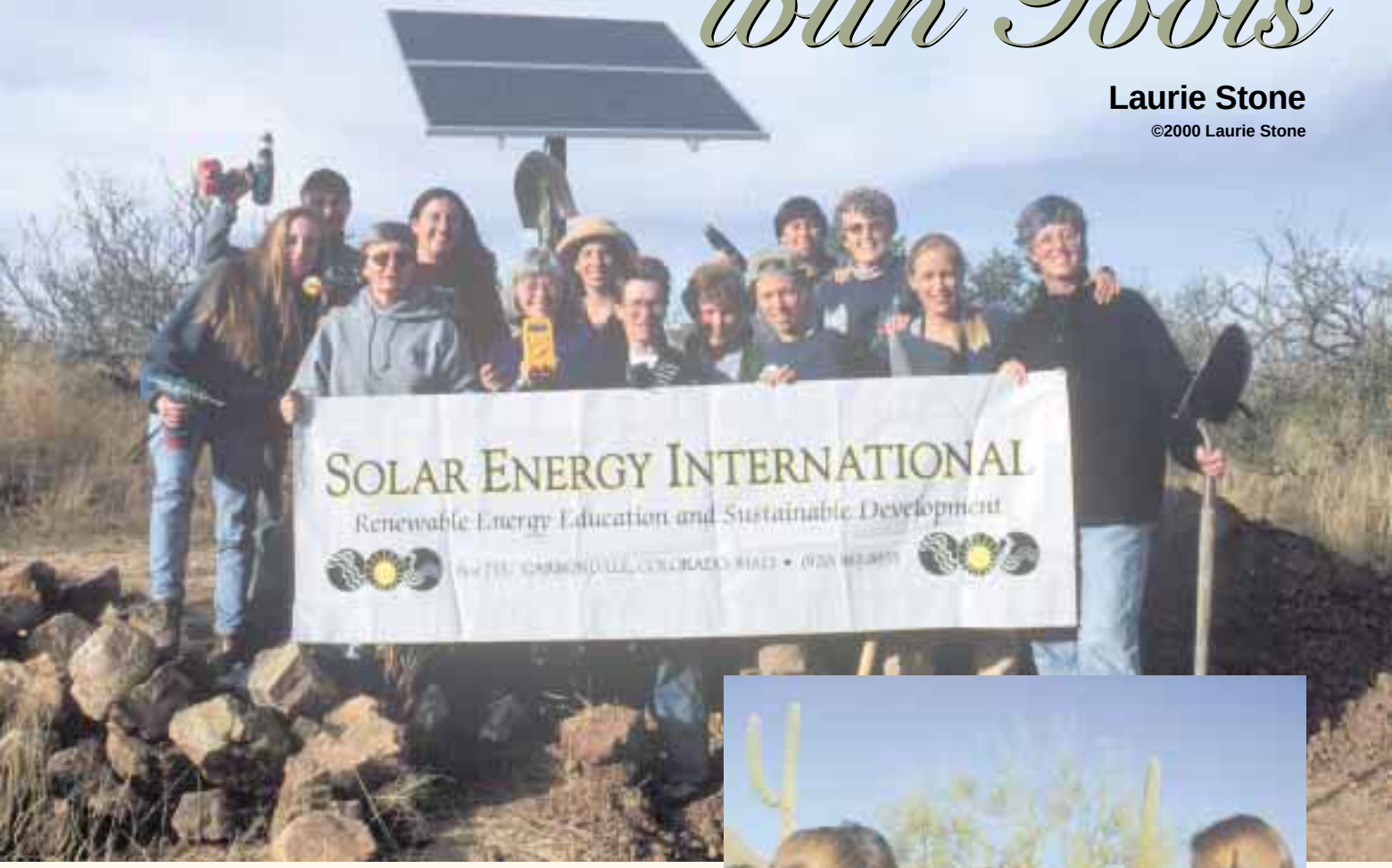
Women Who Run with Tools

Laurie Stone



Above: Solar sisters. Right: Testing short circuit current and open circuit voltage on a PV module.

Last February, a group of dedicated and enthusiastic women descended on Tucson, Arizona to learn how to incorporate solar energy into their lives. Though it hasn't always been this way, women wielding power tools and installing solar electric equipment is becoming more common.

For the past three years, Solar Energy International (SEI), an educational non-profit based in Carbondale, Colorado, has offered photovoltaic workshops for women. Fifty-five women have attended four workshops—three in Tucson, Arizona, and one in Portland, Maine. Twelve year old girls, NASA engineers, ranchers, housewives, and a wide variety of

other women have attended the workshops. They've taken steps toward their goals of bringing renewable energy into their lives. Whether they came to learn about installing a home system, start an RE business, or simply to increase their knowledge of renewables, the women brought an enthusiasm to these classes seldom seen in a coed course.

Arizona PV Workshop

The fourth Women's Photovoltaic Design & Installation workshop was held in Tucson, Arizona in February. The women participants learned about photovoltaics, met other women in the PV field, and learned technical skills not often taught to women. They also installed a system for a former SEI student—a single mom living in rural Arizona.

Women came to the workshop in Arizona from as far away as Canada and New York to learn about solar-electric technology. The diverse group of women included a rancher, a schoolteacher, a nurse, and a grandmother touring the country in her RV, among others. The workshop was taught by five women who have been working in the PV industry as technicians, electricians, educators, and researchers. The instructors included Justine Sanchez and Laurie Stone from Solar Energy International, Carol Weis of Eco Electric (a PV installer in Basalt, Colorado), Marlene Brown of Sandia National Labs, and Melinda Zytaruk, an SEI intern who volunteered to help out.

The classroom part of the workshop was held at the Cooper Environmental Science Campus (Camp Cooper), in the foothills just west of Tucson. Camp Cooper is part of the Tucson Unified School District. Elementary school children from all over Tucson spend one to two days at Camp Cooper learning about desert ecology, wildlife, and solar energy.

For the first four days of the workshop, the women learned the basics of electricity, PV system components, solar site analysis, and how to size a residential system. Through laboratory exercises, they learned how to estimate insolation, using a Solar Pathfinder. They used digital multimeters to test battery voltage as well as array current and voltage. And they learned how to wire a switch, receptacle, and light fixture.

System Tours

Previous SEI women's workshops had already installed stand-alone PV systems on a ramada and three cabins at the camp. One of SEI's coed workshops had installed a grid-tied system on the office. So there was plenty to see at the camp itself. We toured the previously installed PV systems, using them to learn how to draw schematics. We also took two tours to meet with other women in the field, and to see more PV applications.

Katharine Kent talks about being a woman, business owner, and solar pioneer.

Photovoltaic systems at the Cooper Environmental Sciences Campus, where the classroom part of the workshop took place.

Students mount the two Uni-Solar 64 watt PV panels at Darlene's remote desert home.

On the first tour we met with Katharine Kent, who runs the Solar Store, a PV dealership and installation company in Tucson. She enlightened us about the advantages of a woman-run business, but also about the trials and tribulations of being a woman engineer in a male-dominated field. She felt that she was not taken seriously by many of her male colleagues when she first started out. It took her longer to gain respect as an engineer than it would have taken a man.

On our second tour, we met with Judy Knox of Out on Bale fame. Judy showed us the PV-powered straw bale home that she and her husband Matts Myrhman built for Matts' mom, right in the heart of Tucson. Judy also talked about how women are the heart of straw bale construction—it is their interest and passion that usually drags their husbands to straw bale workshops.

Remote Desert Installation

After the women in the workshop had their fill of classroom sessions, laboratory exercises, and tours, we headed for the remote desert of southern Arizona to install a system on Darlene Dobroslavic's house. Darlene had attended the Women's PV workshop the year before, and had been gathering equipment to eventually bring electricity to her remote home. For over two years, Darlene and her nine year old daughter, Brittany, had been living with kerosene lamps, and spending a lot of money on small throw-away batteries for their radio. Needless to say, even a small amount of energy was going to make a big difference in their lives.

Dobroslavic System Loads

Item	*Volts*	*Watts*	*Hrs/day*	*WH/day*
CD player	120	32.0	4	128.0
Television	120	60.0	2	120.0
2 lights	120	40.0	3	120.0
Compost toilet fan	12	1.4	24	33.6
Cell phone charger	12	24.0	1	24.0
			Total	425.6

The participants split up into three groups: one to work on the PV array; one to work on the controller, inverter, and batteries; and one to work on the DC and AC loads. The two 64 watt Uni-Solar modules were mounted on a pole about 40 feet (12 m) from Darlene's house. The 600 watt Trace inverter and the Prostar 30 amp controller were mounted inside a box on the north side of the house. Because of the inverter hum, Darlene decided that her 400 square foot (37m^2) house was too small for her, her daughter, and the inverter, so one of them had to go outside.

SEI students get hands-on experience.

Darlene's exterior-mounted inverter enclosure keeps the hum outside.

The two 220 amp-hour Exide batteries were put in a vented picnic cooler, which will act as the battery box until Darlene builds a custom adobe box for them. Darlene's loads consist of two AC lights, a CD player, cell phone charger, composting toilet fan, and 12 volt DC television. She also hopes to add two more modules to her system someday, which is why she chose an oversized controller and oversized wire.

Comfort Zone

Teaching women-only workshops for photovoltaic technology is important on many levels. Women feel more comfortable asking questions and participating. They are not as apprehensive about using unfamiliar tools, and they meet other women who are working in or trying to get involved in a male-dominated field. The following comments we received from past participants are typical of the feelings women express after attending our women's PV program.

Dobroslavic PV System Costs

Qty	*Description*	*US$*	*%*
2	Uni-Solar modules, 64 watt	$696	32%
1	Trace UX612 inverter, 600 watt	550	25%
	Misc. wire, conduit, & hardware	253	12%
1	Uni-Solar top of pole mount	212	10%
1	Prostar 30 amp controller	175	8%
2	Exide E3600 batteries, 220 AH	116	5%
1	Square D breaker box, 70 amp	65	3%
1	Square D fused disconnect	48	2%
1	Delta lightning arrestor	46	2%
	Total	$2,161	

"I felt very comfortable having longer discussions in a group of all women. I would have felt hurried or bothered by the same discussions in a group with mostly men. Removing the men made the class focus on our individual needs in comfort, and allowed us to ask questions that we may have been intimidated to ask in the presence of men, especially men who have more experience with power tools, wiring, etc."

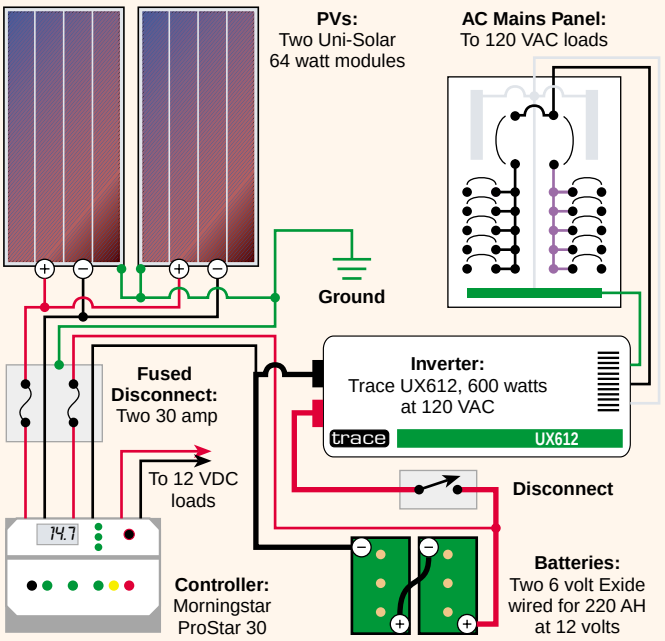
"Women learn differently than men, and work together differently than men. We were able to learn in our own way without the criticism that you sometimes get when dealing in mixed classes."

"Being taught by women in the field inspires confidence in women trying to break into a male-dominated field."

Gaining Conveniences & Confidence

Now that Darlene is powering her small home with the sun, she will be saving money that would have been spent on kerosene and dry-cell batteries. She is gaining conveniences that she had to do without before, and feeling good about using a clean reliable source of energy. And Brittany is excited about some of the new appliances they will have in their lives.

There will also be more women entering the PV field and putting systems on their own homes. These workshops show that women can and will make an important contribution to the renewable energy industry.



Access
Laurie Stone, Solar Energy International, PO Box 715, Carbondale, CO 81623 • 970-963-8855
Fax: 970-963-8866 • sei@solarenergy.org
www.solarenergy.org

Cooper Environmental Science Campus, PO Box 40400, Tucson, AZ 85717 • Phone/Fax: 520-743-7422

Katharine Kent, The Solar Store, 2833 N. Country Club, Tucson, AZ 85716 • 877-264-6374 or 520-322-5180
Fax: 520-322-9531 • kkent@azstarnet.com

Carol Weis, Eco Electric, Inc., PO Box 2389, Basalt, CO 81621 • Phone/Fax: 970-927-9270
ecoelec@rof.net

Marlene Brown, Sandia National Laboratories, PO Box 5800 MS 0753, Albuquerque, NM 87185
505-844-0032 • Fax: 505-844-1504
mbrown@sandia.gov • www.sandia.gov/pv

Judy Knox, Out on Bale, 1037 E. Linden St., Tucson, AZ 85719 • 520-622-6896 • dawnaz@earthlink.net
www.greenbuilder.com/dawn

SEI will offer two women's photovoltaic workshops in the spring and summer of 2001. Contact SEI for dates, or keep your eyes on the SEI ads in *Home Power.*