Food and Agriculture Organization of the United Nations

CIHEAM IAM BARI

AgWA Partnership for agricultural water for Africa

Emerging practices from Agricultural Water Management in Africa and the Near East

Thematic Workshop

Theme 7

Solar powered water lifting for irrigation

Bari, 30 September 2017

Theme 7:

Solar Powered Water Lifting For Irrigation

PRESENTATION OUTLINE

1. Introduction to Tools/Methodology
2. Tools /Methodology in action
3. Al-AFIR Project
4. Project Components
5. Outcomes

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INTRODUCTION TO TOOLS/METHODOLOGY

1 Solar radiation

The amount of energy received from the sun at a given location. This determines how much power each solar module will generate in a day and the size of array needed to pump a required volume of water

2 Solar array

A generator that converts solar radiation into electricity. An array consists of solar modules

3 Control systems & BOS

- Variable speed Drive
- MPPT based Solar Pump Controller
- Cables ,Earthing & Protection Accessories.

4 Pump

The pump moves the water from a source to its delivery point. It needs to be powerful enough to move the necessary volume of water the required distance.

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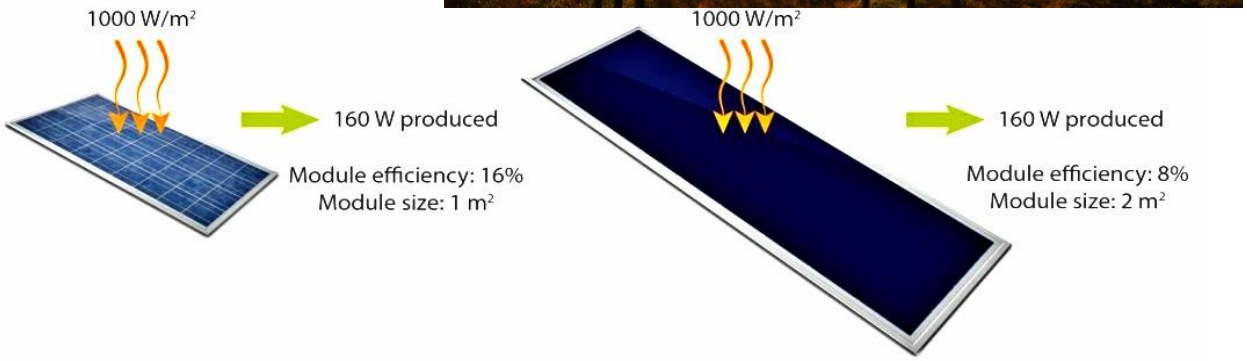
TOOLS/METHODOLOGY IN ACTION

1. Solar Radiation

The amount of energy received from the sun at a given location. This determines how much power each solar module will generate in a day and the size of array needed to pump a required volume of water.

The amount of solar radiation according to:

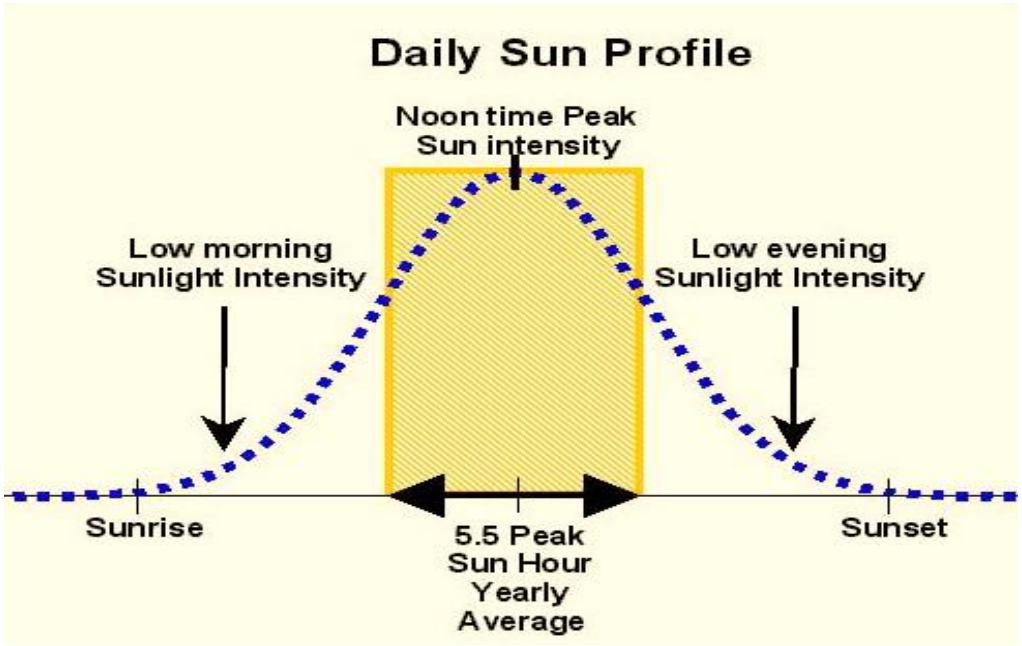
- Geographic location
- Time of day
- Season.
- weather.



TOOLS/METHODOLOGY IN ACTION

Peak Sun Hours

It is the number of hours where the earth receives 1000 W/m2. During this few hours the Solar Panel shall be sized to overcome all the Derate Factors and operate the pump at maximum speed with maximum frequency 50 Hz and minimum frequency 20 Hz



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TOOLS/METHODOLOGY IN ACTION

2. Solar Array

A solar array is the electrical combination of a number of solar modules. The power output of this array will be the sum of the power outputs of the combined solar modules.

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TOOLS/METHODOLOGY IN ACTION

Mounting Structure

Fixing the array in the optimal tilt and orientation,

Fixing the array so it has the optimal tilt and orientation is generally the cheapest option and the one that involves the least maintenance.

Variable Manual tilt angle,

The optimal tilt angle for each month/set of months is calculated according to changes in the altitude of the sun over the months.

Single- or dual-axis tracker that follows the sun,

we can extend the time of available maximum power and thus produce with greater capacity more hours a day.

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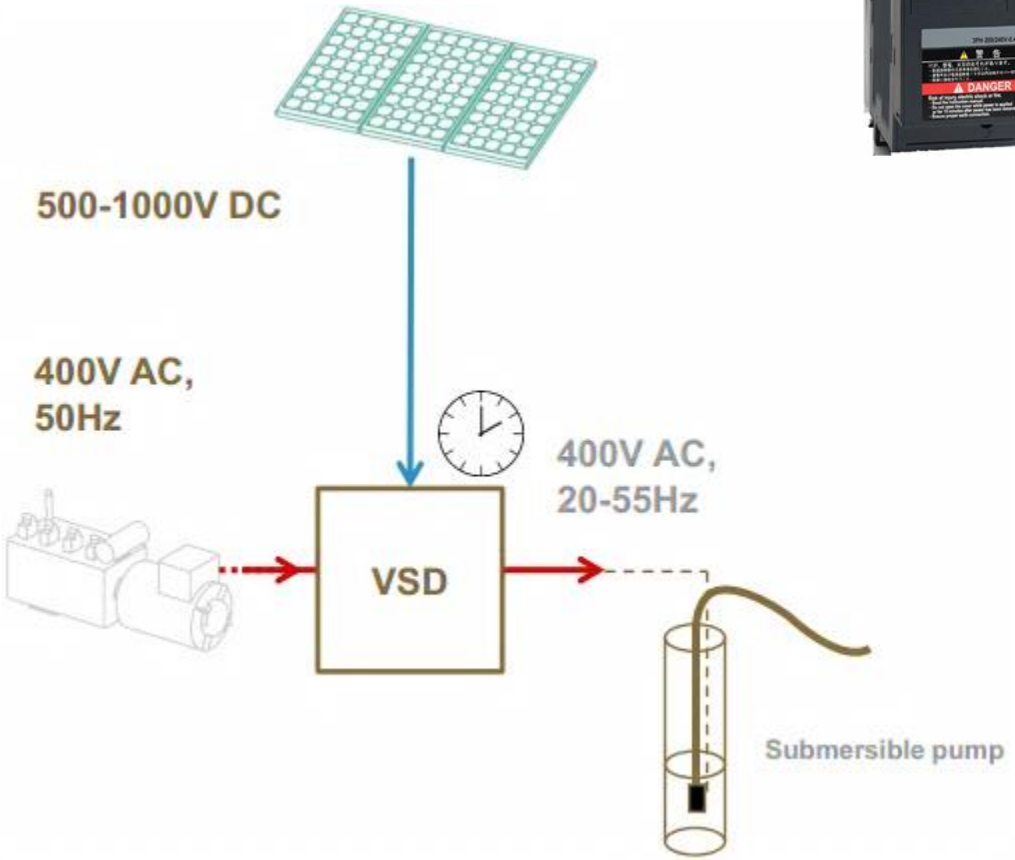
TOOLS/METHODOLOGY IN ACTION

3. Control systems & BOS



The variable speed drive system is probably the most adequate for the agricultural sector. This system uses a variable speed drive that connects and regulates PV Panels and the diesel generator if found . Depending on solar irradiation and the size of the power plant, the diesel generator can be turned off completely.
VSD acts as inverter and at the same time as the controller of the pump.

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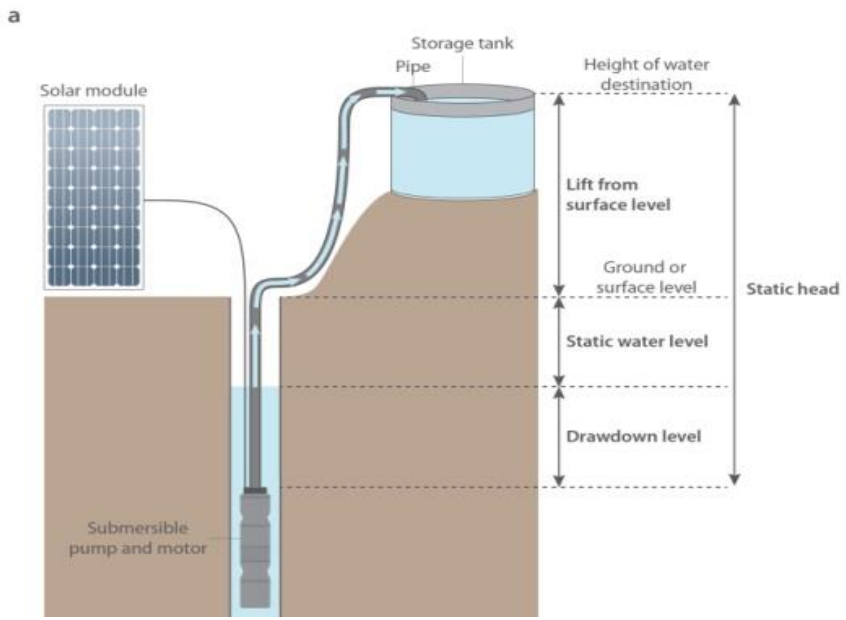
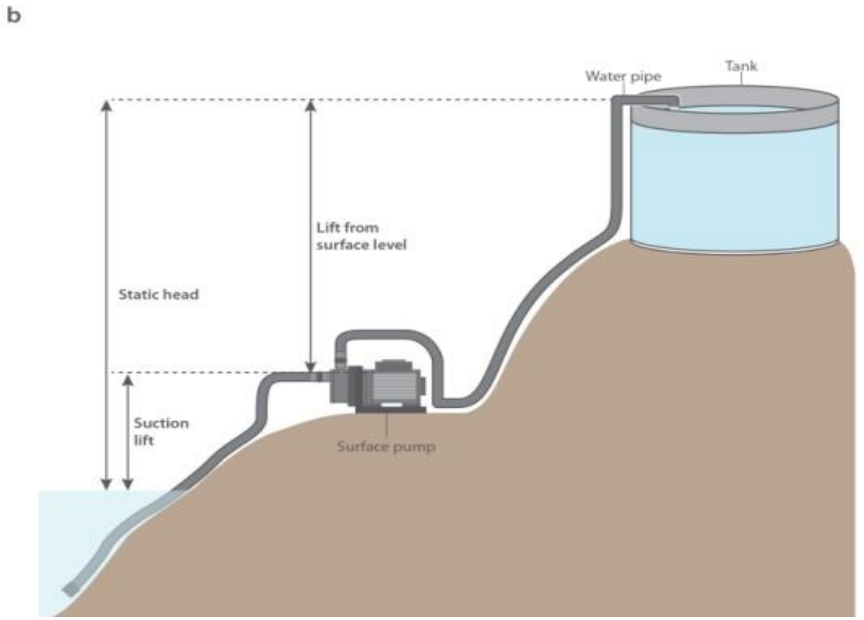
TOOLS/METHODOLOGY IN ACTION

4. Pump

There are three key parameters of a pumping system: **Flow, Head and Power.** Flow refers to the rate at which water can be pumped through the system; the head refers to the amount of resistance to the water movement and the power is the amount of energy required to meet a certain flow rate and head combination.





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PROJECT

Site 3 Al Afir

Al Bihera Governorate /Egypt

Solar Powered Water Lifting for Irrigation
57.6kwp

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PROJECT

Details of existing pump systems at Site 3 are as shown below

Pump Room	Existing pump (HP)		FAO SWP HP	Irrigated Area feddan/ha
	Utility Grid	Diesel		
1	2 Pumps (1×10+1×15)	20	10	56/23
2	2 Pumps (1×20+1×15)	25	10	76/32
3	2 Pumps (1×20+1×15)	20	10	71/30
4	1 Pump (1×20)	25	10	40/17

Farmer's number serviced:
310 farmers Family

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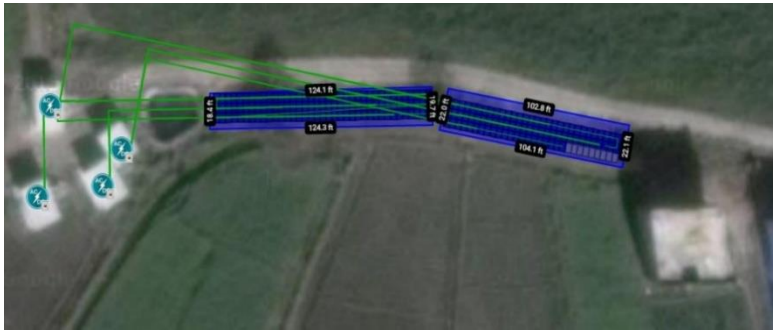
PROJECT COMPONENT

This project under name Al-Afir – Site 3 consists of 4 pump rooms at a single location over a covered mesqa in the Al-Afir region

1. PV module type : poly crystalline
2. Pv module rating : 300 Wdc
3. Array description : 48 modules for each pump room 14.4kwp
4. Array Topology : 16 modules per series string, 3 strings in parallel for each pump
5. VFD : Toshiba VF-s15
6. Inverter : SMA On/grid inverter 10kw



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PARTNERS IN IMPLEMENTATION

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for Sustainable Development

National Water Research Center
المركز القومى لبحوث المياه

SunEdison

CATEC
Consulting And Technical Engineering Co.
Installation • Agency • Engineering

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OUTCOMES

- Reduce dependence on fossil fuels
- Prove the suitability of PV technologies for the region
- Provide sustainable energy for the lifting of irrigation and prove anther potential for other uses in non-irrigation periods
- Creating sustainable Electricity power with minimum operation cost
- Reducing water loses
- Involving farmers in water management through water user association
- Raise awareness for local farmers and WUAs to operate and maintain the system
- Capacity building of technical staff of MRWI with Knowhow transfer process
- Strengthen local production base

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Food and Agriculture Organization
of the United Nation