Worked out specification for the 12.5HP and 15HP BLDC Pumps				
Pump Capacity	**Solar PV capacity**	**Head**	**LPW**	**Discharge**
(HP)	**(W)**	**(m)**	**(L/Wp/d)**	**(L/d)**
12.5	11250	50	23	258750
	11250	70	15	168750
	11250	100	10.5	118125
	11250	150	8.5	95625
	11250	200	6.5	73125
15	13500	50	23	310500
	13500	70	15	202500
	13500	100	10.5	141750
	13500	150	8.5	114750
	13500	200	6.5	87750

REMOTE MONITORING SYSTEM(RMS)

a. Solar System Performance: DC Voltage, DC current, AC output Current, Power, Drive frequency, Energy, etc.

b. Pump Performance: Running Hours, Water Discharge (Output), etc.

c. RMS Performance: %Device Connectivity, %Data Availability, etc.

d. Geo Location: Real time latitude and longitude should be captured with an accuracy of less than 10m horizontal. This is required to ensure that system is not moved from its original location.

e. Events and Notifications: Faults related to Pump Operation, Solar generation, Controller/Drive faults like overload, dry run, short circuit, etc.

f. Consumer Management: Name, Agriculture details, Service No. Contact Details, etc.

g. Asset Management: Ratings, Serial Number, Make, Model Number of Pump, Panel and Controller, Geo Location, IMEI number (of communication module) and ICCID (of SIM).

h. Complaint and Ticket Management
Complaint management system is a part of centralized monitoring software platform.

i. Consumer Mobile Application: Generation, Running Hours, Water Discharge, Complaint logging, etc.

1. Communication Architecture should be (to be seen from tender documents) as mentioned below.

   a. **Communication Connectivity:**

      i. **Pump Controller Connectivity:** Communication between RMS and Pump Controller should be on UART/RS485 MODBUS RTU protocol to ensure interoperability irrespective of make and manufacturer.

      ii. **Remote Connectivity:** RMS of SWPS should be using GSM/GPRS/2G/3G/4G cellular connectivity.

      iii. **Local Connectivity:** Ethernet/Bluetooth/Wi-Fi connectivity to configure parameters, notifications, communication interval, set points etc. or to retrieve locally stored data

      iv. **Sensor Connectivity:** RMS should have provision for at least two Analog and Digital inputs with 0.1% accuracy to address the requirement of local sensors connectivity if required by SIA/Consumer for applications such as irradiation, flow meter for water discharge, moisture sensor for micro irrigation, etc.

As mentioned in specifications, Analog and digital sensor inputs will be required for integration of flow meter for water discharge, moisture sensor for micro irrigation, level sensor for overhead tank water storage etc. Only provision for Analog and digital inputs with 0.1% accuracy of Full-Scale Range is required. Sensors will not be in scope of bidder.

v. RMS should have provision to give remote On/Off command to pump through farmer mobile app. In case, farmer do not have a smart phone, farmer shall be able to on-off pump thru SMS/missed call.
To save ground water, provision for remote operation is required so that farmer can switch on and off remotely.

b. **Communication Modes:**
   i. Push Data on Event/Notification: such as pump on, pump off, protection operated, etc.

   ii. Push Data Periodically: important parameters of solar pump (as mentioned above) should be pushed to central server on configurable interval. Interval should be configurable for 60 sec or less.
   Default interval should be of 15 minutes. However, if required, it should be possible to configure the periodic interval in multiple of 1 minute starting from 1 minute and up to 15 minutes. Further, in case of any abnormalities or event, RMS should push on event immediately.

   iii. Command on Demand: It should be possible to send commands via GSM or GPRS to RMS either to control pump operations or to update configuration.

c. **Communication Protocol:** RMS should provide data on MQTT protocol to establish communication with thousands of systems.

d. **Security:**
   i. Communication between RMS and Server should be secured and encrypted using TLS/SSL/X.509 certificate etc.

   ii. As a part of IoT protocol, Authentication and Authorization should be implemented using token/password mechanism

e. **Message Format:** RMS should provide data in a JSON message format as per requirement of implementing agency.

f. **Data Storage:** In case of unavailability of cellular network, RMS should store data locally and on availability of network it should push data to central Server. Local data storage should be possible for one year in case of unavailability of cellular network. RMUs should have configuration update over the Air of multiple parameters such as IP, APN, Data logging Interval, Set Points etc. is essential. Software updating should be possible with 2G and even without the presence of SD card. Software updating process and/or failure to update software shouldn't disrupt pumping operations.

RMS should be connected to the Solar Energy Data Management Platform of the implementing Agency.

SOLAR PHOTOVOLTAIC WATER PUMPING SYSTEMS

For MICRO PUMPING Applications

I.   **INTRODUCTION:**

A Solar Photovoltaic (SPV) Water Pumping System consists of:

- PV Array:

Capacity in the range of **200Wp to 500Wp.**

These *ranges of Solar Photovoltaic (SPV) Water Pumping Systems are basically for "***MICRO PUMPING"*** applications. However, these may also be used for "Drinking Water Applications wherever such capacities are*

required.

PV Array should be mounted on a suitable structure with a provision for manual tracking.

- Motor Pump Set (Surface or submersible) :

It could be installed on a suitable bore-well, open well, Water Reservoir, Water stream, etc. It could be:

-      D.C. Motor Pump Set (with Brushes or Brush less D.C.)

OR

-      A.C. Induction Motor Pump Set with a suitable Inverter

- Electronics :

  - Inverter for A.C. Motors (Appropriate Electronic Controller in case of B.L.D.C. motors)

  - Electronic Protections.

- Interconnect Cables and

- "On-Off" switch.

II. PERFORMANCE SPECIFICATIONS AND REQUIREMENTS

Solar PV Water Pumps with PV Panel capacity in the range of 200 Wp to 500 Wp may be installed on a suitable bore-well / open well / Water Reservoir / Water stream etc.

FOR 0.25 hp Motor Pump Set and 300 Wp Solar Panel:

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:

(i) Minimum 10, 000 liters of water per day from a Total Dynamic Head of 10 metres and the shut off head being at least 12 metres.

(ii) Minimum 5, 000 liters of water per day from a Total Dynamic Head of 20 metres and the shut off head being at least 30 metres.

(iii) Minimum 3000 liters of water per day from a Total Dynamic Head of 30 metres and the shut off head being at least 45 metres.

FOR 0.5 hp Motor Pump Set and 500 Wp Solar Panel:

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 :

(i) Minimum 20, 000 liters of water per day from a Total Dynamic Head of 10 metres and the shut off head being at least 12 metres.

(ii) Minimum 10, 000 liters of water per day from a Total Dynamic Head of 20 metres and the shut off head being at least 30 metres.

(iii) Minimum 6000 liters of water per day from a Total Dynamic Head of 30 metres and the shut off head being at least 45 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 II.

III. PV ARRAY

The SPV water pumping system should be operated with a PV array capacity in the range of ***200 Watts peak to 500 Watts 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 75 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 siliconsolar 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.

- The efficiency of the PV modules should be minimum 14% and fill factor should 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:**
    a. **Name of the Manufacturer or Distinctive Logo.**
    b. **Model Number**
    c. **Serial Number**
    d. **Year of manufacture**
    e. **Made in India (Subscribe in words)**

IV **MOTOR PUMP-SET**

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

    a. Surface mounted motor pump-set
    b. Submersible motor pump set
    c. Floating motor pump set
    d. Pressure booster pumps
    e. 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 0.5 hp and* should have the following features:

  ➢ The mono block DC/ AC centrifugal motor pump set with the impeller mounted directly on the motor shaft and with appropriate mechanical seals which ensures zero leakage.

  ➢ The motor of the capacity ranging from 0.2 hp to 0.5 hp should be AC, DC or BLDC type. The suction and delivery head will depend on the site-specific condition of the field.

  ➢ Submersible pumps or Surface pumps could also be used according to the dynamic head of the site at which the pump is to be used.

- It is recommended that all parts of the pump and the motor of the submersible pumps should be made of stainless steel or suitable grade of plastic. The impellers and other internal parts can be of suitable grade of modified PPE resins (example Noryl) or Polycarbonate or equivalent.

  - The manufacturers of pumps should self-certify that, the pump and __all external parts of motor used in submersible pump which are in contact with water, are of stainless steel or suitable grade of plastic.__ The pumps used for solar application should have a 5 years warranty so it is essential that the construction of the pump be made using parts which have a much higher durability and do not need replacement or corrode for at least 5 years.

- 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.