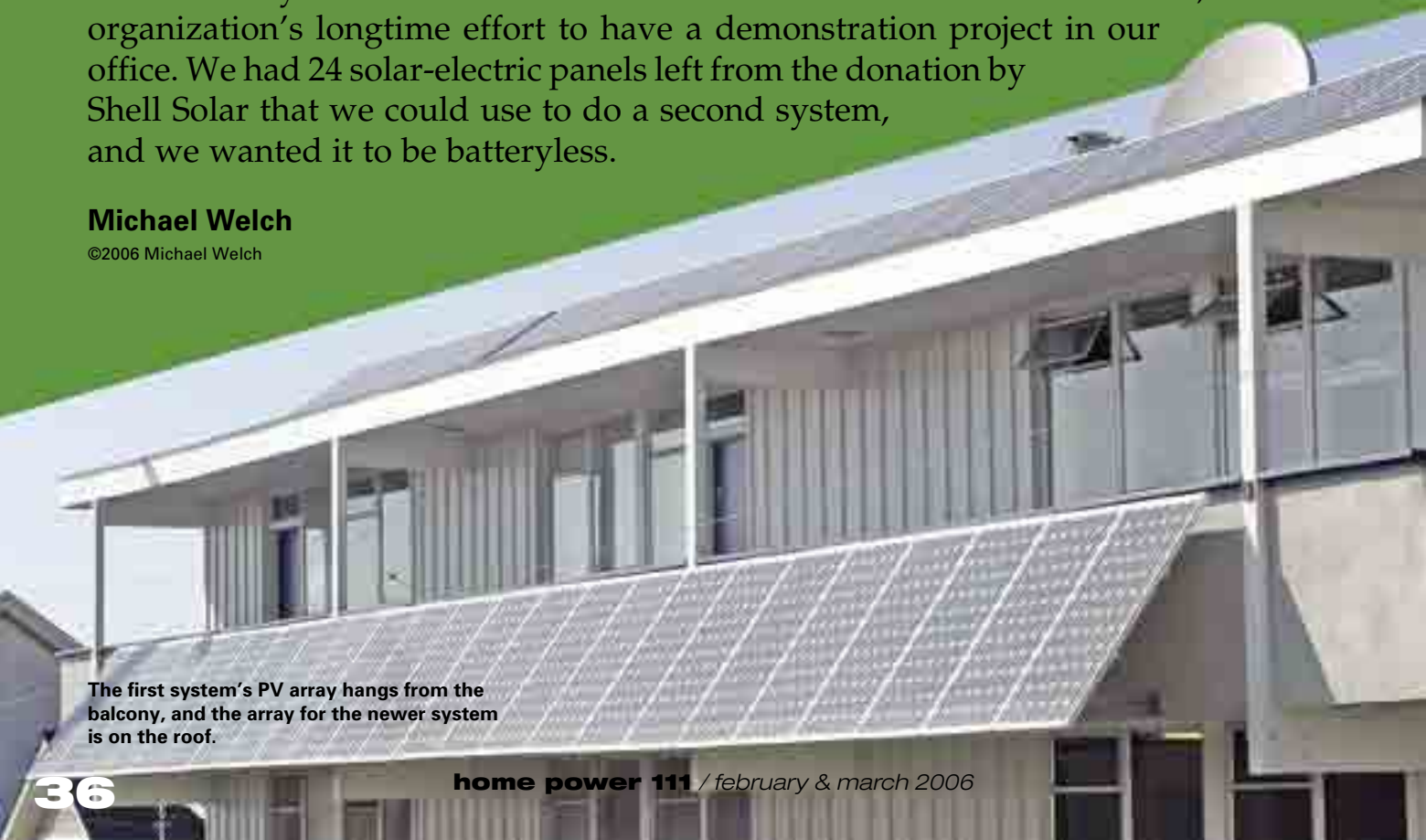
Walking the Talk

Emilly Larson, Claire Anderson and her son Kai, and Debbra Haven drop by to visit author Michael Welch and check out the Redwood Alliance solar-electric systems.

The Next Step

Redwood Alliance's (RA) first solar-electric installation is battery-based and grid-intertied, intended to demonstrate a modern photovoltaic (PV) system to a community that has both plenty of utility outages, and lots of off-grid residents. My article in *HP110* covers all the details of that installation, and the organization's longtime effort to have a demonstration project in our office. We had 24 solar-electric panels left from the donation by Shell Solar that we could use to do a second system, and we wanted it to be batteryless.

Michael Welch



The first system's PV array hangs from the balcony, and the array for the newer system is on the roof.

Volunteers move the 24 Shell Solar panels to the roof for the second installation on the Redwood Alliance building in Arcata, California.

Even in our rural community, many more people are interested in batteryless installations. So it was appropriate that our second system demonstrate that technology.

Maximize Efficiency & Savings

Batteryless setups are less expensive and more efficient than battery-based grid-tie systems. With an identical number of Shell modules, our batteryless system consistently produces about 10 percent more energy than the battery-based installation. It makes a big difference not having to use energy to keep batteries charged up!

In addition, the balance of system (BOS) equipment costs for a batteryless system are significantly less than for a battery-based system. If you have a small PV array but need a big battery backup, your costs including installation could be up to double that of a batteryless setup. The bottom line is that unless you live off grid, have frequent or extended utility outages, or have a nagging fear that worldwide energy woes are going to bring the grid to its knees, you should install a batteryless system.

Peter Brant demonstrates how to remove the inverter from its wiring box, a great feature of the Xantrex GT3 series inverters.

Inverter Choice

When we started looking into which inverter brand to choose, we immediately decided that we did not want to use multiple inverters. That meant we needed an inverter that would handle at least 3 kilowatts (KW) of PV. We investigated most of the inverters included in the grid-tie inverter survey article in *HP106*, and found all the choices to be quite excellent. But we had a special need—the inverter had to be silent, since it would be sitting just three feet from my desk.

After inquiring among a group of RE professionals, the Xantrex GT3 series was recommended to us as being efficient and silent. Through the generosity of Xantrex, we got a chance to find out for ourselves. With the arrival of the inverter, the last piece of our design puzzle was in place. Our contractor Roger, his crew, and our volunteers started the installation.

The inverter was simple to mount. The inverter's mounting plate was lag-screwed to a wall, and the inverter and its wiring box were hung from that plate. All the DC and AC wiring is done inside the wiring box. If the inverter ever needs to be removed or replaced, the wiring box can

The Xantrex GT3 series inverter assembly complete (above), and with the inverter removed, leaving the handy wiring box (shown open, at right).

stay on the wall to provide a safe place to terminate both the AC and DC wiring.

The GT inverter's wiring box has conduit knockouts on both sides, the bottom, and the back, for maximum flexibility. We used two on one side, one for the DC wiring from the array and the other for the AC wiring to the breaker. Our array is divided into two subarrays, and there was space inside the wiring box to easily attach both of them. Both the DC and AC terminals are easy to get to, making wiring handy.

Aesthetics were a paramount concern. Unlike our neat OutBack installation, this time we weren't able to hide all the conduit behind a wall. But we ended up with only two short pieces of conduit between the inverter and our building's wire chase. It still looks great.

Tech Specs

System Overview

Type: Batteryless, grid-tie PV

Location: Arcata, California

Solar resource: 4.4 average daily peak sun-hours

Production: 360 AC KWH per month (to date)

Utility electricity offset: 80 percent

Photovoltaics

Modules: 24 Shell Solar SP130-PC, 130 W STC, 33 Vmp, 24 VDC nominal

Array: Two, 12-module series strings, 3,120 W STC total, 396 Vmp

Array installation: Direct Power & Water LPRGM mounts with custom feet installed on flat roof, SSW-facing, 40-degree tilt

Balance of System

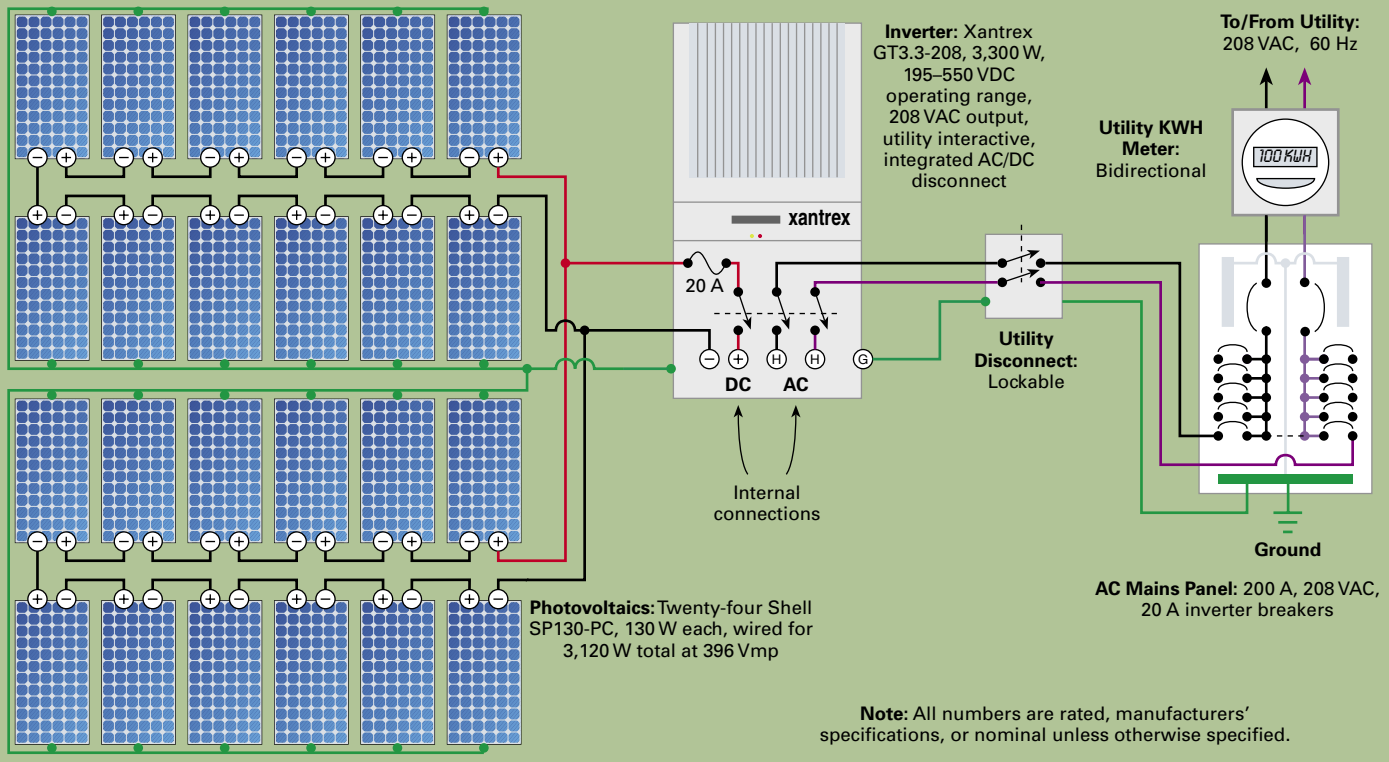
Inverter: Xantrex GT3.3-208, 3,300 W, 195–550 VDC operating range, 208 VAC output

System performance metering: Xantrex GT series internal display, Xantrex GT-View software

Up on the Roof

The installation of the PV modules went pretty smoothly, though as installers know, you always run into some things that do not go perfectly. Getting onto the roof of this two-story building was a hassle and required some bravery on the extension ladder. The landlord was concerned about roof penetrations leaking, and rightfully insisted that a professional roofer be brought on board to guarantee the installation be leak-proof.

The biggest problem we ran into was that the roof surface was inconsistent. The Direct Power & Water racks we used on our first installation's balcony mounts came with infinitely adjustable telescoping legs—necessary for making up for inconsistencies in the balcony construction. There were similar inconsistencies on the "flat" roof our second system was going on, but the legs were not infinitely adjustable, so we had to drill bolt holes in the legs in the



proper places to get the tops of the modules even and parallel with the roof eave. Beware—"telescoping" legs are not the same as infinitely adjustable legs.

Once the final DC wiring from the arrays was done, we were ready for inspections. As with the first system, the electrical inspector liked what he saw and immediately approved it. He only checked what equipment we were using, and gave a cursory look before granting us the approval so the utility could install the new two-way digital meter.

Usage Vs. Production

Redwood Alliance shares the building with four other businesses, and each floor has a separate utility service and meter. The newest array on the roof of the building feeds into the electric meter and utility service that supplies the bottom floor of the building, which has two businesses in it.

It looks like our first system will meet the annual demands of the building's second-floor tenants. But it appears that there needs to be more energy education for the first-floor tenants, since their meter is showing more energy used than the new, second system can possibly produce. I often see lights left on there, and the heater sometimes runs all night. The heater's big blower is part of their electric bill, even though the heater burns gas.

We will be spending some of our California state rebate money on energy efficiency for the building, and when it comes to some electrical users, money talks. We hope to get both first-floor tenants on the energy efficiency bandwagon.

The meter for the Xantrex GT showing net -0.48 KW.

Next Steps

All in all, we are quite pleased with both installations, their output, the equipment choices we made, and the level of support from the manufacturers and the community. Our next step includes a datalogging system that will monitor array outputs, inverter outputs, and total usage for each of the five businesses in the building. We are working with engineering students at Humboldt State University (HSU) with the goal of turning the new information system into someone's master's thesis. Other HSU students are using our building as a test site for their energy auditing class.

We are also working on getting the word out in the community about the demonstration systems. We've been receiving visitors who see the PV arrays from the street and are curious. We've participated in two of the nationwide solar home tours sponsored by the American Solar Energy Society (ASES). In 2004, we had just the first system to show, and last year we were able to show off both.

Redwood Alliance System #2 Costs

Item	List or Street Price (US$)
24 Shell Solar SP130-PC modules	$14,229
Xantrex GT3.3-208 inverter	2,300
4 DP&W LPRGM6-SQ roof mounts	1,568
Miscellaneous wire, conduit, electrical	1,133
Labor, PV system installation	1,000
24 DP&W custom mounting feet	437
Labor, roofer	362
Labor, AC electrical site preparation	342
Permits & documentation	306
Miscellaneous hardware	73
Square D DU221RB utility disconnect	48
Total	$21,798

We welcome the opportunity to demonstrate our two systems. We would also love to show you how we are improving the energy efficiency of our appliances and other loads to maximize the effectiveness of our solar-electric installations. You too can "walk your talk." To find out how, give us a call, and please come by for your own visit.

Access

Michael Welch, Redwood Alliance, PO Box 293, Arcata, CA 95518 • 707-822-7884 • michael.welch@homepower.com • www.redwoodalliance.org

Peter Brant, Brant Electric, PO Box 66, Arcata, CA 95518 • 707-822-3256 • Fax: 707-826-1180 • pbrant@foggy.net • Electrical contractor

Direct Power & Water Corp., 4000-B Vassar Dr. NE, Albuquerque, NM 87107 • 800-260-3792 or 505-889-3585 • Fax: 505-889-3548 • jrandall@directpower.com • www.directpower.com • PV mounts

Roger, The Little House, 1527 Buttermilk Ln., Arcata, CA 95521 • Message only: 707-826-9901 • Solar contractor

Ben Scurfield, Scurfield Solar, PO Box 41, Arcata, CA 95518 • 707-825-0759 • bscurfield@yahoo.com • Solar installer

Shell Solar Industries, 4650 Adohr Ln., Camarillo, CA 93011 • 800-272-6765 or 805-482-6800 • Fax: 805-388-6395 • solarsales@shellsolar.com • www.shellsolar.com • PVs

Xantrex Technology Inc., 8999 Nelson Wy., Burnaby, BC, Canada V5A 4B5 • 800-670-0707 or 604-422-8595 • Fax: 604-442-1591 • information@xantrex.com • www.xantrex.com • Inverter