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Solar power: California's latest gold rush

Green-energy companies are enjoying a boom in investment. But will they live up to expectation, asks Declan Butler.

[Declan Butler](#)

Silicon Valley is greening. Investors are flocking to low-carbon (clean) energy technologies, fuelling a boom in the sector, with investments set to overtake those in Internet start-ups. But does this venture-capital explosion herald another dotcom bubble?

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“Don't make the mistake of looking for the future in your rear-view mirror.”

Vinod Khosla

For the fast-moving entrepreneurs of the valley, who have successfully invested in disruptive technologies such as the Internet to change the face of entire industries, the next frontier is the roughly US\$6-trillion energy market, where the dinosaurs of power-generation utilities have traditionally invested a pittance in research and development. “Venture capital is exactly what we need to try new things outside the bounds of what the traditional energy companies think is worth doing,” says Vinod Khosla, a veteran entrepreneur who co-founded Sun Microsystems and now heads Khosla Ventures in Menlo Park, one of the most prominent clean-energy venture-capital firms. “There is almost no technology risk-taking in any of the energy companies.” Khosla predicts that within five years there will be a green form of electricity that is cheaper than coal, and cleaner fuels that are cheaper than oil.

Google is committing millions to solar, wind and geothermal technologies.

J. SULLIVAN/GETTY

The US venture-capital industry has spent \$2.6 billion on clean-energy technologies in the first three-quarters of this year — up from \$1.8 billion last year, and \$533 million in 2005 — according to new figures released on 28 November by Thomson Financial and the US National Venture Capital Association (NVCA), which represents almost 500 venture-capital funds. Venture capital is a thermometer of a new sector, dealing as it does with investment in new technologies, products and services. And for every dollar invested here, many more are spent in operations, building such things as solar generators, wind farms and biofuel plants. Total worldwide investment in clean tech, including such investments, jumped from \$28.3 billion in 2004 to \$75.4 billion last year. This year, that figure has already climbed to \$94.5 billion, says Philip Verey at the London-based consultancy firm New Energy Finance.

Worldwide, the star attraction for venture-capital investors is solar power. Although other forms of renewable energy can make significant contributions to current markets, only sunlight is available in the amounts required to substitute completely for the energy quantities currently derived from hydrocarbons. This year's US figures show the same trend, with solar attracting the largest share of investments, \$664.6 million, followed by biofuels and smart power systems (see *Nature* **445**, [586–588](#) ; 2007).

Although the United States is lagging far behind European countries such as Denmark and Germany in implementing renewables, its venture-capital investments in clean tech now more than double those in Europe. California scooped \$726.2 million of this year's US clean-tech venture funding, followed by Massachusetts (\$292.6 million) and Texas (\$149.4 million). Almost \$1 billion of US investment went abroad, including a \$200-million investment in Brazil's Brazilian Renewable Energy, which produces ethanol, and a \$118-million investment in

China's Yingli Green Energy Holding Company, which makes photovoltaic solar systems.

On the up

The increases significantly buck a trend — total public and private spending on energy research in the United States and elsewhere has been dropping steadily since the 1970s. In an analysis of energy-research spending published in January (G. F. Nemet and D. M. Kammen *Energy Policy* **35**, 746–755; 2007), the authors estimate that the US invests \$1 billion less in energy R&D than it did a decade ago, and that this now represents just 2% of all federal R&D, compared with 10% in the 1980s. By contrast, spending on defence and health has been increasing by 10–15% annually during that period.

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The clean-tech market is “fraught with pitfalls and not for the inexperienced or the faint of heart”, according to NVCA president Mark Heesen. It is fit only for investors ready to look long-term and with a deep knowledge of the sector, he warns. “Short-term 'tourists' should steer clear.”

But for the moment, investor interest shows no sign of waning, and a string of new companies is preparing initial public offerings. The WilderHill New Energy Global Innovation Index (NEX), which tracks the share performance of new energy companies, is outperforming indices such as the P&P 500 and NASDAQ. Clean energy is already creating its billionaires: Shi Zhengrong, for example, who in 2001 created the company Suntech, making solar cells, is now China's second wealthiest man.

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