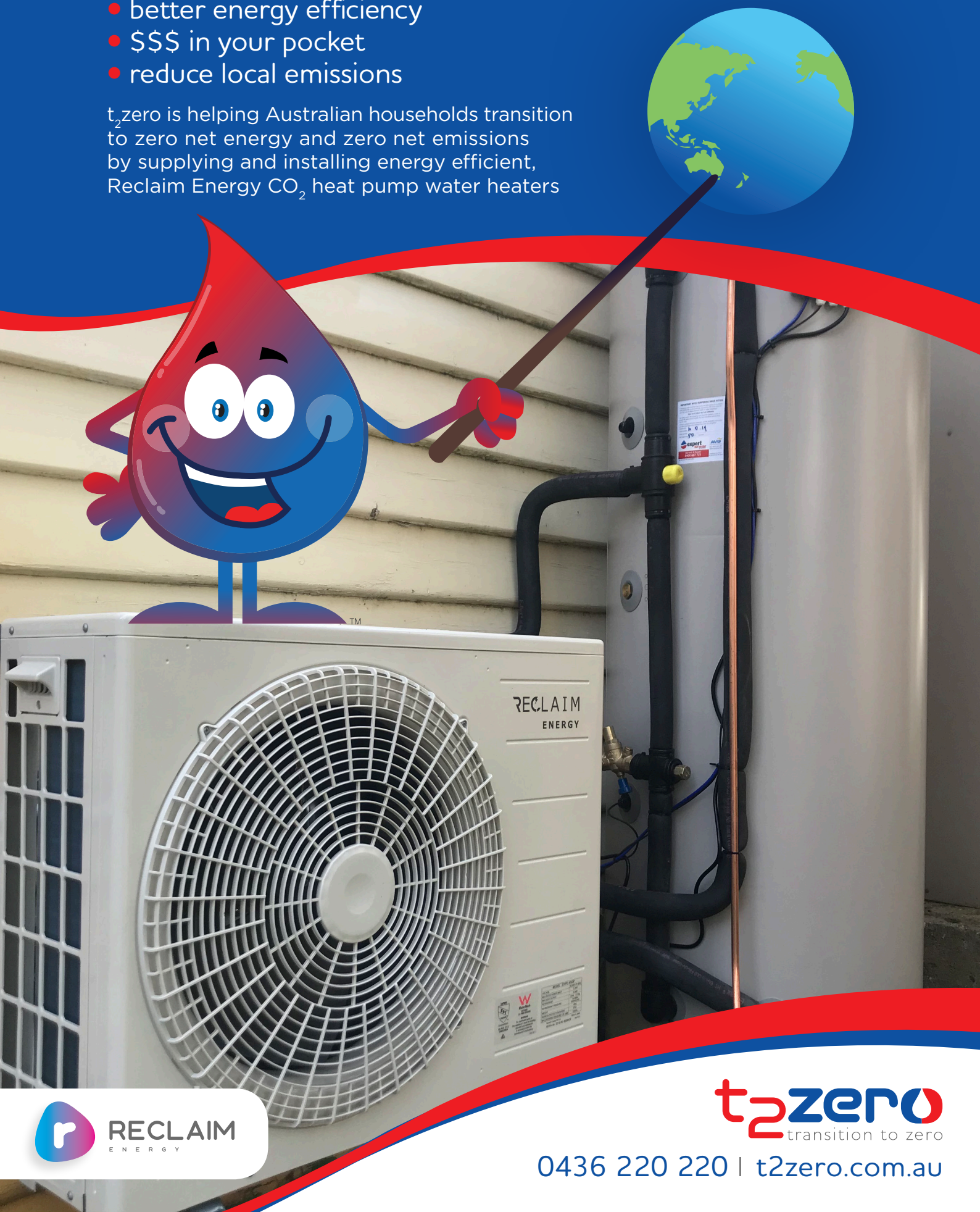
win win win

- better energy efficiency
- $$$ in your pocket
- reduce local emissions

$t_2$zero is helping Australian households transition to zero net energy and zero net emissions by supplying and installing energy efficient, Reclaim Energy CO_2 heat pump water heaters



RECLAIM ENERGY

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What is a heat pump?

A heat pump is a very simple, yet remarkable technology that transfers thermal energy from a heat source to a heat sink. A working fluid (refrigerant) carries the heat while an external energy source performs the work of moving the heat.

The refrigerant is gas that readily absorbs heat energy. Heat is created when the refrigerant is compressed. This heat can be harnessed for heating purposes. The cooling cycle is achieved when the refrigerant is expanded. This cold is used in refrigeration applications. The cycles can be reversed to achieve either heating or cooling.

Heat pump technology has been used in commercial refrigeration and air-conditioning for >100 years. However, it is only relatively recently that the technology has been used for water heating applications.

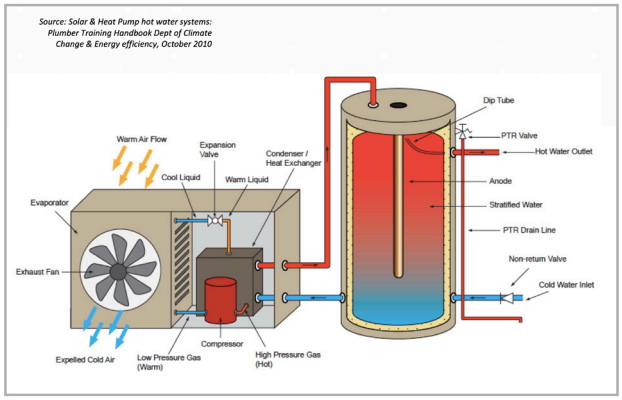
The magic of heat pump technology is that their thermal energy output is a significant multiple of their input electrical energy. This feature makes heat pumps incredibly energy efficient and perfect for applications such as water heating.

Reclaim Energy CO_2 Heat Pump (REHP)

The Reclaim Energy CO_2 heat pump water heater is a split system that allows separation of the storage tank and the heat pump up to 10m horizontally and 5m vertically. Components include:

1. A heat pump
2. A 315L hot water storage tank
3. A controller to activate the heat pump when required

The CO_2 refrigerant provides superior performance in colder climates with NO BOOSTER heating element required.

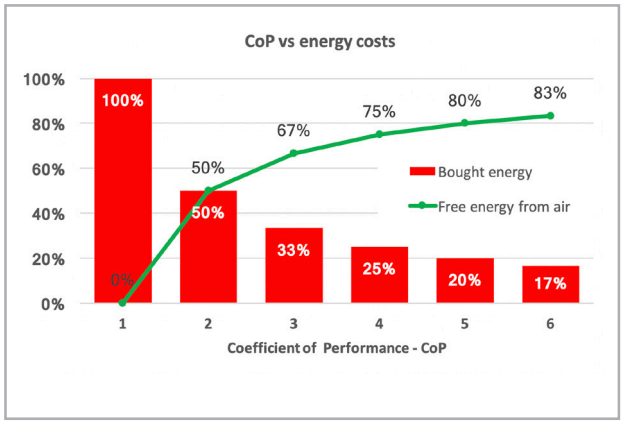


Source: Solar & Heat Pump hot water systems: Plumber Training Handbook, Dept. of Climate change & Energy Efficiency, Oct 2010

CoP: ~80% of the thermal energy generated is FREE

Coefficient of Performance (CoP) is a measure of energy efficiency, with higher being better. While most manufacturers quote a single CoP, in reality, CoP varies with conditions such as inlet water temperature, ambient air temperature and outlet water temperature.

REHP specifies a CoP of 6.02*, indicating that 6 units of thermal energy is generated for every unit of electrical input energy under certain conditions. In practical terms, 5.24kW of thermal energy is generated, while only 0.87kW of electrical is consumed. The 4.37kW (83.33%) difference is sourced from the surrounding air.



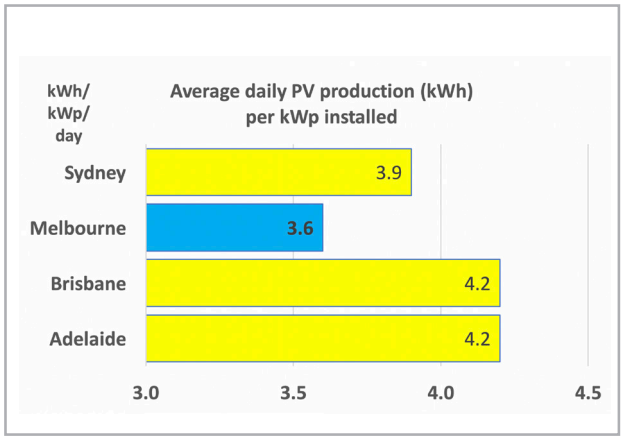
Source: $t_2$zero
*assumes: 30°C ambient air, 21°C inlet water, 63°C outlet water

REHP works seamlessly with rooftop solar PV

Most rooftop solar PV installations are now routinely exceeding 5kWp, with many 10+kWp systems being installed. These systems generate on average 18-36kWh/day (3.6x multiplier).

REHP uses around 3kWh/day (ie 1kW power for around 3 hours per day), representing only 16% of the output from a 5kW system and 8% from a 10kW system.

Electricity generated from rooftop solar PV is the cheapest form of electricity. Running the REHP during peak solar PV production will store 3kWh of energy as hot water. Think of the REHP as a thermal battery.



Source: Clean Energy Council: Consumer guide to buying household solar panels, Aug 2011, Vol 14

The magic of heat pump technology is that their thermal energy output is a significant multiple of their input electrical energy. This feature makes heat pumps *incredibly energy efficient and perfect for applications such as water heating.*

Why choose a REHP?

Significant energy cost savings

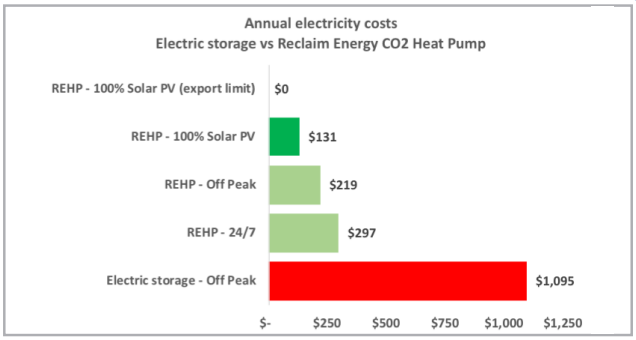
Resistive element, electric storage water heaters are exorbitantly expensive to run, even when running on an off peak tariff. By comparison, the REHP uses a fraction of the electricity and therefore costs materially less to run.

Assuming an electric storage system uses 15kWh/day, the cost to run the system on an off-peak tariff of 20¢/day is $3.00 per day or $1,095 per year.

By comparison, the REHP uses on average 3kWh/day. The daily cost comes down to 60¢/day using an off-peak tariff, **saving $876 every year** or nearly $9,000 over 10 years.

Running costs come down even further when the REHP is powered by rooftop solar PV. The 3kWh/day could be sold at the Feed-In-Tariff (FIT) of 12¢/kWh, "costing" 36¢/day or $131 per year in foregone revenue. Using solar PV, **saves $964 per year** or nearly $10,000 over 10 years.

For larger rooftop solar PV arrays (eg 10kW or higher) with export limits on the amount of electricity they can export (typically 5kW), the excess electricity is FREE as it cannot be sold to the grid. This provides the ultimate **saving – $1,095 per year** or nearly $11,000 over 10 years.



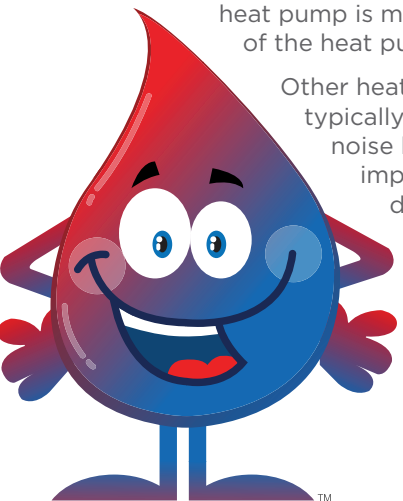
Source: $t_2$zero

Assumptions:
Energy consumption (kWh/d): 15 (ES), 3 (REHP)
Tariffs (¢/kWh): Peak 30¢; Off Peak 20¢; Solar FIT 12¢
24/7 = 5/7 days @ Peak Tariff, 2/7 days @ Off Peak

Whisper quiet

When operating, the REHP is whisper quiet (37 dBA). The level of noise is proportional to the amount of air the heat pump is moving and the quality of the heat pump components.

Other heat pump water heaters typically operate at much higher noise levels. This becomes an important consideration in higher density living environments, particularly when the units are operating overnight to take advantage of cheaper electricity tariffs.



dBA	Example
0	Healthy hearing threshold
10	Gentle breathing
20	Rustling leaves
30	Whisper
37	**REHP operating level**
40	Interior of library
50	Running stream
60	Conversational speech
70	Shower
75	Toilet flushing

Source: www.noisehelp.com/noise-level-chart.html

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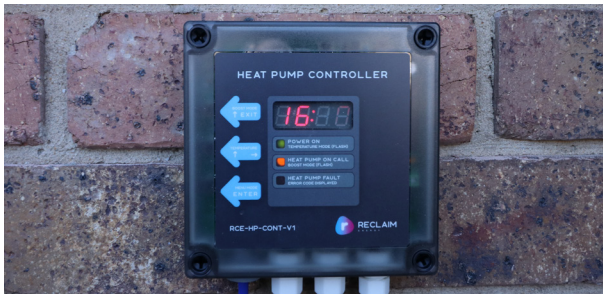
External controller with 5 settings

The Heat Pump Controller provides a user friendly interface that allows customers to easily check and change the user settings when required.

1. 24/7 – continuous
2. Off peak
3. Extended off peak
4. Solar setting (10am – 4pm)
5. User preference – 2 operating periods

The Controller features a "single-shot-boost" function in the event there is a requirement for additional hot water out-of-cycle. This feature activates an entire heating cycle, delivering the first 50L of water within 20 minutes. At the completion of the heating cycle, the controller reverts to the selected setting.

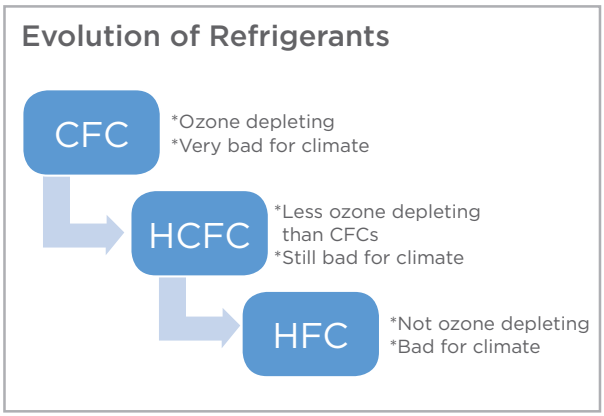


Source: $t_2$zero

CO_2 refrigerant is superior for cooler climates

CO_2 (R-744) has been used as a refrigerant for commercial refrigeration applications for over 100 years. CO_2 is non-toxic, non-flammable and environmentally benign. It was phased out in the middle of last century in favour of CFCs, however is very much back in vogue particularly for water heating applications.

These factors coupled with superior performance in water heating applications have seen a resurgence in the use of CO_2 as a refrigerant in heat pumps, particularly for water heating applications in cooler climates like Victoria.

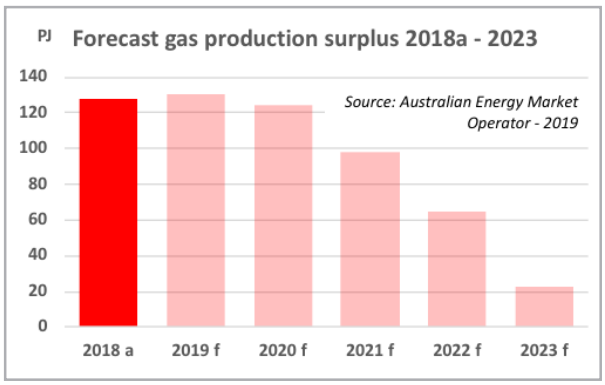


Gas is a non-renewable resource

Surplus Victorian gas supply production is currently exported to NSW & SA. This surplus will all but disappear within 5 years. NSW and SA will be the first to feel the impact as supplies are curtailed.

Since 2010, wholesale gas prices have risen 5-fold. As supplies dwindle, prices will likely rise further.

NSW is already talking about building an LNG receiving terminal in Port Kembla to address the looming gas supply crisis.



Source: Australian Energy Market Operator - 2019

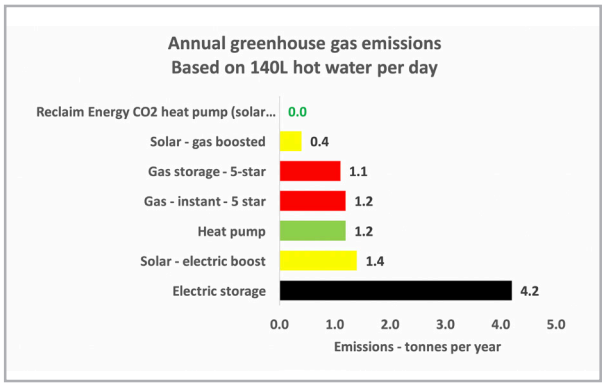
Zero-net emissions when running on Solar PV

The REHP running on solar PV achieves zero-net emissions.

Electric hot water systems use large resistive elements (3.6 – 4.8kW) to heat water. They are a legacy of cheap, coal-fired electricity and were designed to run on the centralised power grid during the night when demand was low.

Solar with electric boosting also uses a large (2.4kW) electric element that isn't suited to rooftop solar PV. Any heat pump featuring "a booster element" or "emergency element" is in reality a hybrid electric storage system.

While gas boosted solar water heating provides a low emissions intensity, gas is non-renewable and resources in Victoria are dwindling quickly (refer above).



Source: Dept of Climate Change & Energy Efficiency, Solar & Heat Pump hot water systems: Plumber training handbook, Oct 2010.

For an obligation free quote:
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