Above: The Solar Energy International class and Jane Sharp in front of Jane's new photovoltaic array.

Jane Goes Solar

Lynne Allen Carter

On the day before Earth Day '95, thirty students arrived at the home of Jane Sharp in a residential area of downtown Chapel Hill, North Carolina. By afternoon of the next day, with the help of savvy friends and technicians, she was plugged into the sun. A solar-powered system had been installed that would run her lights, a ceiling fan, a television and radio, an answering machine, and her typewriter. Thirty students had walked away with a valuable experience — the installation of a PV system. A system that will work almost anywhere on the planet.

Following her visit with Amory Lovins in 1985, Jane Sharp wasted no time in starting her solar quest. When she retired, she used the money from her social security payments to buy low-energy light bulbs, reselling them at cost at street fairs. "Anything we do is helping," she explains. "The more we do, the sooner we can get off the nuclear track." Watching her unload lights out of her Geo Metro is a common sight at area events.

Jane also opens her home office to non-profit organizations. It's not unusual for a lawyer or an activist

to stop by for last-minute photocopying before carpooling to a Senate hearing. Altogether, Jane is a supportive, loving grandmother who fights for her beliefs.

The project to outfit Jane's home with solar power was a natural coalescence of many forces at work in close proximity to each other.

First, Johnny Weiss of SEI (Solar Energy International, Carbondale, CO) wanted to do a week-long PV (photovoltaic) class in Raleigh, North Carolina. Following four days of instruction, he wanted the class to "graduate" by actually installing a *real* system in the area. Next, Joe Flake of Go Solar Enterprises, in a meeting at the Solar Center (the energy section of a department of the NC Department of Commerce) mentioned that SEI needed a PV system installation to use as part of a class project. Jane Sharp was in Joe Flake's audience at the Solar Center. She stood up and offered her home for the class-built PV system.

The Project Begins

Jane Sharp hired Chris Carter and Jacques Menache of the Solar Village Institute, Inc. to contract the installation and coordinate it with the class. Joe Flake proved invaluable here by planning the visit from SEI to NC. He pulled together the classroom and facilities, arranged accommodations, provided meals—all with warm North Carolina hospitality. Jane was thrilled with the whole idea. She would get PV for her home and an entire class could learn from the installation, too.

My part, was completing a circle to work with Johnny Weiss on this level. I've taken classes from him over the last five years at SEI in Carbondale, Colorado. I like SEI because, in organizing classes around the world, they are sending a message of sustainability and hope to people of all races and backgrounds. There were students from Africa, Canada, and Germany working on Jane's installation.

I can recall one moment when Johnny asked Jane during a class, "Why would you put solar on your house? You will never pay for it in your lifetime." Jane's response was clear and vital. "I believe in solar. We must start using solar now. No more nuclear power plants. We must support technologies for *sustainable* energy. And I want to be a part of the solar revolution."

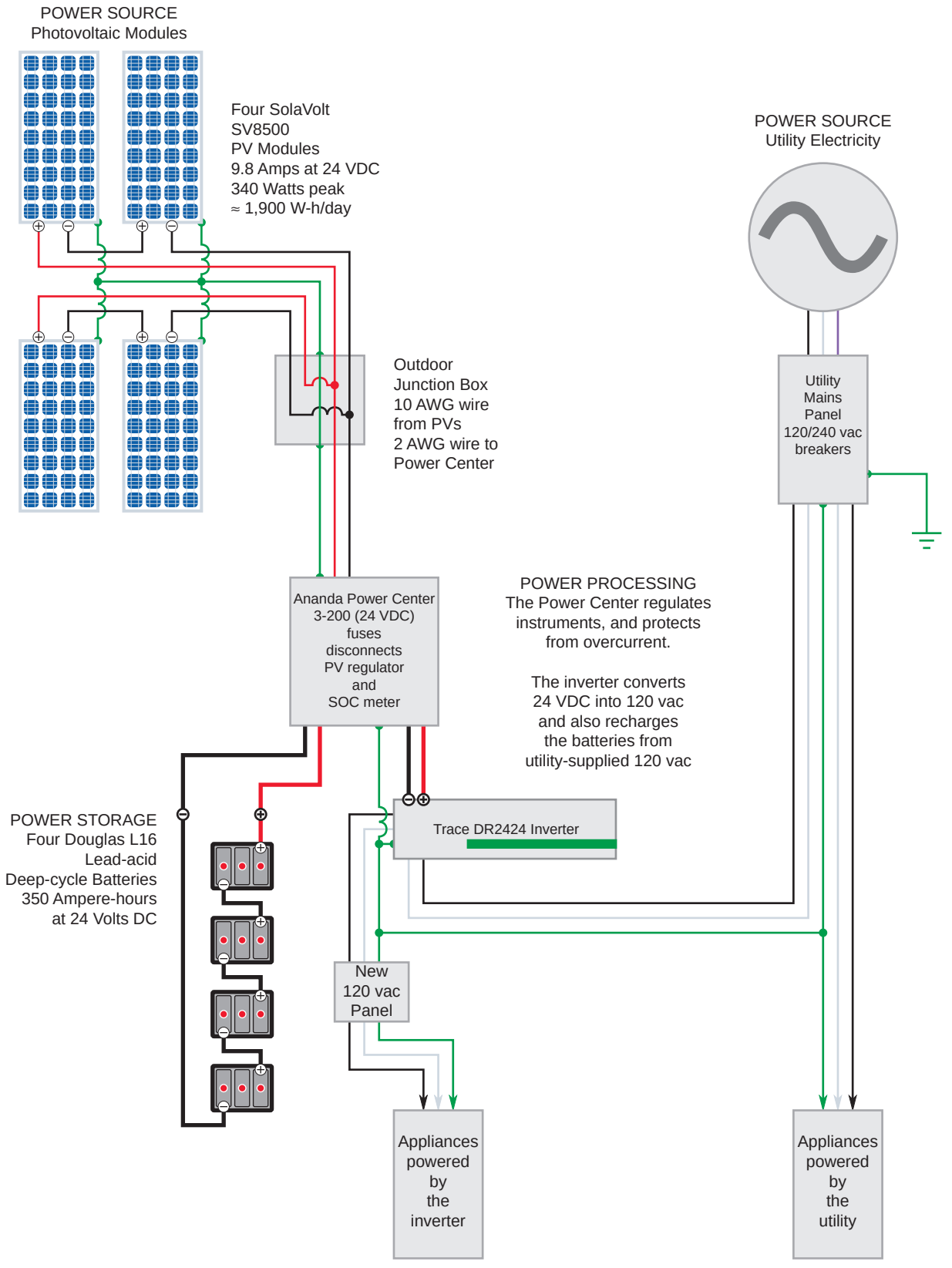
Siting the Solar Array

The roof of Jane's home was not the ideal site for a PV array. It was already crowded with solar hot water collectors and sky lights, limiting the space available for PV panels. Several large evergreens directly south of the house complicated the issue. Using the solar Pathfinder at this point was *crucial* in the design of the

Above: Jane Sharp checks out the owner's manual for her new Trace 2424 inverter.

Above: Chris Carter of Solar Village Institute teaches the class how to properly mount and wire the photovoltaic array. Since PVs will easily produce power for over ten years, details such as module wiring are critical if the array is operate for ten years without problems.

Jane Sharp's PV/Utility System



Above: Chris Carter shows students how to operate a Solar Pathfinder. The Solar Pathfinder is *the* tool for finding the best location for photovoltaic arrays and solar heat collectors.

Above: Johnny Weiss of Solar Energy International (SEI) has done scores of PV installations and classes.

Above: The Ananda Power Center, the Trace inverter, and the vented battery box (with the yellow sun). All these components are safely and neatly installed in Jane's basement

Above: Joe Flake of Go Solar Enterprises runs PV cables through Jane's attic. It is often small matters such as wiring that are critical and difficult. The hands-on training offered by SEI in their on-the-job courses gives their students experience in details such as safe and standard wiring practices. Classroom training is fine and necessary, but it must be backed-up with actual installation experience.

Jane Sharp's PV-powered Appliances

#	Appliance	Run Watts	Hours/ Day	Days/ Week	W-hrs/ Day
1	Televison Set	192	2	7	384
1	Ceiling Fan	58	6	7	348
1	Kitchen Light	38	6	7	228
1	Fan	96	4	3	165
1	Ceiling Light	23	7	7	161
1	Radio/Tape player	13	10	6	111
3	Living Room Lights	15	2	7	90
2	Outdoor Lights	17	1	7	34
1	Table Light	17	1	7	17
1	Porch Light	15	1	7	15
1	Typewriter	42	1	1	6
				Watt-hours per Day	1559

system. For example, it showed that the best solar window (only three hours) was just over the front porch on the north side of the roof. A shade-resistant, high-voltage PV module appeared the best choice, so we chose SolaVolt's 8500 module. The photovoltaic cells in this module are individually protected against the effects of partial shading on the module.

The abundance of trees around the house warranted the use of a pole to get the PV modules clear of roof and tree shadows. With four feet in the ground and nine feet to the eaves, a 20-foot pole would extend the modules seven feet above the roof. Just right!. A 2-inch galvanized, Sch#40 pipe was purchased from the local plumbing supply. (A mistake! This is too small a diameter, and later required extra bracing from the roof.) Some slits were cut on bottom of the pipe, then flared out. A bracket bolted to the eave was installed to hold the pipe away from the gutter. A 4-foot hole was dug and the pipe set. Three bags of concrete were poured around the base and troweled, and the concrete left to cure.

The top of the pole mount was the last piece of equipment to arrive—the day before the project started! We were shocked to discover it was designed for a three-inch pipe. This was not what we had expected. Our two-inch pole was already in the ground. This could be a big disappointment for the class!

Chris got on the phone to Mark at Photocomm and explained the emergency! Mark said he would send out a replacement overnight. Amazing! And it really happened. The next day (Friday), it was delivered to the site. WOW! I thought. Mark said "Its my job."

Battery Storage and Control System

The electrical distribution system was located in the basement. There was plenty of room for the system's batteries, inverter, power center, and the new solar distribution box. Still, the space was crammed with 35 years' worth of hardware and debris belonging to Jane`s late husband, Gordon Sharp, a physicist and inventor. There were several milling machines, lathes, saws, and even a high speed centrifuge. Jane sold the big tools to raise money for her solar-electric system. Eventually, Chris and Jacques removed all the old and unusual wiring in the basement and shoveled piles away until there was adequate workshop space.

Day One: The Class Arrives

The class moved from Raleigh on Friday morning to Jane Sharp's home in Chapel Hill. They jumped right into the project. They unreeled 75 ft. of #2 copper wire from the combiner and threaded it through conduit in the attic space to its end in the basement. Drilling the ceiling plate was more like drilling for oil by hand. Cramped in a hot and humid attic, Joe Flake drilled away. The class focused on placing a four-foot square of 3/8-inch plywood on the concrete block wall. It was painted blue to match the existing shop trim. The Trace DR 24-24 inverter was bolted on this plywood.

"Drilled!", Joe Flake's voice came from the attic. Six people were involved in pulling the line through the wall. Some very creative minds worked to fish a line through, repeatedly without success, because the wall was already filled with conduits and pipes. So, we abandoned this plan and pursued another. Plan B brought the #2 copper array wire back out to the exterior of the house, threaded through more of the

Jane Sharp's PV System Cost

#	Component	Cost	%
4	SolaVolt SV8500 PV Modules	$2,396	38%
1	Trace DR2424 Inverter	$1,175	19%
1	Ananda APT3-200 Power Center	$1,102	18%
4	Douglas L16 Batteries	$520	8%
	Elecrtrical Parts and Wire	$303	5%
	Labor	$240	4%
1	Zomeworks Pole PV Mount	$199	3%
1	Outdoor Wiring Box	$150	2%
	Steel Pole and Concrete	$91	1%
	Lumber and Plywood	$42	1%
	Shipping	$34	1%
		Total cost	$6,252

Above left: Johnny Weiss explains the innards of the Ananda Power Center.
Above center: Students wire a new electical panel for the inverter.
Above right: Raising the PV array to Jane's roof is a job for many hands.

exterior conduit. The re-routed wire made it down the wall and back into the basement with only *inches* of wire to spare.

One highlight of the day was bolting the SolaVolt 8500 PV modules to the frame and wiring them together. All participants in the project wired and rewired them together to ensure a direct experience of this part of the process. Small connectors were crimped to the ends of the wires that interconnected the modules. There are several connection points inside the junction box on the back side of the panel: a positive, a negative, and two user-programmable jumpers.

The class finished up its first day by constructing the battery box and sanding it. The students had been hard at work and were ready for break time. Chris grabbed the two pole mounts and took them home. The shipped part still had to be mated to the existing pole. While we live off of the grid, we have a small welding shop in our art studio. Chris cut the two mounts apart, put the 3-inch top on the 2-inch bottom, and welded them together with a 24 V portable MIG. The rough edges were ground, rust-proof paint was applied and presto! A new top-of-pole mount.

Day Two: The Project Continues

Saturday morning. Chris was up early, loading batteries into the truck and leaving for Jane's home. Jacques was already there, finishing up the conduit down the outside of the building

The students still had plenty of work to do. They wired together the Ananda power center (or APT, a 200-amp, two-pole disconnect) and the Trace DR 2424 inverter using 4/0 welding cable. The APT acts *both* as the charge controller *and* as the junction box for the PV input. It feels convenient and user friendly. Wires from the APT lead directly to the Trace.

Above: Tom Phillips and Chris Carter discuss the installation of components in the basement. One major lesson in every PV installation is *plan ahead!*

The Trace inverter converts 24 Volt DC battery power to 120 vac. It also has a built-in battery charger. This helps back up the system, allowing grid power to recharge the batteries. For Jane, it also means that she can have lots of power if she needs it, for vacuuming or other heavy loads. Small controls on the front of the Trace are designed to help tune the setting of battery charge levels, and adjust the inverter's sensitivity to loads so it "sleeps" when no power is being used.

It's Done

The rest of the installation went very smoothly and the final project looked wonderful. The battery box was

Left:
Lynne Carter of Solar Village Institute and the author of this article on Jane Sharp's PV system.

painted a beautiful blue with a large yellow sun on the front. Jane was sparkling with pride. In fact, when it came time to take photos of the class on the roof of Jane's house around the PV array, Jane climbed right up to be in the picture!

It was Earth Day '95. Since the local newspaper, the Durham *Morning Herald*, had written an article about Jane Sharp and her solar project, the day became a part of Earth Day events everywhere. Families, friends and others filled with curiosity came by to see the SEI class at work. Jane Sharp was everywhere. She took photos, ordered lunch, and hosted guests. She let 30 people run around her home, drill holes, and climb on her roof.

Jane sat with the news reporters in her living room drinking from a recycled Styrofoam cup. "I think we are going to live a much more satisfactory life in the next 20 to 50 years and I intend to help with it," she said. "I'm probably not going to be around for another 50 years," Jane said and smiled, a bright gleam in her eyes, "but I'll be around for a while."

Access

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