Small-scale solar heating
A DIY mini hydronic system

Hydronic systems don't have to heat a whole house. Martin Chape describes his mini DIY system that just heats one room using solar heat.

↑ The solar thermal collector (at rear) that provides the heat for the mini hydronic system.

FOR quite a few years I have dreamed of using the sun to heat my bedroom via a solar thermal hydronic system. Eventually, in spring 2014, I decided to bite the bullet and stop procrastinating. I'd been put off by problems with installing hydronic pipes in the concrete floor; that would have meant either increasing the floor's height by an additional 50 mm, or buying slotted timber flooring to overlay the concrete and hydronic pipes. Both seemed difficult and impractical.

Bargain hunting

Instead, I watched Gumtree for those heavy cast-iron radiators that are popular in the UK. Lo and behold someone local advertised a houseful. I made an offer of $200 for the lot and they even threw in the gas boiler.

It wasn't long before another bargain turned up: a new 180-litre hot water tank that a builder had dropped, damaging the outside casing. I offered him $100 and he accepted. A little panel beating and body filler and the hot water tank looked like new.

Next I needed a heating element. I sourced a set of 30 evacuated tubes from a South Australian supplier and a stainless steel header tank with float from Queensland. Although two of the tubes were broken upon arrival the supplier had sent me an extra box of 10, so I actually have spares left over.

A tricky solar hot water system install

The tubes were supplied with a frame designed to sit on the ground. However, my mounting situation was complex, with the unit to be mounted across a roof hip and with two slopes.

So I first completely assembled the frame on my back deck to get an idea of how it was set up. Then, using the material supplied for the frame and some extra aluminium RHS (rectangular hollow section) from a metal supplier, I was able to fabricate a frame to hold the tubes at an angle from the horizontal, facing north to suit the winter solstice on my sloping roof.

I mounted the header tank containing a float valve on top of the frame, ready to be connected to the mains water supply by my plumber. An overflow point on the header tank was piped down to drain into the roof gutter.

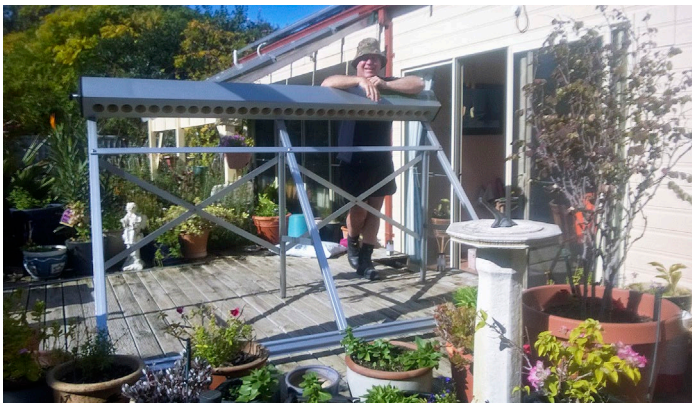
Cast-iron vs fan coil radiators

It was around this time that I discovered I could obtain fan coil units from China and I decided to use these instead of the secondhand cast-iron radiators. It turned out that the cast-iron units were corroding on the inside; dirty water ran out of them when I transported them. This made me aware that they were likely to have a short remaining life.

The fan coil units contain a brass radiator, not unlike a car radiator, which could be made to last quite some years. They also come with built-in electronics, a thermostat, a timer, a control wire to run the flow pump and a remote control, meaning each one can be remotely and independently controlled. To use the cast-iron radiators, I would have had to build all these electronics myself.

In addition, I would have had to mount the

↑ A bunch of secondhand radiators and a boiler for under $200.



↑ The collector frame being tested before going on the roof.

cast-iron units near the floor, possibly behind furniture or at least taking up usable floor space. The fan coil units come in three types, one of which is a high-mounting wall unit that looks very much like the indoor part of a split system air conditioner. This is the type I chose. (The other two types are a narrow floor-mounted unit and a cassette setup that could be mounted in the ceiling.)

The fan coil units are an excellent way to deliver heat or cold to an existing home that doesn't have hydronic pipes installed in the slab at construction time. They can also deliver hot or chilled water.

I ordered a wall-mounted unit and after shipping paid around AU$250.

Installation and wiring

I mounted the 180-litre hot water tank on a small rainwater tank pedestal in my bedroom courtyard, close to where the fan coil unit would be mounted, thus keeping the feeder pipes short. I plumbed the tank to the evacuated tubes on the roof using 12 mm copper tube, over which I slid a UV-stabilised insulation sleeve before wrapping with foil tape from Reece Plumbing, guaranteed to temperatures of 150 °C. I did the same to connect the tank to the fan coil unit through the bedroom wall.

I did the low-pressure plumbing between tank, collector and fan coil unit myself, but employed a plumber to connect the high-pressure mains to the low-pressure header tank containing a float valve.

I bought a Chinese solar hot water system controller, model SR868C8, on eBay. It came with a control panel with a control wire attached. Also supplied were three thermistors of two different types, one for the roof and two for the top and bottom of the tank. Because I could not use the solar HWS control unit with the 240 volts AC it was designed to switch (it was not approved for Australia, although a 12 V DC version is also available), I replaced its transformer with a 24 to 12 volt DC converter to feed the circuit board, then mounted the board into an electrical utility box. The solar control unit now switches a 24 volt DC pump which circulates water from the tank through the tube array during the day. At night a second 24 volt DC pump, operated by the control wire from the fan coil unit, circulates hot water from the tank to heat the room. The 24 V DC for the system is supplied by my previously installed solar-powered air cooler, as seen in *ReNew 126*.

After my plumber hooked in the inlet tank on the roof to the water mains, I filled the whole system with water.

Evaluation

I used the hydronic system through the winter of 2015. Temperatures of 80 °C were achieved in the tank at the end of each day, and throughout winter it successfully supplied heating to keep my bedroom at a comfortable temperature until after midnight.

Future plans include buying or building an adsorption chiller to use the excess of hot water generated by the system during our hot summers. This would allow chilled water to be pumped through the fan coil unit to cool my bedroom. ✸

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↑ The indoor fan coil unit looks a lot like a reverse-cycle air conditioner.

Warning

All plumbing work must be carried out by a licensed plumber. Should a self-installed hydronic system fail, causing damage to your home, your insurance company may not honour any insurance claim.

When working with any pressurised system that involves an uncontrolled heat source such as the sun, care must be taken to provide the required pressure/temperature relief valve and control system to prevent the tank boiling. We highly recommend that if you choose to install a system yourself, solar heating systems should use open-vented tanks (unpressurised) for safety, as this system does.

We also recommend that you use extra-low voltage (12 or 24 V) pumps and electrical systems for safety when doing DIY projects, as mains-powered wiring should only be done by an electrician. As with any electrical system, ensure adequate circuit protection in the form of appropriately rated fuses or circuit breakers are used for each circuit.