

Every now and then some old idea gets rediscovered. One that might seem "gee whiz" brilliant on the surface, but has some really nasty hidden gotchas. Let's look at one that has caused me some grief in the past. Figures one and two will get us started.

This one involves...

### Reactance Limiting

Say you are using the 110 volt ac power line and need to run a much lower voltage device. What are your choices? You might use a step-down transformer, and pick up some safety isolation in the process. You could use a series resistor, inefficiently and hotly burning your difference up as heat. Or, you could rapidly turn your input on and off, changing the duty cycle in a much more efficient and easily adjusted manner. This is what triac lamp dimmers and switch mode supplies are all about. And are often your most popular choice today.

But we have a fourth and sneaky route. You can use the reactance of a capacitor or an inductor to provide the voltage drop for you. In theory, a "pure" capacitor or a "pure" inductor stores energy without dissipation. A reactive voltage drop sometimes can end up "lossless".

For instance, in figure 1, we use an inductor known as a *ballast* to limit current to an older single fluorescent bulb desk lamp. There are three steps to the operation: Both switches are initially closed. The lamp's filaments both light, heating the emitters in the bulb. Your inductor behaves as a reactance limiter to hold the filament current to a design level. After a second or two, the start button is released. All of a sudden we have open circuited an inductor with a large stored magnetic field in it. Your suddenly collapsing field generates a rather large voltage spike of many thousands of volts, "striking" your bulb and lighting it. Your lit bulb now conducts and the reactive ballast acts as a "lossless" run-time current regulator for you.

Use of inductive reactance limiting has worked out fairly well for a long time. But these days, we'll use switch mode electronic ballasts instead. The newer electronic ballasts are smaller, lighter, and more internally efficient. Some are dimmable. They often run the lamps at higher frequencies, for more efficient phosphor excitation and eliminating dangerous strobe effects. They are also gentler on the power line.

Can we use a capacitor as a simple and cheap ac reactive current limiter? At first glance, the answer is yes. But there might be some *severe* problems lurking in the shadows.

Not to mention that *this stunt has recently been outlawed*. For instance, figure two shows a recently proposed line operated generator for hydrogen and oxygen. An electrolysis cell will need only 1.5 volts for operation. So the lion's share of the ac voltage drop takes place across the capacitor. And do so simply and efficiently.

What could possibly go wrong?  
go wrong?

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Well, for openers, we have got a deadly "hot chassis" shock hazard. If the user expects only a volt or two to be present at their cell, they are in for a rude surprise. Two options here: Either provide for a safety isolation transformer, or else seal the *entire* circuit up so nothing is touchable.

Next, any poorly chosen capacitor

can and will explode! A cheap cap, or one with too high an ESR *effective series resistance*, or one not properly ac current rated can quite easily self destruct. Electrolytics, in particular, are a big no-no here.

I do suspect that battle scars still remain on Watson Hall at Lafayette College from the 1960 cap explosion that was a key controlling part of a fall weekend float competition. Or so "some sources close to an associate of the barber of a usually reliable spokesperson" tell me.

Fortunately, it was after we won.

Asides: This also was my first *tv typewriter* having a one character six foot high display that serially spelled out CRUSH LEHIGH. Referring to a grossly inferior remedial school from a ghetto to the west.

Watson Hall also used to have five floors. But that is another story.

Where were we? Oh yeah. Let us get back to the dangers of capacitor reactance limiting. The charge on a capacitor cannot suddenly change, so if you close the switch near an ac line peak *the full line voltage can appear briefly across your load!* In this case, a 1.5 volt system has nearly 200 volts suddenly thrust upon it. Such an ugly *transient* can cause heavy damage, besides badly glitching your power line with a nasty spike.

A series resistor can help, but is not a cure. Thus, using a cap in series with a pilot light or LED may very

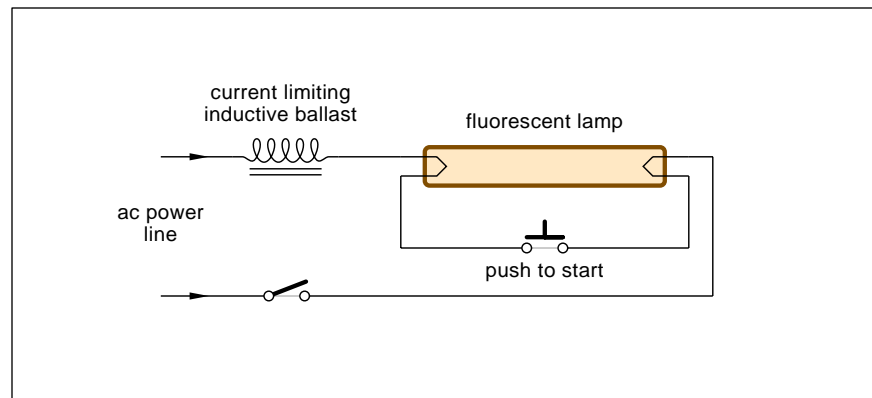


Fig. 1 – FLUORESCENT LAMP BALLAST can offer you "lossless" inductive reactance current limiting.

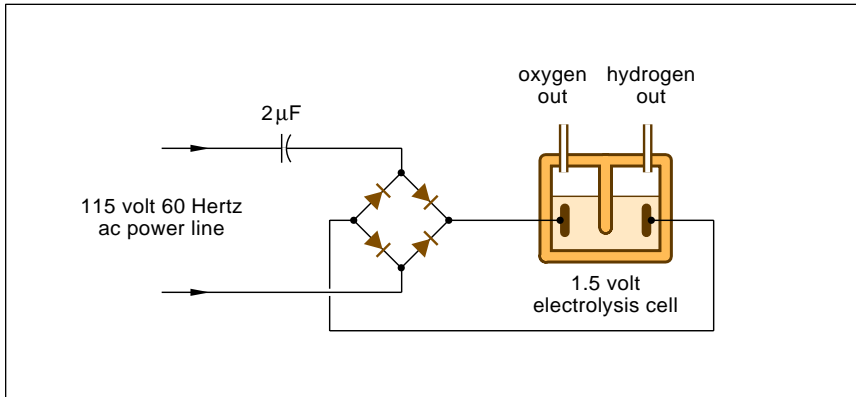


Fig. 2 – BESIDES BEING ILLEGAL, what else do you see wrong with this capacitive reactance current limiter circuit?

much shorten the lamp's life.

Bad idea.

Any series capacitor is largely a current regulator, so output voltage will shift badly with changing load. *With no load, you end up with the full ac line at your output!* Because an electrolysis cell is supposed to be a constant voltage device, this is not normally a problem.

Until you are almost out of water.

This series cap is also a *high pass filter*, so *harmonics are emphasized*.

Your ninth harmonic gets relatively "amplified" by twenty decibels. Once I did try to use a series cap on a 400 Hertz aerospace app. I was amazed to observe huge seventeenth harmonic glitches. Turns out they were highly "amplified" slot noise from the 400 Hertz lab generator. Similarly, any spikes or transients get relatively "amplified" and raise havoc.

Last, and by no means least, use of reactance limiting is now illegal in Europe, and shortly will be in the US.

Highly stringent restrictions severely limit any harmonic or reactive energy you are allowed to put in or take out of the commercial power line.

The 60 Hertz current limit you'll get for various sizes of inductors or capacitors appears in figure three.

Safer and saner alternates to series capacitors are offline switch mode operation and the new *power factor correction* chips. From such sources as *Maxim, Motorola, Unitrode, Burr Brown, Analog Devices*, and many others. Details on new power quality regulations appear in *Compliance Engineering*. Plus, of all places, in *Power Quality* magazine.

### Great New FM Service

Check <http://wmb.r.mit.edu/station/s/locate.html> for a free FM station online directory service. You can find out what that weak mystery station at 91.7 is without having to wait for call letters. You can make complete lists for every expected station in your area, local, distant, fringe, or manic.

Or, if you are planning a trip, just enter the cities for each 30 miles into your route and extract a list of strong local stations to listen to. Better yet, print up a custom glove compartment book for every town that you are ever likely to visit.

We looked into FM DX tricks and techniques on back in [HACK86.PDF](#). You'll do best with an elevated ten element Yagi antenna and some 12 decibel line amplifier sent to a high quality receiver. Such as the Denon TU650-RD. Especially one that lets you switch select a narrower mono IF bandwidth.

But note that local radio stations might have low level *spurs* at wildly different frequencies. In my case, a local spur trashes Tucson's superb KXCI. Also, strong signals can cause *cross mod* and may splatter stuff into unexpected places. So be sure your ultra weak signal is not really just a nearby station in disguise.

### Shades of Gray

There sure are a lot of webizens questioning just how and why all of those "overunity" miracle motors are getting suppressed. A pair of older examples are called the *Gray* motor and the *Adams* motor. There are a

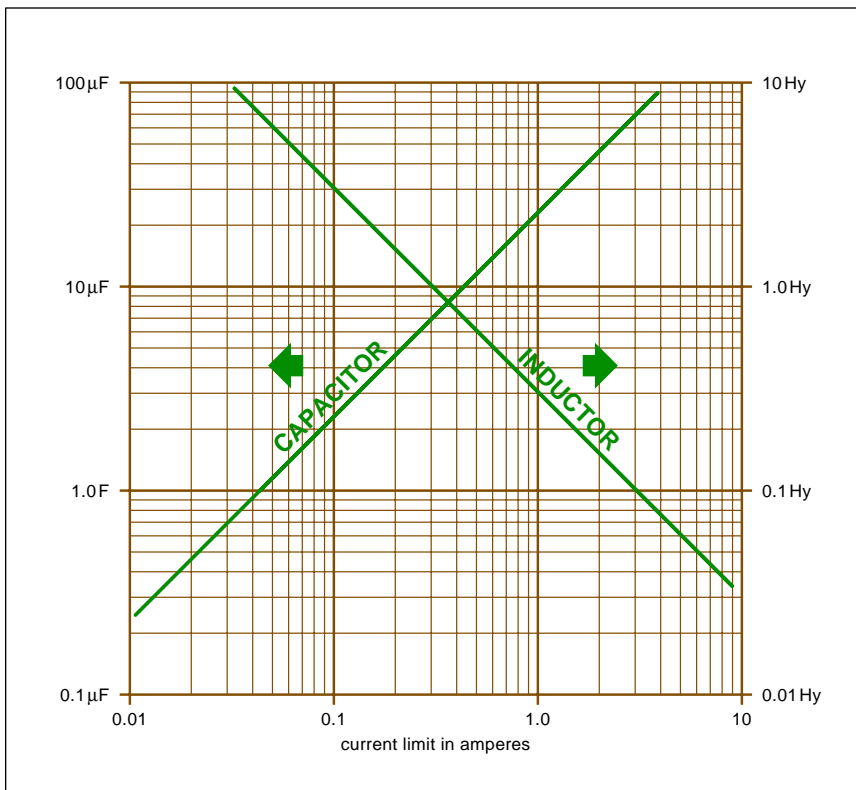


Fig. 3 – MAXIMUM CURRENT LIMITING VALUES for inductors or capacitors connected to the 115 volt, 60 Hertz ac power line.

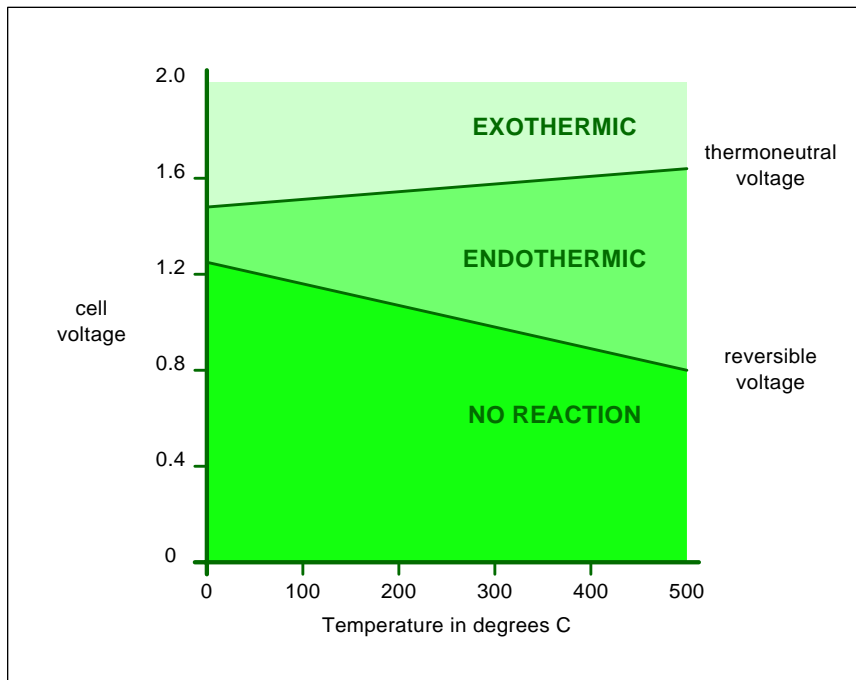


Fig. 4 – NOT ALL HYDROGEN ENERGY need come from the electricity input to an electrolysis cell. Up to one sixth of the energy can sometimes come from waste heat instead. Sadly, this effect is more curious than useful.

dozen equally improbable candidates.

The usual cause for suppression of a miracle motor is labwork that is so utterly and mesmerizingly awful that it is not even wrong.

At that point, the developer will realize the error of his ways and will quietly move on to other things. Or else the supporters find working with a misguided and a wildly intractable "inventor" to flat out not be worth the hassle. Life is too short.

But given enough obstinance, the miracle motor eventually becomes a prime candidate for marketing as a "suppressed" pseudoscience ripoff. With the usual overwording, murky copies and shaky videos.

And that is why miracle motors get suppressed. For the money.

To date, there has *never* been any miracle motor that has been able to survive a diligent enough search for bad enough labwork. Miracle motors simply *do not work*.

There are several reasons for bad labwork. First and foremost is not understanding what a true scientific experiment, or correct measurement, decent documentation, and realistic interpretation is all about. Second is confusing average and rms currents. *Ordinary ac meters lie like a rug!*

Third is failing to understand what a counter emf is and how it works. Fourth is not getting an independent verification.

Fifth, and the real killer, is failing to realize just how excruciatingly difficult it is to accurately measure real power. Especially with strange waveforms, nonlinearities, sparking, noise, harmonics, fields, reactance, or subtle hidden effects.

Most of those casual free energy enthusiasts often fail to pick up on a key point: The beginning electrical engineering students have spent over a century and a half perfecting bad labwork. They labor thousands of hours *each day*. Year in and year out. Creatively finding newer and better ways to trash up measurements, to misintrepret results, fudge reports, or jump to wildly wrong conclusions. They are the undisputed all-time world champions at this.

You have to ask: "Why have all of these bad labwork professionals consistently failed to ever find even the faintest trace of some fumes of anything even remotely overunity?" While doing so with proper training, tools, and environment?

If you want to convince me your miracle motor works, you've got to

(a) Prove to me you do know how to measure instantaneous real power; (b) Show me *one net watt* of long term continuous overunity production; and (c) Show me acceptable *independent* experimental verification.

This from an engineer. A scientist would also insist on (d) show me a peer reviewed and refereed paper in a respected mainstream journal.

More on these miracle motors is located at [www.keelynet.com](http://www.keelynet.com) and at [www.eskimo.com/~billb](http://www.eskimo.com/~billb). More on the problems measuring real power in MUSE112.PDF. Lots more on motor efficiency is found at [www.rmi.org](http://www.rmi.org) and [www.epri.com](http://www.epri.com). And more on a genuine new opportunity to legally improve ac motor efficiency is at my [www.tinaja.com/magsn01.html](http://www.tinaja.com/magsn01.html)

### Handheld Data Acquisition

There are lots of small dedicated computers getting used these days. Doing everything from logging UPS deliveries to evaluating forest stands to entering bar codes to counting cows to warehouse inventory apps. I thought we might gather some of the key players together as our resource sidebar for this month.

On one hand, all of these small handhelds do their job very well. On another, they always seem pricey and klutzily "behind the curve" compared to emerging general purpose laptops and digital personal assistants. One major reason is high *non recurring engineering* or NRE costs; another is the restricted sales volume caused by fragmented niche markets.

The leading two trade journals are *Automatic I.D. News* and *Portable Design*. Other useful mags include *ID Systems*, *Sensors*, *Measurement and Control*, the *Scan Tech News*, and *Pen Computing*.

There are dozens of handheld data computer manufacturers. Your two real biggies seem to be *Data General* and *Fujitsu Personal Systems*. A pair of outfits having case-keyboard-lcd solutions are *Two Technologies* and *QSI Corporation*.

Resellers of new and used gear are *Ryzex Remarketing* and *Dynasys*.

One fine website is *Bar Code 1* at [www.adams1.com/pub/russadam](http://www.adams1.com/pub/russadam) Included are book lists and extensive web links. A second site with lots of tutorial info is [mgfx.com](http://mgfx.com). A third is

SOME HANDHELD COMPUTING RESOURCES

**Aha! Software**

PO Box 391845  
Mountain View CA 94039  
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Cleveland OH 44130  
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**Compsee**

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Mt Gilead NC 27306  
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4400 Computer Drive  
Westboro MA 01580  
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LaPorte IN 46350  
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**Data Vision**

30 Indian Dr  
Ivyland PA 18974  
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**Dynasys**

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Westborough MA 01581  
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**EasyReader**

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Ventura CA 93003  
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**Fujitsu Personal Systems**

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San Jose CA 95134  
(800) 642-7616

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(603) 881-8666

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(813) 734-9175

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550 2nd St SE  
Cedar Rapids IA 52401  
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**Pen Computing**

88 Sunnyside Blvd Ste 203  
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(516) 681-5208

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San Jose CA 95131  
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**QSI Corporation**

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Salt Lake City UT 84115  
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**Ryzex Remarketing**

805 W Orchard Dr  
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**Scan Tech News**

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**Wireless LAN Alliance**

409 Sherman Avenue  
Palo Alto CA 94306  
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Aha's links to Mobile Computing at [www.ahasoft.com/complink.htm](http://www.ahasoft.com/complink.htm)

Key trade associations are AIM, focusing on automatic data collection and identification. Plus WLANA, the Wireless LAN Alliance. And UCC, the Uniform Code Council.

Let me know if I missed anybody important here.

**Another Hydrogen Resource**

One good but misleadingly titled book is *Fuel From Water*. By one Michael Peavey. Published by Merit Products. Lindsay Books now has it in stock at \$20.

Yeah, this one is clearly boom-rah boosterism that is way off scale on optimism. But it does have all of the needed numbers and solid research references you'll need to intelligently study hydrogen. Even some accurate figures for the energy density of

gasoline are included.

This text does point out something rather surprising: Under some rare circumstances, a hydrogen generator can return modestly more energy than is input as electricity.

In a water electrolysis cell, there are two possible energy inputs, heat and electricity. Well, with optimum

conditions, as much as one sixth of the energy needed to make hydrogen can come from waste heat.

Figure four shows details.

At room temperature electrolysis, you should find a threshold of 1.23 volts. Below which no hydrogen gets produced. There is a thermoneutral voltage of 1.47 volts where all of the reaction electricity will get converted into splitting water without adding or removing heat.

Now for the neat part: Heat gets absorbed from the surroundings in an endothermic electrolysis reaction if you are between 1.23 volts and 1.47 volts. Above 1.47 volts, your reaction will become exothermic and excess heat gets dumped to ambient.

Your bottom line here: Burning hydrogen releases 79.3 watt hours per mole of energy. But at its optimum production point, a mere 63.5 watt

**NEED HELP?**

Phone or write all your US Tech Musings questions to:

Don Lancaster  
Synergetics  
Box 809-EN  
Thatcher, AZ, 85552  
(520) 428-4073

US email: [don@tinaja.com](mailto:don@tinaja.com)  
Web page: [www.tinaja.com](http://www.tinaja.com)



## NAMES AND NUMBERS

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**Burr-Brown**

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Tucson AZ 85706  
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(508) 681-6600

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Scottsdale AZ 85260  
(602) 483-0192

**Cypress Semiconductor**

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San Jose CA 95134  
(800) 858-1810

**Electronotes**

1 Pheasant Ln  
Ithaca NY 14850  
(607) 273-8030

**Horn Speaker**

PO Box 1193  
Mabank TX 75147  
(903) 848-0304

**Internet**

2730 Nevada Ave S  
Minneapolis MN 55427  
(800) 328-8456

**Jnl Internet Law**

1185 Americas Ave  
New York NY 10036  
(800) 638-8437

**Lindsay Publications**

PO Box 538  
Bradley IL 60915  
(815) 935-5353

**Maxim**

120 San Gabriel Dr  
Sunnyvale CA 94086  
(800) 998-8800

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2092 Concourse Dr  
San Jose CA 95131  
(408) 433-5200

**Mobile Computing**

29160 Heathercliff #200  
Malibu CA 90265  
(310) 579-3400

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Phoenix AZ 85008  
(800) 521-6274

**Natl Renewable Energy Lab**

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Golden CO 80401  
(303) 231-7681

**Newnes**

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Newton MA 02158  
(617) 928-2500

**Pem**

PO Box 1000  
Danboro PA 18916  
(800) DIAL-PEM

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(805) 650-7070

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San Diego CA 92121  
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Dallas TX 75380  
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7 Continental Blvd  
Merrimack NH 03054  
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hours per mole have to come from electricity while 13.5 watt hours per mole could get extracted from the ambient heat energy. Thus, up to one sixth of the hydrogen produced can sometimes come from waste heat.

Sadly, this "one sixth" gain only takes place at low currents and low production rates. You get a lot more hydrogen a lot faster with the higher voltage exothermic reactions. Any

gain usually is swamped by resistive cell losses as well.

Finally, you can bet that if the best electrolysis cell is endothermic, the best fuel cell would pretty much *have* to be equally exothermic.

**New Tech Lit**

From *Texas Instruments*, two fat data books about *Data Transmission Circuits*. One is on communication

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## Tech Musings

controllers, the other on line circuits. From Cypress, their *Universal Serial Bus Specification* manual. And from Qualcomm, a brand new *Synthesizer Products* data book.

A thorough tutorial on solar cells appears in *Renewable & Sustainable Energy Reviews* of March/June 1997. Included is a detailed bibliography. Copies may be available through the *National Renewable Energy Lab*. The same journal also has a geothermal energy update in it.

Bernie Hutchins' *Electronotes* has long been the finest electronic music synthesizer newsletter. While lower profile than before, these are most definitely still being published. Back copies also remain available.

A good web gateway for wavelets: [www.waveloe.org/wavelet/links.html](http://www.waveloe.org/wavelet/links.html)

New books: From Newnes, Stuart R. Ball's *Embedded Microprocessor Systems*. From Lindsay, his very own *Vacuum Tube Regenerative Receiver* book; and through Jeff Duntemann's *Coriolis*, great heaping bunches of new software development titles.

Freebie samples: *Snap Shot* dome switches from *Snaptron*; new flexible plastic netting from *InterNet* (whose company name is obviously a really baaaad choice); and self-clinching fasteners from *PEM*.

Featured magazines for this month: *The Horn Speaker* on antique radio; a rather costly *Journal of Internet Law* newsletter; and *Mobile Computing*.

For the insider secrets of starting up your own tech venture, pick up a copy of my *Incredible Secret Money Machine II*. Details are in my nearby

*Synergetics* ad. You can preview parts of the text on my *Guru's Lair* at <http://www.tinaja.com/ismm01.html>.

Along with scads of my other reprints, ezines, and lots of carefully chosen annotated links. You'll also find full details of my new and fast *InfoPack* research service.

Also a reminder that my *Guru's Lair* is now welcoming *banner ads*. At a cost that can end up well under two cents per click-through.

As usual, most of the mentioned items should appear in the *Names & Numbers* or the *Handheld Computing Resources* sidebars. Always do check here before you call our US technical helpline shown in that *Need Help?* box you'll find nearby.

Let's hear from you. There's some exciting new opportunities here. ♦