HEAT-PUMP HOT WATER

General operation. Heat-pump hot water services apply the same technology used in a reverse-cycle air conditioner to the heating of water (see Section 3.2.2). They are highly efficient because most of the energy used to heat the water is extracted from the ambient air. These devices are generally capable of reducing hot water mains energy requirements by at least 50% [128], and as much as 70%, compared with a conventional electric hot water system. These type of systems have been available in Australia for more than ten years, but currently represent only about 1.7% of installed systems [128 Table 19].

Configuration. Generally heat-pump hot water services are generally either configured as either:

- **One-piece**. With the evaporator and fan mounted on top of or beside the tank and integrated into a single unit;
- **Split system**. With the heat-pump mechanism in a separate unit plumbed to the tank at installation time.

Cold-weather operation. Conventional wisdom has it that heat-pump hot water services are not suitable in cold climates. It is generally true that efficiency of heat-pump systems are more sensitive to ambient temperature than other water heating systems.

However the cold-weather performance of many contemporary recent models can be good. The rating and regulation of these systems introduced a new climate zone covering cold climates in 2011. The first list of systems tested against the new test regime for this zone was released by the Clean Energy Regulator in November 2011 [129]. The 255 systems on this list include 106 which are tested in the cold-climate Zone 5. The best performing is rated as saving 9.3 kWh/day on average in cold-climate locales, relative to a reference electric hot water service. This is consistent with Pitt & Sherry's results [128 Table 11] which reported an average 47% energy saving in Canberra. Therefore it is safe to say that an appro priately chosen heat pump system will be suitable, and give good energy savings, even in cold climates.

Refrigerants. The global-warming potential (GWP) of refrigerants used in heat pump systems is often very high, which becomes a problem if they leak or are dumped illegally. Some systems are available that use low-GWP refrigerants such as hydrocarbons or CO2.

Noise. Heat pump hot water systems generate noise levels comparable to modern small air-conditioning units. This introduces the need for care in locating units such that any potential annoyance is minimised. For example, locating a unit right next to a bedroom window should be avoided.

FIGURE 3.30
A cut-away view of an evacuated tube collector. [Apricus]

Ventilation. These systems depend on sufficient access to ambient air flow. This precludes installation in confined spaces. Minimum clearance from walls needs to be observed. On the other hand, unlike gas systems, there is no flue gas to be vented, so indoor installation, such as in a garage, is viable given sufficient room volume.

Economies of scale. The technology involved in heat-pump hot water systems is well-understood and readily available, but the market penetration is very low. It follows that, if deployed on a much larger scale, such systems would naturally become more affordable and reliable due to simple effects of scale and product maturation.

Technology Benefits

Compared to the alternatives, heat pump-based hot water services have a number of advantages:

- **Continuous recovery**. Unlike solar-only systems, heat pumps can heat water efficiently even when the sun is not shining;
- **Low boost power**. When boosting, heat-pump systems require much lower power levels than electric resistive boosting. In the context of connecting to a renewable-energy grid and winter-time peak demand, this is a significant consideration;
- **High-efficiency**. They typically achieve a coefficient of performance (COP) of 2 or better. This can lead to a large reduction in energy used compared with a conventional electric or gas system. For a four-person house, the average mains energy requirement is similar to a conventional electric-boosted solar system.
- **Easy installation and location**. Compared with solar, the installation requires much less labour, and the location of the equipment is much less sensitive to local factors such as shading and roof access.
- **No combustion emissions**. When compared to gas hot water units, heat pump systems enjoy the benefit that they do not emit the flue gases. Flue gases can pose problems if not ventilated properly.
- **Consistent load**. Compared with solar, heat pump electrical load is more consistent from day to day, and from season to season.

- **Adaptable load**. Heat pump systems are more flexible about when boosting is delivered, allowing boosting times to be coordinated with available energy sources such as wind.

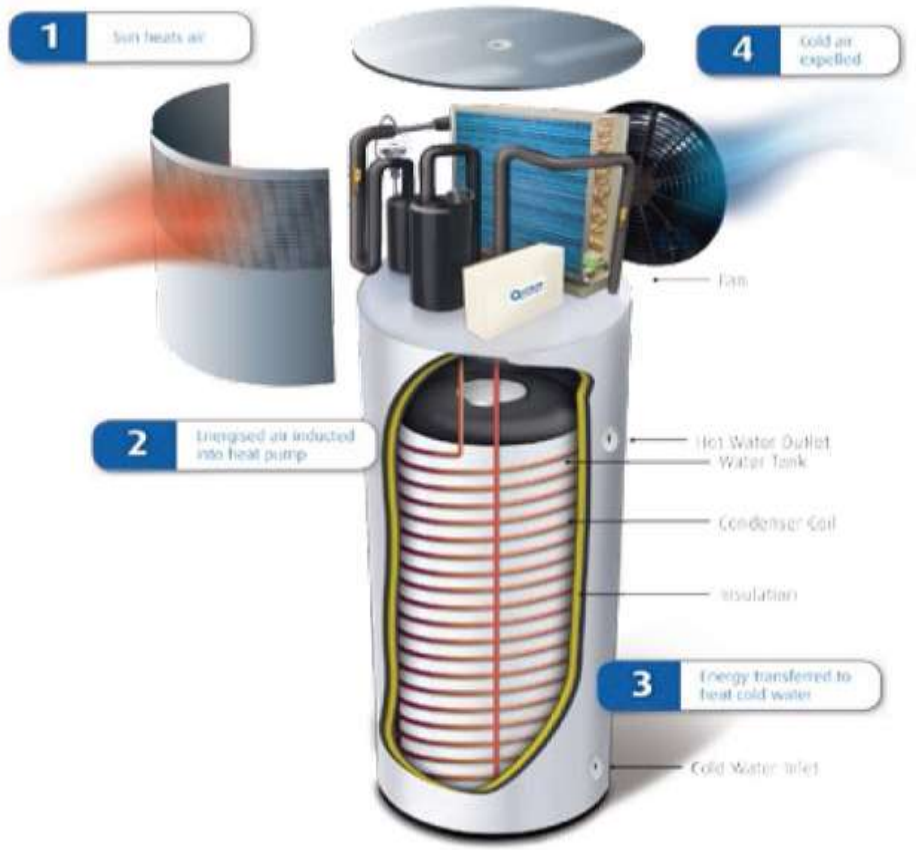

FIGURE 3.31
The internals of a one-piece heat pump system [Quantum]

Costs

A survey of the costs of installed heat pump hot water systems in Australia by this report found the average 2013 cost to be between $3500 to $5000 depending on the brand and tank sizes.

As an indication of costs, at the lower end of the scale, a 310 L heat pump unit was quoted as costing $2,604, based on replacement of an existing electric HWS [130].

The rebate situation is mostly the same as for solar hot water.

Running costs. A study by Pitt & Sherry ([128 Table 10]) reports that using heat-pump hot water systems can lead to considerable savings in operating costs. However this varies greatly with model, location and electricity supply tariff.

Source: http://decarboni.se/publications/zero-carbon-australia-buildings-plan/5-hot-water-systems