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Special Report

CAN VENTURE CAPITAL REALLY INFLUENCE ENVIRONMENTAL SUSTAINABILITY?



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CONTENTS



Can Venture Capital Really Influence Environmental Sustainability?

Startup companies are developing a wide range of new — and sometimes exotic — sustainable-energy technologies to help countries move away from their dependence on dwindling and greenhouse-gas producing fossil fuels. In this special report from the 2011 Wharton Global Alumni Forum in San Francisco, Knowledge@Wharton surveys the role and limitations of venture capital in contributing to this transformation.

Venture Capital Investment in Alternative Fuels Remains Strong 2

Reports that venture capital investment in alternative fuels is slowing, edged out by trendy fields like social networking, appear to be premature. Considerable enthusiasm for clean fuels and related products still exists, according to speakers at the Wharton Global Alumni Forum in San Francisco. The speakers were part of a panel addressing the question, “Can Venture Capital Really Influence Environmental Sustainability?” Their positive outlook is borne out by statistics.

Opportunities for Venture Capital Grow More Focused as Wind and Solar Projects Grow Larger 6

Investors are increasingly turning to large-scale projects as the renewable energy market matures. Wind and solar projects are now frequently measured in utility-scale megawatts, not kilowatts, and require lengthy timelines and large budgets to complete. The main source of funding for such projects thus comes from banks, private equity funds, utilities and governments, noted Bernard David, a speaker at the recent Wharton Global Alumni Forum in San Francisco.

More Than Venture Capital Is Needed to Help Cleantech Startups Cross ‘The Valley of Death’ 10

Venture capital can jump-start sustainable-energy technologies and projects, but it will take far more financial muscle to bring them to fruition. That was a key message of panelists who discussed the question, “Can Venture Capital Really Influence Environmental Sustainability?” at the Wharton Global Alumni Forum in San Francisco.



Venture Capital Investment in Alternative Fuels Remains Strong

Reports that venture capital investment in alternative fuels is slowing, edged out by trendy fields like social networking, appear to be premature. Considerable enthusiasm for clean fuels and related products still exists, according to speakers at the Wharton Global Alumni Forum in San Francisco. The speakers were part of a panel addressing the question, “Can Venture Capital Really Influence Environmental Sustainability?” Their positive outlook is borne out by statistics.

The first quarter of 2011 was a record-breaker for so-called cleantech generally, with global investments (in North America, Europe, China and India) totaling \$2.75 billion in 161 deals, up by more than 50% from the previous quarter. Solar was the leading sector (\$640 million), followed by transportation (\$311 million) and materials (\$296 million). But the momentum slowed. According to preliminary results from Cleantech.com, investment fell 33% in the second quarter of 2011 (to \$1.83 billion), with energy efficiency (\$428 million in 38 deals) taking the lead role.

potential reward. An analysis by Google.org in June 2011 created a model showing that by 2030, “aggressive energy innovation” could reduce American oil consumption by more than 1.1 billion barrels a year, add more than \$155 billion a year to the Gross Domestic Product (GDP) and create 1.1 million net new jobs. Even a five-year delay in putting an accelerated schedule in place could cost the U.S. economy as much as \$3.2 trillion in unrealized GDP gains by 2050, the report said.

“The fuels market is hundreds of billions of gallons and a giant opportunity,” said Andrew Chung, a Forum panelist and director at Lightspeed Venture Partners in Menlo Park, Ca. Lightspeed has invested in algae producer Solazyme, which makes renewable fuels and chemicals through a fermentation process.

According to panelist Ashmeet Sidana, a partner at Foundation Capital in Menlo Park, “Fuels are an incredibly large market with high variety-of-use cases. People use them for all kinds of things, and that makes it extremely attractive for innovation. If you can secure even a small niche of that market, you can build a successful business.”

Panelists focused on three specific niches within the fuels market:

Algae: Serial entrepreneur Bernard David has invested in algae-based fuels, an experience that has led him to conclude that much of the technology is “still an R&D exercise,” although one with potential, said David. Algae is grown, harvested and converted into a base crude oil that can be refined into biodiesel, gasoline or jet fuel. A major advantage is that, unlike corrosive ethanol, algae-based fuel can leverage the existing network of 160,000 gas stations. By contrast, the need for a separate infrastructure has stalled the growth

“The fuels market is hundreds of billions of gallons and a giant opportunity.”

—Andrew Chung, Director,
Lightspeed Venture Partners

There is a reason alternative fuel and plug-in car companies, which access the “alternative fuel” known as electricity, remain an attractive investment. Although the risk is great, so is the

of both hydrogen and ethanol fuels. “Algae could be the Holy Grail, and I want to be bullish on this sector,” said David, a fellow at Wharton’s Initiative for Global Environmental Leadership (IGEL). “It’s important to have other applications for the algae.”

Those “other applications” are what led Chung’s company, Lightspeed, to invest in South San Francisco-based Solazyme — described by *The Economist* magazine as “a promising anomaly” because it grows algae in industrial vats instead of using sunshine to make it in outside pools. In addition to producing renewable crude oil for transportation fuels, with the U.S. Navy as a customer, Solazyme’s algae is used to make cosmetics and both human and animal food. It can replace problematic palm oil in some applications and be used to make soap, lotions, mayonnaise and even the brownies that Chung has sampled. This versatility could be a key to the early success of an algae biofuel investment. Other funding for Solazyme comes from Unilever, Chevron and agribusiness firm Bunge.

Ethanol: Robert W. MacDonald, managing partner of Craton Equity Partners in Los Angeles, sees “an active market” for biofuels, including E85 ethanol and biodiesel, especially in California, where the network of biofuel pumping stations is expanding. E85 fuel is 85% ethanol. But panelist Sidana is also concerned about biofuel “food vs. fuel” issues. The aggressive U.S. expansion of acreage for corn grown for ethanol has led to sharply higher prices and increased competition for crops. In July, the Chinese purchase of 540,000 metric tons of U.S. corn for delivery in the fall sent future prices up again, to approximately \$6.75 per bushel. That was almost double the \$3.60 per bushel corn future price of the previous summer.

Cellulosic ethanol, made from the non-edible parts of plants, avoids this issue. But cellulosic ethanol has struggled to move from the R&D stage to commercial-level production. POET LLC, the world’s largest producer of ethanol, has blamed the slow pace of investment in cellulosic ethanol on an uncertain political climate that includes controversy over the introduction of 15% ethanol fuel (E15) at gas pumps, and the future of the 45-cent-per-gallon tax credit for each gallon of ethanol that fuel blenders mix into gasoline. The Senate voted in June to repeal the credit, but it is still likely to survive.

Ethanol remains popular with the U.S. Department of Energy. The DOE in early July offered Sioux Falls, South Dakota-based POET a \$105-million

loan guarantee to help build the country’s first commercial-scale cellulosic plant. The Emmetsburg, Iowa, facility would produce 25 million gallons of cellulosic ethanol fuel annually.

Sidana was skeptical of the outlook for cellulosic ethanol. Investors like to “discover” a new technology and get in early for larger down-the-road returns, he said, but this can be difficult with early-stage alternative fuels like cellulosic ethanol. “Will you be able to finance it all the way to success?” he asked. “You need a cheap source of financing, and the Department of Energy has provided it in this space, including loan guarantees. But funding of that kind is temporary and subject to the vagaries of politics. And we’re not in the business of predicting political outcomes.”

Electric Cars: Electric vehicle startups also face an uncertain political climate, including the need to renew or extend tax benefits, and also volatile gas prices that can dramatically affect demand. But with carmakers increasingly convinced that the automobile will electrify in the long run, it is also a high-risk, high-reward investment.

Panelist Cynthia Ringo, managing partner at DBL Investors in San Francisco, noted that she “fundamentally believes in electric vehicles.” DBL has invested in Palo Alto, California-based Tesla Motors, which makes the all-electric \$109,000 Tesla Roadster and the forthcoming all-electric \$49,900 Model S Sedan. “We don’t think that fossil-fuel dependence can be addressed solely with hybrids,” Ringo said. “Tesla has had some near-death experiences, and the investment we made was frequently ridiculed. A lot of smart people disagree vehemently in venture capital, but look at how Tesla has developed.”

Tesla Motors has yet to post a profit but raised \$266 million in 2010 in a successful IPO and is widely considered to have some of the world’s best battery technology. The company is also a possible takeover target for Daimler or Toyota; both have invested in Tesla and have technology partnerships with it. Tesla’s “intellectual property, powerful brand image and industry-leading products will make it a very attractive and likely acquisition for a well-established car manufacturer,” according to BusinessInsider.com.

Ringo noted that Tesla’s management team would prefer to remain independent. But if the company is acquired, she said, “it would not affect DBL at all, because we have distributed the stock to our investors already. And it’s possible that an

acquisition would mean a big bump for whoever is holding that stock.”

Panelist MacDonald noted that other electric vehicle (EV) startups “are queuing up to go public.” But he cautioned that new EV makers will have to demonstrate staying power and all the ancillary services that go along with selling an automobile. “The existing companies have an edge over the startups because they have been making cars for many years,” MacDonald said. “With Detroit back on its feet, it will be producing competitive electric vehicles. The startups will need to provide comparable sales and service, and they will have to be ready to handle warranty claims and recalls.”

Sidana pointed to Better Place, a Palo Alto-based EV-charging company, as a potential game changer. Founded in 2007 by Shai Agassi, Better Place has brought to the table two ideas that have changed the debate on building an infrastructure for EVs, according to Sidana. “It is the combination of battery swapping and battery leasing that is so intriguing,” Sidana said. Battery swapping involves installing a fresh pack through an automated process when the old one runs out of charge. “Leased batteries can be easily swapped because there are no ownership issues, and that can eliminate the need for rapid, 480-volt DC charging,” Sidana said.

Exit Strategies: “When we get involved with clients,” noted John Krahulik, the global head of clean technology banking at Bank of America, “part of our job is thinking of exit strategies for investors. And the opportunities for mergers and acquisitions in the cleantech space are massive.” Tesla is just one of many cleantech companies in play, he said.

Krahulik described companies that address energy efficiency — either on the demand or the supply side — attractive investments today. So are companies that offer innovation in clean-water technology and sustainable building. “There are companies trying to figure out the quickest way to fund their model,” Krahulik said. “They’re lining up government-backed capital or finding corporate partners in the venture life cycle. It boils down to economics. We’re looking for technologies that are cost-competitive with or without a government subsidy.”

New technology can be a tough sell, however. “It is fairly infrequent that consumers will gravitate to a product that is economically less attractive than conventional solutions,” said Krahulik. “Companies

that have the right message need to be able to lay out a path forward — a short path. If they can do that, they’ll see good uptake in the markets. And if they can provide a real competitive advantage from energy generation, then exiting through M&A is very attractive. We’ve seen some great exits, and there are seven times more exits through M&A than there are IPOs.” In Tesla’s case, the company could be acquired *after* it has gone through an IPO.

Today’s Market: MacDonald offered an historical cautionary tale. In the 1980s, high oil prices prompted a wide variety of alternative energy projects, he said, including hydroelectric, solar, waste-to-energy and co-generation. “They had a great run of success because of the availability of capital — you could finance your project with 40% equity, and the utilities cooperated. But then oil prices came down again, and everything went away. It took concern about climate change and a new focus on a cleaner environment to renew the interest.”

Today’s up-and-down oil prices continue to affect the market for many types of alternative fuels. Yet there is a greater public consensus about the need for cleantech than there was in the 1980s, according to MacDonald, and the opportunity for investors is larger than ever before and has been building in recent years. “Cleantech investment in the U.S. in 2000 was less than \$500 million,” he said. “Now it is \$9 billion, and \$200 billion is going into clean tech worldwide.”

MacDonald’s Craton Equity Partners created a \$240 million fund dedicated to cleantech in 2004 and secured investments from large pension funds and other sources. “The pension funds are extremely happy, and plan to renew their investment,” he said.

Summing up the outlook for cleantech, MacDonald sees “an active market” for biofuels. While algae fuel is “not our market,” he says, the growing scope of investment in algae is “good for us” because it indicates a growing and much better-prepared alternative fuels market. Craton invests in second- or third-stage companies, and algae fuel is still emerging.

“The deals we’re seeing now at Craton as opposed to five years ago are more mature,” MacDonald added. “There are more investors in the market and better management. There’s a migration of top talent from Fortune 500 corporations to smaller companies because the cleantech opportunity appeals to them.”

While there will always be trendy investment

sectors, MacDonald noted that cleantech provides an alternative to an oil industry that is challenged by supply questions and growing concern about the impact of fossil fuels on climate change. He

acknowledged that “a lot of money has gone into social networking, but the investment market is trillions [of dollars]. We continue to see very strong cleantech activity in the market.” ☀

Useful links:

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<http://www.greentechmedia.com/articles/read/top-5-demand-response/>

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<http://online.wsj.com/article/SB10001424052702304793504576434261682404834.html>

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Opportunities for Venture Capital Grow More Focused as Wind and Solar Projects Grow Larger

Investors are increasingly turning to large-scale projects as the renewable energy market matures. Wind and solar projects are now frequently measured in utility-scale megawatts, not kilowatts, and require lengthy time-lines and large budgets to complete. “Utility-scale generally means ‘really big,’ which implies project finance, not venture capital,” serial entrepreneur Bernard David told the Wharton Alumni Forum in San Francisco. The main source of funding for such projects thus comes from banks, private equity funds, utilities and governments, noted David, a fellow at Wharton’s Initiative for Global Environmental Leadership (IGEL).

In June, Bank of America announced a joint venture to develop the biggest rooftop solar-generation project in the world.

But there are still good opportunities for venture investors in smaller-scale projects, said Jon Kraulik, the global head of clean technology banking at Bank of America and a fellow member of the panel that discussed the question, “Can Venture Capital Really Influence Environmental Sustainability?” Kraulik agreed that venture investment “seems more challenging around the commodity/capital-intensive areas.”

The more interesting opportunities “are elsewhere in the value chain,” he added, “such as micro-inverters and other technology to boost performance.” Micro-inverters turn the current

from a single solar panel into current that can be distributed to a power grid. “Also worth investigating are some of the evolving ownership/financing models.”

Bank of America is exploring distributed generation on a very large scale. In June, the company announced a joint venture with industrial real-estate developer Prologis and utility NRG Energy to develop the biggest rooftop solar-generation project in the world. Plans call for it to generate a total of 733 megawatts — enough power for 100,000 homes — for residential users in 28 states. The U.S. Department of Energy is providing a \$1.4 billion loan guarantee toward the \$2.6 billion overall cost of this enterprise.

Big Projects Spawn Niche Opportunities

The consensus among panelists was that small-cap venture investors, whose primary market is high-risk/high-reward startups, can find attractive prospects in the renewable energy industries. Many such targets are emerging companies that supply products to large-scale wind and solar farms. An example is Japan’s Loopwing, which designs wind turbines that sharply reduce vibration and noise.

Wind installations are growing fast. Around the world, 35.8 gigawatts of wind power were added in 2010, according to the Global Wind Energy Council, bringing the total to 194.4 gigawatts. That’s a 22% increase from the 158.7 gigawatts installed by the end of 2009. And more than half of all the wind power added in 2010 was outside Europe and North America, which had been the biggest markets.

China alone has more than 52 gigawatts of installed wind power, surpassing the second-place U.S. total of 42 gigawatts. And thanks in part to huge

government subsidies and tax incentives, China could have a massive 100 gigawatts by 2020. In addition, China is the world's largest producer of wind-energy equipment.

Spain is also rapidly becoming a major wind player, said panelist Andrew Chung, a director at Lightspeed Venture Partners in Palo Alto, Ca. "It's pretty aggressive what they're trying to do in Spain," Chung said. "Iberdrola is a really large player, the No. 1 developer in the world, and Spain became the largest wind producer in Europe last year."

Other developing countries with big investments in wind last year included Brazil, which installed 326 megawatts, and Mexico, which added 316 megawatts. In North Africa, Egypt, Morocco and Tunisia added a total of 213 megawatts.

Off-shore Wind Farms Face Obstacles

Much of this global development has been taking place offshore, where winds tend to be far more consistent than on land. But delays have kept work from starting on the first U.S. offshore wind farm, the Cape Wind Project off Cape Cod in Massachusetts, for 10 years since it was first proposed. The 130-turbine, 420-megawatt project has been through review processes with no fewer than 17 federal and state agencies and has had to fight a vocal and well-funded opposition campaign from Cape Cod residents who argued that it would spoil the offshore view. The \$2.6 billion project now has a Construction and Operations Plan approved by Interior Secretary Ken Salazar. But even assuming that funding is in hand and no further delays intervene, construction will take two more years.

Offshore wind development has been considerably easier in Europe than in the United States, but it faces hurdles even on the Continent. Analysts expect a 93% drop in orders for new British-made offshore turbines in 2013. Among the reasons cited by London's *Guardian* newspaper are "planning problems, difficulties securing finance and cost overruns on existing projects."

Forum panelist Robert W. MacDonald noted that "large offshore projects like Cape Wind are not our market. Generally, the larger projects have high visibility, longer time frames and bigger capital demands, said MacDonald, the managing partner of Craton Equity Partners in Los Angeles. "You can't go into them thinly capitalized, because they can easily take two or three years more than you were expecting."

The obstacles to offshore wind development, which is twice as costly as on-land projects, have caused a slump in turbine manufacturing that might open a venture-capital window. "The turbine market will come back, but maybe not soon to 2008 and 2009 levels," said Chung. "It's not a bad time to be a wind developer for that reason. Because the turbine makers are on the ropes, developers are in a powerful position to negotiate pricing."

On Land Wind Farms Are Less Controversial

So-called viewshed objections have been rare in the case of large on-the-ground wind farms in economically challenged but wind-rich regions of Texas and New York State. Farmers and ranchers receive substantial subsidies for making their land available in such places.

In June, Google announced that it was investing \$102 million in the Alta Wind Energy Center in Tehachapi, Ca. The utility-scale wind farm has a planned output of 1,550 megawatts. And this wasn't Google's first investment in Alta, which broke ground in 2010. Google's new infusion brought its total commitment to \$157 million.

The search-engine giant's money is coming from its core business rather than its investment arm. Google will use electricity from Alta Wind to power the company's data centers. Google's \$102 million is complemented by a same-sized investment from Citigroup; the two companies will hold leveraged leases over a total of 270 megawatts of Alta's generation capacity.

Google's renewable energy investments now total \$780 million, with most of that capital committed in 2011. And as Bloomberg News reported, "All except two of the company's investments in clean energy projects were structured as tax-equity financing, tapping government incentives that encourage large companies to back promising projects that often have yet to generate income."

Alta has now attracted \$631 million in funding. The wind farm is connected to Southern California Edison, which has a 25-year power-purchase agreement. California is committed to generating 33% of its electricity from renewable energy sources by 2030, which will require a vast purchase of clean power. A total of 27 states and the District of Columbia now have binding commitments to increase their use of renewable energy. Such commitments alone are enough to spur investment in large-scale solar and wind projects.

Other opportunities in the wind industry include the development of longer turbine blades that can generate power in less-robust wind areas. And high-voltage transmission lines to carry wind- and solar-generated energy to cities are urgently needed.

Still another avenue for venture capital lies in the development of large-scale storage systems for the use-it-or-lose-it energy that big wind farms produce. This need is acute among land-based ventures, which generate most of their power at night when demand is low. "The battery industry is in the early stages of figuring out storage options," says Chung, making companies that offer effective energy-storage solutions excellent candidates for venture capital.

Making Steam from Solar Heat

One of the biggest trends in utility-scale solar power is a technology that uses heat from the sun to boil fluids to produce steam that can run conventional turbine generators. Called concentrated solar power (CSP), this technology uses huge reflectors to boil the fluids and works well in regions with intense sunlight, such as the desert Southwest.

Venture capital backers of this technology include DBL Investors, which has a stake in BrightSource Energy (formerly Luz II), a major CSP player based in Oakland, Ca., that has filed to raise \$250 million in a public offering this year. BrightSource is developing a 392-megawatt CSP project in California's Mojave Desert with backing from sources that include Draper Fisher Jurvetson, Google, Morgan Stanley and the French utility Alstom.

Panelist Cynthia Ringo, managing partner at DBL Investors in San Francisco, said the BrightSource project "can generate as much power as a nuclear plant, with no danger except to 39 desert tortoises. It cost \$1 million per tortoise to move them." Tortoise problems caused the Mojave plant to be stalled for several months in 2011 as it waited for U.S. Bureau of Land Management approval. The project was greenlighted again in June.

BrightSource hasn't made money so far. It had losses in both 2008 and 2009, and lost \$71.6 million in 2010 on revenue of just \$13.5 million. But investors plainly like what they see, and the company has 14 power-purchase agreements to deliver 2.6 gigawatts of power to the Pacific Gas and Electric Co. and Southern California Edison. BrightSource estimates the revenue opportunity at \$4 billion. While land-use questions will continue to pop up, the company has control of 110,000

acres in California and the Southwest for further expansion. Two other BrightSource projects are under development in California.

Distributing Power to Grids from Rooftop Solar Panels

Not everyone is convinced that CSP represents the future of solar power. "In general, utility-scale solar is a growing area," says Lightspeed's Chung. But he adds that CSP "hasn't been an early area for investors to really take off on. There have been so many players, with a lot of startups claiming the superiority of different [solar] technologies. Meanwhile, the cost of regular flat-panel solar is coming down rapidly with the price of silicon, and that doesn't require a big investment in the development of mirrors, heat sinks and frames. At Lightspeed, we think that large farms of conventional panels will win in the long run."

Conventional panels can also be used in rooftop solar projects like the one that Bank of America has invested in, which will collect solar power from homes and distribute it to a grid. Unlike CSP, such projects don't have to deal with "land acquisition challenges, power line shortages, water supply problems, endangered species and vocal environmentalists," as the environment and energy publication *Greenwire* has noted.

DBL has put its money on conventional panels for distributed solar generation too. DBL has invested in Solaria in Fremont, Ca., which designs and manufactures conventional silicon products to maximize yield in photovoltaic systems. Solexant, a San Jose, Ca., producer of nanotechnology-enabled thin-film photovoltaics, is another DBL venture.

Still another is SolarCity, a major player in distributed generation. The company, based in San Mateo, Ca., developed a model in 2008 that gives homeowners the option of no-money-down leases. This appeals to consumers who are daunted by up-front photovoltaic costs. SolarCity now has 15,000 customers, has expanded to the East Coast, and received a \$280 million investment from Google earlier this year. Other investors include Draper Fisher Jurvetson and Elon Musk, the CEO of all-electric car maker Tesla Motors and a first cousin of SolarCity CEO Lyndon Rive.

The success of SolarCity has spawned other players in the solar-leasing business. These include SunRun, which closed a \$55 million Series C round in 2010 with investments led by Sequoia Capital; and Sungevity, which has pulled in \$25 million from

venture firms and individual investors that include the actress Cate Blanchett.

SolarCity's rooftop systems also generate tax advantages. The company collects the 30% federal tax credit on residential solar installations and sells it to investors or banks with taxable incomes. Solar City also is eligible for renewable energy credits that can be sold to other companies, and it has set up zero-emission solar-powered battery charging stations for electric vehicles. "Clearly, we believe that solar is a growth area with applications in different parts of the value chain," said Ringo. "It's going to be a huge market, and SolarCity is a solar integrator that has expanded rapidly."

Companies like SolarCity have helped the solar market grow. The total annual manufacturing output of all solar companies in 2000 was just 300 megawatts with worldwide sales of only \$2.5 billion, according to a report by ScottMadden Management Consultants. By 2010, the global market had climbed to \$71.2 billion. The U.S. market grew from \$3.6 billion in 2009 to \$6 billion last year, according to the Solar Energy Industries Association. Congress boosted the industry in 2008 by extending the 30% federal investment tax credit for both residential and solar installations for eight years. Still, the business remains uncertain. The late summer 2011 bankruptcies of three American solar companies — Solyndra, Evergreen Solar and SpectraWatt (representing nearly a fifth of domestic solar panel manufacturing) — was sobering, and a boon to the growing Chinese industry.

But renewables like wind and solar are still a tiny part of the worldwide energy mix. Non-hydroelectric renewables supplied just 1.8% of total global energy consumption in 2010, according to the BP Statistical Review of World Energy. Such renewables are growing rapidly, however, and accounted for fully half of the 194 gigawatts of new global generating capacity installed last year, thanks largely to the expanding size of the projects.

The renewable market continues to have its ups and downs. Investment in global clean technology took a 33% dive in the second quarter of 2011 after recording outstanding first-quarter results. But renewable energy, large and small, had a very good 2010 and grew 32% worldwide.

Meanwhile, wind and solar hardware costs per megawatt of generation capacity have been rapidly dropping. Photovoltaic prices have fallen 60% since mid-2008, while the price of wind equipment has gone down 18% in the past two years. "Photovoltaic efficiency is improving by leaps and bounds," says Robert Giegengack, a professor in the department of earth and environmental science at the University of Pennsylvania. "The large renewable market is somewhat artificial, because there are huge subsidies. But unlike ethanol, wind and solar projects have a positive energy balance when they are done properly."

For large investors, big wind and solar present a ripe opportunity, along with many challenges. And venture investors can benefit from the fact that these maturing technologies will need plenty of support from innovative suppliers. ☀

Useful Links:

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More Than Venture Capital Is Needed to Help Cleantech Startups Cross 'The Valley of Death'

Venture capital can jump-start sustainable-energy technologies and projects, but it will take far more financial muscle to bring them to fruition. That was a key message of panelists who discussed the question, "Can Venture Capital Really Influence Environmental Sustainability?" at the Wharton Global Alumni Forum in San Francisco.

"The American venture capital model may not be the best approach to financing cleantech projects," noted moderator Eric Orts, Wharton professor of legal studies and business ethics, and director of the Initiative for Global Environmental Leadership (IGEL). "The Chinese provide direct government support and they are beating us with consistent funding. There are also high levels of government funding in Europe, and maybe that's an indication we need policy alternatives."

Without government or major private backing, many promising U.S. companies are left to languish in the so-called Valley of Death — the gap between receiving startup funding and producing a commercial product.

Without government or major private backing, many promising U.S. companies are left to languish in the so-called Valley of Death — the gap

between receiving startup funding and producing a commercial product. Those stuck in the valley include companies with a host of innovative ideas. Among them are technologies covering wind and solar power; energy efficiency; water purification; fuel cells; algae as a fuel stock, and cellulosic ethanol from non-edible parts of plants.

"You need more than venture capital to get to launch," said panelist Bernard David, a serial entrepreneur and fellow at IGEL. "To reach the commercial stage, you often need \$100 million or more, so your choices for that level of funding become private equity firms, large companies that have enough cash on their balance sheets, or the public markets."

Meanwhile, the pace of venture funding for cleantech is growing, according to panelist Jon Krahulic, global head of clean technology banking at Bank of America. Krahulic noted that 20% of venture funding now goes to sustainable energy efforts, up from just 3% in 2005.

Bank of America is committed to investing \$20 billion in renewable energy sources and sustainability over the next 10 years. But the money won't be there to shore up shaky companies. The firms most likely to get funded are those that can compete in the marketplace without subsidies, Krahulic added.

However, even healthy companies are going to have a hard time finding sources of large-scale financing in the near term, given the fragile state of the global economy. "Project financing," says David, "became very difficult to obtain with the economic downturn, and that's why there has been such an emphasis on government loan sources."

Private funding remains available to companies that present a compelling case, said Chris Hansen, director of corporate strategy for the global information company IHS and a speaker at the Wharton Energy Conference in 2010. For example, some private equity funds are now cash-rich and becoming less risk-averse, Hansen said. "They are chasing after some earlier-stage investment," he added. But for many American companies unable to find that private financing, waiting for elusive government funding has become a way of life.

U.S. Government Support Continues to Lag

U.S. Energy Secretary Steven Chu recognizes the challenges ahead. "There is a race under way to develop the clean energy technologies the world will demand," Chu told a Department of Energy (DOE) conference last February. "China, the European Union countries and others recognize there will be huge opportunities, and they are investing big money."

Spain is the current investment leader in terms of the size of its economy. Chu showed a slide in which Spain's clean energy investments totaled 0.71% of the country's Gross Domestic Product (GDP). Spain was followed by China (0.70%); Great Britain (0.51%); Brazil (0.47%), Canada (0.25%) and India (0.19%). The United States trailed all those countries with just 0.13% of its GDP devoted to investment in cleantech. However, Spain's 2011 debt crisis and credit downgrade may push it out of the lead.

Strong and consistent government subsidies have borne fruit in China, Japan and Europe. China has surpassed the United States as the largest investor in clean-energy technologies in terms of the overall size of its investment. And while the 51% increase for U.S. cleantech funding between 2009 and 2010 may seem dramatic, it was dwarfed by the 273% gain for the period in Mexico, according to Bloomberg New Energy Finance. Also showing big gains were Italy (207%), Australia (119%) and Canada (56%).

The rise of Asia's "Cleantech Tigers," a group that includes China, Japan, South Korea and India, has been strongly buoyed by government spending. Beijing pledged \$200 billion in funding for Chinese green initiatives in 2009, topping the U.S. by 79%, according to John Adamo, a capital markets associate at Think Green Global Advisors. With 16 of the world's most polluted cities, China has a powerful incentive to shift from its traditional reliance on coal power to renewable sources.

China's goals include production of 20 gigawatts of solar power and 100 gigawatts of wind power by 2020. China wants to generate 15% of its energy from renewable sources by that date, and has begun installing the low-loss, high-voltage transmission lines that will make this possible.

The China Development Bank Corporation has been a major funder of cleantech projects. The bank, lent Chinese wind and solar companies \$35.4 billion in 2010, according to Bloomberg Businessweek. By contrast, the United States provided \$4 billion in grants and \$16 billion in loan guarantees to American wind and solar concerns last year.

South Korea also is coming on strong. While Seoul's support for cleantech is less well-known, the country's installed solar base has grown at a 52% annual clip since 2001. And the "Green New Deal" that South Korea unveiled in 2009 assigns \$84 billion to the cleantech sector, with \$46 billion of that earmarked for technology development. South Korean startups are also eligible for tax benefits and reduced import tariffs.

The United States lags in funding even as it enjoys a substantial edge in innovative technologies. Microsoft founder Bill Gates noted last spring that the country holds a "dominant position" when it comes to "the power to innovate" in energy. Speaking at a fundraiser for the clean-energy nonprofit Climate Solutions, Gates stated: "I know of 100 great new energy ideas, companies being started. I'd say 70% of them are based here in the United States, even if they're looking at doing some manufacturing [elsewhere]." The Chinese "need our innovation," said Gates, "and any solution that turns the energy game into a nationalistic one-upsmanship thing isn't going to get us where we need to go."

Examples of technologies that were developed but never commercialized in the United States include the high-speed magnetic levitation (maglev) train, which can travel more than 300 miles per hour by using magnets to rise above and zip along a guideway. Maglev technology has found willing takers among transit systems in Europe and Asia. But when new technology relocates overseas, it takes jobs and supplier contracts with it.

Here Today, Gone Tomorrow

U.S. government support for cleantech has been sporadic. Hansen of HIS cited a telling example of here-today, gone-tomorrow cleantech funding.

From 1998 to 2000, Hansen worked for the U.S. Department of Commerce's innovative Advanced Technology Program (ATP), an early cleantech sponsor that provided 50-50 matching grants of up to \$500 million to help commercialize new technology. "The funding provided a huge halo effect," Hansen said. "We saw many companies get access to capital after they were selected."

But the program, which was launched under President George H. W. Bush, eventually lost political support. It turned into the Technology Innovation Program under the second President Bush and was "zeroed out" of the federal budget for fiscal 2011, which ends on September 30.

Some slack has been taken up by the DOE's Advanced Research Projects Agency-Energy (ARPA-E), which received \$400 million in 2009 under the American Recovery and Reinvestment Act. This agency is modeled on the military's Defense Advanced Research Projects Agency, or DARPA, which spawned the Internet. ARPA-E's mission includes addressing early-stage "Valley of Death" problems and supporting what the agency calls "creative 'out-of-the-box' transformational energy research that industry by itself cannot or will not support due to its high risk but where success would provide dramatic benefits for the nation."

ARPA-E has funded dozens of projects supporting better batteries, biofuels and grid-level energy storage, among other technologies. But the agency, which requires private-sector matching funds for projects that get federal money, also faces the need to maintain political support for consistent funding. For fiscal 2011, \$180 million was allocated ARPA-E through the appropriations process.

The agency's awards to energy companies range from a few hundred thousand dollars to \$10 million and are designed to support "really disruptive game-changing technologies that can have huge impacts," according to Ilan Gur, senior advisor for commercialization at ARPA-E, in an August interview with Wharton. Gur cautioned that ARPA-E doesn't provide late-stage project finance. It supports companies that are trying to prove their technology or build their first prototype so that private funding can then come in.

As one of the few government agencies that finances innovation, ARPA-E is deluged with proposals. It received 3,700 applications for 37 awards in its first round of funding. "We're extremely excited to see that the technologies

we're supporting have been able to help companies across the funding gaps," Gur said. "It looks like we will have some of the game-changing impacts we were set up to provide."

While the 2009 Recovery Act provided some project-level support beyond ARPA-E, any further large-scale cleantech funding faces an uncertain future.

The stimulus package extended production and investment tax credits for renewable energy through 2012. This extension aims to boost commercial photovoltaic sector capacity 15% over a business-as-usual scenario, and to more than double the amount of wind generation that would otherwise be produced. But the extension is still a finite window, and the trend in recent years has been toward last-minute renewals that create market uncertainty about whether they will be granted. The production tax credit actually expired three separate times between 1999 and 2004, for example.

The Recovery Act also provided \$80 billion in federal spending for renewable energy. This included grants covering as much as 30% of the installation cost of renewable energy facilities. Also included were \$11 billion to modernize the power grid, \$4.5 billion to make federal buildings more energy efficient and a DOE loan guarantee program. It was a massive boost for the sector, but also one-time funding rather than steady support. That level of stimulus spending is not likely to be repeated anytime soon.

Government funding affirms a company's technology, making it easier for the firm to locate other sources of capital. Obtaining DOE loans or loan guarantees is "a pretty laborious process to go through," said panelist David. But for the lucky few that clear all the hurdles, the affirmation is a huge vote of confidence.

David pointed to the positive impact of government support on Palo Alto-based Tesla Motors. The maker of all-electric vehicles received a \$465 million low-interest loan from DOE in 2009. Tesla then obtained a \$50-million investment from Toyota and \$30 million from Panasonic in 2010 and raised \$226 million by going public that same year. "Tesla would never have made it to market with just venture capital," said David. "It needed, and got, larger funding. All of it came through."

But for every Tesla, there are 20 companies that haven't reached the commercialization stage for want of project financing. Government funding remains an essential, if flawed, pathway for them. "Given unpredictable regulatory trends," noted

moderator Orts, it's difficult for governments to plan what to subsidize, and also to demonstrate that they have been successful with their tech funding."

Yet Washington does have a good track record of funding new and unproven technologies that business is later able to capitalize on, Orts added. He cited NASA's Apollo man-on-the-moon program, which led to such innovations as freeze-dried food, effective water purification, commercial fuel cells, insulation that was later used in green buildings, and flame-resistant textiles that are now used to protect firefighters and soldiers.

The Military Option

Orts pointed to DARPA as a defense agency that is providing crucial investment to startup companies while pursuing its own strategic energy independence. For example, algae fuels producer Solazyme holds two U.S. Navy contracts totaling \$8.7 million to deliver demonstration amounts of algae-based jet and ship fuel. The South San Francisco company also develops algae-based products in areas as diverse as cosmetics and food. While the Navy contracts are hardly large enough to commercialize algae fuel, they provided considerable momentum to Solazyme and helped the company attract other investments.

A military contract boosted Bright Automotive, an Anderson, Ind., startup that has developed a plug-in hybrid delivery van called the IDEA. Bright ran through startup backing from Google, Johnson Controls, Duke Energy and others, but then hit a

wall in locating funding to commercialize the IDEA. The U.S. Army provided a short-term lifeline in 2009 in the form of a \$1.4 million contract to test the IDEA in non-combat military applications. Bright then received \$5 million from GM Ventures, the automaker's investment arm, in 2010.

A much-needed \$1.29 million Army contract also helped EnerDel, an Indianapolis supplier of rechargeable lithium-ion batteries for electric cars from Volvo and Norway's Think Global. The contract calls for EnerDel to develop batteries for a hybrid version of the Army's Humvee. "Defense funding is a good alternative — if you can get it," said David. "You can't count on government funding, and it's important to hedge your bets and look for other possible sources."

Indeed, startups that hope to cross the Valley of Death need a clear timeline and a path to the market, according to James Balaschak, energy and resources principal at Deloitte Consulting and a speaker at the Wharton Energy Conference in 2010. Such companies "have to show they're in control of where they're going and how they will spend the cash," he added. "It can't just be throwing money at their ideas"

That's especially true in today's financially constrained investment climate. The projects most likely to win private and government support, said Orts, are those that maximize energy efficiency and "can immediately show cost savings" that justify ongoing investment. ☀

Useful Links:

<http://www.nema.org/gov/trade/positions/upload/Clean%20Energy%20Exports%20Principles%20July%202011.pdf>

<http://www.reuters.com/article/2011/02/22/idUS240110459720110222>

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<http://www.scientificamerican.com/article.cfm?id=graphic-science-clean-tech-funding-up-countries>

<http://www.grist.org/climate-energy/2011-05-11-bill-gates-energy-philanthropy-rd-funding-u.s.-outcompete-china>

<http://www.renewableenergyworld.com/rea/news/article/2009/06/clean-energy-stimulus-funding-aims-for-clean-government-accountability-transparency>

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<http://www.energyboom.com/yes/china-devouring-united-states-clean-energy-financing>

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<http://www.bnet.com/blog/electric-cars/million-dollar-army-contracts-are-a-lifeline-for-ev-and-battery-companies/1052>

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