SUMMER 2012

THE MAINE SUN

NEWSLETTER of the Maine Solar Energy Association

Work with Navajo in New Mexico

By Richard Komp

Last December I gave a photovoltaics workshop in Albuquerque New Mexico, organized by Marlene Brown of the New Mexico Solar Energy Society. One of the participants at that workshop was Kevin Beane, from the Gallup Solar Energy Society. After the workshop, Kevin and I stayed in touch and he organized a more general two week solar course in Gallup for the Native Americans in the Four Corners area of New Mexico and Arizona.

Kevin met me at the World Renewable Energy Forum in Denver (*see story on Page 3*) and we traveled together in his Prius to New Mexico. After spending a couple of days shopping for supplies for the hands-on workshop parts of the course, we started the first week of the course, devoted to photovoltaics. The general pattern of the course held at the Gallup campus of the University of New Mexico, was lectures in the morning and hands-on work in the afternoon. While most of the students were Navajo, we did have some Pueblo Indians also taking the course as well as some teenagers from homestead families. In the first four days we covered the basics of the sun's energy and electricity, how photovoltaic (PV) cells work and how to design PV systems. In the hands-on sessions we built small solar battery chargers and cell phone chargers and then went outside and assembled a prototype 12 volt PV system, connecting up the PV modules, batteries, charge controller and an inverter to make 120 volts AC from the DC produced by the system. The Native Americans enjoyed the fact that the solar battery charger cases were made out of recycled plastic by the Penobscot Indians here in Maine. The workshop generated a lot in interest and the local Gallup newspaper and public radio station both did news stories on the course..

Students testing the output of a string of PV cells

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MESEA Petitions to be ASES Chapter

By Richard Komp

The Maine Solar Energy Association has petitioned the American Solar Energy Society to become a full chapter of that organization. MESEA had been a chapter of the Northeast Sustainable Energy Association (NESEA) for decades but because of the change of focus of NESEA's mission, the NESEA board decided we didn't fit within their vision of a trade group only for professional green builders. MESEA does a lot of workshops and educational programs for the general public so we decided to opt out as a chapter of NESEA and have been negotiating with ASES to become recognized as an ASES chapter. In May we submitted a bundle of paperwork and worked to find and report on at least twenty joint MESEA-ASES members. At the World Renewable Energy Forum in Denver (*see below*) I was the MESEA Official representative and participated in the Chapter Caucus, but the ASES board of directors didn't meet about our membership status until after the Forum was finished. We have received a notice that our application was accepted with the provision that we meet the chapter membership requirements. We need to have two more MESEA members that are also ASES members and all our board members have to be ASES members.

Please think of renewing your membership in MESEA (*see page 7 for the application*) and also think of becoming an ASES member, which only costs $39 a year and includes a subscription to ***Solar Today***, ASES's high quality magazine.

The World Renewable Energy Forum

This year the American Solar Energy Society's (ASES) annual meeting was part of the world Renewable Energy Forum (WREF) in Denver, Colorado. Both Susan Kinne, of the Grupo Fenix in Nicaragua and Susan Kinne (of the Grupo Fenix in Nicaragua) and I gave papers together in the *Energy and Gender* portion of the Forum. This two day event had an all day workshop at the same time on Sunday as the ASES Chapter Caucus so I could only visit the workshop during breaks in the Caucus, since this year I was the Official MESEA representative to the Caucus. ***Continued on Page 3***

Inside

The Maine Sun

Newsletter of the Maine Solar Energy Association

The Maine Sun is published four times a year by the Maine Solar Energy Association (MeSEA), a non-profit organization (sister chapter to the North East Sustainable Energy Association).

Our Mission:

We are dedicated to promoting the public awareness and use of:

- solar energy
- energy conservation
- other renewable non-polluting energy sources
- environmental and health awareness building practices throughout the state of Maine

The Maine Sun welcomes articles, submissions, photographs, and letters. Please send editorial materials to the following address: MeSEA P.O. Box 184 Harrington, ME 04643
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Calendar of Events

MeSEA Website WWW.mainesolar.org

Solar Thermal Workshop July 27-29, Owls Head, Maine A Complete System Installation, "Till Hot-Water Comes Out of the Faucet"

A one, two, or three day participation is available for solar enthusiasts, Fri, July 27 through Sun, July 29, 2012. Led by Dr. Rich Komp, President of the Maine Solar Energy Association, we will finally complete a 'home-built' solar thermal collector system, on Annie Higbee's beautiful home in Owls Head, Maine.
Hours: 9:00 am – 4:00 pm Friday & Saturday 10:00 am – 4:00 pm Sunday.
Cost: $60 one day, $110 two days, $150 all three days, Camping available on site
For more information and to make reservations ($30. deposit required), please call: (207) 542-8302, or (207) 356-0225, Please RSVP by July 14,

Solar Water Heater Workshop, August 3-4, Whitefield ME

We will work with Richard Komp to build two solar water heater collectors using materials available an any building supply store. These collectors in the Maine Solar Primer are so inexpensive that a complete home-built solar water heater system is cheaper without any rebates than the commercial systems are with rebates.
A Free Friday evening lecture is the start of the event.
When: Friday evening 7 to-9pm, Saturday 9 am to 4 pm.
Where: Lucia's house, Whitefield Maine (call for directions).
Cost: $75 with scholarships available for students and some others.
For more information and to make reservations ($30. deposit required), please call: 207-945-5106, or 207- 356-0225 - claudia@mainerural.org or sunwatt@juno.com

Solar Energy Workshops, October 5 – ,14, Jonesport, Maine

Presented by MESEA, DADS, and SEADS of Truth, Inc.

When: Friday, October 5 through Sunday, October 14
Where: 17 Rockwell Rd, SE, Jonesport, ME 04649, 207 497-2204.
Presenters: John Burke, Richard Komp**,** and other experienced **MESEA** trainers.
Attendance Options: You may sign up for…
…a one-day session (Sat or Sun) - **$75**
…or a two-day extended session (Sat and Sun, 9 am to 4 pm)- **$125.**
…or the full ten day intensive program - **$475.** (All noon meals included)
Overnight Accommodations: Limited space is available on site, with an additional fee required, or stay in an accommodation in Jonesport or nearby.
We will try to keep the maximum number of participants to 12 per day.
Call to reserve space and arrange for a $50 Deposit at 207-546-1639, 516-669-2442, or 207-497-2204. Full workshop fee balance is due upon arrival in October. Thanks.
Program:
How to start a PV Cottage Industry: A free Friday lecture, Oct. 5 and 12, 6-8 pm.
Solar PV Assembly Weekend Session: Each weekend session takes participants step by step through the PV assembly procedure used by Dr. Komp in the developing world *PV Cottage Industry* programs. The first day will focus on the first half of PV assembly and liquid silicone encapsulation. We also will show the new method of encapsulating PV modules using EVA polymer in a solar oven (if the sun cooperates). The 65W PV modules are available for sale to participants, to raise funds for work in developing world.
Full Ten Day Program: Includes 2 weekend PV assembly sessions, as well as Friday lecture sessions and a hands-on workshop on **How to build a Solar Hot-Air Collector**, including a Sun-Grabber hot-air collector assembly.

MESEA Spring PV Intensive Workshop

This Spring, MESEA again hosted a two weekend solar PV intensive workshop. The first weekend, April 12 – 15, was attended by two gentlemen from Brown University, Providence, Rhode Island, as well as four 'local' Maine solar enthusiasts. The weekend included a MoveOn.org "*Occupy a Solar Home*", 99% Training, for Direct Action activities coming up this fall, with a focus of keeping corporation & plutocrat money out of politics!

The Occupy a Solar Home Group

The PV workshop group also finished a 65W PV module, that made an appearance at the Hope Festival, on Earth Day, at the UM Orono campus. *(In May the module also was used to measure the power of the Super Full Moon that month, and the 65 watt module produces 390 microwatts under the "brilliant" moonlight – RK)*

The following weekend, April 20 – 22, a group of Mainers, from Steuben, Addison and Portland, were busy assembling a 65W PV module, and managed to find the sun despite the rain, to check the output of the module, with the multi-meter. Both PV modules, utilized the liquid Si, (Sylgard), method, developed in Nicaragua by Marco Antonio of the Grupo Fenix in Nicaragua. We did have another successful workshop series.

Preparing to encapsulate the 65 watt PV module

Continued from page 1. However, on Monday Susan and I each gave papers at the *Energy and Gender* sessions with both of us taking part in giving the papers. Susan talked about the work of the *Mujeres Solar de Totogalpa* (the Solar Women of Totogalpa) while I gave a two part paper: First about the work by Nimia, one of the Solar Women of Totogalpa who taught women and carpenters in Colombia, South America how to build and use solar cookers. Nimia (one of our co-authors in my paper) built a special, large solar oven sized to fit the glass of the biggest PV modules we make; so that we could encapsulate 65 watt PV modules using EVA with concrete blocks as weights replacing the vacuum system normally used by the commercial module manufacturers. The second part of the paper went into the technical details of this new encapsulation system. The Colombia work is the first time anybody in the world had made large PV modules using this new system (*See the Winter 2011-2012 Maine Sun for details*). We got in a bit of trouble with this paper; for while I ended the paper on time, we received a standing ovation for our scientific paper and there were so many questions that the woman in charge of the *Energy and Gender* session yelled at me to stop while Susan was still answering questions. We also had problems getting out of the room and filled the hallway with people still wanting to talk with us. Bad decorum for a scientific conference.

Coop Organizations from Maine and New York - PV Coop ?
By John Burke

During the Spring of 2012, three different groups have expressed interest in getting a PV assembly, worker owned coop running, somewhere in Maine… or in New York… or in-between!

Will we see an organization that will work with displaced workers, with ex-offenders, or with disabled folks who can't get out to work? These possible scenarios exist and three different groups in New York and Maine have a rejuvenated enthusiasm, for just that! These 'unnamed' organizations are interested in exploring the subject, and each one is on their own! This will be a developing story we will follow as well as push toward a resolution.

In New York, a small group of entrepreneurs was moved to attend a one day PV assembly workshop, presented by John Burke and DADSolar, in a Long Island living room. Utilizing the standard MESEA methods, with a liquid silicon encapsulant, (Dow Sylgard 184), the group achieved the final test as the 65W PV module tested in full late afternoon sun, with 20.3 V (no-load) and 2.93 amps short circuit current, a good showing with clouds and trees in and out of the way.

The next step will be a meeting with a local progressive think-tank on Long Island, who will look into a possible cooperative venture, assembling smaller modules for charging cell phones, for example. It is difficult to compete with the Chinese PV manufacturing establishment, but with a product designed for a niche market, there is interest. This is also the view in Maine, where an interested group has expressed a similar desire, to get the folks who want and need employment going on a product or a kit that will inspire local enthusiasm. We look forward to a next step and a report back from the groups.

Academic Visits

By Richard Komp

Since I got back from Nicaragua in the middle of March, I have been invited to a number of academic institutions to give workshops or seminars.

The first trip started with me giving an all-day photovoltaic (PV) workshop at the ***New Forest Institute*** in Brooks, Maine. In addition to talks about on how solar cells work and the new developments in the PV industry, and a PowerPoint presentation on my work in remote villages in developing countries; we also built 10 solar cell phone chargers and two small solar battery chargers.

Early the next morning, I caught a bus to Boston and the Amtrak train to Rensselaer, New York. The next day I gave an all day workshop and attended a Banquet at ***Rensselaer Polytechnic Institute***. The workshop organized by their chapter of Engineers for a Sustainable World (ESW) was a great success with the students constructing 15 solar battery chargers (using cases made for MESEA by the Penobscot Indians out of recycled plastic) and 15 solar cell phone chargers (using cases made from $1- 8"x10" picture frames). At the banquet organized for the ESW donors, I won two raffle prizes even though I had only five raffle tickets. I will have to go back to Troy NY sometime to collect the prizes since I left very early on Sunday mornings train to go back to Boston.

The following Tuesday I gave an all-day seminar on the more technical aspects of PV to the Solar Energy Lab at the ***University of Massachusetts in Lowell***. Carolina Barreto (my student from Nicaragua who is finishing up her PhD studies with a complete Fulbright Scholarship) organized the event. We went over such topics as organic semiconductors, indirect band gap materials, the future of the PV industry and the details of how you build tunnel junctions for multilayer space PV cells. It is nice sometimes to get to talk about those more sophisticated topics. The next morning Carolina took me to the Lowell train station to start my journey back home in Jonesport.

In April I spent three days over the Earth Day weekend at the ***University of Maine – Orono***. On Saturday I manned the MESEA booth for the **Hope Festival**. This year the weather was drizzling and windy so we had an inside table instead of the hoped for outdoor location right next to the entrance where we usually set up shop. I stayed overnight with MESEA board member Claudia Lowd and we went with U of M professor Emily Markides to a rural farm near Bucksport where Emily will be hosting a permaculture course this coming July. We discussed how to bring PV power to the event (I will be going back later this summer to wire up the PV modules and other equipment). After that meeting, Claudia took me to an organic farm where the family was having problems with their off-grid PV system. The problem was shading of the modules in the morning so I suggested that they move the entire array up to the top part of the home's roof to get them above nearby trees. There was nothing else wrong with the installation.

Finally on Monday afternoon I gave a half day workshop for the U of M's Green Corps. We started construction of 15 solar cell phone chargers but the rain came on strong and it got dark before we finished so I gave the students a homework assignment of finishing the modules. It is not a good idea to have a solar workshop outdoors at night in an open sided tent in a nor'easter.

Students at U of M, building solar cell phone chargers

In May, as the start of my trip to Denver and New Mexico (*See the story about these events on Page 1*) I spent a day in Boston. First I gave an afternoon seminar on PV at ***MIT*** where we first had a luncheon meeting discussing photovoltaics as a cottage industry in the 3rd World; then we moved to the student center to have a meeting with the **MIT D-Lab** people about the details of working in Nicaragua and my new method of encapsulating PV modules using ethylene-vinyl-acetate (EVA) using solar ovens instead of the half-million dollar laminating machines. They had a hard time believing that a vacuum system was no longer necessary until I showed photos and gave them the data from our work. One MIT group plans to come to Jonesport to participate in a hands-on workshop on the new EVA encapsulation technique.

After a very nice Indian vegetarian dinner with Sajed Kamal (A professor at ***Brandeis***) we went to Harvard Square for a showing of **Burning in the Sun**, a film about my solar work in Mali, West Africa. This full length film which won the *International Green Peace Film Award* has generated a lot of interest and we had a nice event with a discussion period after the showing. Drew Gillett left with me even before the discussion was finished, to take me to his home near Manchester, New Hampshire to stay overnight, since we were flying together in his little plane to Denver for the *World Renewable Energy Forum.*

Integrating PV into the Grid

by Johan Enslin, Petra Solar

Solar power's role in the global power generation portfolio is growing year over year largely because solar generation increasingly makes economic sense. This burgeoning economic case results from a combination of incentives such as solar renewable energy credits (SRECs) and mandates including renewable portfolio standards (RPS) and because solar solutions-especially when they have smart grid and other functionality built in-can be packaged into profitable business propositions without subsidies. As these forces grow solar power's prominence, power grids must handle far more photovoltaic (PV) input than before. To accomplish this, solar power and the grid have some growing up to do.

Large-scale solar power faces significant challenges integrating into the grid. Centralized solar generation, including large PV arrays, or solar farms, can be subject to intermittency. Even in the sunniest climates, clouds inevitably pass over solar farms, resulting in problems such as voltage fluctuations, distribution losses and reduced power quality and power balancing. In the worst case, this can result in lower power reliability for end users, and utilities feel the effect via increased wear and tear on grid hardware. Solar generation can make capacitor banks, breakers, voltage regulators, load tap changers and other power equipment work harder and wear out faster. PV's potential stress to the grid coincides with pressures from other rapidly developing technologies, such as electric vehicles, which will call for grid upgrades. Several opportunities exist to hasten massive PV integration into the grid. Primary among them is highly distributed PV generation because higher degrees of PV distribution deliver a more stable power supply and reduce impact on grid assets. Standard PV inverters are not optimized for interfacing with the grid; maximum PV penetration requires developing the right inverters for the job. Also, PV's business case can be designed to promote rather than inhibit PV's growth.

Distribution

Throughout power grid history, the most reliable strategies for providing power have relied on a diverse mix of power generation. In PV's case, that generation diversity is best manifested through geography. When generation is concentrated in one location, however, local weather such as cloud cover or snow can affect an entire solar power plant's output. With PV plants' reaching 100-MW capacities, local weather can affect enormous amounts of electrical output, potentially impacting local businesses, hospitals, schools and other power consumers. As we have seen in Public Service Electric and Gas' (PSG&E's) ongoing installation of up to 200,000 Petra Solar PV panels throughout New Jersey, when PV is installed as a virtual power plant (VPP) in a highly distributed network, weather risk attenuates. A statewide or regional network of strategically distrusted PV generation offers consistent power throughout the network because weather impacting one part of the distribution region is unlikely to affect other parts of it simultaneously (see Figure 2).

Such distribution also has economic benefits. While solar farms achieve some economies of scale, these land-intensive projects can fall victim to regulatory entanglement. Distributed systems, however, can be installed on available public infrastructure such as utility and lighting poles, highway infrastructure, public buildings' rooftops and publicly owned marginal land. Such installation schemes usually can be implemented faster than solar farm construction, bringing solar power online incrementally throughout an installation project rather than forcing communities to wait for project completion to reap new power. VPPs also provide opportunities to add smart grid functionality, such as power monitoring and conditioning and grid communications, from the distributed points of PV generation.

Technology

The only way PV generation will integrate with the grid on a large scale is for it to grow up and act like any other power plant. To reach this maturation point, associated technologies-especially inverters, energy storage and weather forecasting-must continue to evolve. Inverters must handle reactive power better so PV can operate in closer proximity to other generators. They must offer better ramp control to mitigate the effects of sunlight loss. Finally, these technologies must offer smart grid functionality such as power conditioning to add to their value and to add value to solar's business case.

Once PV generation functions like any other generation source, it will be dispatchable. System operators will be able to request a certain amount of power and know they will receive it. For PV, this will require better and lower-cost energy storage technology and better weather forecasting systems for centralized and distributed generation so system operators can plan more accurately around likely sunshine and resulting power output.

Cost

Because recent solar subsidies have a limited lifespan, PV also must present an enhanced business case to utilities if they are to implement solar on a large scale. Ever-cheaper solar panels are only part of making PV more affordable. More important is the ability for PV to build a comprehensive value package of which generation is only a part.

Highly distributed PV systems can do this by adding value with smart grid communications, power monitoring, power condition and other ancillary services. In these cases project capital costs may be higher, but with enhanced return on investment, overall project payback arrives more quickly and levelized cost of electricity is lower.

Building such a value proposition, which expands beyond power generation alone, has been core to enabling utility executives to implement systems such as integrated PV and smart grid solutions.

Understanding how peak power usage interplays with PV generation is also critical to maximizing PV's value proposition. Solar generation holds advantages over wind power because solar's peak production naturally comes during peak load and commands higher rates, whereas wind generation tends to produce more at night when power is in lower demand and sells for less. Finally, distributed systems offer cost advantages because they skirt siting, permitting and other regulatory obstacles that can hamstring centralized solar generation and add greatly to their costs. Because distributed PV generates power close to its point of use, distribution power loss is mitigated and no new distribution or transmission infrastructure, like that for accommodating centralized solar farms, must be built.

From Page1. On Friday we went to the remote home of Mary Chee, a Navajo great grandmother, to install a PV system for her off grid house and hogan. The wind was gusting to 60 mph that day so we decided to not try installing a large PV module. Instead, we did the parts of the installation that could be done on the ground. We went back a week later on a Saturday to finish the installation. Mary already had a gasoline generator so we rewired it to run battery chargers and isolated it completely from the AC wiring of the house.

Installing the 250 watt PV array on the roof of Mary Chee's government house.

Since we had done the solar thermal part of the course in the meantime, we had two solar ovens we had built so we used them to cook four flatbread pizzas for lunch for everybody. In the very dry climate and at the 7500 ft. altitude, both the PV modules and the solar cookers worked extremely well, way above specs. The Pizzas were cooked to perfection and disappeared very quickly.

When Kevin and I were organizing the course, we had decided to not teach how to build big 65 watt PV modules since the price of a completely finished, Certified Chinese module was now cheaper than the cost of parts to build our own. However, when it came time to purchasing the modules, we discovered that the cost of a small number of modules, including their shipping to Gallup was about double what we expected. Therefore on my next trip to New Mexico, we will have a course in building PV modules using the new ethylene-vinyl-acetate (EVA) hot encapsulation system using a much bigger solar oven. An important advantage of the Navajos making their own PV modules is that the money will stay in the Four Corners area instead of going off to China.

In addition to the actual course, I also got to travel some in the Four Corners area. On Memorial Day itself some of the Navajo took me to Window Rock and then on into Arizona to a remote place where one of their families lived well off the main road. I checked out the PV systems they already had and explained how to collect rain water to put in the batteries, which were pretty dry, but the rest of the system was working fine (I always carry my multimeter on these trips). We walked down into a canyon that no longer had water and they showed me the wells that are now dry.

Hiking into the dry canyon

After the three day solar thermal part of the course at the university, and after we had finished the installation at Mary Chee's; we traveled to a remote part of northeast Arizonan to visit Louise, one of the "forgotten people" Navajos who live on the edge of the area where the Peabody Coal Company is strip mining thousands of acres of the Four Corners land. I had met Louise at a Gallup Solar meeting where I gave a short presentation on my work on cottage solar energy in the 3rd World, and she wanted to have me check out her old PV system and see the area where she would like to have me come back to teach the cottage PV module manufacturing and installation. The Navajo in this area are very poor; we had to wait about 2 ½ hours at the Hopi cultural center while Louise had to wire somebody for some money to fill the gas tank so that her daughters could drive her from Flagstaff to meet us.

Louise and her brother in front of her hogan with a small older PV module on the roof. ***See page 7.***

From Page 5 Louise had three different PV modules on her roof, made by three different oil companies. Only one was still working when we got there so we tuned her system's wiring up to get it working properly again. We left her with the Shell module on the roof, showed her that the Total (French National oil company) was unfixably broken and brought the oldest PV module I have seen in a long time (a p-on-n module made in the early 70s by what is now Exxon) back with us to reframe and fix the junction box. It is now back on Louise's roof and working again after about 40 years outdoors. On my next trip I will give a workshop right in her hogan, which is big enough.

I spent the final week of my trip in Albuquerque teaching anther PV workshop organized by Marlene Brown, mostly for the people at Sandia Labs, where she works. We made 20 of the small solar battery chargers and 12 of the solar cell phone chargers. It is nice to work with engineers where we can talk about indirect band gap semiconductors, tunnel junctions and organic semiconductor PV cells. We also worked on the reverse engineering to be able to use our solar chargers to recharge Apple iPhones.

I had no problems flying back from Albuquerque to Boston and caught a bus straight to Bangor to get home.

MeSEA Membership Form

Annual membership includes: a subscription to the quarterly MeSEA publication - *The Maine Sun,* 10% discount on workshop fees and MeSEA-sponsored events, networking with other like-minded people in Maine, contribution to the sustainability of our program, and the right to declare your donation to a 501(c)(3) on your taxes.

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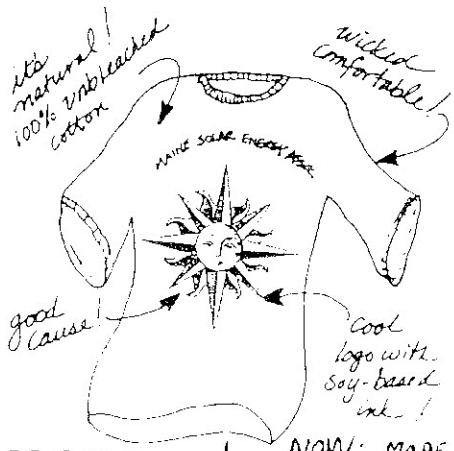

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