

# Kenya Smallholder Solar Irrigation (KSSI) Project

## Technology Profile and Pump Assessments



Caroline Makenzi

# ASD Role in KSSI project

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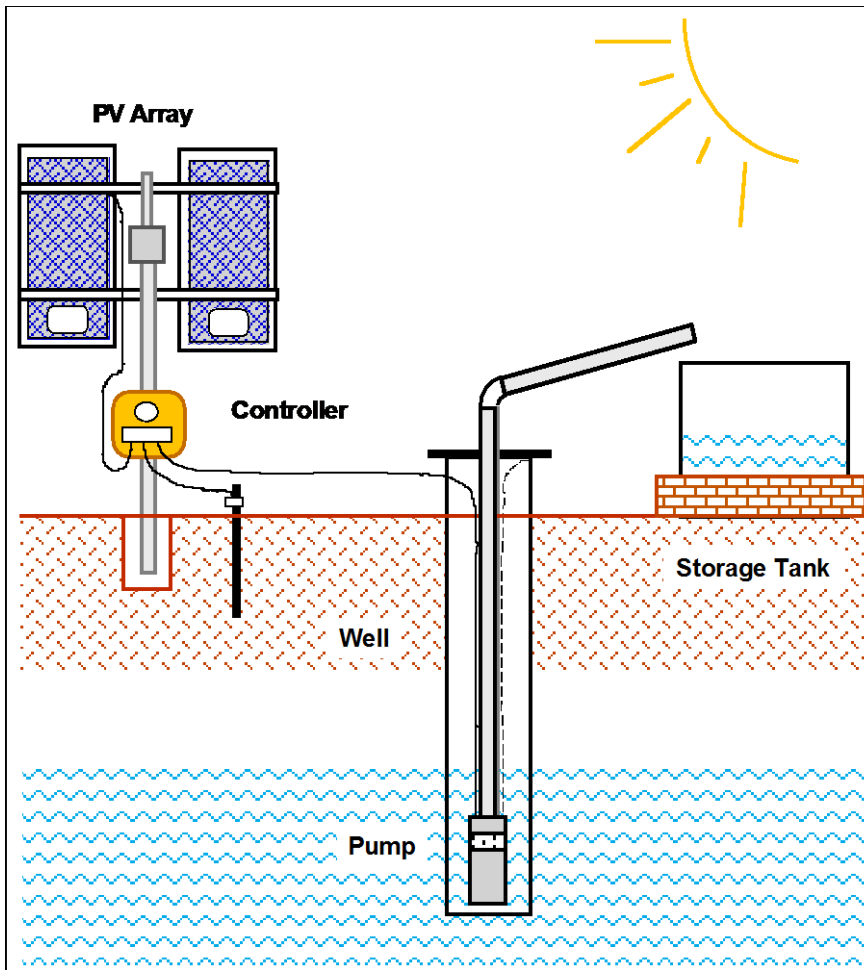
- Independent technical review of retailers' solar pumps
- Site visits and pump testing with Winrock

## **Parameters taken:**

- Overall quality of pump and panel installation
- Pump flow rates
- Irradiation, W/m<sup>2</sup>
- Total dynamic head
- System current and voltage



# SWP System Components



**PV Array**



**Well and Pump**



**Controller/ Inverter**

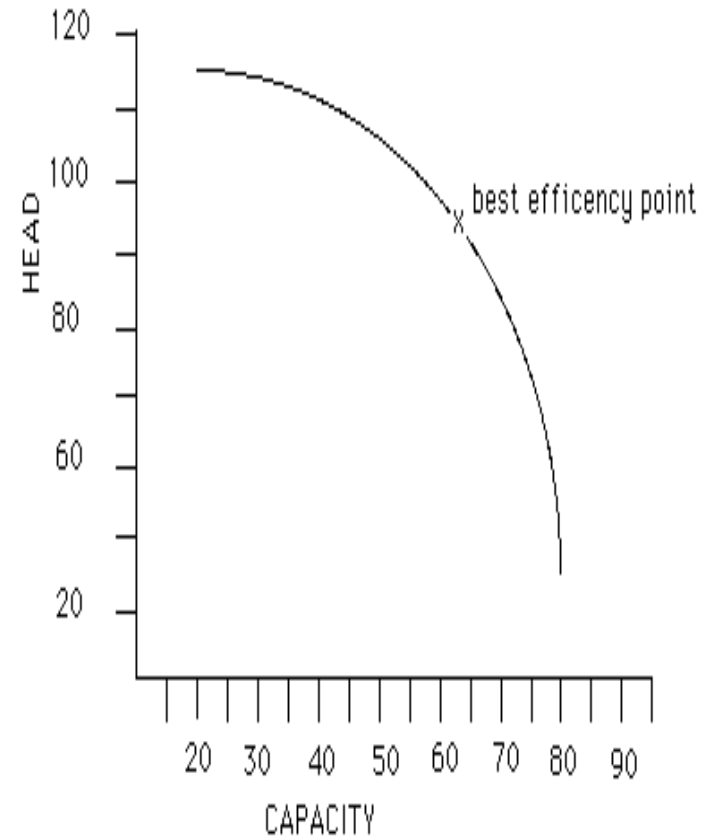


**Water Storage**



# SWP System Components

- Pumps are rated according to their Total Dynamic Head (TDH) and Flow (Q)
- TDH is the total equivalent height that a fluid is to be pumped, taking into account friction losses in the pipe.
- Flow is the amount of water flowing per unit of time.



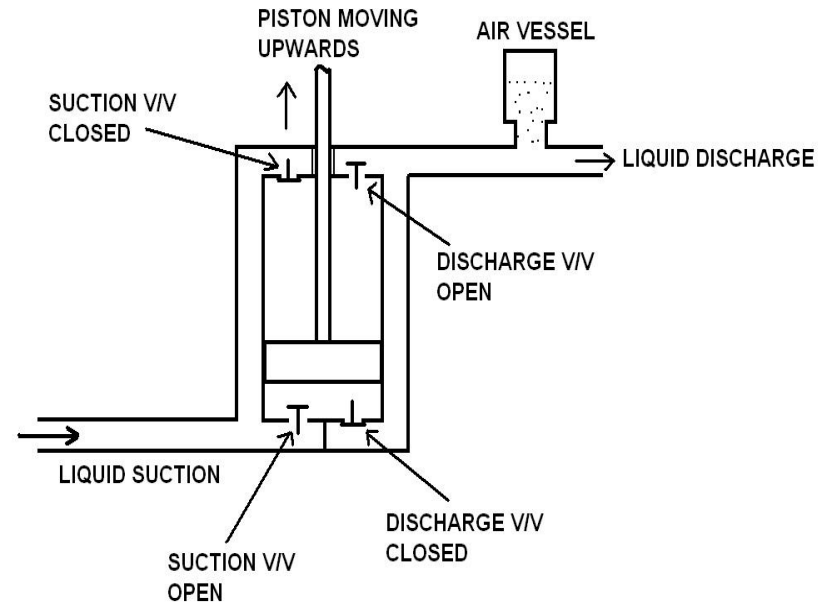
# Pump Types



Helical rotor pump



Centrifugal pump



Piston pump



# Pump Controllers



SWP are designed to work with pump controllers. Without the controller/LCB it will not pump under overcast conditions



## Maximum Power Point Tracker (MPPT):

Allows the pump to operate at the point where the voltage and current give you the maximum power

# Pump type pros & cons

Type of PV Water Pump	Advantages	Disadvantages
Submersible centrifugal	<ul style="list-style-type: none"> <li>Simple, with one moving part.</li> <li>Regular maintenance not required.</li> <li>Efficient at high flow rates or low lift.</li> <li>Good tolerance for moderate amounts of sand and silt.</li> <li>Most conventional, widely available.</li> </ul>	<ul style="list-style-type: none"> <li>Poor efficiency at low volumes (&lt;30 liters per minute) or high lift.</li> <li>Capacity is reduced disproportionately at low speeds (in low-sun conditions).</li> <li>Impellers can fill with sediments and may require periodic cleaning.</li> </ul>
Helical rotor, submersible or surface	<ul style="list-style-type: none"> <li>Simple, with one moving part.</li> <li>Regular maintenance not required.</li> <li>Can manage high dynamic heads</li> <li>Good tolerance for moderate amounts of sand and silt.</li> </ul>	<ul style="list-style-type: none"> <li>Lower flow rates</li> </ul>
Diaphragm, piston, rotary vane	<ul style="list-style-type: none"> <li>Relatively low initial cost.</li> <li>Efficient at very low flow rates (4-20 liters per minute).</li> <li>Maintains full lift capacity at all speeds.</li> </ul>	<ul style="list-style-type: none"> <li>Requires preventive maintenance.</li> <li>Poor tolerance for sand and silt.</li> <li>Requires filtration (rotary vane pump).</li> </ul>
Surface centrifugal	<ul style="list-style-type: none"> <li>Relatively low cost.</li> <li>Efficient for low lift and high flow rates.</li> <li>Easy to inspect and maintain due to surface location.</li> <li>Good tolerance for moderate amounts of sand and silt.</li> </ul>	<ul style="list-style-type: none"> <li>Suction limit is about 6 meters or less.</li> <li>Requires priming (filling the intake).</li> <li>May be damaged by running dry if it loses prime.</li> </ul>

**It is very important to correctly size the pump!**

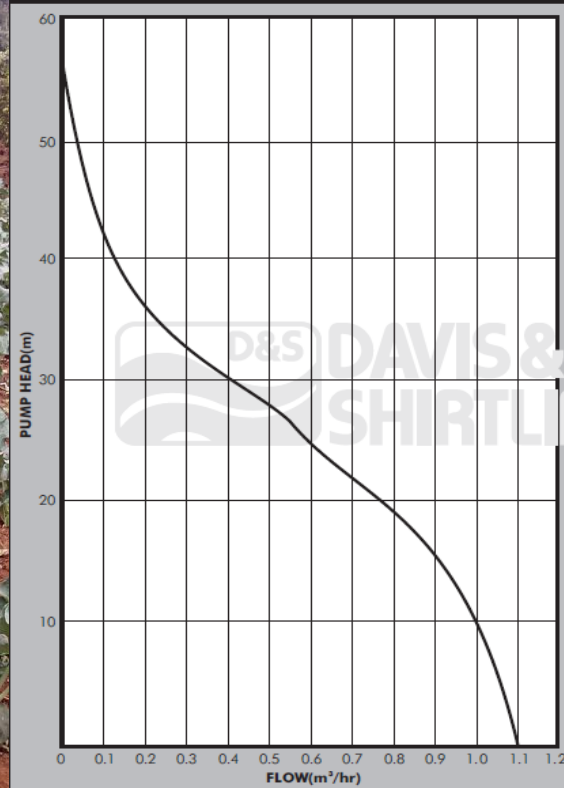
# SunCulture - Nyandarua

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# Taifu pump- Kiambu





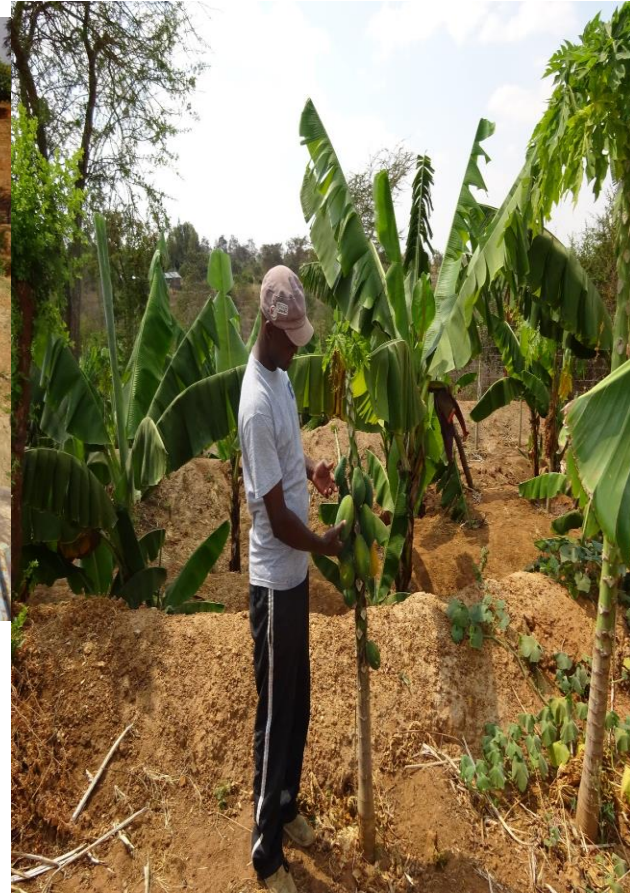
# Maji Pump - Kitui



Height (meters)	MP-400 120W flow rate (L/min)	MP-400 150W flow rate (L/min)
0	17	17
3	16.5	16.5
6	14	16
9	12	15
12	10	12.5
17	4	10.5
20		9

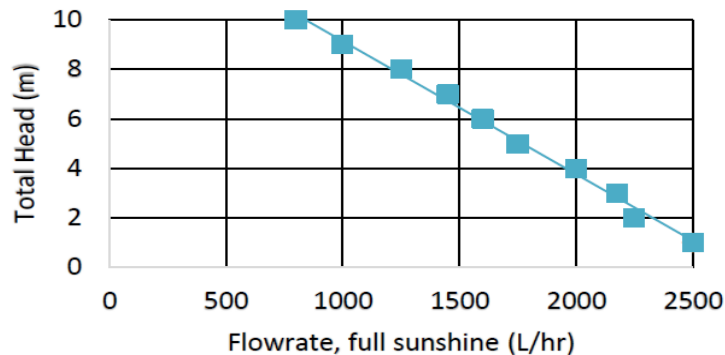


# Kickstart- Machakos





# Futurepump – Kendu Bay





# SWP drip irrigation for onions

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# Lessons learnt

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- Farmers expectations of the solar pumps were generally met
- Most farmers intend to expand their farms due to the improved water access, reliability and reduced energy costs
- There is need for local capacity building at technician level to improve the quality of installations and maintenance at the counties
- Security is a concern which often leads to more portable module configurations i.e temporary module installations placed in the dirt.
- Purchase power continues to be the main barrier to acquisition of solar pumps. The farmers are open to credit options; this will further grow the solar water pump market
- There's need to further increase farmers awareness and build confidence around SWP technologies available in the market. Retailers are doing this through their after sales support



# SWPs can work for decades

## DOE/USAID Estación Torres, Sonora: 20+ years



**480 Wp PVWP system still working after 20 years!**  
**Only 1 pump replacement by rancher after 14 years**