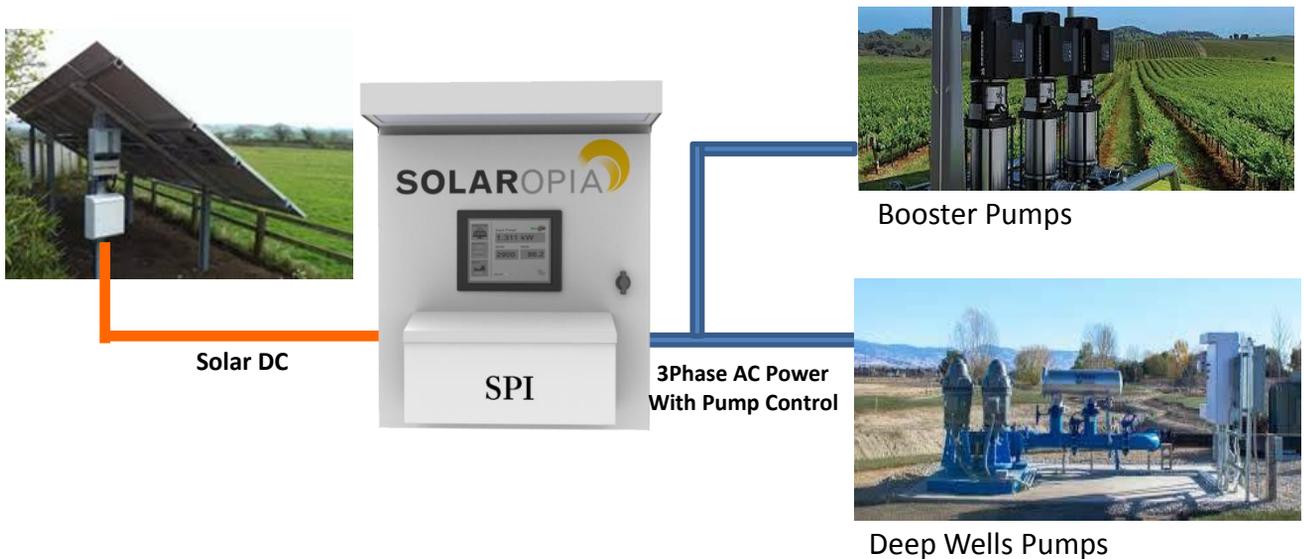


SOLAROPIA

SPI Solar Pumping Inverter-VFD

FREQUENTLY ASKED QUESTIONS (FAQ)



OFF-GRID BATTERY-LESS SOLAR VFD FOR AGRICULTURAL PUMPING

- WHAT IS SPI AND HOW IT IS DIFFERENT FROM OFF-ON GRID SOLAR SYSTEMS?
- HOW SPI IS DIFFERENT FROM CONVENTIONAL VFD SYSTEM?
- IS IT DIFFICULT TO REPLACE EXISTING VFD BY SPI IN EXISTING PUMPING SYSTEMS?
- CAN SPI REPLACE DIESEL GENSETS AND CAN IT OPERATE JOINTLY WITH THEM?
- HOW TO SIZE SOLAR POWER FOR GIVEN Application?
- HOW TO SIZE SOLAR POWER FOR GIVEN PUMP ?
- HOW EASY TO OPERATE SPI ?
- CAN SPI BE OPERATED REMOTELY?
- WHAT ECONOMY SPI OFFERS COMPARED WITH DIESEL GENSETS?
- HOW TO GET CERTIFIED IN SPI SOLAR PUMPING SYSTEMS?

▪ **WHAT IS SPI AND HOW IT IS DIFFERENT FROM OFF-ON GRID SOLAR SYSTEMS?**

SPI is dedicated solar VFD to operate pumps directly from solar PVs. Its output is 3 phase variable frequency AC power to allow control of pump speed per application need. Solar Off-grid and On-grid inverters are general AC power generation systems from PVs with fixed frequency (50 or 60Hz) and they are not designated for pumping applications as they will require separate VFD. In addition, off-grid inverters would require battery bank and battery charger to generate AC power and they are limited to 10 KW system which means they can operate pumps up to 10 hp. SPI is battery less system and it can operate up to 500 HP pumps with single SPI systems. Compared to off-grid inverters SPI reduces the solar pumping system cost by 50% (removing the cost of batteries, chargers, and VFD). SPI also reduces PV requirement by 20-30% as no power losses are incurred in operating Solar VFD from PVs. Compared with On-grid inverters, SPI is grid independent, it can operate without grid (solar only), and with grid or diesel genset (hybrid solar and AC). On-Grid inverters can not operate without grid power or AC external generator like diesel Genset. SPI reduces solar pumping cost by 40% compared with on-grid systems.

▪ **HOW SPI IS DIFFERENT FROM CONVENTIONAL VFD SYSTEMS ?**

SPI offers the same pumping control functions as conventional VFD does, however, it is different in three additional functions:

1. SPI operate with solar power directly from PV and it embeds solar power stabilization and optimization functions
2. SPI embeds additional Power management system that eliminates DC and AC power boards and it automates the switching between DC and AC based on the available solar power or based on operation time – makes it easy to operate solar pumps in any power mode and eliminates the need for power boards.
3. SPI embeds PLC (programmable Logic Controller) for pumping applications with TFT screen to set up Irrigation and application control data such as time to increase-decrease flow, power mode switching, automatic flow-rate and volume control, tank –level control. The SPI eliminates the need to have control board and control system integration with the VFD in pumping applications.

SPI, in general, is a complete solar pumping system while VFD is a pump controller device.

▪ **IS IT DIFFICULT TO REPLACE VFD BY SPI IN EXISTING PUMPING SYSTEMS?**

Not at all. Just take away the VFD and insert the SPI. Plug in the same AC input power and the output AC power to the pump. When the PV array is installed, Plug-in the DC cable from combiners to the SPI. Programming the SPI is simple exercise on SPI user friendly Touch TFT screen – very much like customizing your iPhone. Testing is straight-forward – just select RPM and start running the pump with solar power.

▪ **CAN SPI REPLACE DIESEL GENSET, AND CAN IT OPERATE WITH IT?**

Yes, SPI can totally replace Diesel Genset in rural pumping and irrigation applications. SPI operates everyday at no cost while diesel consumes expensive fuel everyday. In Many irrigation applications Diesel sets are operated 2-3 times a week for pumping. With SPI at lower solar PV array in KW pumps can be operated daily cutting operating cost by more than 50% (see the economy evaluation in the last question of this list)..

■ HOW TO SIZE SOLAR POWER FOR GIVEN APPLICATION

SOLAROPIA provides solar Power sizing tables for given Pumping head (H) and required Flow rate (Q) . A sample table is given below for power sizing to operate pumps up to 300 hp.

Q: FLOW RATE		H: PUMPING HEAD in Feet'-Meter (m)									
GPM	m3/h	75'-25m	150'-50m	250'- 75m	350'-100m	500'-150m	700'-200m	1000'-300m	1200'-400m	1500'-500m	2000'-700m
50	15	1.5KW	3.6 kw	6 kw	7.5 kw	10.5 kw	15 kw	24 kw	30 kw	42 kw	54 kw
100	25	3KW	6 kw	9 kw	12 kw	18 kw	24 kw	36 kw	48 kw	60 kw	72 kw
200	50	6 kw	12 kw	18 kw	24 kw	36 kw	48 kw	72 kw	105 kw	135 kw	165 kw
300	75	12 kw	18 kw	24 kw	36 kw	60 kw	72 kw	105 kw	135 kw	165 kw	210 kw
400	100	18 kw	24 kw	36 kw	48 kw	90 kw	105 kw	135 kw	165 kw	210 kw	270 kw
600	150	24 kw	36 kw	48 kw	75 kw	105 kw	135 kw	165 kw	210 kw	270 kw	330 kw

The pumping head (H) is easy to determine. If the source is deep well water then “H “ is the well dynamic head (the minimum level of the well water) . If the source water is surface , then the head “H” is the pumping pressure . For example most sprinklers will required 2.5 bars “75’ or 25m”. To determine Q- the required flowrate (if it is not specified), one can use the land area to determine it. Most crops require 5-6 GPM per acre land “ 1.5 m3/h per one acre land”. Some corps my need less (4 GPM) and others may need more “up to 8 GPM”. The total required pumping flowrate (Q) will be the land area in acres times 4-to-8 GPM.

Once Hand Q are specified one can use the table above to size the PV power required by the SPI, or use the (H,Q) characteristics supplied by pump manufacturers to determine the pumping operating horse power (hp) . **All SOLAROPIA SPI systems require PV power in KW equal to the pump operating hp which leaves about 33% margin for pump operation in various weather conditions.**

■ HOW TO SIZE SPI SOLAR POWER FOR EXISTING PUMP IN THE FIELD?

One should differentiate between the pump plate name hp (hp indicated on the plate), and the Operating hp for given H ,Q. The first one is the maximum HP that the pump can run per maximum power , the second one is the operation pump power to deliver the required Q per given H. Many pumps in the fields are oversized by 40-50% of their operating hp. For example, if the required operating power is 15 hp, you will find the pump name plate is 25 hp (the reason is to leave margin of running the pump at lowest load to extend its service life , however, If VFD is not used, then the 25 hp will always run at maximum power). So sizing the solar power with SPI to operate existing pump, as a rule of thump, may be equal to 65% of the plate hp . For example for 25hp plate name, one can use 18 KW PV . More precise sizing method is to determine the power based on both H and Q as in the specified table above

■ **HOW EASY TO OPERATE SPI AND PUMP OPERATION OVER DAY TIME?**

SPI is user –friendly system with built-in TFT touch screen that allows users to control pumps stop-start and flow rate in various ways ; direct set from screen , time set, volume set, power mode set (Solar or Hybrid) . In addition, SPI has built-in PLC with programmed functions such as stop pump when tank level Lo-Hi , Volume reach-per day, and many other functions that make it easy to operate pumps in any application .

■ **CAN SPI BE OPERATED REMOTELY?**

Yes, SPI offers various options for remote operations. One option is to use GPRS modem , the other is to use Modbus communications . In addition it offer digital –in that can be remotely operated .

■ **WHAT ECONOMY SPI OFFERS COMPARED WITH DIESEL GENSETS?**

SPI Solar pumping system reduces the cost of pumping by 50% or more. The following table compares data for 50hp pump operated by 50 KW diesel generator, and SPI with 50KW PVs

Pumping System	Lease + Maint. (per month)	Fuel (per month)*	Total (per month)	Saving (per month)	%Saving
Diesel 50 KW Geneset	\$600	\$3000	\$3600	Non	Non
Solar 50KW SPI Generator	\$1,600	Non	\$1,600	\$2000	55%

*50 KW Diesel Generators consumes in average 4 gph / 32 gpd / cost about \$100 per 8h day.

■ **HOW TO GET CERTIFIED IN SPI SOLAR PUMPING SYSTEMS?**

If you have used VFD devices before then you do not need special training – just use the SPI user manual to master the user-friendly built-in TFT touch screen.

If you are first time VFD Pumping controller application – then you can register with us on-line for 2 days training and certification program.

To install Solar systems with SPI you just need to get certification C-46 on regular one week solar classes offered in all states.

