

Don Lancaster's

RESOURCE BIN

number forty eight

Solar and Alternate Energy Resources.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja* questing, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

US callers only, please.

I'm now in the process of setting up my new *Guru's Lair* web site you will find at (where else?) www.tinaja.com This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprint sets for all of the *Resource Bin* and other columns. Plus a brand new *Synergetics Consultant's Newtwork* & lots of links to unique web sites.

You will get the best results if you have both *Netscape Gold* and *Acrobat Reader 3.0* installed. This new reader does utterly amazing things online.

Solar Energy Today

I guess we are long overdue for an update on solar and alternate energy. Certain recent developments (such as passive solar, construction alternates, and control films) are really coming along just fine. Others (like solar hot water) are more or less cost effective in some regions some of the time. But the big one (off-grid solar electricity) still has *serious* problems.

For instance, the largest solar power plant in the world shut down a few years ago. All of their panels are now getting retailed to the hobby market. Today, there is *much* more money to be made in selling surplus junk than there ever was in solar electricity.

Now, out here on any hot Arizona afternoon, there's up to 1200 watts per meter of peak incoming solar energy. Given an efficient enough converter, an average house roof could produce \$45,000.00 worth of electricity a year. Around *thirty times* what is normally

used by the folks living inside.

But efficient converters do not exist. And any solar rooftop system whose amortized yearly cost is \$45,000.01 can end up less than useless.

The first key problem is that silicon solar cells only respond well to *one* particular frequency of light. The light energy is proportional to wavelength. Longer wavelengths do not generate electricity and are thus wasted as low grade heat. And all the "spare change" excess energy from any *shorter* than needed wavelength also burns up as useless heat. Thus, your best possible theoretical efficiency of a silicon cell is only 28 percent.

The second thing that really gets to you is what I call the *nickel and dime effect*. Start with a less than perfect solar cell, losing "a little". Production yields often lose "a little" more, giving less than expected results.

You'll lose "a little" if your cells are made from amorphous silicon rather than single crystals. And then lose "a little" because of your anti-reflection coating. You lose "a little" because the cell wires shade themselves.

You'll lose "a little" because of your protecting glass. You'll lose "a little" because the cells don't fully cover the

NEXT MONTH: Don looks at the very fundamentals of nutting and volting.

expected area. You lose "a little" as the cells age. You use "a little" because of tracking losses.

You'll lose "a little" in your system wiring. You lose "a little" in the series protection diodes. You'll lose "a little" because the ac power converter costs money and is not 100 percent efficient. You lose "a little" because any storage batteries also cost money and are not anywhere near totally efficient.

You'll lose "a little" because, if you have a utility buyback arrangement, they sell you electricity *retail* but buy it from you *wholesale*.

You'll lose "a little" because of your time and bureaucratic zoning hassles.

And "a little" because of repairs.

Thus, individual cells do not a solar system make.

The third key problem is set by the *economic breakeven* limit. If someone gave you all the five percent efficient solar cells in the world, there is *no way* you could generate useful (110 vac at ten cents per KWH) electricity using them. Your costs of structure, land, ac conversion, labor, maintenance, and (above all) the *time value of the money involved* guarantees a net loss.

I have posted some interesting new solar conversion alternatives as my files HACK46.PDF and HACK53.PDF.

One uses direct conversion "crystal set" or "antennaifier" techniques. The other is a dye based solar conversion whose key ingredients are white paint covered by a thin magic dye layer.

Now, I have personally done solar research. And are developing closely with several others in the field. My magic sinewaves should significantly improve the cost and the efficiency of solar inverters.

But going off starry-eyed in a "save the world" mode simply will not hack it. Never did and never will.

Here, as I see it, are the key realities of solar power today...

(1) Solar is a rather diffuse energy resource. It is extremely difficult to efficiently gather and convert into any useful final electrical power form.

(2) You can now buy an *awful* lot of electricity for a mere ten cents off of your local power company.

(3) Solar success takes *bunches* of long term effort and continuous hard work. Frustration is guaranteed.

(4) Any effort that does not build upon the existing resource base and the already done research is doomed to failure. Fer sure.

(5) The "nickel and dime effect" will eat you alive. Every time.

(6) Alternate energy projects *must* include a total economic efficiency analysis. Including time to breakeven and the net return on investment. Fully taking into account *all* subsidies, both obvious and hidden.

Nonetheless, I strongly encourage you to go out and explore solar and other energy options on your own.

Let's look at some great places to get you started...

Home Power

Richard and Karen Perez publish *Home Power* magazine. Off grid and off line in rural Oregon. This is by far your first and foremost resource for low end, shirtsleeves "them that's doing" info. Besides solar, they are into wind and small scale hydro. Plus electric cars, lifestyles, insulation, the electronic fundamentals, lower priced home construction, and much more.

There are several other solar and alternate mags. *Home Energy* is mostly on how to insulate trailers. Its more of an industry trade journal than an end user publication. The original *Muddle Earth News* has long since yuppified. Its solar stuff now seems in the same league as *Popular Science*. Both seem useful, but big bucks, yuppy-oriented, and ad driven.

Much of the original Mother crew have set out on their own, publishing a fine *Backwoods Home* magazine. Still in the spirit of the original.

Backwoods Cabin is one imitator.

My most preferred ongoing "access to tools" resource of all time still is the quarterly *Whole Earth Review*, who've recently published their *Whole Earth Millenium Catalog*.

One good source for many listings of those labor-of-love alternate energy newsletters is *Factsheet Five*. Another "must have" favorite of mine.

Solar II CD

The *Home Power* folks have also just published a new *Solar II* CD. This one is a large collection of highly useful solar energy resources. Acrobat files, color, and sound. Cost is around \$29.

Don't miss this one. It has to be the most outstanding product in alternate energy research today.

World Renewable Energy Directory

This one appears to be the standard industry reference. The full title is *The World Directory of Renewable Energy Suppliers and Services 1995*. This is a European publication from *James and James Science*. ISBN is 1-873936-40-0. I do not know the price. It is free to at least some industry insiders.

Included are 6000+ suppliers from 100 countries. Plus hundreds of solar organizations world wide.

The topics covered include general articles, biomass, rational energy use, energy storage, geothermal, hydro & wave, instrumentation, photovoltaics, solar thermal, and wind power.

Real Goods

The highest profile retail direct mail supplier of alternate energy products does appear to be *Real Goods*. They do have everything from solar panels to efficient lights to books to control films to warm clothes. All in their free catalog. The catalog also includes lots of solar reference info and other tips and techniques.

Speaking of efficient lighting, I've just posted a fundamental review of lighting efficiency tradeoffs as my file MUSE95.PDF to www.tinaja.com

Solar Energy

The leading scholarly publication is *Solar Energy*. It's British and "a little" expensive at \$1200 per year. As the official journal for that *International Solar Energy Society*.

Subscriptions are much cheaper if you are a society member.

This is *the* place to go for first rate technical research. A larger technical library should stock these.

My favorite journal for theoretical energy fundamentals is *Science*. Their December 1, 1995 issue shows what may end up a major breakthrough in fuel cells. On page 1440.

Nature is another superb scientific journal on energy fundamentals.

Both *Power Engineering* and *World Cogeneration* are trade journals. Both are free to qualified subscribers.

Another free trade journal I have found to provide useful solar stuff is *HVAC News*. An oversized shopper for air conditioning contractors.

Solar Today is the "gee whiz" solar publication from the *American Solar Energy Society*. Sorry, but I feel that, at best, this one is second rate.

The free *NASA Tech Briefs* also has

new from DON LANCASTER

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The reprints from all Don's Midnight Engineering columns. Includes a broad range of real world, proven coverage on small scale technical startup ventures. Stuff you can use right now. **\$24.50**

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A complete collection of all Don's Nuts & Volts columns to date, including a new index and his master names and numbers list. **\$24.50**

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SYNERGETICS
Box 809-NV
Tatcher, AZ 85552
(520) 428-4073

Write in 146 on Reader Service Card.

SOLAR AND ALTERNATE ENERGY RESOURCES

AEE Energy Books PO Box 1026 Lilburn GA 30226 (404) 925-9558	EPRI Journal PO Box 10412 Palo Alto CA 94303 (415) 855-2000	James & James Science Waterside House 47 Kenilsh Town Road London NW1 8NZ, UK	Oak Ridge Natl Lab PO Box 2008 Oak Ridge TN 37831 (615) 576-8152	Rocky Mountain Institute 1739 Snowmass Creek Road Snowmass CO 81654 (970) 927-3851	SolarJack 325 East Main St Safford AZ 85546 (520) 428-1092
Am Wind Energy Assn 122 C Street NW 4th Fl Washington DC 20001 (202) 383-2500	Gale Research 835 Penobscot Blvd Detroit MI 48226 (313) 961-2242	Mother Earth News PO Box 70 Hendersonville NC 28793 (704) 693-0211	Office of Energy USID Room 508 SA-18 Washington DC 20523 (703) 875-4047	Sandia National Labs PO Box 5800 Albuquerque NM 87185 (505) 844-5678	Solec 12533 Chadron Avenue Hawthorne CA 90250 (310) 970-0065
Backwoods Home 1257 Siskiyou Blvd Ste 213 Ashland OR 97520 (503) 488-2053	GENie 401 N Washington St Rockville MD 20850 (800) 638-9636	NASA Tech Briefs 41 E 42nd St #921 New York NY 10017 (212) 490-3999	Oregon Solar Assn 7637 SW 33rd Avenue Portland OR 97219 (503) 244-7699	Science/AAAS 1333 H St NW Washington DC 20005 (202) 326-6400	Texas Solar Assn PO Box 16469 Austin TX 78761 (512) 345-5446
Black Range Films Star Rt 2 Box 119 Kingston NM 88042 (505) 895-5652	Home Energy 2124 Kittredge St #95 Berkeley CA 94704 (510) 524-5405	Natl Renewable Energy 409 12th Street SW Ste 710 Washington DC 20024 (202) 651-7500	Pennsylvania Solar Assn 5919 Pulaski Avenue Philadelphia PA (505) 244-7699	Solar Industries Assn 122 C Street NW 4th FL Washington DC 20001 (202) 383-2600	US Dept of Energy 1000 Independence Ave SW Washington DC 20585 (202) 586-1720
Colorado Solar Assn 1617 Cole Blvd Golden CO 80401 (303)231-7673	Home Power PO Box 520 Ashland OR 97520 (916) 475-3179	Nature 65 Bleecker St New York NY 10012 (212) 477-9628	Popular Science 2 Park Ave New York NY 10016 (212) 779-5000	Solar Energy 660 White Plains Road Tarrytown NY 10591 (914) 524-9200	Whole Earth Review 27 Gate Five Rd Sausalito CA 94965 (415) 332-1716
Dialog Information Svcs 3460 Hillview Ave Palo Alto CA 94304 (415) 858-2700	HVAC/Contractor 1350 E Touhy Ave Des Plaines IL 60018 (708) 635-8800	Northeast Solar Assn 50 Miles Street Greenfield MA 01301 (413) 774-6051	Power Engineering #302 1250 S Grove Ave #302 Barrington IL 60010 (708) 382-2450	Solar Engineering/ASME 345 E 47th Street New York NY 10017 (800) 843-2763	World Cogeneration 84-54 118 St Kew Gardens NY 11415 (718) 847-0230
Enterra Group 286 State Route 65 River Falls WI 54022 (715) 425-9798	Intl Solar Soc USA 2400 Central Avenue G-1 Boulder CO 80301 (303) 443-3212	NM Solar Energy Assn 2021 Zearing NW Albuquerque NM 87104 (505) 243-3212	Real Goods 966 Mazzoni St Ukiah CA 95482 (800) 762-7325	Solar Today 2400 Central Ave G1 Boulder CO 80301 (303) 433-3130	Zomeworks PO Box 25805 Albuquerque NM 87125 (505) 242-5354

some government solar stuff in it. The overwhelming majority of its content seems to me to "just barely" miss.

With the exception of *Sandia Labs* who do offer outstanding solar design services, much of government solar power has ended up less than stellar. A largely counterproductive waste.

At least out here in California and Arizona, an alarming fraction of all those outrageous solar subsidies from a decade back were simply gobbled gone by boiler shops and fast buck artists. As investment scams.

One federal demonstration school solar cooling project in the southeast found it worked "a little" better if you added a five ton evaporative cooler to the output. But then somebody asked how big an evaporative cooler they would have needed *without* the feds solar cooling involvement.

The answer: *Three tons!* Oh well.

Online Resources

There's bunches of online solar and alternate energy resources. Many are listed in the Solar II CD. You can also use the usual directories and guides to get a complete listing. One good choice is *yahoo.com*

Let's look at two samples...

solstice.crest.org provides an older collection of traditional solar reports and pubs. Apparently a DOE effort,

its last update was in 1992.

umbra.gsfc.nasa.gov/sdac.html holds a *Solar Data Analysis Center* data base providing information relating to the study of the sun. Astronomical stuff like eclipses and solar flares.

By the way, these two have been excerpted from the new *Gale Guide to Internet Databases*. One of many new printed Internet guides. In general, those online guides, CD's, and search services have more listings and more current info than printed ones.

I have also posted a long list of electrical and electronic Internet sites to my *www.tinaja.com* as MUSE94.PDF. And, of course, the *Dialog Information Service* can be used to instantly find information on any solar or alternate energy topic. By way of your nearby library, on *GENie*, on a CD ROM, or from the other online services.

Solarjack and Zomeworks

You will find lots of solar suppliers listed in *Home Power* magazine and on their Solar II CD ROM. A pair I can heartily recommend are Jim Allen's *Solarjack* and Steve Baer's *Zomeworks*. Both have been hard workers clearly in it for the long haul.

Solarjack is one of the scant few successful tech industries here in the Gila Valley. Their specialty is ultra high efficiency water pumps. All fully

solar compatible. All made locally on fancy CAM production machines. Jim also sells the *Solec* panel modules and similar products.

Jim's first secret to survival is to address the "Uh-Compared to what?" markets where solar power is the *only* solution. Locations like Bolivia, the Narobi desert and a few remote sites on Arizona Indian reservations.

His second secret is integrating the components into an entire workable system. Pumps get fully optimized to panels. While minimizing the nickel and dime effect.

Zomeworks has been in business since solar year one. In fact, Steve's labor-of-love *Sunspots* publications long ago defined the opening spasms of the alternate energy revolution.

Today, Steve recycles those "gold" *Carizzo Solar* panels. He also provides efficient and effective solar trackers, energy control systems, passive solar products, and new *Cool-Cell* battery coolers for remote utility sites.

EPRI and AEE

The *Electric Power Research Institute*, or EPRI for short, has all sorts of solar and alternate energy videotapes and publications. Their membership is a tad pricey at a quarter mil per year. That's for an individual. I didn't ask what their family rate was. But most

of their research materials are offered on a cash-and-carry basis.

They also publish an *EPRI Journal*.

Most of their research is first rate. They are basically a consortium of big electric utilities. Grants are issued to study just about any and all energy options. Ranging from coal, oil, and nuclear on up through solar, wind, and conservation.

The *Association of Energy Engineers* is a professional trade group. They have an outstanding bookstore on just about any and all energy issues. They also do get involved in seminars and industry shows.

Yet another major energy resource is the *Rocky Mountain Institute* run by Amory Lovins. Thorough studies about everything from economics of home energy conservation to new options in hybrid electric vehicles.

Straw Bale Homes

There's a lot of fresh new interest in straw bale house construction. The bales are potentially cheap and offer fine insulation qualities. And they are more manageable than they might first seem. At least around here, zoning officials seem surprisingly receptive.

A really superb series of videos on straw bale homes gets distributed by *Black Range Films*. Including guided tours and detailed step-by-step and hands-on construction details.

Be sure to check these vids out. The same people do alternate construction seminars and run an outstanding (and reasonable cost) wilderness bed and breakfast lodge. Hidden deep in the top secret portion of New Mexico that you can't get to. I'd be happy to meet you there most any time.

Free brochures are offered. Be sure to tell Cathy I sent you.

Magic Sinewaves

My own in-process contribution to solar energy is a brand new technique called *magic sinewaves*. Compared to older PWM pulse width modulation, the magic sinewaves greatly simplify solar inverters and make them much more efficient.

Magic sinewave ac power inverters can run much cooler, using lower cost output transistors and more compact heatsinks. Related magic sinewaves can work with induction motor speed controls and electric autos.

I've got full consulting services and codeveloper programs available on these. All the tools are functional and in place. Including source code and

working chips. If you write, email, or call, I'll be happy to send you a free tutorial reprint on magic sinewaves. You can also pick this one up as file MAGSINT.PDF on my www.tinaja.com Or, for scads more detail, search the *Magic Sinewave* library shelf to pick up dozens of the latest files on this new billion dollar opportunity.

This Month's Contest

For our contest this month, just tell me about some solar resource I don't already know about. Or tell me about some alternate energy story you have been involved in.

Or tell me about most any solar or alternate energy online resources you happen to have discovered.

There will be a largish pile of my new *Incredible Secret Money Machine II* books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) *tinaja quest* for two that will go to the very best of all.

Send all your *written* entries to me here at *Synergetics*, rather than to *Nuts & Volts* editorial.

To be fair to everyone, all entries must be printed and mailed.

Acrobat quality reprints of all my *Nuts & Volts* columns are available on www.tinaja.com This particular one is called NUTS48.PDF. Another alternate energy resource summary appears as my HACK28.PDF file.

A reminder: I have just bought an *entire* community college electronics department at auction. So I have got some great surplus buys. Especially Tek logic analyzers. You could write, call, or email for a free catalog. Or grab it as SURPCAT1.PDF.

Let's hear from you. ♦

Microcomputer pioneer and guru Don Lancaster is the author of 33 books and countless tech articles. Don maintains his no-charge US tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and consulting services. Don also has two free catalogs full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Funding and time constraints restrict this helpline service to US callers only.

Don is in the process of setting up his Guru's Lair at <http://www.tinaja.com>

Full reprints and preprints of all Don's columns and ongoing tech support appear here. You can reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his US Internet address of don@tinaja.com