

## Cleantech and the new world order

September 2011

***The term 'Cleantech' and the term 'BRIC economy' were both coined around a decade ago, in 2001. Today, 'BRICs' are amongst the largest cleantech markets.***

By Anne McIvor, Editor of Cleantech magazine ([www.cleantechinvestor.com](http://www.cleantechinvestor.com)) and Founder of Cleantech Investor Ltd.

Originally published in Top Capital [www.topcapital.com.cn](http://www.topcapital.com.cn). Republished with permission

---

The term 'cleantech' first came into common use around 2001. It was derived from the phrase 'clean technology', defined by the Organisation for Economic Co-operation and Development (OECD) as an "installation or a part of an installation that has been adapted in order to generate less or no pollution." In the OECD definition clean technology is contrasted with "end-of-pipe" technology.

"End-of-pipe", under the OECD definition, refers to environmental emissions control technologies or devices, designed to clean up emissions from fossil fuels, rather than generate clean energy. First used by the venture capital investment community in the US, the term 'cleantech' was initially used to refer to the asset class of finance and investment in clean technologies, specifically venture capital investment. Today, however, the term is often also used much more broadly. We regularly use it to describe technologies which, according to the original OECD terminology, are technically 'end-of-pipe': for example carbon capture and storage (at least the 'post combustion' CCS technologies); exhaust gas cleaning systems; and some clean coal technologies. There is a fine line, however, between many add-on or 'clean-up' technologies and 'pure' clean technologies such as wind or solar.

At Cleantech magazine we tend to adopt an inclusive definition, taking the view that investors interested in the sector, however they define it, are likely to be interested in all sorts of innovative environmental technologies.

Cleantech is sometimes defined as the group of technologies which are emerging to meet the twin challenges of climate change and population growth. Carbon reduction is a key driver behind government incentives for deployment of clean technologies in many countries. Energy security is also an important driver.

There has always been something of a debate about the role of nuclear energy. Nuclear technology has clear benefits in terms of carbon emissions and energy security. However, it clearly has major risks in terms of its potential environmental impact – demonstrated not least by the recent disaster at Fukushima in Japan.

Ron Pernick and Clint Wilder in their seminal book "The Clean Tech Revolution" ruled out including nuclear energy as cleantech. At Cleantech Investor we do tend to keep an eye on new developments in nuclear technology which may become game changers. We take the view that, it's important for investors to keep an eye on new innovations in all areas of energy, irrespective of whether they can be strictly defined as 'cleantech'. For the same reason, we follow developments in natural gas – where new techniques such as 'fracking' have opened up significant new resources of shale gas.

## Cleantech Investment Development

In terms of investment, as with any industry as it matures, cleantech is experiencing a gradual shift along the value chain. SAM Private Equity (SAM) groups the cleantech value chain into three major components: technology development, technology deployment and technology operations. Venture capitalists play the most important role during the first component, technology development. A venture capitalist typically finances the commercial development of a technology as it comes out of a university or research centre. Once the technology reaches a stage where it is commercially viable, it then requires development capital to, say, roll out a manufacturing plant, recruit personnel or to build assets such as wind farms or water treatment facilities. Once deployed, financing is required for project development, construction and operations.

In the US, cleantech became the most popular asset class for venture capitalists in 2010. Statistics from the Cleantech Group show that Cleantech overtook biotech as the most popular investment category (ahead of software and medical devices and equipment) in the US in 2010. Cleantech made up 23% of the US Venture Capital investment in 2010, up from 12% in 2007 and just 4% in 2002. However, there has been some evidence of a slowdown in investment levels. Venture investment in cleantech fell by 33% in the second quarter of 2011 compared to the first quarter.

SAM point out that, as the early clean technologies have matured, a number of venture capital investors have moved up the value chain and are starting to deploy more funds in late-stage venture capital and early stage development capital. SAM points out that some venture capital fund managers are raising third or fourth- generation funds focused on growth stage cleantech companies.

Development capital takes a wide variety of forms. Government incentives are often the key drivers of cleantech. Mechanisms such as feed in tariffs or renewable obligation certificates are common in Europe and the US and grant funding is also commonly available for the sector.

The fastest growing types of funds in cleantech are environmental infrastructure funds which focus on the development of energy or transport infrastructure. These include project- related funds which do not typically own or operate the assets.

There has been something of a switch away from North America in terms of the funds being raised for cleantech. While the industry was initially concentrated in the US, according to data provider Preqin, the mix is now more evenly split between North America, Western Europe and the rest of the world. Another trend is towards regionally focused funds with many of the newer funds focusing on emerging economies and niche regions in the developed markets.

Solar attracted a significant share of the venture capital over the past two years in the US and the investment in biofuels has also been increasing. At the development capital level, however, the US has experienced a slowdown in investment in renewables. This phenomenon has been attributed by some to the increasing interest in natural gas, which is seen as a competing 'low emissions' fuel source. Wind energy in particular suffered in 2010 in the US – which was also the year in which China overtook the US to become the world's largest wind market. In reality however, the reasons for this slowdown, are as much to do with the financial crisis of 2008 as competition from shale gas.

It's worth bearing in mind that renewables still account for less than 2% of the total energy used in the world. Globally, renewables are clearly growing rapidly. Renewables in power generation (which excludes biofuels production) grew by 15.5% in 2010 and their market share has tripled over the past decade. According to BP, their combined contribution to world primary energy growth over the past five years of 10% has been higher than the contribution of petroleum-based products. However, BP calculated the share of renewables – defined as wind, solar, geothermal and hydroelectricity – in the global energy mix to be just 1.8% in 2010.

These figures provide some perspective. While the growth in cleantech in terms of early stage investment may have been enormous, we are still just at the edge of the opportunity – and challenge – to invest in deployment of clean technologies. The size of the 'cleantech' sector is potentially massive.

While some in the US may be concerned that growth in wind has stalled venture capital investments are slowing, overall cleantech growth over the past decade has far outstripped expectations. Research firm the Clean Edge released 'Clean Tech: Profits and Potential', its first publication, in April 2001. In the report for 2011, the authors note that, in relation to the growth projections for solar and wind power contained in the original report: “.....many observers, to put it kindly, thought we were being optimistic”.

The Clean Edge forecast in 2001 that solar power would grow from a global market of \$2.5 billion in 2000 to \$23.5 billion by 2010 and that wind power would grow from a global market of \$4 billion in 2000 to \$43.5 billion by 2010. They turned out to be around 300 per cent short in their solar PV estimates and some 50 per cent short in the wind estimates. According to Clean Edge statistics, the global market for solar photovoltaics grew to \$71.2 billion in 2010, representing a compound annual growth rate (CAGR) of 39.8%. Over the same period the global wind power market has expanded to over \$60.5 billion – a CAGR of 29.7%. Growth rates in other cleantech sectors such as hybrid electric vehicles, green buildings and the smart grid are “similarly spectacular” and the Clean Edge report authors point out that cleantech growth rates “... now rival that of earlier technology revolutions like telephony, computers, and the Internet.”

Clean Edge forecasts further strong growth for the next decade in the core clean technologies of solar, wind and biofuels. The solar market is expected to expand by around 60% over the next decade, to US\$113.6 billion, and the wind market is projected to double to US\$122.9 billion. Clean Edge may again be conservative in its projections but even if it is on target, the growth cleantech will be massive. The projected total market for the three benchmark technologies of biofuels, wind and solar is forecast to rise to a massive US\$349.2 billion by 2020 from US\$118.1 billion in 2010. These figures exclude the other huge growth areas of hybrid and electric vehicle markets and energy efficiency markets such as smart grids and LED lighting.

Funding for cleantech in the early days came from venture capitalists in the west coast of the US, building on the heritage of IT investments. Much of the wind investment was concentrated in Europe at the outset. However, nations such as China and Korea are now investing huge sums to develop technology domestically .

## **BRIC Economies and Cleantech**

The 'Clean Tech Revolution' described by Ron Pernick and Clint Wilder is a global one. Developed economies need to alter their energy mix for reasons ranging from the challenge of climate change to peak oil and energy security. We are seeing utility scale energy investment in sectors such as solar in the US or offshore wind in the UK. Emerging economies need energy to fuel growth and typically consider renewable energy as just one of a variety of energy alternatives.

Around the same time as the term 'clean tech' was first being used by the Clean Edge, in 2001, the term 'BRIC Economy' was being coined by Goldman Sachs economist Jim O'Neill, to refer to Brazil, Russia, India and China. Specialist funds are now emerging to invest in the cleantech opportunity in the BRICs.

Emerging economies are focusing on efficient building techniques to construct – or upgrade – their mega cities. With 50% of the world's population now living in urban environments, the need for clean technologies which preserve and recycle valuable resources such as energy and water is ever more urgent. There is also a strong focus on renewable energy. Brazil has long been a leader in biofuels and hydro electricity. To add to this, India and China are currently seeing rapid growth in cleantech deployment.

China has enthusiastically grasped the cleantech opportunity. In terms of manufacturing and export industry, solar is a natural fit for China, with its low manufacturing costs. But China is also seeing very fast growth in renewable energy generation, with 75% growth in output from renewables in 2010 according to BP.

In 2010, China became the largest wind market in the world overtaking the US. It now has aspirations to invest in wind outside of its own borders. A sign of the times was the recent announcement by Suzlon, the Indian wind turbine manufacturer, that it plans to work with a Chinese utility, to jointly finance and develop wind energy projects in emerging markets including Brazil.

Suzlon is an example of a truly global cleantech company. With this strategy it is straddling three of the 'BRIC' economies. It has already established itself in the wind markets of Europe, having acquired equipment manufacturers, including Repower of Germany (a leader in large offshore wind turbines) and Denmark's Hansen Transmissions (a wind turbine gearbox manufacturer). Suzlon was one of the first 'BRIC' economy wind sector companies to successfully diversify into the developed world. However, its strategy to focus on 'BRIC' and other emerging wind markets comes after its results suffered due to the financial crisis.

Although still small in terms of its installed base of wind, Brazil was the birthplace of one of the world's largest wind turbine blade manufacturers, Tecsis. The Tecsis story is well known amongst venture capitalists outside of Brazil. Entrepreneur Benito Koike founded the company 16 years ago and secured orders from GE, to become the leading supplier of turbine blades into the US. Tecsis saw its order book collapse after the financial crisis in 2008 and subsequent downturn in the US wind market. It came close to failure but recently received financing from a consortium of local Brazilian investors which should secure its future. Brazil's wind market is less developed than those of India or China, but perhaps Tecsis, having focused on export markets at the outset, will now be propelled back to health on the back of a buoyant domestic market.

### **International Competition**

A key feature of cleantech investment in the later stages of development is the desire to create jobs. In this respect, there is something of a competition emerging between the developed economies such as the US (where most of the technology is still being developed) and the emerging markets such as China. Cleantech has already seen its first high profile trade dispute between the US and China. China was offering subsidies on wind turbines manufactured domestically, which have now been withdrawn. The change in the subsidy policy was claimed as a victory in the US – but major domestic Chinese manufacturers such as Sinovel and Goldwind were already sourcing parts internationally – and the policy had not deterred companies such as Suzlon from setting up a manufacturing base in China and benefiting from those subsidies.

The US attitude towards China is perhaps best understood as a defensive one at a time when China's rise to prominence economically is creating a new world order. The fact that cleantech and renewables are the topic of trade disputes between the US and China is perhaps driven by the current downturn in the US renewables market and, despite President Obama's 'Green New Deal', there has been little real progress in terms of job creation.

Renewable energy and cleantech investors, especially in the developed markets, sometimes appear to expect special treatment. Government subsidies are a hot political topic around the world, although the names and the mechanisms may vary. As costs come down and clean technologies approach grid parity, however, the industry will increasingly have to stand on its own merits. Clean Edge points out that clean-energy technologies such as wind and distributed solar PV are reaching cost parity in select markets for the first time in history. Clean Edge projects that distributed solar PV systems will be cost-competitive for US residential retail and commercial customers in a host of US states by 2015 – and in 47 states (for residential customers) and 35 states (for commercial customers) by 2020. With respect to onshore wind, Clean Edge figures show that it is "...one of the least expensive options for new generating capacity additions" in the US.

In the emerging economies, discussions about competition with traditional energy sources are generally not such an issue. Brazil's wind market is competing against natural gas (now plentiful in Brazil thanks to the "pre-salt" offshore oil discoveries). The Brazilian government is pitching wind head to head with natural gas through the energy auction system and the two technologies are currently competitive on cost.

Developed countries which lobby for favourable treatment for cleantech or renewable energy should also bear in mind that oil rich Middle Eastern nations have also entered the cleantech race. Abu Dhabi is working on the Masdar City project, with its related research institute and fund, and Saudi Arabia is focusing on developing solar energy.

Cleantech, like any industry, will be subject to ebbs and flows of investment funding. There will also be trends and fashions in terms of the sub sectors which attract funding. For example, venture capital is currently focussing on energy efficiency and advanced biofuels investments. Development stage funding in renewable energies such as wind and solar will inevitably be beholden to the general economic environment. However, the long term trend for growth is intact.

The developed cleantech markets, including the US, have much to learn from the emerging economies. The 'BRICs' and other emerging markets will increasingly become the drivers of growth

for cleantech. Under the new world order, there is a rapidly emerging market for cleantech products and services in emerging economies, which the rest of the world should grasp as an opportunity.