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MINISTRY OF AGRICULTURE
Department of Agriculture and Cooperation
(Mechanization & Technology Division)

Room No. 298, Krishi Bhawan, New Delhi.
Dated the 9th July, 2015

To

Principal Secretaries (Agriculture) , Director of Agriculture of all
State Governments, Director of Agricultural Engineering (M.P. ,
T.N.)

Subject : **Inclusion of Solar Photovoltaic (SPV) Water Pumping
System in operational guidelines of Sub Mission on
Agricultural Mechanization (SMAM) - reg.**

Sir/Madam

I am directed to enclose herewith a copy of operational guidelines
for financial assistance to promote Solar Photovoltaic Water Pumping
System under the component no. 3 of Sub Mission on Agricultural
Mechanization (SMAM). The same are also available on the website
<http://farmech.gov.in/SMAM/Guidelines%20of%20SMAM1.pdf>

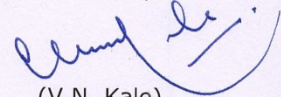
2. All the State Governments are requested that Solar Photovoltaic
Water Pumping System may be promoted in the States for the benefit of
the farmers.

3. The States those who are interested , they may submit the Annual
Action Plan upto Rs. 1 crore (Central Share) latest by 31st August, 2015
for financial assistance for promotion of SPV pumps. The funding pattern
between Central : State will be applicable as per SMAM norms i.e. 50:50.

This issues with the approval of competent authority.

Yours faithfully,

Encl: As above



(V.N. Kale)

Additional Commissioner (M&T)

Tele: 23387200

E.mail: kalevn2000@yahoo.co.in

Copy to :-

1. To All FMTTIs
2. DDG (Engg) , ICAR
3. Associations AMMA, TMA, PTMA, CHMA

Sub Mission on Agricultural Mechanization (SMAM)**Component 3: Financial Assistance for procurement of Agril. Machinery & Equipments**

Type of Agriculture Equipment	For SC,ST,Small & marginal Farmers, women and NE states beneficiaries	For other Beneficiaries
Solar photovoltaic (SPV) Water pumping systems	Maximum permissible subsidy*	Maximum permissible subsidy *
<p>Deep well (Submersible) Solar photovoltaic (SPV) Water pumping systems with A.C Induction Motor pump Set and a suitable inverter</p> <p>Model I</p> <ol style="list-style-type: none"> 1. PV Array 1200 Wp 2. Dynamic Head 45 meter 3. Water output 38000l/ day 4. MS hot dipped galvanized, three times manual tracking facilities 5. Motor 1.3 hp (approx) <p>Model II</p> <ol style="list-style-type: none"> 1. PV Array 1800 Wp 2. Dynamic Head 45 meter 3. Water output 57000l/ day 4. MS hot dipped galvanized, three times manual tracking facilities 5. Motor 2 hp <p>Model III</p> <ol style="list-style-type: none"> 1. PV Array 3000 Wp 2. Dynamic Head 70 meter 3. Water output 57000l/ day 4. MS hot dipped galvanized, three times manual tracking facilities 5. Motor 3.3 hp <p>Model IV</p>	<p>AC Pumps</p> <p>Up to 2 hp : Rs 55,440 per hp >2 to 5 hp: Rs 47,5200 per hp</p>	<p>AC Pumps</p> <p>Up to 2 hp : Rs 50,400per hp >2 to 5 hp: Rs 43200 per hp</p>

<ol style="list-style-type: none"> 1. PV Array 4800 Wp 2. Dynamic Head 70 meter 3. Water output 91000l/ day 4. MS hot dipped galvanized, three times manual tracking facilities 5. Mptor 5 hp 		
<p>Shallow well Solar photovoltaic (SPV) Water pumping systems with A.C Induction Motor pump Set and a suitable inverter</p> <p>Model I</p> <ol style="list-style-type: none"> 1. PV Array 900 Wp 2. Dynamic Head 12meter 3. Water output 81000l/ day 4. Motor capacity 1 hp <p>Model II</p> <ol style="list-style-type: none"> 1. PV Array 1800 Wp 2. Dynamic Head 15 meter 3. Wateroutput 1,62000l/day 4. Motor capacity 2 hp <p>Model III</p> <ol style="list-style-type: none"> 1. PV Array 2700 Wp 2. Dynamic Head 25 meter 3. Wateroutput 1,35000l/day 4. Motor capacity 3 hp 	<p>AC Pumps Up to 2 hp : Rs 55,440 per hp >2 to 5 hp: Rs 47,520 per hp</p>	<p>AC Pumps Up to 2 hp : Rs 50,400per hp >2 to 5 hp: Rs 43,200 per hp</p>
<p>Deep well (Submersible) Solar photovoltaic (SPV) Water pumping systems with D.C Motor pump Set with Brushes or Brush less DC</p> <p>Model I</p> <ol style="list-style-type: none"> 1. PV Array 1200 Wp 2. Dynamic Head 45 meter 3. Water output 42000l/ day 4. MS hot dipped galvanized, three times manual tracking facilities 5. Motor capacity 1.3 hp <p>Model II</p> <ol style="list-style-type: none"> 1. PV Array 1800 Wp 	<p>DC Pump Up to 2 hp : Rs 63,360 per hp >2hpto 5 hp: Rs59,400per hp</p>	<p>DC Pump Up to 2 hp : Rs 57,600 per hp >2hpto 5 hp: Rs 54,000 per hp</p>

<ul style="list-style-type: none"> 2. Dynamic Head 45 meter 3. Water output 63000l/ day 4. MS hot dipped galvanized, three times manual tracking facilities 5. Motor capacity 2 hp <p>Model III</p> <ul style="list-style-type: none"> 1. PV Array 3000 Wp 2. Dynamic Head 70 meter 3. Water output 63000l/ day 4. MS hot dipped galvanized, three times manual tracking facilities 5. Motor capacity 3hp <p>Model IV</p> <ul style="list-style-type: none"> 1. PV Array 4800 Wp 2. Dynamic Head 70 meter 3. Water output 100000l/ day 4. MS hot dipped galvanized, three times manual tracking facilities 5. Motor capacity 5hp 		
<p>Shallow well Solar photovoltaic (SPV) Water pumping systems with D.C Motor pump Set with Brushes or Brush less DC</p> <p>Model I</p> <ul style="list-style-type: none"> 1. PV Array 900 Wp 2. Dynamic Head 12meter 3. Water output 90000l/ day 4. Motor 1 hp <p>Model II</p> <ul style="list-style-type: none"> 1. PV Array 1800 Wp 2. Dynamic Head 15 meter 3. Water output 1,80,000l/ day 4. Motor Capacity 2 hp <p>Model III</p> <ul style="list-style-type: none"> 1. PV Array 2700 Wp 2. Dynamic Head 25 meter 3. Wateroutput 1,48000l/day 4. Motor Capacity 3 hp 	<p>DC Pump Up to 2 hp : Rs 63,360 per hp >2hpto 5 hp: Rs59,400per hp</p>	<p>DC Pump Up to 2 hp : Rs 57,600 per hp >2hpto 5 hp: Rs 54,000 per hp</p>

*Capital subsidy is applicable on the system cost inclusive of installation, commissioning, transportation, insurance 5 years maintenance and taxes wherever applicable.

Beneficiaries: Individual farmer, SHG/UC of farmers/co-operative societies of farmers/FPO's/entrepreneurs

The pumps which will be supplied under Subsidy programmes must qualify as per IEC standard and performance as per the conditions laid down in the enclosed **Appendix** and tested and approved by one of IEC/NABL/MNRE accredited test labs

- (i) **National Institute of Solar Energy, Gurgaon.**
- (ii) **Electronic Quality and Development Center, Ahmedabad**

The similar Programme of Ministry of New and Renewable Energy, Government of India, is also implemented by the State Renewable Agency of respective States. To avoid the duplicity Agricultural Department of State Government may also consult to the State Renewable Agencies while selecting the beneficiary. The list of the beneficiary may be exchanged time to time within both the departments.

Minimum Technical Requirements for design , construction, test procedure and safety for Solar PV Modules and performance Standards for Solar PV pumping system up to 5 HP.

i. Test codes reference for Solar PV Modules

IEC 61215/IS14286 design qualification and type approval must confirm for crystalline Silicon Terrestrial Modules or

IES 61646/Equivalent IS under Development for thin Film Terrestrial Modules.

IEC 616730 part I &II for construction, testing procedure and safety qualification

Testing of Integrated unit of Solar Array and compatible pumping units for performance Test as given below:

II. PERFORMANCE SPECIFICATIONS AND REQUIREMENTS (DUTY CYCLE) up to 5 HP Solar PV pumping System

Solar PV Water Pumps with PV array capacity in the range of 200 Watt to 5 KWp could be installed on a suitable bore-well, open well, Water Reservoir, Water stream, etc.

Under the “Average Daily Solar Radiation” condition of 7.15 KWh’sq.m. on the surface of PV array (i.e coplanar with the PV Modules), the minimum water output from a Solar PV Water Pumping System at different “Total Dynamic Heads” should be as specified below.

For D.C.Motor Pump Set with Brushes or Brush Less D.C.(B.L.D.C):

- (i) 100 liters of water per watt peak of PV array, from a Total Dynamic Head of 10 metres (Suction head, if applicable, minimum of 7 metres) and with the shut off head being at least 12 metres.
- (ii) 55 liters of water per watt peak of PV array, from a Total Dynamic Head of 20 metres (Suction head, if applicable, up to a maximum of 7 metres) and with the shut off head being at least 25 metres.
- (iii) 35 liters of water per watt peak of PV array, from a Total Dynamic Head of 30 metres and the shut off head being at least 45 metres.
- (iv) 21 liters of water per watt peak of PV array, from a Total Dynamic Head of 50 metres and the shut off head being at least 70 metres.
- (v) 14 liters of water per watt peak of PV array, from a Total Dynamic Head of 70 metres and the shut off head being at least 100 metres.

For A.C. Induction Motor Pump Set with a suitable Inverter :

- (i) 90 liters of water per watt peak of PV array, from a Total Dynamic Head of 10 meters (Suction head, if applicable, minimum of 7 metres) and with the shut off head being at least 12 metres.

- (ii) 50 liters of water per watt peak of PV array, from a Total Dynamic Head of 20 metres (Suction head, if applicable, up to a maximum of 7 metres) and with the shut off head being at least 25 metres.
- (iii) 32liters of water per watt peak of PV array, from a Total Dynamic Head of 30 metres and the shut off head being at least 45 metres.
- (iv) 19 liters of water per watt peak of PV array, from a Total Dynamic. Head of 50 metres and the shut off head being at least 70 metres.
- (v) 13 liters of water per watt peak of PV array, from a Total Dynamic Head of 50 metres and the shut off head being at least 70 metres.

The actual duration of pumping of water on a particular day and the quantity of water pumped could vary depending on the solar intensity, location, season, etc.

Indicative performance specifications for the Shallow and Deep well SPV Water Pumping Systems are given in the Annexure-IIC and IID.

III. PV ARRAY

The SPV water pumping system should be operated with a PV array capacity in the range of 200 Watts peak to 5000 Water peak, measured under Standard Test Conditions (STC).

Sufficient number of modules in series and parallel could be used to obtain the required PV array power output. The power output of individual PV modules used in the PV array, under STC, should be a minimum of 74 Watts peak with adequate provision for measurement tolerances. Use of PV modules with higher power output is preferred.

Indigenously produced PV module(s) containing mono/multi crystalline silicon solar cells should be used in the PV array for the SPV Water Pumping systems.

- Modules supplied with the SPV water pumping systems should have certificate as per IEC 61215 specifications or equivalent National or International Standards.
- Modules must qualify to IEC 61730 Part I and II for safety qualification testing , be more than 70%.
- The terminal box on the module should have a provision for “Opening” for replacing the cable, if required.
- There should be a Name Plate fixed inside the module which will give :
 - C. Name of the Manufacturer or Distinctive Logo.
 - d. Model Number
 - e. Serial Number
 - f. Year of manufacture

IV. MOTOR PUMP-SET

The SPV water pumping systems may use any of the following types of motor pump sets:

1. Surface mounted motor pump-set (Upto 10 m head)
2. Submersible motor pump set
3. Floating motor pump set
4. Any other type of motor pump set after approval from Test Centers of the Ministry.

The “**Motor Pump Set**” should have a capacity in the range of 0.2 HP to 5 HP and should have the following features”

- The mono block DC /AC centrifugal motor pump set has its driving unit and impeller mounted on a common shaft, thereby giving it a perfect alignment. The pump should be provided with specially developed mechanical seals which ensure zero leakage.
- The motor is of 1.5 HP having spring loaded carbon brushes in case of D.C. Motor Pump Sets. The suction and delivery head will depend on the site specific condition of the field.
- Submersible pumps could also be used according to the technical need of the particular case
- The suction/delivery pipe (GI/HOPE) electric cables, floating assembly, civil work and other fittings required to install the system.
- The following details should be marked indelibly on the motor pump set:
 - a) Name of the Manufacturer or Distinctive Logo.
 - b) Model Number.
 - c) Serial Number.

V. MOUNTING STRUCTURES and TRACKING SYSTEM

The PV modules should be mounted on metallic structures of adequate strength and appropriate design, which can withstand load of modules and high wind velocities up to 150 km per hour. The support structure used in the pumping system should be hot dip galvanized iron with minimum 80 micron thickness.

To enhance the performance of SPV water pumping systems, manual or passive or auto tracking system must be used. For manual tracking, arrangement for seasonal tilt angle adjustment and three times manual tracking in a day should be provided.

VI. ELECTRONICS AND PROTECTIONS

- Maximum Power Point Tracker (MPPT) should be included to optimally use the Solar panel and maximize the water discharge.
- Inverter could be used, if required, to operate an A.C. Pump.
- Adequate protections should be incorporated against dry operation of motor Pump set, lightning, hails and storms. Full protection against open circuit, accidental short circuit and reverse polarity should be provided.

VII. PERFORMANCE SPECIFICATIONS AND WARRANTY

Solar PV Water Pumps with PV module capacity in the range of 200 Watt to 5 KWp may Solar PV Water Pumps with PV module capacity in the range of 200 Watt to 5 KWp may be installed on a suitable bore-well/open well/ Water Reservoir/Water stream etc. Indicative Performance Specifications for the Shallow and Deep well SPV Water Pumping Systems are given in the Annexure IIA to IID.

The PV Modules must be warranted for output wattage, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years. The whole system including submersible/surface pumps shall be warranted for 5 years. Required Spares for trouble free operation during the Warranty period should be provided along with the system.

IX. ON/OFF SWITCH

A good reliable switch for DC?AC use is to be provided with the motor pump set. Length of cable should be provided for inter connection between the PV array and motor pump set

X. OPERATION AND MAINTENANCE MANUAL

An Operation and Maintenance Manual, in English and the local language, should be provided with the solar PV pumping system. The Manual should have information should solar energy, photovoltaic, modules, DC/AC motor pump set, tracking system, monitoring structures, electronics and switches. It should also have clear instructions about mounting of PV module, DO's and DON'T's and on regular maintenance and Trouble Shooting of the pumping system. Name and address of the person or Centre to be contracted in case of failure or complaint should also be provided. A warranty card for the modules and the motor pump set should also be provided to the beneficiary.

XI. NOTES

- I. Wherever the "water table" or the level of water in reservoir or the water source (e.g. Diggee) from which the water is to be pumped, is within 10 m depth,"Surface motor pump sets" should be proffered.
- II. The type of pump sets used must match the total dynamic head requirement of the site (i.e. the location at which it is installed). Moreover, it should be appropriately tested and certified by the authorized testing centers of the Ministry to meet performance and water discharge norms specified in section II above.
- III. The beneficiary may select an appropriate model (i.e. capacity of PV array and type of motor pump set) as per the site requirement.
- IV. These are the specifications of the pumps up to 5 hp only, if supplier wants to supply pumps above 5-10 hp, he must get a report from Ministry from Ministry of IEC/NABL/MNRE accredited test labs according to supplier specifications

XII. IDENTIFICATION AND TRACEABILITY

Each PV module must be use RF identification Tag (RFID), which must contain the following information:

- i. Name of manufacturer of PV module
- ii. Name of the manufacturer of solar cells
- iii. Month and year of the manufacturing (Separately for solar cells and modules)
- iv. Country of origin (Separately for solar cells and modules)
- v. I-V curve for module
- vi. Peak wattage, I_m , V_m and FF of the module
- vii. Unique serial No and Model No of the module
- viii. Date and year of obtaining the IEC PV module qualification certificate
- ix. Name of the test lab issuing IEC certificate
- x. Other relevant information on traceability of solar cells and modules as per ISO 9000 series

XIII VALIDITY

The validity of test report/certificate of solar pump shall be five years from the date of its release.

XIV While applying for Testing, manufacturer has to give the following details:

- A copy of registration of the company particularly for the relevant product/component/PV system to be tested.
- An adequate proof from the manufacturer, actually showing that they are manufacturing product by the way production, testing and other facilities.
- Certification as per JNNSM standard from the other bought out the items used in the system without above proof test centers are advised not to accept the test samples.

XV. WARRANTY

The mechanical structures, electrical works including power conditioners/Inverters/charge controllers/ maximum power point etc and overall workmanship of the SPV power plants/ systems must be warranted against any manufacturing /design/ installation defects for a minimum period of 5 years.