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Energy Sources

By Thomas E. Ollerman, Ph.D.

The answers to the world's ever increasing need for energy are as old as the sun, as abundant as the wind, and as close as the earth itself. In an effort to end our dependence on fossil fuels, the forces of nature are being harnessed by technologies old and new. Here are some of the latest developments to watch.

WIND

Wind is the dance when cold air meets warm. And few places have steadier dancing conditions than the San Geronio Pass near Palm Springs, Calif. which is the site for the world's first large scale wind farms.

Although construction began in 1981, new, far larger and more efficient turbines constantly replace older models. Wind generated power now costs about 5 cents per kilowatt hour (kwh) – one-eighth of the 1980 price – making it competitive with gas and oil.

Now rows upon rows of turbines towering 200 feet and higher are set to become a fixture on the American landscape – especially in “the Saudi Arabia of Wind” – a wind endowed region stretching from North Dakota to Texas and from Wyoming to Minnesota. But where some worry about ruined views, other see tourism potential. Last year 25,000 sightseers lined up and paid to tour the Palm Springs installation.

Of course out to sea is out of sight. And that's exactly where some of the largest projects in Europe are found. The 20 turbines of the Tuno Knob Windfarm off the west coast of Denmark takes advantage of near constant sea breezes to generate 15 million kwh annually. That's enough to power 4,000 Danish homes.

Executive Trivia Question...

What breakfast food company sponsored the “Adventures of Superman?”

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SOLAR (CONCENTRATORS)

The hydrogen furnaces of the sun power life on earth. But while even single-celled algae are able to transform its rays via photosynthesis, humans have had a harder time tapping into this energy bounty. One of the more cost-effective solutions is a rig known as a parabolic trough solar concentrator. It operates on the same basic principle as using a magnifying glass to light a fire. Concentrators focus the sun's energy, heating tubes filled with synthetic oil to temperatures in excess of 700°F. The heat is then used to power conventional steam turbines to generate electricity.

Operating Co. runs five of the world's nine solar concentrating power plants, all of which are in California's Mojave Desert. It's 4,000 concentrators generate more than 400 million kilowatt hours per year—enough to power 50,000 homes. And, since the greatest amount of solar energy is collected during the middle of a summer day, peak power generation serendipitously coincides with peak demand times.

In 1999, their plants produced enough power to offset the purchase of \$14 million in natural gas. Together, the nine plants generate more than 90% of the world's commercial solar electricity. Though improvements have brought the cost per kilowatt hour from 12 cents down to 7 cents, gas prices will have to remain high for this technology to become truly competitive.

SOLAR (PHOTOVOLTAIC)

Photovoltaic (PV) cells transform sunlight into electricity through

semi-conducting materials - most often silicon. Though the basic technology has been around for more than a century, it wasn't until the Space Race of the 1960s, followed by the oil shocks of the 1970s, that industry interest and technological capabilities fell in step. While still a pricey option compared to grid-based power, PV is a bargain in off-grid situations. Indeed, the bulk of the \$3.6 billion PV-systems market is in developing countries where grids may never be built. But even where the short-term economics may be iffy, PV makes a strong environmental statement.

For the builders of Four Times Square - a super energy-efficient skyscraper in New York City - PV is not only an affirmation of alternative power, but part of the architecture. And PV is PC - witness the lamps of the Olympic Stadium in Sydney. In the Netherlands, a rooftop array atop a new housing development in Amersfoort generates guilders: Electricity is sold back to the grid.

GEOTHERMAL

There's nothing like a volcano to warm things up. And where there's heat, there's power. The Svartsengi Geothermal Plant in Kefiavik, Iceland, located in the middle of an old lava field, produces enough hot water to heat area homes through a 186-mile pipe network - as well as 8 megawatts of electricity for the regional grid.

But it's the waters that draw the crowds. The aptly named Blue Lagoon is filled with waste brine from the plant, cooled to a balmy bath temperature. Rich in miner-

als, some say it is said to have curative powers. In the Western U.S., where geothermal power is already in use, this approach may provide as much as 10% of all electricity by 2020.

BIOMASS

Each year at the Wheelabrator Shasta Energy Co. plant in Anderson, Calif., 750,000 tons of mill, forest, and agricultural waste - a.k.a, biomass - are turned into more than 400 million kilowatt hours (kwh) of power. But power is only part of the story.

Biomass plants annually free up 240 million cubic feet of land-fill space and are 95% cleaner than open-field burning of agricultural by-products. Though biomass is the largest of the renewable industries - capable of generating 7.5 million kilowatts of power in the U.S. - low natural gas prices in the mid-'90s forced many plants to close. Fuel accounts for half the 6.5 cent-per-kwh price. But the answer may be in millions of acres of overgrown national forests. Though environmentalists have concerns about habitat loss, thinning for fire prevention could provide a vast, cheap source of biomass.

“The person who gets the most satisfactory results is not always the person with the most brilliant mind, but rather the person who can best coordinate the brains and talents of associates. We cannot will creativity, but we can will to give ourselves to the encounter with intensity of dedication and commitment”

- Rollo May

From the Institute for Collaborative Alliances
Some Mergers Were Never Meant To Be

by Michael Arnot & Emily Thornton

When Coca-Cola Chairman **Douglas N. Daft** sat down with his board on Nov. 21, 2000 to push his proposed takeover of Quaker Oats Co., investors widely assumed it was a sure bet. By buying Quaker and its Gatorade unit, Coca-Cola Co. would vault to the lead in the fast-growing sports-drink category. With its global distribution network, Coke also could expand Gatorade beyond the U.S., something Quaker wasn't big enough to do. Plus, the deal would keep Gatorade out of the hands of archrival PepsiCo Inc.

A done deal? Hardly. Despite Daft's sales pitch, the board swatted down the acquisition, concluding that it would cost too much. Moreover, Quaker's pantry of food products would have taken the beverage company too far off course.

Daft may have been a bit miffed at being shot down by his own board. But he probably ought to thank the directors. All too often nowadays, corporate boards seem eager to rubber-stamp deals negotiated by empire building CEOs. Those CEOs are, in turn, often egged on by a swarm of investment bankers clamoring for their next big score.

So what's to show for the deal-mania? Sure, some deals pay off - but far too often, they don't. Take the humiliating failure to date of Daimler-Benz's \$36 billion takeover of Chrysler Corp. And don't forget AT&T's \$90 billion

push into cable TV, which the company is now undoing as it breaks into four. Those are only the two most glaring turkeys hatched in the late 90's merger boom. Other boners must include Mattel's purchase of The Learning Co., which ended up costing corporate wonder woman **Jill E. Barad** her job as chairman and CEO.

Which raises an interesting question: Over the past 5 years, which were the 10 worst acquisitions of the merger boom? Who made the biggest blunders? BusinessWeek chose 10 duds after grilling more than a dozen investment bankers and business professors. These deals have been amongst the costliest to shareholders, in terms of lost market capitalization. And many cost the CEOs who engineered them something they care even more about - their jobs.

But these birds, while the biggest, have plenty of company. Indeed, just one in five deals lives up to its promise, according to research by consultant KPMG. Others tend to agree. "An acquisition is just like building a house. It costs twice as much and takes twice as long as you planned." Says, **Thomas Z. Lys**, an accounting professor at Northwestern University's J. L. Kellogg Graduate School of Management.

Moreover, as the number and size of takeovers soar, the tally and scale of duds are rising spectacularly. U.S. corporations have

logged more than \$1.3 trillion in mergers and acquisitions already this year - nearly matching last year's peak of \$1.4 trillion, but more than four times the level of 1995. And investors are clearly turning their noses up at what may prove to be a new crop of stinkers, including America Online's merger with Time Warner and UAL's acquisition of US Airways. AOL shares are off 45% this year; UAL, more than 50%. Critics also worry that General Electric's huge and frenzied \$45 billion deal for Honeywell could be too much for outgoing CEO **John F. Welch** to digest before he turns the reins over to **Jeffrey R. Immelt** in 2002.

DRIVING OFF CLIFFS.

But if everyone knows the odds are stacked toward failure, that's not exactly slowing the charge. Chalk up many of the deals to the hubris of those at the top. While no more than 20% to 30% of mergers outperform industry peers, management watchers say many CEOs and their directors confidently predict they are smart enough to make their deal pay off. That's human nature, says **Ira C. Harris**, a management professor at Notre Dame University's Mendoza College of Business. "Deals fail, but we continue to drive off the cliff."

In some cases, CEOs are simply following high-priced advisers as they dash for the precipice. But investment bankers counter that they and the deals they package get blamed for every post merger problem. Yet often trouble comes from an outside event like a run up in oil prices or a shift in consumer

(Cont. page 6)

The Idea Incubator

by Frank Helton

How can hazelnuts power cars?

Some scientists believe fuel cell-driven cars of the future could be powered by hazelnuts.

Marat Dogru of the University of Newcastle in Britain says hazelnuts could produce the hydrogen needed to generate an electric current for electric and hybrid cars. He and his colleagues tested the nuts for useful gases and found they could extract hydrogen.

This is good news for Turkey because that Eastern country is the world's biggest producer of hazelnuts, burning 250,000 tons of nutshells every year. Turkey's nutshells would produce 6,000 tons of hydrogen - enough to allow 1,000 hydrogen-fueled BMWs to travel 20,000 miles each.

How can we make robotic fish?

Researchers at Japan's Mitsubishi Heavy Industries Ltd. have spent four years and \$1 million developing robots with scales. These robots swim just like the real thing, complete with undulating fins. They swim to an underwater ballet orchestrated by computer and broadcast by radio transmitters. Two models are now showing their moves - a 5.5-pound sea bream and an 88-pound coelacanth - and sea creatures from the Cambrian period are in the works.

Mitsubishi has struck a deal with one amusement park. But applications may reach far beyond

entertainment. Pound for pound, fish use one third less energy than propeller-driven objects. So, artificial fins may improve ship design, says researcher **Yuuzi Terada**. And the technology may also yield robots that can locate sunken ships and study marine ecology.

How can tobacco be nicotine-free?

This month the Agriculture Department is likely to approve a "health food" cigarette whose tobacco is genetically engineered to be nicotine-free. The company that developed it, Liggett Group Inc., has signed up farmers willing to grow thousands of acres' worth in Lancaster, Pa., and is seeking others in Oklahoma. "We've had no problem finding farmers," says a spokesman for Liggett.

Yet south of the Mason-Dixon line, it's another story. Farmers in the Tobacco Belt want nothing to do with the new leaf. What they fear is not that no-nicotine cigarettes will cut into sales of traditional cigarettes, but a backlash against genetically modified tobacco, particularly in the growing markets of Europe and Asia - just as there was vocal hostility against "Frankenfood." And there's considerable resentment against the man who runs Liggett, **Bennett LeBow**. He has long been an industry gadfly, pioneering generic cigarettes made of cheap foreign tobacco, as well as becoming the first to admit cigarettes are addictive and to testify against fel-

low cigarette makers. His adversaries say he's causing trouble again. "He acts as if he has some personal mission to jeopardize the tobacco industry," says **Billy Carter**, a North Carolina grower. But if nicotine-free cigarettes take off, southern farmers may have to rethink the opposition. Given the steady drop in U.S. sales, the Tobacco Belt can sure use new markets.

How can bacteria make sewage smell better?

In-Pipe Technology Co., a Wheaton (Ill.) sewage treatment company, has developed a technique for breaking down waste as it flows from bathrooms and kitchens to water-treatment facilities. The company's new system continuously introduces a patented blend of sewage-eating bacteria through a series of pumps in the sewer lines. In-Pipe President, **Daniel R. Williamson Jr.**, a microbiologist, says the populations of bacteria that produce the noxious odors from sewage are gradually overwhelmed by his blend of "good" bacteria. By the time wastewater reaches a treatment plant, fecal matter and other suspended solids have been reduced by as much as 60%.

Not only does that help boost treatment-plant efficiency, but the beneficial bugs help prolong the useful life of the plants and sewer lines. According to a report by the Water Infrastructure Network, a coalition of municipal agencies, the cost of upgrading and replacing aging wastewater systems to meet the mandates of the Clean Water Act will reach nearly \$1 tril-

lion over the next 20 years. The “wild” bacteria in sewage produce hydrogen sulfide, a gas that is corrosive as well as the source of that rotten-egg smell. But the only by-products of In-Pipe’s secret mix are water, nitrogen, and carbon dioxide.

So why hasn’t anybody tried this approach before? Williamson says In-Pipe was the first to figure out how to grow large quantities of good microbes cheaply, and deliver them continually inside pipelines. A demonstration project is planned this year near Washington, D.C.

How can a nano-tank clean your living room?

Imagine a swarm of minuite robotic sentries, each able to park on a nickel, prowling about your house looking for intruders or sniffing for smoke. The Energy Dept.’s Sandia National Laboratories is going down that road. Researchers there have created MARV, the Mini Autonomous Robot Vehicle, a Lilliputian terminator on tiny tank treads. Powered by three watch batteries, MARV sports an 8K integrated-circuit brain, a heat sensor, and two independent motors that drive the little robot’s tank treads.

The treads are mere rubber bands, but they allow the robot to climb over obstacles - like the pile of a carpet - that its small size would otherwise render unmanageable. Its brain? “The little computer is the same one used in vending machines and treadmills,” says Sandia researcher **Doug R. Adkins**. Future models

might include a radio, a camera, or even a chemical sensor. And since they’re so tiny, the robots could be turned loose in a room to listen in on conversations.

MARV, which is no bigger than the last joint on your little finger, could shrink even more if researchers can figure out how to make a smaller battery.

How can water clean landfills?

The next time you put out the trash, bear in mind that you are creating a foul-smelling time capsule. Your garbage, lodged in the local landfill, lingers for an average of a century before biodegradable parts such as paper, bones, cloth, and the like are completely decomposed. It seems that a large part of the reason our refuse refuses to rot is that landfills are too dry to support the bacteria that digest the garbage.

To test this hypothesis, researchers at Ohio State University sealed trash inside tanks for 15 months. They added a little sewage sludge to provide a working stock of bacteria to the system, and watered it continuously by recirculating the fluid, or leachate, that seeped out the bottom of the pile. Over that time, the mass of the trash decreased by 1.3%. While this was slower than anticipated, researchers say decomposition rates could be accelerated by as much as 10 times.

Professor **Olli H. Tuovinen**, a professor of microbiology at Ohio State University, believes that similar treatment of trash in landfills on a larger scale might allow

it to rot away in as little as 10 years. Trash can decompose about 10 to 20 times faster through this system. This research could mean more rapid redevelopment of the landfills.

Executive Trivia Answer...

Kellogg’s cereals.

Mergers (Cont.)

tastes that affects everyone in an industry. There is a lot of carnage in the marketplace that has nothing to do with mergers.

It's easy to blame mistakes on external events. But the fact is, many deals were simply never well thought out. And every sector of the economy has its share of blunders, from Federated Department Store's acquisition of Fingerhut in retailing to McKesson's deal for HBO & Co. in medical services. But the worst clunkers have a couple of common traits: They were friendly stock transactions – which tend to encourage acquirers to overpay, especially in bull markets – that moved companies beyond core businesses or established markets.

Premiums.

These friendly deals, especially where the buyer isn't intimately familiar with the new markets it finds itself in, can discourage acquirers from making tough decisions when needed early on. Consider DaimlerChrysler. The \$36 billion “merger of equals” in 1998 wed a by-the-books German company that prided itself on precision engineering with a free wheeling U.S. enterprise best known for salesmanship. Instead of the hoped for synergies and cost savings by melding the best of both, Daimler has now lost or pushed out virtually all the U.S. managers as Chrysler slumped from the most-profitable carmaker in the U.S. to its biggest money loser. Shrinking sales caused losses to hit \$1 billion or more in the second half of 2000.

Then there are those who don't know when to stop. Acquirers

typically pay a 30% premium. But as companies keep buying – often, as an industry consolidates – those still in the game have to pay even more. Just as bad, they must settle for a company or business subsidiary from an already picked-over pool of candidates.

In the midst of a health-care consolidation wave, Aetna Inc. bought its way to the top of the managed-care industry. With each deal, Aetna paid more per customer, culminating with its \$1 billion purchase of troubled Prudential Healthcare in 1999. Since then, Aetna has lost 1.6 million subscribers and cut jobs as Prudential bled red ink. After ousting deal architect, **Richard L. Huber** as CEO, Aetna agreed to break up the company.

Do such experiences discourage others? Rarely. Notes **Mark L. Sirower**, a visiting professor at New York University's Leonard N. Stern School of Business who runs the M&A practice at Boston Consulting Group: “Nobody wants you to write a story two years from now that says the world has changed and Charlie just sat there.”

In their merger frenzy, even the shrewdest dealmakers often fail to uncover problems at the company they've targeted. That's what happened to HFS Chairman and CEO **Henry Silverman** when he merged his grab-bag of franchised businesses with direct marketer CUC International to form Cendant. Only after the 1997 merger was completed did Silverman's team uncover massive accounting irregularities at CUC, which tanked Cendant shares and cost it \$2.85 billion to

settle a stockholders' lawsuit.

Time Will Tell

Bum deals are, of course, as old as commerce. The '80s had its share of bombs. Remember Mobil's stab at diversification with its deal for Montgomery Ward? Nor are failed mergers unique to the U.S. Japanese companies are notorious for making ill-timed and overpriced bids for U.S. companies, such as Sony's \$3.4 billion deal in 1989 for Columbia Studios.

Then there are the widely judged failures that, with time, may actually prove successful. Take 3Com Corp.'s \$7.3 billion buy of modem maker U.S. Robotics. Even before the 1997 deal closed, U.S. Robotics started losing money. Another boneheaded takeover, right? No longer. By buying U.S. Robotics, 3Com lucked into a pocket-size organizer that was just hitting the market. It was called the Palm Pilot. Last July, 3Com spun off Palm and more than doubled the value of the stock held by its investors. So who knows? Maybe in a few years, Daimler's **Jurgen E. Schrempp** will be hailed for his masterful takeover of Chrysler.

Ten Worst Mergers

1996

UNION PACIFIC AND SOUTHERN PACIFIC

The \$4 billion deal was to have created a “seamless” rail network from the Midwest to the West Coast. The reality was complete gridlock.

1997

HFS AND CUC INTERNATIONAL

This \$14 billion deal to create Cendant was intended to build a

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Mergers (Cont.)
marketing powerhouse. But accounting irregularities at CUC sent Cendant's share price down 46% in one day and triggered a federal probe.

1998

CONSECO AND GREEN TREE FINANCIAL

With the \$7.6 billion acquisition of lender Green Tree, insurer Conesco foresaw a bonanza. But Green Tree was hit by huge charges on bad loans.

1998

DAIMLER-BENZ AND CHRYSLER

Daimler paid \$36 billion for Chrysler - then the hottest U.S. auto maker. But huge losses, botched product introductions, spiraling costs, and a demoralized U.S. workforce have wiped out \$60 billion in market value.

1999

AETNA AND PRUDENTIAL HEALTHCARE

Aetna hoped that the \$1 billion deal would make it the No. 1 HMO. But Pru and a string of troubled mergers led to the ouster of Aetna's CEO. Now, the company is breaking in two.

1999

ALLIEDSIGNAL AND HONEYWELL

AlliedSignal hoped to combine its efficiency with Honeywell's product innovation. Instead, the \$14 billion combo got hit by rising oil prices, a plunging euro, and management problems.

1999

AT&T, and TCI and MEDIAONE
Its back-to-back deals for a combined \$90 billion, backfired on CEO **C. Michael Armstrong**. He tried to sell consumers on packaged telecom services, but AT&T's core businesses dried up. Now, with its shares in the tank, AT&T is breaking up again.

1999

FEDERATED DEPARTMENT

STORES AND FINGERHUT
Federated paid \$1.7 billion to apply Fingerhut's direct marketing skills to its Macy's and Bloomingdale's units. But Fingerhut's focus on low-end consumers led to huge write-offs.

1999

MATTEL AND LEARNING CO.

Mattel hoped to break into the CD-ROM game market with the \$3.5 billion purchase. But then the Internet caught on, drying up the CD-ROM market. Mattel's stock crashed, and CEO **Jill E. Barad** was ousted.

1999

McKESSON AND HBO

The \$12 billion merger of No. 1 drug wholesaler McKesson and medical software maker HBO & Co. ran into a buzz saw. Auditors uncovered an accounting scandal at HBO, leading to resignations and criminal charges. McKesson shares were off 47% for the year.

Emerging Technologies and Investment Opportunities for the Future

From: George Washington University

Hybrid vehicles:

Cars that combine electric and internal combustion engines are commonly available. 2007

Distance learning:

Schools and colleges routinely use computerized teaching programs and interactive television lectures and seminars, as well as traditional methods. 2012

Computer sensory recognition:

Widespread usage of voice, handwriting, and optical recognition features allows ordinary personal computers to interact with humans. 2009

Parallel processing:

Supercomputers using massive par-

allel processing are commonly used. 2015

Intelligent agents:

Knowbots, navigators, and other intelligent software agents routinely filter and retrieve information for users. 2007

Teleliving:

Greatly expanded use of embedded processors in common objects are integrated into the workplace and home. 2008

Expert systems:

Routine use of expert systems helps decision making in management, medicine, engineering and other fields. 2012

Computer translation:

Computers are able to routinely translate languages in real-time with the accuracy and speed necessary for effective communications. 2018

Ceramic engines:

Cars are powered by ceramic engines that withstand heat and wear much better than steel. 2022

Gene therapy:

Genetic treatments are routinely used to prevent and/or cure inherited diseases. 2025

Optical computers:

Computers using photons rather than electrons to code information enter the commercial market, enabling processing to run at the speed of light. 2012