

Don Lancaster's

RESOURCE BIN

number fifty one

Son of alternate energy the 13th, part 6.

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.

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* columns. Along with some new "rich text" global search features.

The site is still under construction, but I fully intend to move thousands of my files here. So, definitely come visit. But bear with me for a while till things really get into gear.

You will get the best results if you have both *Netscape Gold* and *Acrobat Amber*. These are downloadable from www.netscape.com or www.adobe.com

Alternate Energy Update

I have a pile of stuff left over from our alternate energy column from two month's back. And a quite a bit more has shown up since. Especially lots of feedback from quite a few of you *Nuts & Volts* readers. So I thought a sequel might be in order...

A Contest Winner

Our tinaja contest alternate energy winner was Dave Williams from up in central Colorado. Dave's well thought out letter touched on many topics. He was an engineer participant in many government energy fiascos.

His *Stirling* engine involvement did confirm what I've said several times now: Except for arcane cyrogenic aps, the *Stirling* engine seems to me to be an outright scam whose primary use is to liberate federal agencies of your

hard earned tax dollars. Org.

For openers, any heat engine faces a fundamental limit known as its *Carnot Efficiency*. Which says that the lower your temperature differential between the input and output, the lower your best possible efficiency.

Most solar and geothermal aps start off using inherently low efficiencies. Even more so when you start playing around with ocean thermal or some hot artesian well water.

The problem with a *Stirling* Engine is that it offers you the nickel and dime effect in spades. On top of these low efficiencies. It appears there is a crucial part required for any *Stirling* engine called a *regenerator*.

Uh, a *regenerator* has to be short and fat. And long and thin. Besides being an outstanding conductor of heat. And an excellent insulator.

Sterling does have its fans, though. An external combustion engine that can run on anything from sunlight to oily rags. The only little kicker is that nobody has ever built one that works nearly well enough to be cost effective for any home power uses.

If you require some more details on this continuing absurdity, there is a *Stirling Machine World* that might be happy to accomodate you.

Dave points out that reselling small amounts of power back to your local utility just doesn't make any sense at all. A crucial problem here is that the

NEXT MONTH: Don shows us a few of the Actors and Acrobats he personally uses.

synchronous inverter used for the grid connection *by itself* sometimes takes as much as *thirty years* for payback. Even if the *entire* rest of your solar energy system is *absolutely free*.

Dave's summary is telling...

"Although I don't want to sound too negative, I do consider myself attuned to environmental issues. But you'll have to face all the facts with solar power. What bothered me was the hippies and dreamers I met along the way. People who really believe we should all have pv panels on our roofs. But they don't believe the cost numbers which I would tell them and the basement full of batteries I described."

"People really believe this technology is cheaper and better. And there is a great conspiracy in Washington (oil companies) not to use it. There are only two reasons we don't use solar electricity: It costs too much and it doesn't work! I would only consider solar for fun or for remote areas of the Southwest."

Economic Analysis

Economic analysis is simple enough to do. It's just that a lot of people who should know better don't bother to do so. All you do is add up your costs of setting up some system or venture. You then add in the the time value of the money used for financing.

Next, you realistically evaluate the income you hope to generate. You'll acheive a breakeven *when and if* the venture pays for itself.

For instance, lets assume you find a 50 watt surplus solar panel for \$320. Without getting into interest rates or loan lengths, let's temporarily assume \$80 in time-value-of-money financing charges. For \$400 total.

We will make the totally ridiculous assumption that land, labor, structure, and energy conversion is all free. And that your ap can magically make use of the raw variable current dc coming off your panel. What is our projected time to breakeven?

Let's further assume we are in a good southwest location. If we are lucky, we might actually get a full 50 watts for eight hours per day.

Knock that back down to 40 watts for cloudy days, aging and for repairs.

At ten cents per kilowatt hour, we've generated 3.2 cents per day.

Your economic breakeven here will take place in a mere 12,500 days. Or a tad over 34 years.

In the real world, it becomes uglier. What you have to do is ask how many years it takes to amortize a \$320 loan with a payment rate of 3.2 cents a day. The answer will highly depend upon your interest rate. At three percent interest, payback takes over a century.

At higher interest rates, you *never* break even. In fact, the longer you run the panel, the more it will cost you.

Thus *your solar project will never accomplish anything useful*. Because your interest expenses exceed the 3.2 cents per day of generated revenue. With most solar projects, it is trivially easy to *never* break even.

All of which helps explain just why economics is called the *dismal science*.

There is only one way I know of to "beat" economic analysis. And that's when you can find an "*Uh-Compared to What?*" factor. If your site is remote enough, solar electricity sometimes can make an awful lot of sense. But if a utility grid is nearby, no way.

The cost per kilowatt hour you are willing to pay is the key. For instance, solar calculator users are happy as a clam paying \$50.00 per kilowatt hour or higher for their "free" electricity.

That is fifty *dollars*, not fifty *cents*. Which tells us why a lot more solar cells go into the calculators than ever appear on rooftops.

Four Books

Four publications showed up that do deserve special mention: The *Solar Electric Products & Planning Guide* is a \$5 dealer catalog and design resource available from *Sunelco*. 130 pages of real-world ready solar stuff.

Wind Power for Home and Business does cover renewable energy for the nineties and beyond. It's published by *Sun Lab* and is offered by *Real Goods Trading Company*.

A Kurt McLauren hands-on *Mico Cogeneration* book does deliver some surprising alternate power economics in self-generation that uses your own diesel powered generator.

In some instances, as little as a half mile of new utility line can often lead you to an economic breakeven.

Especially if you can scam cheap to free "contaminated" JP-4 from your smaller local airport. And when the generator's unavoidable waste heat can get reused for hot water.

Finally, you will find a brand new *Community Energy Workbook* from the *Rocky Mountain Institute*. This one is mostly a guidebook and a set of plans for local involvement.

Electric Cars

There's some real hogwash coming down today in the electric car arena.

Firstoff, *all* of the largest trucks and *all* of the most powerful locomotives in the world today *are* electric. They have been so for decades. Thus, your core engineering problem is making electric vehicles *more* wimpy.

Second, you will find an absolutely incredible and mind boggling amount of recoverable energy in a tank of gas or diesel fuel. So much so that there is *no* battery technology available today which *even remotely* will approach the energy density or volume efficiency of a full gas tank.

Not by two orders of magnitude.

Thus, a "batteries only" design for a electric highway auto is a *laughingly ridiculous absurdity* today. Sorry, GM, but you have got an outright joke on your hands. I can't believe they did this on purpose.

Second thought, maybe they did.

Besides suitable batteries just not existing, there's also no way to charge them in Detroit quantities without a total electric utility meltdown.

I strongly feel that batteries-only makes no environmental sense. None whatsoever. Nor any economic sense. The hidden costs and inconveniences here are humongous. All of which is *before* such creature comforts as useful heating or air conditioning.

What does make a *lot* of sense is the *hybrid* vehicle. One having a smallish and a fixed speed diesel or gas engine which is able to continuously charge a small set of batteries.

The batteries get used here to meet peak power demands, for low speed travel in pollution-sensitive areas, to improve safety, to simplify the drive train, and to provide for regenerative braking energy recovery. Your single speed engine can easily be optimized. Pollution can be very low. And all the technology is here today. Plus no new infrastructure is needed.

The minimum number of electric motors, of course, would be four. To give you a full time all wheel drive. While getting rid of all transmissions, differentials, and any other drive train parts. And greatly simplifying brake systems. All of which get replaced by a PIC microprocessor and a wire.

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Actually, if you think about what the semiconductor chip people are up to these days, the optimum number of motors for an electric car is probably something between 4000 and 40,000. All arranged radially on slip-on disks or cartridges. Which let you optimize for pollution, economy, comfort, for off road use, or performance.

Switched reluctance brushless ac technology, of course.

Well yeah, there's that old sprung ~vs~ unsprung weight hassle. But this is surely sovable without any major new breakthroughs.

There definitely is new hope in the battery field. One candidate known as *rechargeable lithium polymer cells* may make it someday. The real motivation in battery improvement, though, will *never* come from Detroit. The hidden agendas and outright stupidities will guarantee that.

Instead, the laptop computers will surely save their day. A laptop needs *far* higher energy density and *much* greater volumetric efficiency than an electric car. They are an instant and in-place billion dollar market. Up for grabs here and now. One that surely will not be ignored.

Let's see. There's this guy named Michael Hackleman who seems to be a leader in alternative electric cars. His brand new book is titled *The New Electric Vehicles*. Detailed reviews of them-thats-doin' conversions, scratch builds, and human-electrics. It even has some planes and boats.

Price is \$25. It's available through the great folks at *Home Power*.

Convert-It is a hands-on electric car textbook from Mike Brown and Shari Prange. This one is available through *Electro Automotive*.

You also may want to check into *Why Wait for Detroit* by Steve McCrea. Offered by the *Southern Florida Electric Auto Association*.

There is also a *Future Drive: Electric Vehicles and Sustainable Transportation*. Published by the *Island Press*.

One source for battery fundamental technology breakthroughs is *Interface* magazine. The official journal of the *Electrochemical Society*. Establishment style electric auto info appears in the *SAE Library* and the *EPRI Journal*.

Along with an occasional mention in *Automotive Industries* or *Automotive Engineering* magazines.

A typical old line text is the rather dull *Electric Vehicle Power Systems*. No one owns up to being its author, but it is *SAE* publication SP-984.

Detailed economical analyses of the hybrid vehicle are offered by Amory Lovins of the *Rocky Mountain Institute*.

Ask for *Supercars—The Coming Light Vehicle Revolution*.

Some bargain priced surplus power driver modules for electric car designs are sold by *Beyond Electronics*. Costs start as low as \$18 for higher current output devices.

Uh, I've also got this sneaky *magic sinewave* scheme that can very much improve the efficiency of electric auto drives. You can write or call me for a free tutorial. Consulting, development services, PIC chips, and seminars are also newly available.

Human Power

An ordinary bicycle is nearly *fifty* times more energy efficient than most cars. In places where weather, traffic, and ripoffs permit, they can be nearly ideal transportation. Thatcher is really superb bike country, yet only a few fitness mavens are ever seen around here on two wheels. Except for those kamakazis who terrorize wilderness mountain trails.

It does turn out there is a *Human Powered Vehicle Association*. Who now publish the *Human Power* mag. Much of the technical content is surprisingly sophisticated. \$20 for four issues. And a *HPV* member's newsletter.

There is also a *Bike Cult* book, that's subtitled *The Ultimate Guide to Human Powered Vehicles*. By David Perry and sold by *Four Walls, Eight Windows*.

One leader in this field is nomadics enthusiast *Steve Roberts*. He is into everything from recumbent bikes to ocean going catamarans.

Steve's temporary current address is often somewhere in or about planet earth. Hard telling, though.

His web site is www.microship.com. Email is at wordy@qualcomm.com. Plus news at nomadness-request@ucsd.edu.

There is also the *Railbike Newsletter*. Railbikes have super training wheels that let them operate on seldom used railroad tracks. One advocacy group is the *Rails to Trails Conservancy*.

Technical bicycle fundamentals do appear in the classic *Bicycling Science* book from the *MIT Press*.

Want a personal HPV project? It

might get really interesting to replace a cycle's crankset with some sort of a new variable displacement hydraulic pump. Routing center delivered oil to the rear wheel. All done with a pair of supply and return tubes.

Besides eliminating the chain and simplifying the shifter mechanisms, this can (A) give you a continuously variable transmission that has (B) an ultra-wide chain length range and (C) seamless on-the-fly shifting easily made (D) leg position efficient. Like an elliptical crank except personalized. And be (E) easily microcontrollable.

Yeah, the prototypes might be a tad pricey. But in high volumes, such a system wouldn't have to be all that expensive. Any thoughts here?

Some Bits and Pieces

Early column readers might just be able to make the *Globalcon '96* energy efficiency conference. It is being held April 3-4, 1996 at Denver's *Colorado Convention Center*. It is sponsored by the *Association of Energy Engineers*.

A product called *Cloud Gel* is clear when it is cold and turns milky white as it gets warm. It's intended for us in environmental control panels. And is sold by *Suntek* in Albuquerque.

A variety of energy and solar home books is offered by the *American Solar Energy Society*.

The *RE News Digest* is a very pricey newsletter on the latest happenings in renewable energy. There's a separate international scholarly journal called *Renewable Energy* and published by *Pergamon Press*.

Other fancy pubs do include *Energy Storage Systems Abstracts*, a *Buildings Energy Technology Abstracts*, and the *Photovoltaic Energy Abstracts*. All from publisher *WindBooks*.

There are zillions of small regional

solar suppliers. One that's sort of in my area is *Hitney Solar Products* on up in Chino Valley. Free catalogs. Lots of similar firms advertise in *Home Power* and *Home Energy* magazines.

E-Source bills itself as the world's leading source for info on advanced techniques for electric efficiency. This is a for-profit subsidiary of the *Rocky Mountain Institute*.

This Month's Contest

Let's just continue our contest from two month's back. Just tell me some alternate energy story. Make it horror, success, or otherwise. Or else tell me about an alternate energy resource I don't already know about.

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.

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.

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