



## Paladin FAQ - #3.

### What is the financial justification for Paladin for a home PV setup?

If you have any significant amount of excess PV (exporting more than say 200 kWh / year) and a hot water cylinder that has an electric element, then Paladin will work well for you.

Here are the generic numbers.

1. An average home uses between 6 and 12 kWh of energy a day just heating hot water.
2. A standard 180 litre hot water tank uses 3.1kWh of energy to raise the water temperature by 15C.
3. A well-insulated tank loses between 0.4 and 0.8 degrees C per hour to thermal losses.

### That's the short version. Here is a slight expansion.

Even a well-made, leak free and well insulated tank uses between 1 and 1.5 kWh of energy a day just holding a working temperature. Add normal domestic use and that becomes around 8kWh a day on average that has to go into the hot water tank. The tank temperature is usually controlled when the thermostat cycles, or, if you are on an energy plan with cheap night rates, overnight, on a timer. The problem with overnight plans is that, depending upon your use pattern, you often have to get a top up on a standard tank during the day (and more importantly - on day rates) as well.

Depending upon the rate you pay per kWh, and your use, this will generally be between \$2-3 per day - just for hot water. If you have excess PV you are paid around 7 to 8c per kWh for your export to the grid. **If that is more than a third of what you have to pay to buy electricity in, then, stop reading - you have a great plan.**

So what if you could just stop exporting excess PV energy and use that excess, and only that excess, to heat water. Well you can, but it takes a bit of work. Just turning on a 3kW element when the sun is out will not work at all well. You have to ONLY transfer exactly the excess PV at that exact moment to the hot water tank. Otherwise you will be heating water with a mix of your own PV and brought power.

If you live in a mythical land at the end of a yellow brick road where the sun shines clear all and every day, then a timer system will be fine, just don't turn on a jug, and Hoover or a cooker, while that hot water heater is on.

Paladin does all the work for you right down to the watt. It isn't perfect, but it will only 'leak' around 5% of your excess PV down the street for export. Indeed some systems do much better than that on a steady day. Paladin does this by reading the grid 3600 times second and deciding every 50th of a second how much the heater 'throttle' needs to be opened, if at all. Paladin also looks after minimum and maximum temperatures and Legionnaire's control as well. Other than that it does nothing at all in its' basic form. Oh the box tells you what is happening and your water temperature, but there are no knobs, controls or anything. It just works. In my mind the ideal diverter just sits on the wall, and the only clue that you have one is the reduction in the energy bill.

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## Back to some math's.

If you have a standard tank of 180 litres every 5C rise takes approximately 1 kWh of power. If you have a standard thermostat it will cycle between 10-15C around it's set value, which is 2-3 kWh at a time. When Paladin is keeping the water temp at a minimum of 40C for whatever reason, it reacts to less than a 0.1C change and sips power in around 20 Watt chunks until there is excess solar again. Also, by the very nature of the solar cycle, you usually finish the day with the highest water temperature possible. Ideally, and that will usually last until the next sunrise. Should the sun not rise, then having a Paladin will not help 😊:)

## How this all costs out is easy enough to figure for your own circumstances.

An average household will use 8kWh a day, 250kWh a month on hot water heating. Take your hot water rate and subtract your PV feed back rate and you have the effective difference. Multiply that by 250 (or whatever your monthly hot water usage is) and that is your monthly saving.

### An example:

A household's tariff is 25c / kWh including GST/VAT/whatever and the feedback tariff is 7c. The difference is then 18c/kWh. Multiply that by hot water use of say 250 kWh/month = \$45 / month savings using Paladin's transfer ability.

I personally transfer around 290 kWh / month in the winter and 160 kWh / month in summer. The difference is down to a very expensive thermal solar (SolaHeart) unit on my roof installed long before the PV. This does 3/8th of sod all in the winter and - as you can tell from the numbers - around 130 kWh / month in summer. On the tariff numbers above this saves me a nominal \$23 / month in the summer, much less in the winter months. In retrospect this was not great for a \$10k investment 12 years ago, but in fairness it will have paid for itself before the next ice age.

Paladin on the other hand, even at a conservative \$45 / month saving, will recover its' full cost (including installation) in about 24 months tops, particularly if you factor in income tax paid on the energy bill. Since the tax position on using your own solar is the same as growing your own tomatoes.

So if you are exporting power to the grid in excess of 200 kWh a month, Paladin can optimise that efficiently and you can take long showers on the sun.

As with all things fiscal, no one size fits all, at all, at all. It all depends on that excess PV, your electricity tariff / buy back rate and hot water usage. Someone with lots of excess PV, a large hot water tank and teenage children can probably get Paladin to break even in less than a year.