SOLAR23 – SOLAR PUMPING SYSTEMS

- Power the way to sustainability!

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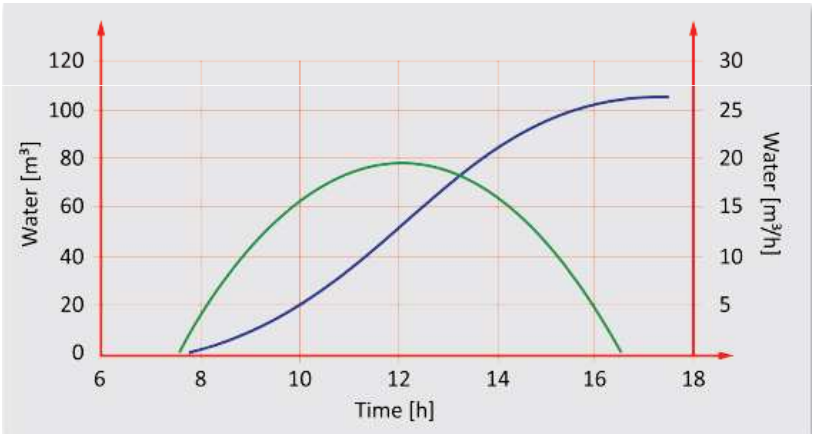

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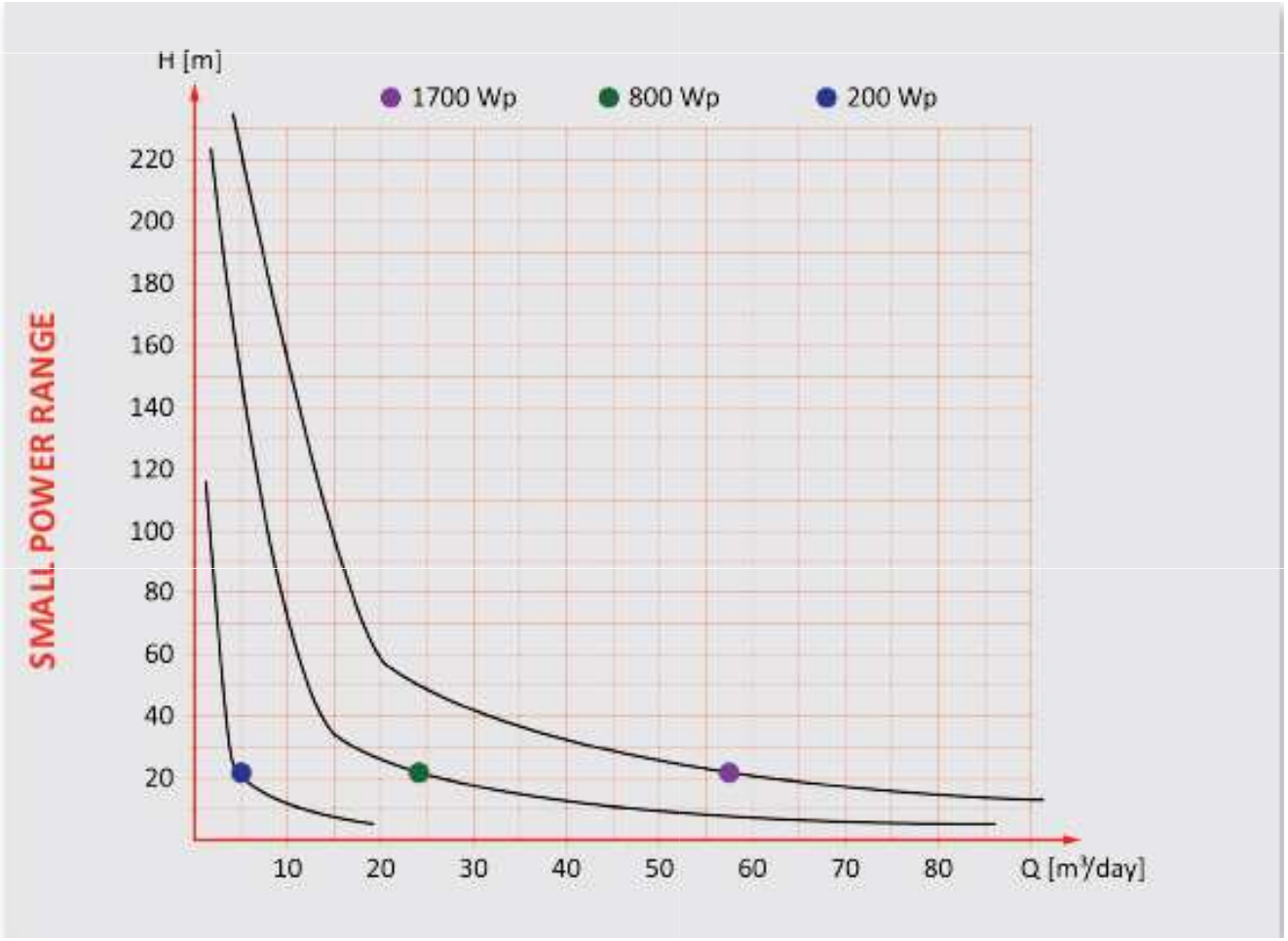
2. power range overview

Category “SMALL”



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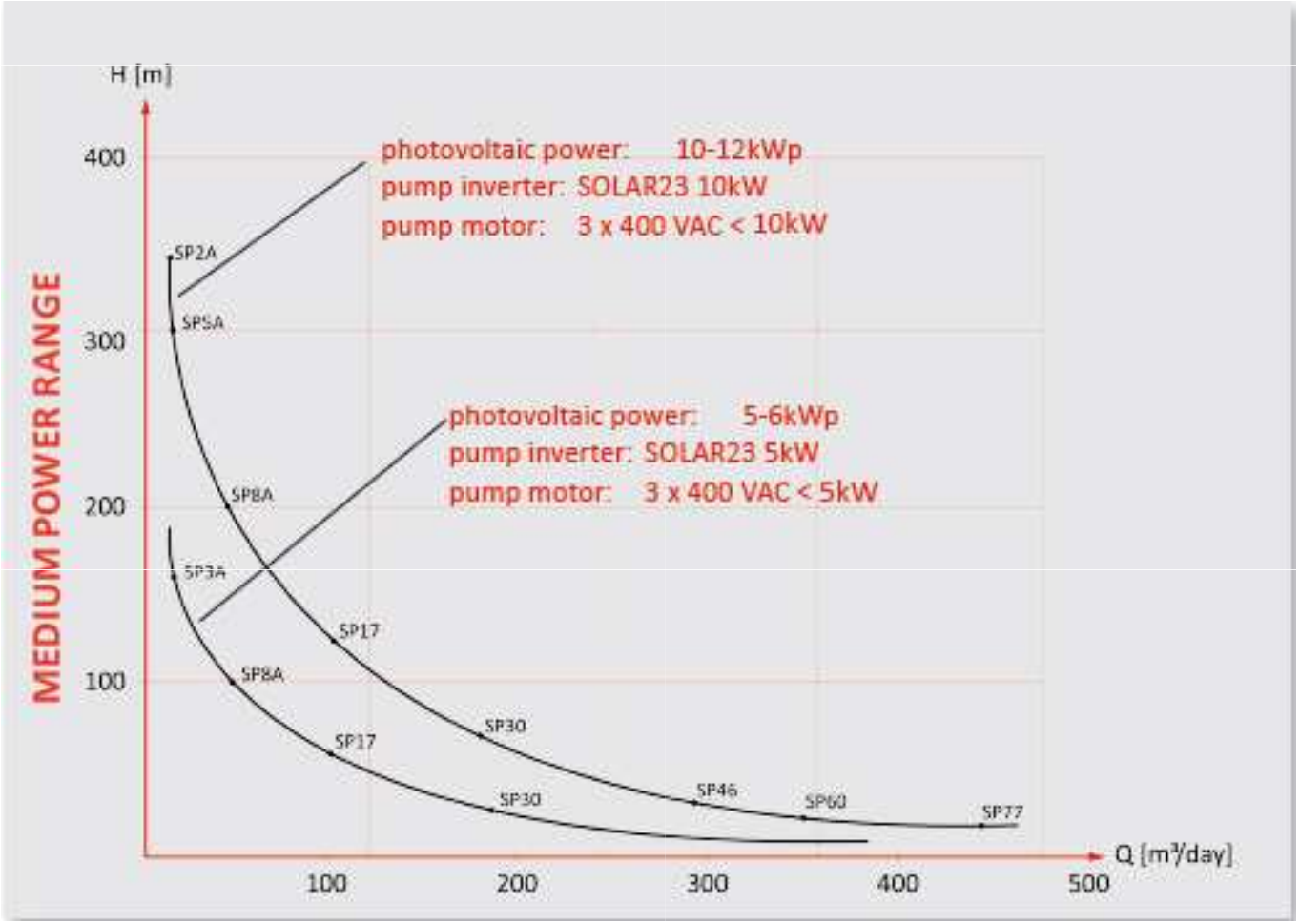
2. power range overview

Category “MEDIUM”



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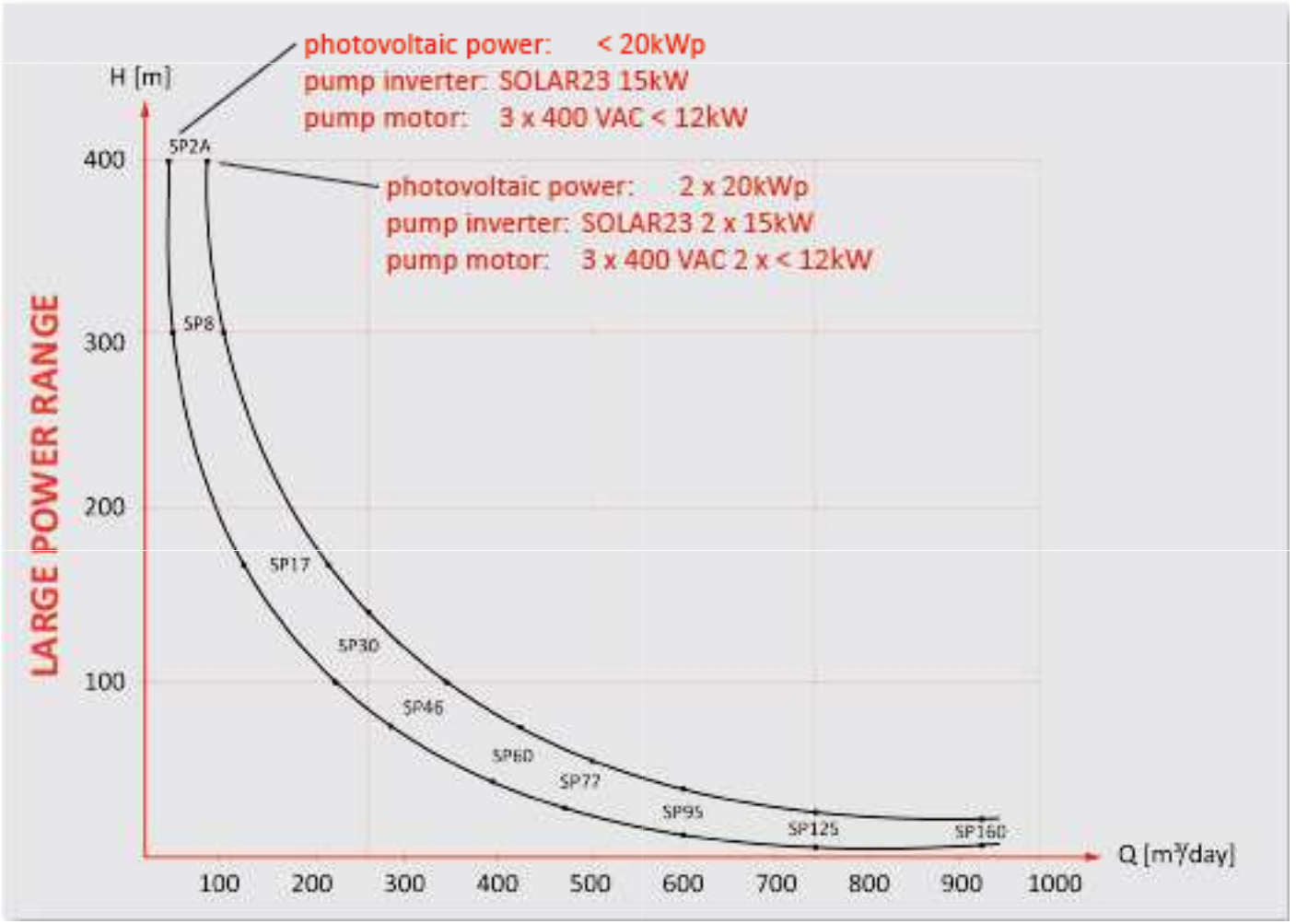
2. power range overview

Category “LARGE”



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3. advantages of pumping systems

SPECIAL FEATURES

- power comes from a renewable energy source (solar modules)
- zero air pollution; operation without exhaust & green-house gases
- zero noise pollution & silent operation against diesel generators
- zero soil pollution; no fuel or oil is spilled
- zero water pollution; no leaking fuel & oil goes to the water sources
- low maitenance required, no moving parts; diesel generators in constant operation need expensive and constant overhaul
- long operation life time > 20 years by high quality materials: solar modules with >20 years performance warranty, pumps made of stainless steel
- no fuel required, no contant refuelung, no transport of fuel to site required
- reliable power supply from sun, no price increases for solar energy against constant price increases for fossil fuels, diesel and electricity (low financial risk)
- reliable power supply against an unstable public grid with constant power outages (low technical risk)
- reliable fuel supply from sun against fossil fuel supply interruption caused by rainy seasons (low natural risk)
- reliable fuel supply from sun against political risks for non supply of fossil fuels from production countries (low political risk)
- reliable power supply in all climatic conditions, hot and cold (low climatic risk); PVPS design is made for 24h seven days a week operation

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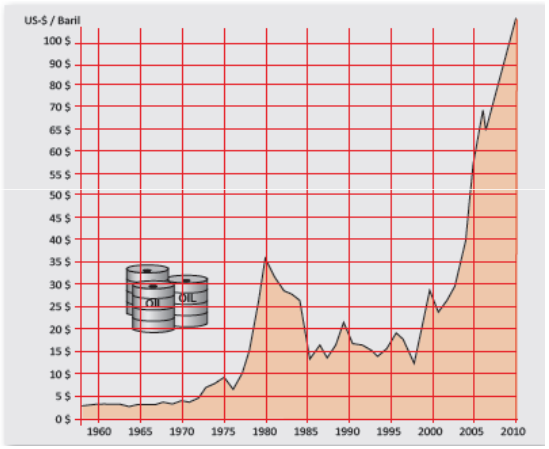
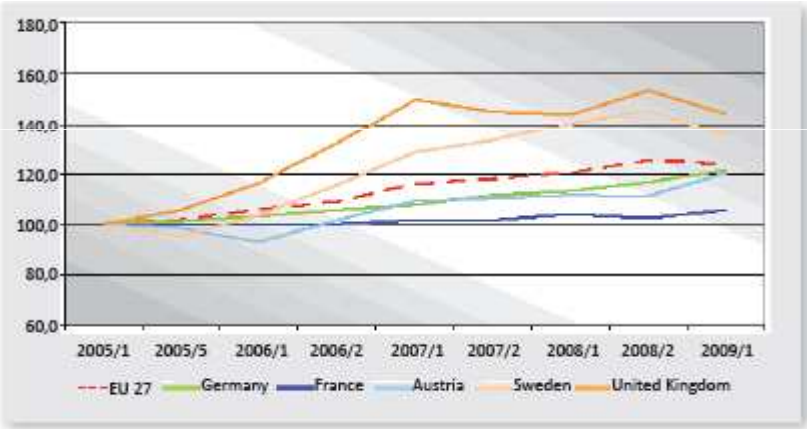
4. economic analysis PV – DIESEL - GRID

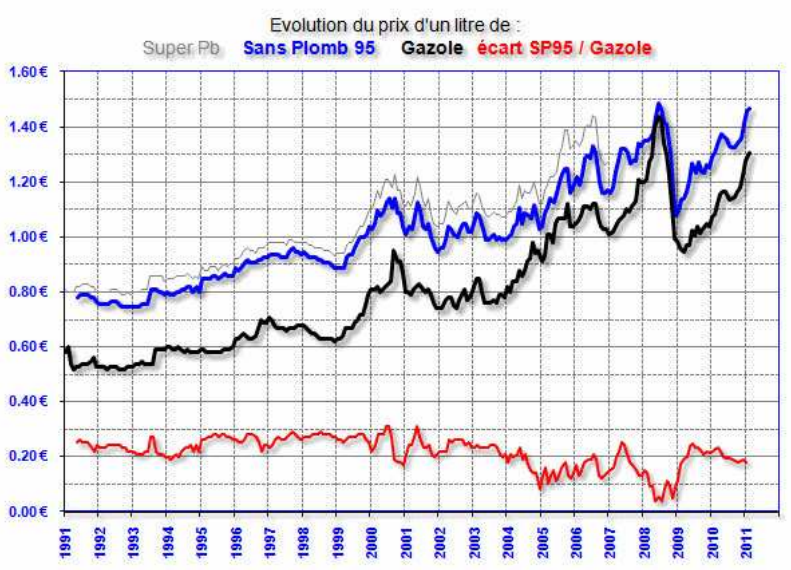


development of crude oil price (past 50 years)

development of crude oil price (past 3 years)



Picture 7: development of electricity price (Germany)



development of diesel prices (past 20 years)

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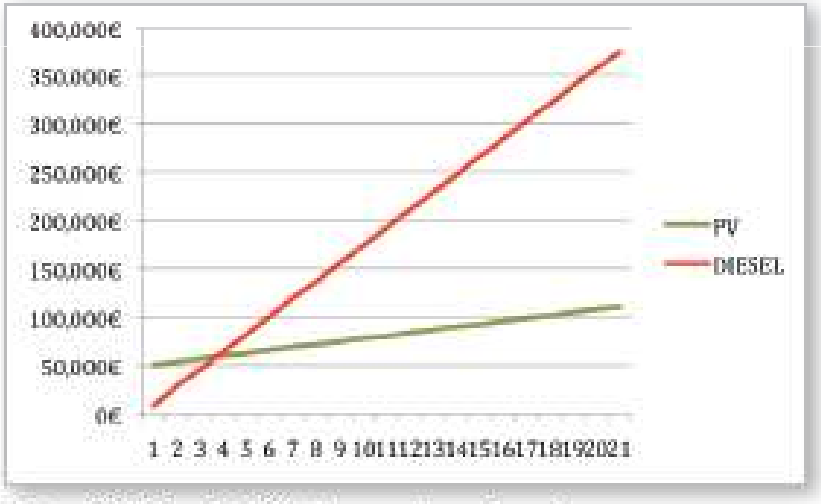
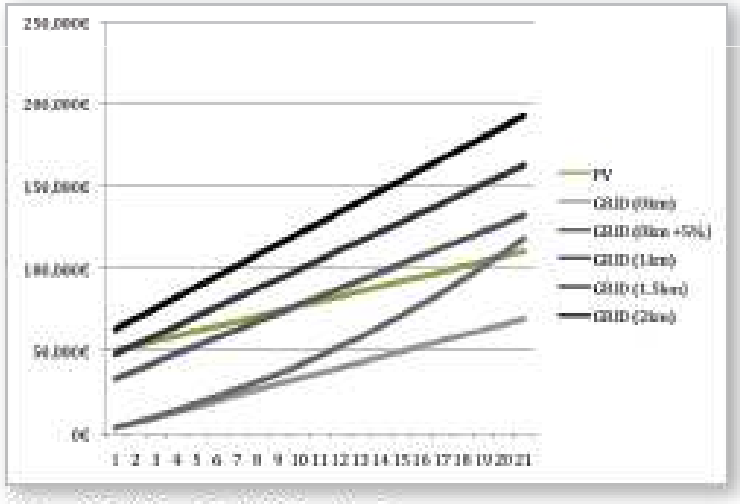
4. economic analysis PV – DIESEL - GRID



Picture 8: PVPS against Diesel powered pumping system



Picture 9: PVPS against Grid extension

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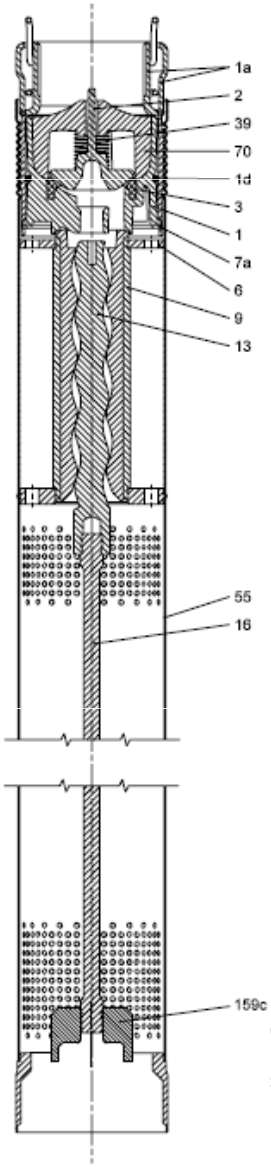
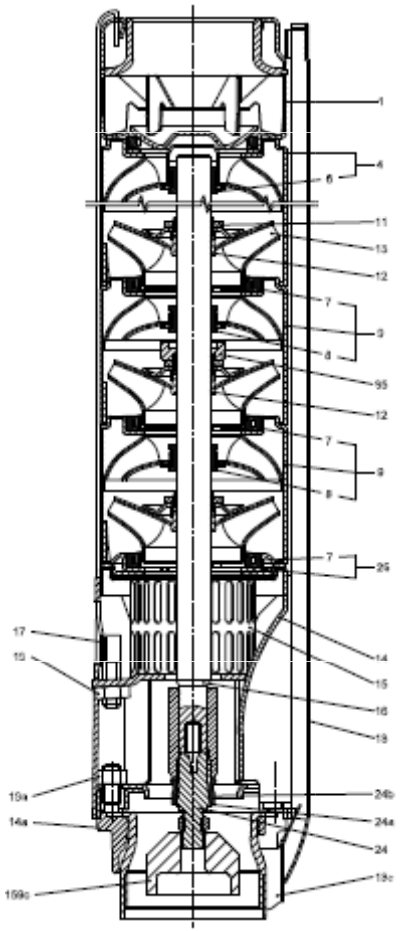
5. GRUNDFOS SQ FLEX pumping system

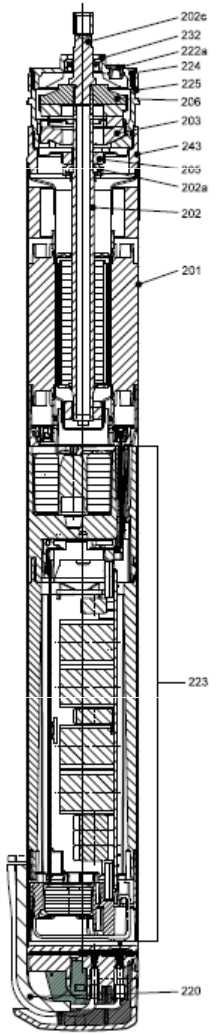


Helical rotor pump
e.g. GRUNDFOS SQF 2.5-2
= 3” pump



Centrifugal pump
e.g. GRUNDFOS SQF 11A-3
= 4” pump

Pump motor
GRUNDFOS MSF 3



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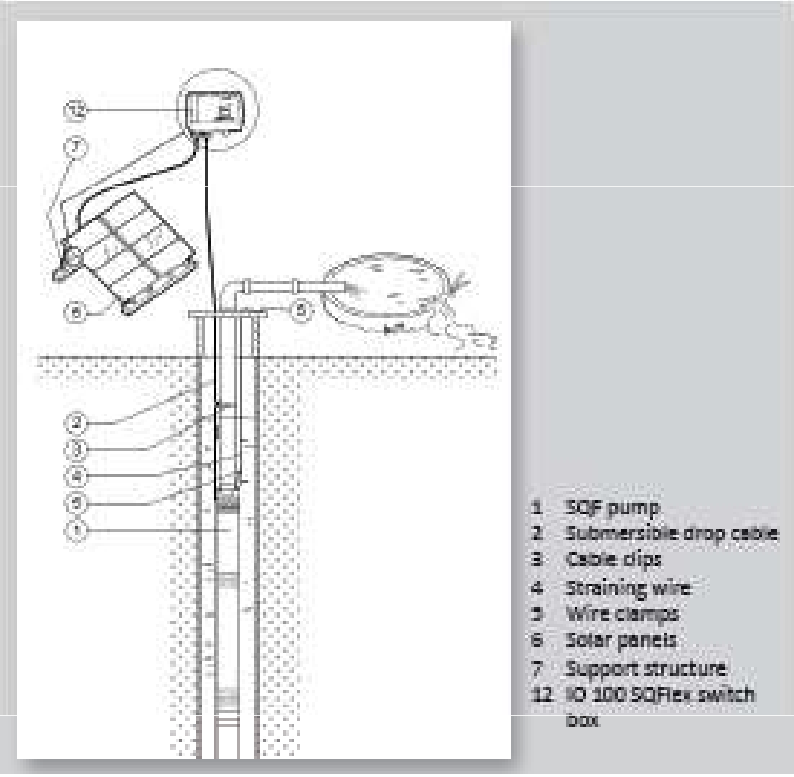
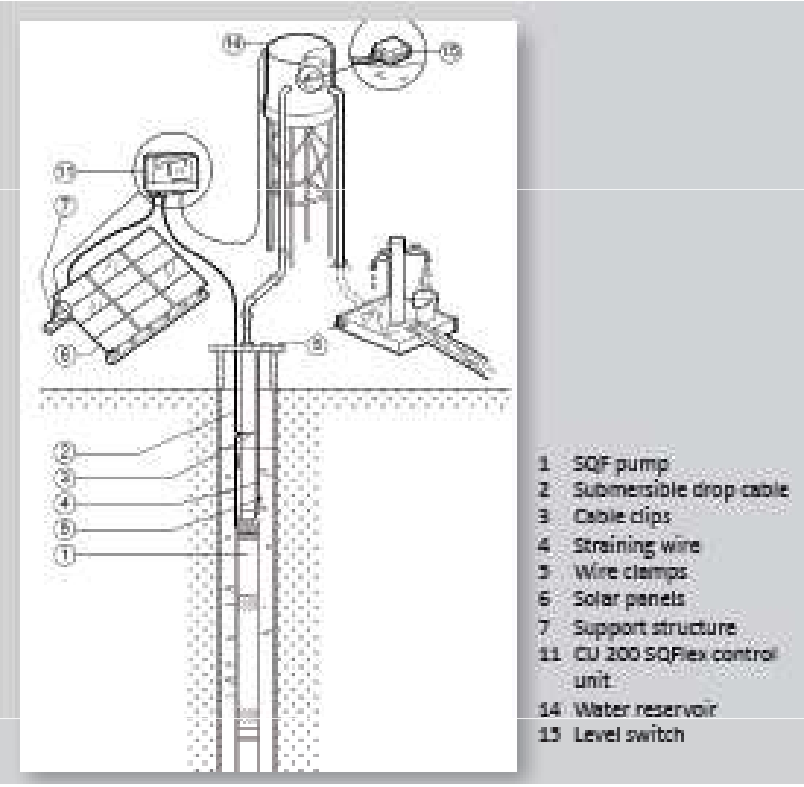
5. GRUNDFOS SQ FLEX pumping system



1 SQF pump
2 Submersible drop cable
3 Cable clips
4 Straining wire
5 Wire clamps
6 Solar panels
7 Support structure
12 IO 100 SQFlex switch box



1 SQF pump
2 Submersible drop cable
3 Cable clips
4 Straining wire
5 Wire clamps
6 Solar panels
7 Support structure
11 CU 200 SQFlex control unit
14 Water reservoir
15 Level switch

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6. SOLAR23 high power range

■ CHARACTERISTICS		PUMP INVERTER 1.5kW	PUMP INVERTER 5kW	PUMP INVERTER 5kW	PUMP INVERTER 10kW	PUMP INVERTER 15kW
INPUT						
Nominal power	[kW]	1.5	5	5	10	15
MPP input voltage range	[VDC]	150 to 420	270 to 420	560 to 720	560 to 720	560 to 720
Maximum input voltage	[VDC]	500	500	850	850	850
Start up input voltage	[VDC]]	> 100	> 200	> 230	> 230	> 230
Maximum input current	[A]	10	18.5	12	18.5	30
Optional AC input voltage	[VAC]	(1x) 100 to 240	1 x 230	1 x 230	1 x 230	1 x 230
OUTPUT						
Maximum power (cos phi = 0.7...1)	[kVA]	1.5	5.0	5.0	10	15
Nominal output voltage	[VAC]	3 x 230	3 x 230	3 x 400	3 x 400	3 x 400
Output frequency	[Hz]	30 to 60	30 to 60	30 to 60	30 to 60	30 to 60
Efficiency	[%]	95	> 95	> 95	> 97	> 97
GENERAL DATA						
Dimensions	[mm]	300 x 235 x 150	502 x 340 x 241	502 x 340 x 241	502 x 340 x 241	502 x 340 x 241
Weight	[kg]	9	23	23	24	27
Service interface		RS232 or USB	RS232	RS232	RS232	RS232
Display		LCD	2 x 7 segments	2 x 7 segments	2 x 7 segments	2 x 7 segments
Operation temperature range	[°C]	-20 to +60				
Dry running protection sensor interface		yes				
Float switch sensor interface		yes				
Enclosure		powder painted steel				
Heatsink		aluminium				
Protection degree		IP54				

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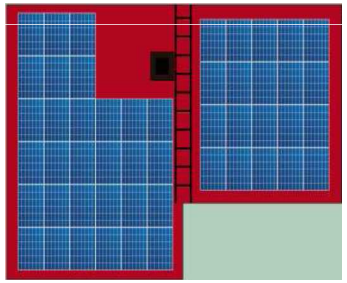
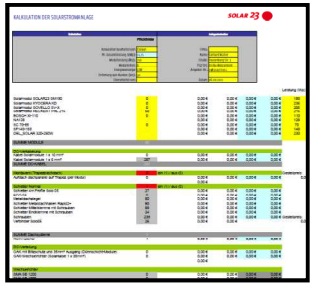
7. SOLAR23 system engineering

Personal selling



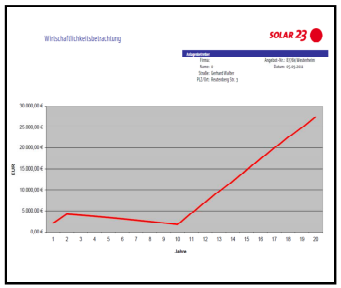
Module coverage plan

Sizing of inverter



Bill of materials

Shadowing



Economic analysis

Turn key installation

After sales service

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7. SOLAR23 system engineering

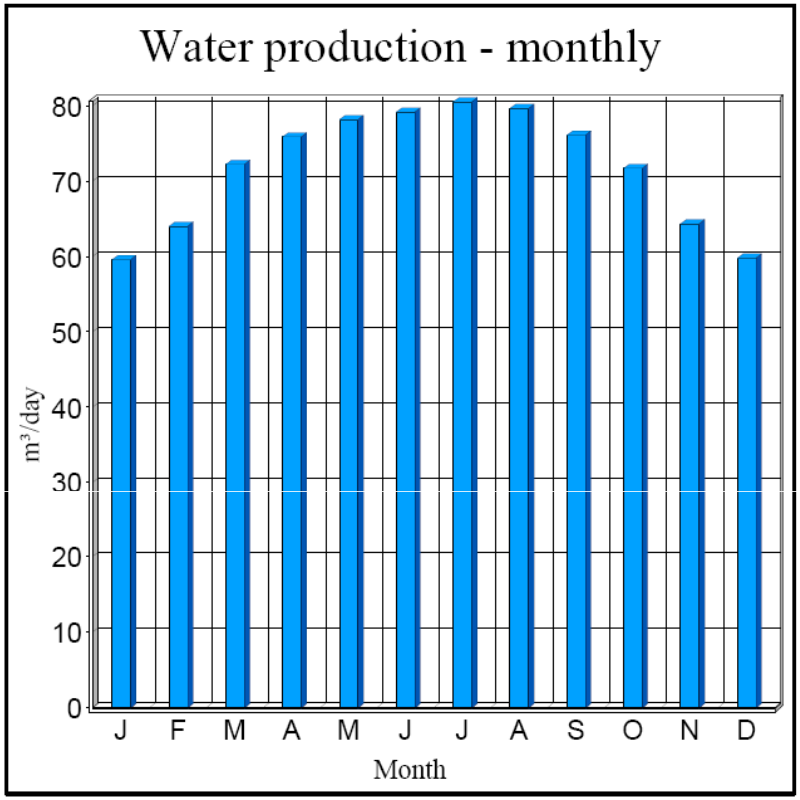
Sizing results - summary

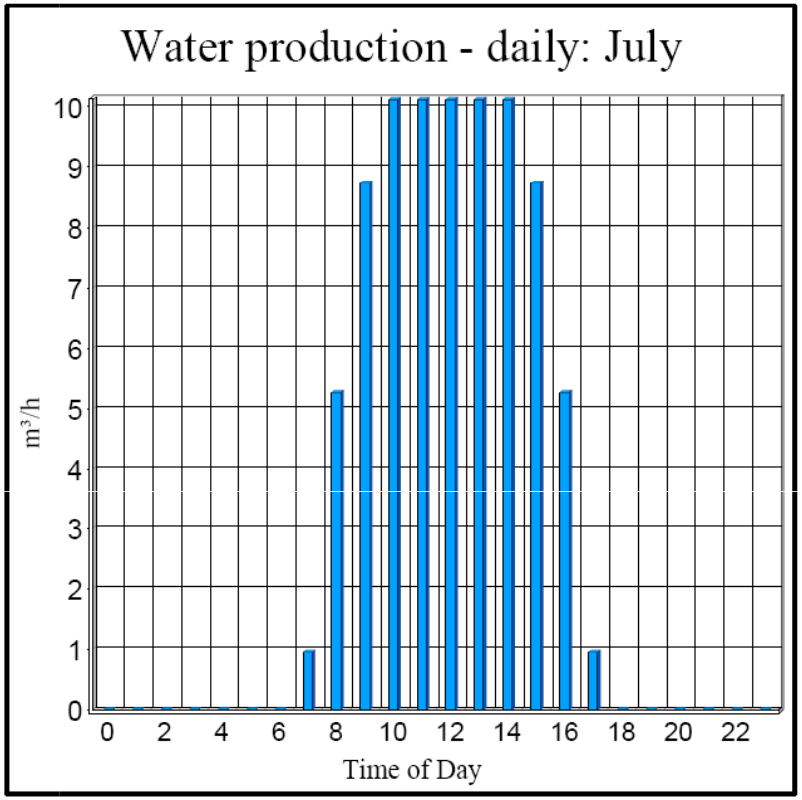
Typical performance at solar radiation 800 W/m²
Flow: 10.0 m³/h
Friction loss: 1.7 m
Total head: 21.7 m
Total cable loss: 1.2 %

Water production, Peak flow and Price
Total water production per year: 26200 m3
Avg. water production per day: 71.9 m³/day
Average water production per watt per day: 34.22 l/Wp/day
Peak flow: 10.1 m³/h

Cables and pipes:
Pump cable (pump - solar array)
Length: 20 m
Size: 2.5 mm²
Pipe Length: 20 m
Pipe diameter:

Solar module configuration:
Number of solar modules in series: 3, in parallel: 7
Solar array rated power: 2.1 kWp
Solar array rated volts: 214.2 V
Sun tracking: No (fixed)





System performance - monthly average

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Water production [m³/day]	60	64	72	76	78	79	81	80	76	72	64	60
Energy production [kWh/day]	8.5	9.3	11.0	11.8	12.1	12.2	12.5	12.5	12.0	11.0	9.4	8.4
Radiation horizontal [kWh/m² day]	3.2	3.9	5.2	6.4	7.3	7.7	7.9	7.2	6.0	4.7	3.5	3.0
Radiation tilt [kWh/m² day]	1.3	1.4	1.5	1.7	1.8	1.9	1.8	1.7	1.6	1.5	1.3	1.3
Tilt angle [deg.]	31	31	31	31	31	31	31	31	31	31	31	31
Avg. Temp. [°C]	25	25	25	25	25	25	25	25	25	25	25	25
Temp. Variation [K]	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

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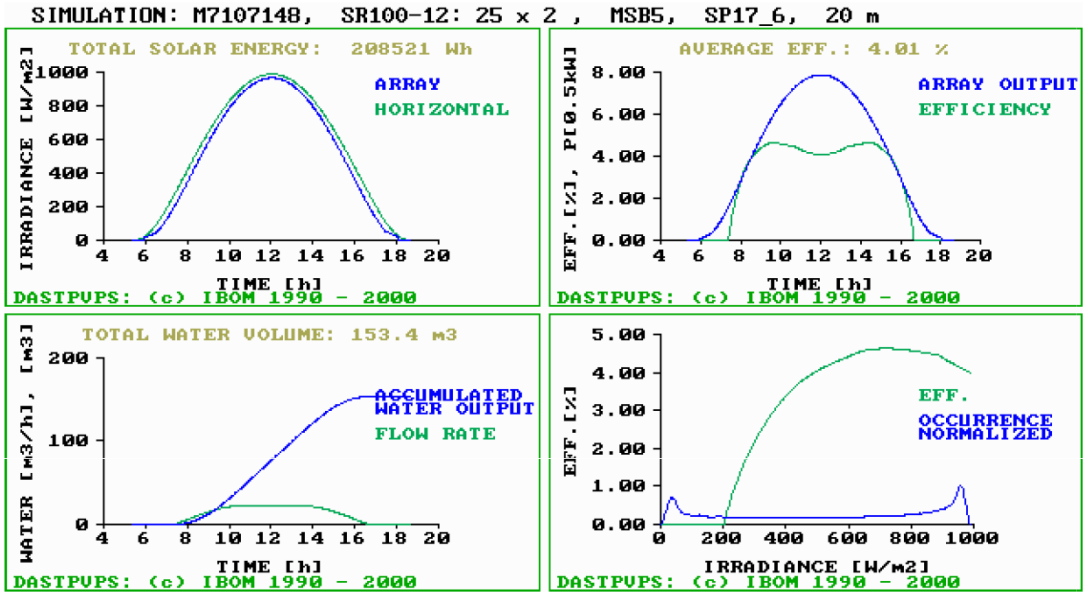
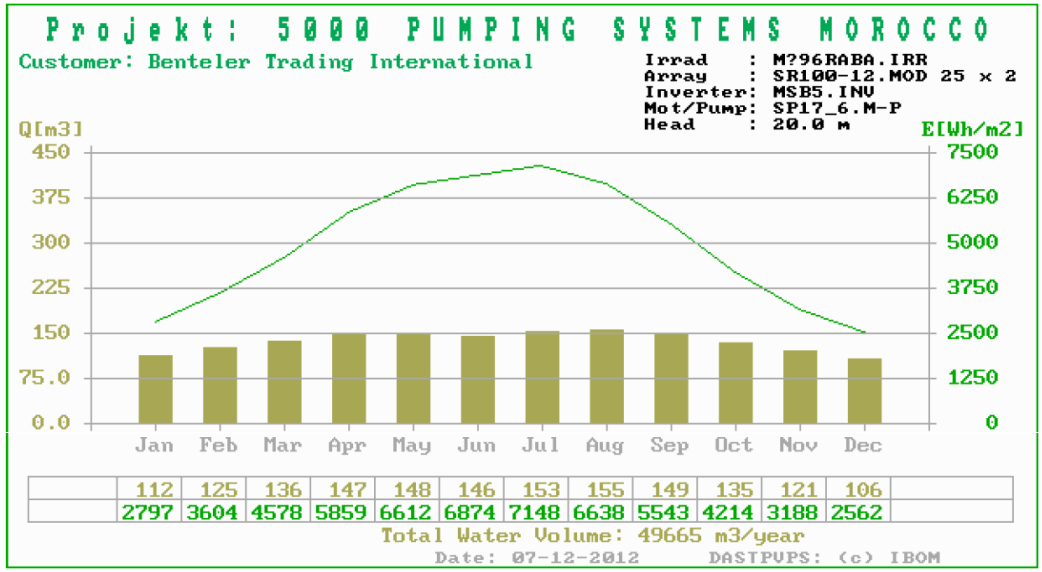
7. SOLAR23 system engineering

WELL HEAD : 20m (max)
DAILY WATER VOLUME: 20m³ / h x 6-8h = 160m³ (max)
IRRADIATION: Rabat (Morocco)





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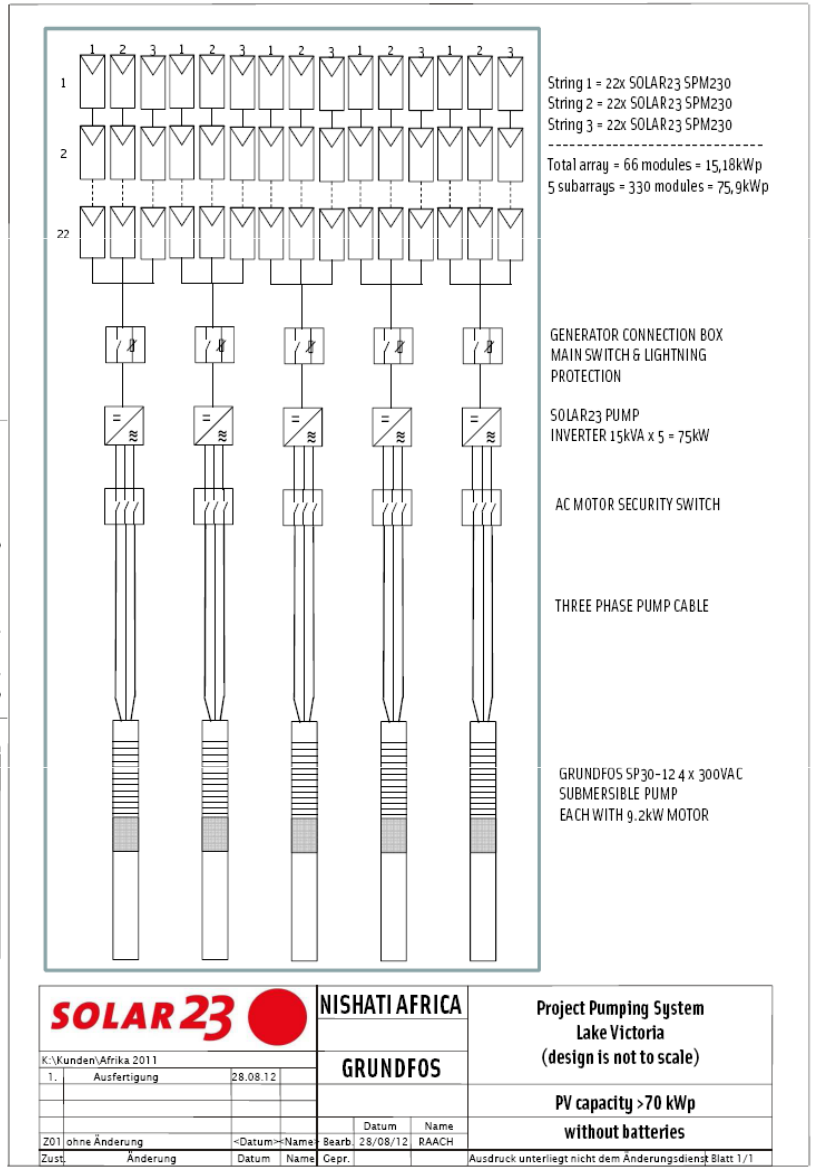
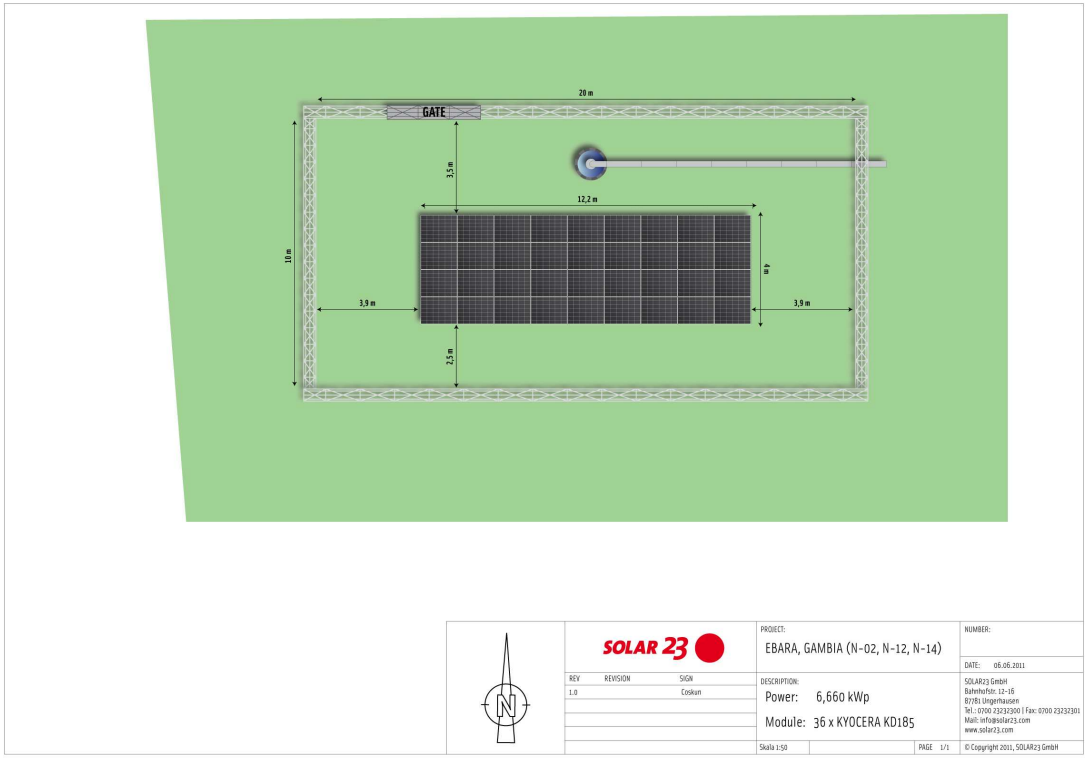
7. SOLAR23 system engineering





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8. piping system and water tank

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9. References

SOMALIA

Project volume:	27 pumping systems
Project duration:	1 year
Application:	drinking water supply
Solar generator per site:	1.2kWp
Components:	Grundfos SQF submersible pumps
Funding:	UNICEF

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10. References (Pumping)

TUNISIA

Project volume:	10 pumping systems
Project duration:	5 year
Application:	drinking water supply, cattle dew pond & irrigation
Solar generator per site:	1kWp and 5kWp
Components:	Grundfos SQF submersible pumps & SOLAR23 pump inverter
Funding:	national funding & GTZ

BURKINA FASO

Project volume:	40 pumping systems
Project duration:	2 years
Application:	drinking water supply, cattle dew pond & irrigation
Solar generator per site:	between 5kWp and 15kWp
Components:	SOLAR23 pump inverters, submersible pumps
Funding:	Luxemburg

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10. References (Pumping)

NIGERIA

Project volume:	more than 2000 pumping systems
Project duration:	10 years
Application:	drinking water supply
Solar generator per site:	Between 1 and 2kWp
Components:	Grundfos SQF submersible pumps
Funding:	national funding

MAURETANIA

Project volume:	10 pumping systems
Project duration:	5 years
Application:	drinking water supply
Solar generator per site:	between 1kWp and 2kWp
Components:	Grundfos SQF submersible pumps
Funding:	GRET

SOLAR 23

THANK YOU FOR YOUR ATTENTION!

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