

Ken Spencer, an ATA student, with a screwdriver in his mouth and energy on his mind. Photo by Michael Ivanovich.

Home Power Generates People Power at ATA's summer PV for Practitioners Workshop

Michael Ivanovich

Thank you *Home Power* magazine! Over half the PV workshop participants credited HP for informing them of the hands-on course recently held in the Colorado Rockies. Entitled PV for Practitioners (see ad in this issue), the design and installation course drew an exciting and diverse group. PV enthusiasts included five electricians from the Hopi PV Foundation, internationals from Canada, Australia, and Pago Pago American Samoa, and me a solar researcher in an epic quest for hands-on.

Program Summary

PV trainers Steve McCarney, Ken Olson and Johnny Weiss of Appropriate Technology Associates (ATA) taught the intensive one/two week course. Both weeks were **Hot**, here's a quick summary. The first week was classroom, laboratory, design, and demonstration instruction. The second week was hands-on field installation--a water pumping system for ranch livestock and two ultra-remote cross-country cabin lighting systems. (See upcoming HPs for detailed articles on the installations). Participants each received a 300 page practical textbook and a thick notebook stuffed with current product literature and a hard-to-find resource information.

Logistics

Glorious summertime high-country weather allowed folks to experience the joys of mountain living. Many camped cheaply at nearby alpine camp grounds, some enjoyed local bread and breakfast establishments, while elitists motelled-it "downtown" in popular tourist style. Family and friends took advantage of the outdoor recreational opportunities--hiking, fishing, rafting, hot-springing, and playing on the swings in Carbondale Central Park during a class Bar-B-Q. The "classroom" had a rather unique ambiance; it was the community room (and bingo hall) of the local volunteer fire department.

Curriculum

The five-day 8AM to 5PM agenda was originally developed by the instructors as part of the Colorado Mountain College's one year course called Solar Retrofit Program. (This year the course has been renamed the Energy Efficient Building Technology Program). Workshop topics for the first week included: PV applications, basics of solar electricity, PV systems components, solar site analysis, using VOM meters, SAPV installation, example case studies, and system sizing and equipment specifications.

Guest speakers provided a wide variety of industry viewpoints. Manufacturers, hardware suppliers, system designers, researchers and experienced PV homeowners gave individual and unique perspectives. Tours briefly visited John Denver's Windstar Foundation and Amory & Hunter Lovin's Rocky Mountain Institute; both of which are energy and appropriate technology research and demonstration facilities. The class also toured residences, a weather station site, and a commercial greenhouse featuring state-of-the-art passive solar construction. Satisfactory performance on daily quizzes and on a comprehensive final test allowed participants to earn a certificate of completion. We even got to fill out teacher/course evaluations.

Design Philosophy

As practical "nuts and bolts" teachers, ATA instructors believe that PV system designing is both an art and a science. Crunching numbers to five decimals on calculators (preferably PV powered) must be combined with "human engineering" in order to provide a necessary holistic approach. Designers need to remember that people will always be the most critical input--that lifestyle affects system sizing as profoundly as peak sun hours and panel efficiency.

ATA trainers consider themselves "industry tire kickers" because they are independent educators and do not act as salesman for specific manufacturers. They shoot straight but keep the atmosphere from getting too serious--the job gets done, done well, and we all have a good time along the way.

As HP's monthly feature, SYSTEMS, highlights, a good design begins with understanding the load. (LOAD = how much electricity you need!). Thorough load analysis is the foundation of cost effective systems. Attention to detail is important for designers as well as installers. ("Prior proper planning prevents piss-poor production"). They should also provide detailed system documentation (ie., accurate electrical schematics), troubleshooting procedures, and maintenance recommendations.

Why Me

On Monday morning, ATA instructors asked us why we were there. I said after two years of procrastinating, I was at workshop for two reasons: 1) to fill some gaps in my graduate, building energy program, and 2) to get away from the pressures of my thesis and ozone-hole research job (no kidding) by basking in the mountains and sun. Here are reasons from a few other folks.

- to get off the grid
- to bring independent power to my reservation and people

- to recharge my wheelchair's batteries
- to help heal the earth
- to make industry connections and learn more about products
- to learn how to install systems so I can work in the field
- to compliment my wind power expertise
- because Samoa needs a PV powered TV transmitter
- because right now I'm more a roofer than a PV installer, and I want to become more of a PV installer than a roofer.

Here's what ATA did to help us along.

Great Lectures

ATA's preparation and planning resulted in a superb production. Their lectures were comprehensive, well-structured, and well-delivered. Their slide projectors and overhead projectors worked without so much as burning out a light bulb. Their samples of modules, batteries, controllers, inverters, panel mounts, and teaching aids lined almost every inch of available wall space. A king-sized bedsheet-turned-projector screen took up the rest.

Guest Speakers

The guest speakers added a lot to special topics such as lighting, cathodic protection, line conditioning, remote telecommunications, and the newest products. Bernie Haines, developer of the Solar Pathfinder, was there to deliver insights about that device (and equip several students with the Professional model at a bargain rate). Here's a list of the other speakers and their topics.

- RMS Electric: wholistic systems design
- Remote Power: PV systems and products
- Solar Energy Research Institute: solar research update
- Photocomm: latest products
- Guardian Control: Cathodic protection
- Rising Sun Enterprises: energy efficient lighting
- Aspen Ski Hut Caretakers: remote ski huts
- University of Colorado: PV powered weather station network
- American Samoa Energy Office: renewables in Pago Pago
- Hopi Foundation: Hopi PV project
- Heliotrope: latest products
- Medical Benevolence Foundation: energy outreach
- Softech Solar: Canadian amorphous & poly-crystalline panels

Major Tours

The tours were a tremendous "plus" to the program. The Windstar and RMI centers provided some rather unique loads to look at...Windstar is using PV for developing wholistic energy and agricultural research processes in their geodesic BioDome. Mobil recently donated to RMI a 2 kW array of panels (@200 watts EACH) and will soon be selling electricity to the local power utility. Holy Cross, while providing un-interruptible power to their computers, lights, and office equipment (and Amory's "think tank", a solar and wood-fired hot tub.)

Minor Tours

Two other tours brought us to the Planted Earth, a new passive-solar greenhouse with a nearby PV powered teepee (both were Steve McCarney's productions), and a PV powered weather station that I helped design and install a few years ago (see [PV International](#), Oct. 1987) as part of a graduate research project.

At Planted Earth's 6000 sq-ft commercial greenhouse, I got a good look at my first teepee PV system. Debi Tena, an electrician from the Hopi Foundation in Second Mesa, AZ got a kick out of it too. The stand alone system home power-ed several fluorescents lights. The Planted Earth also featured innovative passive solar and greenhouse design features. Steve McCarney unraveled the mysteries behind the main greenhouse's rock/soil/concrete thermal storage, double skin plastic glazing and low profile building design. Planted Earth's gift shop and office featured a selective surface trombe wall and a passive freeze proof batch heater.

At my weather site in Carbondale, I put on my field technician's hat and indoctrinated the other attendees into the world of remote telecommunications and automated weather monitoring. Stand alone data acquisition systems are a natural application for PV and a real convenience for data takers since they don't have to replace batteries or cassette storage tapes.

PV Configuration Laboratories

Being a scientist at heart, the labs were, for me, the best aspect of the first week. On a number of occasions, however, Mother Nature teased and annoyed us playing hide and seek with the sun and by giving us *lightning power* instead of solar power. ATA pleaded guilty to brashness by scheduling the sun to appear in time slots normally occupied by clouds in mid July; they sentenced themselves to not do it again.

We did learn a lot in the labs, like how to: use a Solar Pathfinder, wire modules to batteries, controllers, and inverters, and use the hand tools and testy equipment of the trade. My favorite piece of test equipment was the non-intrusive current transducer (an ammeter that clamps around a conductor and measures current by induction rather than breaking the circuit and wiring an ammeter in series and measuring current directly.)

We wired different stand alone systems and directly coupled systems using a variety of loads. We powered pumps, charged batteries, and observed fluorescent light against incandescent (it was an illuminating experience).

In a controller lab, we wired a heavy duty electric drill to a battery that was at a low state of charge. An LVD controller with a voltmeter and ammeter presided over an experiment to try and discharge the battery until the LVD kicked in to keep it from deep discharging. With anxious eyes, we huddled over the meters as the battery's state of charge sunk with the drill bit. Suddenly, a simultaneous *click* from the LVD and brittle silence from the drill signaled the end to a cool experiment.

An Opportune Installation

After the first week of [PV for Practitioners](#), we had a Saturday and Sunday to ourselves to relax and make ready for the upcoming week of installations. Some people did as they should and disappeared into the wilderness, but eight of us volunteered our Saturday to help Mark McCray of RMS Electric add five panels to a remote homeowner's array.

The Sovonics panels were given to the homeowner after being stashed in a barn for over a year. Mark planned on adding five panels to the existing system and on putting two more on a garage to power a propane generator's controllers. He extended the invitation for volunteers because he knew that several students couldn't stay for the second week and would enjoy participating in the installation. Our contributions included putting up a site-built mounting structure and wiring in the panels for the house's ac/DC system. Thanks Mark--that was fun.

Conclusion

ATA's [PV for Practitioners](#) workshop is a winner--it'll make you smart, experienced, and psyched on PV. I recommend that PVer's prepare for it by putting away time and money for both weeks. I'm sure you won't be disappointed--even though it'll cost you some bucks. But like buying energy efficient lights: the cost is up front, but the savings in energy and money is more than worth it.

Rap Up

Special thanks to Jerry and Mia Gamble of Carbondale who let me hole up in their chicken coop so I could write this article; to Colorado College for setting me up with a compete Mac system to keep me company in the coop, and to Johnny Weiss for his inputs and liberal use of his pick-up truck.

Here's a diddy of what's in store for part 2 of this three part series... it's a soul-ful description of the directly coupled SolarJack water pump installation at the Ty-Bar Ranch.

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The Water Pump Rap

Michael Ivanovich

The sun was hot and the mountains high
and the locusts were as nasty as the ground was dry.

But onward we tread with a shake and a rattle
to install a PV pump for a rancher's cattle.

The well went down a hundred-thirty feet deep
but there were no lines for electricity.

So two Arco panels and a SolarJack pump,
directly coupled to the colorado sun,

were bought by the rancher to have his way
and he got a lot of help from ATA.

They set the stage & put the panel post up
but the rest was ours and that was enough.

With smiles and sweat we got **water** flowing
90 gallons an hour with no sign of slowing.

There was a pitless adaptor and an LCB,
plus a Zomeworks tracker

and more, you'll see!