

SPRING 2013

THE MAINE SUN

NEWSLETTER of the Maine Solar Energy Association



Maine Solar Energy Association PV Workshop, March, 2013, with the Manhattan Comprehensive Night & Day High School, NYC By John Burke

For the fifth time in five years, MESEA and John Burke presented the Solar PV assembly workshop, with a new group of environmental science students at the NYC High School. The group of 15 students, from countries on three continents, had a two day presentation, and enjoyed the assembly process, with the 65 W PV module, utilizing the now famous Sylgard encapsulation process, developed by Marco Antonio, of Grupo Fenix, Nicaragua.

Two Fridays, allowed the students and advisors, the opportunity to experience the complete hands-on operation, and for the first time, solder PV cells into 4 strings that will create the 36 cells necessary for the 65 W PV module. We all appreciated the showing of the award winning film **Burning in the Sun**, Bird Girl productions, telling the story of the PV 'cottage industry' efforts in Mali, W. Africa. Dr. Richard Komp, President of MESEA and Skyheat Associates and Carolina Barreto were featured with Daniel Dembele, the young Malian who was the inspiration for this project.



Students assembling a 65 watt PV module in Manhattan

We have had the opportunity to make solar PV modules, used by the students to raise the general public awareness of solar power capabilities with portable PV units to 'recharge' cell phones and lap-top computers, as well as powering a pump for a 'compost tea' unit used at the city park next to the school. We look forward to the next chance to work with the students at this innovative program at MCNDHS, NYC. The **Solar1** group, in NYC, was the original organizers of our involvement with the high school.

Website WWW.mainesolar.org

Complex Work in Nicaragua – December 2012 to March 2013

By Richard Komp

I have just gotten back from my latest trip to Nicaragua. I have been going there to work with the Grupo Fenix every winter since 1997 and this year was no exception. My stays and the complexity of the work seem to increase every year. Some years I have also gone in August to teach a solar course at the Universidad Nacional de Ingeniería (UNI - the National Engineering University). This time the trip was especially complex: They had me working so many places that Susan and I didn't even have time for a weekend at our favorite Pacific Ocean beach. Here is a report on some of this work.

Photovoltaic work in Chantales

Chantales is a department that I had never been to in the southeast part of Nicaragua on the way to Bluefields on the Coasto Alantico; but now Suni Solar (the worker owned profit-making business part of the Grupo Fenix) is doing a lot of work there. Jose Luis Bustimante asked me to go with him to do the final work on a PV system Suni Solar was installing on a remote cell phone tower in the region. *Continued Page 4*



Checking out the inverter system for the 12 KW PV array for an off-grid cell phone tower in Chantales

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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

Opinions expressed by authors or editors do not necessarily reflect the views of MeSEA. The publisher reserves the right to refuse advertising which is not consistent with the goals of this organization. Acceptance of advertising does not constitute endorsement of the advertiser, its products or services.

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Calendar of Events

MESEA Website WWW.mainesolar.org

PASSIVE SOLAR Conversations and Workshops with Dr. Komp - Amherst, Massachusetts, April 2013

Passive Solar Seminar 6 PM. Wednesday April 24, 2013

1st Floor Conference Room, Amherst Police Department, 111 Main Street

Dr. Komp will discuss the physics and practice of using passive solar energy for home and office, drawing examples from his work. Audience participation will be welcomed. Free and open to the public.

Solar Oven Workshop 12-6 PM Thursday April 25, 2013

Woodbury Room, Jones Library, 43 Amity Street Dr. Komp will guide the construction and use of 4 solar ovens. Assembled ovens will be available for purchase for the cost of materials. **Fee** - Sliding scale \$40-55. Maximum: 16 participants. Registration required. Contact: pveaa@comcast.net or call: 413 367 6479. There will be demonstrations of the use of a solar oven during the *Amherst Sustainability Fair* on Saturday May 27, 2013.

Thermosiphon Solar Air Heater Workshop 9AM- 4PM Friday April 26

Workshop site is near the center of Amherst. Dr. Komp will guide the construction of one solar air heater. Lunch included. **FEE:** Sliding scale \$45-60. Max: 16 participants. Registration required. Contact: pveaa@comcast.net or call: 413 367 6479. All fees and donations will help to finance Dr. Komp's international work.

US Green Building Council - Maine Chapter

Thursday, May 16, 2013 - Rines Auditorium, Portland Public Library

5:30 – 7:30 PM A free showing of the film **Burning in the Sun** about Richard Komp's work teaching people in Mali West Africa how to build their own photovoltaic modules and bringing solar lighting and water pumping to a remote village. Dr. Komp will be available for the discussion after the 1 ½ hour film.

This is instead of the **Points & Pints** Event this Thursday.

Portable PV Trailer Assembly workshop

Jonesport, Maine, 12-14 July, 2013 8:30 AM – 4:30 PM

MESEA will provide a three day assembly workshop, for ASES Chapters, NESEA Chapters and the general public, for the hands-on experience of assembling a **Disaster Ready Portable PV Trailer**, designed to provide electrical power for a limited number of days, for an affected population, after a hurricane, tornado or other natural disaster. MESEA will choose re-cycled, donated and locally available materials and supplies, for this project. The outcome will allow the participants the chance to utilize their experience with other groups in other areas of the country, and assemble duplicate PV trailers, where needed. This project is aimed to get the participants from other ASES chapters around the country involved with the efforts, by making an instructional video, so inexperienced folks will easily accomplish the task.

Fee: \$75 per day, \$125 for two days, \$175 for the entire workshop, including lunches. Sleeping space is available for \$30 a day, including breakfast.

Information and Reservations: Rich Komp 207-497-2204, sunwatt@juno.com or John Burke 516-674-9090, dadsolar@yahoo.com

MESEA Website WWW.mainesolar.org



Grid-Tied Vs. Grid Interactive Photovoltaic Arrays

By Mark Cerasuolo

Grid-tied PV systems typically consist of PV modules connected in series to string inverters that convert DC power to AC power, which is then fed directly to the grid. As a building receives this AC energy, it is distributed to appliances and lighting, or other devices where needed. Any energy that exceeds the regular building usage goes back to the grid. In some cases, the utility issues a credit to the next bill.

Grid-interactive systems are based on their grid-tied and off-grid counterparts. Like the inverter in grid-tied systems, the inverter in a grid-interactive system can convert solar-generated DC power into AC power that is then fed directly to the grid. In a grid-interactive system, however, the inverter has multiple additional functions to perform. Under normal conditions, the inverter maintains the battery in a state of full charge in preparation for use during power outages. When the grid goes down, the grid-interactive inverter seamlessly steps in to invert DC power from both the solar and battery sources into useable AC power to run selected loads. The system will charge those batteries during the day from the panels or as required from a generator, or both. The grid-interactive inverter can automatically control the generator to run only when required to recharge the batteries, greatly reducing the generator's run time, noise output and fuel consumption. Additionally, a user can maximize energy savings via peak shaving by taking advantage of using stored energy to offset utility prices when rates are highest and, in turn, only choose to leverage the grid when pricing is most advantageous.

Design criteria for installing a grid-tied system are relatively simple and linear. The energy flow in a grid-tied system is a one-way street and getting electricity back to the grid is usually a cookie-cutter equation. For example, when an installer is sizing a 4 kW PV system, the given array capacity would match with a 4 kW inverter, which feeds into a breaker installed in the main load center.

In a grid-hybrid design, the process is made slightly more challenging by the need to also design the backup capabilities of the system. Questions for an installer to consider include the following: What loads does the system need to run? How much power do these loads consume, and for what duration of power outage does the customer expect to be prepared? What loads are essential?

Every customer's needs for essential loads are unique, but they typically include some mix of lighting, communications, water and refrigeration. What a client decides is critical to run and how long a typical power outage lasts will ultimately determine the components of a grid-interactive installation - including the size of the inverter, the capacity of the energy storage unit, such as a battery bank, and the resulting circuitry for the system. Finally, the installer must install a protected load panel and then decide with the client which loads will be run by backup power. Determining which loads in the house to move and then physically routing circuits to the panel can take additional time.

Extra investment?

There is no question that financial impacts drive the majority of solar power system decisions. The grid-tied market is driven by incentives and, although the buy-down model that dominates much of the industry has the benefit of driving down the cost per installed watt to the lowest possible price in markets that have a saturation of solar, it has the unfortunate potential side effect of penalizing installer margins and profitability as solar becomes a commodity. Some installers may see a differentiating push where customers are willing to pay more in a market; having an add-in of providing additional stability and reliability can make the difference between profit and loss for an installer.

Both grid-interactive and grid-tied systems offer environmental attributes and make their owners money by qualifying them for production credits, available along with lower electricity costs. Both also significantly improve the resale value and marketability of homes and other buildings.

Why would a customer make the extra investment in the grid-interactive option? The traditional utility-provided electrical service is favorable when it works in a predictable way, but unpredictability is increasingly common for two reasons.

First, after several years of severe storms and dangerous weather patterns, grid-tied users are all too familiar with the potential damage of blackouts and brownouts. Some events, such as natural disasters, overloaded utilities and under-investment, may cause prospective solar installations to adopt aspects of grid-hybrid technology for stability. During adverse grid events, all solar power systems must disconnect and cease exporting to the utility in compliance with national and international industry safety regulations. However, grid-interactive systems are designed to run independently from the grid when needed, whereas grid-tied systems require a stable grid to operate.

Unpredictability can also be caused by politics and local policies. Incentives, production credits, net metering and other benefits are all subject to change or revision as economic and political winds shift. In places where utilities initially offered generous incentives and then changed their policies, some renewable energy system owners have found their ability to sell back to the grid reduced or even eliminated, which greatly affects system economics and payback.

In contrast, a grid-interactive system lets the user tie into the local energy utility when desired - and opt out when fiscal and environmental factors make it more attractive to stay off the grid. The stored energy in a battery backup system delivers constant power regardless of solar fluctuations. Bidirectional energy transfer capability, along with battery backup, allows the system to remain connected and deliver power when the grid is down. The added expense of a grid-interactive system is earned back over the system's payback period, especially in commercial applications that fully leverage solar power's accelerated depreciation benefit. In the early days of renewable energy, consumers had the option to tie their usage to the grid or opt out altogether and try to get by with less. That all-or-nothing choice is not necessary in today's market. Users have more options, and they can see savings in the different technologies of solar systems.

Mark Cerasuolo manages marketing at OutBack Power, a designer and manufacturer of balance-of-system components for renewable and other energy applications.



From Page 1. This is a prototype PV system for the *Moviestar* cell phone company and if it works out well, Suni Solar might have a large contract to install such systems all over Nicaragua. The system is extra big in order to take care of the worst case scenario, rather than the normal amount of electricity production and usage. Cell phones are especially useful in emergencies when the utility grid might be down.

After finishing up the installation of the cell phone tower PV array, we drove to where Suni Solar is installing a set of 28 solar microdrip irrigation systems near Juligalpa, the departmental center and largest city in Chantales. The design of these irrigation systems is the outgrowth of a system Carolina Barreto created for her senior thesis work as an agricultural engineer at the UNI in 1999.



Inspecting the progress at a 3 month old solar microdrip irrigation installation near Juligalpa

These 28 irrigation systems, averaging about two acres each, were paid for by a consortium of European Union NGOs. Since the pumps work best in the middle of the day and irrigation is normally done in the early morning and the evening, the tank is designed to hold a day's worth of water. In the years since Carolina and I gave our first solar microdrip irrigation workshop in Nicaragua, this method of growing up to three crops a year of tomatoes and other vegetables, has become the norm and the Totogalpa area of Nicaragua is now called the *Tomato capital of Central America*. Not every farmer uses solar powered pumps but everybody uses the homemade microdrip irrigation systems that use small stainless steel sheet metal screws as the controllable drip emitters.

They also use the thin T-Tapes with their calibrated emitter holes but have discovered that they have to bury the T-Tapes about half an inch under the soil to keep birds from punching holes in the thin plastic to drink the water.

Solar water heater systems

On the way back from Juligalpa, we stopped to check out the high temperature solar water heater system at a dairy that

makes the special Nicaraguan cheese that is very much like Greek Feta cheese except it is made with cow's milk.



Chinese evacuated tube solar water heater on the roof of the cheese making dairy near Juligalpa

The morning that we visited the dairy, the temperature of the water in the storage tank was 95° C (203°F). This high temperature is needed for cleaning the cheese making equipment. Suni Solar has installed a number of these high temperature systems; but the usual solar water heater uses a flat plate collector. Suni is now internationally certified to manufacture these Brazilian collectors in Nicaragua and is now working on making the stainless steel tanks necessary for the higher water pressure in Nicaraguan cities.

While the normal Nicaraguan homeowner sees no need for hot water, the hotels have discovered that their guests like the idea of a shower with two knobs and a choice of water temperature; so Suni Solar is busy installing large solar water heater systems on the big new hotels going up in the area around our barrio in Managua. The Grupo Fenix had a workshop over 10 years ago where we built a prototype PV-Hot Water hybrid collector, which is now installed on the roof of a school near Boaco; but this idea has not caught on yet. We also have only one prototype photovoltaic still that makes fresh water out of sea water while it makes extra electricity.



A flat plate thermosiphon solar water heater built by Suni Solar



Navidad (Christmas) in Nicaragua

For several years now I have been going to Nicaragua before Christmas. This year was the earliest; I arrived on the 11th of December. Susan Kinne, my partner in Nicaragua and an electrical engineering “professor” at the UNI, won’t allow me to get a haircut or trim my beard until after the Christmas season. She has even gotten me a bright red Santa outfit to wear. This year was no exception: While Susan spent Navidad up in Sabana Grande after I left her there, I spent it in Managua.



Rich Komp as Santa in Managua



Suni Solar Christmas party group photo

Suni Solar is a worker owned company so every year at the Christmas Party, I give out the stock certificates the workers have earned during that year. Everybody gets stock each year except the first year workers, they will get a double set of stock after two years. Everybody also gets a basket of other goodies.

Working in Sabana Grande

Susan and I spent New Years’ together in Managua, then we went up to Sabana Grande in northern Nicaragua to work with the volunteers and students who were spending time there as part of their CELL Group semester abroad. Each year we have more and more students and young people from all over the world come to Nicaragua to spend time working with the Grupo Fenix. One of the students who came to work this year was Teemu, a graduate student from Finland. Teemu stayed with me a couple of days at my apartment in the second floor of Suni Solar, then traveled with us to Sabana Grande. He is a systems engineer and is now working with the Solar Women of Totogalpa to study the performance of the water pumping system installed at the *Montana Solar* (Solar Mountain) where Susan is building our home and developing an organic farm. He is also measuring the performance of two of the portable solar ovens we are developing at the Solar Center in Sabana Grande.

Susan and a group of the women have been working hard on the Montana Solar, planting thousands of trees and developing the area. They also have had a workshop on *Natural building* where the group built an outdoor classroom that used four different methods of using mud to build walls, ranging from the traditional adobe through cob construction and two types of wattle and daub. The same experts came back in March to start the construction of a *Youth Center* for children from preschool age to teenagers and young adults. I helped design the round building that incorporates earthquake resistant adobe construction. *To be Continued - next issue*



Building the new adobe and cob construction Youth Center in Sabana Grande, The natural food restaurant in the background uses solar cookers and biogas for cooking.



Maine regulators look to offshore wind

Maine state regulators have found "tangible economic benefit" from Statoil North America's proposed offshore wind Hywind Maine Project that weighs in favor of approving the project's associated revised term sheet.

"Although we recognize that there is an inherent risk in approving the proposal in that Maine may not see all of the economic benefit that is promised, that is a risk that the legislature was aware of when it passed [the Ocean Energy Act during its 2010 session] and approved the use of ratepayer money for the purpose of facilitating the development and operation of offshore wind power and tidal power projects," the state Public Utilities Commission (PUC) said in its Feb. 26 order.

The project is a 12 MW deep-water floating offshore wind facility to be built in the Gulf of Maine at a location where the ocean is at least 300 feet deep, and which is no less than 10 nautical miles from any land area of the state. The transmission interconnection to Maine is contemplated to occur in the Boothbay region, and the project is expected to begin commercial operation in 2016, the PUC added.

In October 2011, Statoil submitted a request for a commercial wind lease on the Outer Continental Shelf off the shore of Maine to the Bureau of Ocean Energy Management (BOEM) identifying the proposed location of the project as a 22.2 square mile area located 12 nautical miles from the coast and 18 nautical miles from Boothbay Harbor. In August 2012, Statoil proposed a term sheet containing the essential terms of a long-term contract for energy and capacity from the project for PUC consideration. In January, Statoil proposed a revised term sheet for a long-term contract for the project that provides for a contract term of 20 years beginning on the commercial operations date and contains an initial price of \$270 per MWh for energy provided during the first year of the contract.

The quantity of energy to be bought under the contract is subject to an annual cap of 41 GWh. The revised term sheet also includes non-pricing terms including a commitment by Statoil to use commercially reasonable efforts to expend at least 40 percent of the capital investments and 40 percent of the operating expenditures for the project in Maine and to establish and maintain the operations center for the project in the state, the PUC added.

The PUC also said that it finds that Statoil has shown a commitment to invest in manufacturing and other facilities in Maine, and that it has taken advantage of all federal support for the project, including subsidies and tax incentives. For instance, Statoil has been awarded a \$4 million U.S. Department of Energy grant to commercialize the Hywind technology.

Benefits to the State of Maine

"Statoil's good-faith commitment to utilize Maine suppliers in a future, larger Northeast Wind Farm has the potential to bring economic benefits to the Maine economy beyond the scope of this pilot project," the PUC said.

The quantified economic benefits to Maine for the project are estimated by Dr. Charles Colgan of the University of Southern Maine to be \$33 million (NPV) and \$63 million (nominal) assuming that the expenditures made by Statoil in Maine reach but do not exceed the level committed to by Statoil of 40 percent of the capital investments and 40 percent of the operating expenditures. The PUC also said that the overall project investment is estimated at \$140 million to \$150 million on a present value basis, with Statoil financing the initial investment in the project from its own funds and other sources, including DOE grants.

"[T]he above market costs to be paid by Maine ratepayers of \$52 million-\$76 million will leverage as much as twice that amount in additional investment in the Maine project," the PUC said, noting that payments under the Statoil contract would not begin until the project is operational and be made only when the project is generating electricity.

Conditional approval

The PUC's approval is conditioned upon a provision in the contract that requires Statoil to elect or waive its termination right within 90 calendar days of being notified of an adverse DOE funding decision with respect to the project. Furthermore, the project must be built and operating within five years of the date the contract is finalized. The PUC also said that Statoil is to submit, before Dec. 1, 2015, a business case for the development and construction of an offshore wind farm no less than 100 MW in the Gulf of Maine.

Commissioner Mark Vannoy dissented from the majority decision saying that rather than encouraging Statoil N.A., to take on the risk to advance to an economically viable commercial technology, the term sheet compensates Statoil, at about seven times the current wholesale market rate, for what amounts to a conservative reproduction of the Hywind concept. The primary area of risk in getting the project built is that of permitting, Vannoy said, adding that the term sheet mitigates that risk by allowing the company to opt out of the project at any stage before Dec. 31, 2015. Vannoy also said that the ratepayer costs do not flow until the project reaches the commercial operation phase and the company begins receiving payment for the electricity that the pilot project produces. At that point, based on the amount of power produced, the above-market payments begin to flow at about \$9.5 million a year for 20 years, Vannoy said.

Among other things, he said the company's term sheet falls short in the area of significant advancement beyond the Hywind prototype that shows that the Hywind approach holds the promise of commercial viability through future expansion from a pilot to a full-scale farm. To bring its risk into a more commensurate relationship with its compensation, the company could have maximized generator size per floating structure, for instance, Vannoy said.

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Renewables Provide 82% of New US Electrical Generating Capacity in 1Q-2013

By Kenneth Bossong, SUN DAY Campaign | April 9, 2013

According to the latest "Energy Infrastructure Update" report from the Federal Energy Regulatory Commission's Office of Energy Projects, renewable energy sources (i.e., biomass, geothermal, solar, water, wind) accounted for 82 percent of all new domestic electrical generating capacity installed in the first three months of 2013 for a total of 1,546 MW.

The balance (340 MW) came from natural gas. Coal, nuclear power, and oil have provided no new generating capacity thus far this year.

Wind led the way for the first quarter of 2013 with 6 new "units" totaling 958 MW followed by solar with 38 units totaling 537 MW. Biomass added 28 new units totaling 46 MW while water had 4 new units with an installed capacity of 5.4 MW



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Coming: The Third Edition

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The Maine Solar Primer

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practical information and diagrams
from past issues of
THE MAINE SUN

The Maine Solar Energy association has published a sourcebook for solar and other renewable energy resources in Maine and New England.

This booklet includes do it yourself plans and basic solar information for everybody.

The Maine Solar Primer is available for \$12 inc. postage from MESEA, PO Box 184, Harrington ME 04643

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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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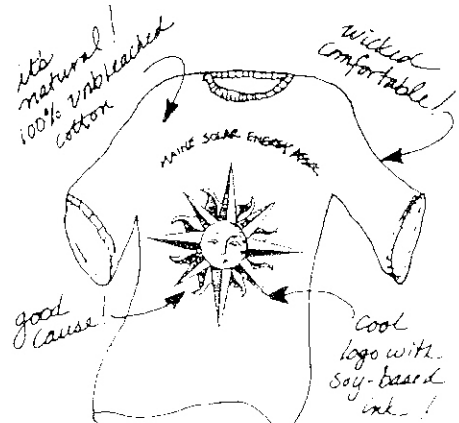
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