



Thursday, 10 September 2016  
تصميم منظومة لرفع المياه الجوفية  
Solar pumping project

### Parameter

Location:	Sudan, Khartoum (15° North; 32° East)	Water temperature:	35 °C		
Required daily output:	10 m <sup>3</sup> ; Sizing for average month	Dirt loss:	6.0 %	Motor cable:	33 m
Pipe type:	plastic	Static head:	28 m	Pipe length:	44 m

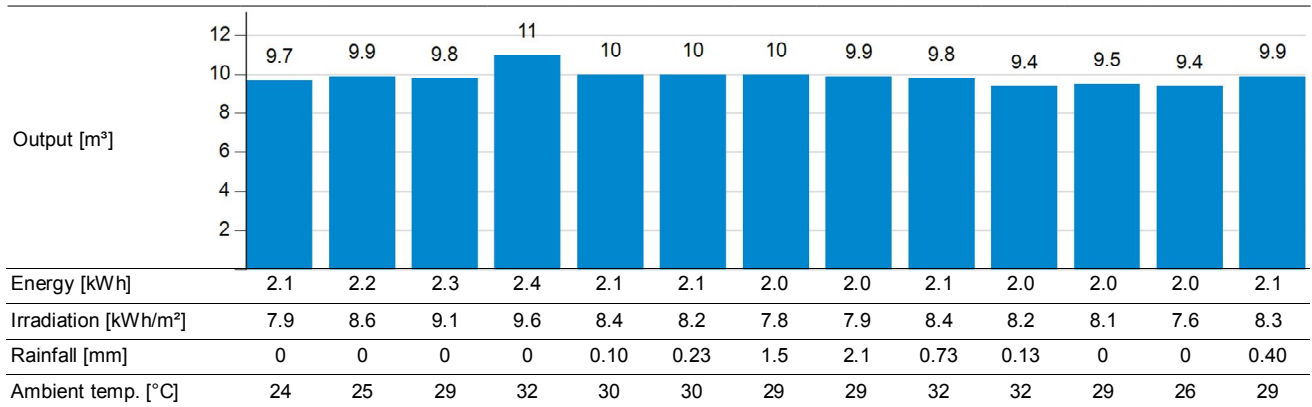
### Products

Quantity	Details
1 pc.	Submersible pump system including controller, motor and pump end
2 pc.	300 Wp; 2 x 1 modules; 20 ° tilted
1 pc.	ETATRACK active Single axis tracker
33 m	4 mm <sup>2</sup> 3-phase cable for power and 1-phase cable for ground
44 m	25 mm (inner diameter) Pipeline
1 set	Well Probe, Surge Protector, PV Disconnect 440-40-1

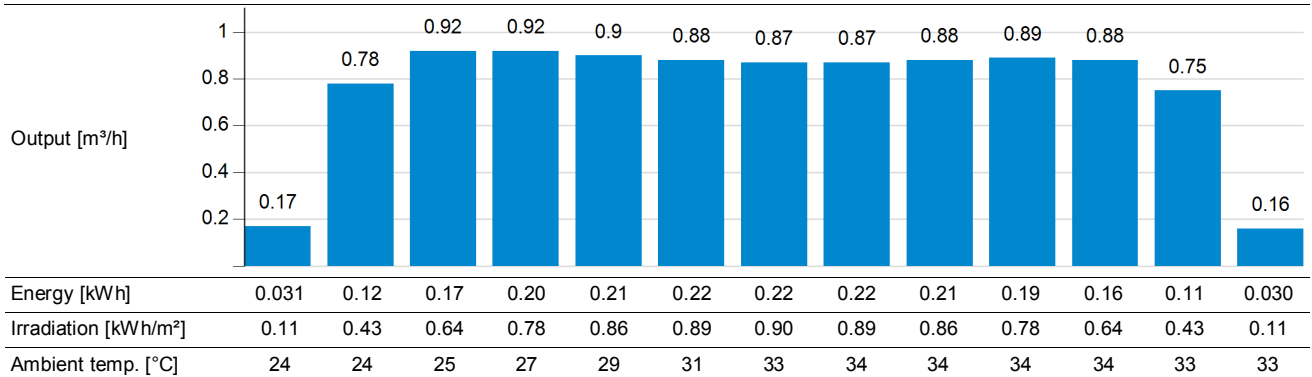
### Daily output in average month

9.9 m<sup>3</sup>

#### Daily values

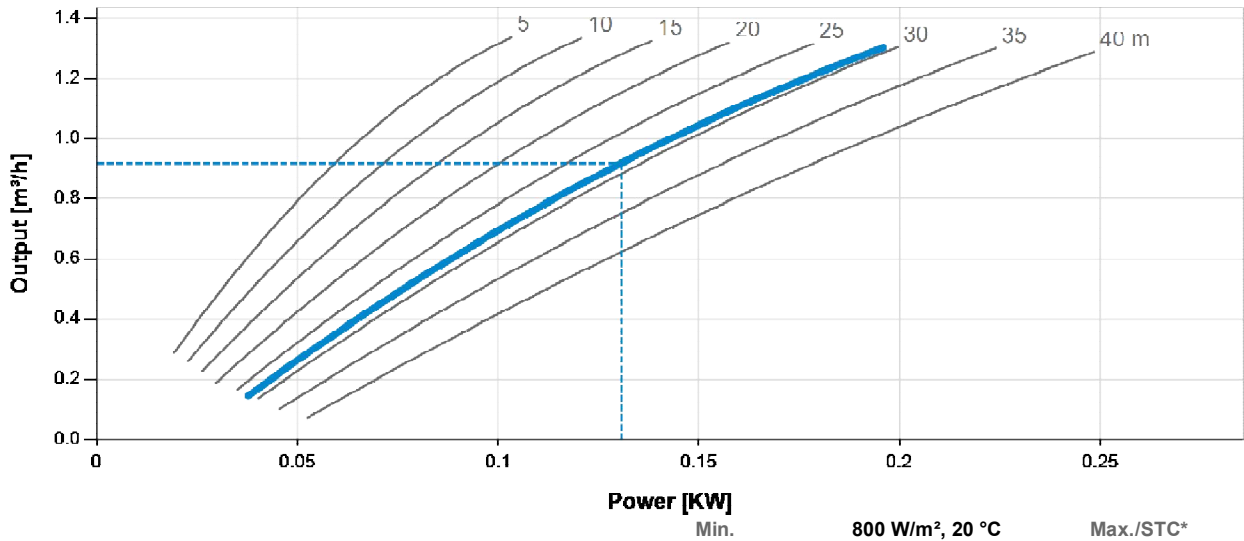


#### Hourly values



Solar pumping project

System characteristic



		Power [KW]	800 W/m <sup>2</sup> , 20 °C	Max./STC*	
		Min.			
<b>PV generator</b>	Cell temperature	[°C]	46	25	
	Temperature loss	[%]	8.8	-	
	Dirt loss	[%]	6.0	-	
	Pmax	[Wp]	206	300	
	Vmp	[V]	34	38	
	Imp	[A]	6.0	8	
	Voc	[V]	41	45	
	Isc	[A]	6.5	9	
	Pout	[W]	136	-	
	Vout	[V]	39	-	
	Iout	[A]	3.4	-	
<b>Motor cable</b>	Power loss	[%]	2.2	2.6	5.7
<b>Pump systems</b>	Motor power	[W]	38	131	196
	Motor voltage	[V EC]	14	38	50
	Motor current	[A]	2.8	3.4	3.9
	Motor speed	[rpm]	762	2,450	3,285
	Flow rate	[m³/h]	0.15	0.92	1.3
	Efficiency	[%]	28	54	54
<b>Pipeline</b>	Flow speed	[m/s]	0.082	0.52	0.74
	Friction loss	[m]	0.018	0.71	1.3

\*STC: Standard test conditions for photovoltaic modules, 1000 W/m<sup>2</sup> solar irradiance, 25 °C cell temperature

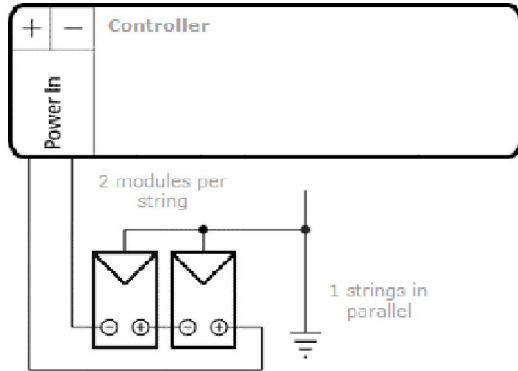


Thursday, 20 October 2016

تصميم منظومة لرفع المياه الجوفية

### Solar pumping project

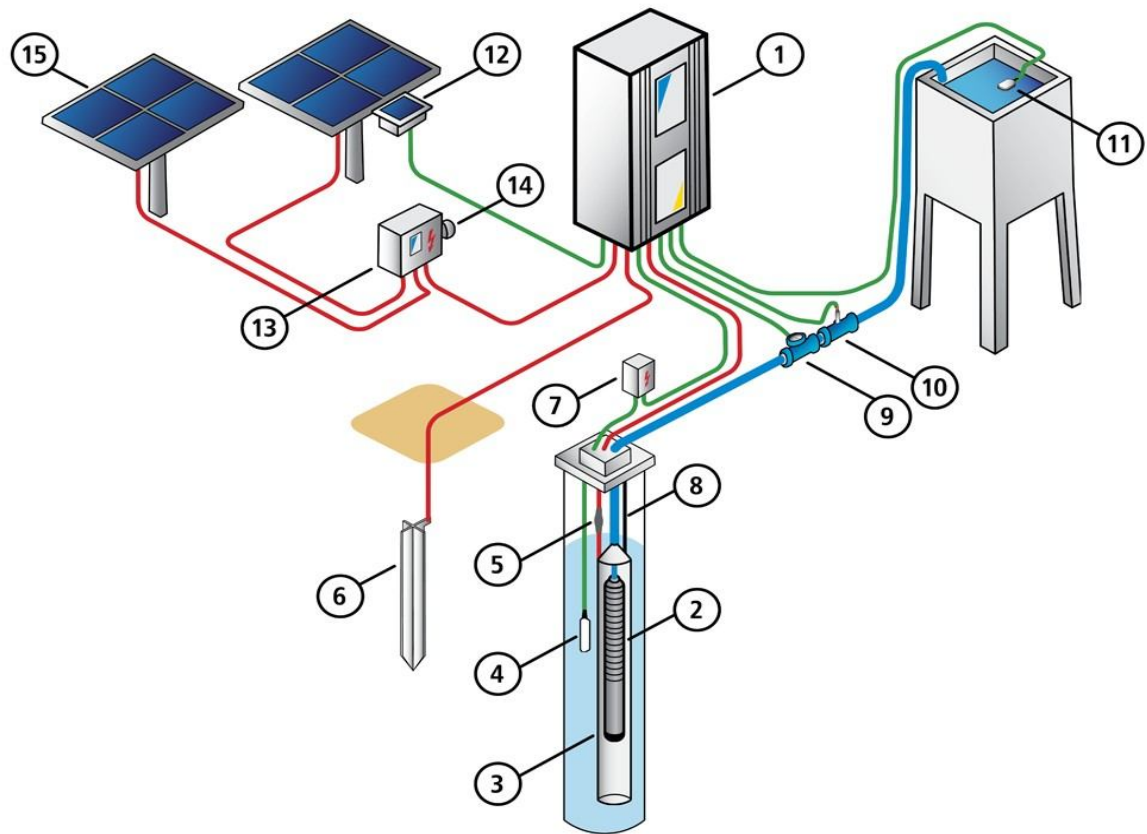
### Wiring diagram



Grounding should be done according to the instructions of the module manufacturer.

Solar pumping project

System Layout



1: PS Controller	11: Float Switch
2: Submersible Pump	12: Sun Switch
3: Stilling Tube	13: PV Disconnect
4: Well Probe	14: Lightning Surge Protector
5: Cable Splice Kit	15: PV Generator
6: Grounding Rod	
7: Surge Protector*	
8: Safety Rope	
9: Water Meter	
10: Pressure Sensor	

\*It is recommended to install a Surge Protector at each controller sensor input.

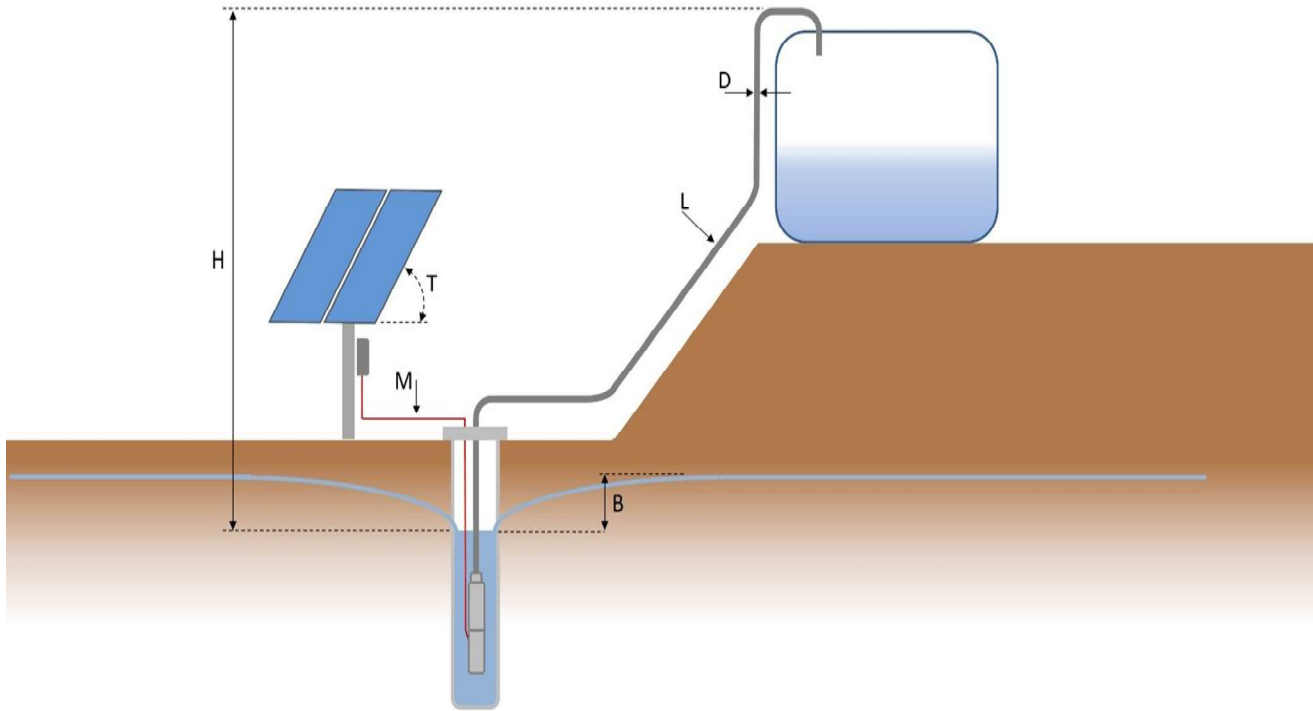


Thursday, 20 October 2016

تصميم منظومة لرفع المياه الجوفية

## Solar pumping project

### Sizing Layout



<b>H (Static head):</b>	Vertical height from the dynamic water level to the highest point of delivery.
<b>B (Drawdown):</b>	Lowering of water level depending on flow rate and recovery rate of the well.
<b>D (Pipeline inner diameter)</b>	
<b>L (Pipe length):</b>	Entire pipeline from the pump outlet to the point of delivery. Ellbows and armatures must be added as an equivalent length of pipeline.
<b>M (Motor cable):</b>	The cable between controller and pump unit.
<b>T (Tilt angle):</b>	Angle of the PV generator surface from the horizontal plane.