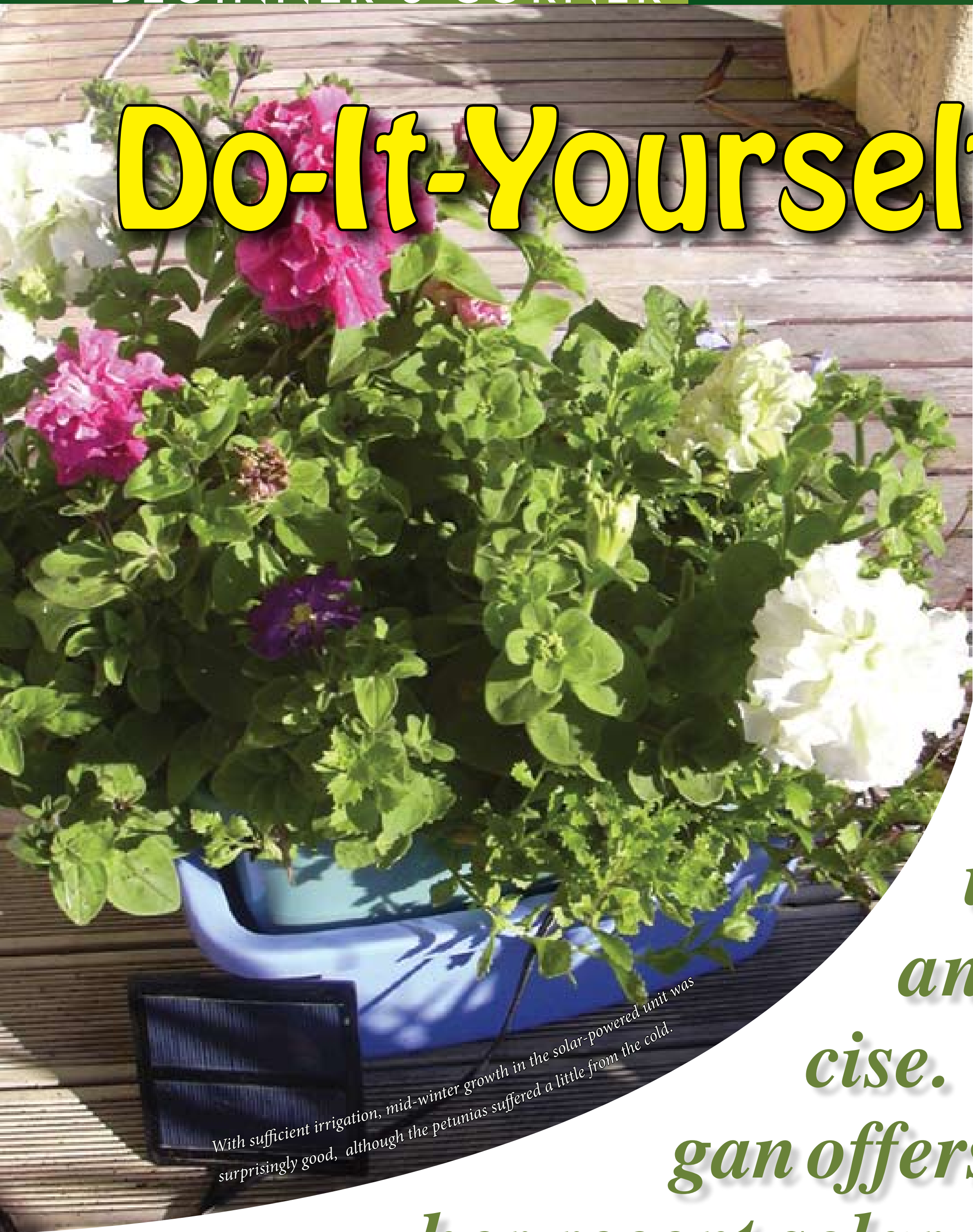
Do-It-Yourself Solar



With sufficient irrigation, mid-winter growth in the solar-powered unit was surprisingly good, although the petunias suffered a little from the cold.

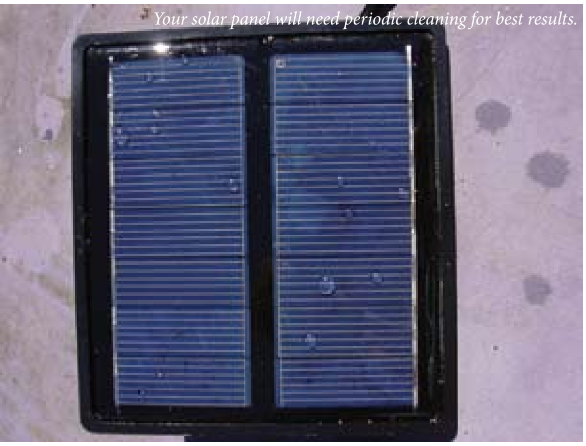
For hydro growers who love to tinker, adding solar power to a hobby hydro unit is a doable and fun exercise. Lynette Morgan offers tips based on her recent solar experiment

Using solar power to run a small hydroponic unit is appealing to me. The idea of utilizing a renewable energy source and the idea of growing plants in a non-powered site is exciting. The prospect of free power was the deciding factor. However, in New Zealand, where I live and work, I battle low light and infrequent, watery sunshine in winter, so the solar unit was going to have to be a year-long experiment to determine if it really was feasible and cost-effective.

Putting It To the Test

My solar hydroponic unit project began last summer, which is a good time to start as there was plentiful sunshine to test the pump, determine its capabilities, spray water far and wide, and design the system based on these factors. The pump used in this case was a small, standard solar-powered fountain or pond pump, commonly available these days. It cost a little more than an electric pump of the same size, approximately US$40.

The pump came with a number of attachments and nozzles for spraying a fine mist of water high into the air and back into ponds, not great for a hydroponic system, but the pump did produce a head height of around 2-3 feet in good light. Once the pump capacity was tested in a range of different light levels, it looked as if the hydroponic system was going to need to consist of the growing bed with a nutrient reservoir in close proximity and preferably not require nutrient to be pumped any higher than around 1 foot. A head height of 1 foot would then be easily achievable on



Your solar panel will need periodic cleaning for best results.

lower solar level days.

To make this as easy and cheap as possible (in case the whole project failed), I decided to customize a system out of two small, plastic laundry tubs, each 10 inches by 14 inches and 7 inches deep. They cost $4 each and are the sort of plastic tubs that easily stack inside each other—the bottom one being the nutrient reservoir, and the top tub being the grow bed.

By stacking the top grow bed tub half way inside the bottom nutrient reservoir tub, the total head height the nutrient needed to be pumped up into and above the grow bed media was only 10 inches. This was perhaps the first mistake, as I had underestimated the power of the New Zealand sunshine, even in winter, and could have allowed for a much higher head height and a deeper grow bed, or even a sophisticated 2-3 tiered grow "stack" system which could have held many more plants Additions to the system are planned soon.

The top grow bed was supported inside the bottom nutrient reservoir by positioning some supports (small plastic plant pots) inside the reservoir which held the grow bed at just the right height. I estimated that the nutrient reservoir when filled to capacity held 5 liters of nutrient, with an air gap of a few inches beneath the grow bed. This allowed the nutrient to drain back from the grow bed, with the droplets cascading down in the nutrient solution, creating some oxygenation in the system. The top grow bed has to be modified by creating a number of drainage holes in the base of the laundry tub—another short fall in my design

Testing the capacity of the solar pump in summer helped determine exactly what head height could be achieved in the system.

as cutting even sized and spaced holes in a thick plastic tub is not easy or very safe. A better option would have been to have found a suitably sized, plant or seedling tray with pre-punched holes, or adapt one of the many stacking pot garden systems we have stashed in the back of the greenhouses.

built a simple solar-powered hydroponic system by stacking one laundry tub inside the other. The bottom tub contained the nutrient reservoir.

Once the tub had suitable-sized drain holes installed, the base was covered in 1-2 inches deep with coarse drainage material, in this case scoria rock, although a range of substrates could be used, including gravel, expanded clay or anything which allows nutrient to drain quickly through the base back into the reservoir. Above this drainage media, the growing substrate I selected turned out to be quite a good choice. I estimated that while a free-draining media such as coarse perlite or even various grow rocks could certainly be used in summer, in the lower solar levels of winter a media that had a good water-holding capacity would be needed to hold nutrient between infrequent and unpredictable irrigations. The mixture selected was a combination of 60% perlite and 40% vermiculite, although similar mixtures could easily be made from coconut fiber and perlite or granulated rockwool. So long as there is a good degree of nutrient retention there should be no irrigation for a day or two in winter.

Working Out the Kinks

The most difficult step in building this system was installing the pump delivery pipe. The solar-powered pump sat down on the base of the bottom nutrient reservoir held down with suction caps on its base. The nutrient delivery pipe had to go up through the base of the grow bed which involved cutting another larger hole directly in the center of the upper tub, just the right size to fit the riser pipe. A hot metal pipe eventually solved that problem and created a nice hole in the plastic.

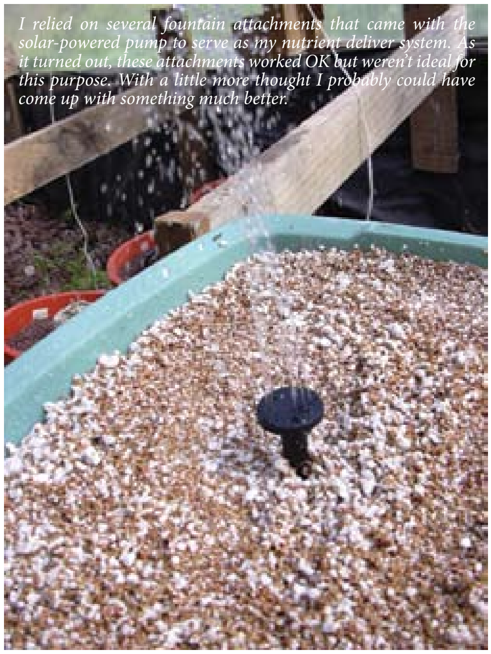
With the pump installed, the top grow bed was slotted on top and filled with growing media, in preparation for the seedlings. At this stage another drawback of this simplistic system design was discovered. To get into the nutrient reservoir to put water in and check EC, pH, etc., the top grow bed had to be lifted up and held up by a second person while the nutrient was checked. Not ideal. And since the damp media and rampant vegetation that later developed became quite heavy, it turned out to be a major design flaw that will take some working on to solve. However, once the nutrient was added to the reservoir and the grow bed settled back on top, the seedlings established rapidly and within a few weeks had provided an impressive display of petunias, lobelia, and gerberas.

One problem that did occur in the first trial of the planted system is that the power of the mid-day summer sun created a huge fountain of nutrient, which sprayed 3 feet above the growing bed, most of which fell back to earth outside of the grow bed and ran the nutrient tank dry. Ideally, a bit more thought should have gone into the nutrient-delivery system, rather then relying on using the fountain sprinkler heads that came with the pump. The problem was solved, however, by a redirection of the nutrient coming from the fountain sprinkler head. By placing a plastic jam jar over this, the nutrient was prevented from cascading up and directed down into the growing media.

Despite having only one nutrient outlet in the growing tub, the growing media had sufficient capillary action to spread the nutrient evenly through the whole system for plant growth. A more advanced model of this system should really involve a bit of irrigation system design so that the nutrient is perhaps diverted into 2-3 outlets on the surface of the growing media. In this way a much wider growing bed tub could have been used, and possibly 3-4 times more plants grown using this small pump.

Once I got my new solar-powered hydro system working, I planted it out and started my trial.

Despite some early teething problems, the solar hydroponic system has thus far worked extremely well. Even in mid-winter there was no problems with a lack of power. An outburst of sun for even a few minutes once or twice a week has been sufficient to keep the plants ticking along in winter, and the low intensity of sun does not seem to have caused any problems to date. Winter conditions, being quite cool, mean that the plants have a greatly reduced water and nutrient requirement, so even one irrigation 2-3 times a week seems to be more than sufficient.



I relied on several fountain attachments that came with the solar-powered pump to serve as my nutrient deliver system. As it turned out, these attachments worked OK but weren't ideal for this purpose. With a little more thought I probably could have come up with something much better.

The only maintenance required for this system has been a quick wipe of the solar panel every now and then. Birds flying overhead have dropped bombs on it on a few occasions. The panel has also needed repositioning every other month to get the most of the sun's movement as the seasons change. The nutrient reservoir certainly needs a water level indicator attached to the outside as it's not possible to see when it's about to run dry without lifting off the now very heavy top grow bed. Adding the water-level indicator is on the plans for the next system modification which is also going to incorporate much more growing space.

I estimated that this very simple system cost less than $50 to make and was up and running within two hours and has been relatively trouble-free ever since. The main problem is it doesn't hold enough of my plants and needs expansion, as all good hydroponic systems eventually do.

After six weeks of growth my solar unit proved to be reliable and required little maintenance.

Together with Simon Lennard, Lynette Morgan owns and operates SUNTEC Hydroponic Consultants, New Zealand. This is part three of a three-part series on growing hydroponically with solar power.

References and Resources

"The Use of Solar Energy for a Small Recirculating Hydroponic System" by N.J.J. Combrink and T.M. Harms. Acta Hort. Vol. 554, p. 285.

Atwater Hydroponics
www.atwaterhydro.net
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