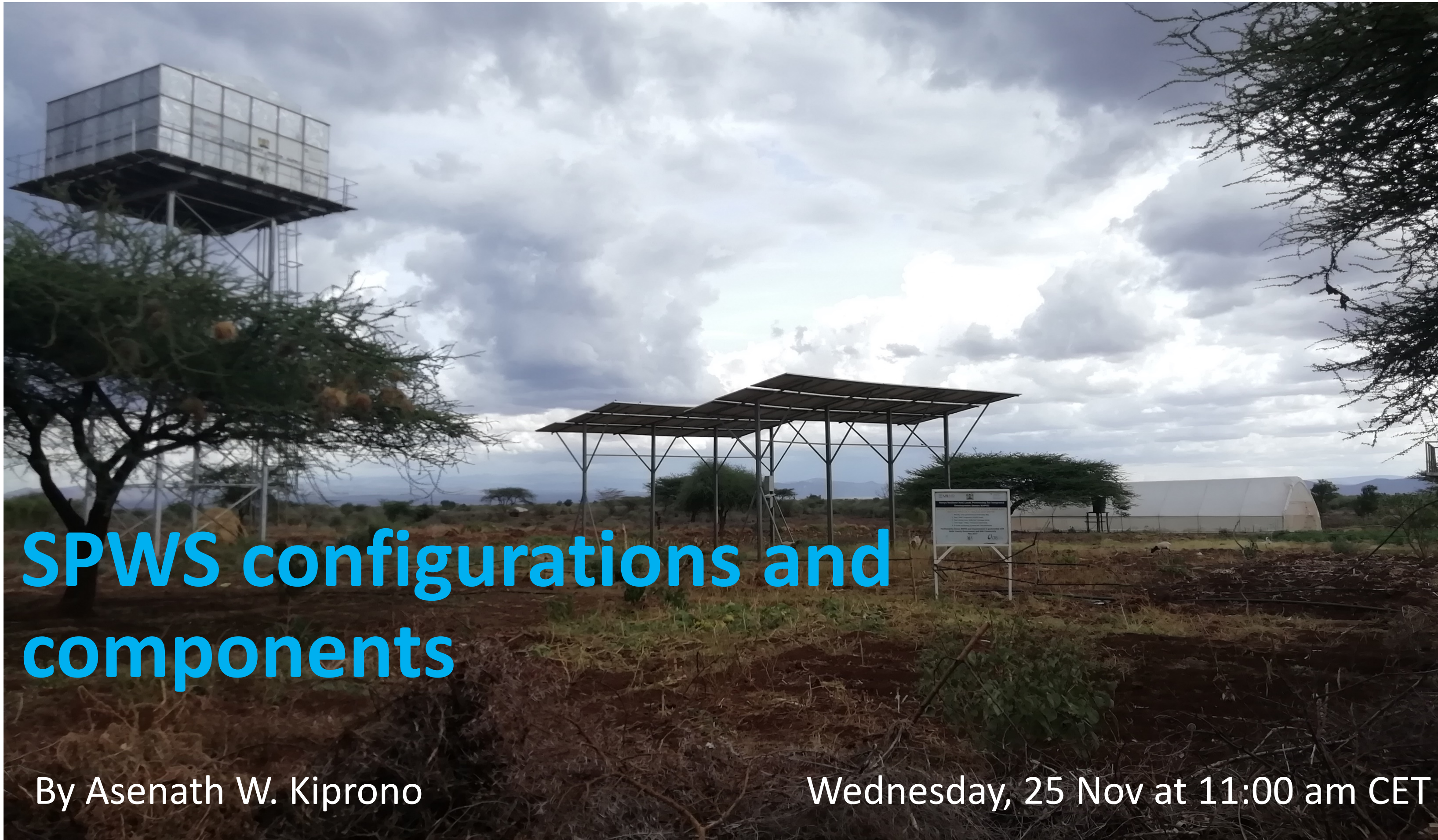

SPWS configurations and components

By Asenath W. Kiprono

Wednesday, 25 Nov at 11:00 am CET

INTRODUCTION OF the global solar and water initiative (GLOSWI)

1. Coordination and Knowledge Sharing
2. Build up Evidence, Development of Knowledge Material
3. We Provide Field Support Through Country Visits
4. Capacity Building
5. Technical Helpline

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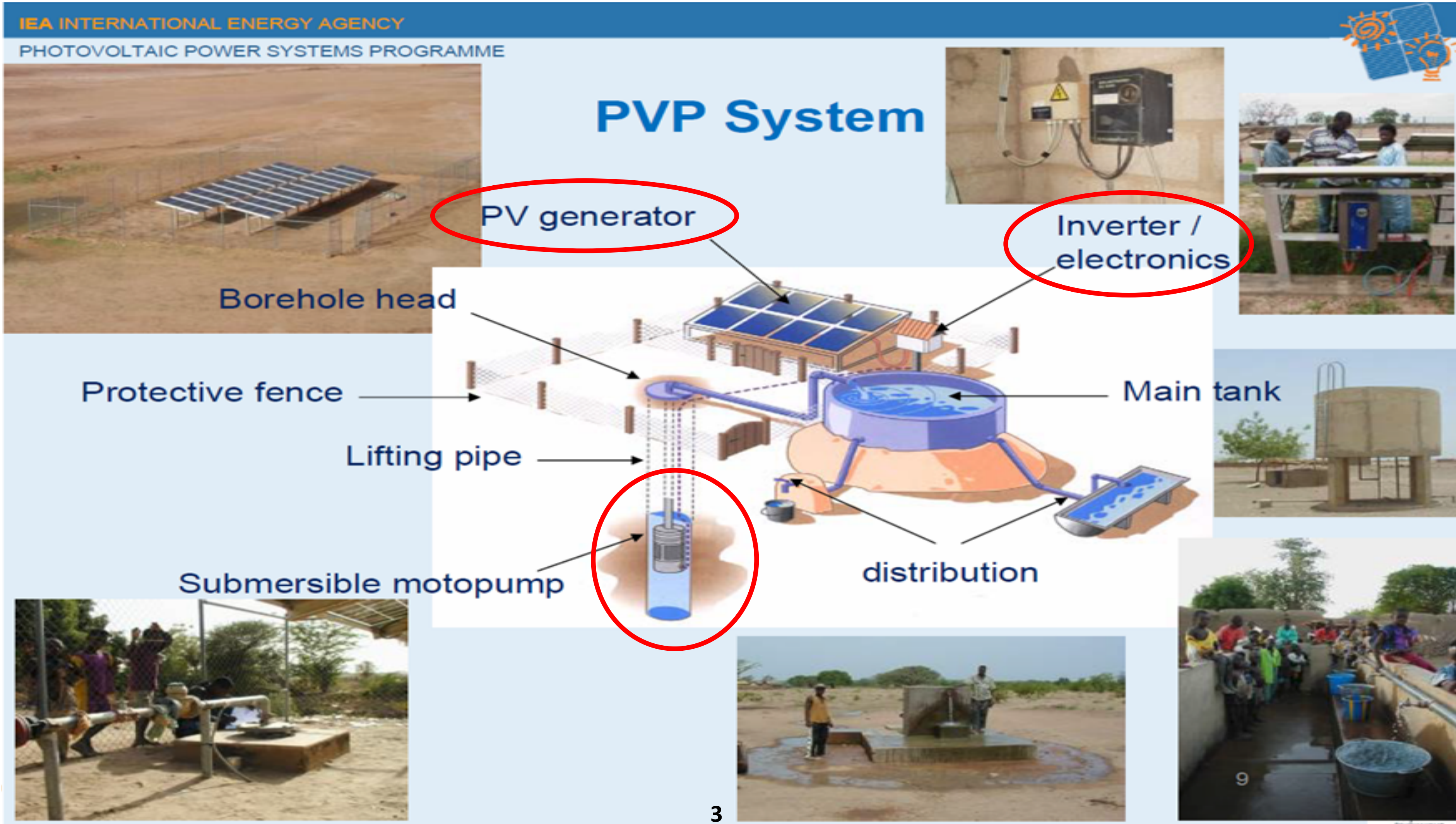
TYPICAL SOLAR PUMPING SCHEME



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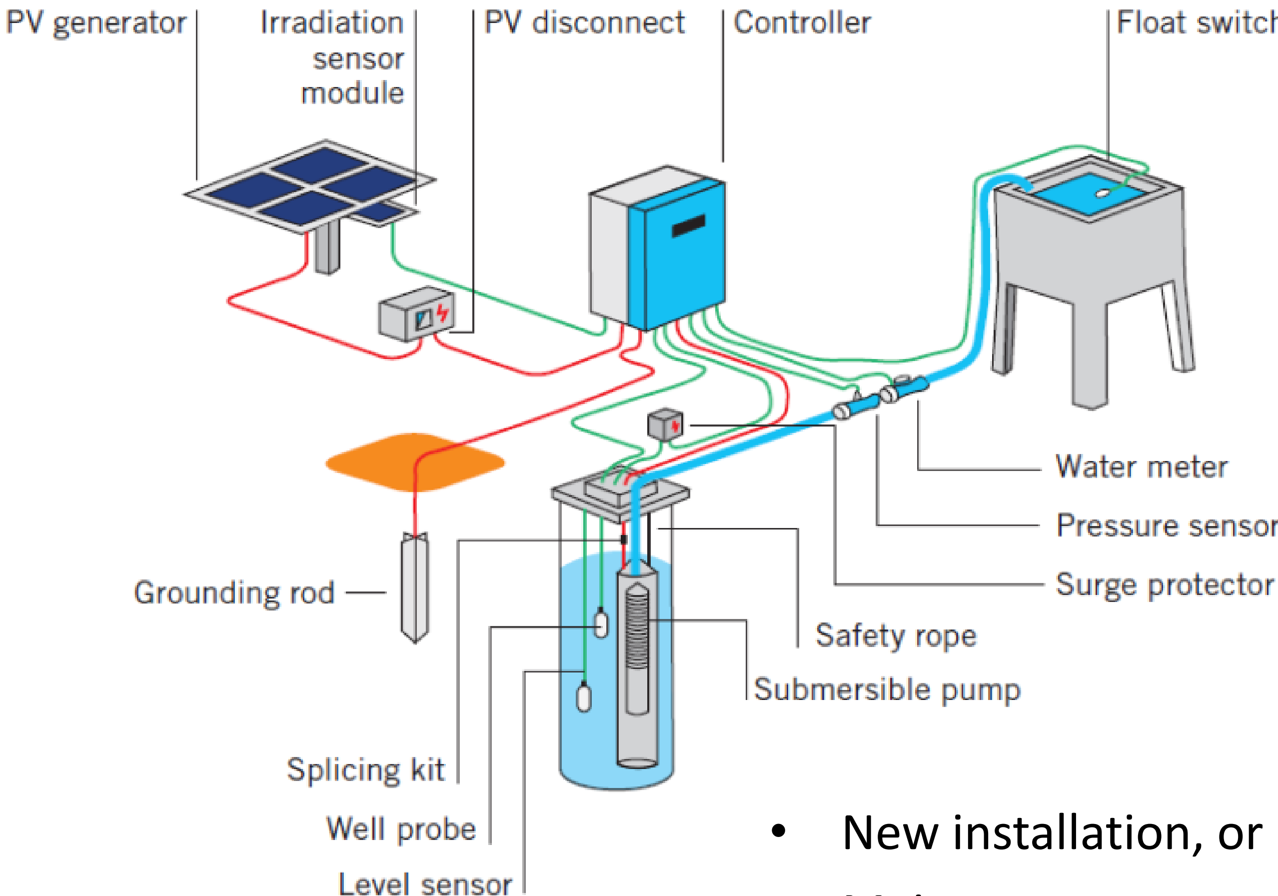
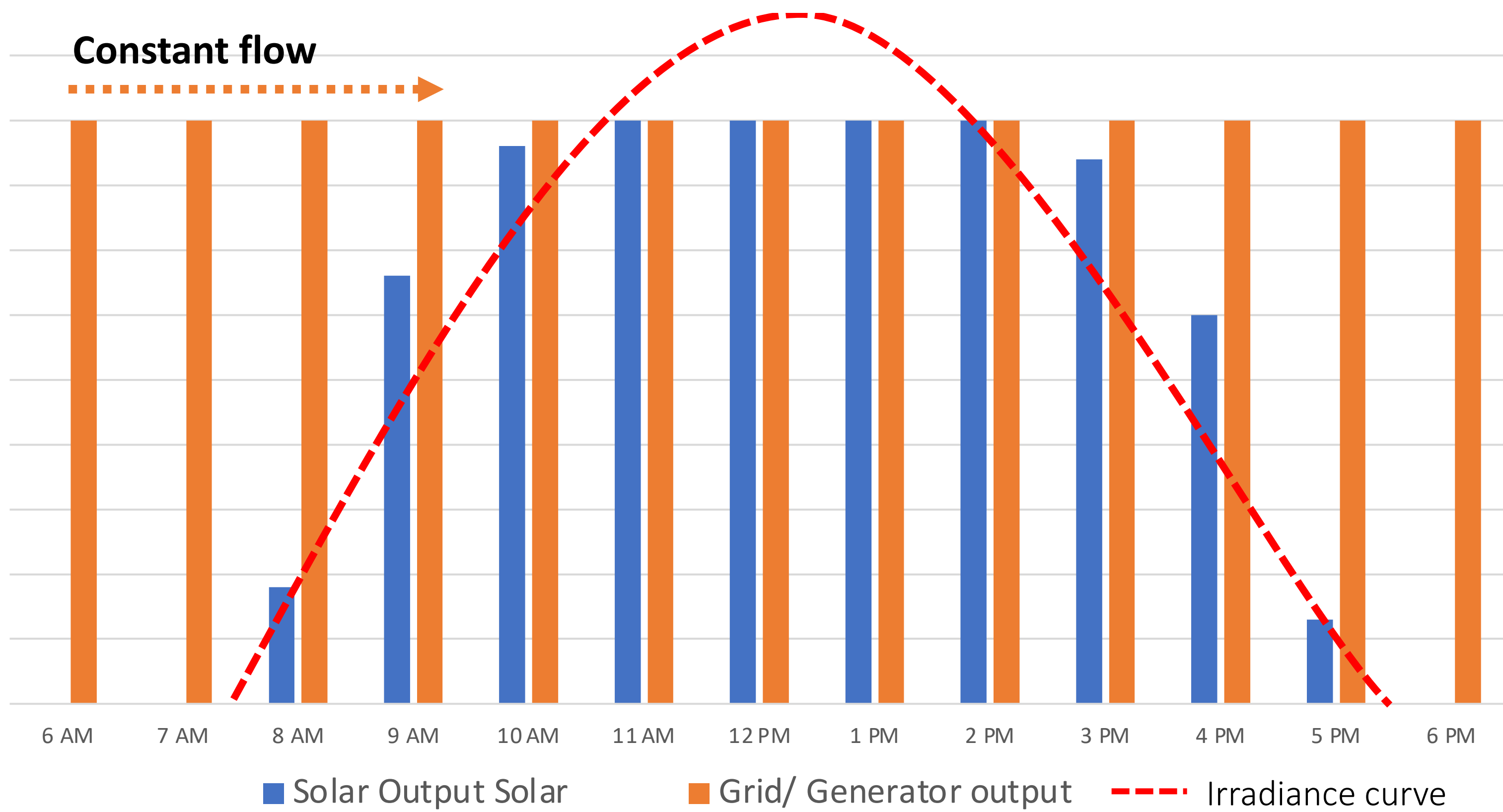


- New installation, or retrofitted
- Main components
- BoS components

SOLAR vs generator/grid operation



- Pump + solar (+ optional stand-by power). No batteries!
- Store water in an elevated tank, rather than storing energy

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DC vs AC pumps/controllers

DC system

- pump coupled to a DC motor + DC controller + PV generator More efficient, last longer, compared to equivalent AC
- Used in smaller applications
- Less than 4kW, lower VDC input

AC system

- pump coupled + AC motor + DC-AC inverter + PV generator
- The inverter can be inbuilt into the pump or mounted on the surface
- Used in large applications
- As large as 250kW, high VDC input, three phase AC output

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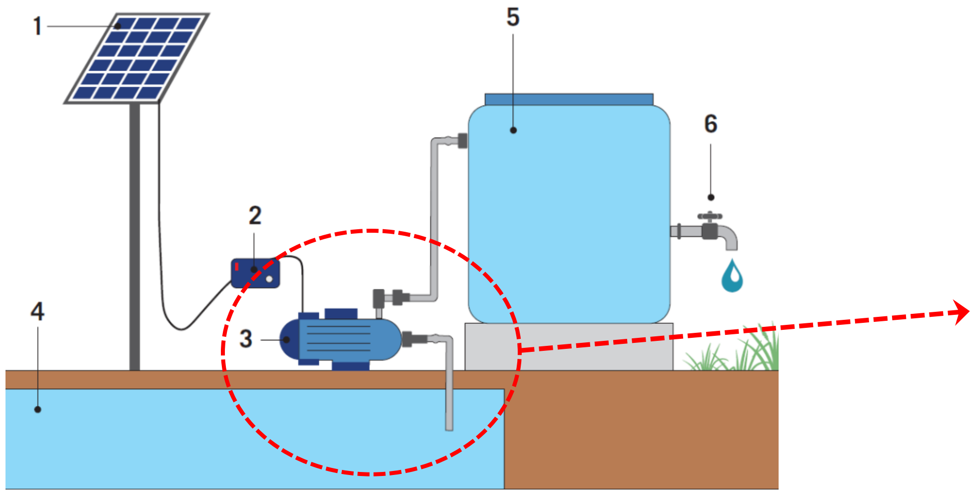
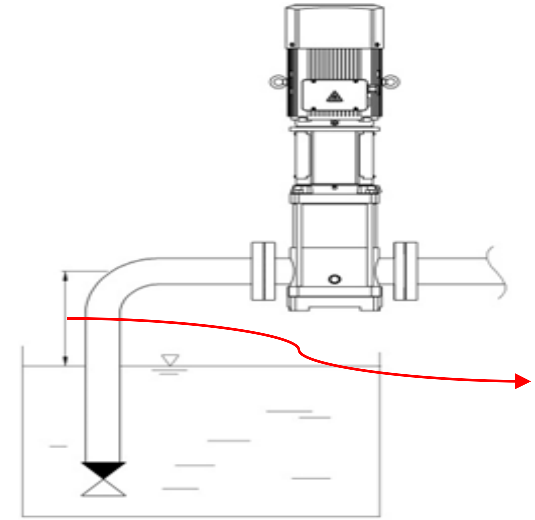
Submersible vs surface pumping systems





Maximum suction head (H) is measured from top of water level to centre of pump inlet pipe

Surface

- More complicated to design
- Require more knowledge
- Pros: higher flows, simpler service

Submersible

- Better efficiency of operation
- Simpler, quiet operation
- Cons: More expensive

FLOATING INSTALLATION

Surface pumps can also be installed floating in a surface water source

- Water source is far from pump location
- Where water levels fluctuate
- Flooding is expected

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…continued

A submersible pump can also be installed floating

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solar Standalone vs hybrid systems

Solar standalone: Single power source from solar to meet full demand

Hybrid: Solar plus stand-by power source (majority in humanitarian is fossil based - diesel).

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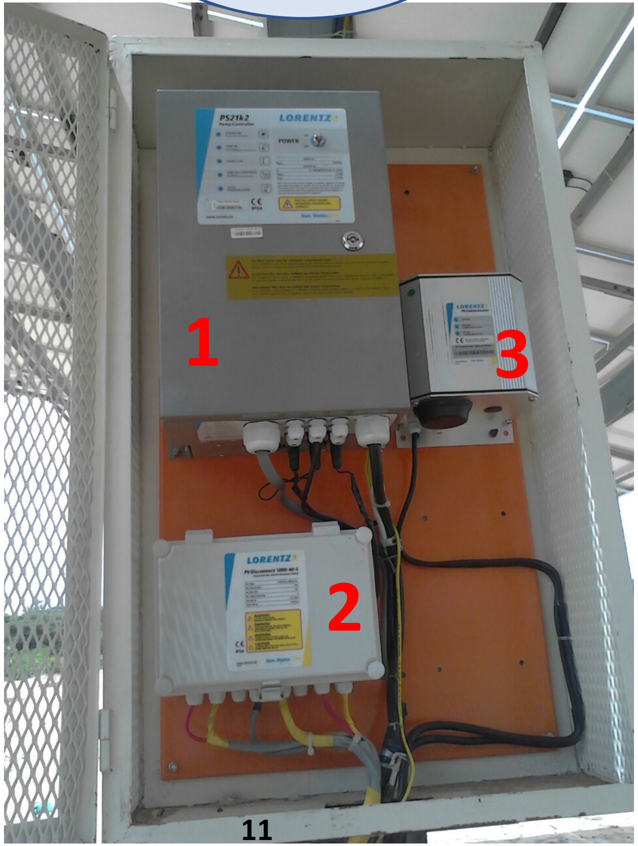
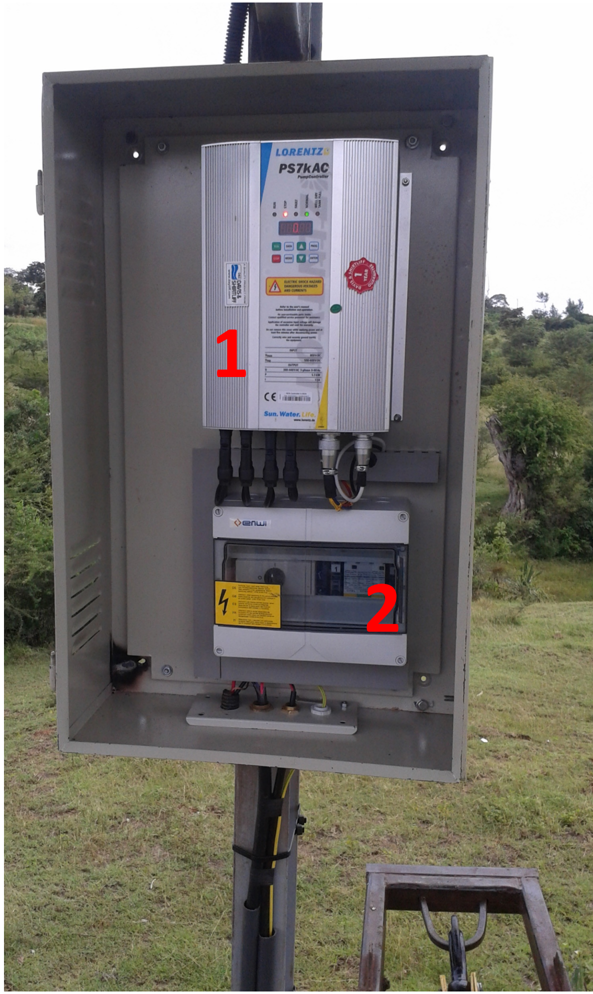
Controls in a STAND ALONE SYSTEM





1 – DC or AC controller
2 – DC Isolation switches
3 – GPRS communicator (optional)

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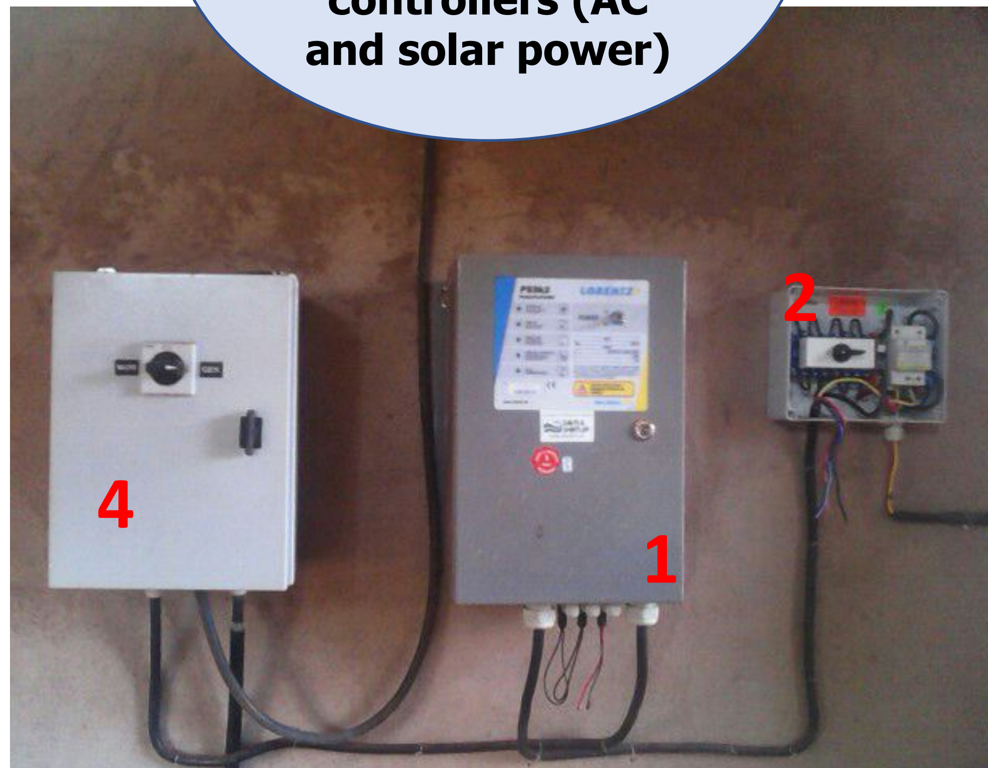
Controls in a **HYBRID SYSTEM**: Manual operation between 2 controllers (AC and solar power)

1 – DC-AC inverter
2 – DC Isolation switches
3 – AC control panel
4 – Manual Changeover switch



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Controls in a HYBRID SYSTEM: Manual operation with one controller for both solar and AC power

1 – DC-AC inverter
2 – DC Isolation switches
3 – Surge protection
*note changeover switch not captured in the picture (mounted elsewhere)

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Controls in a HYBRID SYSTEM: automatic/ power blending

selecting the right configuration

1) Submersible vs surface: Dictated by the application

2) DC vs AC:

   DC pumps for small applications, AC for larger applications

3) Standalone vs hybrid: multiple criteria, more insights

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Judgment for hybrid should be based on

a) Water demand, solar resource and water source capacity

b) Availability of data

c) Possibility of fluctuations in population

d) Prevailing weather conditions and topography

e) Criticality of the water supply

f) Humanitarians interventions….

Other considerations:

- social aspects
- contextual reasons
- economic reasons

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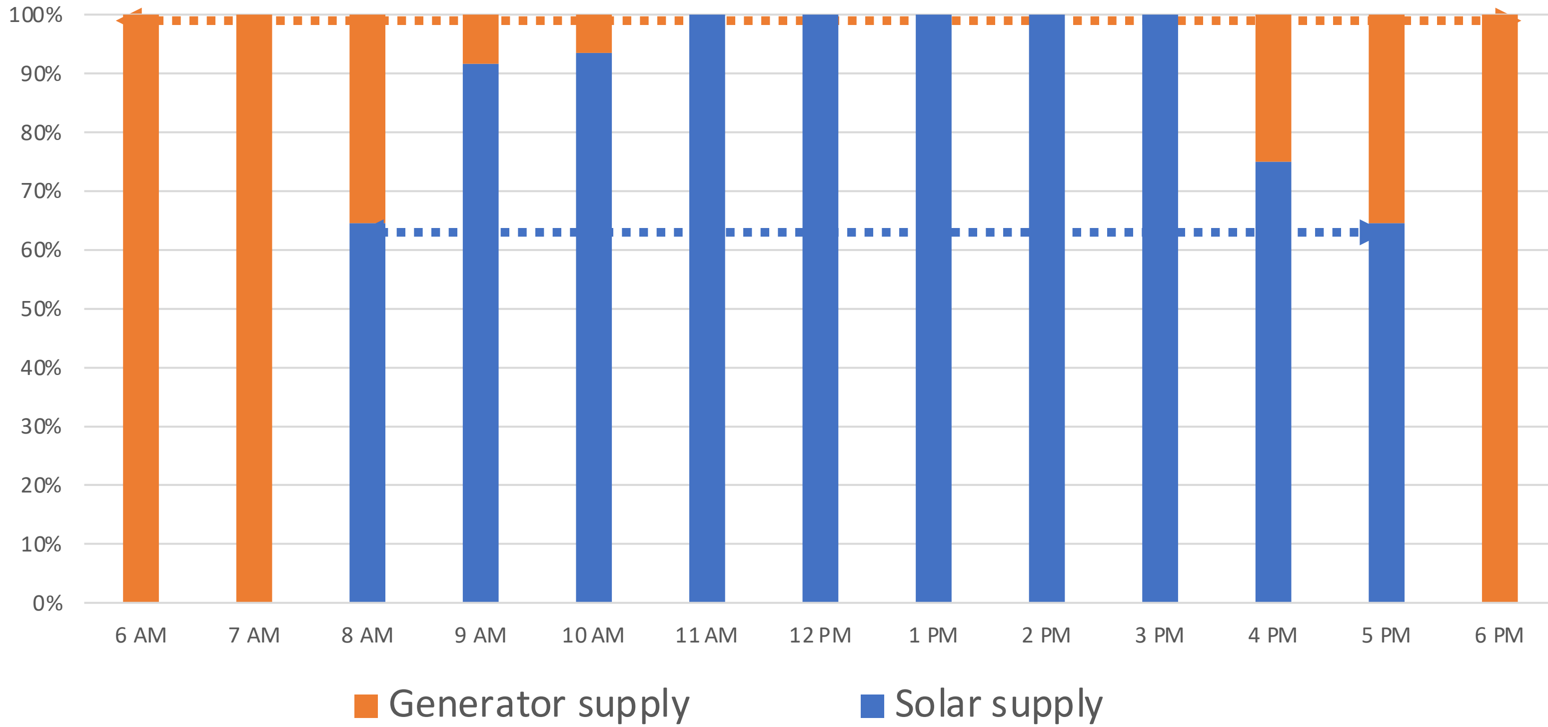

Solar standalone: Single power source from solar to meet full demand

Hybrid: Solar plus stand-by power source (majority in humanitarian is fossil based - diesel).

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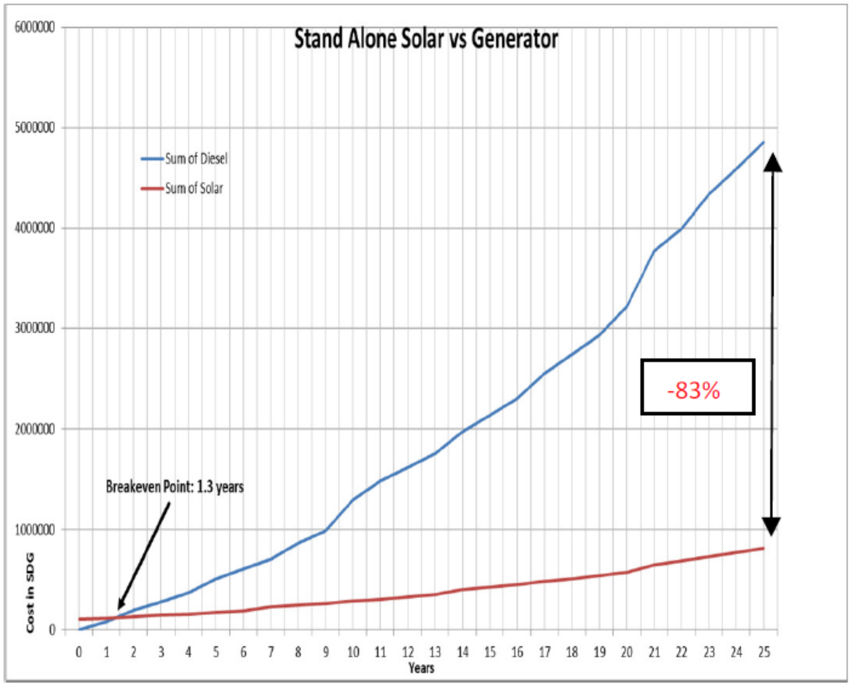
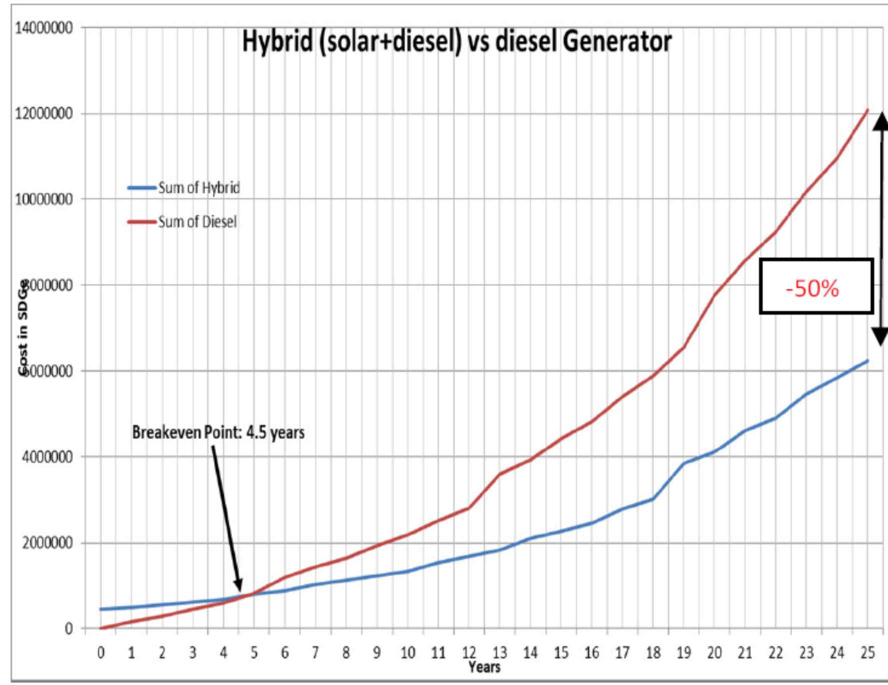
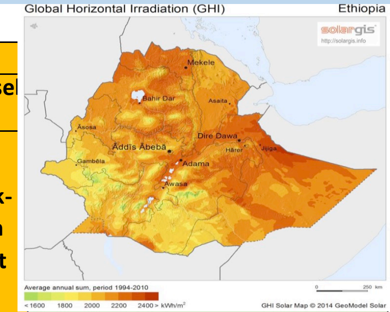




- Economic analysis for decision making
- Consider all other factors

Some rationale for choice of size/configuration (Ethiopia)



	Technical Design					Water Output			Economic/Life Cycle Analysis						
									Generator stand alone		Solar stand alone or Hybrid		Hybrid/Solar - Diesel Comparison		
No.	Tested yield [m3/h]	Daily water Demand (m3/day)	or TDH (m)	Proposed Power Pump kW	Proposed Solar Power Size	Daily Output Solar (m^3/day) in month with least output	Daily Output Generator (m^3/day)	Combined Daily Output (m3/day)	Initial cost (USD)	Cost over Life Cycle (USD)	Initial cost (USD)	Cost over Life Cycle (USD)	Reduction of expenses Hybrid/Solar vs Genset	Break-even point	
1	5.4	100.0	140	4.0	7,500	41.2	58.8	100.0	17,812	271,946	24,309	193,828	**-29%**	2.1 years	Hybrid (demand almost same as no. 3 but borehole is constrained, so smaller pump requiring hybrid
2	10.8	84.0	248	9.2	18,750	57.1	26.9	84.0	35,117	274,631	52,819	149,845	**-45%**	1.75 years	Hybrid (demand is same as no.9 but borehole yield is smaller, so smaller pump requiring hybrid
3	25.2	104	123	9.2	18,750	127.7	0.0	127.7	32,657	200,914	50,359	70,599	**-65%**	1.8 years	Stand alone (retrofitted into a pump of high capacity thus solar pumping more than the demand)
4	54	120	146	22.0	41,250	263.8	0.0	263.8	50,824	402,900	90,386	114,136	**-72%**	1.75 years	Stand alone (demand lower than pumped flow. Decided to extract full potential of the well)
5	18	100	217	15.0	22,500	105.8	0.0	105.8	43,783	296,606	62,433	84,255	**-72%**	1.2 years	Stand alone (Less output than no. 3 but higher head requires more power)
6	7.2	100	217	7.5	11,250	41.4	58.6	100.0	29,579	377,048	39,537	263,924	**-30%**	0.9 years	Hybrid (same reason as no. 1 above)
7	10.8	100	147	5.5	11,250	61.7	38.3	100.0	23,034	254,363	34,319	141,393	**-44%**	1.1 years	Hybrid (same reason as no. 1 above)
8	4.68	90	144	4.0	5,250	27.0	63.0	90.0	17,189	301,214	19,732	226,655	**-25%**	0.5 years	Hybrid (same reason as no. 2 above)
9	18	84	175	11.0	18,750	99.2	0.0	99.2	34,163	208,692	46,867	67,832	**-67%**	1.3 years	Stand alone

GSWI FINDINGS in 8 countries

140 systems assessed in 8 countries			
Configuration	Stand alone	46%	
	Hybrid	54%	
Scale *motor size	Largest	37kW	Hybrid (760m3/day from solar)
	Smallest	1.4kW	Stand alone 17-27m3/day
Size range *motor size	0 - 4kW (10-220m3/day)	47%	65% of all systems within 1.4-7.5kW range
	5.5 – 37kW (36-1298m3/day)	53%	
Life cycle costs	Stand alone	-65% reduction	0 to 2 years payback period
	Hybrid	-45% reduction	2 to 4 years payback period

- ✓ Active, experienced private sector
- ✓ Quality products
- ✓ NGOs, UN working with private sector
- ❖ Importance of building organisational capacity

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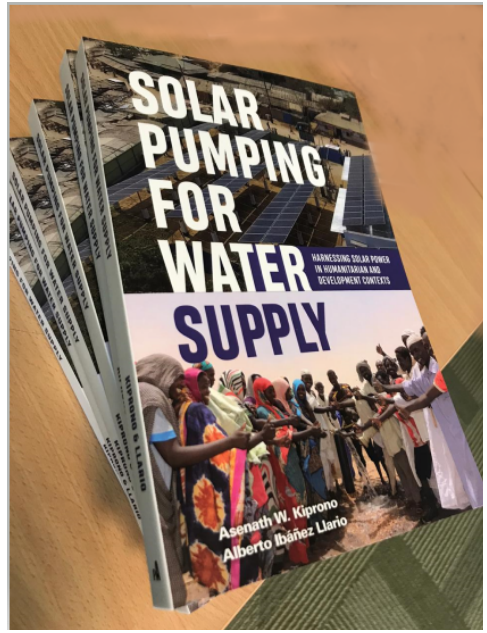
Technical resources – book



Read it open access or order a copy on Practical Action Publishing Website

https://practicalactionpublishing.com/book/2507/solar-pumping-for-water-supply

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Technical resources – online course

SOLAR POWERED WATER SYSTEMS

From: 09/09/20 | **until:** 11/29/21 | Virtual campus | On-line

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https://www.cursofotovoltaica.com/solar-powered-water-systems/

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https://www.strathmore.edu/serc/solar-water-pumping-training/

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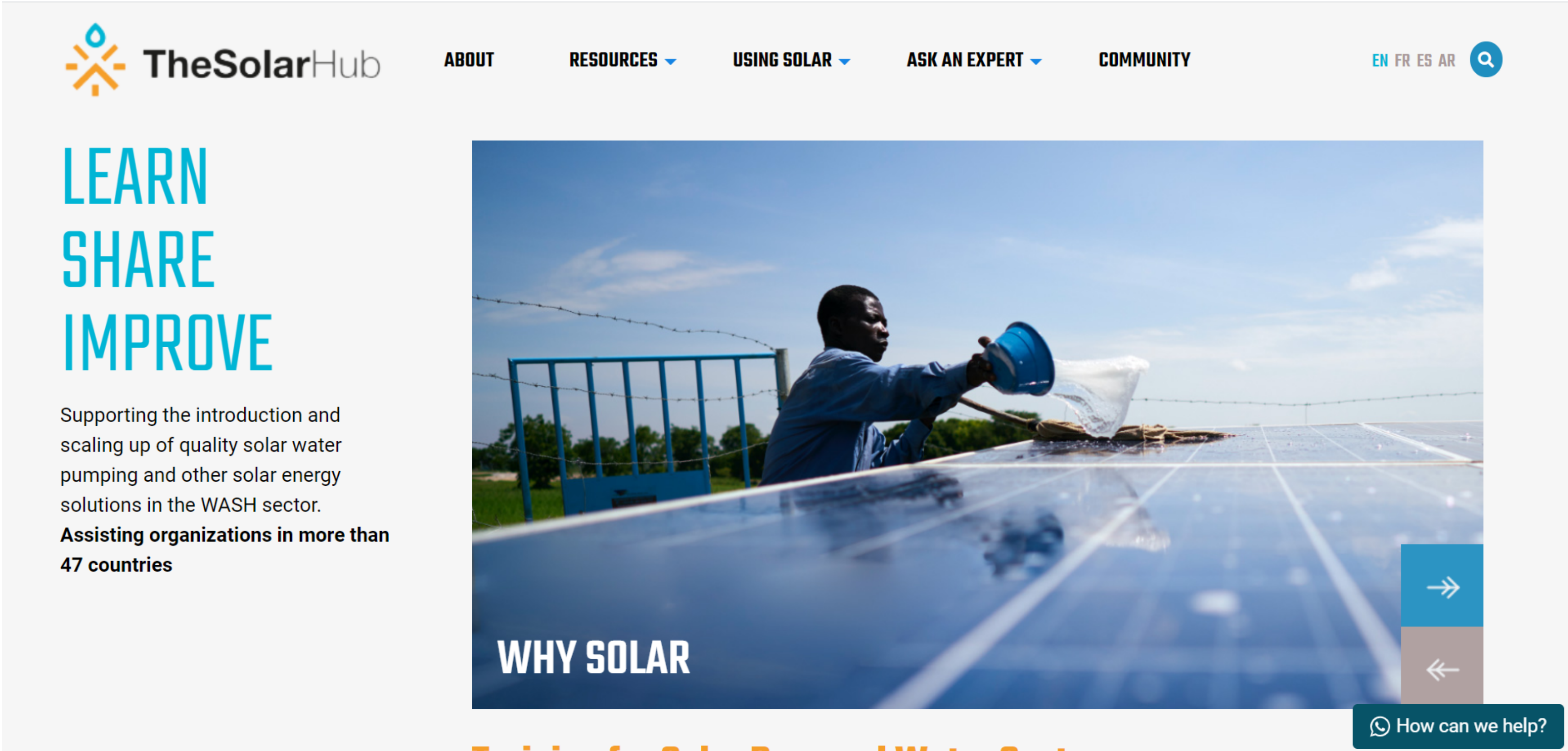
Technical resources – solar pumping website



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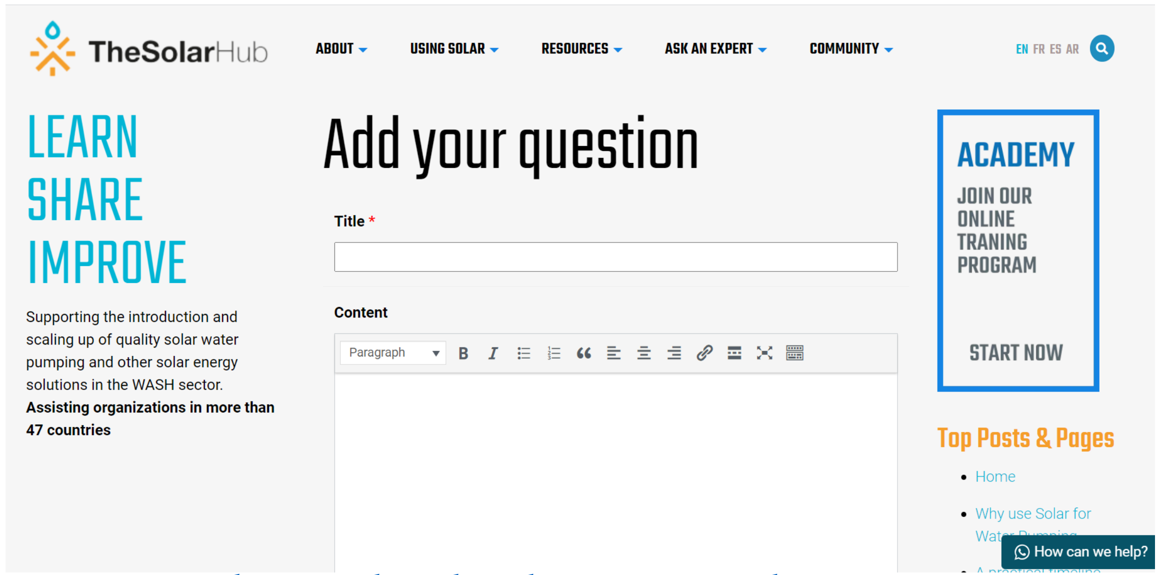
Technical resources - helpline

Email: solarquery@iom.int



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