Food and Agriculture Organization of the United Nations

HOW DIFFERENT COUNTRIES PROMOTE AND MANAGE SOLAR-POWERED IRRIGATION

CASE STUDIES FROM EGYPT, JORDAN AND UGANDA

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Land and Water Division (NSL), FAO

Tunis, 14 December 2022

Regional gathering
Tunis, 12 – 16 December 2022

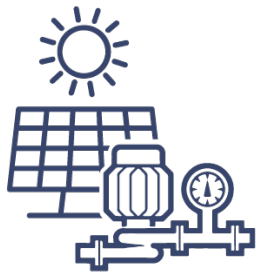
ITALIAN AGENCY FOR DEVELOPMENT COOPERATION

FAO considers a priority to meet water needs, given the importance of the agricultural sector to rural employment and development.

FAO considered approaches to improving agricultural water security and proposes alternative effective methods to diversify agricultural water supply with sustainable energy power source.

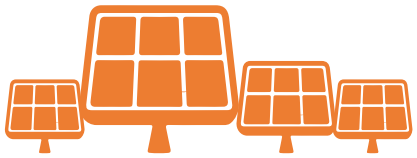
+220KW

Installed capacity



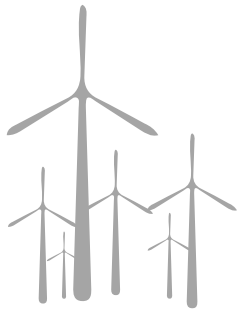
+1200KW

Technical Clearance



430’000KWh

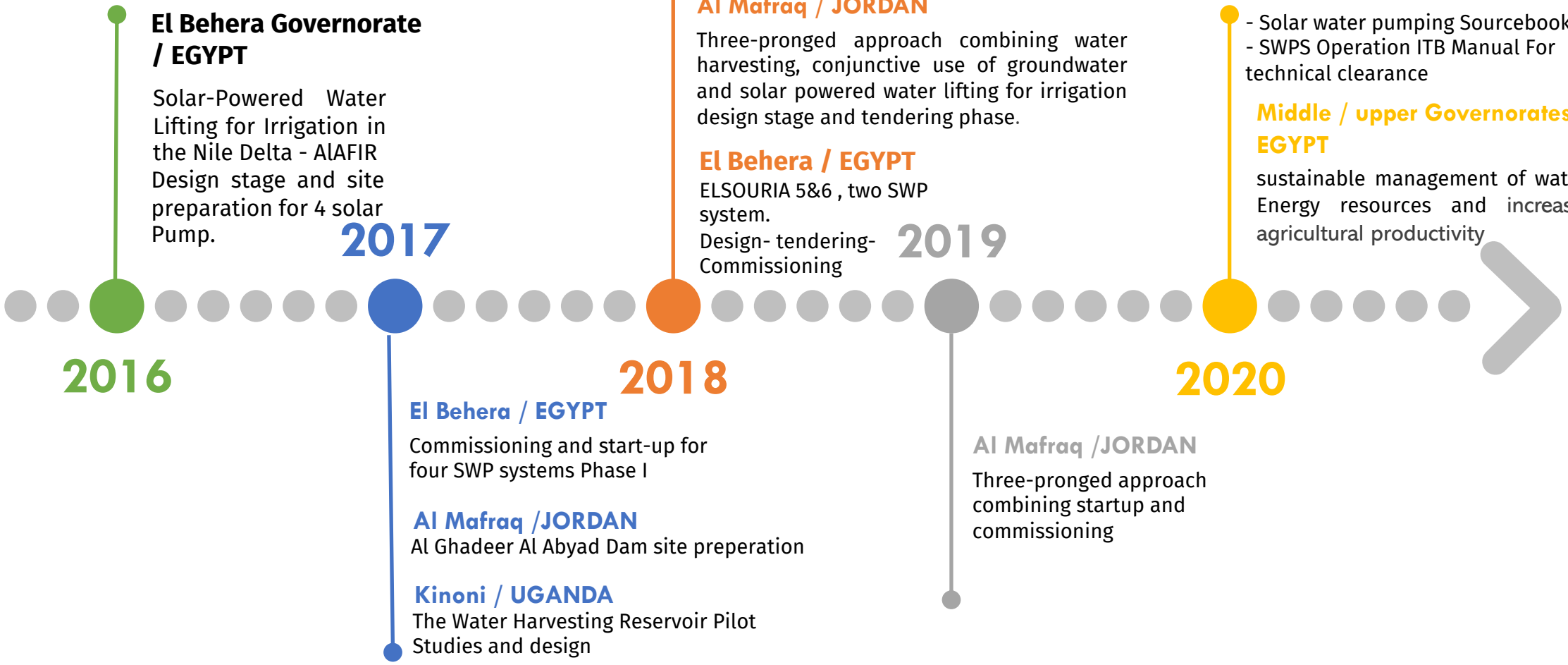
Annual Production Saving



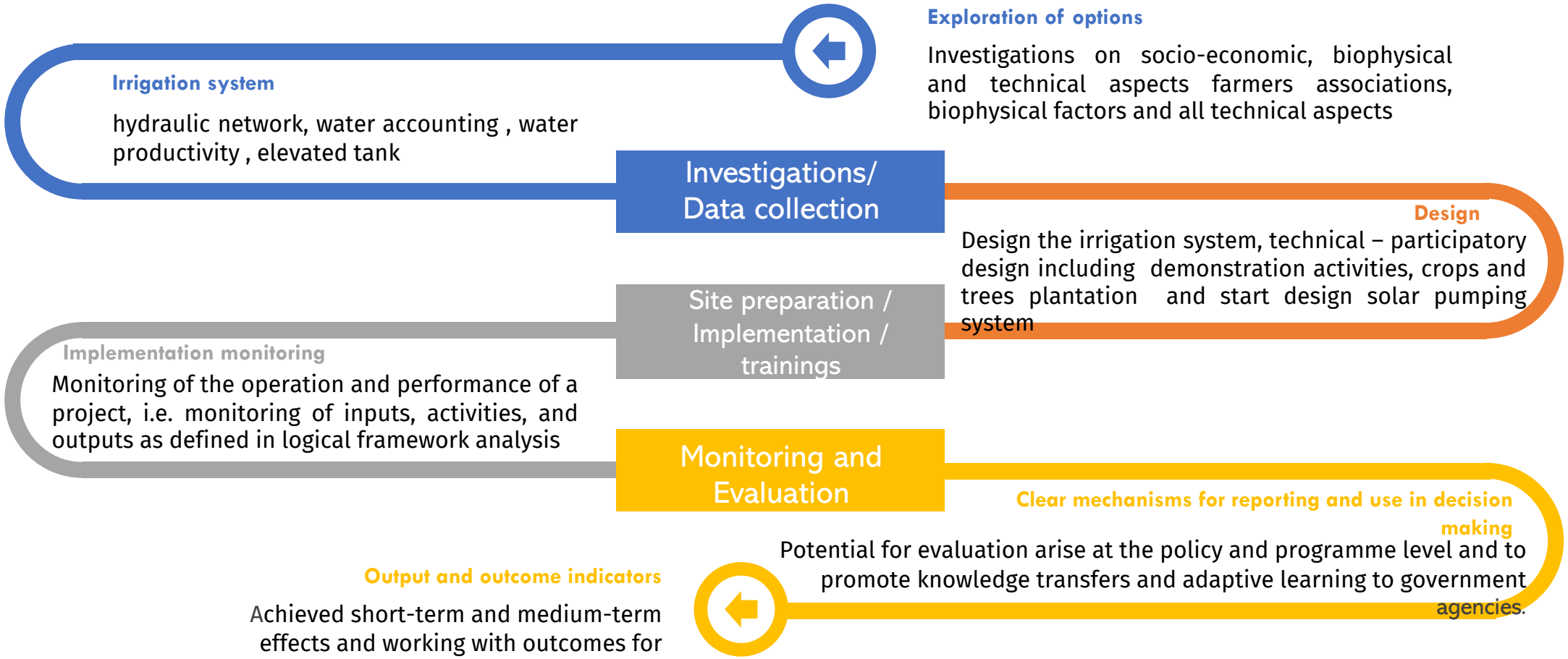
245 Ton

Annual CO2 Saving

- Projects Timeline



• FAO-CBL Teamwork



EGYPT

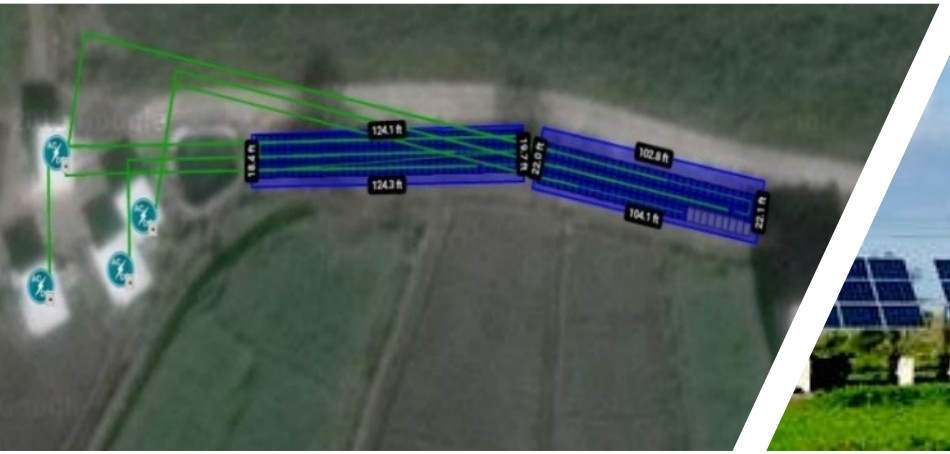
PHASE I
AL AFIR EL- BEHERA GOVERNORAT

SOLAR POWERED WATER LIFTING FOR IRRIGATION 57.6KW

- Installed capacity 57.6 KWp
- Modules: Polycrystalline.
- Mounting: Ground mounting structures

Al-Afir consists of 4 pump rooms at a single location over a covered mesqa in the Al-Afir region

SWP designed to meet the requirement of WUGs in the Nile Delta region of Egypt. To demonstrate the applicability of solar irrigation on this site, we installed one solar pump in each pump room. A 10 HP pump system. PV modules mounted on a suitable steel structure over the covered canal



Source: FAO, 2017, El- Behiera Governorate, Egypt

Source: FAO, 2017, El- Behiera Governorate, Egypt

PHASE I – AL AFIR DESIGN CONCEPT

Four 10HP solar pumps powered by 14.4KWp of PV each installed at the site. PV modules mounted on a suitable steel structure over the covered canal. Pump systems are designed around high efficiency 300Wp modules to minimize area used by modules and maximize power output.

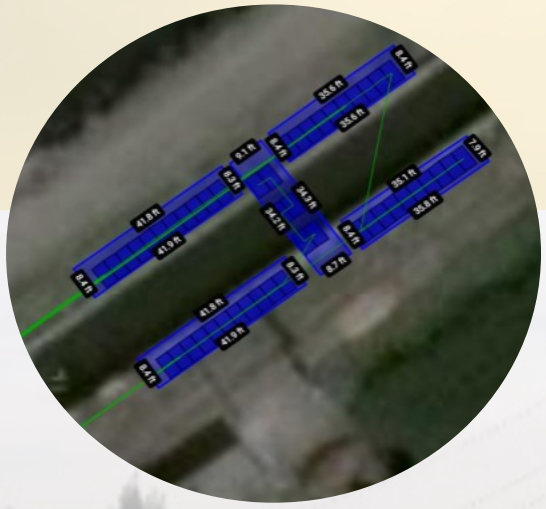
FAO proposed an innovative and cost-effective solution to utilize the existing irrigation canals to mount and produce solar energy according to MWRI requirements. There is a substantial need to use Dead Sea area from Egyptian government , The mounting structure design is emerging as one of the leading PV mounting structure in Egypt.

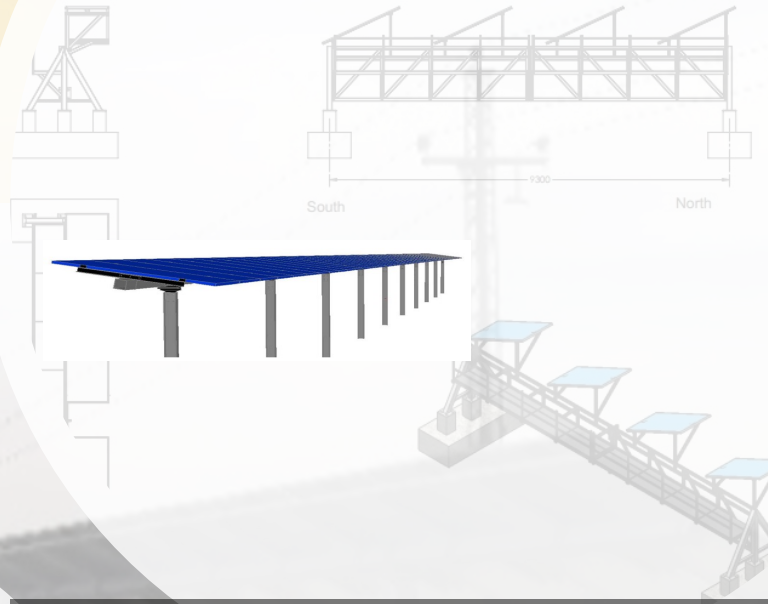
Phase II – Al Sourya

El Behera Governorate
Egypt

Phase II consists of 2 identical pump rooms located along a branch mesqa in the Al-Sourya region

Pump rooms is along a lined stretch of the mesqua. This stretch provides adequate space to install modules, both on the sides of, and across the width of the canal. We installed one solar pump in each pump room. A 10 HP pump system.





Al-Sourya -Behera Governorate

PHASE II

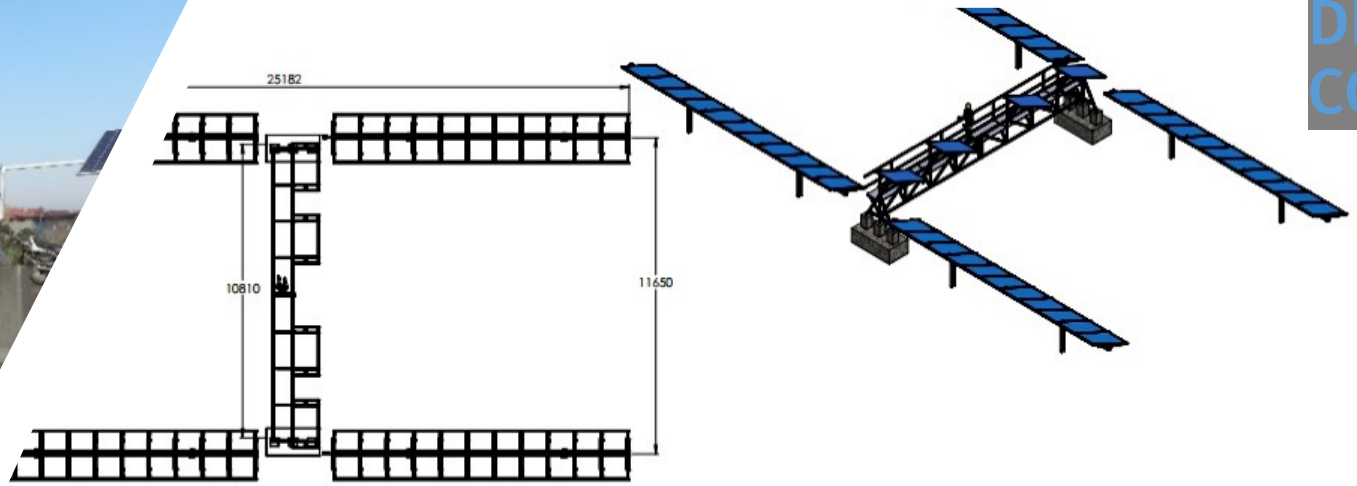
AL SOURYA EL BEHERA, EGYPT
SOLAR POWERED WATER LIFTING FOR IRRIGATION
28.8KWP

Installed capacity 28.8 KWp
Modules: Polycrystalline.
Mounting: Ground mounting structures.

Phase II consists of 2 identical pump rooms located along a branch mesqa in the Al-Sourya region. The controller includes a switch to operate the system, transfer switch to control the system status and give best operation performance to users, and protection mechanisms to ensure easy and safe operation of the system.

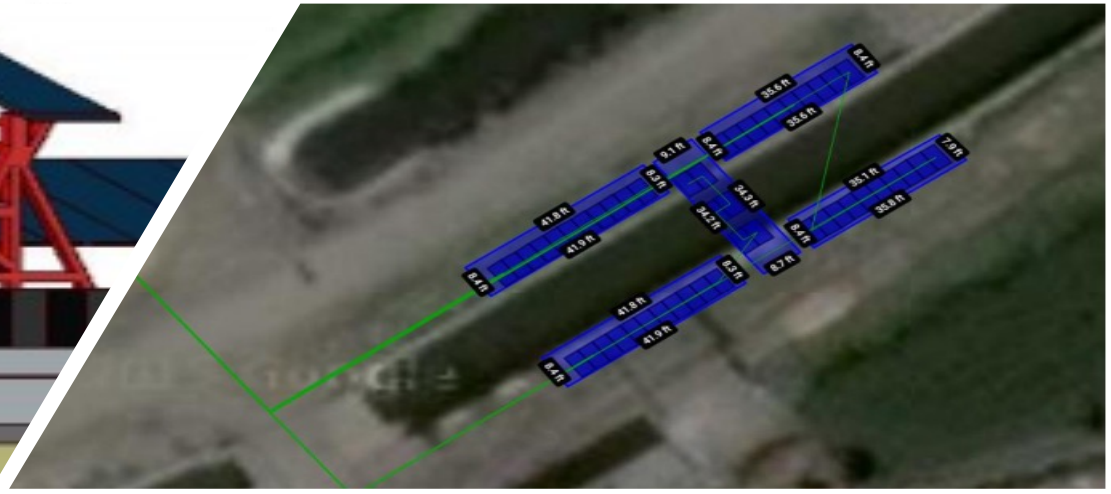
Solar pumps move a volume 160 m3/hr of water under over an extended period of day in between 5-7 hr/day according to all the Derate Factors and operate the pump at maximum speed with maximum frequency 50 Hz and minimum frequency 30 Hz..

Source: FAO, 2019, El- Behiera Governorate, Egypt



DESIGN CONCEPT

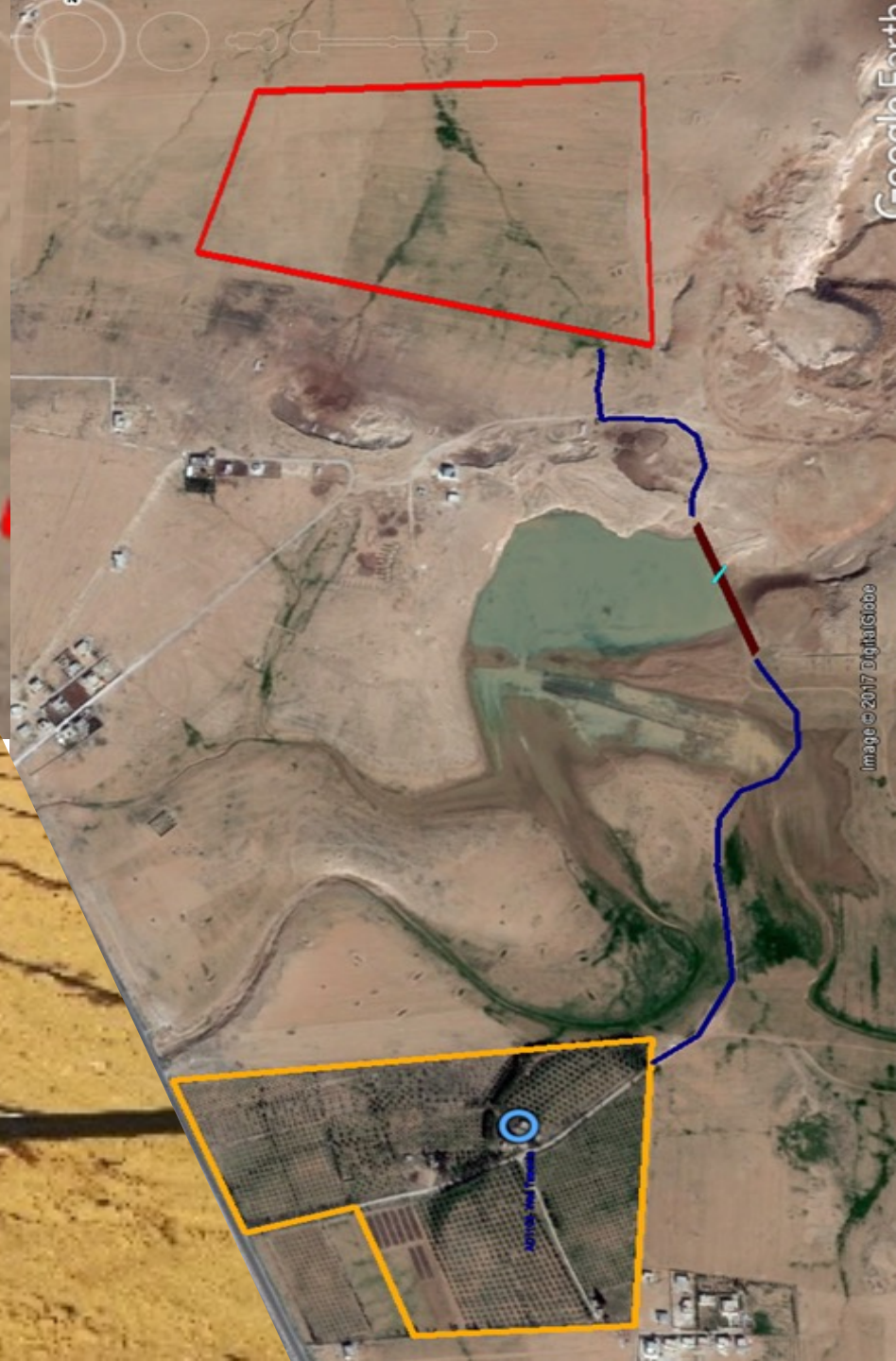
Source: FAO, 2019, El- Behiera Governorate, Egypt



Three-pronged approach combining water harvesting, conjunctive use of groundwater and solar powered water lifting for irrigation

Al Ghadeer Al Abyad Dam

Al-Mafraq - Jordan



Source: FAO, 2018, Al-Mafraq Governorate, Jordan

Water harvesting: WH

Water harvesting provides one such water alternative source, the process of concentrating precipitation through runoff and storage for productive use,

- collection of rainfall for direct application.
- stored in the soil profile for immediate use or stored in reservoir for future productive use.
- a source of groundwater recharge through percolation and seepage.

Conjunctive use of surface and groundwater

an optimal combination of both sources of water, minimizing the undesirable physical, environmental and economic effects of each solution and balancing the water demand and supply.

Solar Energy

Most intense solar radiation coincides with irrigation period and that is simplest way to set up a SWP system “Stand-alone system for direct irrigation “

PROJECT DETAILS AND DESIGN CONCEPT

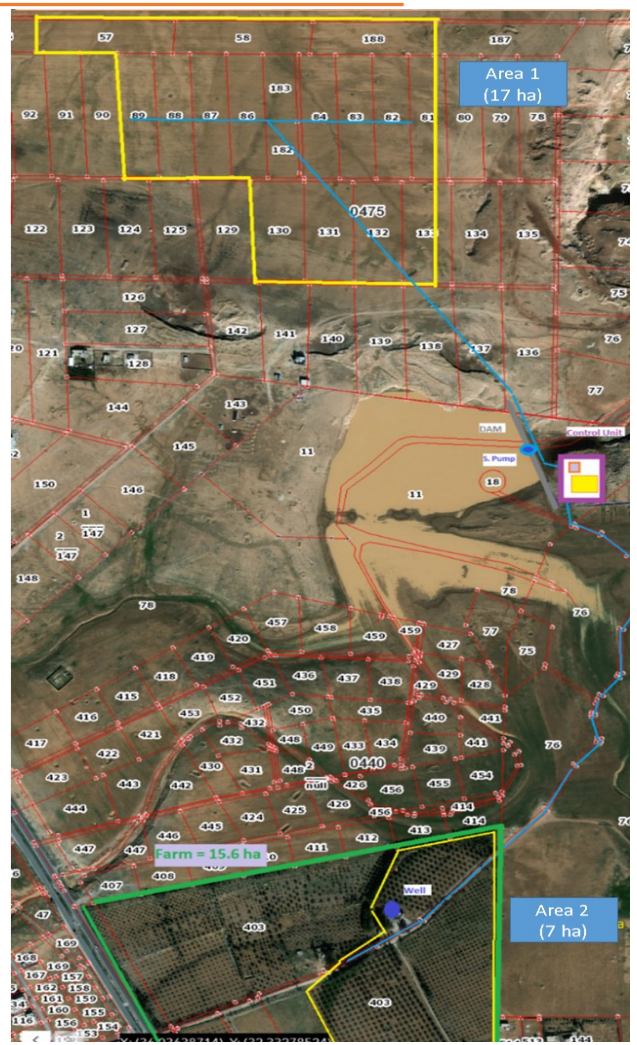
Installed capacity: 100.98 KWp
Modules: Polycrystalline PV-Modules.
Mounting: Ground mounting structures.
Application: Solar water pumping.

Dam Reliable water Amount 200 000 m3
Crop types: Peas, Carrots, Cabbage, Lettuce, Spinach, Cauliflower, Thyme

Northern & Southern Zone Pumps

Two submersed pumps are installed to cover two irrigation zones (Area 1 for 17 ha, and Area two for 7 ha).

	Flow rate m3/hr	Head m	HP
Area one	130	60	50
Area two	65	60	25



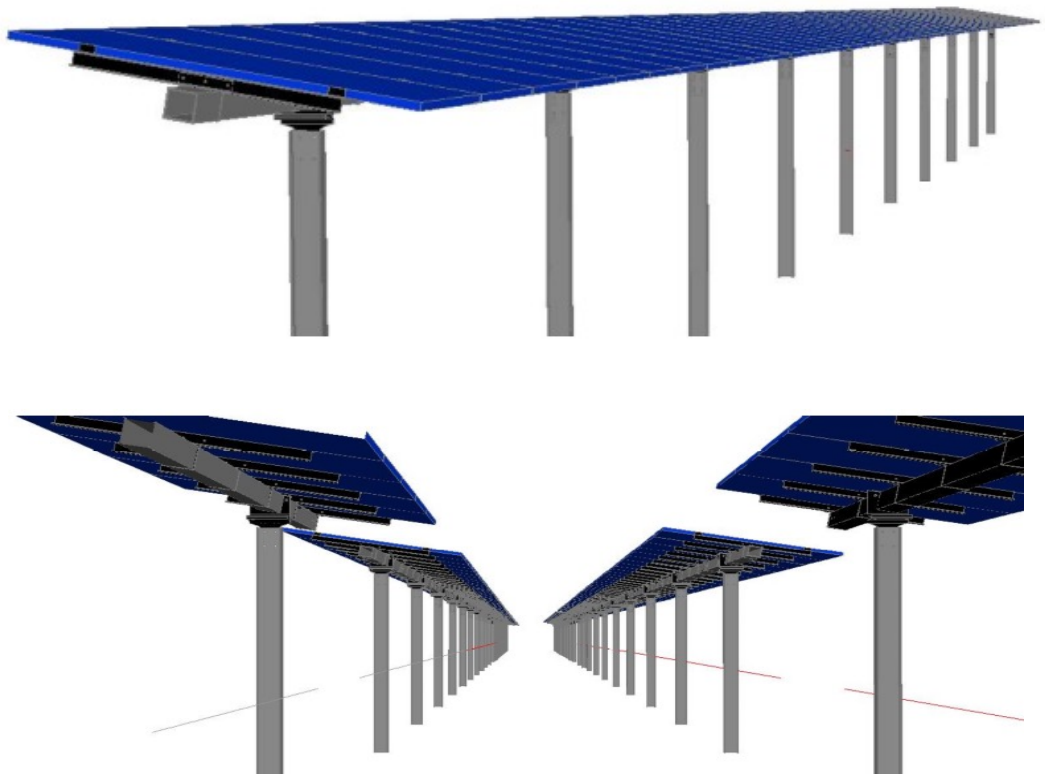
Source: FAO, 2018, Al-Mafraq Governorate, Jordan

PROJECT DETAILS AND DESIGN CONCEPT

- The technical working group's input and feedback was an integral component of the roadmap development since the three-pronged approach considered many factors related to water source capacity, water volume required per day, solar insulation availability, pumping time, static water level, drawdown level, discharge head, pipe size friction, pumping subsystem efficiency.
- Different methods were employed to comply with irrigation needs account, also considering that the demand for irrigation system water varies throughout the year since the peak demand during the October – March.

Source: FAO, 2018, Al-Mafraq Governorate, Jordan

PROJECT DETAILS AND DESIGN CONCEPT



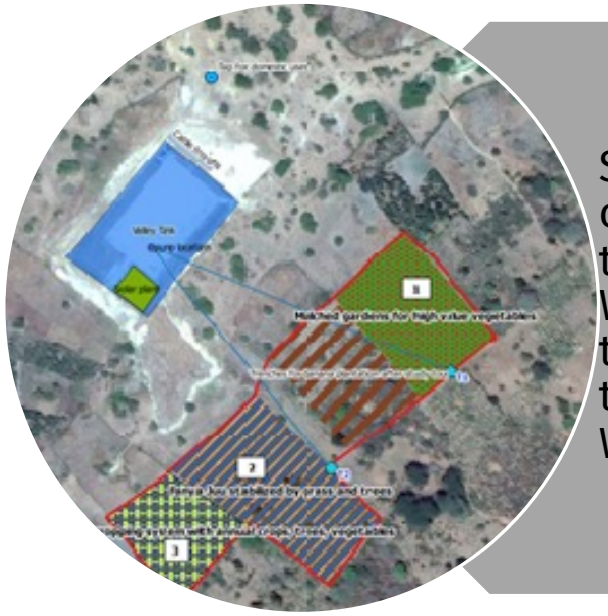
Source: FAO, 2018, Al-Mafraq Governorate, Jordan

PV mounting structure and framework play a vital role in setting up sustainable solar energy system. The mounting structures design adopted in this case are manufactured using hot dip-galvanized material for longer life and have high mechanical strength to withstand wind speeds of up to 33 m/sec different wind speed measurement scales. Galvanized structures also prevent rusting and oxidation of structures ensuring longer life

Source: FAO, 2018, Al-Mafraq Governorate,

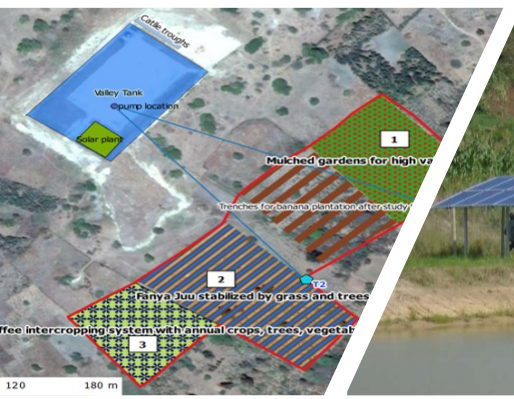
UGANDA

Installed capacity: 3’600 Wp
Modules: Polycrystalline PV-Modules.
Mounting: Ground mounting structures.
Application: Solar water pumping/ diesel hybrid solution



Surface reservoir with 10,000m3 Storage capacity (Inlet, silt trap and overflow) • 3 cattle troughs: troughs built with reinforces concrete. Water flows by gravity from the overhead tanks to cattle toughs. Elevated water tanks: 2 PE tanks are installed each with a capacity of 10 m Water point for domestic uses

Source: FAO, 2018, Kinoni/Mubende, Uganda



The system is designed at maximum water discharge of 24 m3/day , The pump is directly connected to a solar pump inverter and starts operating in the morning when the solar output is higher than the minimum power required to start the pump.

Submersible pump is very flexible regarding its energy supply and performance and has been designed for intermittent and continuous operation.

	m3/hr	Head	
		m	Hp
pump	2.5	60	3

PILOT CONCEPT

The water harvesting reservoir of Kinoni is situated in a depression, far from the area of water use and in a low level, which calls for pumping and energy (the area is a remote one and electrical energy in not available)

THANK YOU

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