SOLAR RISING

September 2004 **Volume 6, Issue 3**

Quarterly Newsletter of the Oregon Solar Energy Industries Association (OSEIA)

Bringing you tomorrow's sustainable energy technologies today!

Payback: It's (past) time to move on (again)

by Jon Miller (OSEIA)

One of the first things people want to know before purchasing solar energy is: what's the payback? This issue resurfaces over and over again no matter how many times it's discounted.

Payback is a thorny issue. Analysts don't want us to 'green' over the economics, but while this notion has some merit, burying our heads in the sand and ignoring how our electricity affects our air, water, food, land, security, and future is also not the answer.

It's time to move on from payback and look at buying and selling renewable energy from a value point of view.

But before we do that, let's look at the fundamentals of the payback argument.

Payback – the wrong issue

Evaluating payback is simple: total cost minus total rebates divided by the value of annual energy produced equals 'the payback'.

For the sake of an example let's say my solar system cost is $20,000, minus rebates of $10,000, then divide by (7¢/kwh * 3200 kwh/year)…

Oops! A long time ago I learned that good decisions can't be made with bad information. 7¢ /kwh is a 'typical' Oregon figure for electricity, but it wouldn't matter what figure I used because it's fundamentally flawed from the beginning.

In Oregon we get over 50% of our electricity from fossil and nuclear fuels. While it's true that solar cells produce pure electricity, that's not true for fossil and nuclear fuels. With fossil and nuclear energy we get a lot more than just electricity.

Along with the electricity produced from coal, natural gas, and nuclear fuels we also get: smog, acid rain, particulate pollution, mercury poisoning, health problems, severe security problems, severe waste storage

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Gov. Kulongoski Declares October Energy Awareness Month

On the inside cover of Green & Solar Homes Oregon is a proclamation by Governor Theodore R. Kulongoski declaring October to be Energy Awareness Month.

"I believe Oregon can become the national leader in renewable energy and renewable product manufacturing, which will stimulate our economy, reduce our reliance on fossil fuels and protect Oregon's environment for the future. Already, PV Powered, one of the emerging leaders in the manufacture of photovoltaic inverters, is located in Oregon. I am also working hard to locate one of the leading photovoltaic panel manufactures in Oregon."

Renewables are the energy source of the future and finally they are getting the recognition that they deserve.

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SOLAR RISING is the newsletter of the Oregon Solar Energy Industries Association (OSEIA). OSEIA is Oregon's local chapter of the Solar Energy Industries Association. The information presented in this newsletter reflects the opinions of the authors and not necessarily those of OSEIA.

The success of the newsletter depends upon your contributions. This is an opportunity to tell the OSEIA members about your activities and to express your opinions. Photographs or figures to accompany articles are most appreciated. Articles of current and timely interest will be given highest priority. Otherwise, articles will be published on a first come basis as room allows.

Send your contributions to:

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Draft OSEIA Meeting Agenda

Sept 14, 2004
12:00 am—3:00 pm
EWEB Conference Room—Eugene

1. (10 min) Introductions
2. (5 min) Approve previous meeting minutes
3. (40 min) Executive Directors report
4. (60 min) OSEIA's 2005 legislative agenda issues
5. (15 min) ETO program update
6. (15 min) Frank Vignola ETO PV performance results
7. (30 min) Membership Issues

More detail agenda on page 5 of this issue.

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Bob-O Schultze
John McIntosh
Tom Scott
David Parker
Diggy Breiling
Andrew Koyaanisqatsi

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Payback: It's (past) time to move on (again)

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issues…

Let's set aside, for a moment, the increased cases of emphysema, asthma, bronchitis, lung cancer, and heart disease. Let's ignore the increased rates of infant mortality and the tens of thousands of premature deaths every year associated with coal fired power plants. Let's forget about fact that we've just poisoned a major food supply, tuna, with mercury (coal is a major 'supplier' of mercury as well as electricity). And let's just look at one issue: global climate change.

Here are a few facts:

Fact 1: Global Climate Change is real. Our planet is warming.

Fact 2: The trend is worsening.

Fact 3: Human activity is a significant factor in global climate change. Our use of fossil fuels is a major culprit.

We don't know exactly what's going to happen but the predictions aren't pretty. The risks and uncertainty surrounding global climate change have the potential to alter civilization as we know it. Think about that for a moment and then look back to the '7¢ / kwh'.

Typical payback calculations are severely flawed. Not only is '7¢/ kwh' for traditional energy sources low but paying only 7¢ for a premium, clean, peak-load energy source like solar is equally unsound.

Payback – Let's move on

As an industry matures, it goes through several stages. They start off with engineers and 'techies' and eventually move into the mainstream with 'user friendly' products. This process just occurred with computers and the hi-tech industry.

The University of Oregon Lundquist School of Business included photovoltaics on the new Lillis Business Complex.

Using payback is a relic of the engineers and techies. Solar energy has had user friendly products for years. It's time to move forward.

When you purchase a Toyota Prius, why is the question: "what is the payback on that gas-electric hybrid" asked? But that same question isn't asked about the purchase of a Ford Explorer SUV, or Mercedes Benz, or in-ground swimming pool, or Starbucks-Vente-Carmel-Machiata…?!

All of these items are expensive and have less expensive competitors. Yet all sell in the millions. Why?

Imagine a car salesman comparing a Ford Explorer ($30,000 and 12mpg) to a Toyota Echo ($10,000 and 50mpg) and discussing the 'payback' time for the Ford? Sound ridiculous? Why are people still doing it with solar energy?

It's time for the solar industry to crawl out from the bunker we've been in since the early 80's and say goodbye to payback. It's inaccurate and misleading.

Economics certainly matter. However, millions of Americans can afford to purchase solar energy today but haven't done so. Why?

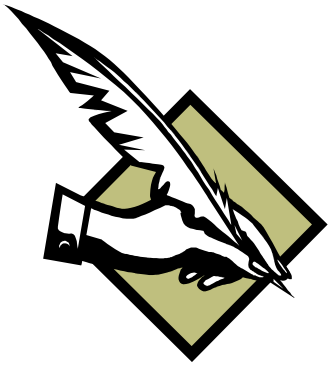
We've got to move forward and sell solar on its merits and value in a positive manner. People feel good about solar energy and that is where buying and selling solar energy starts. Pushing clean solar electricity back onto the grid makes people feel as good as with owning any other premium product.

We need to build on that feeling and note the other great reasons to buy solar: high quality, reliable, clean, quiet, sustainable, local, quality of life… These values are present in a premium product like solar energy.

Solar energy costs a little more than polluting sources of energy. But we're accustomed to paying more for premium products. Solar energy is a premium product that millions of American's can afford. And, after you factor in our environment and our children's future it's worth every penny.

April 13, 2004 MINUTES OF THE OREGON SOLAR ENERGY INDUSTRIES ASSOCIATION

by John McIntosh



The meeting was called to order on April 13, 2004 at 11:00 PM

The meeting was held at 500 E. 4th Ave., Eugene OR

The notice for the meeting was given more than seven days in advance by email, in person at the previous meeting, and by phone.

Present for the meeting were:

Ron Summers, Al Walker, Eric Morrison, Don Spiek, Cliff Schrock, Sonja Ling, Frank Vignola, Steve Musser, Tom Scott, Ray Pokorny, Phil Jefferson, Doug Boleyn, Ryan Mayfeild, Diggy Breiling, Andrew Koyaanisqatsi, Steve Still, David Parker, Bob-O Schultze, Bob Maynard, Newt Loken, Scott Sayles, Vince McClellan, Tim Miller, Trudy Walker, Robison Godlove, Geoff Wickes, Don Clements, Mark Gosvenor, Mike Sanford, Jon Miller

A quorum was present because there are currently 47 voting members and 14 were present at this meeting (10% of voting members are required for a quorum).

I. DISCUSSIONS

Reminded members of SOL deadline – July 1st 2004. Need to send out reminders to rest of membership.

Discussed setting up the SOL Training program. Ron Summers and Tom Scott were interested in getting involved. We need more support from the solar thermal industry to make this happen.

Diggy recommended using another online discussion forum outside of yahoo. Diggy will develop this and send notice to the group.

Discussed ASES conference in Portland on July 9-14th. Need outdoor displays, possible contact with Lloyd center merchants, free workshops, and local energy 'fair' to attract public to event. OSEIA members are encouraged to get a booth and receive reduced rates from ASES. See www.ases.org for more information.

Note from SEIA on federal legislation: the tax credit portion of the energy bill has been separated and moved into another bill that will likely pass this year. We will send the members results of what the new changes will mean after passage of the bill.

OSEIA is currently working with a group of individuals drafting net metering legislation. More details will be available as they are developed.

OSEIA should write a letter regarding flow meter malfunctions. Tom Scott, Ron Summers, and Andrew Koyaanisqatsi volunteered to draft the letter.

Cliff Schrock gave a presentation on a roof jack mounting system with standoffs.

Mark Gosvener, from First Mutual Bank, provided information on a residential loan program for small contractor customers. The loan program appeared quite flexible and many of the contractors were interested. If you want more information contact Mark at: 503-603-1642 or mark_gosvener@pgn.com.

Ryan Mayfield gave a

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April 13, 2004 MINUTES OF THE OREGON SOLAR ENERGY INDUSTRIES ASSOCIATION

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presentation on calculation of string voltages for PV systems.

II. ACTIONS

1. Prior Meeting Minutes: The following motion was made, seconded and passed:

   RESOLVED to approve the minutes of the Jan 13th meeting minutes as written.

2. Quarterly newsletter Hard Copy :

   The following motion was made, seconded and passed:

   Approved up to $150 per quarter for hard copy newsletters

Adjournment: There being no further business, the meeting was adjourned at 3:00PM

OSEIA Membership Meeting Agenda

September 14th 2004
12:00am – 3:00pm
Location: Eugene EWEB Conference Room
(see www.oregonseia.org for link to directions)

1. (10 min) Introductions
2. (5 min) Approve previous meeting minutes
3. (40 min) Executive Directors report
   - LRT/SOL License issues
     - 2 New Apprentice Programs
       - SOL & Combined SOL/LRT
       - 1:1, 1:2 apprentice to trainer ratio
       - I will bring applications for training agents and apprentices for these new programs. If you're interested in hiring a new apprentice please attend this meeting.
     - Getting more licensees involved with license issues
       - Continuing education
       - Apprentice programs
       - BCD rules & regulations
4. (60 min) OSEIA's 2005 legislative agenda issues
   - Net Metering
   - Solar licenses
   - Tax Credit Carry Forward
5. (15 min) ETO program update
6. (15 min) Frank Vignola ETO PV performance results
7. (30 min) Membership Issues
   - 2005 Officer & Board election discussion
   - Set date for next meeting

Pictures from Solar 2004

by Frank Vignola

Solar 2004 was a great success. Approximately 1250 people registered for the four day event in Portland. The conference started with a solar fair held on the roof of the hotel parking garage. Congressman Brian Baird and State Representative Gary Hansen showed up for the event and highlighted the interaction between interested people from the community and the solar experts who were attending the conference.

Brief speeches by John Reynolds, National Organizing Chair for the conference, Dennis Hayes, head of the Bullitt Foundation and the first director of the Solar Energy Research Institute, (now the National Renewable Energy Laboratory {NREL}), and Larry Kazmerski from NREL were part of the opening ceremonies. This also gave the Michael Grainey, director of the Oregon Department of Energy a chance to recognize the solar pioneers in the community.

More pictures are on pages 7, 11 and 12.

Congressman Brian Baird talking to a representatives from Isofoton with the Isofoton 6 kW photovoltaic array in the background.

John Reynolds, Professor Emeritus from the University of Oregon Architecture Department, welcomes people to the Energy fair.

Pictures from Solar 2004

Jon Miller, OSEIA's executive director, accepts a solar pioneer award for the Oregon Solar Energy Industries Association from Michael Grainey, director of the Oregon Department of Energy.

Becky Campbell-Howe, ASES coordinator, Brad Collins, ASES executive director, and Tom Starr, President of ASES, lead in a rousing round of "ASES", sung to the tune of "YMCA" at the ASES banquet. This was a memorial performance in a the events led by Larry Kazmerski of NREL.

Getting ready for the speeches at the solar fair.

Monitoring Solar Electric Systems for the Energy Trust of Oregon

By Frank Vignola

In 2003-2004, the Energy Trust of Oregon (ETO) initiated a program to monitor six different photovoltaic systems in order to adequately determine the kilowatt hours produced by photovoltaic systems (Table 1). The monitoring was done at a variety of locations around the state and with a assortment of system components. Data collected from these systems will be used by the Trust to estimate the kilowatt hours produced by systems installed utilizing ETO funds and to assist trade allies in providing more accurate estimates of power generated by installed systems.

The University of Oregon Solar Radiation Monitoring Laboratory (UO SRML), under contract with ETO installed the monitoring systems between September 2003 and February 2004. A number of conclusions are already beginning to appear in the data collected.

- For example, the PVWatts program used to estimate system performance, can be used to reliably estimate system performance if one knows the conversion efficiency between system DC rating and AC output. In general it appears that the conversion efficiency is between 80 and 90%.
- While some systems performed slightly better than others, performance of the SunVista, SMA, and PV Powered inverters were similar.

Table 1. Photovoltaic systems being monitored

Location	System Size	Panels	Inverter
Bend	1.12 kW_{DC}	BP 140 W	SMA 1800
Cannon Beach	4.20 kW_{DC}	Siemens ST 20 - ST 40	Advanced Energy 5000
Grants Pass	3.30 kW_{DC}	Sharp 185 W	SunVista 3500
Klamath Falls	2.90 kW_{DC}	Sharp 165 W	SMA 2500
Portland	1.20 kW_{DC}	Photowatt 100 W	Advanced Energy 1000
Salem	1.32 kW_{DC}	Sharp 165 W	PV Powered 1100

- A major problem is occurring with the Portland State PV system. When temperatures reach a certain level, the system performance is very erratic. The source of this problem has not been identified.
- Shading is a big problem. When one panel suffers shading in a string, the performance of the whole string is seriously affected.

Five minute data from the solar electric sites is available on the Internet at http://solardata.uoregon.edu. In the near future, plots of the data will also be made available on a daily basis.

A considerable amount of data has been collected so far, and efforts are being made to present the data in a manner that will provide the most insight into PV system performance and that will help lead to better installations. Any feedback on ways to present the data in useful formats contact Frank Vignola at fev@uoregon.edu.

In order to properly estimate the number of panels an inverter can handle without exceeding factory specifications, requests have come in for understanding the voltage and current verses temperature (See Figs. 1 & 2).

As the module or ambient (air) temperature increases, the voltage at which the inverter operates decreases. This is the result of the max power point tracking of the inverter. In Bend, the voltage of the eight 140 Watt BP modules connected in series varies from around 260 to 200 volts (Figs. 1 & 2). Therefore, the inverter for these panels has to operate efficiently in this range.

The max power point voltage decreases approximately 1 volt per an increase of 1°F increase in

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Monitoring Solar Electric Systems for the Energy Trust of Oregon

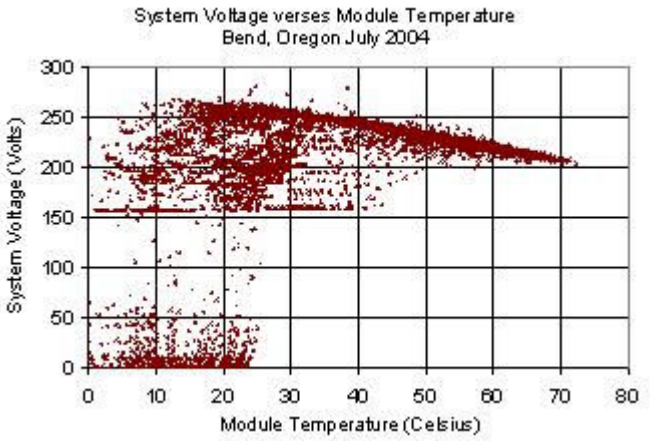

Fig. 1: Plot of system voltage verses solar module temperature. Two pieces of information can be gathered from this data: Module temperatures reached 70° Celsius or 160° F. Voltage decrease by about 1.16 volts for degree Celsius.

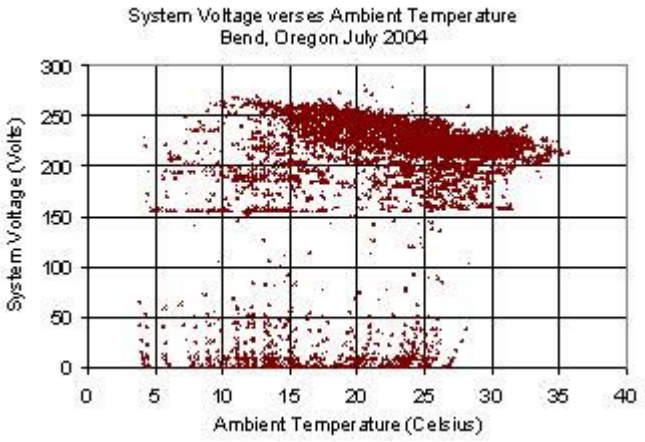

Fig. 2: System voltage verses ambient temperature. The system voltage decreases about 1.8 volts for each 1° Celsius increase or decreases about 1 volt for every 1° F increase. Many factors besides ambient temperature, such as wind speed and direction, affect module temperature.

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ambient temperature.

A more exact measurement is the relationship between max power point voltage and module temperature. The max power point voltage drops approximately 0.65 volts for each degree Fahrenheit the module increase. Of course this drop in voltage will vary with module type. Therefore, as is well understood, module performance will drop as temperature increase and this information can be used to demonstrate the importance of strategies to cool the modules.

Of course, one month or data from one site in only indicative, but it least shows some of the trends and magnitudes certain effects have.

Of vital interest is how well the PVWatts model predicts the performance of the system. One of the first tests performed was to compare the system performance against the model predictions. This was done in Fig. 3 where the ratio between model predictions and system performance is plotted against incident solar radiation. The model performs fairly well over most of the range. However, when the irradiance is about 150 W/m^2, the model systematically underestimates the system performance. Of course more tests are needed to find the cause of this discrepancy. It is either an errors in the model calculation (or programming) or the fact that the model was developed with data from older inverters that did not perform well under when irradiance was low. Again, more effort is necessary to find out why this is happening.

Another important factor is the determination of the proper coefficient estimating the estimated peak AC performance when the peak DC output of the modules is specified under factory conditions. In the example shown in Fig. 3, an 85% reduction between DC and AC output was assumed. An initial evaluation of the data seems to indicate that only a 90% reduction was required for this system. Of course this is only one month and calibration uncertainties and other factors may come into play. But, using a factor between 80 and 90% seem reasonable.

It is interesting to note that at lower intensities, the system performance seems to decrease or that the model over predicts the systems performance. Again these results are preliminary, but the measurements are beginning to result in some conclusions.

Shading can be a much bigger factor than appears on shade analysis forms because shadows

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Monitoring Solar Electric Systems for the Energy Trust of Oregon

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move across the array and affect the whole string while just shading a small portion of the array at one time. Fig. 4 shows the effect of shading for the system in Bend, Oregon. All eight modules are laid out in a row and are connected as one string. The pyranometer is on the upper east side of the array.

In Fig. 4, the dashed red line is the total solar radiation on a horizontal surface. There is a sharp dip in the afternoon about 14:00 (2:00 pm) when a tree shades the pyranometer. This is typical of the shading would be shown on the shading analysis form as a sharp spike.

From about 14:00 to 15:00 the shadow passes across the array and the output decreases by about a factor of 10. The shade analysis form does not capture the effect of the shadow moving across the array. No matter where one stands, the width of the shading would be underestimated.

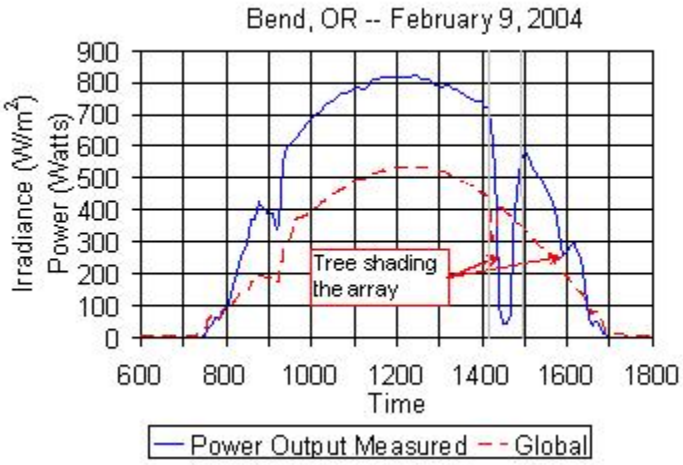

Fig. 4: Effect of shading on system production.

To determine the effect of shading, one would have to do a shading analysis on both sides of the array and then calculate the shading as the shadow moves across the array. This would involve considerable effort, so one must weigh the effect on the total system output. In practice, this means that the estimated effect of shading probably underestimates the reduction in output.

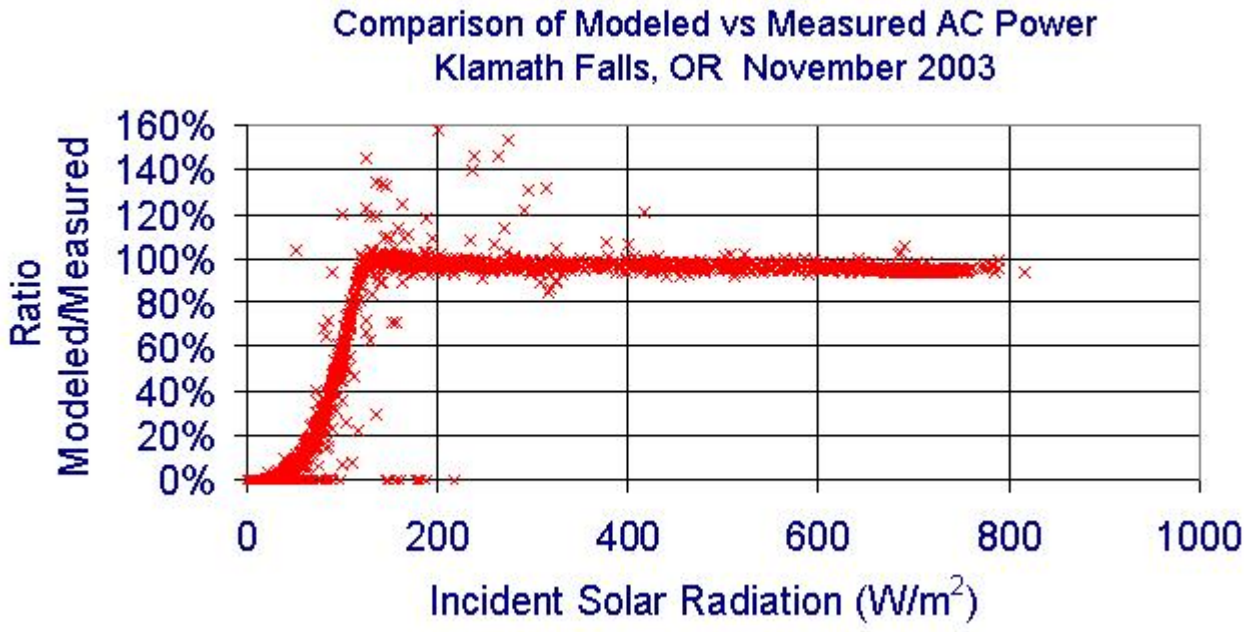

Fig. 3: Plot of PVWatt predictions verses measured system output for Klamath Falls, Oregon. For incident irradiation above 600 W/m² the modeled output is about 95% of the measured output. Therefore the system is performing better than predicted. Below about 150 Watt/m², the modeling does not match performance.

Pictures from Solar 2004

Jennifer Barker from EORenew demonstrates a solar cooker.

Portland's Solar Powered Parking Meter.

Christopher Dymond, a point person for the Oregon Million Solar Roofs Coalition receives the True Solar Champion Award at the Million Solar Roofs Meeting.

Christopher also gave a rousing speech at the annual plenary.

Jon Miller and Representative Gary Hansen At Solar 2004

Now is the time to identify and elect supporters of solar energy. Politicians are now out holding rallies and attending public gathering. Ask those running for office in your district about their stand on solar energy.

Even a small donation to their campaign will help them remember your name the next time you talk to them about issues that are important to you.

Two big issues in this campaign are jobs and education. Tell them that your business is in solar energy and discuss the issues that are important to you.

At the September 14th OSEIA meeting, issues important to OSEIA members will be discussed:

- Net Metering
- Solar licenses
- Tax Credit Carry Forward

OSEIA will be bringing these issues before the state legislature and now is the time that the legislators are listening!

OSEIA

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