The world is changing: a rapid tour of the cleantech innovation world

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DFIF/infoDev Seminar on Low Carbon Innovation, London, July 7 2009
Cleantech Group overview

Cleantech Group LLC Mission:
To accelerate the next wave of innovation - globally

About Cleantech Group
The Cleantech Group defined and introduced cleantech as an investment category in 2002 and popularized it as an investment category.
Through its exclusive membership network, international forums, media and industry research, has helped drive the growth of the clean technology sector.
c.35 FTE staff plus network of associates and partners, operating in 5 distinct regions – China, Europe/Israel, India, MENA, and North America

Geographic Presence
Representatives in Amman, Ann Arbor, Beijing, Delhi, London & San Francisco

Cleantech Group is the global cleantech leader with an unparalleled international network and industry knowledge

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Ecological Overshoot: Carbon Emissions Rising Sharply

ATMOSPHERIC CONCENTRATION OF CARBON DIOXIDE (1744 - 2003)

Source: Earth Presentation, Global Education Project
## Projected Impacts of Climate Change

<table>
<thead>
<tr>
<th>Global temperature change (relative to pre-industrial)</th>
<th>0°C</th>
<th>1°C</th>
<th>2°C</th>
<th>3°C</th>
<th>4°C</th>
<th>5°C</th>
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<td><strong>Food</strong></td>
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<td>Falling crop yields in many areas, particularly developing regions</td>
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<td>Possible rising yields in some high latitude regions</td>
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<td>Falling yields in many developed regions</td>
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<td><strong>Water</strong></td>
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<td>Small mountain glaciers disappear – water supplies threatened in several areas</td>
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<td>Significant decreases in water availability in many areas, including Mediterranean and Southern Africa</td>
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<td>Sea level rise threatens major cities</td>
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<td><strong>Ecosystems</strong></td>
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<td>Extensive Damage to Coral Reefs</td>
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<tr>
<td>Rising number of species face extinction</td>
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<td><strong>Extreme Weather Events</strong></td>
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<td>Rising intensity of storms, forest fires, droughts, flooding and heat waves</td>
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<td><strong>Risk of Abrupt and Major Irreversible Changes</strong></td>
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<tr>
<td>Increasing risk of dangerous feedbacks and abrupt, large-scale shifts in the climate system</td>
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</tbody>
</table>

Source: Stern Review
Ecological Overshoot: Using 1.4x Earth’s Capacity

PEOPLE WITHOUT SAFE DRINKING WATER

- Percentage of population without reasonable access to safe drinking water
  - 0 - 6%
  - 7 - 17%
  - 18 - 32%
  - 33 - 48%

SOIL DEGRADATION

- STABLE SOIL
- DEGRADED SOIL
- VERY DEGRADED SOIL
- AREAS WITHOUT VEGETATION

Source: GLASOD: 1990 Global Assessment of Human Induced Soil Degradation

FISH STOCKS

- UNDER EXPLOITED
- MODERATELY EXPLOITED
- FULLY-HEAVILY EXPLOITED
- OVER EXPLOITED
- DEPLETED
- RECOVERING

UN FAO Fisheries, “Fisheries at the Limit?”, http://www.fao.org
At current growth rates, 10 Billion Population and 400 Megacities by 2050

More people today than all our ancestors combined
Wasting 50%+ Resources from Production to Consumption
example: energy

Source: Lawrence Livermore National Laboratory
Cleantech is way broader a theme than just energy

Typically Ubiquitous Global Applications

**CLEANTECH** encompasses knowledge-based technology products/services that:

- Provide superior performance at lower costs.
- Greatly reduce or eliminate negative ecological impact.
- Improve the productive and responsible use of natural resources.

Doing more with less

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRANSPORTATION</td>
<td>Includes vehicles design, fuels and logistics</td>
</tr>
<tr>
<td>WATER</td>
<td>Includes filtration, purification, water conservation and wastewater treatment, etc.</td>
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<tr>
<td>AIR &amp; ENVIRONMENT</td>
<td>Includes remediation, emission control, trading and offsets, etc.</td>
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<tr>
<td>MATERIALS</td>
<td>Includes environmental friendly nano, bio, chemical materials, etc.</td>
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<tr>
<td>MANUFACTURING/INDUSTRY</td>
<td>Includes monitoring/control appliance and smart production industries.</td>
</tr>
<tr>
<td>AGRICULTURE</td>
<td>Includes land management, natural pesticides, natural fertilizers, etc.</td>
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<tr>
<td>RECYCLING &amp; WASTE</td>
<td>Includes various recycling services and waste treatment services.</td>
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</tbody>
</table>
Cleantech: Benefitting from Knowledge Generated in other Sectors

- **Clean Energy**
- **Cleaner Production & Consumption**
- **Clean Water**

**CONVERGENCE**

- Advanced Materials & Nanotechnology (e.g. catalysts and membranes)
- Information Technology & Internet (e.g. advanced meters and sensors)
- Biotech “CleanBio” (e.g. biopolymers and biofuels)

- Enabling technology of industrial and post-industrial society
- Next and necessary wave of technological innovation that may be biggest job & wealth creation opportunity of 21st century
- Fundamental design revolution: reinterpreting relationship with nature
Global Infrastructure Upgrades
A $40 Trillion Market Opportunity

Total projected cumulative infrastructure spending 2005–2030: $41 trillion

- Middle East: $0.9T (16% of total)
- Africa: $1.1T (1% of total)
- U.S./Canada: $6.5T (17% of total)
- South America/Latin America: $7.4T (12% of total)
- Europe: $9.1T (40% of total)
- Asia/Oceania: $15.8T (27% of total)

- Water: $22.6T (6% of total)
- Power: $9.0T (4% of total)
- Road and rail: $7.8T (4% of total)
- Air/seaports: $1.6T (9% of total)

Source: Booz Allen Hamilton, Global Infrastructure Partners, World Energy Outlook, Organisation for Economic Co-operation and Development (OECD), Boeing, Drewry Shipping Consultants, U.S. Department of Transportation

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Clear Trend to Cost Competitiveness

**Cost Competitiveness**

*Improvements in technology and mass production will drive costs down further*
Emerging Opportunity Areas

1. RE and DG of all kinds
2. Efficiency and Waste Minimization
3. Embedded Intelligence Everywhere
4. Micro and Macro Energy Storage
5. Distributed Water Purification & Distribution
6. Marine and Synthetic Biology
7. Design and related Services (eg Carbon, Supply Chain)

- CLEAN + SMART + DECENTRALIZED
- INNOVATION + INFRASTRUCTURE
- AND’s, not OR’s
Cleantech Group – helping the innovation ecosystem accelerate

We make it our business to inform and to connect hundreds of organisations in a self-serve manner, to advise and accelerate tens in a more tailored and hands-on fashion

Cleantech Network™: Introduced “cleantech” concept in 2002; provides deal flow and research products and global Cleantech Forums™; 1500+ investor members, 5000+ Forum attendees, 22 Forums worldwide, $1.5B+ raised by Cleantech Forum™ presenting companies.

Cleantech Advisory™: Assists corporations, investors & governments, to develop cleantech markets and opportunities
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Why are so many organisations joining the Cleantech Network? To access who and what we know. To help us help them help the market grow.

**Cleantech Forums** — 5 worldwide
a year, $1.5bn raised by presenting companies

**NEW!** — 1st patents database for cleantech

**Market news** — proprietary content daily on cleantech.com, weekly in *Inside Cleantech* (newsletter) and soon, in real time, through a NEW partnership with StrategyEye aggregating another 10,000 sources

**Market data** — cleantech transactions in VC, M&A, IPO

![Market data chart](chart.png)

Combined Total (2005 – 2008*) = $99.4bn

* 2008 to date

**Source: Cleantech Group**

**Cleantech Network**
>1500 Members worldwide. Network advised and supported by global and regional sponsors

![Cleantech Network members](network_members.png)

![Cleantech Forums](forums.png)

**Market insight** — webinars, exclusive interviews, *Quarterly Investment Monitor*, etc.
The Cleantech Network – some of our supporters and advisors

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Cleantech Advisory leverages the Group’s global platform and knowledge assets to help clients on specific agenda’s.

- More than 10,000 cleantech connections & relationships
- Access to Research Labs, universities, industry experts
- 3000+ cleantech investors (including 5 Advisory Boards across the globe)
- Worldwide IP/Patent information and mapping
- A who’s who list of global supporting organizations
- Global knowledge of thousands of technologies & cleantech companies
- 5 annual global industry conferences with 5000+ attendees
- Thousands of service providers and media contacts

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Around the cleantech innovation world…

…in a rapid-fire few minutes of charts and analysis
…using venture investment as a proxy of innovation activity

…where have we come from?

…where are we going?
‘Innovation Financing’ in Global Cleantech 2005 – 2008*

Combined Total (2005 – 2008*) = $99.4bn

Combined Total (2007 – 2008*) = $78.36bn

2005 Total = $4.2bn
2006 Total = $16.9bn
2007 Total = $35.6bn
2008* Total = $42.7bn

Source: Cleantech Group

* 2008 to date
Cleantech investment – where are we, where are we heading?

• 2000-04 – the pioneering
  • Small number of small cleantech funds struggling for recognition. A ‘club’ feel.
  • First wave of specialists emerge in North America & Europe – Element, Rockport

• 2005-08 – the first golden age of cleantech investment
  • Perceptions change as to the nature of the challenges and who it impacts. Record levels of deals done, driven by high oil/commodity prices & legislation.
  • High levels of (cross-border) collaboration.
  • Lots of new money enters the space including 2nd generation of specialist funds in OECD plus first specialists in emerging markets: e.g. Tsing Capital, IDFC, Masdar.

• 2009 –10 – navigating the credit crisis
  • Drivers are still there but investors pulling back, not pulling out – part, a psychological impact and part a reaction to the needs of portfolio companies
  • Some great opportunities for investors with the fresh powder?
  • Policy initiatives globally will be the main driver – all eyes on DC & Copenhagen

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2008 a record year at $8.4B

- 2008 up 38% from 2007
- 6-year CAGR of 60%
With 44% growth in North America...to 70% of world total
…and 38% growth in Europe (to 21% of world total)
While China & India remain developing markets
Solar has dominated global cleantech VC volumes in 2007-08

<table>
<thead>
<tr>
<th>Technology</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>40%</td>
</tr>
<tr>
<td>Biofuels</td>
<td>11%</td>
</tr>
<tr>
<td>Transportation (EVs, batteries, fuel cells)</td>
<td>10%</td>
</tr>
<tr>
<td>Wind</td>
<td>6%</td>
</tr>
<tr>
<td>Green Buildings</td>
<td>5%</td>
</tr>
<tr>
<td>Smart Grid</td>
<td>4%</td>
</tr>
<tr>
<td>Agriculture, Water</td>
<td>2% each</td>
</tr>
</tbody>
</table>
First major down cycle in global cleantech VC has taken us back to volumes more like 2006, than 2007

NB – Q2 09 data as of 12th June 09
...with evidence of the predicted efficiency boom starting to show through?

- **Agricultural investment in 1Q09** surpassed the previous four years’ quarterly average
- Investment in **water conservation technologies** saw in April 2009 alone the largest amount invested in a quarter since 1Q07.
Global Stimulus Spending on Cleantech in 2009


Sources: Cleantech Group, WEF, IEA WEO 2008 and HSBC
Government Spending - Largest Projects in History (Inflation Adjusted)

Sources: NASA

- Louisiana Purchase
- The New Deal
- Marshall Plan
- NASA
- Race to the Moon
- S&L Crisis
- '09 Rescue Funds

$ (billion)
‘Towards a Global Green Recovery’ report presented at the G20 Summit in London estimates that almost $400 billion of some $2.6 trillion in economic stimulus announced by G20 nations are allocated for clean technologies such as renewable energy, improved electrical grids and cleaner cars.

Percentage of stimulus spending directed towards cleantech across selected countries:

**France** - 20 percent  
**US** - 16 percent  
**EU package** - 14 percent  
**Germany** - 13 percent  
**UK** - 7 percent  
**Japan** - 2.6 percent  
**Italy** - 1 percent  
**India** - 0 percent*

*Sources: HSBC*
‘Towards a Global Green Recovery’ report presented at the G20 Summit in London estimates that almost $400 billion of some $2.6 trillion in economic stimulus announced by G20 nations are allocated for clean technologies such as renewable energy, improved electrical grids and cleaner cars.

Percentage of stimulus spending directed towards cleantech across selected countries:

- **South Korea** - 69 percent
- **China** - 38 percent
- **France** - 20 percent
- **US** - 16 percent
- **EU package** - 14 percent
- **Germany** - 13 percent
- **UK** - 7 percent
- **Japan** - 2.6 percent
- **Italy** - 1 percent
- **India** - 0 percent*

*Note: Data for India is marked with an asterisk, possibly indicating a discrepancy or uncertainty in the reported figures.

Sources: HSBC
South Korea’s Stimulus Spending on Cleantech

- South Korea announced plans to invest Won107,000bn ($85 billion) on ‘green growth’ industries over the next five years.
- The government predicts the unprecedented cash-injection, around 2 per cent of the country’s entire GDP, will create up to 1.8m new jobs in renewable energy and environmentally-friendly projects.

- In a presidential statement, the country’s leader, Lee Myung-bak, said that the so-called Green New Deal will significantly boost growth and jobs in an effort to ride out the economic slump.
- “The aim is for South Korea to become the world’s seventh most competitive country by 2020 in terms of energy efficiency and ability to adapt to climate change,” he said.

- The ambitious improvements in energy-efficiency will be achieved via the encouragement of renewable energy projects, including solar and wind power, as well as carbon credit trading, hybrid cars and biofuels.
- As part of the large-scale co-ordinated drive, the country plans to expand state support for research and development, also establishing a fund to offer loans, credit guarantees and favourable tax incentives to small and medium-sized companies developing green technologies.

- Kwon Tae-shin, South Korea’s minister for policy coordination told reporters, “The plan will not only help reduce greenhouse gas emissions, but it will also provide us with a new growth engine.”
China’s Stimulus Spending on Cleantech

• Among 585 billion USD stimulus package, most of the investment will go to **infrastructure**.

• Among the stimulus package, 10 billion RMB (1.47 billion USD) will be used in the next three years to **support technology innovation and develop green cars**.

• About 350 billion RMB (50 billion USD) will be allocated to infrastructure facilities of environmental protection and ecological protection on Boao Forum.

• National Energy Administration (NEA) is formulating a stimulus plan for renewable energy especially **wind power** and **solar**.

• Stimulus plan for building-integrated photovoltaic (BIPV) applications has been released.
India now on the move too....?

• The government of India is about to undertake a major plan to become a world leader in solar energy development, aiming to install 200 gigawatts (GW) of solar capacity by 2050, according to a report in The Hindu newspaper.

• Citing a draft of a National Solar Mission strategy that was leaked to the newspaper, the report said that the Indian government will invest the equivalent of up to $22 billion U.S. over the next 30 years to boost the solar energy industry in India. The strategy calls for rooftop solar panels to be installed on all government and public buildings, and for all new hospitals, hotels, guest houses, nursing homes, and residential complexes covering 500 square meters or more to install solar water heaters. Under the plan, the Indian government will establish new tax breaks and tariff structures for solar energy development, the details of which will reportedly be announced within the next few weeks.

• Our office in Delhi has noted a flurry of announcements post-election re: clean energy initiatives at both the federal and state level. It appears that state gov'ts are competing to project themselves as "cleantech friendly" with Gujarat, Rajasthan, Karnataka, as leading contenders.
Fundamental and irreversible shifts are happening

• Public purse has taken over from the private purse – for the interim
  – A one shot chance to invest wisely
  – Perverse subsidies will hold us back
  – Development and wealth creation can be aligned

• A race to the future is on – many are not in the race
  – Beyond Borders: Innovation is global
  – Leapfrogs:

• Tipping point of cleantech innovation is getting closer
  – Grid parity of solar, for example, only 3-5 years away

• Technology/Innovation nor Capital will NOT be the laggards; it will be unlevel playing fields and incumbents’ self-interests
  – Tolerance for creative destruction
Imagine the un-imagineable: be wary of extrapolating from today’s technology

A high-profile McKinsey/AT&T study in 1986 famously predicted no more than a million wireless subscribers in the U.S. by the turn of the century, citing several 'insurmountable' barriers to market growth.

Contrast that with today's reality - nearing 2.5 billion subscribers across the globe who are using digital wireless technologies for voice, email, internet access, music and video services.
Imagine the unimagineable: be wary of extrapolating from today’s technology

- Abundant availability of clean electricity
  - Cars as mobile power plants
  - Leave the lights on

- Smart Cities/Urban Farming

- Bio-based rural industries

- Industrial Ecology/Zero Emission Manufacturing

- Design for Disassembly: Cradle to Cradle

- Minerals/Metals Constantly Recycled
Thank You!

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www.cleantech.com

Come Join Us in 2009 at:

Cleantech Forum® XXIII
Boston, MA • Sept 8-10, 2009

Cleantech Forum® XXIV
Delhi, India • October 15-16, 2009