

# Tech comes clean

By Bruce Rayner

**UNLESS YOU LIVE** under a rock, you can't avoid all the bad news about the environment. Global warming, carbon footprints, extreme weather, rising sea levels, the possible extinction of polar bears—it's everywhere. Oh, and at our current rate of growth, there will be another 3 billion people on the planet within the next 40 years, up from 6 billion today.

As a market, "cleantech" is large and growing. According to a report by CleanEdge Inc., company revenue in the biofuel, wind, solar-photovoltaic and fuel cell markets is expected to top \$250 billion within the decade, up from \$77 billion last year. And global investment in energy technologies reached close to

\$150 billion in 2007, according to research firm New Energy Finance, as reported by CleanEdge in its 2008 report.

"The market size for cleantech will be measured in the trillions of dollars — it's immeasurably deep," said Erik Straser, partner and leader of the cleantech team at venture capital firm Mohr, Davidow Ventures (Palo Alto, Calif.) Mohr, Davidow has investments in 11 cleantech companies to date, including those exploring solar, biofuel and hydrogen fuel cell technologies.

According to Straser and other investors, we are in the early stages of an investment boom that will last 20 to 30 years. To date, the cleantech business has been driven by a relatively small

number of venture capitalists and entrepreneurial companies. But that's now changing. "Cleantech is going mainstream," Straser said.

Indeed, mainstream venture capital firms, corporate capital funds and even nations are beginning to pour billions into the sector. China, which surpassed the United States in 2006 as the world's largest contributor to greenhouse gas emissions, is investing big in renewable-power technologies. The nation to date has plowed nearly \$3 billion into wind power, \$8.1 billion in solar thermal energy, \$1.7 billion in solar photovoltaics, \$3.1 billion in ethanol and \$1.3 billion in biodiesel, according to Patrick Tam, general partner of Tsing Capital, as reported by China Daily earlier this year.

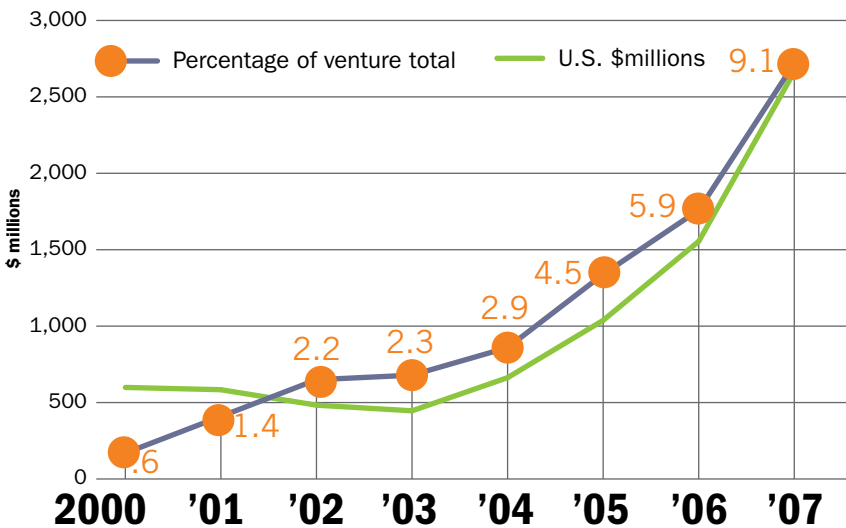
Venture capital investments in China are expected to nearly double, from about \$400 million in 2006 to more than \$720 million this year, according to Cleantech China Research.

India ranks fifth in the world in renewable-energy capacity. To meet the country's energy demand of the next 20 years, however, will require capital investment on the order of \$200 billion.

Even oil-producing nations such as the United Arab Emirates are pouring billions into cleantech ventures and a planned city. (See *Building a Clean Tech City on the Persian Gulf*, p.46.)

The cleantech trajectory looks something like the electronics industry in the days when Silicon Valley was still largely orange groves. Just as the transistor and semiconductor fundamentally transformed our world, many analysts believe cleantech will do the

## Clean-energy venture capital investments in U.S.-based companies

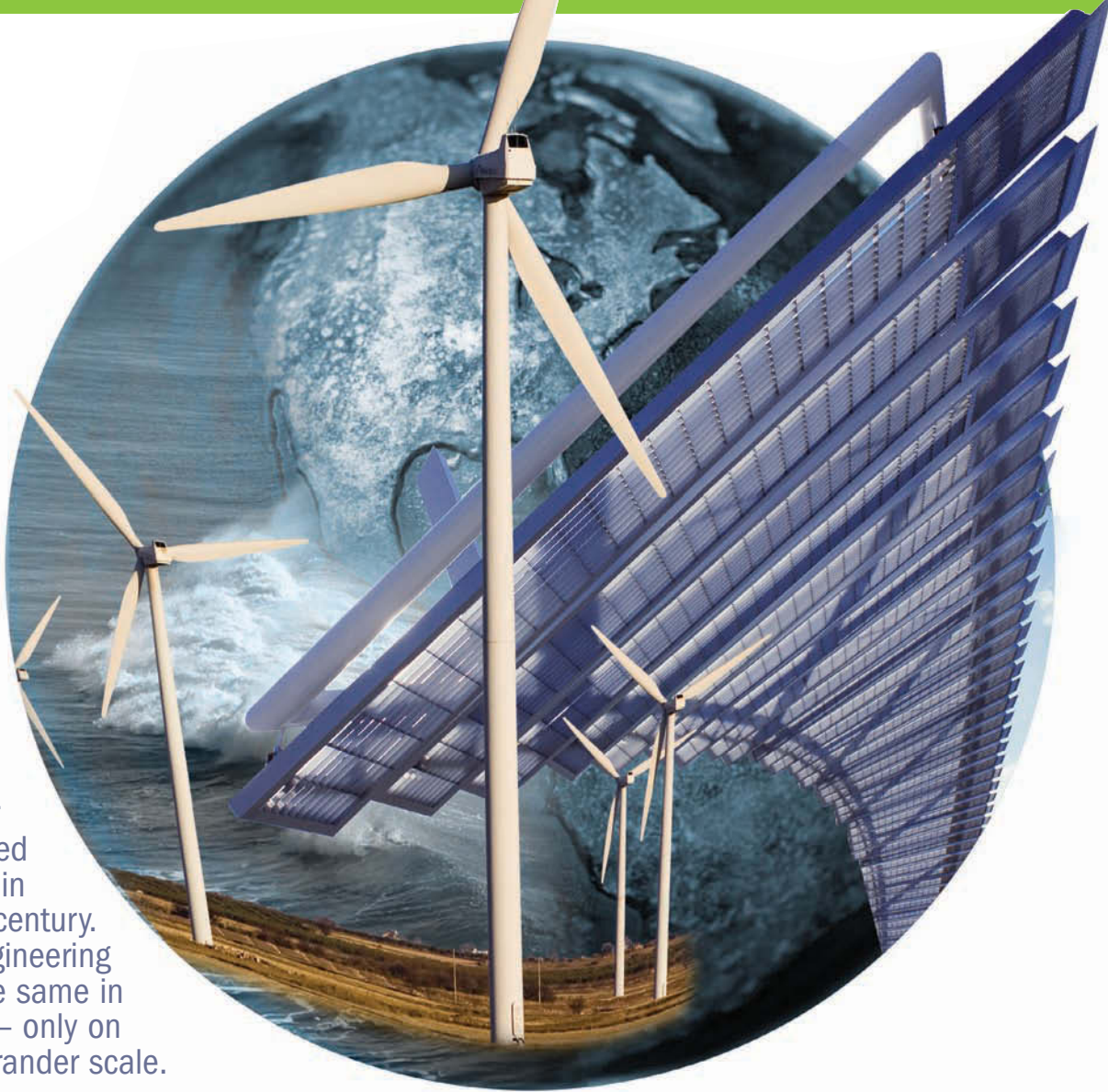


NOTE: New Energy Finance's energy-tech VC numbers include investment in renewable energy, biofuels, low-carbon technologies, and the carbon markets. VC figures are for development and initial commercialization of technologies, products and services, and do not include private investments in public equity (PIPE) or expansion capital deals.

SOURCE: New Energy Finance with supporting data Nth Power and Clean Edge



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The semiconductor transformed our world in the 20th century. Green engineering will do the same in the 21st – only on a much grander scale.

same, only on a grander scale. And of course, the electronics industry is expected to play a leading role in this transformation.

Why electronics? For one, nanotechnology is a driver in the creation of new cleantech applications. Nanotech, defined as below 100 nanometers, is under development by semiconductor, hard-drive and display manufacturers. Its advent has driven investment in lithography technology to produce circuits down to 45 nm to date.

Leading solar-photovoltaic (PV) manufacturers are following in their wake. Thin-film innovators include Nanosolar Inc., HelioVolt Corp., International

Solar Electric Technology and Konarka Technologies Inc.

These companies and others are in a race to commercialize low-cost solar cells using nanoparticle inks sprayed onto flexible substrates. The process is more akin to printing than traditional semiconductor deposition. As they refine their manufacturing processes, the price of solar panels is expected to plummet, thus accelerating the adoption of solar power as a viable alternative to coal and other low-cost nonrenewable sources.

Overall, the market for PV cells is estimated to grow by 40 percent annually until 2010 and 20 percent beyond

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**SANDIA NATIONAL** Labs and Stirling Energy Systems claim a record 31.25 percent for solar-to-grid conversion efficiency. p. 38

that, according to Henning Wicht, senior director and principal analyst for MEMS and photovoltaics at iSuppli Corp. Wicht predicts that the photovoltaic industry will be on par with the semiconductor industry by 2010 in terms of capacity and fab investment. He expects solar to reach grid parity as early as 2012 for regions with a lot of sunshine, such as Spain and Italy, and by 2018 for areas with medium sun exposure, such as Germany.

Opportunities in cleantech, including solar, have been a target for established electronics companies for a few years now. Among those investing in renewable-energy technologies are Applied Materials, Bosch, Cypress Semiconductor, IBM, Intel and Sharp, to name a few.

Intel Investment Capital, for example, has been investing in energy-efficiency ventures that benefit its core businesses, but recently it expanded its scope. "Now we're looking more at the macro scale, at the grid level and at alternative power generation and storage," said Stephen Eichenlaub, managing director of Intel Capital, who focuses on investments in cleantech and emerging platforms.

In July, the microprocessor maker led an investment round in Sulfurcell, a German manufacturer of thin-film copper indium gallium sulfide/selenide photovoltaics. Sulfurcell will use the infusion of cash to build a new production plant in Berlin.

Intel recently announced it is leading a \$50 million investment round in SpectraWatt Inc., the spin-off of a solar-PV cell startup business launched inside its New Business Initiatives group. SpectraWatt expects to break ground on a manufacturing and development facility in Oregon in the second half of 2008 and to ship its first product by mid-2009, according to Intel.

Then there's the investment in Grid Net, a software company that provides WiMax services and reference designs for smart meters to enable the utility industry's Smart Grid. Grid Net is an example of how Intel's investments align with its core business interests, Eichenlaub said. Grid Net has partnered with General Electric and Intel to create an "open ecosystem" smart metering system that utilizes Grid Net's firmware, GE's smart meters and Intel's

WiMax Connection chip sets, according to Grid Net.

While Intel is looking outside its own walls for compatible cleantech investments, it's also among a growing number of electronics companies that are looking inside to apply environmentally responsible practices.

### Innovation inside

Typical internal initiatives include energy conservation (in Intel's case, water stewardship is a major focus), the offsetting and reduction of greenhouse-gas emissions, recycling and reuse of materials and equipment, design-for-environment (both products and processes) and the "greening" of the supply chain.

Energy efficiency and power management have been a driver for RF applications for years and are now being marketed for their environmental advantages as well. The U.S. Environmental Protection Agency's Energy Star program and the European Union's Energy-using Products directive are catalysts driving energy efficiency.

Increasingly, electronics companies of all stripes are touting the environmental benefits of energy efficiency in their products. Actel Corp., for example, is marketing its flash-based FPGAs as more energy-efficient than competing products, particularly when it comes to static-power requirements in cell phones and PDAs.

The challenge, said Actel CEO John East, is to encourage designers to design for low power, whether it's a requirement or not. He believes this mind-set needs to be instilled early in their training.

"While sustainability is an increasingly important area for universities worldwide, with respect to electrical engineering, I think we can do more," said East. "I would love to see more focused coursework on design-for-environment at the undergrad and graduate levels within the electrical-engineering schools."

Supply chain issues, a major concern for many electronics companies for a few years now, were brought into sharp focus in the months leading up to the introduction of the European Union's WEEE and RoHS directives in

## Top U.S. clean tech venture deals in 2007

Total invested (\$ millions), **Technology**

Helio Corp., **Solar**  
**\$100.5**



GreatPoint Energy  
**Efficiency: supply side**  
**\$100**



ArcadianNetworks  
**Efficiency: supply side**  
**\$90**



Solyndra Inc., **Solar**  
**\$79.2**



SolFocus Inc.  
**Solar**  
**\$63.6**



Calera Corp.  
**Solar**  
**\$58.5**



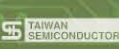
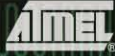
Miasolé Inc.  
**Solar**  
**\$50**



Solaria Corp.  
**Solar**  
**\$50**

Source: New Energy Finance, 2008, as reported by CleanEdge

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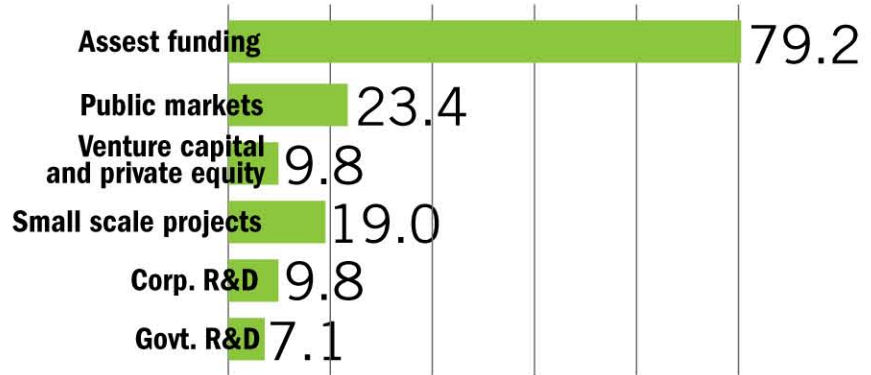
2005 and 2006, respectively. Now, with the June 1 start date for preregistration for the EU's Registration, Evaluation, Authorization and Restriction of Chemicals (Reach) regulation, a new phase of supply chain scrutiny is expected.

Reach ultimately will monitor the use and distribution of thousands of chemicals in the EU. For now, though, the regulation requires that producers of finished products that include a modest number of "substances of very high concern" (SVHC) provide the European "recipient" of the product with information on the substance. In fact, anyone can be defined as a recipient and request this information. Under the directive, the producer company is required to respond within 45 days.

The fear among electronics manufacturers, including semiconductor companies, is that organizations such as Greenpeace and the World Wildlife Fund will launch mass letter-writing campaigns to request this information. This barrage could start as early as Octo-

## 2007 global investments in clean energy

U.S. \$billions



NOTE: Asset financing figure includes a downward adjustment of \$5.3B, reflecting a subsequent reinvestment in projects of VC, PE and public market funds raised by clean-energy companies. Re-investment assumes a one-year lag.

SOURCE: New Energy Finance

ber, which is when the EU is expected to release the candidate SVHC list, said Michael Kirschner, president of Design Chain Associates (San Francisco).

"It's mechanical engineers that need

to be most aware of Reach," he said. "They need to get a better handle on what substances are in the connectors and injection-molded plastics that go into the products." ■



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