

InSight Cleantech

An Overview of Trends in Select Sectors and Markets

April 2008

Cleantech Investments in Emerging Markets

Global investments in cleantech reached US\$148.4 billion in 2007, an increase of 60% over 2006, with private equity and venture capital accounting for US\$9.8 billion, which represents a 34% increase versus 2006. Cleantech is now among the leading venture investment categories, ahead of telecommunications and medical devices. US venture investors predict that increases in investment in the cleantech sector will continue in 2008, but that the sector will be overvalued.

The US market continues to be the largest for cleantech venture investment, with 159 deals comprising US\$2.7 billion in 2007. US investors account for two-thirds of global cleantech investments (domestically and overseas). However, other markets with severe environmental challenges are experiencing tremendous growth. China's intensifying environmental troubles coupled with favorable government policy are expected to drive continued growth, estimated at US\$580 million in 2007. India's cleantech investment is also expected to rise with expanded government investment and environmental policy enforcement; investment will be concentrated in clean energy (primarily wind power) and

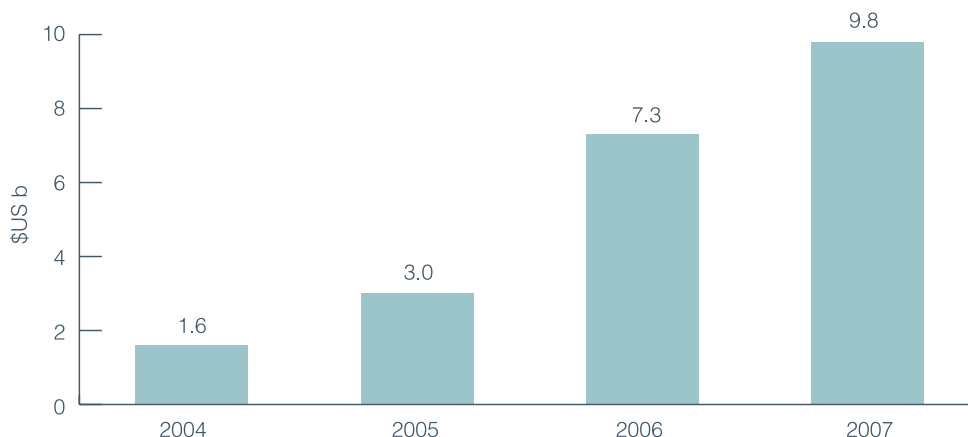
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What is Cleantech?

The term "cleantech" encompasses a broad range of products and services such as:

- **Agriculture**
(Organics, pesticides)
- **Environmental Services**
(Water, waste, air, offsets)
- **Energy Efficiency**
(Lighting, buildings, glass)
- **Renewable Energy**
(Biofuels, solar, wind)
- **Cleantech**
(Nanotech, biotech, materials)
- **Energy Assets**
(Storage, transmission)

Global PE & VC Investment (USD Billions)



Source: New Energy Finance

Cleantech Investments in Emerging Markets continued from page 1

water treatment. Brazil continues to be a very attractive market for biofuels, which accounted for nearly 20% of private equity investment there in 2006–2007.

Two of the five largest cleantech investments in 2007 took place in emerging markets: US\$ 200 million in Brazilian Renewable Energy Co., Ltd, and US\$118 million in Yingli Green Energy Holding Co., Ltd (China).

The leading sectors for cleantech investment are solar technology (roughly 35% of global investment in 2007), followed by biofuels (24%), wind power (21%) and energy efficiency companies (14%).

Public policy initiatives and growing public awareness of environmental and energy security issues are expected to accelerate the pace of investment. Technological advances and growing maturity of the industry enhance the sector's

attractiveness, as does a healthy exit environment—evidenced by the volume of IPOs by cleantech companies in recent years.

Drivers for Investment Growth

- Public concerns about carbon emissions and climate change.
- High oil and energy prices.
- Accelerated growth in emerging markets spurring concerns about energy security and resource scarcity.
- Attractive exit environment (track record).
- Government policies to foster development of many cleantech sectors.
- Advances in technologies (e.g., nanomaterials used in thin-film solar, new chemistry in battery technologies). ■

Fastest-Growing Markets for Cleantech Investment

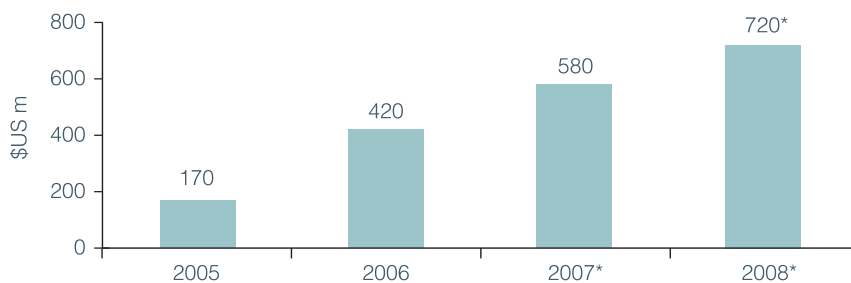
According to Dow Jones VentureOne and Ernst & Young, the United States draws the bulk of cleantech investment. US investment has historically centered on relatively late-stage, capital-intensive investments where government intervention is driving demand, although 59% of investments went to companies in the product development phase in 2007. Between 2003 and 2007, there were 976

cleantech deals worth around US\$8.8 billion in the US, US\$2.7 billion in 2007 alone.

Europe's cleantech sector attracted US\$915 million in capital in 2006 and US\$1.23 billion in 2007, the primary drivers being rigorous national and European Union environmental regulation and strong environmental awareness. Early-stage investments are dominated by government-backed

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Cleantech Investment in China (USD Millions)



* Indicates estimated totals

Source: Cleantech Venture Network

Fastest-Growing Markets for Cleantech Investment continued from page 2

Photo by Fernando Tomas.



In the northern Chinese city of Rizhao, most roof tops and walls are covered with small panels of solar heat collectors.

funds, such as the UK's The Carbon Trust, which invested in more deals than any other European investor between 2003 and 2006. 3i led among European venture capital firms during the same period.

In 2006, China represented one of the largest markets for cleantech outside of the US and Europe, with 26 deals attracting US\$420 million. India's cleantech sector is picking up pace, but lags behind China's. With the exception of Japan and Australia, cleantech investments in other parts of Asia remain negligible, although with the potential for growth. Brazil's extensive biofuels market continues to flourish, while other sectors begin to emerge, such as renewable plastics.

An increasing number of mainstream venture capital funds are starting to invest in the sector. The most active global investors in cleantech include Draper Fisher Jurvetson, Khosla Ventures, Nth Power and Rockport Capital Partners.

China

China's environmental burden is translating to both public and now private spending. China spent 1.3% of GDP on environmental protection 2001–2005, and is evaluating

plans to produce more than 10% of energy supplies from renewables by 2020. In the wake of the recently introduced Renewable Energy Law, intended to fight rampant pollution, China has become one of the most active markets for cleantech investment. Cleantech venture capital represents 0.016 percent of China's GDP, versus North America's 0.022 percent and Europe's 0.005 percent. Cleantech ranks as the third largest category for venture capital investment in China, behind IT and telecom, rising from 8% of venture investment in 2005 to 19% in 2006. Chinese cleantech venture capital investment increased by 147% between 2005 and 2006, jumping from \$170 million to \$420 million (26 deals). Increases are expected to continue, with US\$580 million projected for 2007, and US\$720 million for 2008.

The most active cleantech sector in China is solar energy (70% of investments in 2006). Due to looming issues of water quality and water resources, especially in Northern China, watertech venture investment is expected to reach US\$100 million in 2008.

Notable investments in 2007 included Shunda Holdings Co. Ltd (US\$82m), Baring Asia and Chengwei Ventures' US\$88 million investment in methane producer AAGI—Asian American Gas.

IPOs are becoming an attractive exit route for many cleantech investments. Several Chinese solartech firms have gone public, with more IPOs expected to follow in both solar energy and other cleantech fields. Recent venture-backed IPOs include Yingli Green Energy Holding Co., JA Solar Holdings Co., and LDK Solar, all crystalline silicon photovoltaics producers. The sector's largest venture-backed IPO in the last two years was solar company Q-Cells, which was capitalized with a US\$428.7 million transaction on the *Deutsche Börse Group* in 2005. Chinese LDK Solar Hi-Tech raised US\$361.6 million on the NYSE in 2007 and saw the highest post-money valuation at IPO with US\$2.8 billion.

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Fastest-Growing Markets for Cleantech Investment continued from page 3

India

India shares many of China's environmental woes: pollution, resource scarcity and infrastructure issues—the treatment of solid waste and waste water as well as electricity shortages. Energy security concerns and energy portfolio diversity add to the drivers of increased interest in India's renewable energy market. More than 90% of India's energy needs are met by coal and crude oil, and carbon emissions have grown 65% over the last five years, second only to China.

Private equity and venture capital investment in cleantech in India increased roughly 58% in 2007, rising from USD \$133 million in 2006 to US\$210 million in 2007. Cleantech investors have spent US\$433 million in India since 2000.

The India Cleantech Forum estimates total market size at \$5.29 billion, growing 15% annually. Achieving the necessary scale of cleantech investment in India will be a major challenge, as domestic and international investors have comparatively little expertise in the sector.

The Indian government underlined the importance of cleaner technologies in its 1992 resolution "Policy Statement for Abatement of Pollution," recently replaced by a proposed more comprehensive environmental policy, which envisages 10% of power generation from clean

energy by 2012. However, there is a perceived lack of policy coordination between different levels of government with respect to renewables.

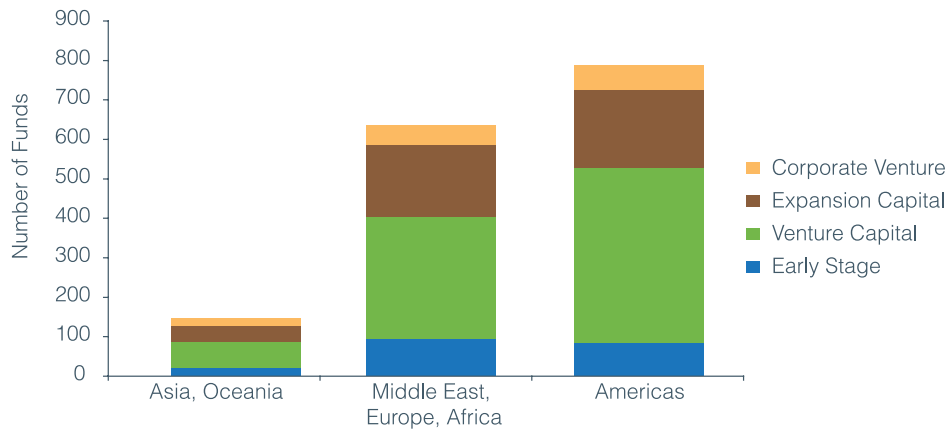
Innovative water initiatives have proven successful on a small scale, and there has been some success in solar and wind power. Electric car manufacturers have also attracted international VC interest. Examples of private equity-style investment in the sector in 2007 included Lakshmi Energy and Foods' biomass plant, Reliance Energy's wind turbine project, Boruka Power's acquisition of SLS Power Industries, and Indivision's US\$25 million investment in wind turbine manufacturer Regen Powertech. The greatest success story to date is Suzlon, a wind power company whose IPO in 2005 was oversubscribed 46 times.

Brazil

Brazil is the world's second largest producer of ethanol as an alternative fuel, and is expected to surpass the U.S. and Europe in production volumes by 2015. Given the high level of development of its biofuels sector (92% of all gas stations sell ethanol), Brazil is extremely well positioned for continued strong profitable growth of its cleantech industry as oil prices soar and global demand for biofuels and corresponding technology such as flex-fuel cars boom. In January

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Global Landscape of VC/PE Funds Targeting Clean Energy (Number of Funds)



* Includes known funds as of September 2007. Excludes Chinese incubators.
Source: New Energy Finance.

Fastest-Growing Markets for Cleantech Investment continued from page 4

2008, the government mandated that all diesel fuel contain at least 2% biodiesel, rising to 5% by 2013. Seven biofuels deals accounted for nearly US\$600 million (as much as 20%) of private equity investment in 2006–2007.

Recent biofuels investments have included US\$200 million in BRESCO, a biofuels holding company, by a consortium of investors, and Clean Energy Brasil's US\$64 million investment in Unialco. In March 2007, the Carlyle Group and Riverstone Holdings invested US\$240 million in four ethanol mills. Notable biofuels IPOs have included Cosan Ltd, Brazil's largest sugar ethanol producer, which raised US\$1 billion on the New York and São Paulo exchanges; and Infinity Bioenergy, an operator of four mills in Brazil that listed on London's AIM in 2006.

In addition to ethanol production, Brazil has also seen investments in timber, wind energy, and renewable plastics. Dow Chemical and Brazil's Crystalsev announced plans to build the world's largest polyethylene from sugar cane plant in July 2007, and Econergy International announced the purchase of the Pedra do Sal wind project. Stratus Group's Cleantech-Biotech Fund invested in Brazil Timber, which manages US\$40 million in forestry assets.

Investment Trends

Total global venture and private equity investments in clean energy technologies reached US\$9.8 billion in 2007, up from US\$7.3 billion in 2006. Roughly two-thirds of all cleantech investments were made by US investors (domestically and in overseas markets). Overall, cleantech's share of total venture capital is increasing: in the United States, it reached 9.1% in 2007 up from 0.6% in

Sampling of Recent Investments in Cleantech

Company	Amount	Location	Date
REVA Electric Car Co.	USD 20M	India	2006
Brazilian Renewable Energy (ethanol producer)	USD 200M	Brazil	2007
Yingli Green Energy Holding Co. Ltd (solar)	USD 118	China	2007
Shunda Holdings Co., Ltd	USD 82M	China	2007
Moser Baer Photo Voltaic Ltd.	USD 100M	India	2007
Vestas RRB India Ltd.	USD 56M	India	2007
Regen Powertech Private Ltd. (wind turbine mfr.)	USD 25M	India	2007
Asian American Gas (methane producer)	USD 88M	China	2007
Adani Power (thermal power)	USD 227M	India	2007
PESCO BEAM Environmental (waste mgmt.)	USD 8M	India	2008
Auro Mira Energy Company (wind power)	Planned USD 30M	India	2008
Doshion Ltd. (water mgmt.)	USD 8.8M	India	2008

Notable Cleantech IPOs

Company	Exchange	Notes
Xinjiang Goldwind Science & Technology Co.	Shenzhen	Share price grew 264%, closing at US\$17.95
Yingli Green Energy	New York	Raised US\$319M through 29M ADRs
Shenzhen Topraysolar	Shenzhen	First solar company to trade in China, share price rose 378%, closing at US\$8
Suzlon Energy	Mumbai, LSE	Follow-on share issue, seeking US\$1.3B to fund expansion

2000 and 5.9% in 1999, according to CleanEdge. Likewise, nearly all clean technology segments have seen major leaps in median valuations, reaching US\$30 million in the US, up from US\$15.8 million in 2001.

While some cleantech sectors are now approaching maturity (such as solar power and biofuels), interest in other sectors is growing, such as waste water treatment and water conservation. Many emerging markets in particular have a marked need for advanced water technologies, but the significance of the issue is also increasingly being recognized in developed economies. ■

Outlook

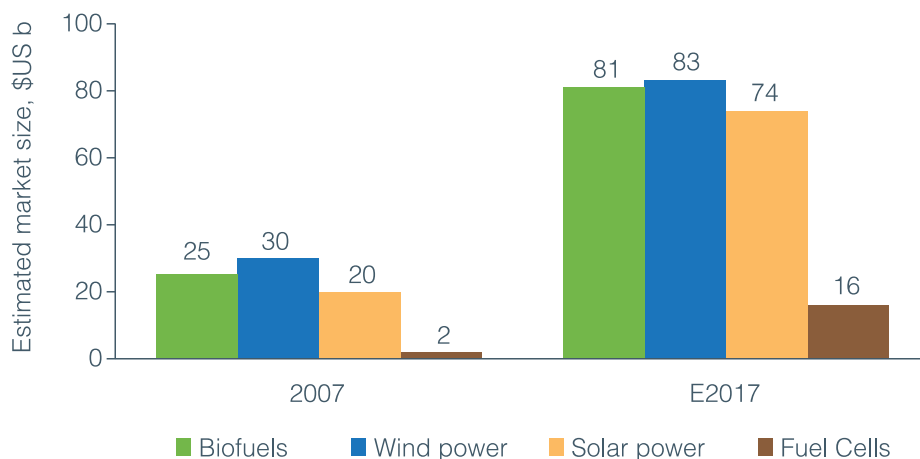
The total market size for clean energy—solar, wind, and biofuels, comprising the bulk of the cleantech opportunity—is estimated at US\$77.3 billion today, with potential to grow to US\$255 billion by 2017.

Global investments in cleantech are predicted to total to \$17 billion through 2009—\$10 billion in North America, \$5 billion in Europe, and \$2 billion for the rest of the world. Beyond the booming solar technology and biofuels sectors, opportunities remain in air, water, and waste technologies—comparatively starved for capital. A National Venture Capital

Association survey of investors revealed that 80% predicted cleantech investment would continue to grow in 2008, however 61% believed the sector would be overvalued.

As China and India develop low-cost, simple solutions to address their own environmental challenges, they will emerge as leading technology and solution providers to other emerging markets. Meanwhile Europe, the US, Japan and other more mature economies are expected to accelerate renewable energy development and environmental protection efforts, driven by consumers and voters.

Projected Growth in Clean Energy, 2007–2017 (USD Billions)



Reports of interest

Cleantech in China: China Cleantech Venture Capital Investment Report (1Q07):

<http://cleantechnetwork.com/index.cfm?pageSRC=Whitepapers&cvwhitepaperID=3>

Cleantech in India: <http://www.cleantechnology.com.au/pdf/1st%20India%20Cleantech%20Forum%202007.pdf>

New Energy Finance Reports: <http://www.newenergyfinance.com/?n=19>

CleanEdge – Clean Energy Trends 2008: <http://www.cleantech.com/reports/trends2008.pdf>

A Strategy for Investing in Emerging Market Environmental Industries:

http://www.globalenvironmentfund.com/Emerging_Market_Environmental_Industries.pdf

Cleantech Venture Network White Papers: <http://cleantechnetwork.com/index.cfm?pageSRC=Whitepapers>

Ernst & Young Global Cleantech Insights Report 2007:

[http://www.ey.com/Global/assets.nsf/International/SGM_Cleantech-InsightsReport2007/\\$file/SGM_Cleantech-InsightsReport2007.pdf](http://www.ey.com/Global/assets.nsf/International/SGM_Cleantech-InsightsReport2007/$file/SGM_Cleantech-InsightsReport2007.pdf)

Firms Investing in Cleantech

Firm	Fund	Geographical focus
3i		Europe, Asia
Actis	Actis Energy Fund (2002, \$650m)	Emerging Markets
Aloe Private Equity	Aloe Environment Fund I & II (2007)	Europe, China, India
Asia West	Asia West Environment Funds I & II	Asia
Asian Development Bank	Asia-Pacific Carbon Fund (2006)	Asia
BDF Management (Societe Generale)	Bioenergy Development Fund (2007, \$200m)	Latin America
Brazilian government	Fundo de Investimento em Participações Brasil Energia	Brazil
BTS Investment Advisors & Rabo India Finance India Limited (RIF)	Indian Renewable Energy Enterprise Development Fund (IREED) (2006, \$30m)	India
Capricorn Venture Partners	Capricorn Cleantech Fund (2007, EUR50m)	Europe
Chrysalix Energy		—
Clearworld Energy Ventures	China Clean Energy Fund	China
Climate Investment Partnership	CIP Global Fund	—
CLSA Capital Partners Ltd	Clean Resources Asia Fund (2006), Clean Water Asia Fund (2007, \$5m)	Asia
Consensus	Masdar Clean Tech Fund, L.P. (\$250m)	Global
Corporacion Financiera Ambiental (CFA)		Central America
DFJ Element	Cleantech Venture Fund (2006, \$284m)	North America, Europe, Asia
Draper Fisher Jurvetson		—
E+Co Capital Latin America	Central American Renewable Energy and Cleaner Production Facility (2006, \$18.5m)	Central America
Econergy International Corporation	CleanTech Fund (\$35m)	Latin America (Brazil and Mexico)
Emerging Power Partners Ltd.	Private Energy Market Fund I & II	Emerging Europe, Asia
EnerCap Capital Partners	EnerCap Power Fund (EUR100m)	Emerging Europe
Englefield Capital	The Englefield Renewable Energy Fund	Europe
Enviro Finance	Enviro Finance Private Equity Fund (\$100m)	Europe, China
Espírito Santo Ventures	ES Ventures Fund I & II	Global
ETF Manager LLP	Environmental Technologies Fund (2006, \$70m)	Europe
FE Clean Energy Group Inc.	FE Clean Energy Latin American Clean Energy Services Fund, Global Asia Clean Energy Services Fund LP	Europe, Latin America, Asia
Fundacja Ekofundusz	EcoFund	Poland
Global Environment Fund (GEF)	Global Emerging Markets Environment Fund (GEEMF) III (2007, \$350m)	Global
Infinity Bioenergy	Infinity Bioenergy Fund (2006, \$516m)	Brazil, other Latin America
Khosla Ventures	(Portfolio of companies in renewables)	—
Kleiner Perkins Caufield & Byers (KPCB)	(Greentech initiative portfolio: \$200M of \$700M dedicated to cleantech)	United States, India, China
Man Investments	China Methane Recovery Fund (\$382m)	China
Mellon Global Investments Brazil	Acucar e Alcool FIP (2007, \$282m)	Brazil
Mesoamerica	Mesoamerica Energy (2004)	Latin America
New Energies Invest (Bank Sarasin)		Europe, United States
Numis	Clean Energy Brazil	Brazil
Peony Capital Ltd	The Peony Fund (\$552m)	China
PTZ/Biomass Technology Group	PTZ/Biomass Technology Fund I (2006, \$63m)	Brazil
Renewable Capital		Europe, Asia
Riverstone/The Carlyle Group	Renewable energy infrastructure fund (\$800m)	Brazil
Shell Foundation	Empowerment Through Energy Fund	Africa
Stratus Investments	Stratus Venture Capital Fund III (2006, \$31m), Stratus BioTech Fund	Brazil
TCW Group (SGAM)	European Clean Energy Fund (2007, \$434m)	Europe
Temple Capital Partners	Clean Energy Brasil (2006, \$197m)	Brazil
Thomas Lloyd Private Equity Group; Hangzhou Jinjiang Group	Jinjiang/ThomasLloyd Green Energy Fund, L.P. (\$500m)	Asia; China
Tianjin (China)	Guangdong Nuclear Power and New Energy Fund	China
Tsing Capital	China Environment Fund I (\$15m), II (\$30m), and III (\$150m, raising now)	China
Warburg Pincus		Europe, Asia
World Resources Institute	New Ventures	Brazil, Mexico, China, Indonesia, India
Zouk Partners	Cleantech Europe (2006)	Europe



Sustainable Results

Global Environment Fund (GEF) has been investing private equity on a global basis in the energy and environmental services sectors since 1990. The firm manages over \$1 billion in capital for leading institutional investors from around the world.



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