

SOLAROPIA

INNOVATIONS IN SOLAR PUMPING TECHNOLOGY



SOLAR POWERED DESALINATION PLANTS



The 21 Century Plants Operate with Solar

S-RO

WORLD'S FIRST RO PLANTS OPERATING WITH SOLAR POWER

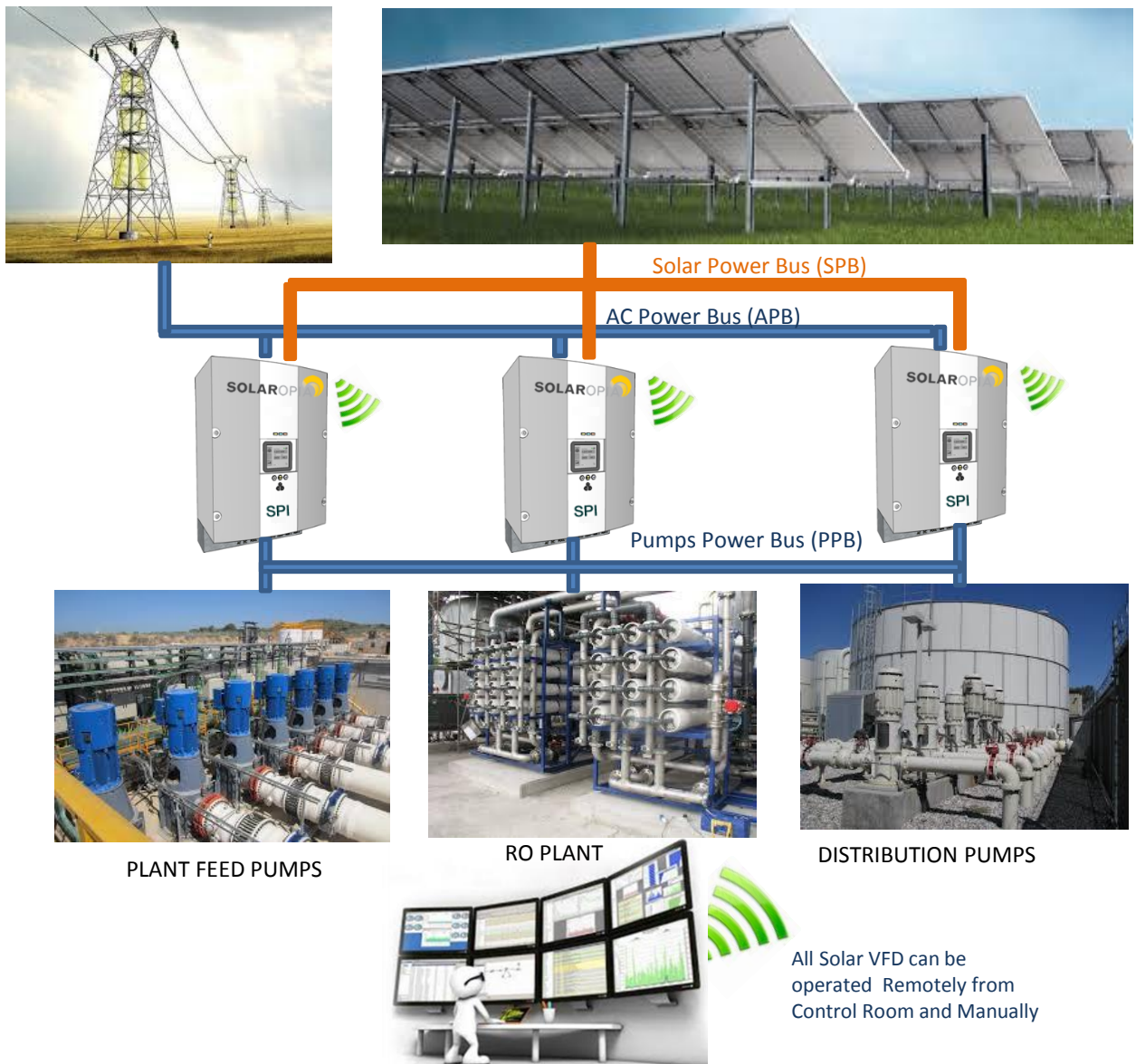
ABOUT S-RO-D

SOLARROPIA S-RO-D CLASS are solar systems dedicated to operate seawater desalination plants directly from PV array. These systems use new solar pumping technologies (SPI Technology) that can operate all pumps in a city scale desalination RO plants (Water feed pumps, High pressure RO pumps, and water distribution pumps) with distinguished solar pumping technologies :

- New Solar VFD technology to operate pumps at various plant loads and directly operate from Solar PVs
- Operate Plant pumps Off-Grid (in Rural Areas Plants)
- Operate 24 hours pumping in hybrid Solar-AC mode (in Urban Areas)
- Pump type independent (no need to change existing plant infrastructure to operate with solar)
- Extremely efficient (about 40% higher efficiency than conventional solar power systems)

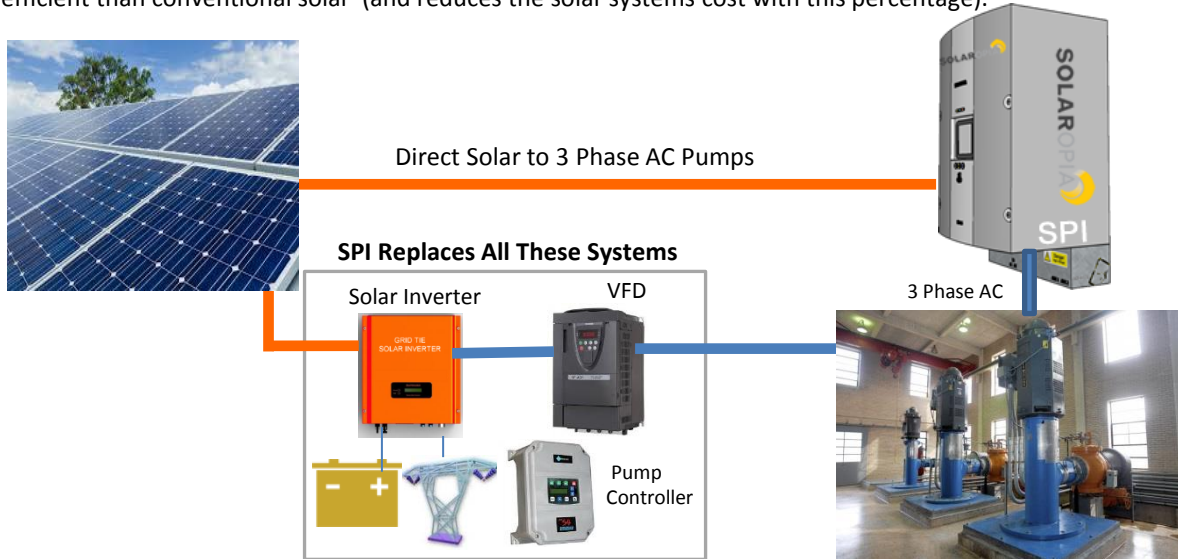
S-RO DESALINATION PLANTS

S-RO operates existing plants without a need to make changes to their infrastructure. The Solar Power plant Bus (SPB) is added to the RO plant and jointly with the existing AC Power Bus (APB) they feed our SPI Solar-VFD systems that operate plant pumps. Whether the plant is operated manually, or by SCADA, no changes in the plant operation is required. Our SPI systems can be easily integrated with the control room using standard industrial communication protocols. S-RO just adds the solar power source to the plant with smart SPI solar technology to operate the plant with clean solar power day time, and grid power night time.



EFFICIENT SOLAR PUMPING TECHNOLOGY

S-RO plants use new SPI solar pumping technology developed by SOLAROPIA for industrial pumping with solar power. Conventional solar inverters (Off and On Grid) are not suited to operate pumps – they would need four systems (Solar Inverter, Transformer, VFD, and Pump Controller) which translates into 20%-30% of solar power losses. SPI solar pumping technology operates pumps directly from PV plants - it eliminates all the losses and the extra systems cost (see the diagram below). Overall, SPI technology is by 40% average more efficient than conventional solar (and reduces the solar systems cost with this percentage).



SOLAR HANDLES DAILY PLANT PRODUCTION

S-RO systems have a great economic advantage – it uses solar power to produce 70% of plant daily production capacity during daytime, 20% in Hybrid mode (AC and Solar power late time of the day), and only 10% with grid power at night time. S-RO swiftly switches between these power modes without interruption in powering RO plants.

THE S-RO PLANT ECONOMY

RO desalination plants are energy intensive -the production of 1AF (about 1000 m3) consumes in average 400 KWh. This power represents about 80% of the plant total operating cost. S-RO will reduce this cost dramatically by about 50% or more making desalination plants an affordable economic water solution, and environmentally clean powered plants.

The cost and saving data for 1 AFPD (10000 m3/day) production is provided below for comparison between the operating cost of S-RO power (average ₺8 per KWh), diesel co-plant power (average ₺22 per KWh), and Utility grid power cost (average ₺18 per KWh). The operating cost is provided for 15 years (S- RO solar plants operate for 15 years minimum and 25 years average). S-RO costs about \$17,5 million and saves about 70% of the diesel operating cost (saving about \$42 million), and 55% of grid power operating cost (saving about \$31,5 million).

Plant Power Source	Operating Cost (\$USD) (1AFPD for 15 years)*	Saving in Operating Cost (\$USD) (15 years)
Diesel Co-Plant Power	\$500,000	\$0
Utility Grid Power	\$400 ,000	\$375,000
S-RO Solar Plant	\$175,000	\$225,000

* The cost is calculated based on production 1AF (1000m3) only at 400 KWh 8 hours/day for 15 years .

S-RO-WD MODELS

S-RO models can be sized for various capacities desalination plants. S-RO models are listed below for up to 1million GPD (1000 m3/day)-seawater source at TDS 45,000 ppm (requires about 1000 psi RO pressure pumps) . Larger plants up to 50 million GPD can be sized using this modular 1 million GPD plant.

RO Plant Capacity		Required Solar Power (KW PV)				S-RO-D REF
GPD	m3/day	Surface Pumps* (H: 75' -25m)	RO Pumps (P: 1000 psi-65 bar)	Distribution Pumps (P: 115 psi-7 bar)	S-RO Plant Power (KWh/ KW PV)	
25000	100	3	42	6	50 KW	S-RO-D 50
50 000	200	6	72	12	100 KW	S-RO-D 100
125 000	500	15	120	24	200 KW	S-RO-D200
300 000	1000	30	300	48	400 KW	S-RO-D400
600000	2000	60	500	120	750 KW	S-RO-D 750
1 000 000	3000	90	700	180	1000 KW	S-RO-D 1000

*Feed pumps power is provided for twice the produced water volume in RO plants at 50% RO recovery rate.

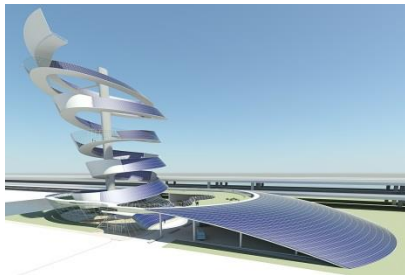
S- RO PLANT IMPLEMENTATION

SOLAROPIA Offers services to install a-operate and commission S-RO plants:

PAC1: Package for New RO plants (designated for RO Plant manufacturers-designers- contractors)

PAC2: Full service package for Existing RO plants (designated for Operator City water Utilities)

PAC1	PAC2
Complete solar System for new designed plants SOOLAROPIA works with RO Plant designers to provide complete solution , install and commission the solar S-RO plant	Complete solar System for existing RO plants SOLAROPIA and its certified partner in the country of installation will provide complete solution , install and commission the solar S-RO plant



S-RO Plant Referencing

S-RO	D	W	P
Plant Type		Plant Power	Package Type: 1, 2

