

POWER OPTIMAL ELON 100

Elon 100 Solar PV Water Heater Quick Reference Guide

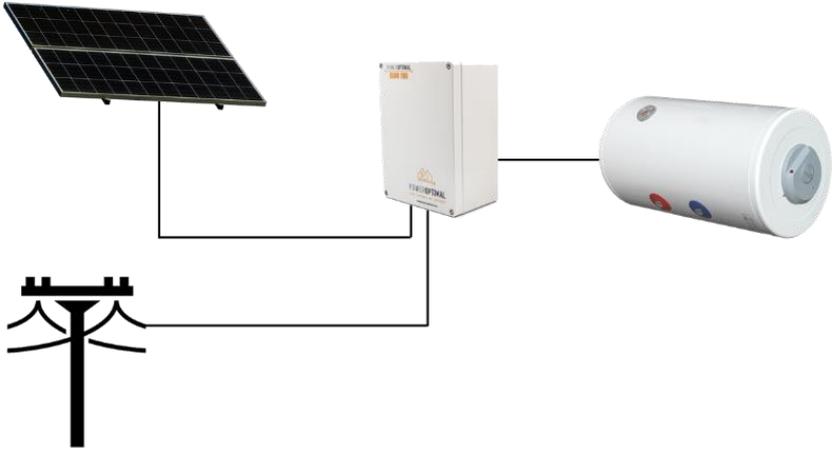


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What does the Elon 100 Solar PV Water Heater do?

The Elon 100 enables you to connect solar photovoltaic (PV) panels to your electric geyser. It **stores energy from the sun in the water in your geyser** – effectively **using the water as a battery**. The unit can also function completely off-grid if you have enough solar panels connected (See the table on the next page).



In order to be able to heat the water in your geyser during the day (to “charge the battery”), the water needs to be below its set point temperature when the sun comes up and the panels start producing energy. Otherwise the energy cannot be stored in the geyser.

To ensure that the water is below setpoint temperature later in the morning, the Elon 100 switches off power from the grid early in the mornings. You will start the day with hot water, but the water in the geyser will gradually cool down as you use hot water during your morning routines. This means that, by the time you are done with your morning showers and washing the dishes, the water in the geyser will be below its maximum (set point), ready to be heated with solar energy.

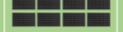
The water will be heated gradually over the day, and in the afternoon the Elon will switch over to grid electricity in case the water is not at set point temperature yet. **(The closer you set the efficiency dial to "MINIMUM", the earlier in the day it will switch back to grid power.)** This means that, by late afternoon, the water in the geyser will be hot again and ready for use – charged with solar energy.

How much energy will my system produce? What should I expect?

Heating water takes a LOT of energy. A household geyser can use up to 40% of a house's electricity. Heating a single 200 litre geyser from 15 °C to 60 °C will use over 10 kWh. This is about the same amount of energy burnt by a person running a distance of over 100 km at 10 km/hr, or enough energy to watch more than 120 hours of TV¹.

The more solar panels you have on your roof, the faster the Elon 100 system will heat your water. Typically, the number of panels has been selected to heat water over most of the sunlight hours (from morning to afternoon). This will be slower than heating water using grid electricity. So you can expect **a gradual temperature rise from morning to afternoon**.

Here is an approximate guide to what you can expect:

Solar Panels (2 m ²)	Showers per day*	50%+ of daily hot water use provided for how many people?	How many people off-grid for hot water?	Solar PV array size kW _p	Matching geyser element size kW	Geyser (water tank) size litres
3 Solar Panels				1.0 	3	100 - 150 
4 Solar Panels				1.2 – 1.3 	3	100 – 150 
5 Solar Panels				1.5 – 1.7 	2	100 - 150 
8 Solar Panels				2.4 – 2.7 	4	150 – 200 

* 6-minute showers at 40 °C with 8 litre/min (low-flow) showerheads

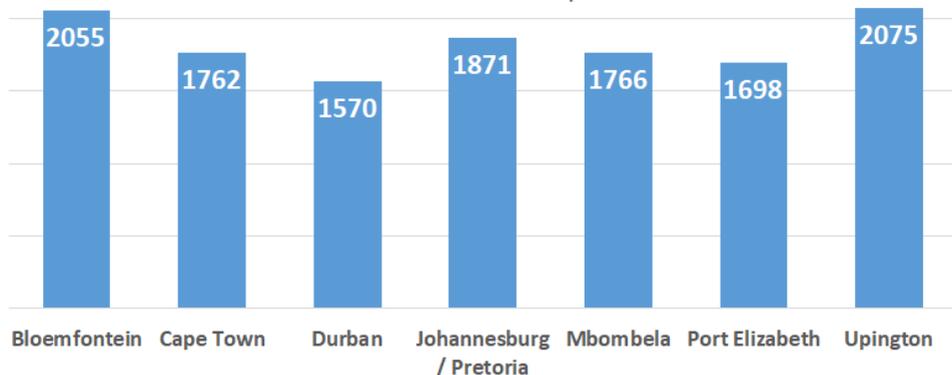
For example, if you have 4 solar panels, the system will (on average over a year) produce enough hot water for 3 showers per day (using a low-flow showerhead).

¹ 46" OLED TV at 82W.

How do seasons and my location affect solar energy production?

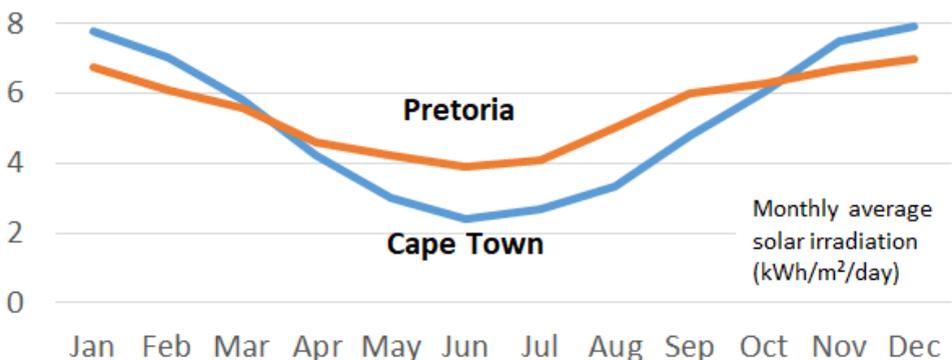
The amount of energy from the sun depends on your location, the time of year as well as the orientation of your solar panels. The best direction for panels in South Africa is to face north, at an angle of about 25 to 35° from horizontal.

Annual solar electricity production for some of the bigger cities in South Africa (kWh/kW_p per year)



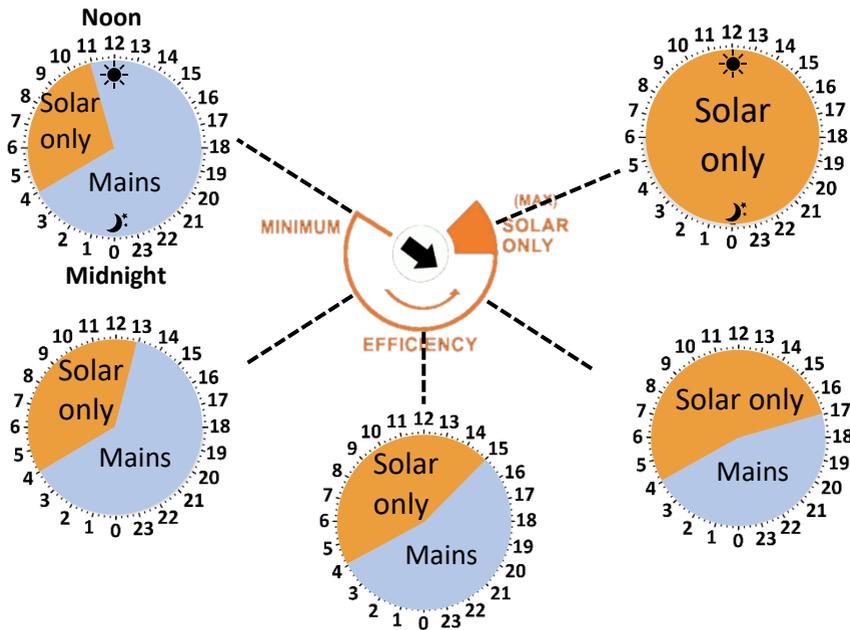
Although Gauteng (Johannesburg / Pretoria) & Cape Town may seem quite similar in terms of total solar energy per year, Cape Town has winter rainfall and Gauteng has summer rainfall. This leads to Cape Town having much lower solar electricity production than Gauteng in winter.

In the winter, Cape Town gets much less solar energy than Pretoria



How to adjust settings on the Elon 100 controller

Turn the dial on the controller to set how much of the day the unit will run on solar power only. It is generally best to just leave it pointing straight down.



When there is too little sun:

Press the **override button** for **5 seconds** (until the red light starts flashing) to force the system **to use grid (mains) electricity for one heating cycle**. To switch to grid power permanently, press the override button for **15s** (until red light comes on permanently). To switch back to normal operation, press the override button again for **15s** (until red light switches off).



What settings should I use?

The closer you set the dial to “Solar Only” (in other words, the more you turn it anti-clockwise), the bigger the portion of the day that the system will use solar energy to heat the water in your geyser.

However, you might not have a sufficient number of solar panels to heat all the water in your geyser every day (and some days will have rain or cloud). So it is best to set it so that it switches back to grid power before you start using hot water again late afternoon. This will ensure that you always have hot water in the mornings and evenings.

How can I increase my savings?

You can increase your savings by **reducing your hot water use** and by **changing your routines**.

The best time to shower for maximum savings is in the mornings. This ensures that the ‘solar’ day starts with the water in the geyser at lower than set point temperature (in other words the battery is not fully charged).

If you have enough solar panels for the number of people and overall level of hot water use in your household (see the table on page 2), you can further increase your savings by setting the Elon efficiency dial to “SOLAR ONLY”. This will ensure that the unit will never use grid (mains) power for heating water. You can still boost with mains power (such as on a cloudy or rainy day) using the **override button** as described earlier.

General hot water energy saving tips

- Shower, don't bath
- Install water-saving or low flow shower heads (these also save energy because of reduced hot water use!)
- Reduce shower duration
- Check that your geyser is well insulated

South Africa is a water-scarce country – reducing hot water use saves both energy and water!

What do the lights on the controller indicate?

The **Mains & Solar indicator lights** indicate the following conditions:

Lights	Meaning
	Mains (red) light flashing Grid (mains) electricity is being used to heat water
	Solar (green) light flashing Solar power is being used to heat water. Rate of flashing indicates rate of solar energy supply
	Red & green alternating No power is being supplied to the geyser element. (Either the water is on temperature already, or the unit is in solar mode and there is not sufficient sunlight)
	Red or green flashing very fast Isolation fault (contact electrician)
	Red light ON Solar power switched off (only grid power allowed to geyser). Press and hold override button for 15 seconds to switch solar power on or off. To switch off both solar and grid power , turn the dial to SOLAR ONLY and then switch off the solar power with the override button as described.
	Both lights OFF No power to unit (e.g. no sun and a power failure, or no sun and geyser breaker at DB board is switched off)

Controller settings for switching off solar or grid power

Desired state	Actions	DB board geyser switch	Controller dial position	Lights
✓ Solar ON ✓ Grid ON	This is the default state.	ON	Anywhere outside the "Solar Only" zone	Normal operation (green and/or red flashing or both alternating)
✓ Solar ON ✗ Grid OFF	Turn controller dial anti-clockwise to the "Solar Only" zone indicated on the controller. Note: you can still boost with grid power for one heating cycle by pressing the Override button for 5s .	ON	In the "Solar Only" zone	Green flashing or both lights alternating. Red would flash if override button has been used.
✗ Solar OFF ✓ Grid ON	Press Override button for 15s until the red light switches on permanently. Grid power is now always ON (24 hours per day).	ON	Anywhere outside the "Solar Only" zone	Red light on
✗ Solar OFF ✗ Grid OFF	Turn efficiency dial all the way anti-clockwise into the "Solar Only" zone. Press Override button for 15s until the red light switches on permanently.	ON	In the "Solar Only" zone	Red light on

Basic troubleshooting

(See the full User Manual at www.poweroptimal.com/manuals for more extensive troubleshooting information.)

Problem	Possible Cause	Action
I have hot water in the morning, but not in the afternoon	<i>Insufficient solar energy.</i> The system is using grid power to heat the water overnight, which ensures you have hot water in the morning. During the day, the system is relying on the sun to heat, which is why the water may be cold.	If it is a once -off problem: Press the “override” button to boost your water temperature with grid power. If it is a regular problem: Turn the controller dial clockwise to use grid power for more of the day (note: this will increase your bill). You can also wait until later in the afternoon to use hot water again.
I have no hot water in the morning or the afternoon, the red light on the controller is on and the dial is in the “Solar Only” zone	Your unit has been switched off (holiday mode)	Press button for 15s until red light switches off, or turn dial clockwise to a position outside the “Solar Only” zone.
I have no warm water in the morning or the afternoon and the lights on the controller are off	There is no power to the system.	Check that the “geyser” switch in your electrical distribution board is not switched off. If not, call an electrician or your installer.
There is warm water, but my electricity consumption is too high.		See page 5 on how to reduce your hot water use & optimise solar energy use.
The system performance is worse than it used to be	The solar panels are dirty (or it is winter season – see p. 3)	Clean the panels with water only.

What are the benefits of a solar PV water heater?

- Much longer life and lower maintenance than solar geysers or heat pump systems. Solar PV panels last 25 years or longer. This means that you will benefit from free solar energy for decades.
- Easy installation - no plumbing changes for retrofit
- You can use your existing electric geyser
- No noise (unlike heat pumps or solar geysers with circulation pumps)
- Lower weight of rooftop components compared to solar geysers means easier installation
- No tank on the roof (unlike thermosiphon solar geysers)
- Hot water during power failures
- Better winter performance than solar thermal

How can solar PV water heating be more cost-effective than solar thermal? Isn't solar thermal efficiency much better than solar PV?

It is true that solar thermal collectors are more efficient per square meter (area) than solar PV modules in collecting solar energy. However, overall efficiency must also include factors such as heat loss in piping (especially in winter) and energy use of solar thermal circulation pumps.

Solar thermal system lifetimes range from about 7 years (for cheap imports) to about 15 years for high quality (and more expensive) systems. (In a comprehensive analysis, Sandia National Laboratories found that about 50% of solar thermal systems fail within a 10-year period.) Solar PV modules are routinely guaranteed at 80% performance after 25 years, and the US National Renewable Energy Laboratory uses a lifetime of 33 years in its solar PV system calculations.

Solar PV module costs have dropped dramatically – by over 80% in the past 5 years – and the trend is continuing. This has **changed the paradigm**. Whilst solar PV systems will continue to require more roof space than solar thermal in the foreseeable future, the key issue is not roof space, but cost. Solar PV systems have become cost-competitive to solar thermal, and the much longer lifetimes and lower maintenance translate into a lower lifetime cost per unit of energy.

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You can download a **full user manual** on our website:



www.poweroptimal.com/manuals

You can also find an **online user instruction video** on our website:



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