FLEXIBLE AND SUSTAINABLE WATER SUPPLY USING CLEAN ENERGY
In recent years, the cost of generating clean energy from renewable sources has decreased sharply. At the same time, governments around the world are insisting that a greater proportion of energy is generated from renewable sources. The drive to increase motor efficiency and reduce CO2 emissions has led to increasing regulation as to how energy is generated. This is a trend that is set to continue.

Solar submersible pumps from Grundfos present a cost effective, flexible and secure water supply solution using clean energy. Utilising solar power saves on energy costs and on the costs of energy infrastructure, wherever the application is installed.

Solar submersible pumps offer tangible benefits

> **Easy installation**

Solar submersible pumping systems can be tailored to your application and local conditions. Supplied as a plug-and-go solution, the solar submersible pumping systems are remarkably easy to install and use under even the most difficult conditions.

> **Extend pump lifetime**

The built-in protection features for the pump motor ensure a low maintenance solar submersible pumping solution.

> **Cost-efficient pumping**

Designed for continuous as well as intermittent operation, solar submersible pumping systems are especially suitable where cost is all-important. Once the initial investment in the system is made, operating costs are low.

Solar submersible pumping systems are ideal for irrigation, livestock and fish farming, and for water supply.

Grundfos pumping systems using renewable energy sources provide the perfect sustainable, reliable and cost-efficient alternative to grid-based systems, with substantial benefits for your investment.

**Bringing down lifecycle costs**

The lifecycle costs of a Grundfos submersible solar pumping solution will be considerably lower than with other water supply systems, because you can save substantial sums on reduced maintenance costs and no energy costs.

Typically, the lifecycle costs for a grid-based pump system would include the following elements:

> Initial purchase price of the pump and all system components
> Operating costs, of which energy is usually the largest single cost item
> Service agreement ensuring correct system sizing, high pump efficiency and performance, technical advice, service and reliable logistics.

For a Grundfos renewable energy-based system, the initial purchase price is the greatest investment. Once the pumping system is installed, you no longer get energy bills, meaning a rapid pay-back time on the initial investment.

The benefits of a relationship with Grundfos mean that the pumping system is sized, configured or packaged to fit your application right from the start, reducing costs for installation, commissioning and service.

You cannot afford not to invest

Renewable energy-based pumping systems are a good investment. Governments increasingly encourage investors to choose renewable energy in new installations, and there is a growing awareness of the low risk of such investments. This is because the installation is not dependent on energy prices staying low to ensure a payback on the investment.
The family of solar submersible pumping systems ranges from 0.05 kW to 9.2 kW, more than meeting the requirements of many irrigation, livestock and fish farming, and water supply applications.

**SQFlex**

- 0.05 kW to 3 kW system, using one SQFlex pump, or two SQFlex pumps with a manifold

**SP with RSI**

- 3 kW to 9.2 kW system, combining a standard SP pump with a Renewable Solar Inverter (RSI). The RSI system is configured especially to run with Grundfos SP pumps

Highly versatile with many applications. Designed for continuous as well as intermittent operation, solar submersible pumping systems are especially suitable for water supply applications such as:

- Villages, schools, hospitals, and single-family houses
- Farms and ranches, including watering of livestock and irrigation of crops and greenhouses
- Watering applications in game parks and game farms

For applications requiring an output greater than 3 kW, the RSI system can be used in any existing SP pump application, providing a very wide range of applications. The only difference is that you use solar panels as the power supply.

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**THE SOLAR SUBMERSIBLE RANGE OF PUMPING SYSTEMS**

The components of the 3 kW to 9.2 kW solar submersible solution: SP pump, a Renewable Solar Inverter (RSI), the GF100C solar panel and the circuit breaker and surge control that make up the combined junction box.

The performance curves are respectively for the SQFlex pump, two SQFlex pumps with manifold and an SP pump with RSI inverter. Up to 3 kW output, two SQFlex pumps with manifold would in most cases be more efficient than using an SP pump with RSI.
**HIGH EFFICIENCY FROM SQFLEX SOLAR SUBMERSIBLE PUMPS**

The complete SQFlex pump range consists of 11 different pump sizes: 5 helical rotor pumps for medium to high heads and low to medium flows, and 6 centrifugal pumps for shallow heads and high flows. It is available in two different stainless steel material variants: type AISI 304 as standard and type AISI 316 for slightly aggressive water. The pump is fitted with a high efficiency motor for DC or AC voltage. This makes pump sizing and selection extremely easy.

SQFlex pumps can run from the GF100C mono crystalline silicon solar panel. The SQFlex system is available with a user-friendly CU200 control unit that maintains two-way communication with the pump and monitors the operating conditions. Built-in diagnostics indicate faults and dry-running, display operating status power consumption and level switch input. A level switch in the water storage tank means the pump only runs when necessary.

**How the SQFlex pump benefits your application**

SQFlex pumps have built-in protection features that protect the pump itself and in many cases the well. Among these features are:

- **One motor size**
  The motor size available for the SQFlex system is 3600 rpm with built-in unique features. Helical pumps and centrifugal pumps have a segmented stator and permanent magnet rotor for high efficiency and starting torque.

- **Runs at any voltage**
  A wide voltage range enables the motor to operate at any voltage from 30 to 300 VDC or from 90 to 240 VAC, which makes pump sizing and selection extremely easy.

- **Built-in motor protection**
  The motor is protected against overloading and overheating, and load condition and voltage is monitored continuously.

- **System monitoring**
  Continuous load condition and voltage monitoring. It is possible to connect the solar submersible pump solution to Grundfos Remote Management (GRM) for system monitoring at a distance.

- **Dry running protection**
  The pump is shut down if it detects water shortage and restarts automatically when water returns to the well or when the motor temperature returns to the safety range. This protects the well from being over-pumped and the motor from burning out.

- **Maximum system efficiency**
  The motor will continuously optimise the speed according to the input power available. This is called Maximum Power Point Tracking (MPPT) and operates only when the pump is connected to DC supply.

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**HIGHLY EFFICIENT SOLAR PANEL**

A new range of high reliability and efficiency solar panel. Made in Germany.

<table>
<thead>
<tr>
<th></th>
<th>GF80S</th>
<th>SW250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Power ($P_{max}$)</td>
<td>80 W</td>
<td>250 W</td>
</tr>
<tr>
<td>Voltage ($V_{mp}$)</td>
<td>17.9 V</td>
<td>20.8 V</td>
</tr>
<tr>
<td>Current ($I_{mp}$)</td>
<td>4.5 A</td>
<td>6.12 A</td>
</tr>
<tr>
<td>Open-Circuit Voltage ($V_{oc}$)</td>
<td>21.9 V</td>
<td>23.8 V</td>
</tr>
<tr>
<td>Short-Circuit Current ($I_{sc}$)</td>
<td>4.8 A</td>
<td>6.64 A</td>
</tr>
<tr>
<td>Reference Cell Temperature ($T_{ref}$)</td>
<td>77 °F / 25 °C</td>
<td>77 °F / 25 °C</td>
</tr>
<tr>
<td>Solar Irradiation at Reference cell Temperature ($I_{ref}$)</td>
<td>1000 W/m²</td>
<td>1000 W/m²</td>
</tr>
<tr>
<td>Net Weight</td>
<td>16.8 lbs / 7.6 kg</td>
<td>46.6 lbs / 21.2 kg</td>
</tr>
</tbody>
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*Performance curves for the entire SQFlex range, based on different levels of solar radiation.*
SP PUMPS FOR SOLAR SUBMERSIBLE SYSTEMS

Grundfos SP submersible pumps are renowned for their high efficiency and reliability throughout the range. Made entirely of corrosion-resistant stainless steel, SP pumps are ideal for a wide variety of applications.

When combined with the RSI inverter system, the SP pump becomes the perfect solution for applications requiring from 3 kW to 9.2 kW output for applications where renewable energy water pumping is preferred.

Grundfos SP pumps represent state-of-the-art hydraulic design. Built to deliver optimum efficiency during periods of high demand, the SP pumps provide low long-term costs and high operating reliability regardless of the application.

The Grundfos SP range offers high efficiency, high resistance to sand and other abrasives, motor burnout protection, and easy maintenance. A complete monitoring system is available for constant optimisation of the pumping system.

Why build a larger solar submersible system?
The cost of solar panels has been decreasing over many years, as manufacturing capacity increases. This has opened up the market for a larger power size off-grid system, as the initial investment in a large system become more acceptable and the return-on-investment looks more attractive than ever before.

Apart from the savings from the solar panels and reduced energy bills, many countries around the world actively advocate the use of renewable energy, and show this by, for example, subsidising irrigation projects to install renewable energy systems. Renewable energy water pumping is therefore no longer limited to well water pumping in remote locations.

Case study, Tanzania.
Country: Tanzania
City: Dodoma
Month: July
Head: 30 m

<table>
<thead>
<tr>
<th>Solar panel (kW)</th>
<th>Average Daily Water Production (m³/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4</td>
<td>33.2</td>
</tr>
<tr>
<td>4.8</td>
<td>88.5</td>
</tr>
<tr>
<td>7.2</td>
<td>162.2</td>
</tr>
<tr>
<td>9.6</td>
<td>240.9</td>
</tr>
<tr>
<td>12</td>
<td>317.6</td>
</tr>
<tr>
<td>14.4</td>
<td>393.8</td>
</tr>
<tr>
<td>16.8</td>
<td>461.5</td>
</tr>
<tr>
<td>19.2</td>
<td>529.1</td>
</tr>
</tbody>
</table>

How much water can solar power pump?
See how much water 75 of the GF100C solar panels together with a SP17-5 pump and RSI5500 can pump in different locations around the world. Total annual water production (m³) and average water production per watt per day (L/Wp/day) are listed for each city.
Grundfos has sourced the RSI off-grid solar inverter to enable us to expand the family of solar submersible pumping systems. The RSI is designed specifically to be compatible with a wide range of the famously reliable SP submersible pumps. This has created a modular system that allows maximum components flexibility with the easiest maintenance. The SP pump can be customised to fit closely the particular application, and a range of material variants ensure top reliability, even in corrosive environments. Grundfos offers global service on all SP pumps.

The Renewable Solar Inverter (RSI) is an off-grid solar inverter with MPPT and fault protection which is easy to operate and can be paired with an SP pump for a larger performance range, greater versatility and for many different applications.

**Benefit from a solar submersible SP solution**

Adding the RSI to your SP application offers tangible benefits, protecting the water source and ensuring water supply, even with intermittent operation.

- Convert power from DC to 3 phase 380 VAC
- MPPT software—the inverter will continuously optimize the output frequency based on the available input power to constantly deliver maximum system efficiency
- Automatic recovery from operation signal stop
- Adjustable operation parameters
- Display historical operation data
- Built-in system protection for:
  - Over or under-voltage protection
  - Over current and overload protection
  - Over-temperature (of inverter) protection
  - Fault detection with error code display
  - Multiple sensor input

**Use on any existing SP installation**
The RSI can be used in any existing SP pump application, so there is a very wide range of applications. The only difference is that you use solar panels as the power supply.

**Grundfos product Name** | **RSI 3000** | **RSI 4000** | **RSI 5500** | **RSI 9200**
---|---|---|---|---
Ambient Temperature | -10 to 50 °C | -10 to 50 °C | -10 to 50 °C | -10 to 50 °C
Relative Humidity | 0 to 95 % | 0 to 95 % | 0 to 95 % | 0 to 95 %

**Electrical**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RSI 3000</th>
<th>RSI 4000</th>
<th>RSI 5500</th>
<th>RSI 9200</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1, Motor (max.) kw</td>
<td>3</td>
<td>4</td>
<td>5.5</td>
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<tr>
<td>Recommended MPPT Voltage</td>
<td>550 to 600</td>
<td>550 to 600</td>
<td>550 to 600</td>
<td>550 to 600</td>
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<tr>
<td>Input DC Voltage, max</td>
<td>750</td>
<td>750</td>
<td>750</td>
<td>750</td>
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<tr>
<td>Input DC Current, max</td>
<td>15</td>
<td>15</td>
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<tr>
<td>Frequency, Hz</td>
<td>30 to 53</td>
<td>30 to 53</td>
<td>30 to 53</td>
<td>30 to 53</td>
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<tr>
<td>Rated Output Voltage, AC</td>
<td>3 x 380 V</td>
<td>3 x 380 V</td>
<td>3 x 380 V</td>
<td>3 x 380 V</td>
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<tr>
<td>Rated Output Current, AC</td>
<td>9</td>
<td>13</td>
<td>18</td>
<td>24</td>
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**Others**

<table>
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<tr>
<th>Parameter</th>
<th>RSI 3000</th>
<th>RSI 4000</th>
<th>RSI 5500</th>
<th>RSI 9200</th>
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<tbody>
<tr>
<td>Enclosure class</td>
<td>IP41</td>
<td>IP41</td>
<td>IP41</td>
<td>IP41</td>
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<tr>
<td>Net Weight, kg</td>
<td>7.2</td>
<td>7.3</td>
<td>7.7</td>
<td>8.2</td>
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**Packing**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RSI 3000</th>
<th>RSI 4000</th>
<th>RSI 5500</th>
<th>RSI 9200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Weight, kg</td>
<td>9.5</td>
<td>9.6</td>
<td>10</td>
<td>10.5</td>
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<tr>
<td>Length, mm</td>
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<td>425</td>
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<tr>
<td>Width, mm</td>
<td>280</td>
<td>325</td>
<td>325</td>
<td>325</td>
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<tr>
<td>Height, mm</td>
<td>225</td>
<td>285</td>
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