



Salad DAYS

Is green tech the Next Big Thing in investing?

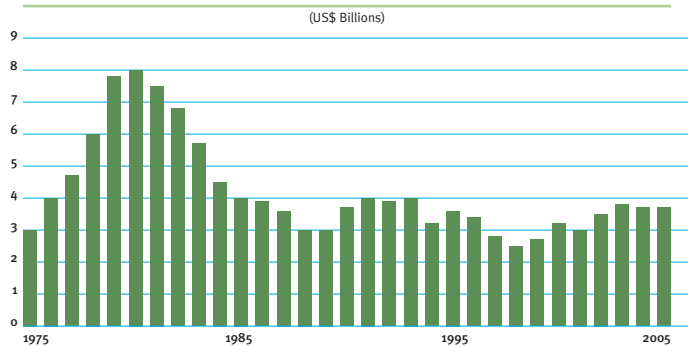
BY JOHN RUBINO

It took a while, but green tech may have finally found, um, its place in the sun.

Capital is pouring into virtually every niche that promises renewable energy or greater efficiency or less pollution. A multitude of new companies are forming or going public, and venture capitalists, brokers, and mutual funds are staffing up for what appears to be the investment world's Next Big Thing.

If this talk of a green tech (or clean tech or enviro tech) boom has a familiar ring, that's because we've been here before—twice. The first time was in the late 1970s when oil shocks and gas lines led the Carter Administration to boost funding for such initiatives as coal gasification and shale oil. “The federal energy budget tripled back then,” recalls Daniel Kammen, founder of the Renewable and Appropriate Energy Laboratory at the University of California, Berkeley. But there was no comparable run-up in private sector spending on alternative energy, and when oil prices fell in the 1980s, funding for the initiatives all but dried up.

U.S. Public Sector Energy R&D Spending



Source: University of California, Berkeley's Renewable and Appropriate Energy Laboratory

Then came the 1990s tech boom. Some of the hot money was directed into solar and fuel cell stocks, sending the prices of many stocks through the roof. “That was essentially excess dot-com money, so it was irrational exuberance,” says Kammen. The run ended when the tech bubble burst, sending clean-tech stocks down and venture capitalists off in search of, well, greener pastures. (So many clean-tech puns, so little time.)

The current surge in interest began a few years ago as rising oil prices put energy efficiency back on investors' radar screens. But this trend appears to have legs, for several reasons.

“PEAK OIL” The oil shocks of the 1970s were primarily caused by political and structural problems. The trouble began when Arab members of OPEC, plus Egypt and Syria, halted oil exports to countries, including the United States, that had supported Israel in the 1973 Arab–Israeli war, and the situation was exacerbated when the United States failed to secure adequate new supplies. But there was plenty of cheap oil in the ground, and as soon as the political turmoil subsided, the flow resumed and prices fell. Today, there is emphatically not plenty of cheap oil in the ground. The world's great oil fields are in decline, and new ones are not being discovered. As a result, oil production has reached a maximum global production rate and production has entered its terminal decline. Hence the flood of books with “Peak Oil” in their titles. At the same time, the growing number of cars on Chinese and Indian roads is sending oil demand inexorably higher. The result is steadily rising oil prices. As London-based Barclays Capital analysts Paul Horsnell and Kevin Norrish told clients in October 2007, “The issue seems no longer to be whether oil will reach US\$100, but when.”

CLIMATE CHANGE In Europe especially, consensus that the world is indeed warming is now driving the embrace of renewable energy. “The idea that energy prices might increase is not new, nor is the idea that oil might be a more finite resource than was imagined 50 years ago,” says Alan South, chief innovation officer of London-based solar energy company Solarcentury. “Climate change is now the dominant factor [in energy policy].”

SURGING ELECTRICITY DEMAND Remember those quaint 1990s predictions that the internet would cut electricity demand by letting people telecommute, shop, and play without leaving home? As it turns out, this forecast missed the other side of the equation: All those new electronic toys are energy hogs. “A flat-panel TV might use 300 watts, which is a third of the

power a house might use at any given time. You have a plasma on with kids playing Halo 3 for 12 hours at a time—that's a lot of power," says John Quealy, energy technology analyst with investment bank Canaccord Adams based in Vancouver, British Columbia.



Meanwhile, the supply of power isn't keeping up. The latest 10-year forecast from the North American Electric Reliability Corporation has peak demand rising by 18 percent and generating capacity growing by less than 9 percent.

GREEN-TECH PROGRESS In the 1970s—and even the late 1990s—most green technologies were nice sounding pipe dreams, far too expensive and inefficient to compete with such traditional sources as gasoline and coal. But thanks to steady progress on cost and efficiency, solar, wind, and several other forms of power generation and management have become economical. So, a utility, business owner, or homeowner can adopt today's green tech with the hope of actually saving money. "You don't really need breakthrough technologies to make a big difference in renewable energy and energy efficiency," contends Richard Kauffman, CEO of Good Energies, a renewable-energy investment firm based in Zug, Switzerland.

BIG SUBSIDIES Governments around the world now see clean tech as the perfect win-win issue: It's politically popular and addresses real needs. So, they are implementing a mosaic of subsidies and mandates designed to speed the transition. Germany pioneered the "feed-in tariff," which allows businesses and homeowners to install solar panels and sell the resulting power back to the grid at very favorable prices. "These incentives are so large that it's actually cheaper to go green," says Lyndon Rive, CEO of solar-system installer Solar City of Foster City, CA. The state of Colorado is requiring that electric utilities derive at least 20 percent of their power from renewable sources such as wind and solar by 2020. Known as a "renewable portfolio standard," this type of mandate is becoming common in the United States. Even Kenya is going green. "With roughly 30,000 small systems sold per year, it has the world's highest household solar ownership rate," says Daniel Kammen.

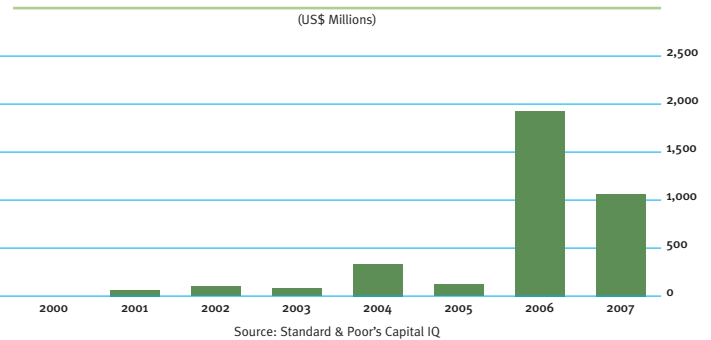
Capital Loves a Winner

Add up the multifaceted need for clean tech, the development of new technologies that really work, and enthusiastic support from every major government, and you have the financial world's dream market. As legendary technologist and venture capitalist Bill Joy said in an October 2007 speech at the Lux Research conference on nanotechnology, "There is a time when panic is the appropriate response. And I think we should go into a panic—not only because of the scale of the problem but also the economic opportunity that becoming more efficient in our use of energy gives to us."

Silicon Valley's venture capitalists have shifted seamlessly from info tech to green tech, with such tech icons as Vinod Khosla, Elon Musk, John Doerr, and Paul Allen frequently

being named when new deals are announced. Meanwhile, virtually every major investment bank and mutual fund is establishing a presence in this sector. Goldman Sachs has stakes in a wide range of wind-power and solar-power companies. Citigroup recently promised US\$50 billion for green investments and financings in the coming decade. And smaller players are morphing into green boutiques. At Baltimore investment bank Signal Hill, for instance, according to clean-energy analyst and managing director Michael Carboy, "Last summer, we made the explicit decision to develop expertise in [clean tech]." Moreover, clients seem to approve. "Interest is significant to tremendous," says Carboy. "Some clients have funds with dedicated investment categories for clean tech and energy and other funds that have an interest in high-growth technology, but there isn't a major account that I visit that doesn't understand the political, societal, economic, scientific, and business arguments for clean tech. Everyone is aware of it."

Alternative Energy Private Equity and Venture Capital Fundings Worldwide



This newfound interest was in evidence at the Solar Power 2007 conference held this past September in Long Beach, CA. "There were something like 12,500 people there," says John Quealy. "Last year, there were maybe 5,000, and the year before, 1,200. A lot of the new attendees are general growth investors."

This fascination with all things green translates into ringing phones at existing clean-tech companies. "There was a time when we had to encourage and cajole analysts to come and see us," says Sanjeev Kumar, chief financial officer of solar-power firm Energy Conversion Devices in Rochester Hills, MI. "Now, I can't return their calls fast enough and address new analysts who want to initiate coverage."

A Multifaceted Opportunity

Clean tech is both broad and complicated. For example, wind and solar have different technical attributes and constraints: wind speed and consistency versus hours of daylight, turbine durability versus solar-cell efficiency, and scalability versus flexibility. Fuel cells are based on chemistry, biofuels on biology, and batteries on both physics and chemistry. And many of these technologies are, in effect, rivals. The success of one may come at the expense of another. So, understanding one technology requires understanding all of them.

And that means understanding the array of “pick and shovel” manufacturers, including the microchip companies that make solar cells, testing instruments, and production equipment; the miners that produce such raw materials as platinum; the info-tech companies that help utilities manage their grids; and the trading shops that soon will do a booming business in carbon credits. The “green building” field alone includes makers of everything from photosensitive windows to low-carbon building blocks to high-efficiency appliances. And because life-style choices figure prominently in most visions of a green future, makers of busses, light rail equipment, and bicycles also count as green-tech plays.

Moreover, green tech is global. Because of differences in history, geography, and politics, Europe, Asia, and (to an extent) Latin America have grabbed the lead in this race. Brazil, for instance, has already converted its transportation system to run on ethanol derived from locally grown sugar cane and is now partially insulated from the effects of peak oil. China is pouring resources into technologies that (it hopes) will prevent it from choking on its own exhaust. Japan’s computer chip manufacturers have become the world’s largest producers of solar panels. And Europe, in addition to offering an array of generous incentives for renewable energy, began tightening environmental rules years

ago, forcing local companies to reduce their carbon footprints and remove pollutants (eliminating lead solder from electronics, for example). “Once you’ve [made such changes in business practices], you’ve already done the hard work,” says Quealy. Extending European business practices to Asia and North America should be relatively easier.

Geography also works in Europe’s favor, notes Bill Joy: “Electric cars will take hold in Europe before the United States because Americans drive longer distances, have heavier cars, and drive more trucks as passenger cars.”

As a result, most of the biggest players in wind and solar are European and Asian. “There are practically no pure-play wind stocks in the United States, while Europe has many,” says Pavel Molchanov, energy analyst with investment bank Raymond James in St. Petersburg, FL. In fact, Germany,



DISRUPTIVE BREAKTHROUGHS: Threats and Opportunities

Brains follow capital. So, it’s no surprise that as research grants and private cash pour into green tech, some of humanity’s best and brightest are tackling its myriad challenges, with a predictable result: Reports of breakthroughs are now a daily occurrence. This accelerating pace of change is undeniably exciting, but for money managers, it adds another layer of complexity by increasing the risk that today’s mainstream green technologies—and high-priced stocks—will be supplanted before they generate adequate returns. Here’s a sampling of potential game-changers that recently made headlines:

SUPERCAPACITOR BATTERY EESstor, a small start-up in Cedar Park, TX, claims to have developed a capacitor that can be charged almost instantly and holds enough power to run an electric car. ZENN Motor Company, a Toronto maker of compact electric cars, reportedly plans to start using the capacitors within a year.

THIN-FILM BATTERIES Today’s lithium polymer thin-film batteries are flexible but expensive. WinterGreen Research, a consultancy based in Lexington, MA, recently predicted that next-generation thin-film batteries will offer 40 times the efficiency of lead-acid batteries for the same price of US\$0.15–0.20 per watt-hour and will charge in a matter of minutes.

VIRUS-BUILT ELECTRONICS MIT engineering professor Angela Belcher is using viruses to bind to and organize inorganic materials,

such as those used in battery electrodes, transistors, and solar cells. The programmed viruses coat themselves with the materials and then, by aligning with other viruses, assemble into crystalline structures useful for making high-performance devices. One possible result: threadlike batteries and other electronic devices that can be woven directly into clothing.”

MIRROR-ENHANCED SOLAR A team at Israel’s Ben Gurion University is using mirrors to direct intense light at gallium arsenide-based solar cells that, according to the inventors, are twice as efficient as ordinary solar panels.

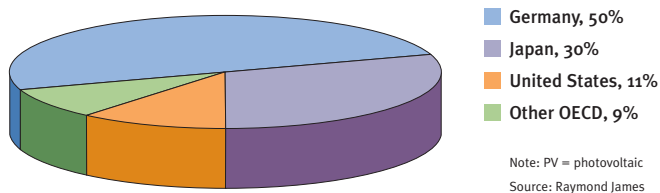
THE WINDBELT A new wind-power technology uses a tight plastic strip stretched in a frame with magnets at each end. When the wind blows across the belt, it vibrates and the magnets move inside wire coils, generating power. The inventor claims 10 times the efficiency of conventional wind turbines.

TRANSPARENT “ALUMINUM” University of Michigan researcher Nicholas Kotov claims to have invented a nanotech process for making commercially viable materials that are as strong as steel but transparent.

BIOLOGICAL FUEL CELLS San Francisco start-up Synthetic Genomics, founded by biotech pioneer J. Craig Venter, claims to have developed “biological fuel cells driven by bacteria that take human wastewater and make drinking water or electricity out of it.”

although not an especially sunny place, is a hotbed of solar technology. “The German government decided that this was going to be a core technology,” says Kauffman, “and they now have university research institutes doing superb work in solar. Q-Cells [a leading solar-panel maker], located in Germany’s ‘Solar Valley’, is now one of the top five job creators in the country.”

Installed PV Capacity, 2006



Will the United States catch up? Almost certainly, given the amount of money and energy now flowing from U.S. venture capitalists into the field. But clean-tech money management will remain a global affair: “My clients are looking at best-in-class clean investments throughout the world,” says Quealy. “A clean fund in Boston may be investing in an Indian wind company, while a Swiss clean fund may be looking at a fuel-

cell start-up in California. The Europeans have led the discussion, but now it’s really taking North America, Australia, India, and China by storm.”

For an analyst, green tech is thus a bit more challenging than the typical sector. “These technologies are not homogeneous at all, and it drives me in a lot of different directions. I have 16 personalities,” says Carboy. So expect tomorrow’s large shops to employ several analysts covering a niche for alternative energy, one for transport, and one for pollution control, and so on. There are, in short, job opportunities galore in this sector.

Tomorrow’s Dot-Coms?

Will the influx of capital send clean-tech stocks riding on a 1990s-style roller coaster? The question is of more than academic import because it bears directly on the value of research. Between 1995 (when Netscape’s IPO ignited the tech boom) and 2000, due diligence on the stock of high-tech companies was virtually worthless because everything, no matter how untested or unprofitable, soared. In 2000, due diligence was worthless because everything, no matter how solid, plunged. Is that what the coming decade holds for green tech?

There are indeed signs of excessively easy money. Reports of venture capitalists handing out blank term sheets at September’s Long Beach solar conference imply an eerily

MAJOR COMPETITORS

SOLAR

Solar power uses sunlight to generate electricity, primarily via silicon-based photovoltaic cells. The technology is becoming steadily more efficient, and longer production runs are cutting solar-panel costs. “Historically, pricing of solar has decreased 20 percent for every doubling of capacity,” says Solar City’s Rive. With nearly every major solar company expanding capacity, he adds, “I can see the point of parity [with grid-delivered power] for homeowners within a few years in many markets.”

WIND

Wind power is conceptually simple: Moving air spins a turbine, which makes electricity. And like solar cells, wind turbines have been steadily gaining efficiency. “Right now, wind is profitable from day one if you can get the transmission lines built,” says Kammen. That’s a big if, however, as is the willingness of neighbors to live with dozens of towering windmills dotting the horizon. But in places where they can be sited and wired up, wind farms are a viable alternative to traditional utility-scale power plants. As a result, wind now vies with solar as the world’s fastest growing energy source.

PLUG-IN HYBRIDS

The traditional hybrid, which uses a small electric motor to supplement a standard internal combustion engine, is more a social statement than solution to Peak Oil, the terminal phase in oil production. According to most studies, the added cost of

two drive trains makes even the latest Prius too expensive to offset its gas savings. Not so for the plug-in hybrid, which uses a rechargeable battery to run an electric motor capable of lasting 40 or more miles between charges. For someone who drives only to work and the grocery store, such a vehicle might use virtually no gasoline. Most large automakers have plug-in hybrids in the pipeline, although none are currently for sale.

BATTERIES

For green tech to fulfill its potential, cheap but powerful batteries are essential. Solar and wind produce electricity only when the sun shines or the wind blows, and if the power is more than the grid needs, the excess is lost if not stored. And plug-in hybrids will succeed or fail on their ability to go long distances on a single charge.

Utilities currently have no economic way to store excess power. And power-storage technology isn’t quite there. Moreover, today’s hybrids use nickel-metal hydride (NiMH) batteries, which lack the power-to-weight ratio required for tomorrow’s plug-ins.

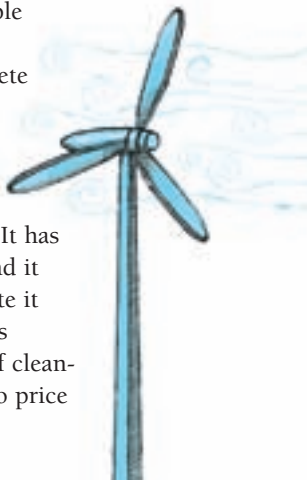
But help is on the way. Because relatively little battery research was done in years past, recent progress has been rapid. “The evolution of batteries, due to laptops and cell phones, is jump-starting the area,” says Kammen.

Closest to market is the lithium-ion battery, which has two to three times the power density of NiMH. In October,

familiar lack of discrimination. And many solar stocks have traced 1990s-style arcs over the past couple of years. “There is a quality of anxiety and a feeding frenzy that we saw during the tech bubble,” concedes Kauffman. “First, we see a relatively limited number of companies in which to invest, which leads to a lot of momentum-oriented trading. Second, there are companies getting funding and/or going public that are not ready for prime time.”

But there are fundamental differences between clean tech and the dot-coms. “In the 1990s,” says Carboy, “the internet was being created before our eyes and we were coming up with systems and software to enable businesses to take advantage of it. You didn’t have anything to compete against; it was open territory.”

Clean tech, on the other hand, addresses the needs of existing markets. “Electricity is not obscure,” Carboy continues. “It has certain physical characteristics, and it doesn’t matter whether we generate it with wind or solar or biogas,” says Carboy. “Ultimately, every piece of clean-energy tech that’s developed has to price itself against existing sources.”



Meanwhile, “Some of the biggest [clean tech] innovators are large companies,” says Quealy. “Sharp is one of the biggest producers of solar panels. General Electric is one of the largest providers of wind turbines. Lots of these companies are generating significant cash flow.” And current growth rates are sustainable. “In the United States,” says Molchanov, “the market share of solar power is 0.05 percent. So, the industry could expand 20 times and still be at 1 percent. Growing 30 percent a year is sustainable for many, many years to come.”

Bubble or not, clean tech may be the logical successor to info tech. “If the second half of the last century was about the world rewiring its nervous system, the first half of this century is going to be about the world reworking its musculature, how it makes and moves things,” says Michael Potts, CEO of the Rocky Mountain Institute, a think tank based in Snowmass, CO. “All of our energy systems were designed with the assumption of cheap and endless energy. So, now, all those systems have to be redesigned with the reality of expensive and limited energy. We see this tsunami of innovation that’s gonna change it all.”

John Rubino, a former financial analyst, is the author of How to Profit from the Coming Real Estate Bust and Main Street, Not Wall Street.

Indianapolis-based Ener1 announced “a fully functional Lithium-ion battery pack developed specifically for the HEV (Hybrid Electric Vehicle) market.”

BIOFUELS

Plants are essentially solar-energy storage devices. They convert sunlight into stalks and leaves that contain energy, which can, in theory, be tapped to make oil substitutes. The first biofuel to be widely used in the United States is corn-based ethanol. But growing corn and turning it into fuel requires more energy than it produces, and because corn is a foodstuff, ethanol drives up food prices. Other biofuels have more potential. Brazil’s sugar-cane ethanol is cheaper than its corn-derived cousin, and several nonfood plants, such as switch grass, appear to yield acceptable amounts of energy. “This is very-early-stage technology, at the ‘science experiment’ stage,” says Pavel Molchanov. “It’s not likely to be commercialized till 2010 at the earliest.”

SMART GRID

Wiring up the developing world was one of history’s great engineering feats. But then, alas, we stopped. While the Internet was allowing merchants and hackers to track our surfing habits down to the level of seconds spent staring at a given page, the electrical grid remained a one-way technology, with power flowing out but no detailed information about usage flowing back.

That situation is about to change. Utilities are building two-way communication capabilities into the grid. Among the features now being added are real-time metering, in which customers can see their bills change before their eyes, and systems that allow utilities to selectively turn off power to specific appliances when demand strains peak capacity.

GREEN BUILDING

Alternative energy is exciting but not the best way to deal with Peak Oil and global warming, according to Rocky Mountain Institute’s Michael Potts. “It’s much less expensive to save energy than it is to create alternative sources,” he says. Through a combination of simple design changes and new technologies, super-efficient windows, and insulation, Potts believes it’s possible to cut the energy appetite of a given facility by 50–90 percent.

FUEL CELLS

Fuel cells convert hydrogen, one of the most abundant elements on earth, to electricity, which explains why fuel cells have been touted for years as the answer to oil. But although fuel-cell costs are falling, they are still too high to allow fuel-cell technology to compete with other technologies, especially in cars. “The plug-in hybrid preempts fuel cells,” declares Carboy. So, look for fuel cells to show up in forklifts and stationary storage applications but not in mass-market vehicles.