EEVC NEWSLETTER

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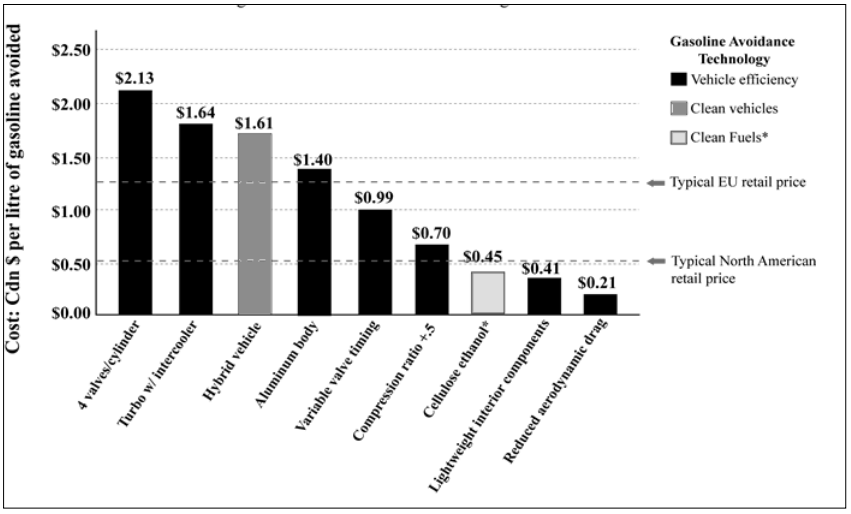
TIME TO GET SERIOUS ABOUT BIOMASS?

This month's president's message is well-timed. With the price of oil past $66 a barrel — and with the government quietly funding projects to slow global warning (don't want to frighten their friends in the oil patch), it's past time for everyone to get serious about renewables. And there's some recent work that may make biomass a better bet than it has been in the past.



Cost of avoiding gasoline consumption: Additional vehicle manufacturing cost amortized over five years of fuel savings. Non-gasoline fuels carried at manufacturing cost. Source: Iogen.

The United States already has 10 gigawatts of installed biomass-based generating capacity, all of it using mature direct-combustion technology (using the biomass as the sole fuel). There is also work in progress on co-firing (using biomass as a supplementary fuel in high-efficiency coal-fueled boilers), high-efficiency gasification combined-cycle systems, fuel cell systems, and modular systems.

All these are ways to generate power, and advocates of greener electricity can applaud them, but unless large numbers of people change to EVs very soon, they won't help with the transportation problems.

Perhaps the most interesting research going on in the biomass field right now concerns the production of ethanol from cellulose. Corn-based ethanol production involves cooking the corn, converting its starches into sugar, fermenting the sugar, then distilling out the ethanol. It's essentially making whiskey.

At one time it took more energy to produce ethanol from corn than was available from the ethanol, but recent advances have increased the energy yield to 1.25:1 to 1.65:1 — not a very efficient process, but it yields a fuel that will run a car and it makes money for Midwest farmers and ethanol producers and their politicians.

Production of ethanol from cellulose (which can come from straw or other crop residue, grasses, wood, or other sources) depended at one time on the use of acids to hydrolyze the cellulose, a rather inefficient process that made sense only if the feedstock was free. Recently, however, the price of enzymes that can break down cellulose has decreased.

One promising crop that can be grown for energy production is, as mentioned in Oliver Perry's message, switchgrass (Panicum virgatum), a summer perennial grass that is native to North America. Switchgrass can be burned directly in power plants or fermented to produce ethanol.

Iogen (Ottawa, ON), and Novozymes (Bagsvaerd, Denmark) are working with the U.S. Department of Energy and the National Renewable Energy Laboratory (NREL) on cutting the cost of enzymes that will break down cellulose for fermentation. Novozymes has succeeded in reducing the overall enzyme cost from more than US$5 to US$0.10 to $0.18 per gallon in laboratory trials. Iogen's EcoEthanol process uses enzyme hydrolysis to convert the cellulose in agriculture residues into sugars, and estimates $0.45 cdn/litre (US$1.44/gal) of gasoline use avoided. This contrasts with US$1.35/gal for hybrid cars.

This does not mean that you could run your car on ethanol for $1.35/gallon, of course, because it does not take taxes into account, and U.S. cars won't run on straight ethanol; they need at least 90% gasoline, so the effect is limited. Still, it's a step in the right direction.

On the other hand, consider that cars in Brazil can run on anything from gasoline to 100% ethanol, and the country plans to be free of imported oil within a few years, so we still have a long way to go.

PRESIDENT'S MESSAGE
Oliver Perry

All of us concerned about the promotion of electric and hybrid vehicles can benefit from an update on current world energy related information. Our sources of global energy greatly affect the economic and political viability of electric transportation. The following information is considered reliable and universally accepted.

After Oil

"Powering the Future" (Cover story, *National Geographic*, August 2005)

I decided to review this month's *National Geographic* cover feature "After Oil" for those of you who do not have a subscription to *National Geographic*. When *National Geographic* speaks, people tend to be attentive. "After Oil" by Michael Parfit, photographs by Sarah Leen.

Quote from Michael Parfit: "I have just installed a dozen solar panels on my roof, and they work. A meter shows that 1,285 watts of power are blasting straight from the sun into my system, charging my batteries, cooling my refrigerator, humming through my computer, liberating my life.

"The euphoria of energy freedom is addictive. Don't get me wrong; I love fossil fuels…We (my wife and I) don't want propane refrigerators, kerosene lamps, or composting toilets. We want a lot of electrical outlets and a cappuccino maker."

Michael Parfit and his wife live on an island that has no utilities; otherwise they live a normal American life. Michael shares with his readers that we Americans have lived under the shadow of one energy crisis after another to today's present concerns over record prices for a barrel of oil. He quotes the *National Geographic* June 2004 report that availability of oil may soon decline and reminds us that instability where most oil is found makes the oil lifeline very fragile. "Natural gas can be hard to transport and is prone to shortages. We won't run out of coal anytime soon, or the largely untapped deposits of tar sands and oil shale. But it is clear that the carbon dioxide spewed by coal and other fossil fuels is warming up the planet, as this magazine reported last September."

(page 4 and 5 August 2005 *National Geographic*)

In light of the above statements Michael says, "Cutting loose from that worry is enticing. With my new panels, nothing stands between me and limitless energy — no foreign nation, no power company, no carbon-emission guilt. I'm free!

"Well almost. Here comes a cloud."

The author's solar system cost him more than $15,000, about $10 per watt of capacity. The supposedly "Holy Grail" of new solar technology is 50 cents per watt. At that price solar could compete with existing technology and really take off. A company by the name of Nanosolar sees the possibility using tiny nano particles that could self assemble on thin sheets of foil-like materials and create the semiconducting surfaces typical of solar cells.

There are those who firmly believe that new solar cell technology will be to electrical energy production as the automobile was to horse and buggy transportation, totally disruptive. Cost projections still cloud solar investment in spite of their enthusiasm.

I thought readers might appreciate some of the facts related to world energy that Michael included in his article. Each quote in itself could spark a full featured documentary.

Quotes from "After Oil"

Present day energy prices for power plants coming on line in 2013. Costs of a kilowatt hour for the following technologies taken from a graph on page 18 *National Geographic*.

Coal	5 cents
Natural Gas	a little over 5 cents
Wind	6 to 7 cents
Nuclear	around 7 cents
Solar	22 cents (Considerably higher and noncompetitive. Solar presently produces less than 1% of the world's total energy production.)

As seen from the above figures, wind energy seems to be the most realistic nonpolluting alternative to fossil fuels.

The world uses some 320 billion kilowatt-hours of energy per day. It's equal to about 22 bulbs burning nonstop for every person on the planet. Within the next century the world may use three times that much.

Every 24 hours California's Carson Refinery produces seven million gallons of gasoline, only 14 percent of the state's daily diet.

Replace one incandescent light bulb with a compact fluorescent lamp and you will save a 500 pound pile of coal over the bulb's lifetime.

In Denmark wind generates 20% of electricity. (Denmark has giant wind turbine farms off shore. Currently they are constructing a prototype giant wind turbine with blades 200 feet long and a net height of 600 feet.)

Wind is currently the biggest success story in renewable energy. Europe's turbines can generate the power of 35 coal-fired plants.

In Flagstaff, Arizona, Southwest Windpower makes wind turbines that you can pick up in one hand capable of producing 400 watts each. The company has sold about 60,000 of the little turbines for off-grid homes, sailboats, lighthouse stations, and weather stations. The company is currently working on a model that will produce two kilowatts in a moderate wind.

A recent law in Spain requires that new buildings include solar energy.

Panels covering less than a quarter of the roof and pavement space in cities and suburbs could supply the U.S. with all of its electricity. (This is equivalent to 10,000 square miles, an area bigger than the state of Vermont.)

One of the largest solar arrays in the world has been constructed in Leipzig, former East Germany. 33,500 photovoltaic panels produce up to 5 megawatts of electricity, enough to power 1,800 homes.

Nine European cities operate hydrogen fuel celled buses as a part of EU's CUTE (Clean Urban Transport for Europe) program; Hamburg, Amsterdam, and Stockholm produce their hydrogen entirely with renewable energy.

Powering all of the world's vehicles with bio-fuels would mean doubling the amount of land devoted to farming.

Yumi Akimoto, a Japanese elder statesman of nuclear chemistry, saw the flash of the bomb at Hiroshima as a boy yet describes nuclear fission as "the pillar of the next century." (Akimoto is an advocate of nuclear fuel reprocessing, a procedure that can repro-

cess spent fuel and can stretch the nuclear fuel supply for decades or more.)

[Editor's note: spent nuclear fuel contains significant quantities of plutonium, which can be extracted chemically and used to fuel nuclear reactors. Unfortunately, it can also be used to make nuclear weapons. The United States discourages reprocessing for that reason]

A few scientists have claimed that cold fusion, which promises energy from a simple jar instead of a high-tech crucible, might work. The verdict so far: No such luck. Hot fusion is more likely to succeed, but it will be a decades-long quest and cost billions of dollars.

After public pressure shut down California's Rancho Seco nuclear power plant in 1989, solar panels took over some of the site. Concerns about radioactive wastes, cost, and security once slowed nuclear development. Now ambitious programs may help sate the appetite for power in China and India, and President George Bush has called for new nuclear plants in the U.S. because they produce vast amounts of electricity. Reactors will remain a key piece of the energy puzzle for generations.

A productive fuel crop is switch grass, a plant native to North America's prairies that grows faster, needs less fertilizer than corn, the source of most ethanol made in the U.S., and thrives on land unfit for other crops. If we increased all automobiles efficiency to the level of a hybrid, and went with the switchgrass crop mix, we could meet two-thirds of the U.S. transportation fuel demand with no additional land.

Without global changes, energy consumption from fossil fuels will leap, generating more climate-altering carbon dioxide. If today's trend continues, the use of alternative energy sources won't rise much. "We're running out of atmosphere faster than we are running out of fossil fuels." says energy scientist Dan Kammen.

Without big push from government, says one expert, we may be condemned to rely on increasingly dirty fossil fuels as cleaner ones like oil and gas run out. "If we don't have a proactive energy policy," he (Hermann Scheer, German Member of Parliament) says, "we'll just wind up using coal, then shale, then tar sands, and it will be a continually diminishing return, and eventually our civilization will collapse."

Summation

Michael Parfit briefly but adequately touches on the major sources of alternative energy available today. His article seems to side with those who feel that carbon dioxide is a leading cause of global warming and that global warming is indeed a serious threat to our globe. There are those, not quoted, who question just how serious the greenhouse gas problem really is. As most of you know the Bush administration has been slow to involve the U.S. in global activities to work with others to curtail fossil fuel use. The debate as to how real the carbon dioxide threat really is will remain with us for time to come. Hopefully some of us will live to see the day when we conclusively know the answer. And I am not sure that the number of Toyota Prius owners vs. the number of truck and SUV owners will answer the question either. The masses have sometimes been wrong.

The National Geographic article states that the U.S. government is studying the possibility of exploiting the country's vast coal reserves to make hydrogen and storing the carbon dioxide produced underground. This strategy, they say, is unproven, but it indicates that our government is not totally blind to a need for change. There was mention of the development of the hydrogen fuel cell car by the U.S., but the future reality was unspecified.

Parfit concludes that nuclear, wind, solar, and bio-methods of producing alternative energy to fossil fuels all must come together if we are to avert serious energy and pollution problems. He also points out that the U.S. greatly lags other nations of the world in developing satisfactory alternatives.

Meanwhile, according to the *Wall Street Journal:*

"Pact with PetroChina is set for an oil pipeline in Canada. *WSJ* Friday April 15, 2005

"Canada Welcomes China's Cash." *WSJ* Friday July 15, 2005

"State-run Chinese companies have come to Canada's resource rich wilderness with checkbooks in hand, hoping to grab stores of oil, copper and zinc buried here. Canada's

trade with China has about doubled since 2000 to more than 30 billion Canadian dollars."

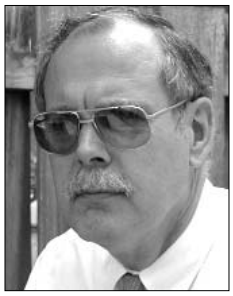
"April 12, 2005: CNOOC (Chinese company) acquires 17% of Alberta oil-sands for 124 million U.S. dollars. This is China's first acquisition in the oil sands."

"April 14, 2005: Canadian pipeline operator Enbridge announces plans to develop a 2 billion U.S. dollar pipeline with PetroChina to provide China access to crude oil from Canada's oil sands."

"May 31, 2005: China Petroleum pays 224 million U.S. dollars for a 40% share in Northern Lights Project, another oil-sands project in Alberta."

Do the above facts have any bearing on the price of gasoline here in the U.S.?

ODD ODORS ON THE WEST COAST
By California Pete



Just attended a uniquely California event: The Gilroy Garlic Festival.

Gilroy is a town about 80 miles south of San Francisco and about 33 miles south of San Jose.

Gilroy has little to recommend it. It's mostly hot, dry and boring. But it has garlic — lots and lots of it. Mark Twain once said that Gilroy was the only town in the world where you could marinate a steak by hanging it outside on a clothesline. In 1978 Dr. Rudy Melone, Gilroy resident and president of local Gavilan College, read about a garlic festival in Arleux, France, which claimed to be Garlic Capital of the World with an event that drew nearly 80,000 people over a three day period to sample their garlic soup. Dr. Melone believed that Gilroy was the Garlic Capital of the World and went about organizing a festival, which kicked off in 1979, with sponsorship from the Christopher Ranch, largest garlic grower in the area. The festival is supported by the whole town, and serves as a major fund raiser for local causes.

The festival, which runs for three days over the last weekend in July, is a little bigger than that one in France; last year 122,675 people attended to sample every kind of food you can imagine with garlic, and some you can't. The chicken, sausage, calamari and the rest, available from booths, are all delicious, but take my advice and skip the garlic Jelly Bellies. And I didn't have the nerve to try the garlic ice cream

What is California's biggest crop?

While the festival is fun, garlic is certainly not California's most valuable crop. That honor goes to marijuana, which was worth an estimated $6 and $8 billion in 2003, compared to $467 million for oranges and $2.3 billion for grapes.

Well, harvest time has come around again, which means that marijuana-eradication season is again upon us. On August 5 a half dozen officers from several agencies assembled to raid a pot crop that had been discovered on public land north of Los Gatos. A gun battle ensued in which one of two people guarding the pot was killed, and a Fish and Game warden wounded. The lawmen then discovered why the growers were so confrontational: there were about 50,000 plants, each worth about $4000. It really is California's biggest crop.

MEETINGS RESUME IN SEPTEMBER

The first post-summer meeting will be held at the regular location: Plymouth-Whitemarsh High School, Room 35 (in the back) at 7:00 p.m.

NEWS UPDATE

CA allows hybrids in HOV lanes

Now that the federal transportation bill has been made into into law, drivers of hybrids that get at least 45 mpg will be able to purchase stickers allowing them to use High Occupancy Vehicle (HOV) lanes with only one person in the car; in some ares, however,

they must also have FasTrak, the local equivalent of EZ-Pass.

Toyota sets RAV4 Electric policy
As mentioned last month, Toyota has rescinded its decision to crush the remaining RAV4 electrics that were out on lease. Highlights of the new policy are as follows:
• RAV4 EVs are not being removed from service based solely on age or lease expiration.
• If the vehicle in operation is sustainable, Toyota is offering fleet lessees lease extensions as their leases expire. Retail lessees may renew their leases, purchase their RAV4 EVs, or return them, at their option.
• RAV4 EVs that are returned to Toyota and are determined to be supportable and safe to operate will be put back into service. They may enter the Toyota company fleet or be donated to community groups, including national and state parks. Determination of the usability of returned RAV4 EVs will be based on overall condition and the status of specific parts and systems such as the battery pack, inverter, and charging components.
• RAV4 EVs that are taken out of service will undergo a thorough recycling process to maximize recovery of materials while reducing exposure of substances of concern.
• Toyota is planning to make more replacement parts available for RAV4 EVs, some new, and perhaps some used.

Not mentioned is what happens to the cars when the batteries wear out.

Toyota plans ten hybrid models

Reuters reports that Toyota Motor Corp. has announced that it will introduce ten more gasoline-electric hybrid vehicles by the early part of the next decade and increase worldwide hybrids sales to 1 million units a year. Plans call for at least 25 % of U.S. sales to be hybrids. To meet the goal the company will have to make hybrid models of virtually all vehicles, including trucks.

Cow pollution in CA

The *Los Angeles Times* reported on August 1 that officials in California's San Joaquin Valley have announced that gases from dairy cows, rather than exhaust from cars, are the region's biggest single source of a chief smog-forming pollutant. Every year, each of the 2.5 million local dairy cow produces 19.3 pounds of volatile organic compounds, according to the San Joaquin Valley Air Pollution Control District, exceeding the amount generated by cars, trucks or pesticides.

COMING EVENTS

2005 SAE Future Transportation Technology Conference
Sept 7-9, Chicago. Co-located with the 2005 IEEE Vehicular Power & Propulsion Conference. For information call 724-772-7131, or go to meetings@sae.org.
2005 Fuel Cell Seminar
Nov 14-18, Palm Springs, CA. For information call 202-973-8671, fuelcell@courtesyassoc.com, www.fuelcellseminar.com.
ITS America 12th World Congress on Intelligent Transportation Systems
Nov. 6-10, San Francisco, CA. Call 202-484-4847, www.itsa.org.
Electric Drive Transportation Association Conference & Exposition 2005
Dec 6-8, Vancouver, BC. Call Pam Turner, EDTA Conference Manager, 408-395-0059, pturner@firstoptionevents.com.
Clean Heavy Duty Vehicle 2006
Feb 22-24, San Diego, CA. Contact: Susan Romeo or Monica Alcaraz, 626-744-5600, Srromeo@weststart.org or Malcaraz@weststart.org, www.weststart.org.
Michelin Challenge Bibendum 2006
June 9-12, Paris. Contact at http://www.challengebibendum.com/challenge/front/affich.jsp?codeRubrique=45&lang=EN, or go to www.www.challengebibendum.com.

MEETING SCHEDULE

Meetings are held in Room 35, Plymouth-Whitemarsh High School, 201 East Germantown Pike in Plymouth Meeting, PA, and begin at 7:00 p.m.

September 14

October 12

November 9

December 14