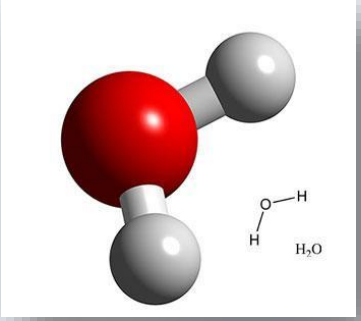
Water, H_2O – it's amazing stuff



Water is an amazing chemical. There is a lot of it on earth but that doesn't alter the fact that it is quite extraordinary. Most of the following characteristics are due to the very tight hydrogen bonding of H_2O

1. It reaches maximum density at 4°C
   Water is one of only a very small number of chemicals that expand below a certain temperature, expansion starts at 4°C and this is why ice floats and doesn't sink below liquid water
2. Water has the highest surface tension of just about any liquid (except mercury)
3. Water to steam expansion ratio is 1:1700, this is colossal and why steam is such a powerful force for industry and locomotion
4. Solvent to a wide range of substances. You not only wash dirt off your hands with it.
5. It is the ONLY chemical that can exist in all three states of matter (solid, liquid, gas) at temperatures found on Earth.

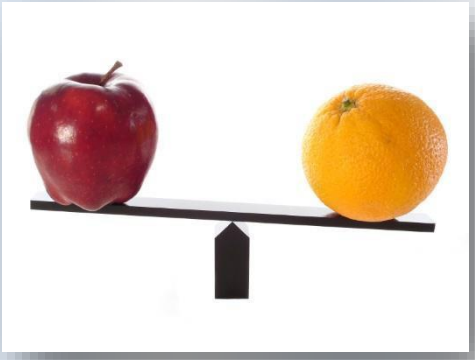
These are all vital elements to life on Earth (there are many great texts covering this on the internet if you would like to explore them more).

Very high energy density

Almost nothing stores more heat energy than water (as a two-way process), only ammonia and some waxes hold more. It is this last fact that makes the Smart Hot Water controller so useful. By using your hot water cylinder as a smart storage device, a **liquid battery** if you will, we can tailor the amount of heat energy stored to best suit your needs.

A 180 litre cylinder can store anywhere from 10 kilowatt hours to 25 kilowatt hours (kWh) of energy*.Compare that to new high energy lithium house batteries that can store 7 kWh. And yet it is 'just water', durable, safe and ubiquitously available.

Comparing Apples with Apples



Be careful when comparing different energy saving devices and alternatives.

1. Consider initial capital cost
2. Quantity of savings on an on-going basis to your specific energy needs.
3. Duration to payback
4. Durability and lifetime of device

If a device has a high initial capital expense, then the savings it generates will have to be considerable and the lifespan of the device must extend well out past the payback point to make a sound economic proposition. Also a percentage saving claim is only part of the information you need when considering investing in a device. You need to factor in what your energy needs are in real terms against percentage savings.

That is; If you are a low energy user then a purely energy efficiency device (the iSmart Hot Water controller is much more than this) then the returns will be lower and payback longer, conversely a high energy user might enjoy rapid payback as the savings percentage amounts to a higher amount of money.

You must understand the value that any device represents for you

Example:

A Hot Water Heat Pump (HWHP) manufacturer states their device is 300% efficient. Sounds great but what does this mean?

It means that the device uses 1/3 the power of an electric element only heating. As there is a considerable capital investment with a HWHP you need to consider at what point is this option good for me. If a HWHP costs $5000 then this can be compared with how many units of electricity this will need to offset to reach payback.

Taking 23cents as a typical unit of electricity price then; 5000 ÷ 0.23 = 21739 units (kWh) could be bought for the same price.

Typical hot water usage is 8kWh per day[1] – with a HWHP that would be 8 x 0.666 (2/3) = 5.33 kWh saved per day.

21739 (HWHP cost) ÷ 5.33 (saved per day) = 4078 days = 11 years 2 months' payback time.

Some people use even less hot water than this so the payback will be even longer BUT if you use more hot water the payback time will come down.

There is another issue; BRANZ states in its HEEP report[2] that the real AVERAGE HWHP efficiency across all units and all conditions is not %300, it is 150% (payback in above example is now 22 years and 4 months). The reason for this is as the air gets colder and / or the heated water cylinder contents become hotter the heat pump must work harder to heat the water, hence the drop in efficiency.

Please note we are not particularly opposed to HWHP's; they are great devices when fit for purpose especially when you have high demand for water. And some makes are better than others.

We also think just about all renewable and energy efficiency devices from Solar Hot Water, Solar Electric and Wood-Burners (with a wetback) have their place under certain circumstances and by no means are mutually exclusive in most combinations.

The point we are making is you need to carefully consider what best suits your circumstances for best value return on your investment.

Another consideration is cost of power, if you can use lower price 'off peak' power to heat your water then not only is this great value but it might make a huge difference to what hot water management device you might be the best option[4]

Also be aware that some options will deteriorate with age as they become worn out or degrade.

Note: Solar Electric panels reduce their output by around 1% each year, there is also reduced output if not cleaned regularly. Devices with moving parts will wear out etc.

We believe the iSmart Hot Water Cylinder is a great investment because;

- Modest initial investment
- The controller does not lose any efficiency in heating your water over its lifetime
- The controller needs no maintenance and is designed for long life operation[3]
- You can set up to make use of low cost power[4]
- Future proof in that it can be easily adapted to just about any hot water cylinder energy input situation that might arise as technology, your circumstances or budget changes.

Author Lance Allen Engineer for the iSmart Controller

References;

[1]180 litre cylinder heated from 12°C to 70°C = Δ58°C (note: stainless and copper can usually go up to 85°C if need be)
1 litre of water heated 1°C takes 4146 joules (1 joule = 1 watt per second) 180 litres requires 4146 x 180 = 746280 joules per °C
Therefore; Δ58°C = 43,284,240 joules or (÷3600 seconds to hours) = 12kWh

[2] The BRANZ heat pump study (SR 237 2010)

[3] Smart Hot Water controllers use power derating techniques (we over specify our components well beyond what is needed), our relay contacts close on the zero crossing of the mains so they are stressed much less and other techniques gained over 15 years of Hot Water Control design and manufacture with over 50,000 thousand units built and in service.

[4]There are a number of different power tariff options for heating water around New Zealand. These vary by geographic location and by power provider. Options include Night Rate power where power is available only during 11 pm to 7 am to heat the water. The Smart controller can be set up to carefully manage this. Night rate be can up to ½ price standard power. There are also many other options including time of use tariffs where power is always available but the cost per unit varies depending on the time of day.