the portability of grid connectivity to solar irrigation pumps should be made and awareness about solar irrigation pump Scheme need to be increased.

Table 3.28: Suggestions by Non-adopter to Expand Solarisation of Irrigation Pumps in Rajasthan

Sr. No.	Suggestions	% to total
1	Awareness about solar irrigation pump schemes	30.0
2	Portability of grid connectivity to solar irrigation pumps	40.0
3	Criteria of subsidy should be relaxed	75.0
4	Increase the subsidy rate	60.0

3.20 Chapter Summary

This chapter presented the results of field survey. The results indicate that after solarisation, gross as well as irrigated has been increased. The changes in cropping pattern were noticed towards high value crops and more area was irrigated through use of micro-irrigation methods. Besides, cop diversification and increase in crop productivity was also reported. The main reason for adoption of solar was because of high cost of diesel and significant time require to fetch it and assured quality solar power supply, while high cost of solar panel was major concern. Lack of finance and awareness about solar irrigation system were the major reasons cited by the non adopters. The major suggestions of respondent households were need to increase in subsidy rate, portability of solar pump with grid, criteria need to be relaxed and awareness campaigns of solar need to be organized.

The next chapter presents summary and policy implications.

Chapter IV

Summary and Policy Implications

4.1 Backdrop:

India relies heavily on agriculture and irrigation is used in about 49 per cent of India's cultivated area, while the rest relies on monsoon rain. Thus, sound and expanded irrigation is critical for improving crop production and raising yields. For over 50 years until 2010, India ranked first with the largest irrigated area in the world. Irrigation in India today is almost entirely reliant on electric and diesel pumps. Irrigation pumps used in agriculture account for about 25 per cent of India's total electricity use, consuming 85 million tons of coal annually, and 12 per cent of India's total diesel consumption, more than 4 billion liters of diesel. Of the nearly 30 million irrigation pumps in use throughout the country, about 70 per cent run on grid electricity, 30 per cent are powered by diesel, and only 0.4 per cent are solar. The annual fossil fuel use associated with diesel and electric pumps amounts to more than four billion litres of diesel, and 85 million tonnes of coal for electricity generation. The demand for irrigation far exceeds the available pumping capacity. Rapidly growing population, coupled with unreliable precipitation patterns and extreme temperatures wrought by climate change impose additional pressure on agricultural productivity in the country. Therefore, improving access to irrigation, while reducing greenhouse gas emissions, has become our national priority

A complex set of factors including global warming, competitive land use and lack of basic infrastructure is creating new challenges for India's vast agrarian population. The ever increasing mismatch between the demand and supply of energy in general and electricity in particular, is posing challenges to farmers located in remote areas and makes them vulnerable to risks, especially the small and marginal farmers. Indian farmers and the national government both face several challenges with regard to irrigation. Electricity in India is provided at highly subsidized low tariffs, mostly at flat rates, and this has led to widespread adoption of inefficient pumps. Farmers have little incentive to save either the electricity, which is either free or highly subsidized, or the water being pumped, resulting in

wasting both. Although the government heavily subsidies agricultural grid connections, grid electricity in rural India is usually intermittent, fraught with voltage fluctuations, and the waiting time for an initial connection can be quite long. Despite the power shortages, coal shortages and increasing trade deficit, put food security of nation at the risk.

The generation of solar energy and irrigation for agriculture could be intricately related to each other. This is because India is a country that is fret with an irregular and ill-spread monsoon. Hence, irrigation is a pre-requisite for sustaining and increasing agricultural output. This is particularly true for the western states of India and especially Gujarat and Rajasthan, where rainfall is often scanty, uneven and irregular; whereas perennial rivers are absent. The role of canal irrigation becomes very crucial in this scenario. However, in the absence of sufficient and reliable canal water supply, the only other option that remains with the farmers is that they irrigate their fields with the help of ground water withdrawn through either electricity or diesel-driven pumps. Provision of power for irrigation and other farm operations therefore, is a high priority area for the States. However, providing farmers reliable energy for pumping is as much of a challenge as is making the availability of water, sufficient. The high operational cost of diesel pump sets forces farmers to practice deficit irrigation of crops, considerably reducing their yield as well as income.

Currently, India has 26 million groundwater pump sets, which run mainly on electricity that is primarily generated in coal-fired power plants, or run by diesel generators. Scarcity of electricity coupled with the increasing unreliability of monsoon forces the reliance on costly diesel-based pumping systems for irrigation. The scarcity of electricity coupled with the perpetual unreliability of monsoon is forcing farmers to look at alternate fuels such as diesel for running irrigation pump sets. However, the costs of using diesel for powering irrigation pump sets are often beyond the means of small and marginal farmers. Consequently, the lack of water often leads to damaging of the crop, thereby, reducing yields and income. In this scenario, environment-friendly, low-maintenance, solar photovoltaic (SPV) pumping systems provide new possibilities for pumping irrigation water. Solar powered pumps are emerging as an alternative solution to those powered by grid electricity

and diesel. Diesel and electric pumps have low capital costs, but their operation depends on the availability of diesel fuel or a reliable supply of electricity. Saving of 9.4 billion liters of diesel over the life cycle of solar pumps is possible if 1 million diesel pumps are replaced with Solar Pumps. Using solar power for irrigation pumps can cut a carbon footprint of Indian agriculture and bolster the country's role in the war against climate change.

Solar power could be an answer to India's energy woes in irrigated agriculture. Solar power generation on the farm itself through installation of solar PV (photovoltaic) panels; and using it to extract groundwater could just be the solution for the above concerns. Solar pumps come with a user-friendly technology and are economically viable. They are easy to use, require little or no maintenance, and run on near-zero marginal cost. Solar power is more reliable, devoid of voltage fluctuations and available during the convenient day-time. India is blessed with more than 300 sunny days in the year, which is ideal for solar energy generation, aptly supported by promotional policies of the Government of India.

The Ministry of New & Renewable Energy (MNRE) has been promoting the Solar-Off Grid Programme since two decades. The programme size has increased many folds with the advent of Solar Mission, giving much impetus to various components of the programme in which solar pumping is one of the major component. Solar Pumping Programme was first started by MNRE in the year 1992. From 1992 to 2015, 34941 number of solar pumps have been installed in the country. This number is minuscule, if we compare with the pumps in agricultural sector. High costs of solar modules during these years resulted in low penetration of solar pumps. However, in recent times the module costs have started decreasing and are presently hovering around one fourth of the price in those days. As a result, the programme has become more viable and scalable. Therefore, present study was undertaken with aim to study the important issues concerning large scale adoption of solar irrigation pumps, its economics/feasibility and problems in adoption of same.

Literature suggests that application of solar energy in irrigation could have myriad benefits. The primary benefit is that it is 'free'. However, the generating apparatus comes with high initial fixed costs like that of capital equipment, costs

of installation, depreciation, interest, protection from theft, vandalism etc. Nevertheless, the marginal costs are indeed 'near zero' (operation, maintenance, repairs). The costs of expansion in irrigated area like that of hose pipes for transporting water across fields is also much lesser compared to operating a diesel pump or getting another electricity connection. Hence, solar pumps could not only provide cheaper irrigation but also expand irrigated area and thus increase the returns on agriculture. It could also extend the farming beyond the kharif season (monsoon); by harnessing ground water and thus aid the diversification of crops. Solarization could also unshackle the farmers from the shortage of electricity supply and its inconvenient timings. They would be able to irrigate not only their own land, but also become irrigation service providers to their neighbouring farmers and also supplementing their own incomes in the process. Solarized pumps could promote conjunctive irrigation by promoting ground water extraction in flood-prone regions like north Bihar, coastal Orissa, north Bengal, Assam and eastern Uttar Pradesh. The government has acted positively in this matter and during the last five years, considerable progress ha s been made in installation of Solar Pumps.

In light of the above, this study attempts to study the status and prospects of solarisation of agricultural pumps in selected districts of Rajasthan. The data were collected from three distinct groups of farmers, viz. farmers who had adopted SIPs with the help of subsidy by the government, farmers who had adopted SIPs without any support in the form of subsidy by the government, and the farmers who had not adopted SIPs. The first group was of 100 sample farmers (25 from each of the four districts under study, i.e. Jaipur, Bikaner, Udaipur and Sriganganagar) who had installed Solar Irrigation Pumps (SIP) with the support of subsidy from the government (beneficiary farmer households). The second group consisted of 5 sample farmers from four districts who had installed SIPs on their own without any support in the form of subsidy (non-beneficiary farmers). The third group included 20 sample farmers (5 each from the four districts under study) who had not yet adopted solarized irrigation (non-adopters). They were still using other conventional fuels for powering their irrigation pumps when they were visited by

the researchers. Thus, the total sample consisted of 125 selected farmers (Table 4.1).

Table 4.1: Sampling Framework in Rajasthan State

Sr. No.	Selected District	Beneficiary farmers	Non-solar adopter	Non-beneficiary farmers	Total
1	Jaipur	25	05	01	31
2	Bikaner	25	05	01	31
3	Udaipur	25	05	01	31
4	Sriganganagar	25	05	02	32
	Total	100	20	05	125

4.2 Policies supporting Solar Power Irrigation in Rajasthan

The state of Rajasthan has 10 per cent of India's land, 5 per cent of its population and only 1 per cent of its water resources, a disadvantage by a factor of the for supply of irrigation water vis-a-vis agriculture area. Acute water shortage, erratic rainfall and recurring droughts in every district have exacerbated the situation. Over 60 per cent of the population depends for livelihood on agriculture or horticulture, often marred by low productivity due to unreliable, inadequate or non availability of irrigation. About 70 per cent irrigation is done through wells or tube-wells energized mainly by grid-power or diesel generators. Approximately 60,000 farmers are waiting for grid-based electricity connections for irrigation. Extension of electric-grid is not feasible in far-flung areas; almost 70 per cent area in the State is classified as desert. Moreover, ground water has deteriorated rapidly in the last two decades. Out of 249 blocks, nearly 200 are in the highly critical zone. Almost 90 per cent of groundwater withdrawal in the State is utilized through flood or furrow-irrigation methods with mere 35 to 45 per cent water-use-efficiency.

Rajasthan is blessed with one of the best solar insolation on earth (6-7 kWh/m2/day) combined with maximum sunny days in a year, about 325, which makes it one of the most attractive destinations for harnessing solar energy for various purposes, especially irrigation. It was thus envisaged that an integrated solar water pump scheme formulated by combining various stand-alone government schemes would be indeed beneficial for the region as well as its

farmers. Subsidies available under various programs were clubbed and the State committed to grant the total subsidy up to 86 per cent of the capital cost. The departments of agriculture, finance and energy of the State, and Union government's Ministries for Agriculture (MoA) and New and Renewable Energy (MNRE) worked in tandem along with various stakeholders to make it is seamless and successful project.

Rajasthan has been pioneer in promoting solar water pumps by adopting suitable policies with an aim to increase solar pump coverage in the state. The solar pump scheme for irrigation began in Rajasthan in 2010 – a combination of the Jawaharlal Nehru National Solar Mission (JNNSM), Rashtriya Krishi Vikas Yojana (RKVY), the water harvesting structure (WHS) scheme under the National Horticulture Mission (NHM), and various other State resources. Under the scheme, farmers are provided with subsidies from RKVY and the Ministry of New and Renewable Energy (MNRE). In the inception year, a subsidy figure of 86% was arrived at (30% from MNRE and 56% from RKVY), through calculations of a base price for the manufacturing and installation of a solar water pump set. The remaining 14 per cent, equivalent to the cost of just the pump set, was to be paid by the farmer, which would amount to about Rs. 56000-63000. In 2010-11, 50 farmers were targeted, which was scaled up to 500 in 2011-12, and 10,000 in 2012-13, eventually covering all 33 districts of the State. There are three, very transparent eligibility criteria for the subsidy –(1) the farmer should own at least 0.5 Ha of land; (2) the land should have a diggi/farm pond or other water storage structure; (3) drip irrigation system should be installed in a portion of the farm. Progressively, the scheme was amended to include the usage of mini-sprinklers as criteria for areas where land holdings are relatively smaller and diggi construction is unfeasible or impractical. This inclusion widened the scope for the popularization of efficient irrigation methods, increasing the water use efficiency in many regions significantly. On the other hand, the subsidy figure was reduced from 86 per cent to 70 per cent to an even lower 60 per cent over the years, and this reduction in the subsidy amount is presently the major cause for farmers backing out from the scheme. Farmers who already have electric connections for irrigation shall be provided with a smaller figure of subsidy, amounting to about 30% of the

total cost of the solar pump set. This calls for a study of the efficacy of the scheme and a detailed evaluation of the impact that these solar water pumps have actually had on farmers already using them, to enable us to ascertain why we should be moving towards this green, efficient, cheap, and emission-free energy source, and/or explaining how the scheme may be further improved for a much wider acceptance and preference among those that require such alternative solutions desperately.

In the year 2008-09, Government of Rajasthan had started scheme of 100 per cent subsidy on solar water pump for government farm then after in 2010-11, pilot project was started and covered only 6 districts to installed solar water pump. To harness the vast amount of energy, the Rajasthan government subsidized 86 percent solar-powered irrigation in 2011-12 and introduced 3 HP DC submersible pumps. MNRE and the Ministry of Agriculture through the financial assistance of the state government had supported. Jawaharlal Nehru National Solar Mission (JNNSM) provides 30 percent of the state government, Rashtriya Krishi Vikas Yojana (RKVY) and the Ministry of New and Renewable Energy offers a 56 per cent subsidy. The solar water pump scheme was scaled up from a mere target of 50 in 2010-11 to 500 (900 per cent increase) in 2011-12; to 2,200 (over 340 per cent increase) for 2012-13; and, to 10,000 (354 per cent increase) for 2013-14. Implementation at large scale was initiated in year 2011-12 when out of 33 districts, 14 districts were covered. Next year i.e. 2012-13 the scheme covered all the 33 districts in the State. In the year 2014-15, all 33 districts were also included, but this time only 2900 solar water pump was kept in the target as the subsidy rate had been reduced, but still achieved a lot of achievement and 242 percent more solar pumps installed than targeted. The good achievement in the next year 2015-16 and 31 percent more installed than the targeted solar pump. After year 2013-14, Rajasthan has also begun targeting high ROI beneficiaries by prioritizing farmers without electric connections. The state has three subsidy slabs—75 per cent for those willing to give up their place in the queue for electric connections, 60 per cent for farmers without an electric connection, and only the 30 per cent MNRE subsidy for those unwilling to give up their electric connection/place in the queue.

Despite water scarcity, Rajasthan is actively pushing for solar pumps. Its horticulture department provides 86 per cent subsidy on pumps, while the rest is borne by the farmer (Table 4.2). Government of Rajasthan brought a new momentum in the space of solar irrigation pumps by introducing 3 HP DC submersible pumps in an 86 percent subsidy scheme launched in 2011-12. There was also a 2 HP DC submersible pump option, but there have been few takers for it. The initial estimates of costs at the Rajasthan level 3 were Rs.6.16 lakh for 3 HP pump and almost Rs. 18-20 lakh for a 10 HP pump. Government of Rajasthan's aggressive policy of subsidizing solar pumps is helping to increase the numbers but there is some evidence that the current subsidy is discouraging cost reduction. Farmers are viewing solar pumps as an all purpose solution to their energy needs (Table 4.3). The top five districts having highest coverage of solar pumps are Bikaner, Jaipur, Sri Ganganagar, Hanumangarh and Sikar.

Table 4.2: Achievements of Solar Irrigation Pump in Rajasthan

Year	Project	No. of District Covered	Target	Achieve-ment	Pump Capacity (WP)	Subsidy (%)	Funding Source
2008-09	Government Farms	7	14	14	1800	100	RKVY
2010-11	Pilot Project	6	50	34	2200/ 3000	86	JNNSM, RKVY
2011-12	First major jump	14	500	1649	2200/ 3000	86	JNNSM, RKVY
2012-13	Second major jump	33	2200	4280	2200/ 3000	86	JNNSM, RKVY State
2013-14	Third major jump	33	10000	10000	2200/ 3000	86	JNNSM, RKVY, State
2014-15	fourth major jump	33	2900	9919	2200/ 3000	30, 60, 75	JNNSM, NCEF, STATE
2015-16	Fifth major jump	33	4702	6170	2200/ 3000	30,60, 75	JNNSM, NCEF, STATE
2016-17	Six major jump	33	7500	n.a.	n.a.	30,60, 75	JNNSM, NCEF, STATE
2017-18	major jump	33	500	n.a.	n.a.	50, 55, 65, 70	JNNSM, NCEF, STATE
2018-19	major jump	33	7500	n.a.	n.a.	50, 55, 65, 70	JNNSM, NCEF, STATE

Note: n.a.- not available.

The solar pump subsidy was only available to farmers who had farm ponds (diggi), did horticulture in at least 0.5 hectare (ha) land and used drip irrigation. The farmer also had to own a minimum of 0.5 ha of land. Further the farmers who owned up to 2 ha of land could apply for 2200 Wp pump and those who had more than 2 ha of land could apply for 3000 Wp pump. The eligibility criterion for solar power pump has been changing every year.

Table 4.3: Base Rate for SPV Solar Pump Project in Rajasthan (2017-18 and 2018-19)

Sr. No.	Details	DC/ AC Mounting	Head (mtr.)	Base Rate (in Rs. Per set)			
				3 Hp	5 Hp	7.5 Hp	10 Hp
1	2	3	4	5	6	7	8
1	SPV Surface pump	DC Static	20	236250	0	0	0
2		AC Static	20	230492	307999	0	0
3	SPV submersible pump	DC Static	20	252266	344000	509839	650090
4		AC Static	20	230265	306390	465560	593250
5	Additional Cost	Head Over 20 m	50	5412	5412	5412	5412
6			75	9020	9020	9020	9020
7			100	12000	12000	12000	12000
7		Manual Tracker		2706	2706	2706	2706
8		Auto Tracker		8118	8118	8118	8118
9	SPV Domestic Lighting System 37 Wp/ 40 Ah Battery / 9 W x 2 fixture			4681	4681	4681	4681
10	Fencing			6765	9020	11275	13530

Source: GOR, Jaipur.

Farmers have to apply to the Horticulture department along with a demand draft for Rs.10000, land ownership record, a tri-partite agreement among the farmer, preferred empanelled supplier and the horticulture department, a quotation from the selected empanelled firm, and a technical drawing of the structure. Once all the applications are collected at Tehsil level, these are verified for compliance with the eligibility criteria. If the applications are more than the quota, a lottery is conducted in the presence of District Collector. A seniority/waiting list is created. If a farmer's name features in the lottery list, he/she has to deposit his 14 percent share minus Rs.10000 with the select firm. Based on the confirmation of the receipt of farmer's share work orders are issued by the Horticulture Department of the state government.

4.3 Findings from Field Survey Data

- Data were collected from 125 sample households comprised of 100 households those who have installed solar irrigation pump with support of subsidy (beneficiary farmer household), 5 sample households who have

installed solarizied irrigation pump on their own (without any subsidy non-beneficiary farmer household) and 20 sample households who have not yet got subsidy nor installed solar irrigation pumps on their farm (non adopters-control group).

- It was observed that except few respondents from beneficiary category, all other selected households from all groups (beneficiary, non-beneficiary and non-adopter category respondents) were male. This indicates farming decisions and adoption of new technology on farm related decision were taken by the male, thus dominance of male could be seen despite of the fact that female contribution is highly significant in the farming and dairying.
- The average age of all the respondents of selected respondents was around 50 years while average family size of household was relatively larger in case of beneficiary households (6.91 person), than non-beneficiary and non adopters households (5.4 and 5.3 members respectively). Out of total adult family members in the family, more than 70 per cent were actively participating in the farming.
- The education status of selected respondents indicate the average education level up to 8 years, while non beneficiary households were relatively more educated (around 11 years) than other groups. The figures on average level of education of respondents indicate that lower level of education among selected respondents.
- The religion-wise distribution of selected respondents indicate that out of total selected households, about 94 per cent households belongs to hindu religion while remaining were from Muslim and Sikh religions. Among the three groups of respondents, same trend was observed except relative high share of Sikh religion among non-beneficiary households as about one fifth of non-beneficiary households were from Sikh religion. In case of social caste distribution, on an average, dominance of other backward class category households was observed followed by households from general category and scheduled caste category. The other backward caste followed by open category comprised beneficiary household group, while opposite composition of

households was observed in case of non beneficiary households. Besides, Open and OBC category households, scheduled caste households were also among selected households under non-adopters group. Thus, at overall level, backward class category respondent dominated the sample followed by general category and then scheduled caste, while very meager share was of Scheduled Tribe respondents

- The details on economic characteristics of the selected households indicate that more than 90 per cent of total beneficiary and non-adopter households were having farming as their principal occupation while three fourth of total non-beneficiary households had service as their principal occupation. Animal husbandry and dairying followed by agriculture labour was subsidiary occupation of beneficiary and non-adopters, while crop cultivation followed by agriculture labour was subsidiary occupation of non-beneficiary households. The main occupation of the selected households was agriculture comprised of cultivation of land as a farmer along with supportive allied activity of animal husbandry and dairying.
- The average years of farming experience of the respondents was around 29 years, which shows that most of the respondents were in farming business since their young age. The income level of both beneficiary and non-beneficiary households as around 98 percent and 50 per cent non-adopter of households are categorized above poverty line. The trend was observed in case of dwelling structure where about 98 per cent households of beneficiary member have pucca structure while in non- beneficiary and non adopter category only 60 per cent and 45 per cent household has pacca house structure.
- On an average, land holding size of selected beneficiary households was 1.21 ha categorizing them as small land holders' group, while non-adopters had much lesser land holing of 0.91 ha as marginal land holders, While corresponding figure for non-beneficiary households was 6.10 ha, indicating larger size of holdings as medium size land holders. Moreover, we also found that the who were having solar water pump had taken land on leasing-in while none of them leasing out the land. Non-beneficiary farmer households had taken larger size of land on leased-in (0.75 hectare) as compared to beneficiary

households (0.01 ha), this might be because the non beneficiary farmers are comparatively wealthy farmers and have more capital than the other two groups.

- Out of the total operational land holdings with selected households, almost all land under operation of non-beneficiary household was under irrigation, while in case of beneficiary households, about 80 per cent land was under irrigation coverage. The non-adopter households could irrigated their three fifth of total operational holdings with available sources of irrigation. Thus, despite of having the large size of land holdings, non-beneficiary had sufficient water and sources of irrigation to irrigate the crop. Due to such sound background of having all land coverage with irrigation, the assured returns must have pushed the farmers to invest in installation of solar pumps on their farm with their own expenditure, i.e. without any subsidy.
- After solarisation, changes in cropped and irrigated area were observed in case of selected beneficiary households. Area under cropped as well as irrigated area was increased by around 17 percent, despite of same cropping intensity was constant. The share of area sown to gross cropped area during kharif and summer season has shown meager increase. Area under irrigation by type of irrigation method has shown some changes after solarisation as compared to situation prevailed during pre-solarisation period of beneficiary farms. The area irrigated by flood method of irrigation has declined by about 30 per cent which must have due to adoption of sprinker and drip method of irrigations. The area under rainfed condition has also shown declined trend. Overall the total gross cropped area has increased about 17 per cent after solarisation. The transformational impact of irrigation is evident in solar water pump Scheme, where solar pumps were used to expand the coverage of the scheme from 40 to 50 hectares. More than 50 per cent beneficiary household area transformation from gravity-fed irrigation to sprinkler and drip irrigation with additional solar booster pumps have been deployed to pump water into a storage reservoir.
- The changes in net sown area, gross cropped area and cropping intensity of sample non-beneficiary households indicate that after solarisation, after

solarisation, significant growth in gross irrigated area and gross cropped area was recorded, that to increase in irrigated area was more than cropped area. Due to which cropping intensity has changed by around 13 per cent points after solarisation as compared to before solarisation year. The increase in area under irrigation may be due to assured and quality power supply through solar during convenient timings during day time for irrigation.

- In case of non-beneficiary households, area irrigated by flood method of irrigation has declined by about 28 per cent. Also rainfed area has declined by 43 per cent after solarisation. While area irrigated through the use of micro irrigation equipments such as sprinkler and drip has recorded significant increase. Overall the total gross cropped area has increased about by 26.04 per cent after solarisation. As increase in gross cropped area was higher for non-beneficiary than the beneficiary may to due to the fact that non beneficiary farmers are economically strong and diesel pump owners, had shifted to solar pumps to avail benefits such as zero operational costs, ease of use throughout the day and cost savings on diesel.
- In case of non-adopter, cropping intensify was 166 per cent mainly because of more than four fifth of total cropped area having irrigation coverage.
- Before solarisation of irrigation pumps, out of selected solar water pumps users, only 37 percent of beneficiary household had grid connection facility available on their farm while all the non-beneficiary farmers had grid connectivity to their irrigation pumps on farm. In case of rate charged towards use of electricity, almost two third pumps of beneficiary households were metered and remaining were charge in flat rate basis. While in case of non-beneficiary households, all irrigation pump had meter and were charged on meter use basis. Average irrigation expenditure per household per year was estimated to be between Rs. 3200-3500/-. Despite of the fact that agriculture require more hours of electricity supply to carry out agricultural operations (irrigation, threshing, etc), selected respondents households reported that they used to get hardly 6 hours of power supply in a day, which indicate the pressure built on respondents to make use of new technology of solar energy.

- The selected households had multiple sources of water available for irrigation and also used multiple method of irrigations such drip and sprinkler irrigation. The average water depth was estimated to around 200 feet and water was lifted through making use of diesel and electric pumps. The average distance of canal/river water was about 1 kms from the field. Around two third of the selected households had water storage facility on the farm, while no one has made attempt to recharge the groundwater through adoption of any innovative technique or practice. The main problem was observed with the availability of electricity to farm connection which is hardly made available though grid for eight hours in a day that to at inconvenient times, irrespective of season. Thus, in order to irrigate the crop during day time with uninterrupted power supply, the solar irrigation pump is the most suitable option available which selected households have installed on their farm.
- Changes in cropping pattern of sample beneficiary households indicate that due to about 17 per cent increase in gross cropped area after solarisation, area under fruits and vegetables, wheat and maize crop has significantly increased during rabi and summer season. The change in cropping pattern was relatively in favor of irrigated crops. During kharif season, major crops grown were paddy, maize, groundnut, cotton, soybean while wheat and gram were sown during rabi season. Due to availability of irrigation facility, crops such as maize, moong, vegetables and fruits were grown during summer season.
- Most of the households, who were previously growing little more than subsistence crops of bajra, maize, soybean in kharif and wheat, gram and mustard in rabi, could grow feed crops, earn income and benefit. After solarisation, the numbers of crops grown have also increased. During survey, respondents have reported that farm yields have increased to an average of 2 to 4 quintal per hectare. Irrigation enables farmers to grow three crops per annum and rotate crops to grow a diversity of nutritious and cash crops, such as vegetables and fruit crops and flowers also. This indicates that solarisation helps to increase the area under cultivation during the summer season or under the perennial with commercial crops like vegetables.

- While in case of non-beneficiary households, kharif season was the major season. Crops were grown in all three seasons (kharif, rabi and summer) before solarisation as well because of the fact that they are economically sound and thus can make full use of water through diesel and electricity pump. While after solarisation, the share in area of traditional crops such as jowar, moong, moth, guar and bajra has decreased and area under other horticulture crops like vegetables and fruits crops has increased. After solarisation, gross cropped area of the non-beneficiary households has increased by 25 percent. It was also observed that after solarisation, the numbers of crops grown during year has been increased, as seen in case of beneficiary households. In kharif season, the major crops grown were cotton, soybean and bajra while during rabi season, wheat, gram and rapeseed & mustard crops were grown. The fodder and vegetables crops were grown by the non beneficiary farmers during summer season. The increase in share of the area under commercial crops, fruits and vegetables and perennial crops indicate the benefit of solar energy availability with selected non beneficiary households for irrigating the crops.
- In case of non-adopters (control group) households, major crops grown during Kharif season were bajra, moong, moth, groundnut, guar and other minor crops while wheat, gram, rapeseed and mustard were major crops grown during rabi season. It was very pleasant to note here is that significant area during summer season was allotted under fodder crops indicates the scarcity of fodder in the selected area. The distribution of area under irrigation by type of irrigation method used by all non adopter farmers adopted flood irrigation system.
- The details on possession of irrigation pumps of selected households indicate that Solar pumps essentially are a collection of solar PV panels, AC or DC pumps and the associated electronics that have been optimized for high efficiency operations. All non-beneficiary households have used submersible DC pumps while in case of beneficiary households, 54 per cent households had DC pumps on their farm. As a technology, while AC technology is now catching up, DC technology is considered to be more suitable given the wider operating range and higher efficiencies reported by beneficiary.

- The details about the installation of solar panels and availability of power with selected beneficiary and non-beneficiary households indicate that land area covered by the solar pump installed was around 4.8 ha in case of beneficiary households while same was 4.4 ha in case of non-beneficiary households. All the selected households had solar panels on farm. About two third of installed solar PV panels were with automatic rotation system while remaining were with manually rotation system. On an average 4-6 poles are were installed with mean number of stand poles between 12-15, having average size of panel of 3 feet by 5 feet. Mean area covered by the each stand pole was around 5 feet by 5 feet. No installed solar panel have meter to record the power generated and used. About 37 percent solar plants of beneficiary households and 5 percent of non beneficiary households were connected to grid. None of farmers has installed the solar power storage cell. The solar power generated mostly been sued for agriculture purpose while few of beneficiary households used for household purposes as well. None of the selected households had use solar power to sell irrigation water to neighboring farmer, thus no additional income through sale of water was reported.
- Rajasthan comprises about 10.4 percent of India's landmass in which 60 per cent area are is desert and 5.5 percent of the total population but has only one percent of the nation's water resources. Groundwater is either saline or declining at a fast rate. The grid power supply available for only 5 to 6 hour for form field and its very expensive. In such a scenario, selected households were asked about the reasons for adoption of solar power generation unit on their farm. The selected households have cited multiple reasons for choosing solar on their farm.
- About two third of beneficiary households mentioned that to avoid hassle of irrigating crop irrigation during night hours was the major reason for adoption of solar irrigation pump. More than 50 percent of selected households strongly reported that they adopted the solar water pump due to costly diesel, followed by non-availability of electricity connection, unreliability of electricity supply/ inconvenient grid supply timings, high electric bill. Few of the beneficiary households wanted to try renewable technology as it is environment-friendly

while few wanted to take advantage of subsidy being offered for installation of solar pumps on farm. While in case of non-beneficiary households, major three reasons quoted were saving electric bill followed by costly to run electric pumps and inconvenient time of electric supply/costly diesel. Thus, findings about the reasons for adoption of the solar water irrigation pump under different category suggests that high cost of electricity along with inconvenient hours of electricity supply and high cost of diesel has pushed the farmers to adopt pollution free power generation thorugh solar.

- Government of Rajasthan brought a new momentum in the space of solar irrigation pumps by introducing 3 HP DC submersible pumps with 86 percent subsidy scheme launched in 2011-12. There was also a 2 HP DC submersible pump option, but there have been few takers for it. The State government leveraged central financial assistance coming from MNRE and Agriculture Ministry for the same. The state government provides 56 percent subsidy under Rashtriya Krishi Vikas Yojana (RKVY) and the New and Renewable Energy Ministry of Government of India provides the balance 30 percent under Jawaharlal Nehru National Solar Mission (JNNSM). The project was implemented through the Horticulture Society under the Agriculture department of Government of Rajasthan. The beneficiaries had to pay 30 to 32 per cent of the system cost. The agriculture department of Rajasthan provided 68-72 per cent of total cost as subsidy through JNNMS and RKVY scheme. The cost of 5 HP solar pumps was about 30 to 33 per cent higher than 3 HP solar. It may be noted that, the major sources of institutional credit was commercial banks followed by cooperative banks, for both beneficiary and non-beneficiary farmers. About 50 to 80 per cent amount had taken loan by beneficiary while corresponding figure for non beneficiary household was 45 to 55 with interest rate ranges between to 7 per cent. The cost of documentation incurred by selected households was about Rs. 1111/- per households while in case of non beneficiary households same was Rs. 1848/-. The expenditure of Rs. 1584/- was incurred towards installation by the beneficiary while corresponding figure for non-beneficiary household was Rs. 1848/-.

- The process of installation of solar pump took almost 6-7 days while average number of visits of representative of agency was more in case of non-beneficiary (about 5 visits) compared to beneficiary households (about 3 visits). The company-wise distribution of solar panels indicates that Jain Irrigation Company had supplied major share of pumps (as solar pump supplier) in both groups. The other major suppliers were Shakti, Lubi, Tata Solar, Waaree, etc. More than 95 per cent of selected respondents had received training/ demonstration about operating solar pump from solar water pump through supplier agency while about more than 98 per cent of beneficiary and non beneficiary household had satisfied with support services provided by agency and quality of solar panels. More than 90 per cent responded are insured the solar pump.
- Government of Rajasthan had many times improved the policy and eligibility criteria of receiving subsidy on solar water pump. The solar pump subsidy was only available to the farmers who fulfill the basic criteria fixed for same such as farmer should have farm ponds (diggi), had land at least 0.5 hectare (ha) land and availability of micro irrigation instruments or ready to take solar with micro irrigation and no grid connection. It can be seen in table 3.19 that more than 80 per cent beneficiary had fulfilled these conditions.
- Storage tanks in different sizes are used to store the water that is pumped. The water that is stored in the tank can be used for irrigation when needed. There are different types of agricultural irrigation method used.. More than 90 percent beneficiary households had used solar with MIS while 100 per cent non-beneficiary households have used MIS and Solar pump without subsidy. All solar water pump users advise to others to adopt solarisation of irrigation pumps with the information of the government policies in the solar irrigation sector, particularly solar subsidies regard and economic benefit of solar irrigation pump.
- To supplement the intermittent and inadequate canal supply, many farmers have also dug tubewells. It can be seen in table that the depth of water level is was around 210 feet in case of beneficiary households during both the periods,

while same has slightly increased to about 235 feet in case of non-beneficiary users. The depth of groundwater was stagnant possibly may be due to farm pond as recharger for ground water on beneficiary farm.

- Diesel was used as fuel to drive the water pump during rabi season. On an average about 4 litre of diesel was used per bigha watering of land by the selected respondents and approximate expenditure of repair of diesel pump was estimated to be between Rs. 8500-10000/- was incurred. Some of the beneficiary and non beneficiary farmers had to incurred expenditure to the tune of amount of Rs. 4581-/ and Rs. 6847/- towards repair of their electric pumps. On an average, about more than two hours time was spent on procuring diesel/petrol per week to fetch diesel from about 10-12 kms away from village/farm. But after solarisation, not only large reduction in operational and maintenance cost was observed but also complete removal of reliance on fuel has been observed. It was surprising to note here is that no selected respondent have commented on the excessive water withdrawal for long run as well as on steps taken to curtail water withdrawal for self use as no one had reported sale of water. Besides, no efforts were made by anyone respondents to recharge water.
- About 20 to 25 per cent respondent have realized that the crop productivity have increased and about 40 to 45 per cent respondent have adopted the crop diversity after adoption of solar which help them to increase the numbers of crops in a season. They are now growing commercial crops and also reported that the after solar, the productivity of traditional crop increased. None of farmers of beneficiary and non-beneficiary has sold the water but the exchange and borrow water from each other. Due to increase in availability of power during convenient timings, farmers have diversified their cropping pattern towards high value crops as well as some of them have noticed positive increase in productivity of crops grown.
- Solar panels are generally self cleaning, but in particularly dry areas or where panel tilt is minimal, dust and other substances such as bird droppings can build up over time and impact on the amount electricity generated by a module. Grime and bird poop doesn't need to cover an entire panel to have an effect.

This is where cleaning solar panels may have to be done. As solar electricity generation is depend on the exposure of solar panel surface area which may over time get dusty and with other substances such as bird droppings can build up over time may impact on the amount electricity generated by a module. Therefore, regular cleaning of solar panels need to be carried out by the farmers. It was observed that different time schedules are adopted by the households for cleaning of solar panel surface and no similar pattern observed. Two third of beneficiary households and one fourth of non-beneficiary households has been cleaning the same twice in a week, half of the non-beneficiary households and one tenth of beneficiary households clean solar panel once in a week. The approximate time for cleaning the solar panel surface is estimated to about 20-22 minutes. On average, 45 per cent of the solar panels users clean the panels in once a week and 25 percent of the respondents are cleaned twice in a week. The estimated time for the cleaning of solar panels is 28 to 30 minutes.

- The experiences with solarized irrigation of selected households indicate that ease of opinion and maintenance along with convenience time for irrigation with output of water were major positive aspect of solarisation. The other supportive factors of solarisations noted by the selected households were reduction in use of fertilizers, use of micro-irrigation method.
- More than 90 per cent beneficiary and non beneficiary farmers had great experience of solar i.e. ease of operation, ease to maintenance, less labour and supervision required and the timing for irrigation are very convenience, used of fertilizer decrease with increase of micro irrigation after solarisation. Some of the selected respondents using electric pumps were dissatisfied with use of electric pump due to its unreliable power supply, depleting water tables and high expenditure on diesel.
- Solar pumping systems allow vital water resources to be accessed in remote rural locations. Solar water pumps require no fuel and minimal maintenance. All selected respondents reported the advantage of no cost of fuel followed by no maintenance cost and quality of power supply. The other advantages reported by respondents were no harassment of irrigating crop in night, saving

on labour cost, almost no monthly cost of operation and no harassment of fetching diesel.

- Most of the selected households mentioned the two prominent disadvantages of solar panels such as it require a huge initial investment and only can be used during sunny days. As installation of solar panel requires usually around Rs. 4.5 lakhs to 6.5 lakhs depending on the size of the panel and horse power of solar panel. This is the main reason that discourages people to install solar panels. Unfortunately, sun doesn't shine 24 hours, and solar power relies on it. Since solar electricity storage is not yet fully developed, so it can be used during sunny days.
- About 79 per cent of farmers had given first preference to lack of fund for non adopting water pump followed by hesitation to invest/ lack of confidence/ risk averse (66.05%), less land, unviable for investment on solar pump (57.40%), opposition from family members (56.55%). unviable for investment on solar pump, Subsidy is insufficient, ground water is at great depth, unsuitable for solar and came to know about it much later.
- About 70 per cent non-adopter HH has suggested that the criteria of subsidy should be relaxed and need to increase subsidy rate. About 40 per cent respondents had suggested that the portability of grid connectivity to solar irrigation pumps should be made and awareness about solar irrigation pump Scheme need to be increased.

4.4 Policy Implications:

- Both the central and state governments have policies and incentives place to grow the use of solar pumps in the irrigation sector. However there is a felt need for raising awareness among farming community and for putting project delivery mechanism in place.
- Presently, cost of solar pump appears to be high for individual farmer. Large scale adoption and production will lead to cost cutting. Community based projects can reach out to marginal farmers and other low-income group individuals.

- Feasible costing and assistance from state/ central government will encourage more farmers to opt for the technology. With partnership of state energy departments, Vidyut Vitaran Nigams, and private partners, technology can be disseminated at large scale.
- Portability of grid connectivity to solar irrigation pumps should be made and awareness about solar irrigation pump scheme need to be increased.
- Majority of the beneficiary farmers suggested that solarized irrigation could be expanded if the SIPs were made more user-friendly in terms of their requirement of space, technical features as well as financing; including that for insurance.
- Solar cooperative need to established and individual SIPs in group under cooperative structure can be connected with the grid in order to evacuate the surplus power generated there from into the grid, it could not only prevent the wastage of solar power but also provide the farmers with a supplementary source of income by way of selling solar power.
- The farmers were also in need of awareness about insurance and its coverage against risks of damage of SIPs or theft of their solar panels.
- Also, the procedure for availing subsidy should be simplified and the criteria for eligibility should be relaxed so as to include more farmers as beneficiaries
- Clearly, more needs to be done in the direction of convincing the farmers about the advantages of solarized irrigation per se, so that they would come forward to adopt in large numbers, regardless of the subsidy on offer or the initial capital costs thereof.
- There is a need of innovative policies for governing ground water level in a sustainable way. There is a need for metering agriculture water use and total water extraction by farmers using solar, electric or diesel pump.

References

Banerjee, Sudeshna Ghosh, Barnes Douglas, Singh Bipul, Mayer Kristy, Samad Hussain (2015) *Power for All: Electricity Access Challenge in India*. Washington DC: World Bank Group.

Bassi, Nitin (2015), "Irrigation and Energy Nexus-Solar Pumps Are Not Viable", *Economic and Political Weekly*, March 7, 2015, Vol. L, No.10.

Bhatt, Sonal and S.S. Kalamkar, (2017), "Solar Power Generation and Usage in irrigation: Lessons from a Novel Cooperative Initiative in India", *Indian Journal of Economics and Development*, Vol.13, No.3, Society for Economics and Development, Ludhiana, pp: 413-423.

Census of India (2011), Census of India, Guharat, Registrar General & Census Commissioner, New Delhi.

Chawla, Kanika and Shalu Agarwal (2016), "Renewable Energy and Make-in-India", *Kurushetra,* May, pp.19-21.

C-STEP, (2010). "Harnessing Solar Energy: Options for India" Centre for Study of Science, Technology and Policy (C-STEP).

Desai, Amit. Application of Solar PV based Pumping for irrigation: A survey Report. Centre for Technology Alternatives for Rural Areas, Indian Institute of Technology Bombay, 2012. http://www.ctara.iitb.ac.in/tdsl/pastreports/autumn2012/solarpvpumpingsurvey.pdf.

FAO (2002), Crops and Drops: Making the best use of water for agriculture. Rome: Food and Agriculture Organization, 2002. ftp://ftp.fao.org/docrep/fao/005/y3918e/y3918e00.pdf.

Gambhir, A, S Dixit, V Toro and V Singh (2012): Solar Rooftop PV in India: Need to Prioritise Insitu Generation for Self-consumption with a Net-metering Approach", Prayas Policy Discussion Paper, November, p 20, available online: http://www.prayaspune.org/peg/publications /item/186-solar-rooftop-pv-in-india.html, last accessed on 8 October.

GOI (2018), *Agricultural Statistics at a Glance 2017,* Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, New Delhi.

HWWI, (2005). CDM potentials for SPV Pumps in India Hamburgisches Welt Wirtschafts Institute (HWWI), Research Paper No 4. Available at Research_Paper_4.pdf.

Kishore, Avinash, Tushaar Shah and Nidhi Prabha Tewari (2014), "Solar Irrigation Pumps- Farmers Experience and State Policy in Rajasthan", *Economic and Political Weekly*, March 8, 2014, Vol. XLIX, No.10.

Mishra, Arabinda, Gopal K. Sarangi, Shivani Wadhera, (2016), "Off-grid Energy Development in India-An Approach towards Sustainability", *Economic and Political Weekly*, Vol. LI, No.22, May 28, 2016.

MNRE (2016a) *Annual Report 2015-16, National Solar Mission*. New Delhi.

MNRE (2017a) *Annual Report 2016-2017 Ch. 4: National Solar Mission*. New Delhi.

MSSRF (2007), *Measures of Impact of Science and Technology in India: Agriculture and Rural Development,* M.S. Swaminathan Research Foundation, Chennai and Office of the Principal Scientific Adviser, Government of India.

Murthy, K. V. S. Ramachandra and M. Ramalinga Raju (2009), Analysis On Electrical Energy Consumption Of Agricultural Sector In Indian Context, ARPN Journal of Engineering and Applied Sciences VOL. 4, NO. 2, April 2009, PP. 6-9.

Nair, Avinash, (2015), "Sunny days ahead as farmers harvest solar power in Gujarat", *Indian Express*, Ahmedabad, December 26, 2015.

Nair, Avinash, (2016) "In Kheda Village, farmer group makes hay while the sun shines", *Indian Express*, May 7, 2016, Ahmedabad edition.

NITI (2015), Report of the Expert Group on 175GW RE by 2022, National Institution for Transforming India, Governemnt of India, New Delhi (https://niti.gov.in/writereaddata/files/writereaddata/files/document_publication/report-175-GW-RE.pdf

Omar Ellabban, Haitham Abu-Rub, Frede Blaabjerg (2014), "Renewable Energy Resources: Current Status, Future Prospects and their Enabling Technology", *Renewable and Sustainable Energy Reviews,* 39, pp. 748–764.

Pearson, Natalie Obiko and Ganesh Nagarajan. (2014) "Solar water pumps wean farmers from India's archaic grid." Bloomberg. http://www.bloomberg.com/news/print/2014-02-07/solar-water-pumps-wean-farmers-from-india-s-archaic-grid.html.

REN21 (2010), Renewables 2010 Global Status Report, Renewable Energy Policy Network for the 21st Century, Paris (Available at http://www.harbortaxgroup.com/wp-content/uploads/2014/07/REN21_GSR_2010_ full_revised-Sept2010.pdf).

REN21 (2018), Renewables 2018 Global Status Report, Renewable Energy Policy Network for the 21st Century, Paris (Available at http://www.ren21.net/wp-content/uploads/2018/06/17-8652_GSR2018_FullReport_web_final_.pdf).

Renner, Judith. (2012) "Global Irrigated Area at Record Levels, But Expansion Slowing." Worldwatch Institute.http://www.worldwatch.org/global-irrigated-area-record-levels-expansion-slowing-0.

Rosegrant, Mark W., Siwa Msangi, Timothy Sulser and Rowena Valmonte Santos (2006), "Bioenergy and Agriculture: Promises and Challenges Biofuels and the Global Food Balance", 2020 Focus 14, International Food Policy Research Institute (IFPRI), Washington and The Energy and Resources Institute (TERI), New Delhi, December.

Sahasranaman, M.; M.D. Kumar; N. Bassi; M. Singh and A. Ganguly (2018), "Solar Irrigation Cooperatives: Creating the Frankenstein's Monster for India's Groundwater", *Economic and Political Weekly,* Vol 53, No. 21, PP. 65-68.

Shah, Tushaar and Avinash Kishore, (2012), "Solar-Powered Pump Irrigation and India's Groundwater Economy-A Preliminary Discussion of Opportunities and

Threats", *Water Policy Research Highlight No. 26*, IWMI-Tata Water Policy Program, Anand; also downloadable from www.iwmi.org/iwmi-tata/apm2012

Shah, Tushaar, Neha Durga, Omkar Jani and Akhilesh Mangal, (2016), "A new Anand Cooperative Model-this time, in Solar Farming", *Indian Express daily*, Ahmedabad, May 21, 2016.

Shah, Tushaar, Shilp Verma and Neha Durga (2014), "Karnataka's Smart New Solar Pump Policy for Irrigation", November 29, 2014, Vol. X LIX, No. 48, Economic & Political Weekly, pp: 10-14.

Shah, Tushaar; Ashok Gulati, Hemant P, Ganga Shreedhar, R.C. Jain (2009), "Secret of Gujarat's Agrarian Miracle after 2000", *Economic and Political Weekly*, Vol. XLIV, No. 52, December 26, pp. 45-55.

Shah, Tushaar; Neha Durga and Shilp Verma (2015), "Harvesting Solar riches", The Financial Express, April 1, Financial Express (epaper.finanacialexpress.com).

Shah, Tushaar; Neha Durga; Shilpi Verma and Rahul Rathod (2016), Solar Power as Remunerative Crop, IWMI-Tata Water Policy Program, Water Policy Research Highlights, No. 10 (https://iwmi-tata.blogspot.com/).

Shah, Tushaar; Shilpi Verma and Neha Durga (2014), "Karnataka's Smart, New Solar Pump Policy for Irrigation", *Economic and Political Weekly,* Vol. XLIX, No. 48, November 29, pp.1014.

SPRERI (2014), *Annual Report 2013-14,* Sardar Patel Renewable Energy Research, Vallabh Vidyanagar, Gujarat.

SSEF (2014), 'Feasibility analysis for solar agricultural water pumps in India', (January), Working Paper, Shakti Sustainable Energy Foundation, New Delhi (http://shaktifoundation.in/wp-content/uploads/2014/02/feasibility-analysis-for-solar-High-Res-1.pdf).

SSEF (2018) *High-level impact of Ministry of Renewable Energy's (MNRE) Solar Water Pump Scheme in Four States,* Shakti Sustainable Energy Foundation, New Delhi.

TERI (2012) Integrated Renewable Energy Resource Assessment for Gujarat, The Energy and Resources Institute, New Delhi (*www.teriin.org/sites/default/files/2018-02/Final%20Report_0.doc).*

Tewari, Nidhi Prabha, (2012), "Solar Irrigation Pumps-The Rajasthan Experience", Water Policy Research Highlight No. 35, *IWMI-Tata Water Policy Program, Anand*; also downloadable from www.iwmi.org/iwmi-tata/apm2012

TOI (2018), Solar Harvest- Changing Lives, Times of India, Ahmedabad Edition, December 2, 2018., p. 4.

Upadhyay, Anand. (2014). "The Rise of Solar Pumps in India." Clean Technica. http://cleantechnica.com/2014/08/11/rise-solar-pumps-india/ .

Raymond, Anne and Abhishek Jain (2018), Solar For Irrigation – A Comparative Assessment Of Deployment Strategies, Council on Energy, Environment and Water, Thapar House, 124, Janpath, New Delhi 110001, India.

Sook Shim, Hyeon (2017), Solar-Powered Irrigation Pumps in India—Capital Subsidy Policies and the Water-Energy Efficiency Nexus- Case Study, Global Green Growth Institute, Republic of Korea.

Websites referred:

http://www.gidb.org/power-sector-gujarat

https://guj-epd.gujarat.gov.in/webcontroller/page/project

http://guj-epd.gov.in/epd_jyotiyojna.htm

http://www.un.org/esa/sustdev/csd/csd16/PF/presentations/farmers_relief.pdf

https://powermin.nic.in/en/content/power-sector-glance-all-india -Government of India, Ministry of Power

https://mnre.gov.in/file-manager/annual-report/2015-2016/EN/Chapter%201/chapter_1.htm

http://planningcommission.nic.in/reports/genrep/pov_rep0707.pdf

http://crossasia-repository.ub.uni-heidelberg.de/3909/1/MasterThesis_FarmersSuicides_AHoefle.pdf

http://www.mnre.gov.in/mission-and-vision-2/achievements/ (Accessed on March 22, 2015)

https://powermin.nic.in/en/content/power-sector-glance-all-india -Government of India, Ministry of Power

(http://www.igen-re.in/files/giz__2013__report_solar_water_pumping_for_irrigation_in_bihar.pdf (Potential for Solar PV Water Pumping for Irrigation in Bihar)

http://www.fao.org/nr/water/aquastat/didyouknow/index3.stm

https://niti.gov.in/writereaddata/files/writereaddata/files/document_publication/report-175-GW-RE.pdf

https://en.wikipedia.org/wiki/Renewable_energy_in_India

https://mnre.gov.in/file-manager/grid-solar/100000MW-Grid-Connected-Solar-Power-Projects-by-2021-22.pdf

www.energyefficiencycentre.org/-/media/Sites/energyefficiencycentre/Publications/C2E2-Publications/INDIA-HIO-REPORT_WEB.ashx?la=da&hash=41BDFEF46FA4CDCF5AF778ADF45A0EAF3B99B8A5

http://www.iwmi.cgiar.org/News_Room/Press_Releases/2016/press_release_worlds_first_solar_irrigation_cooperative_receives_award. pdf?galog=no.

http://ggrc.co.in/webui/Content.aspx?PageId=114

www.energetica-india.net/download.php?seccion=articles&archivo...pdf

Annexure I: Power Supply Position in the Country (2009-10 to 2018-19)

Year	Energy				Peak			
	Requirement	Availability	Surplus(+)/Deficts(-)		Peak Demand	Peak Met	Surplus(+) / Deficts(-)	
	(MU)	(MU)	(MU)	(%)	(MW)	(MW)	(MW)	(%)
2009-10	8,30,594	7,46,644	-83,950	-10.1	1,19,166	1,04,009	-15,157	-12.7
2010-11	8,61,591	7,88,355	-73,236	-8.5	1,22,287	1,10,256	-12,031	-9.8
2011-12	9,37,199	8,57,886	-79,313	-8.5	1,30,006	1,16,191	-13,815	-10.6
2012-13	9,95,557	9,08,652	-86,905	-8.7	1,35,453	1,23,294	-12,159	-9
2013-14	10,02,257	9,59,829	-42,428	-4.2	1,35,918	1,29,815	-6,103	-4.5
2014-15	10,68,923	10,30,785	-38,138	-3.6	1,48,166	1,41,160	-7,006	-4.7
2015-16	11,14,408	10,90,850	-23,558	-2.1	1,53,366	1,48,463	-4,903	-3.2
2016-17	11,42,929	11,35,334	-7,595	-0.7	1,59,542	1,56,934	-2,608	-1.6
2017-18	12,12,134	12,03,567	-8,567	-0.7	1,64,066	1,60,752	-3,314	-2
2018-19*	7,69,399	7,64,627	-4,773	-0.6	1,77,022	1,75,528	-1,494	-0.8

Source: * Upto October 2018 (Provisional),
Source: CEA- Central Electricity Authority https://powermin.nic.in/en/content/power-sector-glance-all-india.

Annexure II: State-wise Power Generation from Various Renewable Energy Sources in India (2016-2017)

(In Mega Watts)

Sl. No.	States/ UTs	Wind Power	Small Hydro Power	Bio-Energy			Solar	Total
				Biomass Power	Bagasse Cogeneration	Waste to Energy		
1	Andhra Pradesh	14497	978	578	300	123	38440	54916
2	Arunachal Pradesh	236	1341	8			8650	10236
3	Assam	112	239	212		8	13760	14330
4	Bihar	144	223	619	300	73	11200	12559
5	Chhattisgarh	314	1107	236		24	18270	19951
6	Goa		7	26			880	912
7	Gujarat	35071	202	1221	350	112	35770	72726
8	Haryana	93	110	1333	350	24	4560	6470
9	Himachal Pradesh	64	2398	142		2	33840	36446
10	Jammu & Kashmir	5685	1431	43			111050	118208
11	Jharkhand	91	209	90		10	18180	18580
12	Karnataka	13593	4141	1131	450		24700	44015
13	Kerala	837	704	1044		36	6110	8732
14	Madhya Pradesh	2931	820	1364		78	61660	66853
15	Maharashtra	5961	794	1887	1250	287	64320	74500
16	Manipur	56	109	13		2	10630	10811
17	Meghalaya	82	230	11		2	5860	6185
18	Mizoram		169	1		2	9090	9261
19	Nagaland	16	197	10			7290	7513
20	Orissa	1384	295	246		22	25780	27728
21	Punjab		441	3172	300	45	2810	6768
22	Rajasthan	5050	57	1039		62	142310	148518
23	Sikkim	98	267	2			4940	5307
24	Tamil Nadu	14152	660	1070	450	151	17670	34152
25	Telangana						20410	20410
26	Tripura		47	3		2	2080	2131
27	Uttar Pradesh	1260	461	1617	1250	176	22830	27593
28	Uttarakhand	534	1708	24		5	16800	19071
29	West Bengal	22	396	396		148	6260	7222
30	Andaman & Nicobar	365	8				0	373
31	Chandigarh					6	0	6
32	Dadra & Nagar Haveli						0	0
33	Daman & Diu	4					0	4
34	Delhi					131	2050	2181
35	Lakshadweep						0	0
36	Puducherry	120				3	0	123
37	Others					1022	790	1812
	Total	102772	19749	17536	5000	2554	748990	896602

Source: https://mnre.gov.in/file-manager/annual-report/2016-2017/EN/pdf/1.pdf

Annexure III: Total Installed Capacity (as on 31.10.2018)

Sr. No.	Fuel	MW	% of Total
A	Total Thermal	2,21,768	64.10%
	Coal	1,95,993	56.60%
	Gas	24,937	7.20%
	Oil	838	0.20%
B	Hydro (Renewable)	45,487	13.10%
C	Nuclear	6,780	2.00%
D	RES* (MNRE)	72,013	20.80%
	Total	346,048	

Notes: * Installed capacity in respect of RES (MNRE) as on 30.06.2018; RES (Renewable Energy Sources) include Small Hydro Project, Biomass Gasifier, Biomass Power, Urban & Industrial Waste Power, Solar and Wind Energy.
Source: https://powermin.nic.in/en/content/power-sector-glance-all-india

Annexure IV: Grid Connected Targets for Solar Power Installations

MW	Grid Connected Targets for Solar Power Installations							
	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	Total
Rooftop Solar	200	4800	5000	6000	7000	8000	9000	40000
Ground Mounted Solar	1800	7200	10000	10000	10000	9500	8500	57000
Total	2000	12000	15000	16000	17000	17500	17500	97000

Source: http://mnre.gov.in/file-manager/grid-solar/100000MW-Grid-Connected-Solar-Power-Projects-by-2021-22.pdf

Annexure V: Growth of Electricity Consumption in India

Growth of Electricity Consumption in India								
Year	Consumption (GWh)	% of Total						Per-Capita /year (in kWh)
		Domestic	Commercial	Industrial	Traction	**Agriculture**	Misc	
31-Dec-1947	4,182	10.11	4.26	70.78	6.62	2.99	5.24	16.3
31-Dec-1950	5,610	9.36	5.51	72.32	5.49	2.89	4.44	18.2
31-Mar-1956	10,150	9.20	5.38	74.03	3.99	3.11	4.29	30.9
31-Mar-1961	16,804	8.88	5.05	74.67	2.70	4.96	3.75	45.9
31-Mar-1966	30,455	7.73	5.42	74.19	3.47	6.21	2.97	73.9
31-Mar-1974	55,557	8.36	5.38	68.02	2.76	11.36	4.13	126.2
31-Mar-1979	84,005	9.02	5.15	64.81	2.60	14.32	4.10	171.6
31-Mar-1985	124,569	12.45	5.57	59.02	2.31	16.83	3.83	228.7
31-Mar-1990	195,098	15.16	4.89	51.45	2.09	22.58	3.83	329.2
31-Mar-1997	315,294	17.53	5.56	44.17	2.09	26.65	4.01	464.6
31-Mar-2002	374,670	21.27	6.44	42.57	2.16	21.80	5.75	671.9
31-Mar-2007	525,672	21.12	7.65	45.89	2.05	18.84	4.45	559.2
31-March-2012	785,194	22.00	8.00	45.00	2.00	18.00	5.00	883.6
31-March-2013	824,301	22.29	8.83	44.40	1.71	17.89	4.88	914.4
31-March-2014	881,562	22.95	8.80	43.17	1.75	18.19	5.14	957
31-March-2015	938,823	23.53	8.77	42.10	1.79	18.45	5.37	1010.0
31-March-2016	1,001,191	23.86	8.59	42.30	1.66	17.30	6.29	1075
31-March-2017	1,066,268	24.32	9.22	40.01	1.61	18.33	6.50	1122
31-March-2018	1,130,244	24.20	8.51	41.48	1.27	18.08	6.47	1149

Source:

Annexure VI: Consumption of Electricity for Agricultural Purposes

Year	Consumption for Agricultural Purposes (GWh)	Total Consumption (GWh)	% Share of Agricultural Consumption to total Consumption
1983-84	18234	102344	17.82
1984-85	20960	114068	18.38
1985-86	23422	122999	19.04
1986-87	29444	135952	21.66
1987-88	35267	145613	24.22
1988-89	38878	160196	24.27
1989-90	44056	195419	25.11
1990-91	50321	190357	26.44
1991-92	58557	207645	28.2
1992-93	63328	220674	28.7
1993-94	70699	238569	29.63
1994-95	79301	259630	30.54
1995-96	85732	277029	30.95
1996-97	84019	280206	29.98
1997-98	91242	296749	30.75
1998-99	97195	309734	31.38
1999-00	90934	312841	29.07
2000-01	84729	316600	26.76
2001-02	81673	322459	25.33
2002-03	84486	339598	24.88
2003-04	87089	360937	24.13
2004-05	88555	386134	22.93
2005-06	90292	411887	21.92
2006-07	99023	455748	21.73
2007-08	104182	501977	20.75
2008-09	107776	527564	20.43
2009-10	119492	569618	20.98
2010-11	126377	616969	20.48
2011-12	140960	672933	20.95
2012-13	147462	708843	20.8
2013-14	152744	751908	20.31
2014-15	168913	814250	20.74

Source: GOI (2017).

Annexure VII: State-wise Consumption of Electricity for Agriculture purpose in 2013-14

Region	State/UT	Consumption for Agriculture Purpose (GWh)	Total Energy sold (GWh)	% Share of Consumption for Agriculture
Northern	Haryana	8535.22	29082.52	29.35
	Himachal Pradesh	47.64	7649.49	0.62
	Jammu & Kashmir	280.73	5754.36	4.88
	Punjab	10223.57	37556.79	27.22
	Rajasthan	17262.84	43151	40.01
	Uttar Pradesh	10210.93	59176.69	17.25
	Uttarakhand	343.99	9596.89	3.58
	Chandigarh	1.46	1419.27	0.1
	Delhi	29.23	23980.79	0.12
	Sub-Total	46935.61	217367.8	21.59
Western	Gujarat	14729.72	66877.5	22.02
	Madhya Pradesh	11858.49	36770.45	32.25
	Chhattisgarh	2492.2	14791.14	16.85
	Maharashtra	22257.94	100842.25	22.07
	Goa	21	3085.2	0.68
	Daman & Diu	3.15	1818.54	0.17
	D. & N. Haveli	3.82	5189.51	0.07
	Sub-Total	51366.32	229374.59	22.39
Southern	Andhra Pradesh	21857.35	72919.24	29.97
	Karnataka	18077.62	53716.25	33.65
	Kerala	317.81	18024.6	1.76
	Tamil Nadu	12295	71772.37	17.13
	Puducherry	57	2531.92	2.25
	Lakshdweep	0	41.03	0
	Sub-Total	52604.78	219005.41	24.02
Eastern	Bihar	321.79	7979.71	4.03
	Jharkhand	92.4	18174.64	0.51
	Odisha	171.82	14411.46	1.19
	West Bengal	1183.15	36591.59	3.23
	A. & N. Islands	0.88	215.77	0.41
	Sikkim	0	404.71	0
	Sub-Total	1770.04	77777.88	2.28
North Eastern	Assam	36	4763	0.76
	Manipur	1.66	397.96	0.42
	Nagaland	0.05	394.5	0.01
	Tripura	29.56	722.28	4.09
	Arunachal Pradesh	0.06	480.52	0.01
	Mizoram	0.06	302.79	0.02
	Sub-Total(NER)	67.59	8382.56	0.81
	Total (All India)	**152744.34**	**751908.24**	**20.31**

Note: GWh: Giga Watt-hour,
Source: Central Electricity Authority, New Delhi; Source: GOI (2017).

Annexure VIII: Types and Configuration of Solar Pumps

(a) Types of Pump

Surface Pump: Placed besides the water source (lake, well, etc.).

Submersible Pump: Placed in the water source.

Floating pump: Placed on top of the water.

(b) There are three main solar water pumping configurations used in India:

- **Brushless Direct Current (DC) pump:** Highest efficiency, low maintenance, but higher cost compared to other pumping technologies.
- **DC positive displacement pump:** Less efficient than brushless motors but performs well under low power conditions, and can achieve high lift.
- **3 AC centrifugal pump:** Not as efficient as DC pumps, yet, reasonably priced, easily available/ serviced and deep reaching, making it currently the most preferred choice among users and system integrators.

(c) Components of a solar PV water pumping system:

- **Solar PV array:** The Solar PV array is a set of photovoltaic modules connected in series and possibly strings of modules connected in parallel.
- **Controller:** The Controller is an electronic device which matches the PV power to the motor and regulates the operation of the pump according to the input from the solar PV array.
- **Pump Set:** Pump sets generally comprise of the motor, which drives the operation and the actual pump which moves the water under pressure.

(d) Water pumping motors are "alternating current' (AC) or 'direct current' (DC):

- **AC Motors:** AC Motors require inverters to convert DC to AC. Solar pumping systems use special electronically controlled variable-frequency inverters, which optimises matching between the panel and the pump.
- **DC Motor:** The DC Motors with permanent magnet are generally more efficient. DC Motors may be with or without carbon brushes. DC motors with carbon brushes need to be replaced after approximately every 2 years. Brushless designs require electronic commutation. Brushless DC Motors are becoming popular in the solar water pumps.

(e) Main solar water pump technologies:

- **Centrifugal Pump:** Centrifugal pump uses high-speed rotation to suck in water through the middle of the pump. Most AC pumps use such a centrifugal impeller.
- **Positive Displacement Pump:** The positive displacement pump is currently being used in many solar water pumps. The pump transfers water into a chamber and then forces it out using a piston or helical screw.

राजस्थान सरकार
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क्रमांक प.1 ( ) नि.उ. / Solar/GL/2014-15/3255-3479 दिनांकः 15.10.14

उप निदेशक उद्यान – जयपुर / कोटा / जोधपुर / उदयपुर

सहायक निदेशक उद्यान – अलवर / अजमेर / बीकानेर / बासंवाडा / बाडमेर / भीलवाडा / भरतपुर / बारां / बून्दी / चित्तौडगढ / चूरू / दौसा / धौलपुर / डूंगरपुर / श्रीगंगानगर / हनुमानगढ / जैसलमेर / जालौर / झुन्झुनू / झालावाड / करौली / नागौर / पाली / प्रतापगढ / सीकर / राजसमंद / टोंक / सवाईमाधोपुर / सिरोही

विषयः सौर उर्जा आधारित पम्प परियोजना 2014–15 हेतु दिशा निर्देश।

उपरोक्त विषयान्तर्गत माननीया मुख्यमंत्री महोदया की बजट घोषणा अनुसार 5HP तक के सौर उर्जा पम्प संयंत्र कृषकों को वर्ष 2014–15 में अनुदान पर स्थापित करने के अनुसरण में जवाहर लाल नेहरू राष्ट्रीय सौर मिशन (JLNNSM) / राष्ट्रीय क्लीन एनर्जी फण्ड (NCEF) तथा राज्य योजना अन्तर्गत सौर उर्जा आधारित पम्प परियोजना हेतु कार्यान्वयन दिशा निर्देश संलग्न कर भिजवाये जा रहे है।

उल्लेखनीय है कि परियोजना के अध्यधीन किसी भी प्रकार के कार्बन क्रेडिट सम्बन्धी प्राधिकार RHDS / उद्यान विभाग राजस्थान के पास होगा।

संलग्न उपरोक्तानुसार।

ह0 / –
निदेशक उद्यान एवं
सदस्य सचिव, RHDS

क्रमांक प.1 ( ) नि.उ. / Solar/GL/2014-15/3255-3479 दिनांकः 15.10.14

प्रतिलिपि निम्न को सूचनार्थ एवं अग्रिम आवश्यक कार्यवाही हेतु प्रेषित है :–

1. निजी सचिव, अतिरिक्त मुख्य सचिव (कृषि),राजस्थान जयपुर।
2. निजी सचिव, प्रमुख शासन सचिव (उद्यानिकी),राजस्थान जयपुर।
3. निजी सचिव, प्रमुख शासन सचिव (ऊर्जा),राजस्थान जयपुर।
4. वरिष्ठ निजी सहायक, आयुक्त कृषि, कृषि आयुक्तालय, पंत कृषि भवन, जयपुर।
5. अध्यक्ष, जिला होर्टीकल्चर सोसायटी एवं जिला कलेक्टर.....
6. प्रबन्ध निदेशक, (RE& O) राजस्थान राज्य अक्षय ऊर्जा निगम लि0, (RRECL), E-166 ए यूधिष्ठिर मार्ग, सी–स्कीम, जयपुर।
7. प्रबन्ध निदेशक, राजस्थान राज्य भूमि विकास बैंक, सहकार भवन जयपुर।
8. प्रबन्ध निदेशक, अपैक्स बैंक (दी राजस्थान स्टेट सैन्ट्रल को0 बैंक लि0), लाल कोठी, जयपुर।
9. संयुक्त निदेशक / उप निदेशक उद्यान (योजना), मु. पंत कृषि भवन, जयपुर।
10. समस्त खण्डीय संयुक्त निदेशक उद्यान / कृषि विस्तार .....
11. समस्त संभागीय उप निदेशक उद्यान / उप निदेशक, कृषि विस्तार .....
12. समस्त सहायक निदेशक कृषि (वि.)
13. आरक्षी पत्रावली

ह0 / –
निदेशक उद्यान एवं
सदस्य सचिव, RHDS

"हाईटेक उद्यानिकी/कृषि हेतु सौर ऊर्जा आधारित पम्प परियोजना 2014–15"

1. भूमिका

राज्य मे सौर उर्जा की अपार सम्भावना को ध्यान में रखते हुये कृषि क्षेत्र मे गैर–पारम्परिक एवं पर्यावरण मित्र उर्जा के उपयोग हेतु उद्यान विभाग द्वारा राज्य के कृषकों हेतु सौर उर्जा आधारित पम्प परियोजना का क्रियान्वयन वित्तीय वर्ष 2014–15 में किया जा रहा है। यह परियोजना जवाहर लाल नेहरू राष्ट्रीय सौर मिशन (JLNNSM)/ राष्ट्रीय क्लीन एनर्जी फण्ड (NCEF) तथा राज्य योजना के तहत क्रियान्वित की जावेगी। परियोजना का क्रियान्वयन स्वरूप इस प्रकार है –

2. कृषक चयन पात्रता

कृषक चयन निम्न पात्रता के आधार पर किया जाना है:–

सौलर पम्प संयंत्र 3 HP

1. कृषक के पास न्यूनतम 0.5 हैक्टेयर का भू–स्वामित्व हो।
2. कृषक द्वारा सिचांई हेतु ड्रिप संयंत्र आवश्यक रूप से काम मे लिया जावें।
3. कृषक के पास जल संग्रहण ढांचा, डिग्गी, फार्म पोण्ड, जल हौज या भूमिगत जल स्त्रोत (अधिकतम 75 मीटर गहराई) की व्यवस्था हो । उक्त जल संग्रहण ढ़ाचों की न्यूनतम संग्रहण क्षमता निम्नानुसार हो –

क्र.सं.	ढ़ाचा	न्यूनतम क्षमता (घन मीटर मे)
1.	जल संग्रहण ढांचा	1000
2.	डिग्गी	400
3.	फार्म पोण्ड	1000
4.	जल हौज (सब्जी/बगीचे हेतु)	50
5.	जल हौज (संरक्षित खेती हेतु)	20

4. कृषक द्वारा उच्च उद्यानिकी यथा ग्रीन हाउस/शेडनेट हाउस/लो–टनल्स (न्यूनतम 1000 व.मी.) या ड्रिप पर सब्जियॉ/फूल/फलोद्यान/कृषि फसल (न्यूनतम 0.5 है0) लिये जा रहे हो। मिनी स्प्रिकंलर पर 0.5 है. क्षेत्र में उद्यानिकी/कृषि फसल लेने वाले कृषक भी पात्र होगे।
5. संरक्षित खेती अपनाने वाले कृषकों को प्राथमिकता से चयनित कर लाभान्वित किया जा सकेगा।

सौलर पम्प संयत्र 5 HP-

1. कृषक के पास न्यूनतम 1.0 हैक्टयर से अधिक का भू–स्वामित्व हों।
2. कृषक द्वारा न्यूनतम 2000 वर्ग मीटर उच्च उद्यानिकी ग्रीन हाउस/शेडनेट हाउस/लो टनल्स या न्यूनतम 0.75 हैक्टसर में ड्रिप पर सब्जियॉ/फूल/फलोद्यान/कृषि फसल लिये जा रहे हों।
3. मिनी स्प्रिंकलर पर न्यूनतम 0.75 हैक्टेयर क्षेत्र में उद्यानिकी/कृषि फसल लेने वाले कृषक भी पात्र होगे।
4. कृषक के पास जल संग्रहण ढांचा, डिग्गी, फार्म पोण्ड, जल हौज या भूमिगत जल स्त्रोत (अधिकतम 75 मीटर गहराई) की व्यवस्था हों। उक्त जल संग्रहण ढाचों की न्यूनतम संग्रहण क्षमता निम्नानुसार हो :–

क्र.स.	ढाचां	न्यूनतम क्षमता (घन मीटर में)
1.	जल संग्रहण ढांचा	1500
2.	डिग्गी	800
3.	फार्म पौण्ड	1500
4.	जल हौज (सब्जी/बगीचे हेतु)	75
5.	जल हौज (सरक्षिंत खेती हेतु)	40

5. संरक्षित खेती अपनाने वाले कृषकों को प्राथमिकता से चयनित कर लाभान्वित किया जा सकेगा।

3. चयनित जिले एवं लक्ष्य

परियोजना के तहत केन्द्र सरकार से प्राप्त अनुमति के आधार पर राज्य के समस्त जिलों हेतु 2900 सौर उर्जा आधारित पम्प के लक्ष्यों का निर्धारण किया गया है।
केन्द्र सरकार से अतिरिक्त लक्ष्यो की अनुमति उपरान्त जिलो को अतिरिक्त लक्ष्यो का आवंटन किया जाएगा। लक्ष्यो का जिलेवार आवंटन निम्न प्रकार हैः–

Tentative Categorywise & Districtwise Targets of Solar Pump Project 2014-15

(in Nos.)

S. No.	Districts	Total Targets	5 HP			Total	3 HP			Total	Total Categorywise Target			G.T.
			Gen	SCP	TSP		Gen	SCP	TSP		Gen	SCP	TSP	
1	Ajmer	50	16	3	2	21	20	5	4	29	36	8	6	**50**
2	Alwar	30	9	2	1	12	13	3	2	18	22	5	3	**30**
3	Bansawara	25	7	2	1	10	11	2	2	15	18	4	3	**25**
4	Baran	20	6	1	1	8	9	2	1	12	15	3	2	**20**
5	Barmer	25	7	2	1	10	11	2	2	15	18	4	3	**25**
6	Bharatpur	20	6	1	1	8	9	2	1	12	15	3	2	**20**
7	Bhilwara	180	53	12	9	74	76	17	13	106	129	29	22	**180**
8	Bikaner	375	111	25	19	155	159	35	26	220	270	60	45	**375**
9	Bundi	20	6	1	1	8	9	2	1	12	15	3	2	**20**
10	Chittorgarh	75	22	5	4	31	32	7	5	44	54	12	9	**75**

S. No.	Districts	Total Targets	5 HP			Total	3 HP			Total	Total Categorywise Target			G.T.
			Gen	SCP	TSP		Gen	SCP	TSP		Gen	SCP	TSP	
11	Churu	20	6	1	1	8	9	2	1	12	15	3	2	**20**
12	Dausa	25	7	2	1	10	11	2	2	15	18	4	3	**25**
13	Dholpur	10	3	1	0	4	4	1	1	6	7	2	1	**10**
14	Dungarpur	30	9	2	1	12	13	3	2	18	22	5	3	**30**
15	Hanumangarh	225	67	15	11	93	95	21	16	132	162	36	27	**225**
16	Jaipur	450	134	30	22	186	190	42	32	264	324	72	54	**450**
17	Jaisalmer	100	29	7	5	41	43	9	7	59	72	16	12	**100**
18	Jalore	40	12	3	2	17	16	4	3	23	28	7	5	**40**
19	Jhalawar	50	16	3	2	21	20	5	4	29	36	8	6	**50**
20	Jhunujhunu	75	22	5	4	31	32	7	5	44	54	12	9	**75**
21	Jodhpur	50	16	3	2	21	20	5	4	29	36	8	6	**50**
22	Karoli	20	6	1	1	8	9	2	1	12	15	3	2	**20**
23	Kota	35	10	2	2	14	16	3	2	21	26	5	4	**35**
24	Nagaur	35	10	2	2	14	16	3	2	21	26	5	4	**35**
25	Pali	50	16	3	2	21	20	5	4	29	36	8	6	**50**
26	Pratapgarh	50	16	3	2	21	20	5	4	29	36	8	6	**50**
27	Rajsamand	30	9	2	1	12	13	3	2	18	22	5	3	**30**
28	Sawai Madhopur	45	14	3	2	19	19	4	3	26	33	7	5	**45**
29	Shri Ganganagar	350	105	23	17	145	147	33	25	205	252	56	42	**350**
30	Sikar	270	81	18	13	112	114	25	19	158	195	43	32	**270**
31	Sirohi	20	6	1	1	8	9	2	1	12	15	3	2	**20**
32	Tonk	60	18	4	3	25	25	6	4	35	43	10	7	**60**
33	Udaipur	40	12	3	2	17	16	4	3	23	28	7	5	**40**
	Grand Total	**2900**	**870**	**191**	**139**	**1200**	**1223**	**273**	**204**	**1700**	**2093**	**464**	**343**	**2900**

आवंटित लक्ष्यों के अनुसार किसी जिलें विशेष में प्राप्ति/ मॉग न होने की स्थिति मे लक्ष्यों का हस्तातंरण मांग अनुसार अन्य जिलों को किया जा सकेगा। कृषकों से प्राप्त आवेदन अनुसार विभिन्न रेटिंग के लक्ष्य निर्धारित कर कृषकों को लाभान्वित किया जायेगा। लक्ष्यों की प्राप्ति में कृषक श्रेणी अनुसूचित जाति व अनुसूचित जनजाति को वांछित लाभ प्रदान किया जावें।

4. अनुदान पत्रावलियों के साथ लगाये जाने वाले दस्तावेज–

1. आवेदन पत्र मय लाभार्थी की पासपोर्ट साईज फोटो (संलग्नक–1)
2. कृषक शपथ पत्र (संलग्नक–2)
3. कृषक हिस्सा राशि संग्रहण (संलग्नक– 3 अ) कृषक द्वारा पंजीकरण हेतु राशि रू. 10,000 का डिमाण्ड ड्राफ्ट (सदस्य सचिव, एचडीएस के पक्ष में) आवेदन पत्र के साथ

प्रस्तुत किया जावेगा, जिसका समायोजन पात्रता की स्थिति मे कृषक हिस्सा राशि हेतु किया जा सकेगा।

4. आवेदन पात्रता सत्यापन प्रमाण–पत्र (सलग्नक –3 ब)
5. भूमि की जमाबंदी या पासबुक की प्रतिलिपि (भू–स्वामित्व)
6. सिंचाई स्त्रोत
7. त्रि–पार्टी अनुबन्ध (संलग्नक–4)
8. तकनीकी आर्थिक सर्वे एवं डिजाईन मेप
9. सूचीबद्ध निर्माता का बिल/ प्रफोर्मा इनवॉइस/ कॉटेशन

5. पम्प क्षमता निर्धारण व तकनीकी मापदण्ड

1. 0.5 हैक्टेयर व इससे अधिक का भू स्वामित्व – 3 HP
2. 1.00 हैक्टेयर से अधिक का भू–स्वामित्व : 5 HP
3. अधिक भू–स्वामित्व के कृषकों द्वारा कम क्षमता पम्प की मांग होने पर तदानुसार क्षमता का संयंत्र दिया जा सकता है।
4. संयंत्रो के तकनीकी मापदण्ड एवं विभिन्न पम्पस् वांछित जल डिस्चार्ज मापदण्ड की प्रति संलग्नक–10 पर स्थित है।
5. राज्य के डार्क जोनस् में सर्वे के अनुसार पूर्व में स्थापित नलकूप/ कुओं पर ही सौर उर्जा पम्प संयंत्र देय होगें। नए नलकूप /कुओं हेतु सक्षम स्तर पर अनुमति लिये जाने के उपरान्त ही सौर उर्जा पम्प संयंत्र की पत्रावली ली जावेगी।

6. सूचीबद्व आपूर्तिकर्त्ता / निर्माता

सौर पम्प संयंत्र स्थापना हेतु सूचीबद्व आपूर्तिकर्ता/निर्माता के बारे में EOI प्रक्रिया पूर्ण होने पर सूचित कर दिया जायेगा।

7. अनुदान

1. सोलर पम्प परियोजना हेतु आधार दर पर 70 प्रतिशत अनुदान देय होगा।
2. परियोजना के तहत 30 प्रतिशत अनुदान जवाहर लाल नेहरू राष्ट्रीय सौर मिशन (JLNNSM)/ राष्ट्रीय क्लीन एनर्जी फण्ड (NCEF) से तथा 40 प्रतिशत राज्य योजना मद से देय होगा। (अनुदान MNRE के दिशा–निर्देशानुसार प्रति हॉर्स पावर के आधार पर देय होगा)

8. आधार दर

सौर पम्प संयंत्र की आधार दर के बारे में EOI प्रक्रिया पूर्ण होने पर सूचित कर दिया जायेगा।

9. परियोजना संचालन प्रक्रिया

1. परियोजना हेतु इच्छुक पात्र कृषकों से आवेदन–पत्र निर्धारित प्रपत्र में प्राप्त करने तिथि समाचार पत्रो में शीघ्र प्रकाशित की जायेगी। निर्धारित लक्ष्यों की प्राप्ति के मध्यनजर आवश्यकता की स्थिति मे आवेदन प्राप्ति हेतु अवधि बढ़ाई जा सकेगी।

2. जिला स्तर पर कृषक प्राथमिकता पंजिका का संधारण किया जावेगा।
3. जिन जिलों में लक्ष्यों की सीमा में आवेदन प्राप्त होते हैं, उनका निस्तारण वरिष्ठता के आधार पर **"पहले आओ पहले पाओ"** के आधार पर किया जाना है।
4. जिन जिलों में लक्ष्य से अधिक आवेदन प्राप्त होते है। उनमें कृषक चयन जिला कलेक्टर की अध्यक्षता में लॉटरी द्वारा किया जाना है, शेष कृषकों की वरीयता सूची आगामी वित्तीय वर्ष में संभावित कार्यक्रम क्रियान्वयन हेतु संधारित किया जाना है।

10. अनुदान प्रक्रिया

1. सोलर पम्प सेट हेतु उद्यान विभाग या RHDS से सूचीबद्व/ अनुमोदित फर्म द्वारा स्थापना पर ही अनुदान देय होगा।
2. कृषक द्वारा निर्धारित आवेदन पत्र मय वांछित दस्तावेज सम्बन्धित क्षेत्र के कृषि/ उद्यान विभाग कार्यालय में स्वयं/ कृषि पर्यवेक्षक/ सहायक कृषि अधिकारी/ बैंक/ आपूर्तिकर्ता डीलर/ निर्माता के माध्यम से प्रेषित किया जावें। निर्माता चयन सम्बन्धित कृषक स्तर से किया जावेगा।
3. आवेदन के समय कृषक द्वारा पम्प क्षमता/ माउन्टिग ढांचे का प्रकार (फिक्स/मेन्यूअल ट्रेकर /ओटो ट्रेकर) तथा डोमेस्टिक लाईटिंग सिस्टम का विकल्प आवयश्क रूप से प्रदान किया जायेगा।
4. राज्य के डार्क जोनस् में पूर्व में स्थापित नलकूप/ कुओं पर ही सौर उर्जा पम्प संयंत्र स्थापना पर अनुदान देय होगा।
5. कृषक द्वारा आवेदन पत्र के साथ राशि रू. 10,000 का डी.डी. एवं आवश्यक दस्तावेजों के अलावा पात्रता सत्यापन प्रमाण पत्र निर्धारित प्रपत्र में सलग्न करना होगा, ताकि संयत्र स्थापना प्रक्रिया में विलम्ब ना हो। (संलग्नक– 3ब)
6. पात्र आवेदन सम्बन्धित जिला उद्यान कार्यालय द्वारा निर्धारित समयावधि तक प्राप्त किये जायेगें।
7. सम्बन्धित जिला इकाई द्वारा पत्रावलियों की पात्रता एवं दस्तावेज जांच कर पात्र पत्रावलियों की सूची अध्यक्ष, जिला HDS एवं कलेक्टर के समक्ष प्रस्तुत की जावेगी। अपात्र कृषकों की पंजीकरण राशि यथाशीघ्र (अधिकतम एक माह की अवधि में) वापस लौटा दी जावेगी।
8. निर्धारित लक्ष्यों की सीमा मे प्राप्त पत्रावलियों का अनुमोदन अध्यक्ष, जिला HDS एवं कलेक्टर स्तर से किया जावेगा।
9. लक्ष्यों की सीमा से अधिक पत्रावलियों का अध्यक्ष, जिला HDS एवं कलेक्टर के स्तर से चयन लॉटरी द्वारा किया जावेगा। लॉटरी के माध्यम से लक्ष्य सीमा से अधिक समस्त पत्रावलियों की वरीयता भी निर्धारित की जावेगी, जिससे अनिच्छुक कृषको के स्थान पर या अधिक लक्ष्यों की स्थिति मे उन्हे मौका मिल सकें। उक्त सूची का अनुमोदन अध्यक्ष, जिला HDS एवं कलेक्टर स्तर पर किया जायेगा।
10. जिला उद्यान अधिकारी द्वारा सौर उर्जा आधारित पम्प परियोजना के अन्तर्गत चयनित कृषको को पत्र द्वारा सूचित किया जायेगा एवं कृषको की सूची कार्यालय नोटिस बोर्ड पर चस्पा की जावेगी।
11. अनुमोदित सूची के अनुसार जिला HDS द्वारा चयनित कृषक से सोलर पम्प निर्माता कार्यादायी फर्म का कोटेशन प्रस्तुत करने के उपरान्त प्रशासनिक स्वीकृति निर्धारित प्रपत्र (संलग्न 5) मे निकाली जावेगी। प्रशासनिक स्वीकृति की प्रति तत् दिवस को

उद्यान निदेशालय, खण्डीय उप निदेशक उद्यान व सम्बन्धित निर्माता को फैक्स / ई–मेल द्वारा प्रेषित की जावेगी।

12. प्रशासनिक स्वीकृति की 15 दिवस की अवधि में कृषक द्वारा प्रस्तुत राशि `10,000 के अलावा शेष राशि HDS या सीधे ही संबधित निर्माता को जमा कराई जायेगी। इस दौरान संयंत्र प्रदाता द्वारा साईट का विस्तृत सर्वेक्षण कार्य सम्पन्न किया जावेगा।
13. कृषक अंश राशि 10,000 का भुगतान DD / RTGS के माध्यम से HDS द्वारा सम्बन्धित निर्माता को प्रशासनिक स्वीकृति उपरान्त किया जावेगा।
14. कृषक अंश प्राप्ति की सूचना पर DHDS स्तर से कार्यादेश जारी किया जायेगा (संलग्नक –6)। पहले कृषक अंश जमा कराने वाले कृषकों को कार्यादेश वरीयता मिलेगी।
15. सम्बन्धित सूचीबद्ध निर्माता द्वारा कृषक हिस्सा राशि प्राप्त करते ही सम्बन्धित जिला इकाई व निदेशालय को सूचित करते हुये यथाशीघ्र (अधिकतम 45 दिवस) माल आपूर्ति की जावेगी।
16. सम्बन्धित जिलाधिकारी द्वारा निदेशालय को माल आपूर्ति का सत्यापन कर सूचना निर्धारित प्रपत्र (संलग्न 7) मे भिजवाना होगा ताकि द्वितीय चरण का भुगतान किया जा सकें।
17. सम्बन्धित सूचीबद्ध निर्माता द्वारा स्थापन कार्य (कार्यादेश जारी होने के 45 दिवस में आपूर्ति व 20 दिन में स्थापन्न कार्य) सम्पन्न करना होगा।
18. DHDS स्तर से संयंत्र स्थापना के 7 दिवस में संयंत्र का निर्धारित प्रपत्र अनुसार भौतिक सत्यापन किया जावें (संलग्न 8 I & II) । भौतिक सत्यापन की आवश्यकता के अनुसार निदेशालय स्तर से अतिरिक्त दलों का गठन किया जा सकेगा।
19. भौतिक सत्यापन की रिपोर्ट संबंधित जिला इकाईयों द्वारा निर्धारित प्रपत्र (संलग्न 9) मे निदेशालय को प्रस्तुत की जावेगी। जिससे तीसरे चरण का भुगतान सम्पन्न किया जा सकें।
20. सौर उर्जा पम्प परियोजना के प्रचार– प्रसार को बढावा देने व तकनीकी पहलुओं की जानकारी देने हेतु कृषि अनुसंधान केन्द्र / कृषि विज्ञान केन्द्र / राजहंस नर्सरी / सरकारी कृषि फार्म पर भी सौलर पम्प स्थापित करने पर नियमानुसार अनुदान देय होगा।

11. अनुदान भुगतान चरण

1. भुगतान – लाभार्थी / DHDS/ उद्यान निदेशालय द्वारा सम्बन्धित निर्माता फर्म को 3 चरणों में किया जावेगा–
   (अ) संयंत्र आपूर्ति कार्यादेश पर 30 प्रतिशत कृषक हिस्सा राशि का भुगतान DHDS / कृषक के स्तर पर।
   (ब) कृषक के खेत पर माल आपूर्ति एवं सयंत्र के पांच वर्ष सही संचालन की गारण्टी के पेटे सयंत्र लागत की 10 प्रतिशत बैंक गारण्टी के रूप मे प्रस्तुत करने पर 40 प्रतिशत राशि का भुगतान उद्यान निदेशालय द्वारा।
   (स) शेष 30 प्रतिशत राशि उद्यान निदेशालय द्वाराः–
      1. कृषक खेत पर सफलता पूर्वक सयंत्र स्थापन कार्य पूर्ण करने पर।
      2. निर्धारित दल द्वारा सौर उर्जा पम्प संयंत्र का भौतिक सत्यापन करने पर।

12. भौतिक सत्यापन

1. माल आपूर्ति व सफलतापूर्वक स्थापन कार्य का भौतिक सत्यापन 7 दिवस में किया जावे।
2. माल आपूर्ति का भौतिक सत्यापन सहायक कृषि अधिकारी/ कृषि अधिकारी/ सहायक निदेशक/ उपनिदेशक स्तर के कम से कम एक अधिकारी द्वारा किया जावे।
3. स्थापित संयंत्र के भौतिक सत्यापन 3 सदस्यीय दल द्वारा किया जावेगा। इसमें कृषि/ उद्यान विभाग के सहायक कृषि अधिकारी स्तर या इससे उपर के दो अधिकारी तथा एक सदस्य अभियन्ता RRECL /उर्जा विभाग/ ग्रामीण विकास विभाग/ जिला कलेक्टर द्वारा नामित सहायक अभियंता /RHDS द्वारा नामित होगा।
4. भौतिक सत्यापन यथासम्भव उपनिदेशक कृषि/ उद्यान या सहायक निदेशक कृषि/ उद्यान की उपस्थिति में हो।
5. भौतिक सत्यापन के दौरान संयंत्र का फोटो भी लिया जावे।
6. भौतिक सत्यापन हेतु सहायक कृषि अधिकारी स्तर या इससे उपर के कृषि विभाग/ जिला परिषद् के अधिकारी भी अधिकृत होंगे।
7. कार्य अधिकता एवं कार्य को गति प्रदान करने के प्रयोजनार्थ इस हेतु RHDS स्तर से विशेषज्ञ सेवायें हायर की जा सकती है।

13. सूचीबद्ध निर्माताओं के दायित्व

1. सूचीबद्ध निर्माता के अधिकृत इंजिनियर द्वारा कृषक का विस्तृत सर्वे किया जाकर संयंत्र स्थापन का तकनीकी ड्राइंग/डिजाईन तैयार किया जावेगा।
2. निर्माता द्वारा कृषक को संयंत्र संचालन एवं रखरखाव का मैन्यूअल प्रदान किया जावेगा एवं संयंत्र के समग्र बिन्दुओ पर कृषक प्रशिक्षण आयोजित किया जावेगा।
3. डिजाईन के अनुसार सिविल कार्य सम्पन्न कराया जावेगा।
4. आपूर्तिकर्ताओं द्वारा प्रस्तुत सौर ऊर्जा आधारित पम्प परियोजना के मॉडयूल माउंटिग ढांचे की डिजाईन प्रचलित वायु, वेग, लोड को तकनिकी रूप से सहन करने योग्य हो।
5. सौर उर्जा पम्प सयंत्र स्थापना से पूर्व सम्बन्धित कम्पनी द्वारा कृषक के पानी के जल स्तर / उपलब्धता का निर्धारण अपने विशेषज्ञ से करवाकर यह सुनिश्चित करेगी की किस क्षमता का पम्प सैट लगाया जावें, पम्प का चुनाव /स्थापन उपरान्त निर्धारित मात्रा में पानी का डिस्चार्ज नही होने पर कम्पनी की जिम्मेदारी होगी। (संलग्न– 3स)
6. संयंत्र के पार्टस जवाहर लाल नेहरू राष्ट्रीय सौर उर्जा मिशन के मापदण्डों के अनुसार होगें।
7. सौर पेनल/ मॉड्यूल 125 WP या इससे अधिक क्षमता के होंगे।
8. निर्माता प्रत्येक आपूर्ति किये जाने वाले मॉड्यूल/ पेनल का IV-Curve DHDS को प्रस्तुत करेगा।
9. आपूर्तित माल का पूर्ण विवरण व मापदण्ड, डिजाईन व तकमिना सम्बन्धित जिला इकाई को उपलब्ध कराना होगा।
10. सूचीबद्व निर्माता द्वारा निदेशालय स्तर के दल से प्री–डिस्पेंच निरीक्षण करवाया जाना अनिवार्य होगा।
11. सूचीबद्व निर्माता द्वारा प्री–डिस्पेंच निरीक्षण के लिये 15 दिवस पूर्व निदेशालय को सूचित करना होगा।

12. Outsourcing किए गये सामान के स्त्रोत की स्पष्ट जानकारी सूचीबद्व निर्माता द्वारा दी जायेगी।
13. कार्यादेश /प्रशासनिक स्वीकृति के 45 दिवस मे संयंत्र माल आपूर्ति एवं 20 दिवस मे स्थापन कार्य सम्पन्न करना होगा। निर्धारित अवधि मे बिना किसी युक्ति संगत कारण के विलम्ब की स्थिति मे नियमानुसार पैनल्टी (45+20) लागू होगी।
14. संयंत्र की पांच वर्ष की गारण्टी तथा इसके पश्चात् आगामी पांच वर्ष हेतु विक्रय पश्चात् सेवा (After sales service) प्रदान की जावेगी।
15. सूचीबद्व निर्माता द्वारा कृषक के खेत पर स्थापित सोलर पम्प संयंत्र की फेन्सिंग (निर्धारित मापदण्ड अनुसार) का कार्य एवं बीमा करवाया जायेगा।
16. निर्माता द्वारा सभी स्टेक होल्डर्स (RHDS/DHDS/कृषक) को सर्विस सेंटर की जानकारी उपलब्ध करवानी होगी।
17. संयंत्र संचालन व रखरखाव सम्बन्धी साहित्य पुस्तिका (मैन्युअल) जो कि कृषक सुलभ हिन्दी भाषा मे हो, लाभार्थियों को प्रदान की जावेगी।
18. निर्माता द्वारा कस्टमर केयर सेन्टर स्थापित किया जावेगा तथा टोल फ्री नबंर की जानकारी प्रत्येक स्टेक होल्डर को उपलब्ध करानी होगी।
19. विगत् वर्षो के साथ–साथ चालू वित्तीय वर्ष के दौरान स्थापित कुल संयंत्रो की संख्या जिला विशेष मे 100 या इससे अधिक होने की स्थिति मे सम्बन्धित जिला मुख्यालय पर कस्टमर केयर सेन्टर स्थापित किया जाना आवश्यक होगा। इस केन्द्र पर कम से कम एक तकनिकी व्यक्ति रखा जायेगा जिसके नाम, मोबाईल नम्बर व पता सम्बन्धित जिला इकाई, लाभार्थी व वेबसाईट पर उपलब्ध कराना होगा।
20. अगर कार्यदायी फर्म द्वारा राजस्थान मे विगत् पॉच वर्षो सहित चालु वित्तीय वर्ष तक 500 या इससे अधिक संयंत्र कर लिये है तो जयपुर मुख्यालय पर कस्टमर केयर सेन्टर स्थापित करना होगा जिसमे कम से कम 5 तकनिकीकर्मी होगे। इनके नाम, मोबाईल नम्बर व पते सम्बन्धित कृषक, जिला इकाई, मुख्यालय तथा वेबसाईट पर उपलब्ध कराना होगा।
21. स्थापित किये जाने वाले संयंत्रो के डाटा आवश्यकतानुसार विभागीय वेबसाईट पर अपलोड करने होगे। ये डाटा प्रत्येक महीने के प्रथम दिवस तथा नये संयंत्र स्थापन के दस दिवस मे आवश्यक रूप से अद्यतन (अपडेट) किया जावेगा।
22. कार्यदायी फर्म द्वारा स्थापित संयंत्रो का प्रत्येक तिमाही (अप्रैल–जुन, जुलाई–सितम्बर, अक्टूबर–दिसम्बर व जनवरी–मार्च) के दौरान निरीक्षण करना होगा तथा इसकी सूचना जिला इकाई को प्रस्तुत करनी होगी।
23. कार्यदायी फर्म द्वारा कृषकों को रखरखाव (मेन्टीनेंस) व योजना सम्बन्धी जानकारी प्रदान की जावेगी।
24. कार्यदायी फर्मस के स्तर से रखरखाव सम्बन्धी Clauses की गम्भीरता से पालना सुनिश्चित की जावेगी। जिससे लाभार्थीयों को संयंत्र मे किसी प्रकार के फाल्ट की स्थिति मे इधर–उधर चक्कर न काटना पडें।
25. किसी प्रकार के फाल्ट की सूचना डाक, टेलीफोन, फैक्स, ई–मेल या अन्य तरीके से प्राप्त होने की स्थिति में तीन कार्य दिवसों मे आवश्यक रूप से साईट भ्रमण आदि जरिये से इस पर कार्यवाही की जावेगी।

26. कार्यदायी फर्म से अपेक्षा की जाती है कि वह समुचित मात्रा मे स्पेयर पार्ट का स्टॉक रखे जिससे की संयंत्र शिकायत के 5 दिवस मे आवश्यक रूप से पुनः चालु किया जा सकें।
27. संयंत्रो के रखरखाव कार्य के विफलता की स्थिति में फर्म की बैंक गारण्टी रिवोक की जा सकेगी तथा पॉच या इससे अधिक संयंत्रो के रखरखाव की विफलता पर फर्म को काली सूची मे डाले जाने की कार्यवाही की जा सकेगी, जिसके निर्णय का अंतिम अधिकारी मिशन निदेशक, या सदस्य सचिव, RHDS को होगा।

14. कृषक के दायित्व

1. आवेदन पत्र प्रस्तुत करना तथा कृषक हिस्सा राशि जमा करवाना।
2. संयंत्र की माल आपूर्ति एवं स्थापन हेतु स्थल (छाया रहित कम से कम 60 वर्ग.मी.) एवं जल स्त्रोत उपलब्ध करवाना।
3. भौतिक सत्यापन व अन्य निरीक्षण के समय लाभार्थी यथासम्भव स्वंय या अन्य परिवार के जिम्मेदार सदस्य की उपस्थिति सुनिश्चित करेगा।
4. संयंत्र का बीमा कार्यदायी फर्म द्वारा करवाया जायेगा। सौलर पम्प सयंत्र के उचित रख– रखाव एवं सुरक्षा की समस्त जिम्मेदारी कृषक की होगी।
5. संयंत्र के खुर्द–बुर्द करने की स्थिति में सम्बन्धित कृषक के विरूद नियमानुसार विधिक कार्यवाही अमल मे लायी जावेगी तथा संयंत्र हेतु जारी की गई राशि वसूली योग्य होगी।
6. त्रि–पार्टी अनुबन्ध।

15. योजना का ऑन–लाईन क्रियान्वयन

सौर पम्प परियोजना हेतु साफटवेयर डवलमेन्ट का कार्य प्रगति पर है। साफटवेयर की शुरूआत के साथ ही वांछित डाटा अपडेट करने की कार्यवाही सम्बन्धित जिला इकाई व कार्यदायी फर्म द्वारा सम्पन्न की जावेगी। ततपश्चात् योजना का क्रियान्वयन एवं मोनिटिंरिग वेब आधारित साफटवेयर से होगी।

Government of Rajasthan

Commissionerate of Horticulture, Rajasthan, Jaipur

No. F ( )DH/Solar/EOI/2014-15/ 4731-4936 Dated: 05.02.2015

All Member Secretary, DHDS / Dy. Director, Horticulture .....

Assistant Director Horticulture .....

Subject: Empanelment of SPV Manufactures under Solar Pumping Project 2014-15 (JNNSM & State Resources).

Please find herewith the tentative list of the manufacturers empanelled for SPV Solar Pumping Programme for the year 2014-15 –

S.No,	Name of Firm	Address of Firm	Contact No.	Fax No.
1	2	3	4	5
1	Alpex Exports Pvt. Ltd.	81/2, Ist Floor, Shri Aurbido Marg, Near Hero Honda Show Room, Adhchini, New Delhi-17	011-26547000, 26522132	011-26515355
2	Central Electronics Ltd.	4, Industrial Area, Sahibabad - 201010 (UP)	020-2895151/2895165	
3	HBL Power Systems Ltd.	8-2-601, Road No. 10, Banjara Hills, Hyderabad- 500034	011-22161210 22164292/3, 22143139/40	011-22160062
4	HHV Solar Technologies Pvt. Ltd.	No. 31,32,33,34 & 37, Phase-I, KIADB Industrial Area, Dabaspet, Bangalure-562111	080-22633784	
5	Jain Irrigation Systems Ltd.	(Solar Division), Jain Energy Park, Jain Velly, Shirsoli Road, Jalgaon 425001	0257-2260033/44 Ext. 803, 0141-2203515	0257-2261155
6	JJ PV SOLAR Pvt. Ltd.	Survey No. 236, Plot No. 2, Village - Veraval (Shaper), District - Rajkot, Gujarat - 360024		
7	Kotak Urja Pvt. Ltd.	378, 10th cross, 4th Phase, Peenya Industrial Area, Banglore- 560058	080-28363330	080-28362347
8	Lanco Solar Energy Pvt. Ltd.	Plot-4, Software Units Layout, Hitec City, Madhapur, Hyderabad-500081 A.P.	0124-6725200/677100 Ext. 2855	0124-4741021
9	LUBI Electronics	Sardar Patel Ring Road, Nr. Bright School, Nana Chiloda, Distt. Gandhinagar, Gujarat- 382325	079-39845300	079-39845599
10	Modern Solar Pvt. Ltd.	7, Camac Street, 3rd Floor, Azimganj House, Kolkata - 700017	(033) 24750337, 65228530	
11	Premier Solar Systems Pvt. Ltd.	3rd Floor, VV Tower, Karkhana Main Road, Secunderanbad-5000009, A.P.	040-27744415/16	040-27744417
12	PV Power Technologies Pvt. Ltd.	GJ14, SEEPZ, SDF VII, Andheri(East), MUMBAI - 400 096	022-42214800	022-42214801

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website: horticulture. rajasthan.gov.in, Email: rajasthan_mis@rediffmail.com
Ph. 0141-2227606, 2227706 Telefax 0141-2227840

13	Rajasthan Electronics & Instruments Ltd.	2, Kanakpura Industrial Area, Sirsi Road, Jaipur, Rajasthan - 302 012	0141-2470531	0141-2470139/ 2470531
14	TATA Power Solar Systems Ltd.	4-B, M6-Uppal Plaza, Jasola, New Delhi-110025	080-67772000	080-67772252

Conditions of empanelment:

1. The firms who conform to IEC certificate for their PV modules may opt the pump model/ brand which have qualified in Solar Energy Centre, MNRE/ NISE /EQDC /CPRI / IHITC or equivalent test.
2. The empanelled manufacturers have to declare their water output performance with all possible configuration and commitment to follow the same on Rs.100 non judicial stamp paper. They are also required to submit the declared designs as per EOI point No. II.3.1.V Both the documents need to be submitted within seven days failing which the empanelment may be liable for cancellation automatically.
3. The information regarding water output performance is also to be submitted to the district units.
4. The empanelled manufacturer have to submit the qualified test report to RHDS/ RREC from Solar Energy Centre, MNRE/ NISE /EQDC /CPRI / IHITC (or equivalent approved by RHDS) for the particular pump model which is to be supplied by the firm in the project. The subsidy payment will be released only after submitting the qualified test report.
5. If the installed pump does not qualify the MNRE norms in the test report, then the supplier has to replace the same with the qualified pump model.
6. Provision of alternate manual tracking system will be provided in auto tracking structures to combat the situations during nonworking of auto trackers.
7. The supply and commissioning of the system will be completed within 65 (45+20) days after issuance of the work order. Each firm should achieve significant targets.
8. The Toll free number will be communicated to the RHDS and concerned district units within 15 days.
9. The bill of quantities (BOQ) and the prescribed quotation of the firm will be communicated to the district units and RHDS.
10. The carbon credit of the project will be the sole authority of the RHDS/ Horticulture Department and no any such claim of the empanelled firm will be entertained.
11. The list of authorized agents/ dealers/ customer care centre/ service center as submitted to Commissionerate is supposed to be made available to the concerned offices and any change may be intimated.
12. Execute an agreement on Rs. 100/-stamp for due performance of obligation as per terms & conditions of EOI within 07 days, failing which the empanelment may be liable for cancellation automatically (EOI 32.2).
13. Submit a performance security in the form of a bank guarantee of Rs. 100.00 lac, shall be submitted with a validity of 1 year along with agreement (EOI 32.2).
14. Submit a affidavit on Rs.100 non judicial stamp paper of not supplying SPV pump anywhere in the country at lower rate compared to accepted rate(Base Rate) of RHDS (L1).

15. The subsidy calculation will be done on the L-1 rates which is the base rate.

Base Rates for supplies are:

Details	DC/ AC	Mounting Structure	Head (meter)	Base Rate (Rs.) 3 Hp	Base Rate (Rs.) 5 Hp	Remarks
SPV Surface pump	DC	Static	20	3,87,887	6,20,000	-
	AC	Static	20	4,10,000	5,70,000	-
SPV Submersible pump	DC	Static	20	4,49,513	6,21,068	-
	AC	Static	20	4,14,678	5,80,000	-
Additional cost (Rs.)	50 m head over 20 m					6,500
	75 m head over 20 m					11,000
	Manual tracking System					4,050
	Auto tracking System					17,500
SPV Domestic Lighting System 37 WP/ 40 Ah Battery / 9 W x 2 fixture						7,999
Fencing around Solar Panels & Structure						14,000

S.N.	Details	DC/ AC Mounting Structure	Head (meter)	Base Rate (in Rs. Per set)		Subsidy (in Rs. Per set)		Farmer Share (In Rs. Per set)	
				3 Hp	5 Hp	3 Hp	5 Hp	3 Hp	5 Hp
1	SPV Surface pump	DC Manual	20	391937	624050	278275	452120	113662	171930
2		DC Auto Tracker	20	405387	637500	283655	457500	121732	180000
3		AC Manual	20	414050	574050	262820	391620	151230	182430
4		AC Auto Tracker	20	427500	587500	268200	397000	159300	190500
5	SPV Submersible pump	DC Manual	20	453563	625118	302925	452547	150638	172571
6			50	460063	631618	305525	455147	154538	176471
7			75	464563	636118	307325	456947	157238	179171
8		DC Auto Tracker	20	467013	638568	308305	457927	158708	180641
9			50	473513	645068	310905	460527	162608	184541
10			75	478013	649568	312705	462327	165308	187241
11	SPV Submersible pump	AC Manual	20	418728	584050	264691	395620	154037	188430
12			50	425228	590550	267291	398220	157937	192330
13			75	429728	595050	269091	400020	160637	195030
14		AC Auto Tracker	20	432178	597500	270071	401000	162107	196500
15			50	438678	604000	272671	403600	166007	200400
16			75	443178	608500	274471	405400	168707	203100
17	SPV Surface pump with DLS	DC Manual	20	399936	632049	281474	455320	118462	176729
18		DC Auto Tracker	20	413386	645499	286854	460700	126532	184799
19		AC Manual	20	422049	582049	266020	394820	156029	187229
20		AC Auto Tracker	20	435499	595499	271400	400200	164099	195299
21	SPV Submersible pump with DLS	DC Manual	20	461562	633117	306125	455747	155437	177370
22			50	468062	639617	308725	458347	159337	181270
23			75	472562	644117	310525	460147	162037	183970
24		DC Auto Tracker	20	475012	646567	311505	461127	163507	185440
25			50	481512	653067	314105	463727	167407	189340
26			75	486012	657567	315905	465527	170107	192040
27	SPV Submersible pump with DLS	AC Manual	20	426727	592049	267891	398820	158836	193229
28			50	433227	598549	270491	401420	162736	197129
29			75	437727	603049	272291	403220	165436	199829
30		AC Auto Tracker	20	440177	605499	273271	404200	166906	201299
31			50	446677	611999	275871	406800	170806	205199
32			75	451177	616499	277671	408600	173506	207899
33	SPV Surface pump with DLS & fencing	DC Manual	20	413936	646049	287074	460920	126862	185129
34		DC Auto Tracker	20	427386	659499	292454	466300	134932	193199
35		AC Manual	20	436049	596049	271620	400420	164429	195629
36		AC Auto Tracker	20	449499	609499	277000	405800	172499	203699
37	SPV Submersible pump with DLS & fencing	DC Manual	20	475562	647117	311725	461347	163837	185770
38			50	482062	653617	314325	463947	167737	189670
39			75	486562	658117	316125	465747	170437	192370
40		DC Auto Tracker	20	489012	660567	317105	466727	171907	193840
41			50	495512	667067	319705	469327	175807	197740
42			75	500012	671567	321505	471127	178507	200440

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S.N.	Details	DC/ AC Mounting Structure	Head (meter)	Base Rate (in Rs. Per set)		Subsidy (in Rs. Per set)		Farmer Share (in Rs. Per set)	
				3 Hp	5 Hp	3 Hp	5 Hp	3 Hp	5 Hp
43	SPV Submersible pump with DLS & fencing	AC Manual	20	440727	606049	273491	404420	167236	201629
44			50	447227	612549	276091	407020	171136	205529
45			75	451727	617049	277891	408820	173836	208229
46		AC Auto Tracker	20	454177	619499	278871	409800	175306	209699
47			50	460677	625999	281471	412400	179206	213599
48			75	465177	630499	283271	414200	181906	216299

Note :

1. Basis of MNRE subsidy calculation is Rs. 32400/- per HP for AC pumps and Rs. 40500/- for DC pumps.
2. In addition to above State Plan subsidy is 40% of Base rate.
3. As per MNRE guidelines subsidy will be allowed only on manual & auto tracking enabled SPV pumps.

The subsidy would be payable on the supply of the solar pumping system by the empanelled manufacturer only. In case of any complaints regarding sub standard/ defective supplies, Commissionerate of Horticulture must be informed with full details of the case so that necessary action can be taken against the defaulter.

(Kuldeep Ranka)
Secretary cum Commissioner Horticulture &
Member Secretary, RHDS

No. F ( )DH/Solar/EOI/2014-15/ 4731-4936 Dated: 05.02.2015

Copy forwarded for information & necessary action:-

1. PS to Additional Chief Secretary, Agriculture, Rajasthan, Jaipur
2. PS to Additional Chief Secretary, Horticulture, Rajasthan, Jaipur.
3. PA to Jt. Secretary to Govt. of India, MNRE, Block No.14, C.G.O. Complex Lodi Road, New Delhi- 110 003
4. PA to Secretary Energy & Chairman RRECL, Jaipur.
5. PA to Secretary & Commissioner Agriculture and Horticulture, Commissionerate of Horticulture, Rajasthan, Jaipur.
6. MD, RRECL, E-166, Yudhisthir Marg, C-Scheme, Jaipur.
7. Dr. G. Prasad, Scientist –E / Director, MNRE, Govt. of India, Block No. 14, C.G.O. Complex Road, New Delhi-110003
8. General Manager (RE&O) / Director Technical Rajasthan Renewable Energy Corporation Ltd. E-166, Yudhisthir Marg, C-Scheme, Jaipur.
9. Jt. Director Horticulture Jaipur/ Kota / Jodhpur.
10. All Jt. Director Agriculture (Ext.) .....
11. Project Director Agriculture (Ext.), CAD Kota
12. All Divisional Dy. Director Horticulture .....
13. All Dy. Director Agriculture (Ext.) Zila Parishad .....
14. All Project Director ATMA .....
15. All Assistant Director Agriculture (Ext.).....
16. M.D. Rajashtan State Land Development Bank Nehru Sahakar Bhawan Jaipur.
17. M.D. The Rajasthan State Cooperative Bank Limited, Lal Kothi, Jaipur.
18. The concerned Firm M/s .....

(Kuldeep Ranka)
Secretary cum Commissioner Horticulture &
Member Secretary, RHDS

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राजस्थान सरकार
उद्यान आयुक्तालय, पंत कृषि भवन, जयपुर

क्रमांक प.1 ( ) आ.उ./Solar/GL/2015-16/ 4348-4520 दिनांक: 3..12.15

उप निदेशक उद्यान – जयपुर / कोटा / जोधपुर / उदयपुर

सहायक निदेशक उद्यान – अलवर / अजमेर / बीकानेर / बासंवाडा / बाडमेर / भीलवाडा / भरतपुर / बारां / बून्दी / चित्तौडगढ / चूरू / दौसा / धौलपुर / डूंगरपुर / श्रीगंगानगर / हनुमानगढ / जैसलमेर / जालौर / झुन्झुनू / झालावाड / करौली / नागौर / पाली / प्रतापगढ / सीकर / राजसमंद / टोंक / सवाईमाधोपुर / सिरोही

विषयः सौर उर्जा आधारित पम्प परियोजना 2015–16 हेतु दिशा निर्देश।

उपरोक्त विषयान्तर्गत लेख है कि 5HP के सौर उर्जा पम्प संयंत्र कृषकों को वर्ष 2015–16 में अनुदान पर स्थापित करने हेतु जवाहर लाल नेहरू राष्ट्रीय सौर मिशन (JLNNSM) / राष्ट्रीय क्लीन एनर्जी फण्ड (NCEF) तथा राज्य योजना अन्तर्गत सौर उर्जा आधारित पम्प परियोजना हेतु कियान्वयन दिशा निर्देश संलग्न कर भिजवाये जा रहे है। योजनान्तर्गत जारी दिशा–निर्देशों के साथ निम्न बिन्दुओं की पालना आवश्यक रूप से सुनिश्चित की जावें।

1. सर्वप्रथम वर्ष 2014–15 में लॉटरी प्रकिया द्वारा चयनित किये गये कृषकों में से शेष रहे कृषकों को लाभान्वित किया जावें। (संलग्न विस्तृत दिशा–निर्देश के बिन्दु संख्या 3 सौर उर्जा पम्प सयंत्र हेतु प्राथमिकता, संचालन प्रकिया एवं अनुदान का पैरा 1)
2. वर्ष 2014–15 की लॉटरी द्वारा चयनित कृषकों की सूची पूर्ण होने पर सौर उर्जा पम्प संयंत्रो के लक्ष्य शेष होने पर जिला उद्यान कार्यालय द्वारा स्थानीय समाचार पत्रो में योजना का प्रचार–प्रसार उपरान्त निश्चित अवधि तक पत्रावलियॉ प्राप्त की जावें एवं 'पहले आओ, पहले पाओ' के आधार पर वरीयता दी जावेगी। जिला स्तर पर कृषक प्राथमिकता पंजिका का संधारण किया जावेगा। लेकिन विद्युत कनेक्शन समर्पित करने वाले कृषकों को इसमें भी प्राथमिकता रहेगी। (संलग्न विस्तृत दिशा–निर्देश के बिन्दु संख्या 3 सौर उर्जा पम्प सयंत्र हेतु प्राथमिकता, संचालन प्रकिया एवं अनुदान का पैरा 2)
3. ऐसें कृषक जिनके पास कृषि विद्युत कनेक्शन नही है, द्वारा उद्यान विभाग से अनुदान पर सौर उर्जा पम्प सयंत्र स्थापित करवाने पर लाभान्वित कृषकों की सूची जिला उद्यान कार्यालयों द्वारा विद्युत विभाग को भेजी जावें ताकि भविष्य में उन कृषकों को कृषि विद्युत कनेक्शन स्थापना पर अनुदान देय नही होगा।
4. वर्ष 2015–16 के दिशानिर्देशो में कृषक हिस्सा राशि कृषक द्वारा केवल DHDS के खाते में ही जमा करवायी जायेगी व सूचीबद्व आपूर्तिकर्ता को कार्यादेश उपरान्त सयंत्र (माल) आपूर्ति पर सयंत्र लागत का 70 प्रतिशत (कृषक हिस्सा / अनुदान) का भुगतान किया जावेगा।

उल्लेखनीय है कि परियोजना के अध्यधीन किसी भी प्रकार के कार्बन क्रेडिट सम्बन्धी प्राधिकार RHDS / उद्यान विभाग राजस्थान के पास होगा।

संलग्न उपरोक्तानुसार।

आयुक्त उद्यान एवं
सदस्य सचिव, RHDS

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प्रतिलिपि निम्न को सूचनार्थ एवं अग्रिम आवश्यक कार्यवाही हेतु प्रेषित है :–

1. निजी सचिव, प्रमुख शासन सचिव (ऊर्जा), राजस्थान जयपुर।
2. निजी सचिव, सचिव एवं आयुक्त कृषि एवं उद्यान, उद्यान आयुक्तालय, पंत कृषि भवन, जयपुर।
3. प्रबन्ध निदेशक, (RE&O) राजस्थान राज्य अक्षय ऊर्जा निगम लि0, (RRECL), E-166 ए यूधिष्ठिर मार्ग, सी–स्कीम, जयपुर।
4. अध्यक्ष, जिला होर्टीकल्चर सोसायटी एवं जिला कलेक्टर .....
5. अध्यक्ष एवं प्रबन्ध निदेशक, विद्युत वितरण निगम लि0, जयपुर/अजमेर/जोधपुर।
6. प्रबन्ध निदेशक, राजस्थान राज्य भूमि विकास बैंक, सहकार भवन जयपुर।
7. प्रबन्ध निदेशक, अपैक्स बैंक (दी राजस्थान स्टेट सैन्ट्रल को0 बैंक लि0), लाल कोठी, जयपुर।
8. अधीक्षण अभियंता, विद्युत वितरण निगम लि0, जयपुर/अजमेर/जोधपुर, जिला.....।
9. संयुक्त निदेशक/उप निदेशक उद्यान (योजना), मु. पंत कृषि भवन, जयपुर।
10. समस्त खण्डीय संयुक्त निदेशक उद्यान/कृषि विस्तार .....
11. समस्त संभागीय उप निदेशक उद्यान .....
12. उप निदेशक, कृषि विस्तार (जिला परिषद) .....
13. समस्त सहायक निदेशक कृषि (वि.)
14. आरक्षी पत्रावली

आयुक्त उद्यान एवं
सदस्य सचिव, RHDS

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"हाईटेक उद्यानिकी/कृषि हेतु सौर ऊर्जा आधारित पम्प परियोजना 2015–16"

1. भूमिका

राज्य मे सौर उर्जा की अपार सम्भावना को ध्यान में रखते हुये कृषि क्षेत्र मे गैर–पारम्परिक एवं पर्यावरण मित्र उर्जा के उपयोग हेतु उद्यान विभाग द्वारा राज्य के कृषकों हेतु सौर उर्जा आधारित पम्प परियोजना का कियान्वयन वित्तीय वर्ष 2015–16 में किया जा रहा है। यह परियोजना जवाहर लाल नेहरू राष्ट्रीय सौर मिशन (JLNNSM)/ राष्ट्रीय क्लीन एनर्जी फण्ड (NCEF) तथा राज्य योजना के तहत् कियान्वित की जावेगी। परियोजना का कियान्वयन स्वरूप इस प्रकार है –

2. कृषक चयन पात्रता

कृषक चयन निम्न पात्रता के आधार पर किया जाना है:–

सौलर पम्प संयंत्र 3 HP

1. कृषक के पास न्यूनतम 0.5 हैक्टेयर का भू–स्वामित्व हो।
2. कृषक द्वारा सिचांई हेतु ड्रिप/मिनि स्प्रिकंलर /स्प्रिकंलर संयंत्र आवश्यक रूप से काम मे लिया जावें।
3. कृषक के पास जल संग्रहण ढांचा, डिग्गी, फार्म पोण्ड, जल हौज या भूनिगत जल स्त्रोत (अधिकतम 75 मीटर गहराई) की व्यवस्था हो । उक्त जल संग्रहण ढ़ाचों की न्यूनतम संग्रहण क्षमता निम्नानुसार हो –

क्र.सं.	ढ़ाचा	न्यूनतम क्षमता (घन मीटर मे)
1.	जल संग्रहण ढांचा	1000
2.	डिग्गी	400
3.	फार्म पोण्ड	1000
4.	जल हौज (सब्जी/बगीचे हेतु)	50
5.	जल हौज (संरक्षित खेती हेतु)	20

4. कृषक द्वारा उच्च उद्यानिकी यथा ग्रीन हाउस/शेडनेट हाउस्/लो–टनल्स् (न्यूनतम 1000 व.मी.) या ड्रिप पर सब्जियॉ/फूल/फलोद्यान/कृषि फसल (न्यूनतम 0.5 है0) लिये जा रहे हो। मिनी स्प्रिकंलर/स्प्रिकंलर पर 0.5 है. क्षेत्र में उद्यानिकी/कृषि फसल लेने वाले कृषक भी पात्र होगे।
5. संरक्षित खेती अपनाने वाले कृषकों को प्राथमिकता से चयनित कर लाभान्वित किया जा सकेगा।

सौलर पम्प संयत्र 5 HP-

1. कृषक के पास न्यूनतम 1.0 हैक्टयर या इससे अधिक का भू–स्वामित्व हों।
2. कृषक द्वारा न्यूनतम 2000 वर्ग मीटर उच्च उद्यानिकी ग्रीन हाउस/शेडनेट हाउस/लो–टनल्स् या न्यूनतम 0.75 हैक्टयर में ड्रिप पर सब्जियॉ/फूल/फलोद्यान/कृषि फसल लिये जा रहे हों।
3. मिनी स्प्रिंकलर/स्प्रिकलर पर न्यूनतम 0.75 हैक्टेयर क्षेत्र में उद्यानिकी/कृषि फसल लेने वाले कृषक भी पात्र होगे।
4. कृषक के पास जल संग्रहण ढांचा, डिग्गी, फार्म पोण्ड, जल हौज या भूमिगत जल स्त्रोत (अधिकतम 75 मीटर गहराई) की व्यवस्था हों। उक्त् जल संग्रहण ढाचों की न्यूनतम संग्रहण क्षमता निम्नानुसार हो :–

क्र.स.	ढाचां	न्यूनतम क्षमता (घन मीटर में)
1.	जल संग्रहण ढांचा	1500
2.	डिग्गी	800
3.	फार्म पौण्ड	1500
4.	जल हौज (सब्जी/बगीचे हेतु)	75
5.	जल हौज (सरक्षिंत खेती हेतु)	40

5. संरक्षित खेती अपनाने वाले कृषकों को प्राथमिकता से चयनित कर लाभान्वित किया जा सकेगा।

3. सौर उर्जा पम्प सयंत्र हेतु प्राथमिकता, संचालन प्रकिया एवं अनुदान

1. सर्वप्रथम वर्ष 2014–15 में लॉटरी प्रकिया द्वारा चयनित किये गये कृषकों में से शेष रहे कृषकों को लाभान्वित किया जावें। वर्ष 2014–15 की लॉटरी प्रकिया में चयनित कृषकों की निम्नानुसार प्राथमिकता तय की जावें–

   (अ) प्रथम प्राथमिकता, विद्युत कनेक्शन प्राप्त करने हेतु सम्बन्धित डिस्काम की वरीयता सूची में नाम है तथा विद्युत कनेक्शन हेतु वरियता समर्पित करने को सहमत है। (संलग्न– 3 द I एवं 2ब)

   (ब) द्वितीय प्राथमिकता, जिन कृषकों के पास विद्युत कनेक्शन नही है, को दी जावें। (संलग्न– 3 द II, III, एव 2ब)

   (स) तृतीय प्राथमिकता, जिन कृषकों के पास विद्युत कनेक्शन है या जिन कृषकों का विद्युत कनेक्शन प्राप्त करने हेतु सम्बन्धित डिस्काम की वरीयता सूची में नाम है, लेकिन वह कृषि विद्युत कनेक्शन समर्पित नही करना चाहते, को दी जावें। (संलग्न– 3 द I एव 2ब)
2. वर्ष 2014–15 की लॉटरी द्वारा चयनित कृषकों की सूची पूर्ण होने पर सौर उर्जा पम्प संयंत्रो के लक्ष्य शेष होने पर जिला उद्यान कार्यालय द्वारा स्थानीय समाचार पत्रो में योजना का प्रचार–प्रसार उपरान्त निश्चित अवधि तक पत्रावलियॉ प्राप्त की जावें एवं 'पहले आओ, पहले पाओ' के आधार पर वरीयता दी जावेगी। जिला स्तर पर कृषक प्राथमिकता पंजिका का संधारण किया जावेगा। लेकिन विद्युत कनेक्शन समर्पित करने वाले कृषकों को इसमें भी प्राथमिकता रहेगी। नई पत्रावलियों की प्राथमिकता ''पहले आओ पहले पाओ'' के आधार को ध्यान में रखते हुये (अ, ब तथा स श्रेणी में अलग–अलग) निम्नानुसार की जावें:–

(अ) प्रथम प्राथमिकता, विद्युत कनेक्शन प्राप्त करने हेतु सम्बन्धित डिस्काम की वरीयता सूची में नाम है तथा विद्युत कनेक्शन हेतु वरियता समर्पित करने को सहमत है। (संलग्न– 3 द I एवं 2ब)

(ब) द्वितीय प्राथमिकता, जिन कृषकों के पास विद्युत कनेक्शन नही है, को दी जावें। (संलग्न– 3 द II, III, एवं 2ब)

(स) तृतीय प्राथमिकता, जिन कृषकों के पास विद्युत कनेक्शन है या जिन कृषकों का विद्युत कनेक्शन प्राप्त करने हेतु सम्बन्धित डिस्काम की वरीयता सूची में नाम है, लेकिन वह कृषि विद्युत कनेक्शन समर्पित नही करना चाहते, को दी जावें। (संलग्न– 3 द I एवं 2ब)

3. कृषक, जिनका नाम कृषि विद्युत कनेक्शन प्राप्त करने हेतु वर्ष 2015–16 की वरीयता सूची में है तथा विद्युत कनेक्शन समर्पित करने को सहमत है, ऐसे कृषकों को भारत सरकार (MNRE) द्वारा देय अनुदान (राशि 32,400 रू. प्रति एचपी एसी पम्प हेतु व राशि 40,500 रू प्रति एचपी डीसी पम्प हेतु) जो कि लगभग आधार दर का 30 प्रतिशत है, के अलावा राज्य योजना अन्तर्गत आधार लागत का 45 प्रतिशत अतिरिक्त अनुदान देय होगा। इस प्रकार कुल देय अनुदान आधार लागत का लगभग 75 प्रतिशत होगा।
4. कृषक, जिनके पास कृषि विद्युत कनेक्शन नही है या उनका नाम डिस्काम की वरीयता सूची में नही है, को भारत सरकार (MNRE) द्वारा देय अनुदान (राशि 32,400 रू. प्रति एचपी एसी पम्प हेतु व राशि 40,500 रू प्रति एचपी डीसी पम्प हेतु) जो कि लगभग आधार दर का 30 प्रतिशत है, के अलावा राज्य योजना अन्तर्गत आधार लागत का 30 प्रतिशत अतिरिक्त अनुदान देय होगा। इस प्रकार कुल देय अनुदान आधार लागत का लगभग 60 प्रतिशत होगा। इस श्रेणी अन्तर्गत लाभान्वित कृषकों की सूची जिला कार्यालय द्वारा सम्बन्धित विद्युत विभाग को भेजी जावेगी एवं भविष्य में उन्हे कृषि विद्युत कनेक्शन स्थापना पर अनुदान देय नही होगा।
5. कृषक, जिनके के पास कृषि विद्युत कनेक्शन है या जिनका नाम कृषि विद्युत कनेक्शन प्राप्त करने की वरीयता सूची में है एवं वह विद्युत कनेक्शन समर्पित नही करना चाहते, उन्हे भारत सरकार (MNRE) द्वारा देय अनुदान (राशि 32,400 रू. प्रति एचपी एसी पम्प हेतु व राशि 40,500 रू प्रति एचपी डीसी पम्प हेतु) जो कि लगभग आधार दर का 30 प्रतिशत ही देय होगा।

4. चयनित जिले एवं लक्ष्य

परियोजना के तहत् राज्य के समस्त जिलों हेतु 4702 सौर उर्जा आधारित पम्प के लक्ष्यों का निर्धारण किया गया है।

लक्ष्यों का जिलेवार आवंटन निम्न प्रकार हैः–

क.सं.	जिले का नाम	5 एचपी			कुल योग
		सामान्य	अ.जा	अ.ज.जा.	
1	अजमेर	80	45	5	130
2	अलवर	28	15	10	53
3	बांसवाडा	10	15	35	60
4	बारां	15	15	5	35
5	बाडमेर	70	15	3	88
6	भरतपुर	10	6	5	21
7	भीलवाडा	120	30	12	162

क.सं.	जिले का नाम	5 एचपी			कुल योग
		सामान्य	अ.जा	अ.ज.जा.	
8	बीकानेर	540	55	5	600
9	बूंदी	25	10	5	40
10	चित्तौडगढ़	130	40	15	185
11	चुरू	90	20	3	113
12	दौसा	20	13	35	68
13	धौलपुर	8	15	3	26
14	डूंगरपुर	8	23	40	71
15	हनुमानगढ़	150	23	0	173
16	जयपुर	550	45	120	715
17	जैसलमेर	140	45	20	205
18	जालौर	50	25	8	83
19	झालावाड़	10	13	3	26
20	झुझुनूं	140	30	8	178
21	जोधुपर	88	23	8	119
22	करौली	10	13	8	31
23	कोटा	18	15	8	41
24	नागौर	30	13	2	45
25	पाली	70	18	5	93
26	प्रतापगढ़	50	18	40	108
27	राजसमन्द	25	13	3	41
28	सवाईमाधोपुर	16	13	20	49
29	श्रीगंगानगर	500	38	0	538
30	सीकर	270	33	14	317
31	सिरोही	30	18	45	93
32	टोंक	45	21	16	82
33	उदयपुर	40	18	55	113
	योग	3386	752	564	4702

नोट : श्रीगंगानगर जिलें मे माननीया मुख्यमंत्री महोदया की "सरकार आपके द्वार" कार्यक्रम मे की गयी घोषणा अनुसार गन्ना उत्पादक कृषकों के यहॉ ड्रिप संयंत्र स्थापित करवाये जाने है। इन ड्रिप संयंत्रो के संचालन हेतु 100 सौर उर्जा पम्प संयंत्रो का विशेष आवंटन गन्ना उत्पादक कृषकों के लिये किया गया है।

आवंटित लक्ष्यों के अनुसार किसी जिलें विशेष में प्राप्ति/ मॉग न होने की स्थिति मे लक्ष्यों का हस्तातंरण मांग अनुसार अन्य जिलों को किया जा सकेगा। कृषकों से प्राप्त आवेदन अनुसार विभिन्न रेटिंग के लक्ष्य निर्धारित कर कृषकों को लाभान्वित किया जायेगा। लक्ष्यों की प्राप्ति में कृषक श्रेणी अनुसूचित जाति व अनुसूचित जनजाति को वांछित लाभ प्रदान किया जावें।

5. अनुदान पत्रावलियों के साथ लगाये जाने वाले दस्तावेज–

1. आवेदन–पत्र मय लाभार्थी की पासपोर्ट साईज फोटो (संलग्नक–1)
2. कृषक शपथ–पत्र (संलग्नक–2 एवं 2ब)

3. कृषक हिस्सा राशि संग्रहण (संलग्नक– 3 अ) कृषक द्वारा पंजीकरण हेतु राशि रू. 10,000 का डिमाण्ड ड्राफ्ट (सदस्य सचिव, एचडीएस के पक्ष में) आवेदन पत्र के साथ प्रस्तुत किया जावेगा, जिसका समायोजन पात्रता की स्थिति मे कृषक हिस्सा राशि हेतु किया जा सकेगा।
4. आवेदन पात्रता सत्यापन प्रमाण–पत्र (सलग्नक –3 ब)
5. सौर पम्प हेतु कार्यदार्यी फर्म द्वारा तकनिकी रिपोर्ट (सलग्नक –3 स)
6. सम्बन्धित डिस्काम मे कृषि कनेक्शन प्राप्त करने की वरियता सूची में अंकन होने या न होने का प्रमाण–पत्र (सलग्नक –3 द I, II, III)
7. भूमि की जमाबंदी या पासबुक की प्रतिलिपि (भू–स्वामित्व)
8. सिंचाई स्त्रोत
9. कृषि विद्युत कनेक्शन का बिल
10. त्रि–पार्टी अनुबन्ध (संलग्नक–4)
11. तकनीकी आर्थिक सर्वे एवं डिजाईन मेप
12. सूचीबद्ध निर्माता का बिल/ प्रफोर्मा इनवॉइस/ कॉटेशन

6. पम्प क्षमता निर्धारण व तकनीकी मापदण्ड

1. 0.5 हैक्टेयर व इससे अधिक का भू स्वामित्व – 3 HP
2. 1.00 हैक्टेयर व इससे अधिक का भू–स्वामित्व : 5 HP
3. अधिक भू–स्वामित्व के कृषकों द्वारा कम क्षमता पम्प की मांग होने पर तदानुसार क्षमता का संयंत्र दिया जा सकता है।
4. संयंत्रो के तकनीकी मापदण्ड एवं विभिन्न पम्पस् वांछित जल डिस्चार्ज मापदण्ड की प्रति संलग्नक–10 पर स्थित है।
5. राज्य के डार्क जोनस् में सर्वे के अनुसार पूर्व में स्थापित नलकूप/ कुओं पर ही सौर उर्जा पम्प संयंत्र देय होगें। नए नलकूप /कुओं हेतु सक्षम स्तर पर अनुमति लिये जाने के उपरान्त ही सौर उर्जा पम्प संयंत्र की पत्रावली ली जावेगी।

7. सूचीबद्व आपूर्तिकर्त्ता / निर्माता

सौर पम्प संयंत्र स्थापना हेतु सूचीबद्व आपूर्तिकर्ता/निर्माता के बारे में EOI प्रक्रिया पूर्ण होने पर सूचित कर दिया जायेगा।

8. अनुदान

1. सोलर पम्प परियोजना हेतु आधार दर पर लगभग 30/60/75 प्रतिशत अनुदान देय होगा।
2. परियोजना के तहत जवाहर लाल नेहरू राष्ट्रीय सौर मिशन (JLNNSM)/ राष्ट्रीय क्लीन एनर्जी फण्ड (NCEF) से देय अनुदान (राशि 32,400 रू. प्रति एचपी एसी पम्प हेतु व राशि 40,500 रू प्रति एचपी डीसी पम्प हेतु) जो कि लगभग आधार दर का 30 प्रतिशत है एवं 0/30/45 प्रतिशत राज्य योजना मद से अनुदान देय होगा।
3. अनुदान का कृषक श्रेणीवार विस्तृत विवरण दिशा–निर्देशो के बिन्दु संख्या 3 पर दिया गया है।

9. आधार दर

सौर पम्प संयंत्र की आधार दर के बारे में EOI प्रक्रिया पूर्ण होने पर सूचित कर दिया जायेगा।

10. अनुदान प्रकिया

1. सोलर पम्प सेट हेतु उद्यान विभाग या RHDS से सूचीबद्व/ अनुमोदित फर्म द्वारा स्थापना पर ही अनुदान देय होगा।
2. कृषक द्वारा निर्धारित आवेदन पत्र मय वांछित दस्तावेज सम्बन्धित क्षेत्र के कृषि/ उद्यान विभाग कार्यालय में स्वयं/ कृषि पर्यवेक्षक/ सहायक कृषि अधिकारी/ बैंक/ आपूर्तिकर्ता डीलर/ निर्माता के माध्यम से प्रेषित किया जावें। निर्माता चयन सम्बन्धित कृषक स्तर से किया जावेगा।
3. आवेदन के समय कृषक द्वारा पम्प क्षमता/ माउन्टिग ढांचे का प्रकार (मेन्यूअल ट्रेकर /ऑटो ट्रेकर) तथा फेन्सिग अनिवार्य एवं डोमेस्टिक लाईटिंग सिस्टम का विकल्प आवश्यक रूप से प्रदान किया जायेगा।
4. राज्य के डार्क जोनस् में पूर्व में स्थापित नलकूप/ कुओं पर ही सौर उर्जा पम्प संयंत्र स्थापना पर अनुदान देय होगा।
5. कृषक द्वारा आवेदन पत्र के साथ राशि रू. 10,000 का डी.डी. एवं आवश्यक दस्तावेजों के अलावा पात्रता सत्यापन प्रमाण पत्र एवं विद्युत विभाग द्वारा जारी प्रमाण–पत्र निर्धारित प्रपत्र में सलग्न करना होगा, ताकि संयत्र स्थापना प्रकिया में विलम्ब ना हो।
6. पात्र आवेदन सम्बन्धित जिला उद्यान कार्यालय द्वारा निर्धारित समयावधि तक प्राप्त किये जायेगें।
7. सम्बन्धित जिला इकाई द्वारा पत्रावलियों की पात्रता एवं दस्तावेज जांच कर पात्र पत्रावलियों की सूची अध्यक्ष, जिला HDS एवं कलेक्टर के समक्ष प्रस्तुत की जावेगी। अपात्र कृषकों की पंजीकरण राशि यथाशीघ्र (अधिकतम एक माह की अवधि में) वापस लौटा दी जावेगी।
8. जिला उद्यान अधिकारी द्वारा सौर उर्जा आधारित पम्प परियोजना के अन्तर्गत चयनित कृषको को पत्र द्वारा सूचित किया जायेगा एवं कृषको की सूची कार्यालय नोटिस बोर्ड पर चस्पा की जावेगी।
9. अनुमोदित सूची के अनुसार जिला HDS द्वारा चयनित कृषक से आपूर्तिकर्ता कार्यदायी फर्म का कोटेशन प्रस्तुत करने के उपरान्त, प्रशासनिक स्वीकृति निर्धारित प्रपत्र (संलग्न 5) मे निकाली जावेगी। प्रशासनिक स्वीकृति की प्रति तत् दिवस को उद्यान आयुक्तालय, खण्डीय उप निदेशक उद्यान व सम्बन्धित आपूर्तिकर्ता फर्म को फैक्स / ई–मेल द्वारा प्रेषित की जावेगी।
10. प्रशासनिक स्वीकृति की 15 दिवस की अवधि में चयनित कृषक द्वारा प्रस्तुत राशि रू. 10,000 के अलावा शेष कृषक हिस्सा राशि केवल जिला HDS को जमा कराई जायेगी। इस दौरान संयंत्र प्रदाता द्वारा साईट का विस्तृत सर्वेक्षण कार्य सम्पन्न किया जावेगा।
11. चयनित कृषक द्वारा कृषक हिस्सा राशि, केवल जिला HDS को जमा कराने के उपरांत DHDS स्तर से कार्यादेश जारी किया जायेगा (संलग्नक –6)।
12. कृषक अंश राशि 10,000 एवं शेष कृषक हिस्सा राशि का भुगतान DD/ RTGS के माध्यम से HDS द्वारा सम्बन्धित आपूर्तिकर्ता फर्म को परिशिष्ठ–7-I & II जारी होने के उपरान्त किया जावेगा।
13. सम्बन्धित् जिला इकाई द्वारा कार्यदायी फर्म के पक्ष में कार्यादेश जारी करने उपरांत कार्यदायी फर्म द्वारा (अधिकतम 45 दिवस) माल–आपूर्ति की जावेगी।
14. सम्बन्धित जिलाधिकारी द्वारा आयुक्तालय को माल–आपूर्ति का सत्यापन कर सूचना निर्धारित प्रपत्र (परिशिष्ठ 7-I & II) मे भिजवाना होगा ताकि प्रथम चरण का अनुदान भुगतान किया जा सकें।

15. सम्बन्धित सूचीबद्ध आपूर्तिकर्ता फर्म द्वारा स्थापन कार्य (कार्यादेश जारी होने के 45 दिवस में आपूर्ति व 20 दिन में स्थापन्न कार्य) सम्पन्न करना होगा।
16. DHDS स्तर से संयंत्र स्थापना के 7 दिवस में संयंत्र का निर्धारित प्रपत्र अनुसार भौतिक सत्यापन किया जावें (संलग्न 8 I & II)। भौतिक सत्यापन की आवश्यकता के अनुसार आयुक्तालय स्तर से अतिरिक्त दलों का गठन किया जा सकेगा।
17. भौतिक सत्यापन की रिपोर्ट संबंधित जिला इकाईयों द्वारा निर्धारित प्रपत्र (परिशिष्ठ– 9, 8 I & II) मे आयुक्तालय को प्रस्तुत की जावेगी। जिससे अंतिम चरण का अनुदान भुगतान सम्पन्न किया जा सकें।
18. सौर उर्जा पम्प परियोजना के प्रचार– प्रसार को बढावा देने व तकनीकी पहलुओं की जानकारी देने हेतु कृषि अनुसंधान केन्द्र/ कृषि विज्ञान केन्द्र/ राजहंस नर्सरी/ सरकारी कृषि फार्म पर भी सौलर पम्प स्थापित करने पर नियमानुसार अनुदान देय होगा।

11. कृषक हिस्सा एवं अनुदान राशि का भुगतान

1. भुगतान – DHDS/उद्यान आयुक्तालय द्वारा सम्बन्धित आपूर्तिकर्ता फर्म को 2 चरणों में किया जावेगा –

(अ) कृषक के खेत पर माल–आपूर्ति उपरांत कृषक हिस्सा राशि का भुगतान DHDS स्तर पर एवं उद्यान आयुक्तालय स्तर पर संयंत्र के पांच वर्ष सही संचालन की गारण्टी के पेटे संयंत्र लागत की 10 प्रतिशत बैंक गारण्टी के रूप मे उद्यान आयुक्तालय को प्रस्तुत करने पर (अधिकतम आधार लागत का 70 प्रतिशत)

1. कृषक हिस्सा राशि का भुगतान DHDS स्तर पर कृषक श्रेणीवार –
   I. 75 प्रतिशत कृषक श्रेणी देय अनुदान – सम्पूर्ण 25 प्रतिशत कृषक हिस्सा राशि का भुगतान
   II. 60 प्रतिशत कृषक श्रेणी देय अनुदान – सम्पूर्ण 40 प्रतिशत कृषक हिस्सा राशि का भुगतान
   III. 30 प्रतिशत कृषक श्रेणी देय अनुदान – सम्पूर्ण 70 प्रतिशत कृषक हिस्सा राशि का भुगतान (आयुक्तालय को माल–आपूर्ति की रिपोर्ट प्रस्तुत करने (परिशिष्ठ–7, 7-I) एवं आयुक्तालय की अनुमति उपरांत)
2. राज्य योजना से अनुदान राशि (45/30 प्रतिशत) का भुगतान आयुक्तालय द्वारा

माल–आपूर्ति पर अधिकतम भुगतान, आधार लागत का 70 प्रतिशत तक देय होगा। जो कि कृषक हिस्सा राशि एवं अनुदान राशि को मिलाकर हो सकता है।

(ब) शेष/अंतिम अनुदान लगभग 30 प्रतिशत (जेएनएनएसएम मद) उद्यान आयुक्तालय द्वारा –

1. कृषक खेत पर सफलता पूर्वक सयंत्र स्थापन कार्य पूर्ण करने पर।
2. निर्धारित दल द्वारा सौर उर्जा पम्प संयंत्र का भौतिक सत्यापन करने पर।

12. भौतिक सत्यापन

1. माल–आपूर्ति व सफलतापूर्वक स्थापन कार्य का भौतिक सत्यापन 7 दिवस में किया जावे।
2. माल–आपूर्ति का भौतिक सत्यापन सहायक कृषि अधिकारी/ कृषि अधिकारी/ सहायक निदेशक/ उपनिदेशक स्तर के कम से कम एक अधिकारी द्वारा किया जावें।

3. कृषि पर्यवेक्षक द्वारा माल–आपूर्ति का भौतिक सत्यापन करने पर सहायक निदेशक/ उपनिदेशक स्तर के कम से कम एक अधिकारी द्वारा प्रति हस्ताक्षरित की जावें।
4. स्थापित संयंत्र के भौतिक सत्यापन 3 सदस्यीय दल द्वारा किया जावेगा। इसमें कृषि/ उद्यान विभाग के सहायक कृषि अधिकारी स्तर या इससे उपर के दो अधिकारी तथा एक सदस्य अभियन्ता RRECL /उर्जा विभाग/ ग्रामीण विकास विभाग/ जिला कलेक्टर द्वारा नामित सहायक अभियंता /RHDS द्वारा नामित होगा।
5. भौतिक सत्यापन यथासम्भव उपनिदेशक कृषि/ उद्यान या सहायक निदेशक कृषि/ उद्यान की उपस्थिति में हो।
6. भौतिक सत्यापन के दौरान स्थापित संयंत्र का फोटो भी लिया जावे।
7. भौतिक सत्यापन हेतु सहायक कृषि अधिकारी स्तर के साथ इससे उपर के कृषि विभाग/ जिला परिषद् के अधिकारी भी अधिकृत होंगे।
8. कार्य अधिकता एवं कार्य को गति प्रदान करने के प्रयोजनार्थ इस हेतु RHDS स्तर से विशेषज्ञ सेवायें हायर की जा सकती है।

13. सूचीबद्ध निर्माताओं के दायित्व

1. सूचीबद्ध निर्माता के अधिकृत इंजिनियर द्वारा कृषक का विस्तृत सर्वे किया जाकर संयंत्र स्थापन का तकनीकी ड्राइंग/डिजाईन तैयार किया जावेगा।
2. आपूर्तिकर्ता द्वारा कृषक को संयंत्र संचालन एवं रखरखाव का मैन्यूअल प्रदान किया जावेगा एवं संयंत्र के समग्र बिन्दुओ पर कृषक प्रशिक्षण आयोजित किया जावेगा।
3. डिजाईन के अनुसार सिविल कार्य सम्पन्न कराया जावेगा।
4. आपूर्तिकर्ताओं द्वारा प्रस्तुत सौर ऊर्जा आधारित पम्प परियोजना के मॉडयूल माउंटिग ढांचे की डिजाईन प्रचलित वायु, वेग, लोड को तकनिकी रूप से सहन करने योग्य हो।
5. सौर उर्जा पम्प सयंत्र स्थापना से पूर्व सम्बन्धित कम्पनी द्वारा कृषक के पानी के जल स्तर / उपलब्धता का निर्धारण अपने विशेषज्ञ से करवाकर यह सुनिश्चित करेगी की किस क्षमता का पम्प सैट लगाया जावें, पम्प का चुनाव /स्थापन उपरान्त निर्धारित मात्रा में पानी का डिस्चार्ज नही होने पर कम्पनी की जिम्मेदारी होगी। (संलग्न– 3स)
6. संयंत्र के पार्टस जवाहर लाल नेहरू राष्ट्रीय सौर उर्जा मिशन के मापदण्डों के अनुसार होगें।
7. सौर पेनल/ मॉड्यूल 125 WP या इससे अधिक क्षमता के होंगे।
8. आपूर्तिकर्ता प्रत्येक आपूर्ति किये जाने वाले मॉड्यूल/ पेनल का IV-Curve DHDS को प्रस्तुत करेगा।
9. सूचीबद्व आपूर्तिकर्ता द्वारा आपूर्ति किये जाने वाले संयंत्र में या साथ रिमोट मोनिटरिंग सिस्टम अनिवार्य रूप से दिया जायेगा।
10. आपूर्तित माल का पूर्ण विवरण व मापदण्ड, डिजाईन व तकमिना सम्बन्धित जिला इकाई को उपलब्ध कराना होगा।
11. सूचीबद्व आपूर्तिकर्ता द्वारा आयुक्तालय स्तर के दल से प्री–डिस्पेंच निरीक्षण करवाया जाना अनिवार्य होगा।
12. सूचीबद्व आपूर्तिकर्ता द्वारा प्री–डिस्पेंच निरीक्षण के लिये 15 दिवस पूर्व आयुक्तालय को सूचित करना होगा।
13. Outsourcing किए गये सामान के स्त्रोत की स्पष्ट जानकारी सूचीबद्व निर्माता द्वारा दी जायेगी।
14. कार्यादेश /प्रशासनिक स्वीकृति के 45 दिवस मे संयंत्र माल आपूर्ति एवं 20 दिवस मे स्थापन कार्य सम्पन्न करना होगा। निर्धारित अवधि मे बिना किसी युक्ति संगत कारण

के विलम्ब की स्थिति मे. नियमानुसार पैनल्टी अंतिम भुगतान में (45+20=65) लागू होगी।

15. संयंत्र की पांच वर्ष की गारण्टी तथा इसके पश्चात् आगामी पांच वर्ष हेतु विक्रय पश्चात् सेवा (After sales service) प्रदान की जावेगी।
16. सूचीबद्व निर्माता द्वारा कृषक के खेत पर स्थापित सोलर पम्प संयंत्र की फेन्सिंग (निर्धारित मापदण्ड अनुसार) का कार्य एवं बीमा (एक मुश्त मे, पॉच वर्ष के लिए) करवाया जायेगा।
17. निर्माता द्वारा सभी स्टेक होल्डर्स (RHDS/DHDS/कृषक) को सर्विस सेंटर की जानकारी उपलब्ध करवानी होगी।
18. संयंत्र संचालन व रखरखाव सम्बन्धी साहित्य पुस्तिका (मैन्युअल) जो कि कृषक सुलभ हिन्दी भाषा मे हो, लाभार्थियों को प्रदान की जावेगी।
19. निर्माता द्वारा कस्टमर केयर सेन्टर स्थापित किया जावेगा तथा टोल फ्री नबंर की जानकारी प्रत्येक स्टेक होल्डर को उपलब्ध करानी होगी।
20. विगत् वर्षो के साथ–साथ चालू वित्तीय वर्ष के दौरान स्थापित कुल संयंत्रो की संख्या जिला विशेष मे 100 या इससे अधिक होने की स्थिति मे सम्बन्धित जिला मुख्यालय पर कस्टमर केयर सेन्टर स्थापित किया जाना आवश्यक होगा। इस केन्द्र पर कम से कम एक तकनिकी व्यक्ति रखा जायेगा जिसके नाम, मोबाईल नम्बर व पता सम्बन्धित जिला इकाई, लाभार्थी व वेबसाईट पर उपलब्ध कराना होगा।
21. अगर कार्यदायी फर्म द्वारा राजस्थान मे विगत् वर्षो सहित चालु वित्तीय वर्ष तक 500 या इससे अधिक संयंत्र कर लिये है तो जयपुर मुख्यालय पर कस्टमर केयर सेन्टर स्थापित करना होगा जिसमे कम से कम 5 तकनिकीकर्मी होगे। इनके नाम, मोबाईल नम्बर व पते सम्बन्धित कृषक, जिला इकाई, मुख्यालय तथा वेबसाईट पर उपलब्ध कराना होगा।
22. स्थापित किये जाने वाले संयंत्रो के डाटा आवश्यकतानुसार विभागीय वेबसाईट पर अपलोड करने होगे। ये डाटा प्रत्येक महीने के प्रथम दिवस तथा नये संयंत्र स्थापन के दस दिवस मे आवश्यक रूप से अद्यतन (अपडेट) किया जावेगा।
23. कार्यदायी फर्म द्वारा स्थापित संयंत्रो का प्रत्येक तिमाही (अप्रैल–जुन, जुलाई–सितम्बर, अक्टूबर–दिसम्बर व जनवरी–मार्च) के दौरान निरीक्षण करना होगा तथा इसकी सूचना जिला इकाई को प्रस्तुत करनी होगी।
24. कार्यदायी फर्म द्वारा कृषकों को रखरखाव (मेन्टीनेंस) व योजना सम्बन्धी जानकारी प्रदान की जावेगी।
25. कार्यदायी फर्मस के स्तर से रखरखाव सम्बन्धी Clauses की गम्भीरता से पालना सुनिश्चित की जावेगी। जिससे लाभार्थीयों को संयंत्र मे किसी प्रकार के फाल्ट की स्थिति मे इधर–उधर चक्कर न काटना पडें।
26. किसी प्रकार के फाल्ट की सूचना डाक, टेलीफोन, फैक्स, ई–मेल या अन्य तरीके से प्राप्त होने की स्थिति में तीन कार्य दिवसों मे आवश्यक रूप से साईट भ्रमण आदि जरिये से इस पर कार्यवाही की जावेगी।
27. कार्यदायी फर्म से अपेक्षा की जाती है कि वह समुचित मात्रा मे स्पेयर पार्ट का स्टॉक रखे जिससे की संयंत्र शिकायत के 5 दिवस मे आवश्यक रूप से पुनः चालु किया जा सकें।
28. संयंत्रो के रखरखाव कार्य के विफलता की स्थिति में फर्म की बैंक गारण्टी रिवोक की जा सकेगी तथा पॉच या इससे अधिक संयंत्रो के रखरखाव की विफलता पर फर्म को

काली सूची मे डाले जाने की कार्यवाही की जा सकेगी, जिसके निर्णय का अंतिम अधिकारी मिशन निदेशक, या सदस्य सचिव, RHDS को होगा।

14. कृषक के दायित्व

1. आवेदन–पत्र के साथ आवश्यक दस्तावेज प्रस्तुत करना तथा HDS कार्यालय में कृषक हिस्सा राशि जमा करवाना।
2. संयंत्र की माल आपूर्ति एवं स्थापन हेतु स्थल (छाया रहित कम से कम 60 वर्ग.मी.) एवं जल स्त्रोत उपलब्ध करवाना।
3. भौतिक सत्यापन व अन्य निरीक्षण के समय लाभार्थी यथासम्भव स्वंय या अन्य परिवार के जिम्मेदार सदस्य की उपस्थिति सुनिश्चित करेगा।
4. संयंत्र का बीमा कार्यदायी फर्म द्वारा करवाया जायेगा। सौलर पम्प सयंत्र के उचित रख– रखाव एवं सुरक्षा की समस्त जिम्मेदारी कृषक की होगी।
5. स्थापित सौर पम्प संयंत्र का संचालन कृषक द्वारा विद्युत/बिजली कनेक्शन से नही किया जावेगा, पाये जाने की स्थिति में कार्यवाही अमल में लायी जावेगी।
6. संयंत्र के खुर्द–बुर्द करने की स्थिति में सम्बन्धित कृषक के विरूद नियमानुसार विधिक कार्यवाही अमल मे लायी जावेगी तथा संयंत्र हेतु जारी की गई राशि वसूली योग्य होगी।
7. त्रि–पार्टी अनुबन्ध।

15. योजना की रिमोट मॉनिटरिंग –

योजना की मॉनिटरिंग हेतु एमएनआरई द्वारा जारी वर्ष 2015–16 दिशा–निर्देशानुसार सूचीबद्व आपूर्तिकर्ता द्वारा संयंत्र स्थापना के साथ रिमोट मोनेटरिंग सिस्टम आवश्यक रूप से स्थापित करना होगा। रिमोट मॉनिटरिंग सिस्टम सौर उर्जा पम्प स्थापना का आवश्यक अंग होगा व इसके बिना सूचीबद्व आपूर्तिकर्ता फर्म को अनुदान देय नही होगा। राज्य एवं जिला स्तर पर रिमोट मॉनिटरिंग सिस्टम से पम्प संचालन सम्बन्धी आवश्यक सूचनाओं की मॉनिटरिंग हेतु पासवर्ड सूचीबद्व निर्माता फर्म द्वारा विभाग को उपलब्ध कराने होगें।

(Provision for remote monitoring of the installed pumps must be made in the controllers or the inverters either through an integral arrangement or through an externally fitted arrangement. It should be possible to ascertain the daily water output, the power generated by the PV array, the UP TIME of the pump during the year, Number of days the pump was unused or under breakdown/repairs.)

राजस्थान सरकार
उद्यान निदेशालय, पंत कृषि भवन, जयपुर

क्रमांक प.1 ( ) नि.उ./Solar/GL/2016-17/ 1436-1611 दिनांक 20.07.16

उप निदेशक उद्यान – जयपुर/कोटा/जोधपुर/उदयपुर

सहायक निदेशक उद्यान – अलवर/अजमेर/बीकानेर/बासंवाडा/बाडमेर/भीलवाडा/भरतपुर/बारां/बून्दी/चित्तौडगढ/चूरू/दौसा/धौलपुर/डूंगरपुर/श्रीगंगानगर/हनुमानगढ/जैसलमेर/जालौर/झुन्झुनू/झालावाड/करौली/नागौर/पाली/प्रतापगढ/सीकर/राजसमंद/टोंक/सवाईमाधोपुर/ सिरोही

विषयः सौर उर्जा आधारित पम्प परियोजना 2016–17 हेतु दिशा निर्देश।

उपरोक्त विषयान्तर्गत लेख है कि 3HP व 5HP के सौर उर्जा पम्प संयंत्र कृषकों को वर्ष 2016–17 में अनुदान पर स्थापित करने हेतु जवाहर लाल नेहरू राष्ट्रीय सौर मिशन (JLNNSM)/राष्ट्रीय क्लीन एनर्जी फण्ड (NCEF) तथा राज्य योजना अन्तर्गत सौर उर्जा आधारित पम्प परियोजना हेतु कियान्वयन दिशा–निर्देश संलग्न कर भिजवाये जा रहे है। योजनान्तर्गत जारी दिशा–निर्देशों के साथ निम्न बिन्दुओं की पालना आवश्यक रूप से सुनिश्चित की जावें।

1. सर्वप्रथम जिला उद्यान कार्यालयों में पूर्व में प्राप्त पत्रावलियों (लम्बित पत्रावलियॉं) का निस्तारण किया जावें।
2. वर्ष 2016–17 के दिशा–निर्देशानुसार लम्बित पत्रावलियों के निस्तारण उपरान्त नई पत्रावलियॉं ऑन–लाईन प्राप्त की जावें।
3. सौर उर्जा पम्प परियोजना वर्ष 2016–17 अन्तर्गत कार्यादेश जारी करने की अंतिम तिथि 25 जनवरी, 2017 रखी गयी है। अतः वित्तीय वर्ष 2016–17 में ही संयंत्रो की स्थापना का कार्य सुनिश्चित करावें।

अतः दिशा–निर्देशानुसार निर्धारित समय मे लक्ष्यों की प्राप्ति सुनिश्चित करें। यहॉं उल्लेखनीय है कि परियोजना के अध्यधीन किसी भी प्रकार के कार्बन क्रेडिट सम्बन्धी प्राधिकार RHDS/उद्यान विभाग राजस्थान के पास होगा।

संलग्नः– उपरोक्तानुसार।

निदेशक उद्यान एवं
सदस्य सचिव, RHDS

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प्रतिलिपि निम्न को सूचनार्थ एवं अग्रिम आवश्यक कार्यवाही हेतु प्रेषित है :–

1. निजी सचिव, प्रमुख शासन सचिव, कृषि एवं उद्यानिकी, राजस्थान, जयपुर।
2. निजी सचिव, प्रमुख शासन सचिव (ऊर्जा), राजस्थान जयपुर।
3. निजी सहायक, निदेशक कृषि, कृषि निदेशालय, पंत कृषि भवन, जयपुर।
4. निजी सहायक, प्रबन्ध निदेशक, (RE&O) राजस्थान राज्य अक्षय ऊर्जा निगम लि0, (RRECL), E-166 ए यूधिष्ठिर मार्ग, सी–स्कीम, जयपुर।
5. निजी सहायक, निदेशक उद्यान, उद्यान निदेशालय, पंत कृषि भवन, जयपुर।
6. अध्यक्ष, जिला होर्टीकल्चर सोसायटी एवं जिला कलेक्टर .....
7. अध्यक्ष एवं प्रबन्ध निदेशक, विद्युत वितरण निगम लि0, जयपुर/अजमेर/जोधपुर।
8. प्रबन्ध निदेशक, राजस्थान राज्य भूमि विकास बैंक, सहकार भवन जयपुर।

पंत कृषि भवन, भगवान दास रोड, जयपुर– 302005
website: horticulture.rajasthan.gov.in, Email: rajasthan_solar@rediffmail.com
Ph. 0141-2227606,2227706 Telefax 0141- 2227840

9. प्रबन्ध निदेशक, अपैक्स बैंक (दी राजस्थान स्टेट सैन्ट्रल को0 बैंक लि0), लाल कोठी, जयपुर।
10. समस्त जिला अधीक्षण अभियंता, विद्युत वितरण निगम लि0।
11. संयुक्त निदेशक/उप निदेशक उद्यान (योजना), मु. पंत कृषि भवन, जयपुर।
12. समस्त खण्डीय संयुक्त निदेशक उद्यान/कृषि विस्तार .....
13. समस्त संभागीय उप निदेशक उद्यान .....
14. उप निदेशक, कृषि विस्तार (जिला परिषद) .....
15. समस्त सहायक निदेशक कृषि (वि.)
16. आरक्षी पत्रावली

निदेशक उद्यान एवं
सदस्य सचिव, RHDS

पंत कृषि भवन, भगवान दास रोड, जयपुर– 302005
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"हाईटेक उद्यानिकी/कृषि हेतु सौर ऊर्जा आधारित पम्प परियोजना 2016–17"

1. भूमिका

राज्य मे सौर उर्जा की अपार सम्भावना को ध्यान में रखते हुये कृषि क्षेत्र मे गैर–पारम्परिक एवं पर्यावरण मित्र उर्जा के उपयोग हेतु उद्यान विभाग द्वारा राज्य के कृषकों हेतु सौर उर्जा आधारित पम्प परियोजना का क्रियान्वयन वित्तीय वर्ष 2016–17 में किया जा रहा है। यह परियोजना जवाहर लाल नेहरू राष्ट्रीय सौर मिशन (JLNNSM)/ राष्ट्रीय क्लीन एनर्जी फण्ड (NCEF) तथा राज्य योजना के तहत् क्रियान्वित की जावेगी। परियोजना का क्रियान्वयन स्वरूप इस प्रकार है –

2. कृषक चयन पात्रता

कृषक चयन निम्न पात्रता के आधार पर किया जाना हैः–

सौलर पम्प संयंत्र 3 HP

1. कृषक के पास न्यूनतम 0.5 हैक्टेयर का भू–स्वामित्व हो।
2. कृषक द्वारा सिचांई हेतु ड्रिप/मिनि स्प्रिकंलर /स्प्रिकंलर संयंत्र आवश्यक रूप से काम मे लिया जावें।
3. कृषक के पास जल संग्रहण ढांचा, डिग्गी, फार्म पोण्ड, जल हौज या भूमिगत जल स्त्रोत (अधिकतम 75 मीटर गहराई) की व्यवस्था हो । उक्त जल संग्रहण ढ़ाचों की न्यूनतम संग्रहण क्षमता निम्नानुसार हो –

क्र.सं.	ढ़ाचा	न्यूनतम क्षमता (घन मीटर मे)
1.	जल संग्रहण ढांचा	1000
2.	डिग्गी	400
3.	फार्म पोण्ड	1000
4.	जल हौज (सब्जी/बगीचे हेतु)	50
5.	जल हौज (संरक्षित खेती हेतु)	20

4. कृषक द्वारा उच्च उद्यानिकी यथा ग्रीन हाउस/शेडनेट हाउस्/लो–टनल्स् (न्यूनतम 1000 व.मी.) या ड्रिप पर सब्जियॉ/फूल/फलोद्यान/कृषि फसल (न्यूनतम 0.5 है0) लिये जा रहे हो। मिनी स्प्रिकंलर/स्प्रिकंलर पर 0.5 है. क्षेत्र में उद्यानिकी/कृषि फसल लेने वाले कृषक भी पात्र होगे।
5. संरक्षित खेती अपनाने वाले कृषकों को प्राथमिकता से चयनित कर लाभान्वित किया जा सकेगा।

सौलर पम्प संयत्र 5 HP-

1. कृषक के पास न्यूनतम 1.0 हैक्टयर या इससे अधिक का भू–स्वामित्व हों।
2. कृषक द्वारा न्यूनतम 2000 वर्ग मीटर उच्च उद्यानिकी ग्रीन हाउस/शेडनेट हाउस/लो–टनल्स् या न्यूनतम 0.75 हैक्टयर में ड्रिप पर सब्जियॉ/फूल/फलोद्यान/कृषि फसल लिये जा रहे हों।
3. मिनी स्प्रिंकलर/स्प्रिकंलर पर न्यूनतम 0.75 हैक्टेयर क्षेत्र में उद्यानिकी/कृषि फसल लेने वाले कृषक भी पात्र होगे।
4. कृषक के पास जल संग्रहण ढांचा, डिग्गी, फार्म पोण्ड, जल हौज या भूमिगत जल स्त्रोत (अधिकतम 75 मीटर गहराई) की व्यवस्था हों। उक्त् जल संग्रहण ढाचों की न्यूनतम संग्रहण क्षमता निम्नानुसार हो :–

क्र.स.	ढाचां	न्यूनतम क्षमता (घन मीटर में)
1.	जल संग्रहण ढांचा	1500
2.	डिग्गी	800
3.	फार्म पौण्ड	1500
4.	जल हौज (सब्जी/बगीचे हेतु)	75
5.	जल हौज (सरक्षिंत खेती हेतु)	40

5. संरक्षित खेती अपनाने वाले कृषकों को प्राथमिकता से चयनित कर लाभान्वित किया जा सकेगा।

3. सौर उर्जा पम्प सयंत्र हेतु प्राथमिकता, संचालन प्रकिया एवं अनुदान

1. वर्ष 2016–17 के दिशा–निर्देशानुसार सर्वप्रथम जिला उद्यान कार्यालय में पूर्व में लम्बित पत्रावलियो का निस्तारण किया जावें एवं लम्बित पत्रावलियों के निस्तारण उपरान्त जिला उद्यान कार्यालय द्वारा स्थानीय समाचार पत्रो में योजना का प्रचार–प्रसार कर पत्रावलियॉ ऑनलाईन ही प्राप्त की जावें एवं 'पहले आओ, पहले पाओ' के आधार पर वरीयता दी जावें। जिला स्तर पर कृषक प्राथमिकता पंजिका का संधारण किया जावें। नई पत्रावलियों की प्राथमिकता ''पहले आओ पहले पाओ'' के आधार को ध्यान में रखते हुये (**अ, ब तथा स श्रेणी** में अलग–अलग) निम्नानुसार की जावें:–

   (अ) प्रथम प्राथमिकता, जिनका नाम कृषि विद्युत कनेक्शन प्राप्त करने हेतु वर्ष 2016–17 की वरीयता सूची में है तथा सौर उर्जा पम्प संयंत्र पर अनुदान हेतु वरियता समर्पित करने को सहमत है। (संलग्न– 3 द I एवं 2 ब)

   (ब) द्वितीय प्राथमिकता, जिन कृषकों के पास कृषि विद्युत कनेक्शन नही है, को दी जावें। (संलग्न– 3 द II, III, एवं 2 ब)

   (स) तृतीय प्राथमिकता, जिन कृषकों के पास कृषि विद्युत कनेक्शन है या जिन कृषकों का कृषि विद्युत कनेक्शन प्राप्त करने हेतु सम्बन्धित डिस्काम की वर्ष 2016–17 की वरीयता सूची में नाम है, लेकिन वह कृषि विद्युत कनेक्शन समर्पित नही करना चाहते, को दी जावें। (संलग्न– 3 द I एवं 2 ब)
2. कृषक, जिनका नाम कृषि विद्युत कनेक्शन प्राप्त करने हेतु वर्ष 2016–17 की वरीयता सूची में है तथा कृषि विद्युत कनेक्शन समर्पित करने को सहमत है, ऐसे कृषकों को भारत सरकार (MNRE) द्वारा देय अनुदान (राशि 32,400 रू. प्रति एचपी एसी पम्प हेतु व राशि 40,500 रू प्रति एचपी डीसी पम्प हेतु) जो कि लगभग आधार दर का 30

प्रतिशत है, के अलावा राज्य योजना अन्तर्गत आधार लागत का 45 प्रतिशत अतिरिक्त अनुदान देय होगा। इस प्रकार कुल देय अनुदान आधार लागत का लगभग 75 प्रतिशत होगा। इस हेतु कृषकों को दिशा–निर्देशों के बिन्दु संख्या 3.1.अ के अनुसार डिस्कॉम से प्रमाण–पत्र प्राप्त करना होगा।

3. कृषक, जिनके पास कृषि विद्युत कनेक्शन नही है या उनका नाम डिस्काम की वर्ष 2016–17 की वरीयता सूची में नही है, को भारत सरकार (MNRE) द्वारा देय अनुदान (राशि 32,400 रू. प्रति एचपी एसी पम्प हेतु व राशि 40,500 रू प्रति एचपी डीसी पम्प हेतु) जो कि लगभग आधार दर का 30 प्रतिशत है, के अलावा राज्य योजना अन्तर्गत आधार लागत का 30 प्रतिशत अतिरिक्त अनुदान देय होगा। इस प्रकार कुल देय अनुदान आधार लागत का लगभग 60 प्रतिशत होगा। इस हेतु कृषकों को दिशा–निर्देशों के बिन्दु संख्या 3.1.ब के अनुसार डिस्कॉम से प्रमाण–पत्र प्राप्त करना होगा या कृषि विद्युत कनेक्शन नही होने का शपथ–पत्र (10 रू. नॉन–ज्यूडिशियल स्टाम्प) देना होगा एवं शपथ–पत्र के आधार पर सम्बन्धित जिलाधिकारी द्वारा कृषकों की सूची सत्यापन हेतु जिले के डिस्काम कार्यालय को भिजवायी जावें। सूची के सत्यापन के आधार पर अनुदान हेतु प्रशासनिक स्वीकृति जारी की जावें।

   इस श्रेणी अन्तर्गत लाभान्वित कृषकों की सूची जिला कार्यालय द्वारा सम्बन्धित विद्युत विभाग को भेजी जावेगी एवं भविष्य में उन्हे कृषि विद्युत कनेक्शन स्थापना पर अनुदान देय नही होगा।

4. कृषक, जिनके के पास कृषि विद्युत कनेक्शन है या जिनका नाम कृषि विद्युत कनेक्शन प्राप्त करने की वर्ष 2016–17 की वरीयता सूची में है एवं वह कृषि विद्युत कनेक्शन समर्पित नही करना चाहते, उन्हे भारत सरकार (MNRE) द्वारा देय अनुदान (राशि 32,400 रू. प्रति एचपी एसी पम्प हेतु व राशि 40,500 रू प्रति एचपी डीसी पम्प हेतु) जो कि लगभग आधार दर का 30 प्रतिशत ही देय होगा। जिन कृषकों द्वारा कृषि विद्युत कनेक्शन हेतु आवेदन कर रखा है एवं सम्बन्धित डिस्कॉम की कृषि विद्युत कनेक्शन प्राप्त करने की वर्ष 2016–17 की वरीयता सूची मे नाम है, परन्तु वह अपनी वरीयता समर्पित नही करना चाहता है। ऐसे कृषकों को दिशा–निर्देशों के बिन्दु संख्या 3.1.स के अनुसार डिस्कॉम से प्रमाण–पत्र प्राप्त करना होगा।

4. चयनित जिले एवं लक्ष्य

परियोजना के तहत् राज्य के समस्त जिलों हेतु 7500 सौर उर्जा आधारित पम्प के लक्ष्यों का निर्धारण किया गया है।

लक्ष्यों का आवंटन जिलेवार एवं श्रेणीवार निम्न प्रकार है:–

क्र.सं.	जिले का नाम	सामान्य	अ.जा	अ.ज.जा.	कुल योग
1	अजमेर	133	32	33	198
2	अलवर	50	11	10	71
3	बांसवाडा	72	16	22	110
4	बारां	15	8	6	29
5	बाडमेर	275	72	44	391
6	भरतपुर	14	3	3	20
7	भीलवाडा	252	56	42	350
8	बीकानेर	759	160	81	1000

क्र.सं.	जिले का नाम	सामान्य	अ.जा	अ.ज.जा.	कुल योग
9	बूंदी	35	6	12	53
10	चित्तौडगढ़	180	40	29	249
11	चुरू	108	24	18	150
12	दौसा	36	8	6	50
13	धौलपुर	14	3	2	19
14	डूंगरपुर	36	8	6	50
15	हनुमानगढ़	595	128	64	787
16	जयपुर	575	128	115	818
17	जैसलमेर	324	72	54	450
18	जालौर	149	26	25	200
19	झालावाड़	22	5	4	31
20	झुझुनूं	150	48	30	228
21	जोधुपर	173	38	29	240
22	करौली	15	5	5	25
23	कोटा	29	6	5	40
24	नागौर	50	10	8	68
25	पाली	150	25	19	194
26	प्रतापगढ़	58	13	12	83
27	राजसमन्द	59	16	25	100
28	सवाईमाधोपुर	60	16	12	88
29	श्रीगंगानगर	587	117	96	800
30	सीकर	100	34	23	157
31	सिरोही	100	12	8	120
32	टोंक	130	29	22	181
33	उदयपुर	95	25	30	150
	योग	**5400**	**1200**	**900**	**7500**

आवंटित लक्ष्यों के अनुसार किसी जिलें विशेष में प्राप्ति/ मॉग न होने की स्थिति मे लक्ष्यों का हस्तातंरण मांग अनुसार अन्य जिलों को किया जा सकेगा। लक्ष्यों की प्राप्ति में कृषक श्रेणी अनुसूचित जाति व अनुसूचित जनजाति को वांछित लाभ प्रदान किया जावें। **सौर उर्जा पम्प परियोजना वर्ष 2016–17 अन्तर्गत कार्यादेश जारी करने की अंतिम तिथि 25 जनवरी, 2017 रहेगी।**

5. अनुदान पत्रावलियों के साथ लगाये जाने वाले दस्तावेज–

1. आवेदन–पत्र मय लाभार्थी की पासपोर्ट साईज फोटो (संलग्नक–1)
2. कृषक शपथ–पत्र (संलग्नक–2 अ एवं 2 ब)
3. कृषक हिस्सा राशि संग्रहण (संलग्नक– 3 अ) कृषक द्वारा पंजीकरण हेतु राशि रू. 10,000 का डिमाण्ड ड्राफ्ट (सदस्य सचिव, एचडीएस के पक्ष में) आवेदन–पत्र के साथ प्रस्तुत किया जावेगा, जिसका समायोजन पात्रता की स्थिति मे कृषक हिस्सा राशि हेतु किया जा सकेगा।
4. आवेदन पात्रता सत्यापन प्रमाण–पत्र (सलग्नक –3 ब)
5. सौर पम्प हेतु कार्यदार्यी फर्म द्वारा तकनिकी रिपोर्ट (सलग्नक –3 स)
6. सम्बन्धित डिस्काम मे कृषि कनेक्शन प्राप्त करने की वरियता सूची में अंकन होने या न होने का प्रमाण–पत्र (सलग्नक –3 द I, II, III)
7. भूमि की जमाबंदी या पासबुक की प्रतिलिपि (भू–स्वामित्व)
8. सिंचाई स्त्रोत
9. नवीनतम कृषि विद्युत कनेक्शन का बिल
10. त्रि–पार्टी अनुबन्ध (संलग्नक–4)
11. सूचीबद्ध आपूर्तिकर्त्ता फर्म का बिल/ प्रफोर्मा इनवॉइस/ कॉटेशन एवं डिजाईन मेप

6. पम्प क्षमता निर्धारण व तकनीकी मापदण्ड

1. 0.5 हैक्टेयर व इससे अधिक का भू स्वामित्व – 3 HP
2. 1.00 हैक्टेयर व इससे अधिक का भू–स्वामित्व : 5 HP
3. अधिक भू–स्वामित्व के कृषकों द्वारा कम क्षमता पम्प की मांग होने पर तदानुसार क्षमता का संयंत्र दिया जा सकता है।
4. संयंत्रो के तकनीकी मापदण्ड एवं विभिन्न पम्पस् वांछित जल डिस्चार्ज मापदण्ड एमएनआरई के वर्ष 2015–16 के दिशा–निर्देशानुसार एवं ईओआई की शर्तो (स्कोप ऑफ वर्क) के अनुसार रहेगें।
5. राज्य के डार्क जोनस् में सर्वे के अनुसार पूर्व में स्थापित नलकूप/ कुओं पर ही सौर उर्जा पम्प संयंत्र देय होगें। नए नलकूप /कुओं हेतु सक्षम स्तर पर अनुमति लिये जाने के उपरान्त ही सौर उर्जा पम्प संयंत्र की पत्रावली ली जावेगी।

7. सूचीबद्व आपूर्तिकर्त्ता फर्म

परियोजना के क्रियान्वयन हेतु चालू वित्तीय वर्ष के दौरान सूचीबद्वता आपूर्तिकर्ता फर्मस् इस प्रकार है :–

S.No,	Name of Firm	Address of Firm	Contact No.	Fax No.
1	2	3	4	5
1	Alpex Exports Pvt. Ltd.	81/2, Ist Floor, Shri Aurbido Marg, Near Hero Honda Show Room, Adhchini, New Delhi-17	011-26547000, 26522132	011-26515355
2	ANCO MOTORS	Kakad House, "B" Wing, Flat No. 'F' 5th Floor, Barrack Road, Dhobi Talao, Mumbai-400020	022-23424764/2340060	022-23412457
3	AVI Appliances Pvt. Ltd.	65-65, Narayan Industrial Estate, Opp. Raipur Mill Compound saraspur, Ahmedabad- 380018	079-22774464	079-22774463

S.No.	Name of Firm	Address of Firm	Contact No.	Fax No.
1	2	3	4	5
4	Fourth Partner Energy Pvt. Ltd.	704, Krishna Appartments, Tilak Road, Abids, Hyderabad-(A.P.) 500001	0124-4296347	0124-27177544
5	Jain Irrigation Systems Ltd.	(Solar Division), Jain Energy Park, Jain Velly, Shirsoli Road, Jalgaon 425001	0257-2260033/44 Ext. 803, 0141-2203515	0257-2261155
6	KISAN SOLAR	A/2, Atuiya Bhawan, Near CERC, S.G. Highway, Thaltej, Ahmedabad-380054	0141-4004449	
7	Kotak Urja Pvt Ltd.	378, 10th cross, 4th Phase, Peenya Industria Area, Banglore- 560058	080-28363330	080-28362347
8	LUBI Electronice	Sardar Patel Ring Road, Nr. Bright School, Nana Chiloda, Distt. Gandhinagar, Gujarat- 382325	079-39845300	079-39845599
9	Modern Solar Pvt. Ltd.	7, Camac Street, 3rd Floor, Azimganj House, Kolkata - 700017	(033) 24750337, 65228530	
10	Premier Solar Systems P Ltd.	3rd Floor, VV Tower, Karkhana Main Road, Secunderanbad-5000009, A.P.	040-27744415/16	040-27744417
11	PV Power Technologies Pvt. Ltd.	GJ14, SEEPZ, SDF VII, Andheri(East), MUMBAI - 400 096	022-42214800	022-42214801
12	Rajasthan Electronics & Intruments Ltd.	2, Kanakpura Industrial Area, Sirsi Road, Jaipur, Rajasthan - 302 012	0141-2470531	0141-2470139/ 2470531
13	Rotomag Moter & Controls Pvt. Ltd.	2102/03, GIDC, Vitthal Udhyog nagar, Near Anand, Gujarat - 388121	02692 -236005 / 2364009	02692 239805
14	Shakti Pumps(I) Ltd.	Plot no. 401, sector-3, industrial Area pithampur Dhar, District - Madhya Pradesh	07292410500	
15	Span Pumps Pvt. Ltd.	Office No. 1001, Tower-II, Montreai Business Center, Baner Road, Baner, Pune Maharashtra - 411045	0120-66000408	
16	Topsun Energy Limited,	B-101, Electronics Estate, Sector 25, Gandhinagar, Gujarat	079-23288804	079-23288805
17	Waaree Energies Limited,	602, Western Edge-I, Off. Western Express Highway, Borivall (E), Mumbai - 400066	022-66444444	022-66444400

8. अनुदान

1. सोलर पम्प परियोजना हेतु आधार दर पर लगभग 30/60/75 प्रतिशत अनुदान देय होगा।
2. परियोजना के तहत जवाहर लाल नेहरू राष्ट्रीय सौर मिशन (JLNNSM)/ राष्ट्रीय क्लीन एनर्जी फण्ड (NCEF) से देय अनुदान (राशि 32,400 रू. प्रति एचपी एसी पम्प हेतु व राशि 40,500 रू प्रति एचपी डीसी पम्प हेतु) जो कि लगभग आधार दर का 30 प्रतिशत है एवं 0/30/45 प्रतिशत राज्य योजना मद से अनुदान देय होगा।
3. अनुदान का कृषक श्रेणीवार विस्तृत विवरण दिशा–निर्देशो के बिन्दु संख्या 3 पर दिया गया है।

9. आधार दर

चालू वित्तीय वर्ष 2016–17 की आधार दर इस प्रकार है –

Details	DC/ AC	Mounting Structure	Head (meter)	Base Rate (Rs.) 3 Hp	Base Rate (Rs.) 5 Hp	Remarks
SPV Surface pump	DC	Static	20	3,25,900	5,09,000	-
	AC	Static	20	3,37,000	5,20,000	-
SPV Submersible pump	DC	Static	20	3,72,000	5,09,000	-
	AC	Static	20	3,40,000	4,84,000	-
Additional cost (Rs.)	50 m head over 20 m					6,500
	75 m head over 20 m					11,000
	Manual tracking System					4,050
	Auto tracking System					17,500
SPV Domestic Lighting System 37 WP/ 40 Ah Battery / 9 W x 2 fixture						7,999
3HP Solar pump system fencing around Solar Panels & Structure						10,000
5HP Solar pump system fencing around Solar Panels & Structure						14,000

चालू वित्तीय वर्ष 2016–17 की कृषकवार श्रेणी अनुदान दर इस प्रकार है –

S.N.	Details	DC/ AC Mounting Structure	Head (meter)	Base Rate (in Rs. Per set)		Subsidy (in Rs. Per set)						Farmer Share (in Rs. Per set)	
				3 Hp	5 Hp	MNRE	SP	3 Hp	MNRE	SP	5 Hp	3 Hp	5 Hp
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	**Farmer Category having agriculture electric connection (As per the guideline of 2015-16)**												
1	SPV Surface pump with Fencing	DC Manual	20	339950	527050	121500	0	121500	202500	0	202500	218450	324550
2		DC Auto Tracker	20	353400	540500	121500	0	121500	202500	0	202500	231900	338000
3		AC Manual	20	351050	538050	97200	0	97200	162000	0	162000	253850	376050
4		AC Auto Tracker	20	364500	551500	97200	0	97200	162000	0	162000	267300	389500
5	SPV Submersible pump with Fencing	DC Manual	20	386050	527050	121500	0	121500	202500	0	202500	264550	324550
6			50	392550	533550	121500	0	121500	202500	0	202500	271050	331050
7			75	397050	538050	121500	0	121500	202500	0	202500	275550	335550
8		DC Auto Tracker	20	399500	540500	121500	0	121500	202500	0	202500	278000	338000
9			50	406000	547000	121500	0	121500	202500	0	202500	284500	344500
10			75	410500	551500	121500	0	121500	202500	0	202500	289000	349000
11	SPV Submersible pump with Fencing	AC Manual	20	354050	502050	97200	0	97200	162000	0	162000	256850	340050
12			50	360550	508550	97200	0	97200	162000	0	162000	263350	346550
13			75	365050	513050	97200	0	97200	162000	0	162000	267850	351050
14		AC Auto Tracker	20	367500	515500	97200	0	97200	162000	0	162000	270300	353500
15			50	374000	522000	97200	0	97200	162000	0	162000	276800	360000
16			75	378500	526500	97200	0	97200	162000	0	162000	281300	364500
17	SPV Surface pump with DLS & fencing	DC Manual	20	347949	535049	121500	0	121500	202500	0	202500	226449	332549
18		DC Auto Tracker	20	361399	548499	121500	0	121500	202500	0	202500	239899	345999
19		AC Manual	20	359049	546049	97200	0	97200	162000	0	162000	261849	384049
20		AC Auto Tracker	20	372499	559499	97200	0	97200	162000	0	162000	275299	397499
21	SPV Submersible pump with DLS & fencing	DC Manual	20	394049	535049	121500	0	121500	202500	0	202500	272549	332549
22			50	400549	541549	121500	0	121500	202500	0	202500	279049	339049
23			75	405049	546049	121500	0	121500	202500	0	202500	283549	343549
24		DC Auto Tracker	20	407499	548499	121500	0	121500	202500	0	202500	285999	345999
25			50	413999	554999	121500	0	121500	202500	0	202500	292499	352499
26			75	418499	559499	121500	0	121500	202500	0	202500	296999	356999
27	SPV Submersible pump with DLS & fencing	AC Manual	20	362049	510049	97200	0	97200	162000	0	162000	264849	348049
28			50	368549	516549	97200	0	97200	162000	0	162000	271349	354549
29			75	373049	521049	97200	0	97200	162000	0	162000	275849	359049
30		AC Auto Tracker	20	375499	523499	97200	0	97200	162000	0	162000	278299	361499
31			50	381999	529999	97200	0	97200	162000	0	162000	284799	367999
32			75	386499	534499	97200	0	97200	162000	0	162000	289299	372499

S.N.	Details	DC/ AC Mounting Structure	Head (meter)	Base Rate (in Rs. Per set)		Subsidy (in Rs. Per set)						Farmer Share (in Rs. Per set)	
				3 Hp	5 Hp	MNRE	SP	3 Hp	MNRE	SP	5 Hp	3 Hp	5 Hp
1	2	3	4	5	6	7	8	9	10	11	12	13	14
2	**Farmer Category not having agriculture electric connection (As per the guideline of 2015-16)**												
1	SPV Surface pump with Fencing	DC Manual	20	339950	527050	121500	101985	223485	202500	158115	360615	116465	166435
2		DC Auto Tracker	20	353400	540500	121500	106020	227520	202500	162150	364650	125880	175850
3		AC Manual	20	351050	538050	97200	105315	202515	162000	161415	323415	148535	214635
4		AC Auto Tracker	20	364500	551500	97200	109350	206550	162000	165450	327450	157950	224050
5	SPV Submersible pump with Fencing	DC Manual	20	386050	527050	121500	115815	237315	202500	158115	360615	148735	166435
6			50	392550	533550	121500	117765	239265	202500	160065	362565	153285	170985
7			75	397050	538050	121500	119115	240615	202500	161415	363915	156435	174135
8		DC Auto Tracker	20	399500	540500	121500	119850	241350	202500	162150	364650	158150	175850
9			50	406000	547000	121500	121800	243300	202500	164100	366600	162700	180400
10			75	410500	551500	121500	123150	244650	202500	165450	367950	165850	183550
11	SPV Submersible pump with Fencing	AC Manual	20	354050	502050	97200	106215	203415	162000	150615	312615	150635	189435
12			50	360550	508550	97200	108165	205365	162000	152565	314565	155185	193985
13			75	365050	513050	97200	109515	206715	162000	153915	315915	158335	197135
14		AC Auto Tracker	20	367500	515500	97200	110250	207450	162000	154650	316650	160050	198850
15			50	374000	522000	97200	112200	209400	162000	156600	318600	164600	203400
16			75	378500	526500	97200	113550	210750	162000	157950	319950	167750	206550
17	SPV Surface pump with DLS & fencing	DC Manual	20	347949	535049	121500	104385	225885	202500	160515	363015	122064	172034
18		DC Auto Tracker	20	361399	548499	121500	108420	229920	202500	164550	367050	131479	181449
19		AC Manual	20	359049	546049	97200	107715	204915	162000	163815	325815	154134	220234
20		AC Auto Tracker	20	372499	559499	97200	111750	208950	162000	167850	329850	163549	229649
21	SPV Submersible pump with DLS & fencing	DC Manual	20	394049	535049	121500	118215	239715	202500	160515	363015	154334	172034
22			50	400549	541549	121500	120165	241665	202500	162465	364965	158884	176584
23			75	405049	546049	121500	121515	243015	202500	163815	366315	162034	179734
24		DC Auto Tracker	20	407499	548499	121500	122250	243750	202500	164550	367050	163749	181449
25			50	413999	554999	121500	124200	245700	202500	166500	369000	168299	185999
26			75	418499	559499	121500	125550	247050	202500	167850	370350	171449	189149
27	SPV Submersible pump with DLS & fencing	AC Manual	20	362049	510049	97200	108615	205815	162000	153015	315015	156234	195034
28			50	368549	516549	97200	110565	207765	162000	154965	316965	160784	199584
29			75	373049	521049	97200	111915	209115	162000	156315	318315	163934	202734
30		AC Auto Tracker	20	375499	523499	97200	112650	209850	162000	157050	319050	165649	204449
31			50	381999	529999	97200	114600	211800	162000	159000	321000	170199	208999
32			75	386499	534499	97200	115950	213150	162000	160350	322350	173349	212149
3	**Farmer Category applied for agriculture electric connection and wants to surrender their application in lieu of solar pumps subsidy (As per the guideline of 2015-16)**												
1	SPV Surface pump with Fencing	DC Manual	20	339950	527050	121500	152978	274478	202500	237173	439673	65472	87377
2		DC Auto Tracker	20	353400	540500	121500	159030	280530	202500	243225	445725	72870	94775
3		AC Manual	20	351050	538050	97200	157973	255173	162000	242123	404123	95877	133927
4		AC Auto Tracker	20	364500	551500	97200	164025	261225	162000	248175	410175	103275	141325
5	SPV Submersible pump with Fencing	DC Manual	20	386050	527050	121500	173723	295223	202500	237173	439673	90827	87377
6			50	392550	533550	121500	176648	298148	202500	240098	442598	94402	90952
7			75	397050	538050	121500	178673	300173	202500	242123	444623	96877	93427
8		DC Auto Tracker	20	399500	540500	121500	179775	301275	202500	243225	445725	98225	94775
9			50	406000	547000	121500	182700	304200	202500	246150	448650	101800	98350
10			75	410500	551500	121500	184725	306225	202500	248175	450675	104275	100825
11	SPV Submersible pump with Fencing	AC Manual	20	354050	502050	97200	159323	256523	162000	225923	387923	97527	114127
12			50	360550	508550	97200	162248	259448	162000	228848	390848	101102	117702
13			75	365050	513050	97200	164273	261473	162000	230873	392873	103577	120177
14		AC Auto Tracker	20	367500	515500	97200	165375	262575	162000	231975	393975	104925	121525
15			50	374000	522000	97200	168300	265500	162000	234900	396900	108500	125100
16			75	378500	526500	97200	170325	267525	162000	236925	398925	110975	127575
17	SPV Surface pump with DLS & fencing	DC Manual	20	347949	535049	121500	156577	278077	202500	240772	443272	69872	91777
18		DC Auto Tracker	20	361399	548499	121500	162630	284130	202500	246825	449325	77269	99174
19		AC Manual	20	359049	546049	97200	161572	258772	162000	245722	407722	100277	138327
20		AC Auto Tracker	20	372499	559499	97200	167625	264825	162000	251775	413775	107674	145724

S.N.	Details	DC/ AC Mounting Structure	Head (meter)	Base Rate (in Rs. Per set)		Subsidy (in Rs. Per set)						Farmer Share (in Rs. Per set)	
				3 Hp	5 Hp	MNRE	SP	3 Hp	MNRE	SP	5 Hp	3 Hp	5 Hp
1	2	3	4	5	6	7	8	9	10	11	12	13	14
21	SPV Submersible pump with DLS & fencing	DC Manual	20	394049	535049	121500	177322	298822	202500	240772	443272	95227	91777
22			50	400549	541549	121500	180247	301747	202500	243697	446197	98802	95352
23			75	405049	546049	121500	182272	303772	202500	245722	448222	101277	97827
24		DC Auto Tracker	20	407499	548499	121500	183375	304875	202500	246825	449325	102624	99174
25			50	413999	554999	121500	186300	307800	202500	249750	452250	106199	102749
26			75	418499	559499	121500	188325	309825	202500	251775	454275	108674	105224
27	SPV Submersible pump with DLS & fencing	AC Manual	20	362049	510049	97200	162922	260122	162000	229522	391522	101927	118527
28			50	368549	516549	97200	165847	263047	162000	232447	394447	105502	122102
29			75	373049	521049	97200	167872	265072	162000	234472	396472	107977	124577
30		AC Auto Tracker	20	375499	523499	97200	168975	266175	162000	235575	397575	109324	125924
31			50	381999	529999	97200	171900	269100	162000	238500	400500	112899	129499
32			75	386499	534499	97200	173925	271125	162000	240525	402525	115374	131974

Note :

1. **Basis of MNRE subsidy calculation is Rs. 32400/- per HP for AC pumps and Rs. 40500/- for DC pumps.**
2. **In addition to above State Plan subsidy is 30% of Base rate for farmers not having agriculture electric connection & 45% for farmers who have applied for agriculture electric connection and wants to surrender their application in lieu of solar pumps subsidy.**
3. **As per MNRE guidelines subsidy will be allowed only on manual & auto tracking enabled SPV pumps along with remote monitoring mechanism (RMM).**

The subsidy would be payable on the supply of the solar pumping system by the empanelled firm only. In case of any complaints regarding sub standard/ defective supplies, Directorate of Horticulture must be informed with full details of the case so that necessary action can be taken against the defaulter.

10. अनुदान प्रक्रिया

1. सोलर पम्प सेट हेतु उद्यान विभाग या RHDS से सूचीबद्व/ अनुमोदित फर्म द्वारा स्थापना पर ही अनुदान देय होगा।
2. कृषक द्वारा निर्धारित आवेदन पत्र मय वांछित दस्तावेज सम्बन्धित क्षेत्र के कृषि/ उद्यान विभाग कार्यालय में स्वयं/ कृषि पर्यवेक्षक/ सहायक कृषि अधिकारी/ बैंक/ आपूर्तिकर्ता डीलर/ आपूर्तिकर्त्ता फर्म के माध्यम से प्रेषित किया जावें। आपूर्तिकर्ता चयन सम्बन्धित कृषक स्तर से किया जावेगा।
3. आवेदन के समय कृषक द्वारा पम्प क्षमता/ माउन्टिग ढांचे का प्रकार (मेन्यूअल ट्रेकर /ऑटो ट्रेकर) तथा फेन्सिग अनिवार्य एवं डोमेस्टिक लाईटिंग सिस्टम का विकल्प आवश्यक रूप से प्रदान किया जायेगा।
4. राज्य के डार्क जोनस् में पूर्व में स्थापित नलकूप/ कुओं पर ही सौर उर्जा पम्प संयंत्र स्थापना पर अनुदान देय होगा।
5. कृषक द्वारा आवेदन पत्र के साथ राशि रू. 10,000 का डी.डी. एवं आवश्यक दस्तावेजों के अलावा पात्रता सत्यापन प्रमाण पत्र एवं विद्युत विभाग द्वारा जारी प्रमाण–पत्र/ कृषि विद्युत कनेक्शन नही होने का शपथ–पत्र 10 रू. नॉन–ज्यूडिशियल स्टाम्प (60 प्रतिशत अनुदान श्रेणी के लिए) निर्धारित प्रपत्र में सलग्न करना होगा, ताकि संयत्र स्थापना प्रक्रिया में विलम्ब ना हो।
6. अपात्र कृषकों की पंजीकरण राशि यथाशीघ्र (अधिकतम एक माह की अवधि में) वापस लौटा दी जावेगी।
7. जिला उद्यान अधिकारी द्वारा सौर उर्जा आधारित पम्प परियोजना के अन्तर्गत चयनित कृषको को पत्र द्वारा सूचित किया जायेगा एवं कृषको की सूची कार्यालय नोटिस बोर्ड पर चस्पा की जावेगी।

8. अनुमोदित सूची के अनुसार जिला HDS द्वारा चयनित कृषक से आपूर्तिकर्ता कार्यदायी फर्म का कोटेशन प्रस्तुत करने के उपरान्त, प्रशासनिक स्वीकृति निर्धारित प्रपत्र (संलग्न 5) मे निकाली जावेगी। प्रशासनिक स्वीकृति की प्रति तत् दिवस को उद्यान निदेशालय, खण्डीय उप निदेशक उद्यान व सम्बन्धित आपूर्तिकर्ता फर्म को फैक्स / ई–मेल द्वारा प्रेषित की जावेगी।
9. प्रशासनिक स्वीकृति 15 दिवस की अवधि में चयनित कृषक द्वारा प्रस्तुत राशि रू. 10,000 के अलावा **शेष कृषक हिस्सा राशि केवल जिला HDS को जमा कराई जायेगी।** इस दौरान संयंत्र प्रदाता द्वारा साईट का विस्तृत सर्वेक्षण कार्य सम्पन्न किया जावेगा।
10. चयनित कृषक द्वारा कृषक हिस्सा राशि, केवल जिला HDS को जमा कराने के उपरांत DHDS स्तर से कार्यादेश जारी किया जायेगा (संलग्नक –6)।
11. सम्बन्धित् जिला इकाई द्वारा कार्यादेश के साथ जारी कृषक हिस्सा राशि का स्वीकृति क्रमांक, दिनांक एवं राशि का विवरण कार्यादेश में अंकित किया जावें तथा संयत्र आपूर्ति रिपोर्ट प्रपत्र–7 में शेष जारी कृषक हिस्सा राशि का स्वीकृति क्रमांक, दिनांक एवं राशि का अंकन किया जावें।
12. सम्बन्धित् जिला इकाई द्वारा कार्यदायी फर्म के पक्ष में कार्यादेश जारी करने उपरांत कार्यदायी फर्म द्वारा (अधिकतम 45 दिवस) माल–आपूर्ति की जावेगी।
13. सम्बन्धित जिलाधिकारी द्वारा निदेशालय को माल–आपूर्ति का सत्यापन कर सूचना निर्धारित प्रपत्र (परिशिष्ठ 7-I & II) मे भिजवाना होगा ताकि प्रथम चरण का अनुदान भुगतान किया जा सकें।
14. सम्बन्धित सूचीबद्ध आपूर्तिकर्ता फर्म द्वारा स्थापन कार्य (कार्यादेश जारी होने के 45 दिवस में आपूर्ति व 20 दिन में स्थापन्न कार्य) सम्पन्न करना होगा।
15. DHDS स्तर से संयंत्र स्थापना के 7 दिवस में संयंत्र का निर्धारित प्रपत्र अनुसार भौतिक सत्यापन किया जावें (संलग्न 8 I & II)। भौतिक सत्यापन की आवश्यकता के अनुसार निदेशालय स्तर से अतिरिक्त दलों का गठन किया जा सकेगा।
16. भौतिक सत्यापन की रिपोर्ट संबंधित जिला इकाईयों द्वारा निर्धारित प्रपत्र (परिशिष्ठ– 9, 8 I & II) मे निदेशालय को प्रस्तुत की जावेगी। जिससे अंतिम चरण का अनुदान भुगतान सम्पन्न किया जा सकें।
17. सौर उर्जा पम्प परियोजना के प्रचार– प्रसार को बढावा देने व तकनीकी पहलुओं की जानकारी देने हेतु कृषि अनुसंधान केन्द्र/ कृषि विज्ञान केन्द्र/ राजहंस नर्सरी/ सरकारी कृषि फार्म पर भी सौलर पम्प स्थापित करने पर नियमानुसार अनुदान देय होगा।

11. कृषक हिस्सा एवं अनुदान राशि का भुगतान

1. भुगतान – DHDS/उद्यान निदेशालय द्वारा सम्बन्धित् आपूर्तिकर्ता फर्म को 2 चरणों में किया जावेगा –

   (अ) कार्यादेश के साथ DHDS (जिला होर्टीकल्चर डवलपमेंट सोसायटी) में जमा कृषक हिस्सा राशि में से अधिकतम 5 HP के सयंत्र हेतु राशि 1,00,000/– (एक लाख रूपये मात्र) व 3 HP के सयंत्र हेतु राशि रू. 75,000/– (अक्षरे पिचेहत्तर हजार रूपये मात्र) या वास्तविक कृषक हिस्सा राशि (कृषक हिस्सा राशि 5 एचपी के संयत्र हेतु 100,000/– व 3 एचपी के संयत्र हेतु 75,000/– से कम होने की स्थिति में) का अग्रिम भुगतान सूचीबद्व संयंत्र आपूर्तिकर्ता को किया जावेगा।

(ब) कृषक के खेत पर माल–आपूर्ति उपरांत कृषक हिस्सा राशि का भुगतान DHDS स्तर पर एवं उद्यान निदेशालय स्तर पर संयंत्र के पांच वर्ष सही संचालन की गारण्टी के पेटे संयंत्र लागत की 10 प्रतिशत बैंक गारण्टी के रूप मे उद्यान निदेशालय को प्रस्तुत करने पर (अधिकतम आधार लागत का लगभग 70 प्रतिशत)

1. कृषक हिस्सा राशि का भुगतान DHDS स्तर पर कृषक श्रेणीवार –
   - I. 75 प्रतिशत कृषक श्रेणी – कार्यादेश के साथ भुगतान की गयी कृषक हिस्सा राशि के अलावा शेष कृषक हिस्सा राशि का भुगतान
   - II. 60 प्रतिशत कृषक श्रेणी – कार्यादेश के साथ भुगतान की गयी कृषक हिस्सा राशि के अलावा शेष कृषक हिस्सा राशि का भुगतान
   - III. 30 प्रतिशत कृषक श्रेणी – कार्यादेश के साथ भुगतान की गयी कृषक हिस्सा राशि के अलावा शेष कृषक हिस्सा राशि का भुगतान (आयुक्तालय को माल–आपूर्ति की रिपोर्ट प्रस्तुत करने (परिशिष्ठ–7, 7-I) एवं निदेशालय की अनुमति उपरांत)
2. राज्य योजना से अनुदान राशि (45/30/0 प्रतिशत) का भुगतान निदेशालय द्वारा।

माल–आपूर्ति पर अधिकतम भुगतान, आधार लागत का लगभग 70 प्रतिशत तक देय होगा। जो कि कृषक हिस्सा राशि एवं अनुदान राशि को मिलाकर हो सकता है।

(स) शेष/अंतिम अनुदान लगभग 30 प्रतिशत (जेएनएनएसएम मद से प्रति HP के आधार पर MNRE के दिशा–निर्देशानुशार) उद्यान निदेशालय द्वारा –

1. कृषक खेत पर सफलता पूर्वक सयंत्र स्थापन कार्य पूर्ण करने पर।
2. निर्धारित दल द्वारा सौर उर्जा पम्प संयंत्र का भौतिक सत्यापन करने पर।

12. भौतिक सत्यापन

1. माल–आपूर्ति व सफलतापूर्वक स्थापन कार्य का भौतिक सत्यापन 7 दिवस में किया जावे।
2. माल–आपूर्ति का भौतिक सत्यापन सहायक कृषि अधिकारी/ कृषि अधिकारी/ सहायक निदेशक/ उपनिदेशक स्तर के कम से कम एक अधिकारी द्वारा किया जावें।
3. कृषि पर्यवेक्षक द्वारा माल–आपूर्ति का भौतिक सत्यापन करने पर सहायक निदेशक/ उपनिदेशक स्तर के कम से कम एक अधिकारी द्वारा प्रति हस्ताक्षरित की जावें।
4. स्थापित संयंत्र के भौतिक सत्यापन 3 सदस्यीय दल द्वारा किया जावेगा। इसमें कृषि/ उद्यान विभाग के सहायक कृषि अधिकारी स्तर या इससे उपर के दो अधिकारी तथा एक सदस्य अभियन्ता RRECL /उर्जा विभाग/ ग्रामीण विकास विभाग/ जिला कलेक्टर द्वारा नामित सहायक अभियंता /RHDS द्वारा नामित होगा।
5. भौतिक सत्यापन यथासम्भव उपनिदेशक कृषि/ उद्यान या सहायक निदेशक कृषि/ उद्यान की उपस्थिति में हो।
6. भौतिक सत्यापन के दौरान स्थापित सौर पम्प संयंत्र एवं सूक्ष्म सिचांई संयत्र का फोटो मय दिनांक के साथ सत्यापित किया जावें।
7. भौतिक सत्यापन हेतु सहायक कृषि अधिकारी स्तर के साथ इससे उपर के कृषि विभाग/ जिला परिषद् के अधिकारी भी अधिकृत होंगे।
8. कार्य अधिकता एवं कार्य को गति प्रदान करने के प्रयोजनार्थ इस हेतु RHDS स्तर से विशेषज्ञ सेवायें हायर की जा सकती है।

13. सूचीबद्ध आपूर्तिकर्ता के दायित्व

1. सूचीबद्ध आपूर्तिकर्ता के अधिकृत इंजिनियर द्वारा कृषक का विस्तृत सर्वे किया जाकर संयंत्र स्थापन का तकनीकी ड्राइंग/डिजाईन तैयार किया जावेगा।
2. आपूर्तिकर्ता द्वारा कृषक को संयंत्र संचालन एवं रखरखाव का मैन्यूअल प्रदान किया जावेगा एवं संयंत्र के समग्र बिन्दुओ पर कृषक प्रशिक्षण आयोजित किया जावेगा।
3. डिजाईन के अनुसार सिविल कार्य सम्पन्न कराया जावेगा।
4. आपूर्तिकर्ताओं द्वारा प्रस्तुत सौर ऊर्जा आधारित पम्प परियोजना के मॉडयूल माउंटिग ढांचे की डिजाईन प्रचलित वायु, वेग, लोड को तकनिकी रूप से सहन करने योग्य हो।
5. सौर उर्जा पम्प सयंत्र स्थापना से पूर्व सम्बन्धित कम्पनी द्वारा कृषक के पानी के जल स्तर /उपलब्धता का निर्धारण अपने विशेषज्ञ से करवाकर यह सुनिश्चित करेगी की किस क्षमता का पम्प सैट लगाया जावें, पम्प का चुनाव /स्थापन उपरान्त निर्धारित मात्रा में पानी का डिस्चार्ज नही होने पर कम्पनी की जिम्मेदारी होगी। (संलग्न– 3स)
6. संयंत्र के पार्टस जवाहर लाल नेहरू राष्ट्रीय सौर उर्जा मिशन के मापदण्डों के अनुसार होगें।
7. सौर पेनल/ मॉड्यूल 125 WP या इससे अधिक क्षमता के होंगे।
8. आपूर्तिकर्ता प्रत्येक आपूर्ति किये जाने वाले मॉड्यूल/ पेनल का IV-Curve DHDS को प्रस्तुत करेगा।
9. सूचीबद्व आपूर्तिकर्ता द्वारा आपूर्ति किये जाने वाले संयंत्र में या साथ रिमोट मोनिटरिंग सिस्टम अनिवार्य रूप से दिया जायेगा।
10. आपूर्तित माल का पूर्ण विवरण व मापदण्ड, डिजाईन व तकमिना सम्बन्धित जिला इकाई को उपलब्ध कराना होगा।
11. सूचीबद्व आपूर्तिकर्ता द्वारा निदेशालय स्तर के दल से प्री–डिस्पेंच निरीक्षण करवाया जाना अनिवार्य होगा।
12. सूचीबद्व आपूर्तिकर्ता द्वारा प्री–डिस्पेंच निरीक्षण के लिये 15 दिवस पूर्व निदेशालय को सूचित करना होगा व MNRE के वर्ष 2015–16 के दिशा–निर्देशानुसार व EOI (ईओआई) की शर्तो के अनुसार सौर ऊर्जा पम्प सयंत्रों के आपूर्ति किये जाने वाले सामान की टेस्ट–रिपोर्ट प्रस्तुत करनी होगी।
13. Outsourcing किए गये सामान के स्त्रोत की स्पष्ट जानकारी सूचीबद्व आपूर्तिकर्ता द्वारा दी जायेगी।
14. कार्यादेश /प्रशासनिक स्वीकृति के 45 दिवस मे संयंत्र माल आपूर्ति एवं 20 दिवस मे स्थापन कार्य सम्पन्न करना होगा। निर्धारित अवधि मे बिना किसी युक्ति संगत कारण के विलम्ब की स्थिति मे नियमानुसार पैनल्टी अंतिम भुगतान में (45+20=**65**) लागू होगी।
15. संयंत्र की पांच वर्ष की गारण्टी तथा इसके पश्चात् आगामी पांच वर्ष हेतु विक्रय पश्चात् सेवा (After sales service) प्रदान की जावेगी।
16. सूचीबद्व आपूर्तिकर्ता/फर्म द्वारा कृषक के खेत पर स्थापित सोलर पम्प संयंत्र की फेन्सिंग (निर्धारित मापदण्ड अनुसार) का कार्य एवं बीमा करवाया जायेगा। आपूर्तिकर्ता फर्म द्वारा बीमा से सम्बन्धित प्रकिया में देरी होने की स्थिति में स्वंय अपने स्तर पर कृषक की समस्या का समाधान 7 दिवस में अनिवार्य रूप से किया जाना सुनिश्चित करें।
17. संयत्र आपूर्तिकर्ता द्वारा सभी स्टेक होल्डर्स (RHDS/DHDS/कृषक) को सर्विस सेंटर की जानकारी उपलब्ध करवानी होगी।

18. संयंत्र संचालन व रखरखाव सम्बन्धी साहित्य पुस्तिका (मैन्युअल) जो कि कृषक सुलभ हिन्दी भाषा मे हो, लाभार्थियों को प्रदान की जावेगी।
19. संयत्र आपूर्तिकर्ता द्वारा कस्टमर केयर सेन्टर स्थापित किया जावेगा तथा टोल फ्री नबंर की जानकारी प्रत्येक स्टेक होल्डर को उपलब्ध करानी होगी।
20. विगत् वर्षो के साथ–साथ चालू वित्तीय वर्ष के दौरान स्थापित कुल संयंत्रो की संख्या जिला विशेष मे 100 या इससे अधिक होने की स्थिति मे सम्बन्धित जिला मुख्यालय पर कस्टमर केयर सेन्टर स्थापित किया जाना आवश्यक होगा। इस केन्द्र पर कम से कम एक तकनिकी व्यक्ति रखा जायेगा जिसके नाम, मोबाईल नम्बर व पता सम्बन्धित जिला इकाई, लाभार्थी व वेबसाईट पर उपलब्ध कराना होगा।
21. अगर कार्यदायी फर्म द्वारा राजस्थान मे विगत् वर्षो सहित चालु वित्तीय वर्ष तक 500 या इससे अधिक संयंत्र कर लिये है तो जयपुर मुख्यालय पर कस्टमर केयर सेन्टर स्थापित करना होगा जिसमे कम से कम 5 तकनिकीकर्मी होगे। इनके नाम, मोबाईल नम्बर व पते सम्बन्धित कृषक, जिला इकाई, मुख्यालय तथा वेबसाईट पर उपलब्ध कराना होगा।
22. स्थापित किये जाने वाले संयंत्रो के डाटा आवश्यकतानुसार विभागीय वेबसाईट पर अपलोड करने होगे। ये डाटा प्रत्येक महीने के प्रथम दिवस तथा नये संयंत्र स्थापन के दस दिवस मे आवश्यक रूप से अद्यतन (अपडेट) किया जावेगा।
23. कार्यदायी फर्म द्वारा स्थापित संयंत्रो का प्रत्येक तिमाही (अप्रैल–जुन, जुलाई–सितम्बर, अक्टूबर–दिसम्बर व जनवरी–मार्च) के दौरान निरीक्षण करना होगा तथा इसकी सूचना जिला इकाई को प्रस्तुत करनी होगी।
24. कार्यदायी फर्म द्वारा कृषकों को रखरखाव (मेन्टीनेंस) व योजना सम्बन्धी जानकारी प्रदान की जावेगी।
25. कार्यदायी फर्मस के स्तर से रखरखाव सम्बन्धी Clauses की गम्भीरता से पालना सुनिश्चित की जावेगी। जिससे लाभार्थियों को संयंत्र मे किसी प्रकार के फाल्ट की स्थिति मे इधर–उधर चक्कर न काटना पडें।
26. किसी प्रकार के फाल्ट की सूचना डाक, टेलीफोन, फैक्स, ई–मेल या अन्य तरीके से प्राप्त होने की स्थिति में तीन कार्य दिवसों मे आवश्यक रूप से साईट भ्रमण आदि जरिये से इस पर कार्यवाही की जावेगी।
27. कार्यदायी फर्म से अपेक्षा की जाती है कि वह समुचित मात्रा मे स्पेयर पार्ट का स्टॉक रखे जिससे की संयंत्र शिकायत के 5 दिवस मे आवश्यक रूप से पुनः चालु किया जा सकें।
28. संयंत्रो के रखरखाव कार्य के विफलता की स्थिति में फर्म की बैंक गारण्टी रिवोक की जा सकेगी तथा पॉच या इससे अधिक संयंत्रो के रखरखाव की विफलता पर फर्म को काली सूची मे डाले जाने की कार्यवाही की जा सकेगी, जिसके निर्णय का अंतिम अधिकारी मिशन निदेशक, या सदस्य सचिव, RHDS को होगा।

14. कृषक के दायित्व

1. आवेदन–पत्र के साथ आवश्यक दस्तावेज प्रस्तुत करना तथा HDS कार्यालय में कृषक हिस्सा राशि जमा करवाना।
2. संयंत्र की माल आपूर्ति एवं स्थापन हेतु स्थल (छाया रहित कम से कम 60 वर्ग.मी.) एवं जल स्त्रोत उपलब्ध करवाना।
3. भौतिक सत्यापन व अन्य निरीक्षण के समय लाभार्थी यथासम्भव स्वंय या अन्य परिवार के जिम्मेदार सदस्य की उपस्थिति सुनिश्चित करेगा।

4. संयंत्र का बीमा कार्यदायी फर्म द्वारा करवाया जायेगा। सौलर पम्प सयंत्र के उचित रख– रखाव एवं सुरक्षा की समस्त जिम्मेदारी कृषक की होगी।
5. स्थापित सौर पम्प संयंत्र का संचालन कृषक द्वारा विद्युत/बिजली कनेक्शन से नही किया जावेगा, पाये जाने की स्थिति में कार्यवाही अमल में लायी जावेगी।
6. कृषक द्वारा संयंत्र के खुर्द–बुर्द करने की स्थिति में सम्बन्धित कृषक के विरूद नियमानुसार विधिक कार्यवाही अमल मे लायी जावेगी तथा संयंत्र हेतु जारी की गई अनुदान राशि वसूली योग्य होगी।
7. त्रि–पार्टी अनुबन्ध।

15. योजना की रिमोट मॉनिटरिंग –

योजना की मॉनिटरिंग हेतु एमएनआरई द्वारा जारी वर्ष 2016–17 दिशा–निर्देशानुसार सूचीबद्व आपूर्तिकर्ता द्वारा संयंत्र स्थापना के साथ रिमोट मोनेटरिंग सिस्टम आवश्यक रूप से स्थापित करना होगा। रिमोट मॉनिटरिंग सिस्टम सौर उर्जा पम्प स्थापना का आवश्यक अंग होगा व इसके बिना सूचीबद्व आपूर्तिकर्ता फर्म को अनुदान देय नही होगा। राज्य एवं जिला स्तर पर रिमोट मॉनिटरिंग सिस्टम से पम्प संचालन सम्बन्धी आवश्यक सूचनाओं की मॉनिटरिंग हेतु पासवर्ड सूचीबद्व आपूर्तिकर्ता फर्म द्वारा विभाग को उपलब्ध कराने होगें।

(Provision for remote monitoring of the installed pumps must be made in the controllers or the inverters either through an integral arrangement or through an externally fitted arrangement. It should be possible to ascertain the daily water output, the power generated by the PV array, the UP TIME of the pump during the year, Number of days the pump was unused or under breakdown/repairs.)

राजस्थान सरकार
उद्यान निदेशालय, पंत कृषि भवन, जयपुर

क्रमांक प.1 ( ) नि.उ./Solar/GL/2017-18/5401-5526 दिनांक: 01/11/17

समस्त उप/सहायक निदेशक उद्यान .....

विषयः सौर उर्जा आधारित पम्प परियोजना 2017–18 हेतु दिशा निर्देश।

उपरोक्त विषयान्तर्गत लेख है कि 3 एचपी व 5 एचपी के सौर उर्जा पम्प संयंत्र कृषकों को वर्ष 2017–18 में अनुदान पर उपलब्ध कराने हेतु जवाहर लाल नेहरू राष्ट्रीय सौर मिशन (JLNNSM) तथा राज्य योजना अन्तर्गत सौर उर्जा आधारित पम्प परियोजना हेतु कियान्वयन दिशा–निर्देश संलग्न कर भिजवाये जा रहे है। योजनान्तर्गत जारी दिशा–निर्देशों के साथ निम्नलिखित बिन्दुओ की पालना आवश्यक रूप से सुनिशिचित की जावें :–

1. सर्वप्रथम जिला उद्यान कार्यालयों में पूर्व में प्राप्त पत्रावलियों (लम्बित पत्रावलियॉ) का निस्तारण कर, नवीन पत्रावलिया ऑन–लाईन ही प्राप्त की जावें एवं इस वर्ष से ऑन–लाईन आवेदन पत्र के साथ अग्रिम कृषक हिस्सा राशि रू. 10,000 नही ली जावेगी। कृषक द्वारा सम्पूर्ण कृषक हिस्सा राशि कार्यादेश से पूर्व सम्बन्धित कार्यालय में जमा करानी होगी।
2. सौर उर्जा पम्प संयंत्रो पर अनुदान 3 व 5 एचपी तक के संयंत्रो पर ही देय होगा। कृषक द्वारा पात्रता से अधिक एचपी का संयंत्र स्वेच्छानुसार स्थापित करवाने पर अतिरिक्त कृषक हिस्सा राशि, कृषक द्वारा स्वयं वहन की जावेगी।

अतः दिशा–निर्देशानुसार निर्धारित समय मे लक्ष्यों की प्राप्ति सुनिश्चित करें। यहॉ उल्लेखनीय है कि परियोजना के अध्यधीन किसी भी प्रकार के कार्बन क्रेडिट सम्बन्धी प्राधिकार RHDS/उद्यान विभाग राजस्थान के पास होगा।

संलग्नः– उपरोक्तानुसार।

निदेशक उद्यान एवं
सदस्य सचिव, RHDS

क्रमांक प.1 ( ) नि.उ./Solar/GL/2017-18/5401-5526 दिनांक: 01/11/17

प्रतिलिपि निम्न को सूचनार्थ एवं अग्रिम आवश्यक कार्यवाही हेतु प्रेषित है :–

1. निजी सचिव, प्रमुख शासन सचिव, कृषि एवं उद्यानिकी, राजस्थान, जयपुर।
2. निजी सचिव, प्रमुख शासन सचिव (ऊर्जा), राजस्थान जयपुर।
3. निजी सहायक, निदेशक कृषि, कृषि निदेशालय, पंत कृषि भवन, जयपुर।
4. निजी सहायक, प्रबन्ध निदेशक, (RE&O) राजस्थान राज्य अक्षय ऊर्जा निगम लि0, (RRECL), E-166 ए यूधिष्ठिर मार्ग, सी–स्कीम, जयपुर।
5. अध्यक्ष, जिला होर्टीकल्चर सोसायटी एवं जिला कलेक्टर .....
6. अध्यक्ष एवं प्रबन्ध निदेशक, विद्युत वितरण निगम लि0, जयपुर/अजमेर/जोधपुर।
7. प्रबन्ध निदेशक, राजस्थान राज्य भूमि विक स बैंक, सहकार भवन जयपुर।
8. समस्त जिला अधीक्षण अभियंता, विद्युत वितरण निगम लि0।
9. संयुक्त निदेशक/उप निदेशक उद्यान (योजना), मु. पंत कृषि भवन, जयपुर।
10. समस्त खण्डीय संयुक्त निदेशक उद्यान/कृषि विस्तार .....
11. समस्त संभागीय उप निदेशक उद्यान .....
12. उप निदेशक, कृषि विस्तार (जिला परिषद) .....
13. समस्त सहायक निदेशक कृषि (वि.) .....
14. आरक्षी पत्रावली

निदेशक उद्यान एवं
सदस्य सचिव, RHDS

पंत कृषि भवन, भगवान दास रोड, जयपुर– 302005
website: horticulture.rajasthan.gov.in, Email: rajasthan_solar@rediffmail.com
Ph. 0141-2227606,2227706 Telefax 0141- 2227840

"हाईटेक उद्यानिकी/कृषि हेतु सौर ऊर्जा आधारित पम्प परियोजना 2017–18"

1. भूमिका

राज्य मे सौर उर्जा की अपार सम्भावना को ध्यान में रखते हुये कृषि क्षेत्र मे गैर–पारम्परिक एवं पर्यावरण मित्र उर्जा के उपयोग हेतु उद्यान विभाग द्वारा राज्य के कृषकों हेतु सौर उर्जा आधारित पम्प परियोजना का क्रियान्वयन वित्तीय वर्ष 2017–18 में किया जा रहा है। यह परियोजना जवाहर लाल नेहरू राष्ट्रीय सौर मिशन (JLNNSM) तथा राज्य योजना के तहत् क्रियान्वित की जावेगी। परियोजना का क्रियान्वयन स्वरूप इस प्रकार है –

2. कृषक चयन पात्रता

कृषक चयन निम्न पात्रता के आधार पर किया जाना है:–

सौलर पम्प संयंत्र 3 HP

1. कृषक के पास न्यूनतम 0.5 हैक्टेयर का भू–स्वामित्व हो।
2. कृषक द्वारा सिचांई हेतु ड्रिप/मिनि स्प्रिकंलर /स्प्रिकंलर संयंत्र आवश्यक रूप से काम मे लिया जावें।
3. कृषक के पास जल संग्रहण ढांचा, डिग्गी, फार्म पोण्ड, जल हौज या भूमिगत जल स्त्रोत (अधिकतम 100 मीटर गहराई) की व्यवस्था हो । उक्त जल संग्रहण ढ़ाचों की न्यूनतम संग्रहण क्षमता निम्नानुसार हो –

क्र.सं.	ढ़ाचा	न्यूनतम क्षमता (घन मीटर मे)
1.	जल संग्रहण ढांचा	1000
2.	डिग्गी	400
3.	फार्म पोण्ड	1000
4.	जल हौज (सब्जी/बगीचे हेतु)	50
5.	जल हौज (संरक्षित खेती हेतु)	20

4. कृषक द्वारा उच्च उद्यानिकी यथा ग्रीन हाउस/शेडनेट हाउस्/लो–टनल्स् (न्यूनतम 1000 वर्ग मीटर) या ड्रिप पर सब्जियॉ/फूल/फलोद्यान/कृषि फसल (न्यूनतम 0.5 है0) लिये जा रहे हो। मिनी स्प्रिकंलर/स्प्रिकंलर पर 0.5 है. क्षेत्र में उद्यानिकी/कृषि फसल लेने वाले कृषक भी पात्र होगे।
5. संरक्षित खेती अपनाने वाले कृषकों को प्राथमिकता से चयनित कर लाभान्वित किया जा सकेगा।
6. सतही जल स्त्रोत जिसमें डिग्गी, सामुदायिक पोण्ड, जल हौज आदि आते है, के लिये तकनीकी रूप से 3 एचपी के सौर उर्जा पम्प सयंत्र ही उचित है। इस कारण सतही जल स्त्रोत वाले कृषकों को 3 एचपी के सौर उर्जा पम्प सयंत्रों पर ही अनुदान देय होगा।
7. यथासम्भव लघु एवं सीमान्त कृषकों को प्राथमिकता दी जावें।

8. सतही जल स्त्रोत जिसमें डिग्गी, सामुदायिक पोण्ड, जल हौज आदि पर जो कृषक अपनी आवश्यकता अनुसार एवं स्वेच्छा से 5 एचपी, 7.5 एचपी या 10 एचपी के सौर उर्जा पम्प सयंत्र लगाना चाहते है, ऐसे कृषकों को सौर उर्जा पम्प सयंत्रो पर अनुदान 3 एचपी के पम्प सयंत्र पर देय अनुदान के बराबर होगा। शेष राशि कृषक स्वयं के स्तर पर वहन करेगा।

<u>सौलर पम्प संयत्र 5 HP</u>

1. कृषक के पास न्यूनतम 1.0 हैक्टयर या इससे अधिक का भू–स्वामित्व हों।
2. कृषक द्वारा न्यूनतम 2000 वर्ग मीटर उच्च उद्यानिकी ग्रीन हाउस/शेडनेट हाउस/लो–टनल्स् या न्यूनतम 0.75 हैक्टयर में ड्रिप पर सब्जियॉ/फूल/फलोद्यान/कृषि फसल लिये जा रहे हों।
3. मिनी स्प्रिंकलर/स्प्रिकंलर पर न्यूनतम 0.75 हैक्टेयर क्षेत्र में उद्यानिकी/कृषि फसल लेने वाले कृषक भी पात्र होगे।
4. कृषक के पास जल संग्रहण ढांचा, डिग्गी, फार्म पोण्ड, जल हौज या भूमिगत जल स्त्रोत (अधिकतम 100 मीटर गहराई) की व्यवस्था हों। उक्त् जल संग्रहण ढाचों की न्यूनतम संग्रहण क्षमता निम्नानुसार हो :–

क्र.स.	ढाचां	न्यूनतम क्षमता (घन मीटर में)
1.	जल संग्रहण ढांचा	1500
2.	डिग्गी	800
3.	फार्म पौण्ड	1500
4.	जल हौज (सब्जी/बगीचे हेतु)	75
5.	जल हौज (सरक्षिंत खेती हेतु)	40

5. संरक्षित खेती अपनाने वाले कृषकों को प्राथमिकता से चयनित कर लाभान्वित किया जा सकेगा।
6. यथासम्भव लघु एवं सीमान्त कृषकों को प्राथमिकता दी जावें।
7. भूमिगत जल स्त्रोत जिसमें कुआं एवं ट्यूबवैल/नलकूप आदि पर जो कृषक अपनी आवश्यकता अनुसार एवं स्वेच्छा से 7.5 एचपी या 10 एचपी के सौर उर्जा पम्प सयंत्र लगाना चाहते है, ऐसे कृषकों को सौर उर्जा पम्प सयंत्रो पर अनुदान 5 एचपी के पम्प सयंत्र पर देय अनुदान के बराबर होगा। शेष राशि कृषक स्वयं के स्तर पर वहन करेगा।

3. सौर उर्जा पम्प सयंत्र हेतु प्राथमिकता, संचालन प्रकिया एवं अनुदानः–

वर्ष 2017–18 के दिशा–निर्देशानुसार सर्वप्रथम जिला उद्यान कार्यालय में पूर्व में लम्बित ऑन लाईन पत्रावलियो का निस्तारण किया जावें। वर्ष 2017–18 में सौर उर्जा पम्प सयंत्रों पर अनुदान निम्नानुसार देय होगाः–

1. कृषक जिनके द्वारा कृषि विद्युत कनेक्शन हेतु वर्ष 2016–17 तक (अनुसूचित जाति एवं अनुसूचित जनजाति के कृषकों पर वर्ष 2016–17 की बाध्यता लागू नही होगी) विद्युत विभाग (डिस्कॉम) में आवेदन कर रखा है व कृषक का नाम कृषि विद्युत कनेक्शन हेतु डिस्कॉम की सूची में है तथा कृषक कृषि विद्युत कनेक्शन आवेदन समर्पित करने को सहमत है ऐसे कृषकों को योजना अन्तर्गत भारत सरकार (MNRE) द्वारा 3 एचपी पर देय 25 प्रतिशत व 5 एचपी पर देय 20 प्रतिशत अनुदान के अलावा आधार लागत का 45 प्रतिशत अतिरिक्त अनुदान राज्य योजना से देय होगा। इस प्रकार कुल देय

अनुदान 3 एचपी सयंत्र पर 70 प्रतिशत व 5 एचपी सयंत्र पर 65 प्रतिशत होगा। इस श्रेणी के कृषकों को संलग्न प्रपत्र– 3 द I में सम्बन्धित डिस्कॉम से प्रमाण पत्र प्राप्त करना होगा व संलग्न प्रपत्र 2 (ब) पर कृषकों को शपथ पत्र देना होगा।

इस श्रेणी अन्तर्गत लाभान्वित कृषकों की सूची जिला कार्यालय द्वारा सम्बन्धित विद्युत विभाग को भेजी जावेगी एवं भविष्य में उन्हे कभी भी अनुदानित कृषि विद्युत कनेक्शन देय नही होगा।

2. कृषक, जिनके पास कृषि विद्युत कनेक्शन नही है व न ही कृषक द्वारा डिस्कॉम में कृषि विद्युत कनेक्शन हेतु वर्ष 2016–17 तक आवेदन किया गया है। ऐसे कृषकों को योजना अन्तर्गत भारत सरकार (MNRE) द्वारा 3 एचपी पर देय 25 प्रतिशत व 5 एचपी पर देय 20 प्रतिशत अनुदान के अलावा आधार लागत का 30 प्रतिशत अतिरिक्त अनुदान राज्य योजना से देय होगा। इस प्रकार कुल देय अनुदान 3 एचपी सयंत्र पर 55 प्रतिशत व 5 एचपी सयंत्र पर 50 प्रतिशत होगा। इस श्रेणी के कृषकों को संलग्न– 3 द II में सम्बन्धित डिस्कॉम से प्रमाण पत्र प्राप्त करना होगा व संलग्न प्रपत्र 2 (ब) पर कृषकों को शपथ पत्र देना होगा।

   कृषक द्वारा प्रमाण पत्र प्रस्तुत नही करने की स्थिति में कृषि विद्युत कनेक्शन नही होने का शपथ–पत्र (50 रू. नॉन–ज्यूडिशियल स्टाम्प) देना होगा एवं शपथ–पत्र के आधार पर सम्बन्धित जिलाधिकारी द्वारा कृषकों की सूची सत्यापन हेतु जिले के डिस्कॉम कार्यालय को भिजवायी जावें। सूची के सत्यापन के आधार पर अनुदान हेतु प्रशासनिक स्वीकृति जारी की जावें।

   इस श्रेणी अन्तर्गत लाभान्वित कृषकों की सूची जिला कार्यालय द्वारा सम्बन्धित विद्युत विभाग को भेजी जावेगी एवं भविष्य में उन्हे कृषि विद्युत कनेक्शन स्थापना पर अनुदान देय नही होगा।

3. कृषक, जिनके पास वर्तमान में कृषि विद्युत कनेक्शन है/ पूर्व में सौर पम्प परियोजना अन्तर्गत अनुदान प्राप्त कर किया है, उन्हें सौर उर्जा पम्प सयंत्र स्थापना पर अनुदान देय नही होगा।

4. चयनित जिले एवं लक्ष्य

परियोजना के तहत् राज्य के समस्त जिलों हेतु MNRE, भारत सरकार से प्राप्त लक्ष्यों अनुसार 5000 सौर उर्जा आधारित पम्प संयंत्र (2500 सौर उर्जा पम्प सयंत्र 3 एचपी एवं 2500 सौर उर्जा पम्प सयंत्र 5 एचपी) स्थापित करवाये जाने प्रस्तावित है। जिलेवार लक्ष्यों का आवंटन निम्नानुसार है –

क्रं. सं	जिला	आवंटित लक्ष्य (संख्या में)											
		3 एचपी				5 एचपी				योग			
		सा	अजा	अजजा	योग	सा	अजा	अजजा	योग	सा	अजा	अजजा	योग
1	अजमेर	40	10	11	61	72	10	11	93	112	20	22	154
2	अलवर	24	6	6	36	24	6	6	36	48	12	12	72
3	बाँसवाड़ा	7	4	6	17	25	5	10	40	32	9	16	57
4	बारां	1	1	1	3	10	0	0	10	11	1	1	13
5	बाड़मेर	40	13	15	68	95	12	15	122	135	25	30	190
6	भरतपुर	2	1	1	4	10	0	0	10	12	1	1	14
7	भीलवाड़ा	33	8	6	47	50	9	7	66	83	17	13	113
8	बीकानेर	330	126	97	553	35	7	0	42	365	133	97	595
9	बूँदी	14	3	3	20	24	4	3	31	38	7	6	51

क्र. सं	जिला	आवंटित लक्ष्य (संख्या में)											
		3 एचपी				5 एचपी				योग			
		सा	अजा	अजजा	योग	सा	अजा	अजजा	योग	सा	अजा	अजजा	योग
10	चित्तौड़गढ़	25	11	8	44	40	11	9	60	65	22	17	104
11	चूरू	71	24	18	113	92	24	18	134	163	48	36	247
12	दौसा	4	1	1	6	13	1	2	16	17	2	3	22
13	धौलपुर	1	1	1	3	10	1	1	12	11	2	2	15
14	डूंगरपुर	6	3	3	12	21	5	10	36	27	8	13	48
15	हनुमानगढ़	351	58	10	419	25	2	7	34	376	60	17	453
16	जयपुर	15	15	15	45	360	72	85	517	375	87	100	562
17	जैसलमेर	65	19	14	98	50	19	15	84	115	38	29	182
18	जालौर	100	37	21	158	70	30	22	122	170	67	43	280
19	झालावाड़	3	1	0	4	10	1	1	12	13	2	1	16
20	झुंझूंनू	13	10	12	35	70	25	13	108	83	35	25	143
21	जोधपुर	25	9	5	39	50	10	5	65	75	19	10	104
22	करौली	1	1	1	3	10	0	0	10	11	1	1	13
23	कोटा	6	1	2	9	25	2	2	29	31	3	4	38
24	नागौर	10	2	2	14	25	3	2	30	35	5	4	44
25	पाली	20	6	5	31	39	6	5	50	59	12	10	81
26	प्रतापगढ़	18	5	3	26	25	5	4	34	43	10	7	60
27	राजसमंद	22	4	3	29	21	4	3	28	43	8	6	57
28	सवाई माधोपुर	14	3	7	24	21	4	8	33	35	7	15	57
29	सीकर	10	6	4	20	56	6	5	67	66	12	9	87
30	सिरोही	25	16	13	54	104	17	14	135	129	33	27	189
31	श्रीगंगानगर	320	85	3	408	31	7	0	38	351	92	3	446
32	टोंक	20	20	20	60	200	55	58	313	220	75	78	373
33	उदयपुर	20	9	8	37	65	10	8	83	85	19	16	120
योग		**1656**	**519**	**325**	**2500**	**1778**	**373**	**349**	**2500**	**3434**	**892**	**674**	**5000**

आवंटित लक्ष्यों के अनुसार किसी जिलें विशेष में प्राप्ति/मॉग न होने की स्थिति मे लक्ष्यों का हस्तातंरण मांग अनुसार अन्य जिलों को किया जा सकेगा। लक्ष्यों की प्राप्ति में कृषक श्रेणी अनुसूचित जाति व अनुसूचित जनजाति को वांछित लाभ प्रदान किया जावें।

5. अनुदान पत्रावलियों के साथ लगाये जाने वाले दस्तावेज–

1. आवेदन–पत्र मय लाभार्थी की पासपोर्ट साईज फोटो (संलग्नक–1)
2. कृषक का आधार कार्ड/भामाशाह कार्ड की छाया प्रति
3. कृषक शपथ–पत्र (संलग्नक–2 अ एवं 2 ब)
4. आवेदन पात्रता सत्यापन प्रमाण–पत्र (सलग्नक –3 ब)
5. सौर पम्प हेतु कार्यदार्यी फर्म द्वारा तकनीकी रिपोर्ट (सलग्नक –3 स)
6. सम्बन्धित डिस्कॉम मे कृषि कनेक्शन प्राप्त करने की सूची में अंकन होने या न होने का प्रमाण–पत्र (सलग्नक –3 द I, II)
7. भूमि की जमाबंदी या पासबुक की प्रतिलिपि (भू–स्वामित्व)
8. सिंचाई स्त्रोत
9. त्रि–पार्टी अनुबन्ध (संलग्नक–4)
10. सूचीबद्ध आपूर्तिकर्त्ता फर्म का बिल/ प्रफोर्मा इनवॉइस/ कॉटेशन एवं डिजाईन मेप

6. पम्प क्षमता निर्धारण व तकनीकी मापदण्ड

1. 0.5 हैक्टेयर व इससे अधिक का भू स्वामित्व : 3 HP

2. 1.00 हैक्टेयर व इससे अधिक का भू–स्वामित्व : 5 HP
3. अधिक भू–स्वामित्व के कृषकों द्वारा कम क्षमता पम्प की मांग होने पर तदानुसार क्षमता का संयंत्र दिया जा सकता है।
4. संयंत्रो के तकनीकी मापदण्ड एवं विभिन्न पम्पस् वांछित जल डिस्चार्ज मापदण्ड एमएनआरई के वर्ष 2017–18 के दिशा–निर्देशानुसार एवं ईओआई की शर्तो (स्कोप ऑफ वर्क) के अनुसार रहेगें।
5. राज्य के डार्क जोनस् में सर्वे के अनुसार पूर्व में स्थापित नलकूप/ कुओं पर ही सौर उर्जा पम्प संयंत्र देय होगें। नए नलकूप /कुओं हेतु सक्षम स्तर पर अनुमति लिये जाने के उपरान्त ही सौर उर्जा पम्प संयंत्र की पत्रावली ली जावेगी।
6. सतही जल स्त्रोत जिसमें डिग्गी, सामुदायिक पोण्ड, जल हौज आदि के लिये तकनीकी रूप से 3 एचपी के सौर उर्जा पम्प सयंत्र सही कार्य करते है, इस कारण से सतही जल स्त्रोतों पर 3 एचपी के सौर उर्जा पम्प सयंत्र ही स्थापित करवाये जावेगे।
7. कृषक का खेत जहां पर वह सौर उर्जा पम्प सयंत्र स्थापित करवाना चाहता है, वह ग्रिड (पावर हाउस) से कम से कम 300 मीटर दूरी पर होना आवश्यक है।

7. सूचीबद्व आपूर्तिकर्त्ता फर्म

परियोजना के क्रियान्वयन हेतु चालू वित्तीय वर्ष के दौरान सूचीबद्व आपूर्तिकर्ता फर्मस् का चयन प्रक्रियाधीन है जो कि शीध्र सूचित किया जावेगा।

8. अनुदान

1. सोलर पम्प परियोजना हेतु आधार दर का 70/65/55/50 प्रतिशत अनुदान देय होगा।
2. परियोजना के तहत जवाहर लाल नेहरू राष्ट्रीय सौर मिशन (JLNNSM) से देय अनुदान वर्ष 2017–18 हेतु नवीन एवं नवीकरणीय ऊर्जा मंत्रालय (MNRE), भारत सरकार द्वारा 3 एचपी पर 25 प्रतिशत व 5 एचपी पर 20 प्रतिशत अनुदान देय है एवं 3 एचपी व 5 एचपी के संयंत्रों पर राज्य योजना अन्तर्गत 30/45 प्रतिशत अतिरिक्त अनुदान देय होगा।
3. अनुदान का कृषक श्रेणीवार विस्तृत विवरण दिशा–निर्देशो के बिन्दु संख्या 3 पर दिया गया है।
4. नवीन एवं नवीकरणीय ऊर्जा मंत्रालय (MNRE), भारत सरकार के वर्ष 2017–18 के दिशा–निर्देशानुसार सौर उर्जा पम्प सयंत्रों पर अनुदान केवल उन्हीं कृषकों को दिया जाना प्रस्तावित है जिनके पास डीजल पम्प सेट है या ऊर्जा का अन्य कोई स्त्रोत सिंचाई हेतु नही है। जिन कृषकों के पास पूर्व में कृषि विद्युत कनेक्शन है/ पूर्व में सौर पम्प परियोजना अन्तर्गत अनुदान प्राप्त कर किया है उन्हें कोई अनुदान देय नही होगा।

9. आधार दर

वित्तीय वर्ष 2017–18 हेतु आधार दरों का निर्धारण प्रक्रियाधीन है। विभाग द्वारा शीघ्र ही आधार दर जारी कर दी जायेगी।

10. अनुदान प्रक्रिया

1. सोलर पम्प सेट हेतु उद्यान विभाग या RHDS से सूचीबद्व/अनुमोदित फर्म द्वारा स्थापना पर ही अनुदान देय होगा।
2. कृषक द्वारा निर्धारित आवेदन पत्र मय वांछित दस्तावेज सम्बन्धित क्षेत्र के कृषि/उद्यान विभाग कार्यालय में स्वयं/कृषि पर्यवेक्षक/सहायक कृषि अधिकारी/बैंक/आपूर्तिकर्ता डीलर/आपूर्तिकर्त्ता फर्म के माध्यम से प्रेषित किया जावें। आपूर्तिकर्ता चयन सम्बन्धित कृषक स्तर से किया जावेगा।
3. आवेदन के समय कृषक द्वारा पम्प क्षमता/ माउन्टिग ढांचे का प्रकार (मेन्यूअल ट्रेकर /ऑटो ट्रेकर) तथा फेन्सिग अनिवार्य एवं डोमेस्टिक लाईटिंग सिस्टम का विकल्प आवश्यक रूप से प्रदान किया जायेगा।
4. राज्य के डार्क जोनस् में पूर्व में स्थापित नलकूप/कुओं पर ही सौर उर्जा पम्प संयंत्र स्थापना पर अनुदान देय होगा।
5. कृषक द्वारा आवेदन पत्र के साथ आवश्यक दस्तावेजों के अलावा पात्रता सत्यापन प्रमाण पत्र एवं विद्युत विभाग द्वारा जारी प्रमाण–पत्र/ कृषि विद्युत कनेक्शन नही होने का शपथ–पत्र 50 रू. नॉन–ज्यूडिशियल स्टाम्प (50/55 प्रतिशत अनुदान श्रेणी के लिए) निर्धारित प्रपत्र में सलग्न करना होगा, ताकि संयत्र स्थापना प्रक्रिया में विलम्ब ना हो।
6. जिला उद्यान अधिकारी द्वारा सौर उर्जा आधारित पम्प परियोजना के अन्तर्गत चयनित कृषको को पत्र द्वारा सूचित किया जायेगा एवं कृषको की सूची कार्यालय नोटिस बोर्ड पर चस्पा की जावेगी।
7. अनुमोदित सूची के अनुसार जिला होर्टिकल्चर डवलपमेन्ट सोसायटी (DHDS) द्वारा चयनित कृषक से आपूर्तिकर्ता कार्यदायी फर्म का कोटेशन प्रस्तुत करने के उपरान्त, प्रशासनिक स्वीकृति निर्धारित प्रपत्र (संलग्न 5) मे निकाली जावेगी। प्रशासनिक स्वीकृति की प्रति तत् दिवस को उद्यान निदेशालय, खण्डीय उप निदेशक उद्यान व सम्बन्धित आपूर्तिकर्ता फर्म को फैक्स/ई–मेल द्वारा प्रेषित की जावेगी।
8. प्रशासनिक स्वीकृति उपरांत कृषक हिस्सा राशि कृषक द्वारा केवल जिला होर्टिकल्चर डवलपमेन्ट सोसायटी (DHDS) को जमा कराई जायेगी। इस दौरान संयंत्र प्रदाता द्वारा साईट का विस्तृत सर्वेक्षण कार्य सम्पन्न किया जावेगा।
9. चयनित कृषक द्वारा कृषक हिस्सा राशि, केवल जिला होर्टिकल्चर डवलपमेन्ट सोसायटी (DHDS) को जमा कराने के उपरांत DHDS स्तर से कार्यादेश जारी किया जायेगा (संलग्नक –6)।
10. सम्बन्धित् जिला इकाई द्वारा कार्यादेश के साथ जारी कृषक हिस्सा राशि (बैंक गारण्टी प्रस्तुत करने पर) का स्वीकृति क्रमांक, दिनांक एवं राशि का विवरण कार्यादेश में अंकित किया जावें।
11. सम्बन्धित् जिला इकाई द्वारा कार्यदायी फर्म के पक्ष में कार्यादेश जारी करने उपरांत कार्यदायी फर्म द्वारा (अधिकतम 45 दिवस) माल–आपूर्ति की जावेगी।
12. सम्बन्धित जिलाधिकारी द्वारा निदेशालय को सामान–आपूर्ति का सत्यापन कर सूचना निर्धारित प्रपत्र (परिशिष्ठ 7-I & II) मे भिजवाना होगा ताकि सामान–आपूर्ति का अनुदान भुगतान किया जा सकें।
13. सम्बन्धित सूचीबद्ध आपूर्तिकर्ता फर्म द्वारा स्थापन कार्य (कार्यादेश जारी होने के 45 दिवस में आपूर्ति व 20 दिन में स्थापन्न कार्य) सम्पन्न करना होगा।

14. DHDS स्तर से संयंत्र स्थापना के 7 दिवस में संयंत्र का निर्धारित प्रपत्र अनुसार भौतिक सत्यापन किया जावें (संलग्न 8 I & II)। भौतिक सत्यापन की आवश्यकता के अनुसार निदेशालय स्तर से अतिरिक्त दलों का गठन किया जा सकेगा।
15. भौतिक सत्यापन की रिपोर्ट संबंधित जिला इकाईयों द्वारा निर्धारित प्रपत्र (परिशिष्ठ– 9, 8 I & II) मे निदेशालय को प्रस्तुत की जावेगी। जिससे अंतिम चरण का अनुदान भुगतान सम्पन्न किया जा सकें।
16. सौर उर्जा पम्प परियोजना के प्रचार– प्रसार को बढावा देने व तकनीकी पहलुओं की जानकारी देने हेतु कृषि अनुसंधान केन्द्र/कृषि विज्ञान केन्द्र/राजहंस नर्सरी/ सरकारी कृषि फार्म पर भी सौलर पम्प स्थापित करने पर नियमानुसार अनुदान देय होगा।

11. कृषक हिस्सा एवं अनुदान राशि का भुगतान

1. भुगतान – DHDS/उद्यान निदेशालय द्वारा सम्बन्धित् आपूर्तिकर्ता फर्म को 2 चरणों में किया जावेगा –

   (अ) कार्यादेश के साथ DHDS (जिला होर्टीकल्चर डवलपमेंट सोसायटी) में जमा कृषक हिस्सा राशि का अग्रिम भुगतान केवल 90 दिन की बैंक गारन्टी के विरूद्व ही देय होगा। सूचीबद्व आपूर्तिकर्ता द्वारा 90 दिन की बैंक गारन्टी कृषक हिस्सा राशि के बराबर जिला होर्टीकल्चर डवलपमेंट सोसायटी के नाम जिला कार्यालय में जमा करवानी होगी।
   सूचीबद्व आपूर्तिकर्ता द्वारा बैंक गारन्टी नही देने पर कृषक हिस्सा राशि का भुगतान सौर उर्जा पम्प सयंत्र की माल आपूर्ति पर DHDS (जिला होर्टीकल्चर डवलपमेंट सोसायटी) द्वारा किया जावेगा।

   (ब) संयंत्र आपूर्तिकर्ता द्वारा सयंत्र के पांच वर्ष सही संचालन की गारण्टी के पेटे संयंत्र लागत की 10 प्रतिशत बैंक गारण्टी के रूप मे उद्यान निदेशालय को प्रस्तुत करने पर एवं कृषक के खेत पर माल–आपूर्ति उपरांत उद्यान निदेशालय द्वारा सयंत्र की आधार लागत का राज्य योजना से अतिरिक्त अनुदान (45/30 प्रतिशत) का भुगतान देय होगा।
   माल–आपूर्ति पर अधिकतम भुगतान, आधार लागत का 80 प्रतिशत तक, जो कि कृषक हिस्सा राशि (DHDS द्वारा देय) एवं अनुदान राशि (RHDS द्वारा देय) को मिलाकर हो सकता है।

   (स) अंतिम भुगतान जो कि आधार लागत का 25/20 प्रतिशत होगा (जेएनएनएसएम मद से MNRE के दिशा–निर्देशानुशार) उद्यान निदेशालय द्वारा निम्नानुसार सौर उर्जा पम्प सयंत्र की सफल स्थापना उपरांत देय होगा :–

   1. कृषक खेत पर सफलता पूर्वक सयंत्र स्थापन कार्य पूर्ण करने पर।
   2. निर्धारित दल द्वारा सौर उर्जा पम्प संयंत्र का भौतिक सत्यापन करने पर।

12. भौतिक सत्यापन

1. माल–आपूर्ति व सफलतापूर्वक स्थापन कार्य का भौतिक सत्यापन 7 दिवस में किया जावे।
2. माल–आपूर्ति का भौतिक सत्यापन सहायक कृषि अधिकारी/ कृषि अधिकारी/ सहायक निदेशक/ उपनिदेशक स्तर के कम से कम एक अधिकारी द्वारा किया जावें।

3. कृषि पर्यवेक्षक द्वारा माल–आपूर्ति का भौतिक सत्यापन करने पर सहायक निदेशक/ उपनिदेशक स्तर के कम से कम एक अधिकारी द्वारा प्रति हस्ताक्षरित की जावें।
4. स्थापित संयंत्र के भौतिक सत्यापन 3 सदस्यीय दल द्वारा किया जावेगा। इसमें कृषि/ उद्यान विभाग के सहायक कृषि अधिकारी स्तर या इससे उपर के दो अधिकारी तथा एक सदस्य अभियन्ता RRECL /उर्जा विभाग/ ग्रामीण विकास विभाग/ जिला कलेक्टर द्वारा नामित सहायक अभियंता /RHDS द्वारा नामित होगा।
5. भौतिक सत्यापन यथासम्भव उपनिदेशक कृषि/ उद्यान या सहायक निदेशक कृषि/ उद्यान की उपस्थिति में हो।
6. स्थापित सौर उर्जा पम्प सयंत्र की फोटो में भौतिक सत्यापन दिनांक अंकित करें एवं सौर उर्जा पम्प सयंत्र की भौतिक सत्यापन रिपोर्ट के साथ सूक्ष्म सिंचाई सयंत्र की फोटों भी सत्यापित कर भिजवाया जाना सुनिश्चित करावें।
7. भौतिक सत्यापन हेतु सहायक कृषि अधिकारी स्तर के साथ इससे उपर के कृषि विभाग/ जिला परिषद् के अधिकारी भी अधिकृत होंगे।
8. कार्य अधिकता एवं कार्य को गति प्रदान करने के प्रयोजनार्थ इस हेतु RHDS स्तर से विशेषज्ञ सेवायें हायर की जा सकती है।

13. सूचीबद्ध आपूर्तिकर्ता के दायित्व

1. सूचीबद्ध आपूर्तिकर्ता के अधिकृत इंजिनियर द्वारा कृषक का विस्तृत सर्वे किया जाकर संयंत्र स्थापन का तकनीकी ड्राइंग/डिजाईन तैयार किया जावेगा।
2. आपूर्तिकर्ता द्वारा कृषक को संयंत्र संचालन एवं रखरखाव का मैन्यूअल प्रदान किया जावेगा एवं संयंत्र के समग्र बिन्दुओ पर कृषक प्रशिक्षण आयोजित किया जावेगा।
3. डिजाईन के अनुसार सिविल कार्य सम्पन्न कराया जावेगा।
4. आपूर्तिकर्ताओं द्वारा प्रस्तुत सौर ऊर्जा आधारित पम्प परियोजना के मॉडयूल माउंटिग ढांचे की डिजाईन प्रचलित वायु, वेग, लोड को तकनिकी रूप से सहन करने योग्य हो।
5. सौर उर्जा पम्प सयंत्र स्थापना से पूर्व सम्बन्धित कम्पनी द्वारा कृषक के पानी के जल स्तर /उपलब्धता का निर्धारण अपने विशेषज्ञ से करवाकर यह सुनिश्चित करेगी की किस क्षमता का पम्प सैट लगाया जावें, पम्प का चुनाव /स्थापन उपरान्त निर्धारित मात्रा में पानी का डिस्चार्ज नही होने पर कम्पनी की जिम्मेदारी होगी। (संलग्न– 3स)
6. संयंत्र के पार्टस जवाहर लाल नेहरू राष्ट्रीय सौर उर्जा मिशन के मापदण्डों के अनुसार होगें।
7. सौर पेनल/ मॉड्यूल 200 WP या इससे अधिक क्षमता के होंगे।
8. आपूर्तिकर्ता प्रत्येक आपूर्ति किये जाने वाले मॉड्यूल/पेनल का IV-Curve DHDS को प्रस्तुत करेगा।
9. सूचीबद्व आपूर्तिकर्ता द्वारा आपूर्ति किये जाने वाले संयंत्र में या साथ रिमोट मोनिटरिंग सिस्टम अनिवार्य रूप से दिया जायेगा।
10. आपूर्तित माल का पूर्ण विवरण व मापदण्ड, डिजाईन व तकमिना सम्बन्धित जिला इकाई को उपलब्ध कराना होगा।
11. सूचीबद्व आपूर्तिकर्ता द्वारा निदेशालय स्तर के दल से प्री–डिस्पेंच निरीक्षण करवाया जाना अनिवार्य होगा।
12. सूचीबद्व आपूर्तिकर्ता द्वारा प्री–डिस्पेंच निरीक्षण के लिये 15 दिवस पूर्व निदेशालय को सूचित करना होगा व MNRE के नवीनतम दिशा–निर्देशानुसार व EOI (ईओआई) की

शर्तो के अनुसार सौर ऊर्जा पम्प सयंत्रों के आपूर्ति किये जाने वाले सामान की टेस्ट–रिपोर्ट प्रस्तुत करनी होगी।

13. Outsourcing किए गये सामान के स्त्रोत की स्पष्ट जानकारी सूचीबद्व आपूर्तिकर्ता द्वारा दी जायेगी।
14. कार्यादेश /प्रशासनिक स्वीकृति के 45 दिवस मे संयंत्र माल आपूर्ति एवं 20 दिवस मे स्थापन कार्य सम्पन्न करना होगा। निर्धारित अवधि मे बिना किसी युक्ति संगत कारण के विलम्ब की स्थिति मे नियमानुसार पैनल्टी अंतिम भुगतान में (45+20=**65**) लागू होगी।
15. संयंत्र की पांच वर्ष की गारण्टी तथा इसके पश्चात् आगामी पांच वर्ष हेतु विक्रय पश्चात् सेवा (After sales service) प्रदान की जावेगी।
16. सूचीबद्व आपूर्तिकर्ता/फर्म द्वारा कृषक के खेत पर स्थापित सोलर पम्प संयंत्र की फेन्सिंग (निर्धारित मापदण्ड अनुसार) का कार्य एवं बीमा करवाया जायेगा। आपूर्तिकर्ता फर्म द्वारा बीमा से सम्बन्धित प्रकिया में देरी होने की स्थिति में स्वंय अपने स्तर पर कृषक की समस्या का समाधान 7 दिवस में अनिवार्य रूप से किया जाना सुनिश्चित करें।
17. संयत्र आपूर्तिकर्ता द्वारा सभी स्टेक होल्डर्स (RHDS/DHDS/कृषक) को सर्विस सेंटर की जानकारी उपलब्ध करवानी होगी।
18. संयंत्र संचालन व रखरखाव सम्बन्धी साहित्य पुस्तिका (मैन्युअल) जो कि कृषक सुलभ हिन्दी भाषा मे हो, लाभार्थियों को प्रदान की जावेगी।
19. संयत्र आपूर्तिकर्ता द्वारा कस्टमर केयर सेन्टर स्थापित किया जावेगा तथा टोल फ्री नबंर की जानकारी प्रत्येक स्टेक होल्डर को उपलब्ध करानी होगी।
20. विगत् वर्षो के साथ–साथ चालू वित्तीय वर्ष के दौरान स्थापित कुल संयंत्रो की संख्या जिला विशेष मे 100 या इससे अधिक होने की स्थिति मे सम्बन्धित जिला मुख्यालय पर कस्टमर केयर सेन्टर स्थापित किया जाना आवश्यक होगा। इस केन्द्र पर कम से कम एक तकनिकी व्यक्ति रखा जायेगा जिसके नाम, मोबाईल नम्बर व पता सम्बन्धित जिला इकाई, लाभार्थी व वेबसाईट पर उपलब्ध कराना होगा।
21. अगर कार्यदायी फर्म द्वारा राजस्थान मे विगत् वर्षो सहित चालु वित्तीय वर्ष तक 500 या इससे अधिक संयंत्र कर लिये है तो जयपुर मुख्यालय पर कस्टमर केयर सेन्टर स्थापित करना होगा जिसमे कम से कम 5 तकनिकीकर्मी होगे। इनके नाम, मोबाईल नम्बर व पते सम्बन्धित कृषक, जिला इकाई, मुख्यालय तथा वेबसाईट पर उपलब्ध कराना होगा।
22. स्थापित किये जाने वाले संयंत्रो के डाटा आवश्यकतानुसार विभागीय वेबसाईट पर अपलोड करने होगे। ये डाटा प्रत्येक महीने के प्रथम दिवस तथा नये संयंत्र स्थापन के दस दिवस मे आवश्यक रूप से अद्यतन (अपडेट) किया जावेगा।
23. कार्यदायी फर्म द्वारा स्थापित संयंत्रो का प्रत्येक तिमाही (अप्रैल–जुन, जुलाई–सितम्बर, अक्टूबर–दिसम्बर व जनवरी–मार्च) के दौरान निरीक्षण करना होगा तथा इसकी सूचना जिला इकाई को प्रस्तुत करनी होगी।
24. कार्यदायी फर्म द्वारा कृषकों को रखरखाव (मेन्टीनेंस) व योजना सम्बन्धी जानकारी प्रदान की जावेगी।
25. कार्यदायी फर्मस के स्तर से रखरखाव सम्बन्धी Clauses की गम्भीरता से पालना सुनिश्चित की जावेगी। जिससे लाभार्थियों को संयंत्र मे किसी प्रकार के फाल्ट की स्थिति मे इधर–उधर चक्कर न काटना पडें।

26. किसी प्रकार के फाल्ट की सूचना डाक, टेलीफोन, फैक्स, ई–मेल या अन्य तरीके से प्राप्त होने की स्थिति में तीन कार्य दिवसों मे आवश्यक रूप से साईट भ्रमण आदि जरिये से इस पर कार्यवाही की जावेगी।
27. कार्यदायी फर्म से अपेक्षा की जाती है कि वह समुचित मात्रा मे स्पेयर पार्ट का स्टॉक रखे जिससे की संयंत्र शिकायत के 5 दिवस मे आवश्यक रूप से पुनः चालु किया जा सकें।
28. संयंत्रो के रखरखाव कार्य के विफलता की स्थिति में फर्म की बैंक गारण्टी रिवोक की जा सकेगी तथा पॉच या इससे अधिक संयंत्रो के रखरखाव की विफलता पर फर्म को काली सूची मे डाले जाने की कार्यवाही की जा सकेगी, जिसके निर्णय का अंतिम अधिकार मिशन निदेशक, या सदस्य सचिव, RHDS को होगा।

14. कृषक के दायित्व

1. आवेदन–पत्र के साथ आवश्यक दस्तावेज प्रस्तुत करना तथा HDS कार्यालय में प्रशासनिक स्वीकृति उपरान्त कृषक हिस्सा राशि जमा करवाना।
2. संयंत्र की माल आपूर्ति एवं स्थापन हेतु स्थल (छाया रहित कम से कम 60 वर्ग.मी.) एवं जल स्त्रोत उपलब्ध करवाना।
3. भौतिक सत्यापन व अन्य निरीक्षण के समय लाभार्थी यथासम्भव स्वंय या अन्य परिवार के जिम्मेदार सदस्य की उपस्थिति सुनिश्चित करेगा।
4. संयंत्र का बीमा कार्यदायी फर्म द्वारा करवाया जायेगा। सौलर पम्प सयंत्र के उचित रख– रखाव एवं सुरक्षा की समस्त जिम्मेदारी कृषक की होगी।
5. स्थापित सौर पम्प संयंत्र का संचालन कृषक द्वारा विद्युत/बिजली कनेक्शन से नही किया जावेगा, पाये जाने की स्थिति में कार्यवाही अमल में लायी जावेगी।
6. कृषक द्वारा संयंत्र के खुर्द–बुर्द करने की स्थिति में सम्बन्धित कृषक के विरूद नियमानुसार विधिक कार्यवाही अमल मे लायी जावेगी तथा संयंत्र हेतु जारी की गई अनुदान राशि वसूली योग्य होगी।
7. त्रि–पार्टी अनुबन्ध।

15. योजना की रिमोट मॉनिटरिंग –

योजना की मॉनिटरिंग हेतु एमएनआरई द्वारा जारी दिशा–निर्देशानुसार सूचीबद्व आपूर्तिकर्ता द्वारा संयंत्र स्थापना के साथ रिमोट मोनेटरिंग सिस्टम आवश्यक रूप से स्थापित करना होगा। रिमोट मॉनिटरिंग सिस्टम सौर उर्जा पम्प स्थापना का आवश्यक अंग होगा व इसके बिना सूचीबद्व आपूर्तिकर्ता फर्म को अनुदान देय नही होगा। राज्य एवं जिला स्तर पर रिमोट मॉनिटरिंग सिस्टम से पम्प संचालन सम्बन्धी आवश्यक सूचनाओं की मॉनिटरिंग हेतु पासवर्ड सूचीबद्व आपूर्तिकर्ता फर्म द्वारा विभाग को उपलब्ध कराने होगें।

(Provision for remote monitoring of the installed pumps must be made in the controllers or the inverters either through an integral arrangement or through an externally fitted arrangement. It should be possible to ascertain the daily water output, the power generated by the PV array, the UP TIME of the pump during the year, Number of days the pump was unused or under breakdown/repairs.)

Annexure X

Comments on the Draft Report received from

Agro-Economic Research Centre, Gokhale Institute of Politics and Economics (Deemed University), Pune, Maharashtra

Comments on draft report

1.	Title of report	"Solarisation of Agricultural Water Pumps in Rajasthan, AERC Report No. 173"
2.	Date of receipt of the Draft report	January 21, 2019
3.	Date of dispatch of the comments	January 30, 2019
4.	Comments on the Objectives of the study	Objectives of the study have been satisfied.
5.	Comments on the methodology	Primary and Secondary data have been used and analysed
6.	Comments on analysis, organization, presentation etc.	The study is a very good attempt to understand solarisation of Agricultural Water Pumps in Rajasthan. However the following may be noted: (a) In chapter 3, in last column, in case of Tables 3.1 to 3.4, "Total" may be replaced by "Average". (b) In Table 3.3 Percentage may be written against (A) and (B). (c) In Table 3.4 the average operational landholding size is shown as 2.74 ha. However, a simple average of three groups may not be proper as sample size of non-beneficiaries is 5 and non-adopters is 20 while sample size of beneficiaries is 100. Hence addition of operational holding of 125 sample households and dividing by 125 will give the correct average

size of operational holding.

(d) Table 3.5 shows decline in cropping intensity of sample beneficiaries from 158.55 percent before solarisation to 155.94 percent after solarisation. However on p 71, it is mentioned that there is 17 percent increase in gross cropped area .... Wheat, maize showed increase ..However, it is observed that share of wheat in gross cropped area declined from 18.49 percent before solarisation to 16.75 percent after solarisation. In this context it would be useful to show actual Net Sown Area and Gross Cropped Area of sample households before and after solarisation.

(e) On p 83, the expenditure on diesel and electric pumpsets is indicated. The time period over which this expenditure is incurred must be specified.

(f) The actual increase in income of beneficiaries and non-beneficiaries before and after solarisation must be indicated, if possible as this will strengthen the case for solarisation. This per hectare income can be compared with the per hectare income of non-adopters.

7. References: Major references covered

8. General remarks: The study is a comprehensive study on solar pumps in Rajasthan and appropriate policy measures have been suggested.

9. Overall view on acceptability of report: The report is acceptable and with suitable changes as suggested the report can be strengthened and then treated as final.

Annexure XI

Action taken by the authors based on the comments received from the Coordinator of the study.

- All the comments made by the Coordinator of the study have been addressed at the appropriate places in this final report.

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