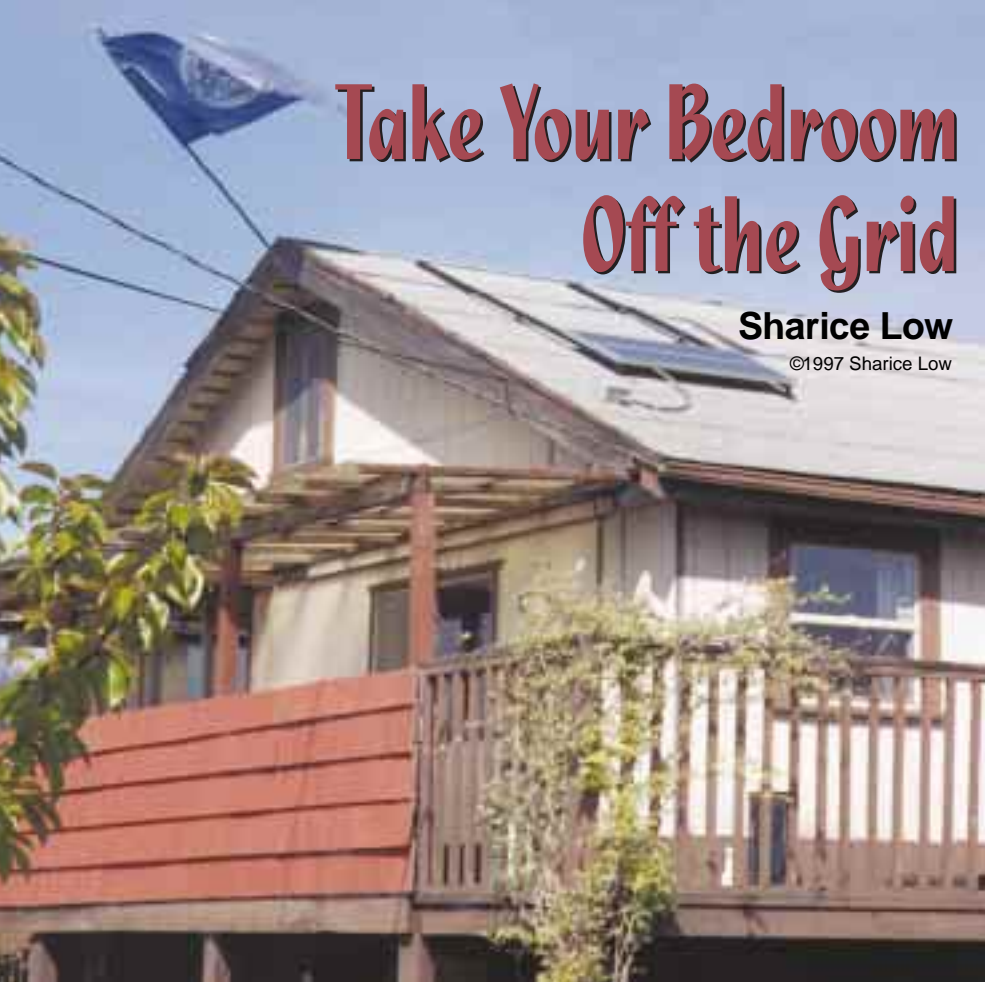


Take Your Bedroom Off the Grid

Sharice Low

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Left: Earth Church flies the flag of its namesake.

equipment, and hardware, to run DC lighting and stereo equipment. Or you could use a small system with an inverter and a plug strip to power some of the appliances in your home. With a little electrical knowledge you could even separate out and power one existing household circuit using solar electricity. At any time more modules and/or batteries can be added. Whenever possible, size wiring, controls, and safety equipment to handle some growth, as it can be difficult and expensive to change later on. So next year, when you get your income tax returns, for example, you can add two more panels, and the next year two more. Then a couple years down the road, you can take another circuit of your house off the grid and gradually expand, until one day your whole home is powered entirely by solar electricity!

In recent years there has been a growing interest in renewable energy. The problem is that many people cannot afford to implement a complete renewable energy system all at once. As interest grows and renewable energy equipment prices fall, people will not be ready to take advantage unless the industry and non-profits undertake serious public education.

Redwood Alliance, an environmental organization that deals with energy issues, has addressed the problem with a workshop teaching the public to implement a renewable energy system a little at a time: "Take Your Bedroom Off the Grid." The idea is that many people can afford \$600 to \$2500 to take a portion of their house off the grid. It may be with one module and one battery to run 12 Volt DC equipment, or a more elaborate system powering an isolated ac circuit in their house.

Start Small and Expand

A system like this is implemented with expansion in mind, starting out small with what you can afford and expanding as time goes on. At a relatively low cost you could invest in one module, a small battery, safety

Education

With the "Take Your Bedroom Off the Grid" idea people will be educated so that they can make the right decisions, choose the right equipment, choose the right installers, or do it themselves. Even more basic, most people do not at all recognize the possibility that they can make or use renewable electricity. So, Redwood Alliance undertook the project of bringing an educational workshop to its community, Arcata California. We wanted the workshop to include

Below: Instructor Johnny Weiss and workshop organizer Sharice Low.



everything from the basics of what renewable energy is, to system sizing, efficiency within the home, system design, and an actual hands-on installation. We also wanted the workshop to be affordable and accessible to as many people as possible. We expected a wide range of attendees, but knew that most of them would be novices in the world of home-made electricity.

Redwood Alliance would like to share our workshop with any interested communities. If you would like to introduce the "Take Your Bedroom Off the Grid" concept in your own area, please contact us.

Do Folks Want It?

The first task to putting on a workshop of this sort, which as far as we know had never been done before, was to determine the demand. We composed a returnable questionnaire asking about the level of interest in such a workshop, the amount of money community members would be willing to pay for the workshop, the timing and length that would be preferable, and if they would be interested in allowing us to use their home for the hands-on installation portion of the seminar. We did a sample mailing of 500 questionnaires, of which we received 30 back. We felt that this response was good enough to send out the additional 1500 questionnaires. Our total number of responses was 135, and of those responses 23 people participated in the seminar. We used the information from the questionnaires to get a feel for how many people would attend the workshop. Based on this we were able to make projections for the attendance price of the workshop. We also decided, based on the responses, that a weekend long workshop would be the most appropriate, as most people in our community could not participate during the week.

Below: Johnny Weiss lays out PV theory for workshop attendees in Arcata, California.



Above: John Gary of Earth Church looks over two PV panels on a rack that can hold six: room for expansion.

Our next task was to decide if we were able to afford having the workshop professionally taught. We hired Johnny Weiss of Solar Energy International to handle the workshop lecturing. Johnny's knowledge and experience in putting on educational workshops is vast, and he had quite a task condensing weeks of information into one weekend worth of lectures. He did a tremendous job and helped to make our seminar a success.

We wanted our community members to be able to afford a reasonably priced informative workshop. In order to do this and still have the lecturing and preliminary installation work professionally done meant that we had to find sponsorship. We received a cash sponsorship and help with advertising from our local North Coast Co-op, who is always doing a lot for our community. Alternative Energy Engineering paid for a significant portion of our mailing costs, provided assistance (thanks to Jay Peltz) and equipment





Above: L-R Janet McVicar, Lori Rose, Raul Lozano, and Elias Elias get their hands on the technology.

(modules, wiring, batteries, and multi-meters) for the lab stations on the second day of our seminar. AEE also agreed to give all workshop participants a discount on system equipment. Bob-O Schultze and Joe Schwartz of Electron Connection devoted numerous hours to our workshop. They did a site survey of the five potential homes for the hands-on installation portion of our workshop, and handled the preliminary work for the installation itself (running conduit, installing breaker boxes, and installing the brackets for the PV roof mount). It was important having these experienced electricians on site during the installation to head off any problems the participants had. Truly, without the help of each of our sponsors, this seminar would never have been possible.

Workshop Schedule

The workshop started off with an introductory slide show on Friday night that was open to the public and targeted for those who wanted only a general overview of what is going on in the renewable energy industry. Johnny had an interesting slide show on the whys and hows of the renewable energy.

The rest of the seminar was three days of in-depth explanation and implementation for the participants who paid. Depending on the participant's schedule, finances, and amount of desired knowledge, they could participate in one, two, or all three days of the workshop.

Saturday's workshop began with the needs and consideration of designing a solar electric system. It was an opportunity to get a basic understanding for those who were considering having someone

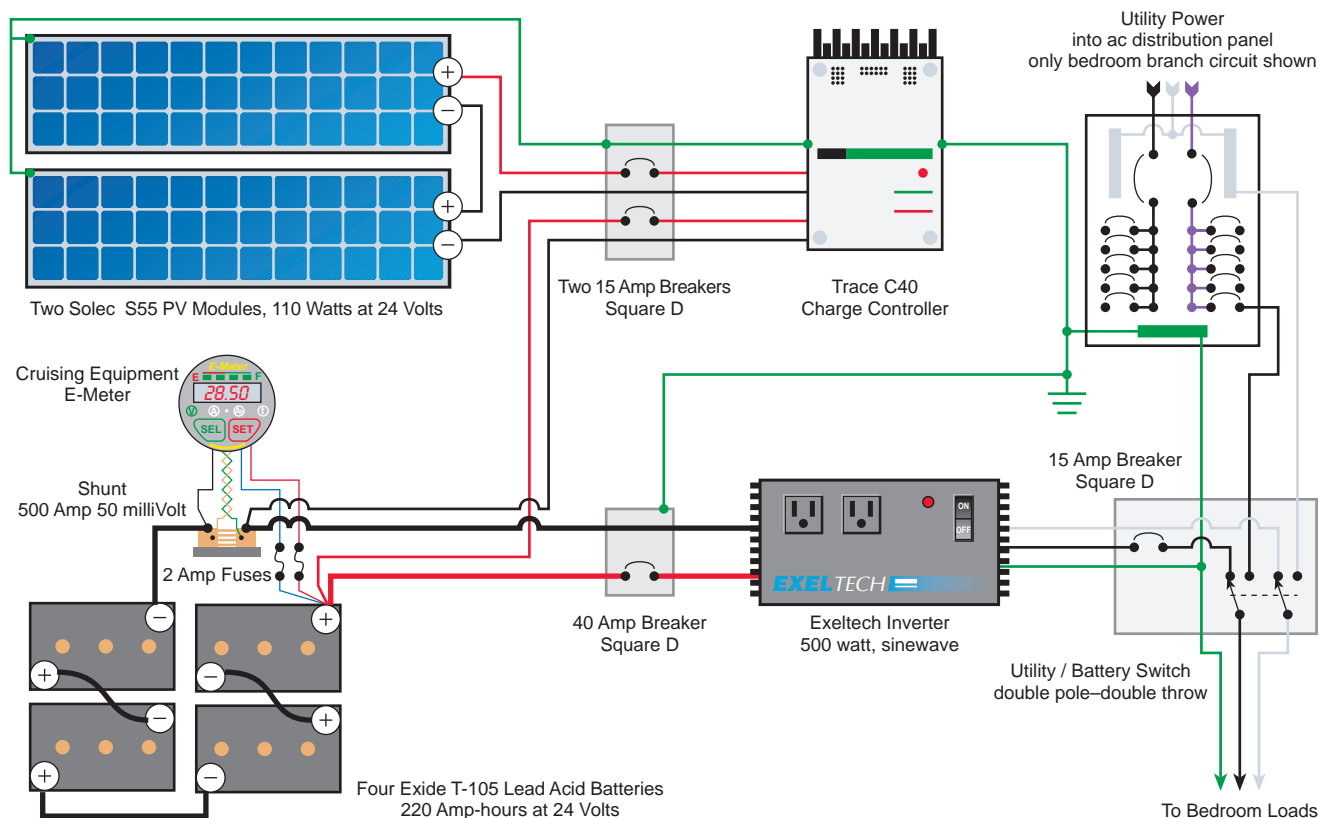
professionally install their solar electric system, or for those who just wanted to know more about it. Some of the information presented included PV electricity concepts, solar site analysis, system sizing, and electrical loads. The cost of attending Saturday only was \$25.

Sunday's workshop was more in-depth and built upon Saturday's. It was for those who want to learn still more or want to do their own installation. The participants learned details about the hardware of solar electric systems and worked at hands-on lab stations. The cost of attending both Saturday and Sunday was \$45.

Monday's session was the final option, with on-site lab work and the actual hands-on installation of a real system. This was the best part! We charged \$60 to attend all three days.

Below: Jay Peltz helps set up Sunday's PV wiring lab.





We started Monday's installation with a lab, where we wired one module to a water pump in a bucket and demonstrated the effects of shading the module. We then did exercises about how to wire the batteries and modules which we were about to install, working with series and parallel wiring. The rest of the day we worked in small groups mounting the panels, wiring the batteries, and hooking up the inverter and charge controller. All groups were assisted by a

professional, and the participants were free to move among the groups as the day progressed. That way everyone had a hand in the whole procedure.

Earth Church

The system that we installed was several steps up from the most basic system you can implement. The site for the system was the Earth Church, a demonstration home for sustainable living. Of the five sites looked at for our hands-on portion of the workshop, the Earth Church had the funds and the most appropriate situation for the installation of a demonstration system. The Earth Church has a two module, 24 Volt system that powers an isolated ac circuit supplying roughly half of their home.

Left: Trace C-40 charge controller and bracketing 15 Amp breakers.

Right: Exeltech 500 watt inverter, breakers, and utility/battery switch.

We mounted the array on the roof, with an adjustable tilting rack big enough to hold six modules. The angle is manually adjusted twice a year, at spring and fall equinox.

From the array, the power ran though #2 wire in conduit into the basement, where we mounted the charge controller, inverter, and placed the batteries. We used four 220 Amp-hour batteries, wired in series to give us 24 Volts. The batteries were stored in Rubbermaid® containers to contain spills.





Above: Author Sharice Low (far right), Johnny Weis, and workshop participants.

Grid-Solar Switch

A neat thing about the system that the workshop participants installed at Earth Church is that there is always power. When the batteries are full and the sun is shining, there is solar electric power. Then, when the batteries are low from days of raining, as it is prone to do here on the North Coast, John Gary, of Earth Church can flip the transfer switch and go back on the grid until his batteries are recharged from the sun. This is a good way for first-time users to learn a system's capacity and how important the management of electrical loads can be. The only problem with this system is that there is no battery charger to keep the batteries topped off, and the array is probably not large enough to equalize the batteries. This could lessen the life of the batteries over a long period of time.

To increase the ease with which the system owners can understand their system and see what is going on inside, an E-Meter was installed in their living room. An E-Meter is used to measure battery Ampere-hours, Voltage, Current, and the time remaining until the battery is fully discharged. These things are critical to understanding the state of charge of the batteries. This

Take Your Bedroom Off the Grid Workshop Installation

| # | Component | Cost | % |
|---|-------------------------------------|-------|-----|
| 2 | Solec S55 55 Watt Modules | \$700 | 27% |
| 1 | Exeltech 500 watt Sinewave Inverter | \$625 | 24% |
| 4 | Exide T-105 220 Amp-hour Batteries | \$340 | 13% |
| 1 | E-meter | \$195 | 8% |
| 1 | Trace C40 Charge Controller | \$185 | 7% |
| 1 | Rack Roof Mount (for 6 Modules) | \$178 | 7% |
| | Misc. Cable, Conduit, and Hardware | \$125 | 5% |
| 3 | Circuit Breakers | \$95 | 4% |
| 2 | Square D Boxes | \$85 | 3% |
| 1 | Toggle Switch | \$30 | 1% |
| 2 | 18 gal Rubbermaid Containers | \$22 | 1% |

Total \$2,580

also tells the Earth Church when to switch back over to the grid, in order to give the batteries a chance to recharge.

Earth Church plans to run their batteries only to 70% before recharging again. At 220 Amp-hours, this gives them approximately 70 Amp-hours per cycle, given that the batteries are charged completely each time. The Earth Church uses this power mostly for lighting. At the present time they do not have compact fluorescent lighting, but are hoping to be able to purchase new lights soon. The use of compact fluorescent will greatly increase the amount of power that is left over for other things, or increase the length of time between switching back to the grid.

Expansion Plans

Redwood Alliance is going to be lending the Earth Church four more 45 Watt modules to complete their array of six panels, still running at 24 Volts. This will increase the power going into their system, which has already been prewired to accommodate a full array. In the future the Earth Church will be expanding their system. They will next save up their money (\$2500) for

Below: Exide T-105s in spill-proof tubs.



a higher powered inverter which will allow them to eventually take their whole house off the grid or even sell their excess power to the utility. Their final step will be to add more batteries to their system.

Success

We felt the workshop was a tremendous success. Participants were able to attend a workshop and gain valuable experience, and take home not only lessons learned, but also an in depth 100 page information packet on PV basics, system design, system efficiency, mounting, and much, much more. (We have extra packets for sale at \$12, contact Redwood Alliance.) As for us at Redwood Alliance, the workshop took a considerable amount of time and work to put on, but proved to be a lot of fun and well worth the experience. Maybe it will become an annual event locally.

We had hoped to break even on the workshop expenditures. As of date we are about \$350 in the hole, due to the forgotten cost and the over printing of the information packets for the seminar. All things considered, we made it happen and we fared well. We would like to share our experience with others. If you are interested in doing this workshop in your community, please contact us.

Access

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