



Forum for the Future

# Clean Capital

## Financing clean technology firms in the UK



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Library House [www.libraryhouse.net](http://www.libraryhouse.net)

New Energy Finance [www.newenergyfinance.com](http://www.newenergyfinance.com)

A list of organisations consulted as part of this study is available at Appendix 1.

**The views expressed in this report are those of Forum for the Future. All information provided is for educational purposes only, and is not financial advice in any form.**

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**Cover Image:** Konarka's Power Plastic™. A thin film solar photovoltaic cell represents the next generation of solar technology, using novel materials to manufacture cheaper, more efficient and more portable solar cells that do not rely on silicon. Source: Konarka Technologies Inc.

The Impax ET 50 Index tracks the 50 largest by market capitalisation global pure play environmental technology companies. Source: Impax Asset Management.

## Ministerial foreword

The Government is committed to substantial support for the development of clean technologies and is keen to ensure that the UK takes a lead in this growing market. Increased investment in the science base and through the Technology Programme, a crucial part of the government's Science and Innovation Investment Framework, is clear evidence of that commitment. We are also exploring the role of public procurement in driving forward innovation in this area.

At an industrial level, investment in 'clean technologies' help to improve process efficiencies, so reducing production costs and improving the 'bottom line'. They also offer substantial environmental benefits, by minimising waste generation and preventing pollution, as well as reducing the amounts of non-renewable or harmful inputs used. From a consumer perspective, the purchase of cleaner products helps the economy to decouple economic growth from increased resource usage.

Overall, investments in clean technologies helps to put the UK on a growth trajectory that is inherently more sustainable and competitive. They are also a crucial mechanism for enabling us to deliver our environmental targets.

But we cannot do this by acting alone – we need to work closely with the financial sector, and other stakeholders, who can access the capital markets and bring their vast expertise to bear on this emerging sector, helping to catalyse the transition of these innovative and clean technologies from the research laboratories to the final end user.

Forum for the Future has been a valuable partner in this process and has facilitated real engagement by Government with the finance industry, as well as SME eco-innovators.

Financing is often cited as a barrier to development and uptake of clean technologies. The 2005 review of the London Principles identified the examination of the provision of finance for eco-innovation as being one of two areas where further work was required. Therefore, we greatly welcome this report which advances our understanding and thinking on the emerging cleantech sector, particularly in defining more closely the role that Government, the finance sector and cleantech firms themselves play in determining the success of the sector.

We are also encouraged to see that the availability of finance for young cleantech firms has improved significantly in recent years, particularly for those companies that demonstrate strong management capability, a good business plan and a clearly defined market.

As always, we must never be complacent, especially with the considerable impetus and knowledge base that is concurrently building up in the USA, across mainland Europe and in developing economies. We will look carefully at the recommendations for Government made in this report and trust that cleantech firms and financial institutions will do the same for those addressed to them.

To ensure the UK maintains its excellent lead in this field and sustains its provision of finance, we need to continue to work closely together on this agenda. This report, and the underpinning workshops and research that have led to its publication, is the first stage in that critical process of joint working.



**Malcolm Wicks**

*Science and Innovation Minister  
Department for Trade and Industry*




**Ian Pearson**

*Climate Change and Environment Minister  
Department for Environment, Food and Rural Affairs*



## Foreword by Jonathon Porritt and Michael Snyder

In 2001 the City of London Corporation was approached by the Government and asked to take the lead in preparing the UK's Financial Services submission to the Johannesburg Earth Summit.

In response to this challenge, the City of London and Forum for the Future joined forces to develop the London Principles, a pioneering analysis of the role played by the financial services sector in supporting sustainable development.

The world has moved on since Johannesburg, and the last five years have seen the environment rise from a fringe issue to a mainstream political concern.

To quote Mahatma Gandhi: "First they ignore you, then they laugh at you, then they fight you, and then you win."

Naturally, climate change figures prominently amongst these concerns; in the wake of the Stern Review, the realisation has finally sunk in that we have moved beyond discussing whether there is a problem, to discussing what we need to do about it, and how urgently. Clean technologies are now recognised as the technologies of the future. They are no longer niche markets, but increasingly mainstream, and naturally SMEs have a vital part to play in eco-innovation, both through the development of new environmental technology, and the application of old technology in new and innovative ways.

In ten years' time, clean technologies will be taken for granted in mainstream business models the way that information technologies are now. By focussing in on the role that the financial services sector plays in supporting this vital component of the UK's economy, we hope to highlight some of the critical issues that will make this vision a reality.



**Jonathon Porritt**  
*Founder Director,  
Forum for the Future*



**Michael Snyder**  
*Chairman of Policy and Resources  
City of London Corporation*



## Executive summary

This report presents the findings of a project examining the UK financing landscape for clean technology (cleantech) firms, undertaken by Forum for the Future with support from the City of London Corporation, DTI, Defra and Gresham College as part of a follow on process to the London Principles initiative. The project convened two workshops, conducted interviews and drew on national and international data sources.

Cleantech is a broader concept than traditionally-defined environmental technology, incorporating resource efficiency, clean energy and advanced materials, and has a spread of end-users beyond the environmental goods and services sector, which is dominated by large water and waste utilities.

### Key findings

**UK cleantech finance has improved significantly over the last five years**, with increased venture capital (VC) investment and stock exchange listings for cleantech firms. This upward trend is supported by macroeconomic drivers, such as increased demand for energy and commodities from emerging markets, supportive frameworks created by government policies, more robust technologies and growing social concern being translated into political, corporate and, to some extent, consumer action.

However, at this stage in the cleantech investment cycle, a lot of activity is made up of speculative investments in pre-revenue firms. This is creating some signs of a bubble in certain subsectors like solar, biofuels and carbon trading and possibly distorting valuations. Although the long-term drivers are robust, there may be some short-term corrections. Future cleantech firm performance and investor awareness will be critical variables in managing the evolution of cleantech as an investment space.

### Increased venture capital activity

- **The UK is a leader amongst European peers in share and spread of cleantech venture capital.** According to figures from the Cleantech Venture Network, the UK accounted for almost a third (€603 million) of the total €1.9 billion invested across Europe between 2003 and Quarter 2 2006.
- **Energy related segments account for 61% of total UK investment compared to 92% in Germany.** Energy dominates the cleantech space globally, but the UK also has significant allocations to materials recovery and recycling, manufacturing and industrial and advanced materials segments. Transportation and logistics, water purification and management, and air and environmental quality are underrepresented, with a combined share of 7% of total investment.
- **A UK cleantech venture capital 'industry' is starting to emerge.** While some dedicated cleantech venture capital firms are UK based, it's the large mainstream players who are expanding their cleantech portfolios. A series of brokerage events, a network of incubators, and investment readiness services are creating an early stage finance ecosystem.

### Growing stock market presence for cleantech firms

- **London's AIM is the cleantech market of choice with around 61 firms with a combined market capitalisation of over £4 billion.** The Alternative Investment Market (AIM) – the junior stock exchange – is becoming home to smaller cleantech firms from around the globe. There have been 16 initial public offerings (IPOs) so far in 2006. A favourable regulatory regime compared to Sarbanes-Oxley and other requirements in the US, relatively lower size thresholds and a cluster of advisory expertise in London are encouraging more firms to seek AIM listings.
- **Broad spread of firms but clean energy and carbon trading dominate AIM.** Cleantech firms on AIM come in a variety of sizes and from various sub-sectors but the space is dominated

by a few large players mainly from clean energy and carbon trading – the top 10 firms account for 61% of the total market capitalisation and include many overseas listings. Some AIM flotations have acted as late stage venture capital funding, raising relatively low amounts for pre-revenue companies, and many stocks are very volatile.

- **Increased mainstream investor exposure.** More investment vehicles are available to expand exposure to cleantech opportunities. Approximately 165 dedicated funds operate globally, including a varied mix of underlying asset classes in venture capital, equity, debt and infrastructure. A broader range of investors are looking at cleantech opportunities, including small to mid cap listed equity funds from mainstream asset managers, dedicated investment vehicles and plays by hedge funds. The established UK Socially Responsible Investment community has not taken a significant position in listed cleantech equity until now, perhaps because the stocks are too small and volatile to fit existing strategies.

## Improving finance for UK cleantech firms

Although the UK is on an upward trend in cleantech finance, the current situation is a recent phenomenon, has grown from a small base and is still fragile. Most UK cleantech investments are speculative future plays in firms that are yet to demonstrate revenue growth and profitability. There are significant hurdles to be overcome before these firms can deliver competitive products to market successfully. Current capacity shortages in wind turbines and silicon supply for solar cells illustrate the next round of manufacturing and supply chain challenges after the technology innovation phase is complete.

The UK faces strong global competition from established European firms and activity in the USA as well as emerging cleantech players from China and India. The world's first solar billionaire is the founder of the US listed Chinese firm Suntech Power and India's Suzlon Energy is amongst the top five wind turbine players. The UK is trailing behind peers in creating successful cleantech corporations; none of the top ten global cleantech firms are UK based and most activity is retained within business units of major energy corporations. UK stakeholders need to build on the existing platform to deliver strong economic and environmental value in the future. We offer some recommendations to improve UK financing for government, cleantech firms and the financial sector.

## Recommendations for government

Government plays a critical role in the cleantech space, much more so than in comparable areas like biotechnology or IT. Its most important function is to maintain a joined-up approach to policy and provide consistency for the private sector to develop and invest in new technologies.

- Set robust mid- to long-term targets for sustainability outcomes to provide technology developers and financiers with a stable platform for innovation.
- Target mechanisms to increase commercialisation, address early stage financing gaps and improve scalable funding models.
- Capture emerging European opportunities over the next six years through the 7th Framework R&D and Competitiveness and Innovation Programmes (2007-2013)
- Leverage public procurement to drive innovation and create additional demand.
- Address wider barriers to investment including testing and certification procedures and fine-tune fiscal incentives.

## Recommendations for cleantech firms

Cleantech firms, both start-ups and more established players, can improve investment readiness to gain increased investor confidence and support.

- Identify and exploit verifiable routes to market through a strong experienced management team and a viable business model.

- Explore partnership options with industry for R&D, manufacturing and distribution to accelerate market penetration.
- Pursue considered fundraising strategies and good investor relations through improved financial reporting.

### **Recommendations for financial institutions**

The successful development of the UK cleantech space will require the involvement of a broad range of financial institutions – from venture capitalists and banks through to insurers, investors and brokers.

- Venture capital firms should support long-term growth of the cleantech sector through building up the necessary technology and market intelligence to add value to portfolios.
- Banks and insurers should improve coverage through small business support and, more critically, provision of debt capital and risk management products.
- Asset managers should expand cleantech investment products across asset classes – including listed equity, debt and infrastructure funds.
- SRI managers with themed funds should explore options to increase cleantech exposure and act as cornerstone investors in some areas.
- Analysts should enhance sell side coverage of cleantech stocks to provide more robust information for investor decision-making.
- UK institutional investors can play a stronger role as prudent but proactive suppliers of capital across the cleantech space.

## Introduction to this report

Technological innovation is an important part of the solution to impending environmental and social problems caused by rapidly growing resource use, increasing pollution to air, water and land and the threat of irreversible climate change. The interaction of several complex factors will determine the potential role and impact of new technology, making reliable predictions difficult. What is certain is the need for public and private finance throughout the innovation chain from technology development through to commercialisation and eventual industrial scale deployment.

This final report presents the results of a project examining UK financing of clean technologies (cleantech) firms, undertaken by Forum for the Future with support from the City of London Corporation, Defra, DTI and Gresham College, as part of a follow on process to the London Principles project.<sup>1</sup>

The project convened two stakeholder workshops in May and September 2006, consulted with a range of other practitioners and drew together information from a range of UK and international sources to present a comprehensive overview of current trends, issues and obstacles in the finance of cleantech firms in the UK.

The outcomes of this project will also feed into initiatives at the European level, particularly under the EU Environmental Technologies Action Plan and the work undertaken by the European Partners for the Environment initiative to map a shared vision for eco-innovation across European member states.<sup>2</sup>

**Section 1** introduces the cleantech space, outlining sub-sectors and main players, and sets the context for the rest of the report.

**Section 2** examines finance for seed and early stage cleantech firms, looking at trends in venture capital investment and issues in early stage finance.

**Section 3** looks at public market activity for cleantech firms and briefly touches on asset finance for technology deployment.

**Section 4** presents some recommendations for improving UK cleantech finance, targeted for government, cleantech firms and financial institutions.

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<sup>1</sup> The London Principles promote banking, insurance and investment for sustainable development and were launched at the Johannesburg Earth Summit in 2002. A progress review in 2005 identified action on financing environmental technologies as a key area of future focus. Phase II of the London Principles has two workstreams on access to finance for environmental technologies (this project) and access to finance for developing countries. See [www.forumforthefuture.org.uk](http://www.forumforthefuture.org.uk) for more information.

<sup>2</sup> See [www.epe.be](http://www.epe.be) for an overview of activities.

# 1 An introduction to clean technologies

## Section summary:

- The cleantech space – technologies, players and market drivers
- Overview of sustainability challenges in climate change, water and resource availability

Cleantech is broader than environmental technologies and has stronger economic drivers

10 broad cleantech sub-sectors can be identified... with a wide range of commercial actors

## What are clean technologies?

Clean technologies (cleantech) are technologies – including products, services and processes – that reduce or eliminate the environmental impact of currently available technology through increasing resource efficiency, improving performance and reducing waste. Although often used interchangeably, cleantech and environmental technologies are different concepts. Historically, environmental technologies used to refer to environmental protection measures – end of pipe pollution control, waste management and land remediation technologies.<sup>3</sup> Markets for these technologies were primarily driven by compliance and regulatory concerns rather than economic factors. The current cleantech space is more focused on resource efficiency and advanced materials and energy technologies, underpinned by stronger market incentives and macroeconomic drivers. However, regulatory factors are still significant for some areas, particularly in waste legislation and incentive frameworks for renewable energy.<sup>4</sup>

Attempts to classify the cleantech space have to take account of the breadth and diversity of technologies and applications as shown in figure 1 (a) and (b) below.

**Figure 1 (a) Cleantech subsectors tracked by Cleantech Venture Network**  
**(b) Types of cleantech businesses**

	Type	Key features	Examples
<ul style="list-style-type: none"> <li>● Agriculture and nutrition</li> <li>● Air quality</li> <li>● Enabling technologies</li> <li>● Energy related</li> <li>● Environmental IT</li> <li>● Manufacturing/industrial</li> <li>● Materials and nanotechnology</li> <li>● Materials recovery and recycling</li> <li>● Transportation and logistics</li> <li>● Water purification and management</li> </ul>	<b>Cleantech SMEs</b>	Smaller companies that apply already developed technologies or provide other ancillary services. They may not have very fast or high growth potential but are a vital part of cleantech value chains.	<ul style="list-style-type: none"> <li>● Wind and solar household installation</li> <li>● Niche green products (e.g. construction)</li> </ul>
	<b>Technology start-ups</b>	Young companies commercialising technologies into products and entering markets with good growth potential.	<ul style="list-style-type: none"> <li>● Ceres Power</li> <li>● Nanosolar</li> </ul>
	<b>Pure Play cleantech</b>	Cleantech firms that have developed into significant independent corporations, usually publicly listed and making the majority of revenue from cleantech as core business.	<ul style="list-style-type: none"> <li>● Vestas Wind</li> <li>● Suzlon Energy</li> <li>● Suntech Power</li> </ul>
	<b>Traditional environmental goods and services</b>	Water utilities and waste management companies, including large private or public firms and a wide range of smaller waste management companies, environmental consultancies, contaminated land remediation etc.	<ul style="list-style-type: none"> <li>● Severn Trent</li> <li>● SITA</li> <li>● Veolia</li> </ul>
	<b>Subsidiaries</b>	Business units within major corporations involved in cleantech, which form a small part of the overall business.	<ul style="list-style-type: none"> <li>● General Electric</li> <li>● Mitsubishi</li> <li>● Sharp</li> </ul>

Some firms may not define themselves as operating in cleantech, or may be subsidiaries of much larger corporations, not to mention teams within other sectors researching more environmentally benign technologies – such as hybrid drive development in the automotive industry. This project focuses on technology start-ups as a crucial source of innovative activity, particularly disruptive technologies, compared to more established firms. Start-ups are vulnerable to financing constraints, condemning promising technologies to perish in the ‘valley of death’ between the laboratory and the market place.

<sup>3</sup> Cleantech Venture Network ‘Cleantech Venture Investment: Patterns and Performance’ 2005

<sup>4</sup> ‘Enabling Business in Resource Management’ Final report of the Innovation and Growth Team 2002

## Potential multibillion-pound global markets for successful technologies

Existing EGS global market worth \$515 billion, estimated to grow to \$690 billion by 2010.

Estimates for the DTI suggest that the global Environmental Goods and Services (EGS) sector was worth \$515 billion in 2002 and is forecast to grow by 3% a year to \$690 billion by 2010.<sup>5</sup> This is dominated by utility services – waste management and water and wastewater treatment alone account for about 72% of the existing global market. Attempts to map the UK EGS sector using a bottom up approach show that it had an estimated turnover of £25 billion in 2004, employed 400,000 people and had 17,000 companies.<sup>6</sup> Recent estimates suggest that the domestic market is forecast to grow substantially, expanding to £34 billion by 2010 and on to £46 billion by 2015, again dominated by waste and water segments.<sup>7</sup>

Cleantech operates across standard industry sectors.

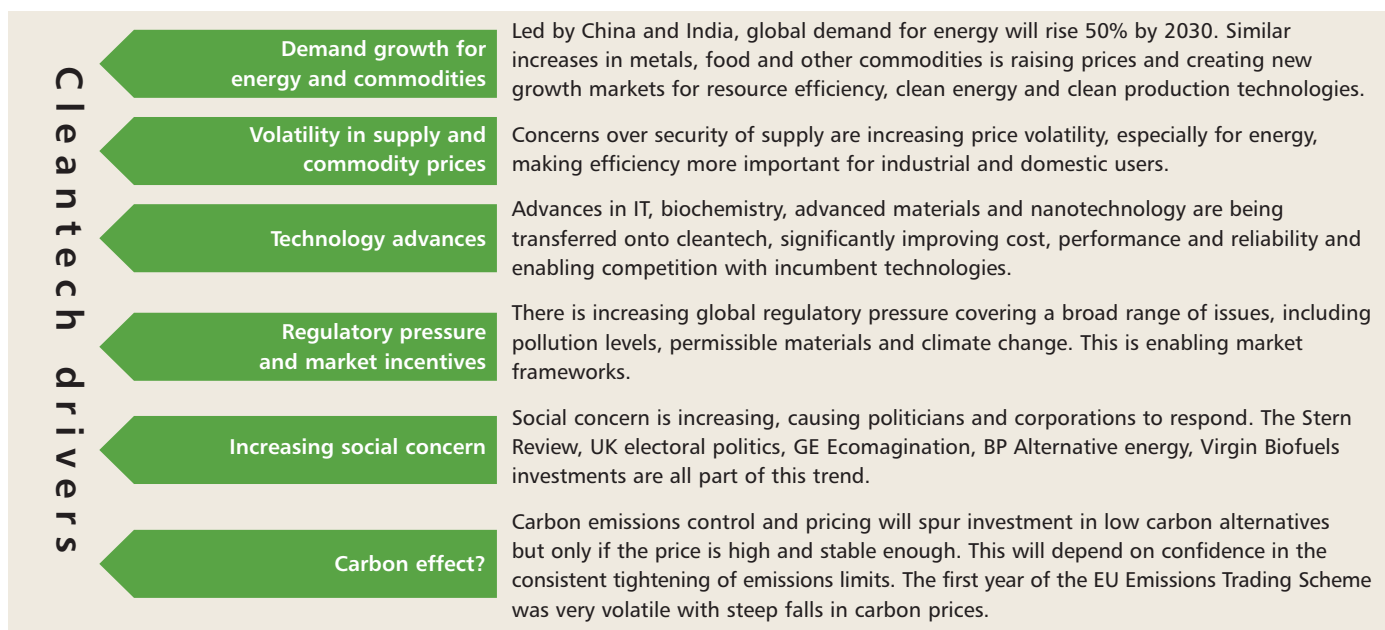
However potential cleantech end-user markets could be much greater as they range across industry sectors rather than being confined to the traditional EGS sector. Estimates for selected subsectors, especially clean energy, forecast accelerating markets that will outpace the growth rates of the wider EGS sector. The total global market for fuel cells, solar, wind and biofuels is forecast to grow fourfold from \$39.2 billion in 2005 to \$167 billion by 2015.<sup>8</sup> The Stern Review<sup>9</sup> estimates that spending on low carbon investments in developing economies alone will reach £20-30 billion per annum.

## Macroeconomic factors promoting cleantech

Cleantech has a powerful long-term growth story to entice investors

Although many of the individual technologies under the cleantech banner have been developing for decades, the last five years have seen the cleantech 'story' gain increased traction through invoking some long-term fundamental drivers.

Figure 2 A wide range of drivers promoting cleantech



<sup>5</sup> 'Enabling Business in Resource Management' Final report of the Innovation and Growth Team 2002

<sup>6</sup> DTI/Defra Environmental Industries Unit 'Mapping the UK Environmental Goods and Services Sector', 2004

<sup>7</sup> UKCEED for DTI/Defra Environmental Industries Unit 'Study of Emerging Markets in the Environmental Sector' 2006

<sup>8</sup> Clean Edge Inc 'Clean Energy Trends 2006'.

<sup>9</sup> The Stern Review, which reported its findings in November 2006 is at [www.hm-treasury.gov.uk/independent\\_reviews/stern\\_review\\_economics\\_climate\\_change/sternreview\\_index.cfm](http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm)

Nanotechnology can transform cleantech but has its own risks too.

## Identifying and leveraging technology synergies

Advances in materials science, design, computing, electronics, biotechnology and nanotechnology can have powerful cleantech applications and significantly improve performance, reliability and cost. Nanotechnology<sup>10</sup> is one area of particular interest as it can potentially transform cleantech, but must be carefully harnessed. There are concerns about its potential environmental, social and ethical issues – including risk management, liability regimes, toxicity and human health impacts as well as recycling and safe disposal of nanomaterials.<sup>11</sup> Providing that nanotechnology develops responsibly, there are several near-term commercial cleantech applications, and an increasing number of firms are actively developing and bringing these to market.

### Figure 3 Cleantech and nanotechnology opportunities

**Nanotechnology enabling a solar PV breakthrough** through developing new thin film, flexible plastic based cells that do not rely on silicon or radically improving the efficiency of existing cells. The US firm Nanosolar has recently attracted \$100 million in follow on funding for its flexible solar cell technology that reduces cost tenfold and is building the world's largest solar PV plant.

**Hydrogen production and storage** could be revolutionised by nanoscale fabrication. Carbon nanotubes can enable a tenfold improvement in fuel cell performance and significantly reduce the need for expensive catalysts like platinum.

**Advanced catalysts offer significant environmental promise** as they allow materials to be broken down into more environmentally benign alternatives and improve material efficiency. Nanostructured catalysts are already in the market. UK firm Oxonica launched Envirox,<sup>TM</sup> a fuel borne catalyst for diesel engines that increases fuel efficiency by up to 11% and reduces particulate and CO<sub>2</sub> emissions.

Cleantech can only be part of a sustainability solution.

## The scope of the challenge

Cleantech is only part of the solution and not a panacea for solving the problems of sustainable development. Some cleantech innovations can have environmental and social downsides, such as the impact of first generation biofuels on biodiversity and global food crop prices. Cleantech also does not directly address some important social issues around poverty, economic insecurity and other factors that are an integral part of sustainable development, although technologies such as low cost off-grid solar have pro-poor impacts.

Nevertheless, cleantech has the potential to address some critical global sustainability challenges but this will require massive investment in innovation, commercialisation and deployment. There may be enormous opportunities to deploy advanced cleantech as emerging markets overhaul and construct massive new infrastructure projects, and new low cost solutions in energy and water have tremendous potential for addressing low-income groups. Before examining the current state of play in UK cleantech finance, we offer a brief perspective on the scale of the task ahead.

<sup>10</sup> Nanotechnology is an umbrella term. "Nanoscience is the study of phenomena and manipulation of materials at atomic, molecular and macromolecular scales, where properties differ significantly from those at a larger scale. Nanotechnologies are the design, characterisation, production and application of structures, devices and systems by controlling shape and size at nanometre scale" Source: Royal Society 2004

<sup>11</sup> See [www.nanologue.net](http://www.nanologue.net) for an explanation of nanotechnology risk and opportunities.

**Figure 4 Cleantech needs to address critical global sustainability challenges**<sup>12</sup>

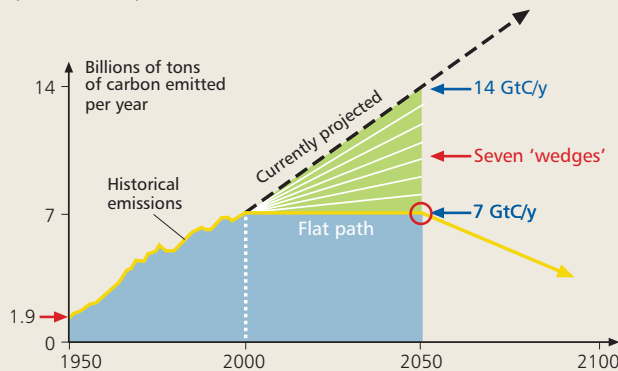
Massive scale up of low carbon energy technologies.

### Addressing climate change.

The Stern Review estimates that \$185 billion a year is required to stabilise global greenhouse gas emissions at 550 parts per million CO<sub>2</sub> equivalent by 2050 (current levels are around 430 ppm). Electricity generation will need to be decarbonised by at least 60%, with cuts in transport emissions as well. Stern recommends a technology portfolio approach, arguing that a broad set of technologies will be required.

The Princeton Wedges model offers a set of solutions that will each remove one gigaton of carbon/year (GT/y) to stabilise current emissions by 2050 at 7GT/y instead of the projected 14GT/y (see figure below). This will require massive scaling up of renewables and other emissions reduction measures.

Scaling up clean energy technologies is a Herculean task. Current capacity shortages in wind turbines and silicon supply for solar cells illustrate the next round of manufacturing and supply chain challenges after the technology innovation phase is complete.



### Some potential 1 gigaton wedges

- 1 Wind** – 300,000 5mw turbines that cover an area the size of Portugal.
- 2 Solar** – 700 times current capacity, growing 60 times faster, and covering 10 million hectares of land.
- 3 Biofuels** – 250 million hectares of crops, one sixth of world crop production.
- 4 Advanced vehicles** – 2 billion cars with 60mpg (lubes, hybrids, lightweight materials).
- 5 Carbon sequestration** – Carbon capture and storage at 700 1GW coal power plants

Critical water shortages require new solutions.

### Overcoming water scarcity

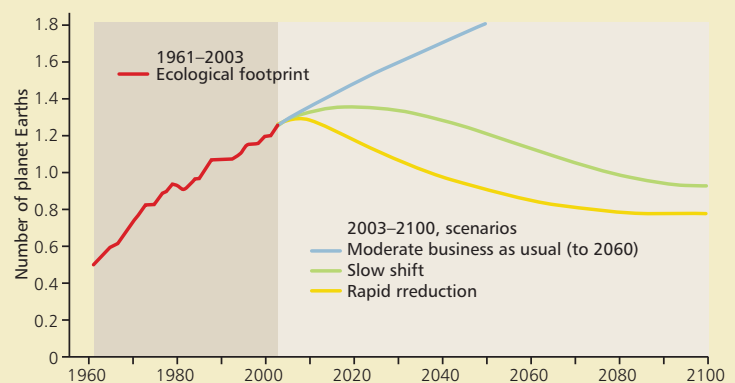
Water is a critical global challenge because of demand growth, increasing scarcity and resource degradation. 40% of the global population will live in water-stressed areas by 2025 and overall demand is set to double every 20 years. To meet the Millennium Development Goal by 2015 requires 370,000 people per day to gain access to sanitation and 260,000 to water. This is estimated to cost at least \$30-40 billion per year above current spending but current funding levels are about 10-20% of the sum needed.

Technologies that significantly improve water efficiency, new advanced effluent and wastewater treatment solutions and low energy water purification systems have tremendous potential to provide solutions to the emerging water crisis but must be commercialised and financed.

Step change in resource efficiency to offset impacts of demand growth.

### Managing Unsustainable Consumption

Consumption levels of natural and synthetic resources are rising globally. As affluence increases, consumption demand is set to grow to unsustainable levels. Forecasts of future growth using ecological footprinting methodology show that global demand already exceeds the Earth's regenerative capacity in 2006 and under a business as usual scenario is set to be almost double – effectively requiring two planet earths to meet global demand (see figure right). The Rapid Reduction scenario assumes a massive step change in cleantech deployment, 60% carbon emission cuts, and radically different ecological management. While there are no comprehensive estimates of the scale of investment required, it is clear that immense technology gains will be needed to significantly offset the impact of demand growth.



It is clear that cleantech needs to play a central role in meeting the global challenges outlined above. The next section explores the current financing landscape for early stage cleantech firms in the UK and identifies some options on how it may be enhanced.

<sup>12</sup> Data reported in this section is taken from the Stern Review on the Economics of Climate Change HM Treasury, 2006. (see [www.hm-treasury.gov.uk/independent\\_reviews/stern\\_review\\_economics\\_climate\\_change/sternreview\\_index.cfm](http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm)), Pacala & Socolow Stabilisation wedges [www.princeton.edu/~cmi/resources/stabwedge.htm](http://www.princeton.edu/~cmi/resources/stabwedge.htm), IEA World Energy Outlook 2004, REN Global Renewables Status 2006, 'Business case for water' UNEP FI, WWF Living Planet Report 2006

## 2 Financing seed, early and expansion stage cleantech firms

### Section summary:

- Current trends in UK and global cleantech venture capital
- Assessment of financing issues for start-ups – financial and non-financial barriers
- Public and private initiatives to improve early stage finance – investment readiness, targeted funds and stronger research commercialisation
- Addressing wider barriers to investment – improving testing and certification, lobbying and procurement

Equity capital is essential for start-ups with high-growth potential.

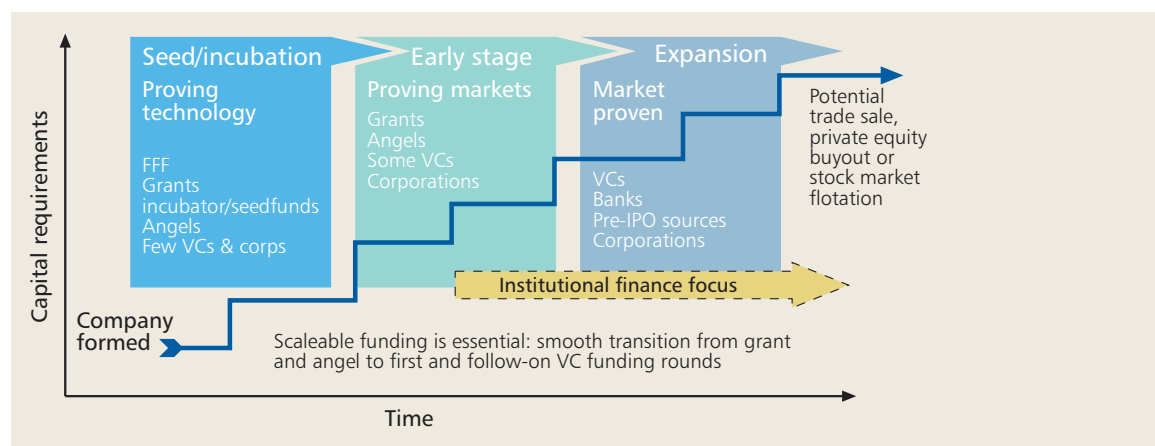
Private investors and grant support are essential at seed stages.

### Different funding sources operate at stages of company evolution

This section focuses on equity capital as the most appropriate financing option for technology and innovation-driven start-ups with high growth potential but low collateral and limited cash flow to service debt repayments. Equity investors such as venture capital firms share the risk of failure with the company, provide value added through understanding technology and market synergies and offer management support to early stage businesses, including board participation.

Institutional private finance (i.e. venture capital<sup>13</sup>) mainly starts to operate when the technology and market potential are proven. The combination of very high risk and small deal size make early investments unattractive. At seed or incubation stages, firms generally need to access grant funding, mobilise personal funds (known as Founder, Friends and Family (FFF) stages) or use Angel investors.<sup>14</sup> However, some specialised private venture capital firms, publicly backed funds and university based seed funds focus on seed and very early stage investments. Start ups, particularly technology-based, need to access finance as the business progresses, making scaleable funding provision very important in managing 'cash burn' and unlocking new funding as the firm hits development milestones.

Figure 5 Main providers of finance at each stage



### Current trends in cleantech venture capital

Historically low venture capital involvement due to poor market prospects and legacy of failures.

The first generation of cleantech firms – which were more focused on the environmental protection space – were not very successful at raising finance from venture capital funds. Many did not have strong business plans, technologies were embryonic and markets were completely dependent on regulation. The few venture capital firms who backed some of the more promising companies based on market potential anticipated from the enforcement of stricter environmental regulation lost

<sup>13</sup> For this report, Venture capital is defined as investment in early stage and expansion companies and Private equity as later stage buy-outs and project investments.

<sup>14</sup> Angel investors are usually high net worth private individuals who take an equity stake in early stage companies. Unlike institutional venture capital funds, they often invest smaller amounts, are more comfortable assuming higher risk at early stages and may undertake less onerous due diligence.

money when expected legislation was implemented with watered-down standards. In the UK, anecdotal reports claim some early investors made losses due to problems in developing renewable energy technologies. Low awareness of environmental markets amongst investors – and more compelling opportunities from IT and biotech – led venture capital investors on both sides of the Atlantic to stay away until fairly recently.

## Steady growth in cleantech venture capital investment in North America and Europe

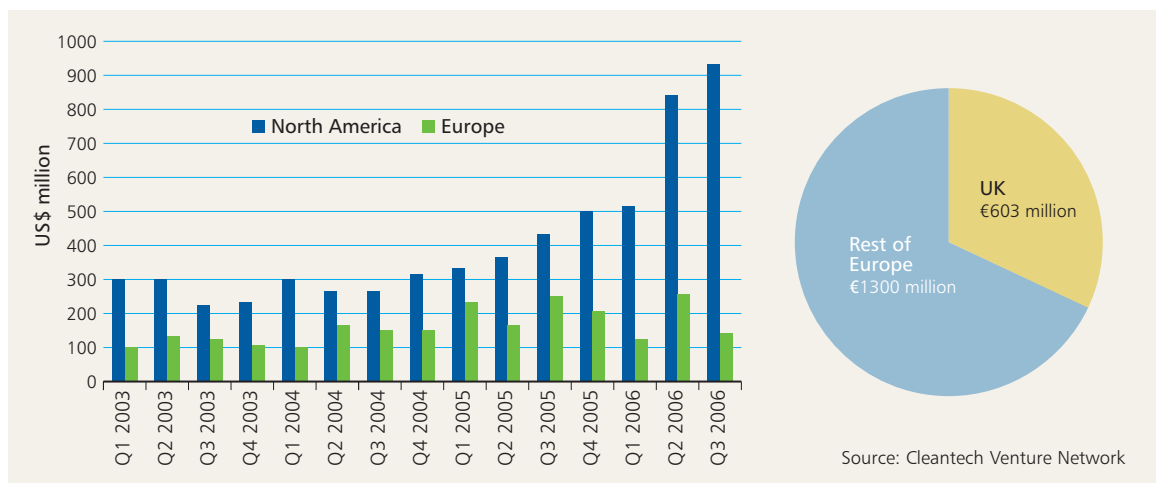
Cleantech goes mainstream in the US – 3rd largest venture capital investment category.

In Q2, 2006, the cleantech space became the third most invested venture capital category in North America – US\$843 million accounting for 13.4% of total venture capital investment – overtaking semiconductors, telecoms and medical segments and trailing only IT and biotech. A trickle of venture capital money is turning into a massive capital inflow amidst signs of increasing hype as the cleantech story convinces more and more investors.

UK dominates in Europe, accounting for a third of total investment.

Cleantech first started attracting attention during the dotcom boom as well-capitalised venture capital funds hunted for other technology-related opportunities. North American cleantech venture capital investment has seen eight straight quarters of growth and hit a total of \$2.9 billion in 2006. Energy-related investments account for \$2.1 billion or 74% of the total.<sup>15</sup> Recent US figures have been inflated by a few very large project finance type investments made by venture capital funds in biofuel production facilities. European investment levels are a lot lower but are also on an upward trend, albeit a bumpy one. Investment tends to rise and dip quarter to quarter and has recently fallen again in Q3 2006. The UK is a clear leader within European cleantech venture capital investment, capturing almost 32% of the total €1.9 billion invested between 2003 and Q2 2006.<sup>16</sup>

**Figure 6 (a) North American and European cleantech venture capital 2003 – Q2 2006**  
**(b) UK share of total European cleantech venture capital**



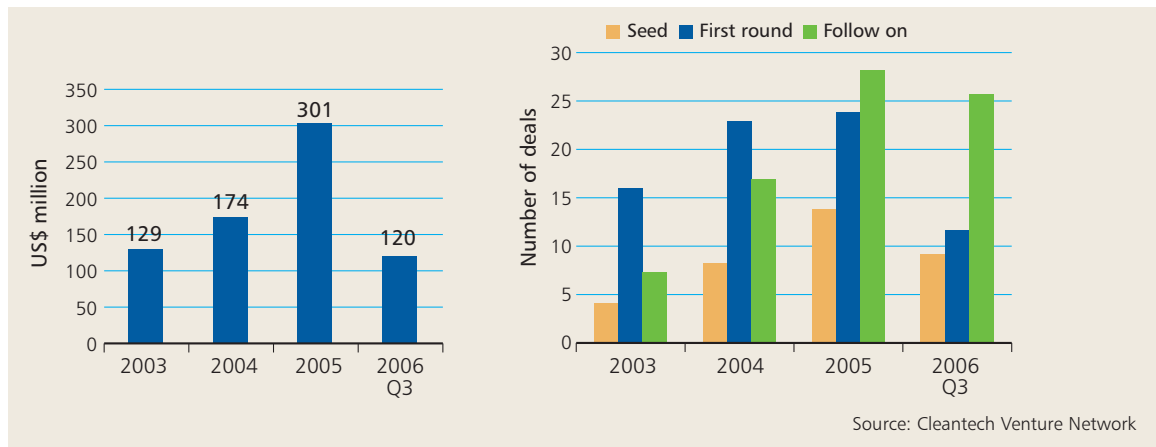
Rising investment levels and healthy trend in funding by stage.

To some extent, this is a reflection of the strength of the UK's financial architecture and venture capital industry compared to most European counterparts, where conventional bank loans and corporate venturing are more common. But the growth and dominance of UK cleantech venture capital is a positive, and welcome, indicator of technological innovation. However, true success will only be demonstrated in the evolution of these firms into sustained growth businesses. As section 2.2 will discuss, the UK is behind peers in creating large and globally competitive cleantech corporations.

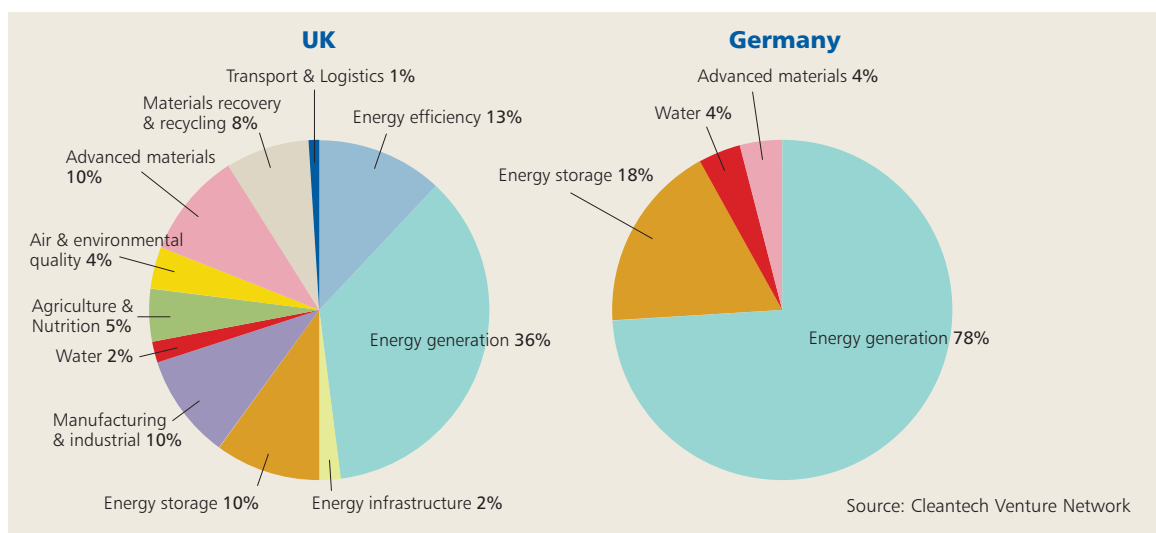
Investment levels have been rising since 2003, reaching a high in 2005, but have dipped in 2006. This may be due to alternative financing options from earlier public market flotations on AIM and increased hedge fund involvement. There is a healthy trend in funding by stage, with an increase in follow on rounds as many first round investments require additional capital.

<sup>15</sup> Cleantech Venture Network

<sup>16</sup> Cleantech Venture Network 'Cleantech Capital Monitor' November 2006

**Figure 7(a) UK Cleantech venture capital 2003 – Q3 2006 (b) Number of deals by stage 2003 – Q3 2006**

Venture capital funds are spreading their investments across a broad set of technologies in a range of sub-sectors, following diversified investment strategies.

**Figure 8 UK and Germany cleantech venture capital investment by sub-sector 2003 – Q2 2006**

UK has 61% invested in energy related segments compared to 92% in Germany.

Although energy-related investment dominates in both the UK and Germany, the emphasis in Germany is overwhelmingly on energy generation firms such as solar and fuel cell players. Adding in energy storage technologies means that almost 92% of overall German venture capital investment is in clean energy with small allocations to water technologies and advanced materials. In contrast, the UK has a much broader investment base. Energy related investments account for 61% but this includes 13% invested in energy efficiency and 2% in infrastructure. The advanced materials, manufacturing & industrial and materials recovery & recycling segments have each received about 10% (approximately €60/ £40 million) of venture capital investments. Transportation & logistics, water purification & management and air & environmental quality are underrepresented, with a combined share of 7% of total investment.

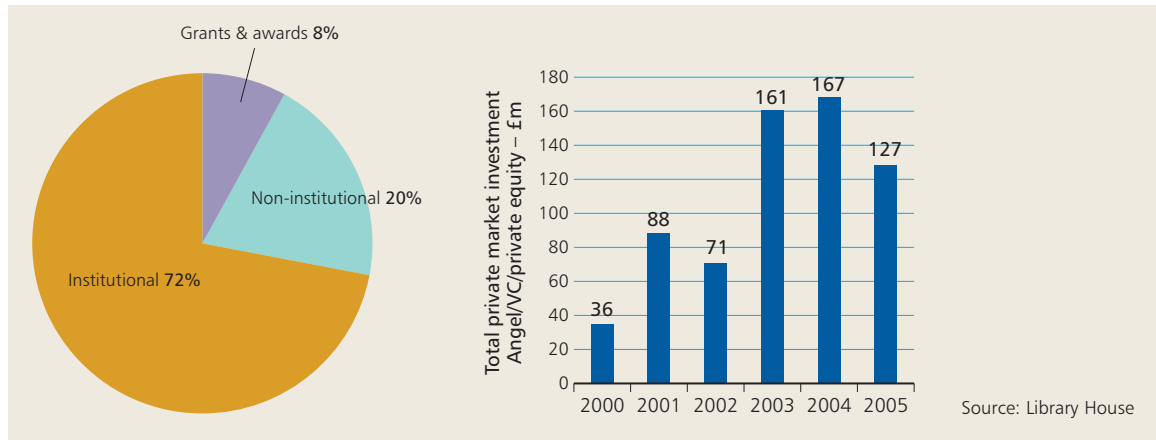
'Carbontech' definition captures over 300 UK firms.

The UK research firm Library House maintains a UK data set – but a different definition and methodology does not allow a like for like comparison with Cleantech Venture Network figures. Library House conducted a bottom up analysis, screening over 4,000 companies to identify over 300 UK-based cleantech firms – as defined by the Carbon Trust to cover technologies that have the potential to reduce carbon emissions through the energy supply chain: including generation, infrastructure and consumption. The firms and investments captured by this definition are spread across a range of standard industry sectors including energy, industrial and chemicals and materials.<sup>17</sup> To minimise confusion with other datasets, we refer to this definition as carbontech. Institutional funding (venture capital) provides the majority of capital invested into private

<sup>17</sup> Library House 'Warming to cleantech' 2006

carbontech firms in the UK. Although non-institutional funding (business angels and other private investors) and grants/awards are lower in volume, they are vital for some firms, especially those which are further away from market entry and need significant levels of R&D funding to develop technologies.

**Figure 9 (a) UK carbontech Investment by type of funding and (b) UK carbontech total private market investment 2000-2005**



Grant and non-institutional funding accounts for around 40% of the capital invested in carbontech firms classified as operating in the energy sector, whilst other firms – such as those creating chemical and material or IT applications that reduce carbon emissions – have much lower levels. Total private market investment – including business angels, venture capital and private equity (not including later stage buyouts) – has been growing since 2000 but dipped slightly in 2005. Library House tracked 285 firms for its 2005 report and found only two new additional firms in a repeat survey conducted in 2006.

New Energy Finance, a research and analytics firm focused on clean energy, also maintains an extensive global database of clean energy finance. According to their figures, around US\$ 250 million was invested in the UK in clean energy venture capital/ private equity (excluding projects) in 2005, accounting for 7% of global activity.

### A much broader range of investors are getting involved

Large US Institutional Investors allocating significant funds to cleantech VC

The cleantech story is getting much easier to sell onto investors as they grasp the macroeconomic logic and see others getting involved. Major drivers in the US are large institutional investors, primarily state pension funds, which are increasing exposure to cleantech as part of a strategic response to climate change within investment portfolios. The US based Investor Network on Climate Risk (INCR) recently announced that its members have allocated a total of \$1 billion to cleantech over the last 18 months. While the majority of this will be committed to listed equity and infrastructure assets, there is also significant inflow to cleantech venture capital and private equity funds. The lead shown by a respected fund like CalPERS in committing \$200 million to cleantech venture capital funds is sending out a strong message and encouraging others to get involved. CalPERS is also considering options to act as a lead investor in a fund-of-funds investment that would provide a vehicle for smaller US pension funds to participate in the cleantech sector.<sup>18</sup>

UK investors are yet to ramp up cleantech investments on a similar scale

UK institutional investors are behind on this trend, but a recent £60 million mandate awarded to Robeco by the Environment Agency Pension Fund to invest in a sustainable private equity fund of funds is an encouraging sign, although reports suggest that the majority of this capital has been invested outside in the UK. Several pension funds, including Universities Superannuation Scheme and London Pension Fund Authority are investors in Impax Environmental Markets, an AIM listed investment vehicle, but which primarily invests in quoted companies.

<sup>18</sup> Environmental Finance, May 2006 (A fund of funds invests in a portfolio of other funds but does not make direct investments in companies)

Less appetite for early stage funds. Carbon Trust pulls IPO in November 2006.

Harder to raise cleantech funds in UK and Europe compared to US.

Big names such as 3i, Kleiner Perkins and Draper Fisher Jurvetson are actively investing. \$2 billion of US funds raised in 2006.

Corporate venturing is also on the up, with Big Oil leading the way.

Early stage cleantech investment portfolios are much more difficult to sell to investors compared to an investment strategy in more established firms. The Low Carbon Accelerator, a new AIM listed fund launched in October 2006 has raised £44.5 million to invest in a range of unquoted private companies specialising in low carbon applications in buildings and building products; green fuels; energy generation and energy efficiency. This fund intends to invest in proven businesses and has attracted allocations of around £2 million each from Derbyshire County Council Pension Fund and South Yorkshire Pensions Authority.<sup>19</sup> However, the Carbon Trust has recently pulled the proposed IPO of its venture capital fund which would have invested in earlier stage low carbon companies. According to reports in the Financial Times, primary investor concerns were the higher risk of unproven investments and the capital structure as an AIM listed vehicle instead of a standard private equity arrangement.<sup>20</sup>

The Institutional Investors Group on Climate Change (IIGCC), which has several UK and European members, has taken steps to highlight clean energy investment opportunities. The US is definitely ahead on institutional investor understanding and support of cleantech, enabling venture capital firms to raise large dedicated funds. Some UK-based venture capital firms report that it is much harder to attract significant amounts of capital for a dedicated cleantech fund compared to the US, and this undermines the ability of firms to provide scaleable follow-on funding at expansion stages. This situation is shared with European counterparts – for clean energy investments, later stage funding rounds averaged US\$8.8 million in Europe compared to \$14.2 million in the Americas.<sup>21</sup>

### Generalists joining sector specialists in hunting for deals

There has been a series of announcements of new specialist venture capital funds dedicated to cleantech investment. Growing investor demand is funnelling more capital to the smaller specialist cleantech funds and enabling large mainstream players to raise dedicated cleantech funds. In the US, Draper Fisher Jurvetson has established a joint venture dedicated cleantech fund capitalised at \$284 million, Vantage Point a fund of \$225 million and many others resulted in new fund announcements of over \$2 billion around June 2006.<sup>22</sup>

While the UK has some dedicated cleantech venture capital firms – such as WHEB Ventures, Foursome Investments and Conduit Ventures – most of the investment comes from mainstream firms like 3i and Quester Partners. This has benefits but, since cleantech investments do not form a strategic portfolio for almost all mainstream UK firms, this can also inhibit developing expertise in cleantech markets and understanding of technology synergies.<sup>23</sup>

Corporate venturing is also on the increase worldwide, primarily by venture arms of large oil and gas and energy corporations. Based on 2005 figures before many of the large dedicated funds were raised, Shell is estimated to be the largest 'venture capital' style investor at \$150 million annually, Chevron Technology Ventures is fifth at \$100 million per year.<sup>24</sup> Corporate venture capital funds invest directly in cleantech firms but also invest in other cleantech venture capital funds. While this is a tiny fraction of these companies' total expenditure, they are still big fish in energy-related cleantech venture capital. GE, Norsk Hydro, EDF and Siemens are some other prominent players. Analysts indicate that corporate venturing is more prominent in Europe than in the UK, especially due to fiscal incentives in Germany and other parts of continental Europe.

Hedge Funds and private equity firms have also entered the investment equation in the UK. Although most tend to prefer later stage financing and more mature companies or cleantech infrastructure projects, there are some reported instances of hedge fund involvement in relatively early funding rounds.

<sup>19</sup> Low Carbon Accelerator Prospectus

<sup>20</sup> FT Fund Management 'Cleantech IPO pulled' 30 October 2006

<sup>21</sup> New Energy Finance 2006 H1 Roundup

<sup>22</sup> Red Herring 'Too Late to get into cleantech', 21 September, 2006

<sup>23</sup> Library House 'Investment trends in UK Clean Technology 2000-2004' 2005

<sup>24</sup> Red Herring 'Big Oil's Clean Hedge' 27 June 2005

Increasing venture capital attention is pushing up competition for deals.

As competition over deals increases, some analysts are concerned about distorted valuations from eager uninformed investors, or the potential for diluting due diligence processes and financing companies that are not ideal investment propositions. This is fuelling concerns around asset bubbles and increasing froth in the cleantech venture capital space. This is a concern in both North America and the UK. There may be some situations where valuations might have been distorted or due diligence processes rushed due to the growing competition for sourcing and completing the best investments.

## Improving early stage finance

Despite steadily increasing venture capital investment in UK cleantech, there are still several barriers to financing early stage cleantech companies. Given the increasing capital inflow that is available for cleantech venture capital investment, supply side shortages are not an issue. There is more than enough money available – some analysts might even argue that there's too much money chasing too few deals as the cleantech space adjusts to rapidly increasing attention by the mainstream financial community. There are a number of reasons for funding issues – including the obvious focus on a strong investment case. Some firms do not present viable business propositions, others may not be appropriate for venture capital funding and need to access other options, or the firm may not be ready or willing to accept venture capital investment conditions.

## What do venture capital funds look for in cleantech investments?

Venture capital firms manage funds that are very specialised investment vehicles that must generate significant returns for their investors – who include high net worth individuals, corporations, and institutional investors – within a specified timeframe. The key features of what venture capital funds look for in potential investments are outlined in the table below.

**Table 1 VC expectations of potential cleantech investments**

<b>Risk-reward profile</b>	Venture capital firms assume very high levels of risk but need to ensure that potential returns on investment can justify that exposure. Typically, minimum rates of return will exceed 20-25%.
<b>Growth, scalability and market prospects</b>	Firms need a clearly defined route to market, evidence of verifiable market potential with high growth prospects and a scalable business model. Markets driven by environmental regulation are unreliable due to high public policy risk and venture capital firms prefer proven demand. Strong Intellectual Property Rights (IPR) is also essential for innovative technology based ventures.
<b>Exit routes and time horizon</b>	Venture capital firms need to see a clear mechanism for 'exiting' their investments and realising returns. Exits normally happen through flotation on the stockmarket (IPO), or sale of the stake to another investor, company management or through a merger. Most venture capital firms prefer to operate within a 3-6 year timeframe and are constrained by capital structures – normally a 10 year closed end fund structure for most firms – which means that investments and returns must be realised within this period. The long gestation period on many clean technologies makes investment challenging.
<b>Management capability</b>	Strong entrepreneurial skills and excellent management capability are essential to develop technology potential into viable businesses. Venture capital firms prefer experienced entrepreneurs and management teams.
<b>Deal size</b>	To manage risk and assess investments, venture capital firms undertake rigorous due diligence. Consequently, they have very high fixed transaction costs requiring deals of a sufficient size to warrant management attention. Most venture capital firms typically start investing in the £1-2million range.

Funding gaps are difficult to identify but some technologies may be more vulnerable than others.

Financial barriers may operate for specific technologies and in specific development stages. These funding gaps are difficult to verify empirically and attitudes about their existence and impact differ widely – usually venture capital firms and entrepreneurs will have very different views. Cleantech start-ups' perceptions of funding shortages may not take account of the fact that the firm may not be a viable investment proposition. Finance providers may cluster around specific investment themes and stages without recognising that funding gaps exist.

Some commentators have highlighted a finance gap in the £250,000 to £2million range. However, a study of the entire early stage venture capital landscape in the UK found little evidence of this.

No evidence of broader equity gap across UK venture capital investment.

More than half of all first round institutional (i.e. venture capital firms) deals are between the £250,000 to £2 million range. Public sector funding is making a difference in the supply of capital between the £100,000 to £500,000 range but private venture capital firms do also invest at this level.<sup>25</sup> Because it is an immature market, venture capital attitude tends to fluctuate with experience so that a successful early-stage intervention will often encourage further investment of this kind, whilst venture capital funds will quickly withdraw where they or a peer experience company failures.

Some key financing obstacles reported by entrepreneurs.

This analysis is not sector specific and there are several barriers to accessing some financing packages for cleantech firms. These are based largely on anecdotal evidence and some research carried out by the joint Defra/DTI Environmental Industries Unit (EIU).

**Table 2 Issues in the supply of finance to cleantech start-ups**

Issue	Explanation	Potential solutions
Accessing grant finance schemes	Excessive gatekeeping on many grant schemes with a demanding application process.	Clearly communicated criteria Incubation support
Difficulties accessing equity finance (under £250,000) at seed stage	Very small deal size is below VC threshold.	Access Government equity schemes Improve cleantech angel networks
Excessive management time spent chasing funding	Executives spend considerable time chasing small sums every 6-10 months, detracting attention from core business.	Scaleability in early Government funding schemes depending on hitting milestones More alignment with seed funding
Finance for pre-commercial pilots and demonstrators	Technology demonstrators are essential to many cleantech firms attracting customers but are very high risk for financiers and may also require significant capital.	Targeted grant schemes from Government for specific technologies within State Aid rules Public procurement

## Some cleantech SMEs may be unsuitable for venture capital investment

What about those cleantech firms that are not technology developers but instead deploy technologies or act as service providers? They cannot usually offer the high growth potential, strong patent protection and investment returns that venture capital funds require – typically offering between 10-15% when the minimum most venture capital funds look for is 25% and over<sup>26</sup> – and face the same problems as many other SMEs in sourcing debt finance from banks due to weak balance sheets, a lack of collateral and relatively low capital requirements. However, these SMEs are a vital part of the cleantech sector and need to access finance to survive and grow. The UK government has a range of generic schemes that offer both equity and debt support to SMEs.

- **Regional Venture Capital Funds (RVCFs)** are capitalised by public money but are managed by professional venture capital managers. The RVCFs currently have a very small cleantech portfolio although investments have been made in the following areas: waste recycling; water analysis; microbiological decontamination in the food processing industry; and, seed matting technology (enabling plants to grow without agrochemicals).<sup>27</sup>
- **Enterprise Capital Funds (ECFs)** are the Government's new intervention in the equity gap. They will be commercially run and invest a mix of public and private money into small firms with the capacity and willingness for high growth. Six funds have so far been established and more are expected to be established in the future.
- **The Small Firms Loan Guarantee (SFLG)** allows small companies to access conventional banking loans with Government acting as a guarantor. The SFLG has been used by around 400 cleantech firms – a total of around £30 million to firms in waste disposal and recycling; collection, purification and distribution of water; insulation; and technical testing and analysis.<sup>28</sup>

<sup>25</sup> Library House 'Venture Backed Report' 2006

<sup>26</sup> 'Enabling Business in Resource Management' Final report of the Innovation and Growth Team 2002

<sup>27</sup> Source: Environmental Industries Unit

<sup>28</sup> Source: Environmental Industries Unit

- **The Enterprise Investment Scheme**, in which business angels are offered a tax incentive for investing in start-ups, is another example of a fiscal tool which could be used to leverage investment into the cleantech sector. However, this instrument is at present overly complicated and not effectively targeted.

## Government sponsored sector specific funding schemes

Targeted government programmes supplement generic small business funding schemes.

Government can improve support through leveraging the existing mechanisms described above, promoting better understanding of the schemes and training both entrepreneurs and specialised finance providers. UK government agencies have put in place a series of measures to address these issues. The generic small business funding schemes mentioned earlier are supplemented by targeted cleantech initiatives.

- **The £30 million 21st Century Sustainable Technologies Fund** – one of the six Enterprise Capital Funds (ECF) set up to invest up to £2million in equity using a combination of public and private money.
- **The Carbon Trust venture capital programme** typically invests between £250,000 and £2 million alongside private venture capital investors on the same commercial terms. Investment is restricted to low carbon technologies. The venture capital fund has invested £6.8 million in 8 firms, 2 of which are now listed.
- **WRAP's £5.5 million fund** invested in recycling ventures. The fund was managed by Impax and has recently been wound down as there were difficulties in sourcing enough deals and an increase in private venture capital activity in recycling, which meant there was little rationale to continue with the fund.<sup>29</sup>

From 2007, €430 million will become available for increasing eco-innovation in the EU.

Currently undergoing approval processes in the European Parliament, the proposed new Competitiveness and Innovation Programme is designed to support the innovation agenda within the European Union's Lisbon Strategy for making Europe a competitive knowledge driven economy. The CIP is planned to run from 2007-2013, with a focus on innovation and entrepreneurship, and has earmarked €430 million for eco-innovation as well as €730 million for a separate "Intelligent Energy-Europe" initiative that will finance renewables and energy efficiency projects in a range of sectors.<sup>30</sup>

Government is investigating expanding its portfolio of sector-specific investment schemes, especially through the proposed Environmental Transformation Fund. This Fund will be financed through auctioning off a proportion of allowances under the 2008 – 2012 allocation period for the EU Emissions Trading Scheme. More information on the Fund will be released in the 2008 spending review.

Increased allocation from generic European schemes.

Proposed generic instruments to promote access to finance for SMEs include increasing investment into risk capital funds (including €1 billion to the European Investment Fund to operate, amongst other schemes, a high growth innovative SME facility which invests in other European early and expansion stage funds). This offers an excellent opportunity to plug some of the more persistent gaps in UK cleantech finance but must be used within an integrated strategy over six years, complement existing initiatives, and bring in private sector expertise where needed.

## Financing pre-commercial demonstrators and pilot plants

High risk deters funding for critical pre-commercial demonstrators.

The term 'demonstrators' covers a wide range of issues from early demonstration of new technologies to support for practical demonstration of large projects for example in renewables.

There has been concern over a pre-commercial funding gap for demonstrator projects, particularly those which require significant capital investment, such as a new recycling facility or pilot plants. Cleantech firms cannot finance these plants on weak balance sheets and cannot usually access finance from late stage venture capital funds or corporate partners. Funding large-scale infrastructure has moved towards structured or project finance in recent decades. However, banks and other

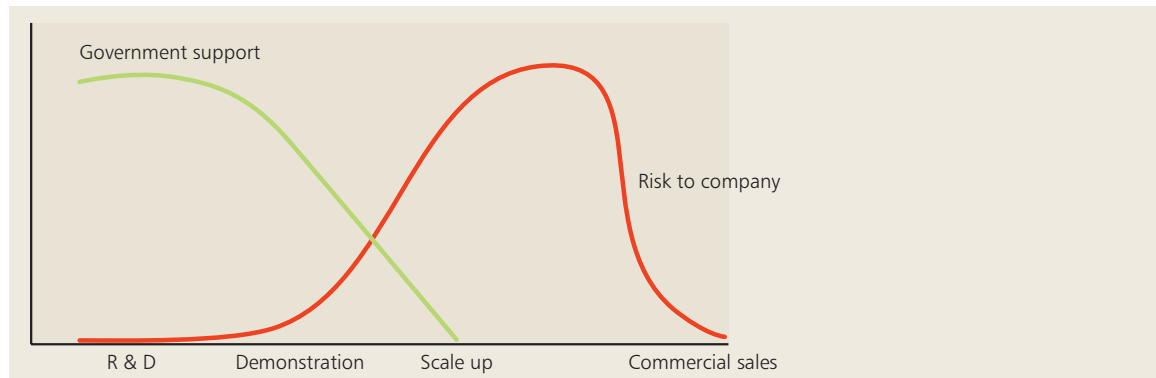
<sup>29</sup> See [www.edie.net/news/news\\_story.asp?id=12088](http://www.edie.net/news/news_story.asp?id=12088)

<sup>30</sup> European Union. See [http://ec.europa.eu/enterprise/enterprise\\_policy/cip/index\\_en.htm](http://ec.europa.eu/enterprise/enterprise_policy/cip/index_en.htm)

sources will not provide capital with such high technology and public policy risk, and alternative sources of funding are prohibitively expensive.<sup>31</sup>

A recent report by the Environmental Innovations Advisory Group<sup>32</sup> highlighted the 'valley of death' by means of this graph.

**Figure 10 Government support and risk to company**



Various initiatives involving a blend of public and private capital have been suggested to overcome this pre-commercial gap. European Union State Aid rules mean that government has restrictive limits on providing direct support to private demonstrator projects. The UK tends not to promote direct state ownership of assets, as is the case in Europe, so alternative proposals have been put forth.

Some direct investment solutions have been suggested in the past...

- A public-private fund for investing in pre-commercial demonstrator projects was suggested in 2002 by the IGT. The public component would be used to offset the risk premium to draw in debt finance from banks by functioning to take the risk equity portion of deals and taking a first loss position.<sup>33</sup>
- A 2005 study by the Clean Energy Group suggests multiple options for improving commercialisation and demonstrator funding including a leveraged approach involving public funders joining forces with one or more corporate leaders interested in investment from a given clean energy subsector. Funds would be pooled and invested through a special purpose vehicle and provide a range of instruments including full debt and equity financing, subordinated debt and loans with warrants.<sup>34</sup>

At the moment, the appetite to create new public-private structures in the UK Treasury or other agencies appears to be limited. However, the Energy Technology Institute is a prime example of such a partnership, requesting contributions of £5m from every large energy company to fund R&D.<sup>35</sup>

...but are difficult to justify. More analysis and a different approach to solutions are needed.

There has been improvement in the range of targeted support for demonstrators through schemes from the Carbon Trust, such as the £50 million Marine Renewables Deployment Fund (MRDF) and Defra's New Technologies Demonstrator Programme – with a budget of £30 million, the programme has now allocated funding to nine demonstration projects covering gasification, in-vessel composting, mechanical biological treatment (MBT), anaerobic digestion, and aerobic digestion. Capital grant schemes have been aimed at stimulating the diffusion of offshore wind, biomass technologies and photovoltaics.<sup>36</sup> There is also scope within the DTI Technology Programme to provide up to 25% funding for pre-commercial demonstrators in competitions (see later section).

<sup>31</sup> Clean Energy Group 'The potential for transatlantic investment in Clean Technology: An opportunity assessment of the clean energy sector' 2005

<sup>32</sup> Bridging the Gap between environmental necessity and economic opportunity – First Report of the Environmental Innovations Advisory Group, November 2006

<sup>33</sup> 'Enabling Business in Resource Management' Final report of the Innovation and Growth Team 2002

<sup>34</sup> Clean Energy Group 'The potential for transatlantic investment in Clean Technology: An opportunity assessment of the clean energy sector' 2005

<sup>35</sup> see <http://www.dti.gov.uk/science/science-funding/eti/page34027.html>

<sup>36</sup> see <http://www.dti.gov.uk/energy/sources/renewables/business-investment/funding/capital-grants/page19413.html>

There has been little detailed current analysis of the barriers to financing pre-commercial demonstrators and no comprehensive demand-side data to justify a new intervention beyond the various schemes that already exist. Previous analysis<sup>37</sup> suggests that there may be some gaps in demonstrator funding for industrial processes, water and contaminated land. Government should undertake research across the cleantech/environmental technology space to establish the current state of play – using a mixture of qualitative and quantitative data – to determine the best way forward on this issue.

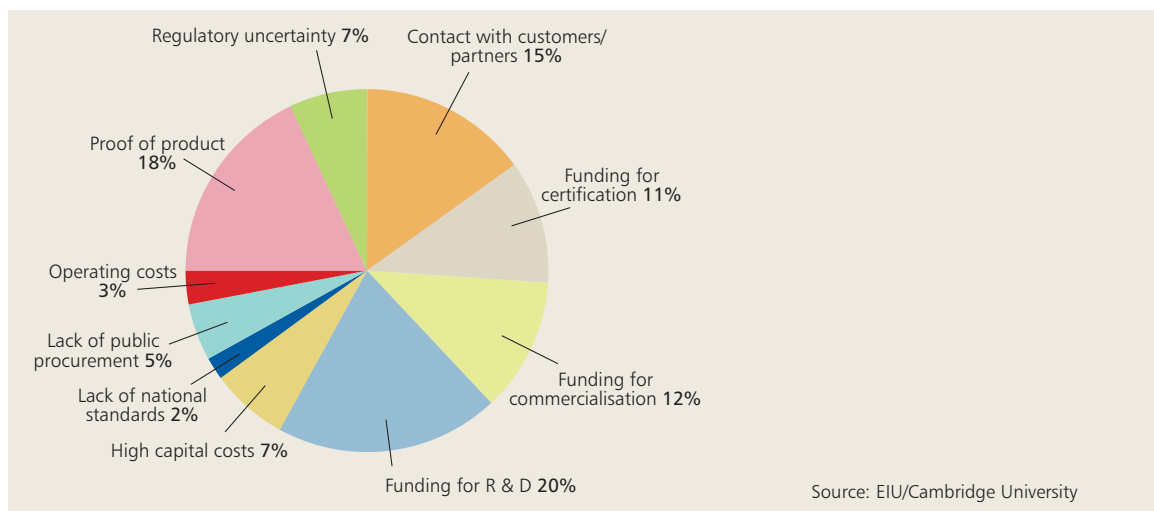
### Cleantech start-ups face a range of financial and non-financial difficulties

Reported difficulties vary by cleantech sub-sector.

Despite the broad basket of generic and targeted government support there are still many cleantech start-ups in the UK that report difficulties in meeting specific financial needs. Research carried out by Cambridge University for EIU<sup>38</sup> on 73 young cleantech SMEs on their perception of barriers to growth highlighted some obstacles to accessing funding for R&D and further commercialisation including critical testing and certification stages. The importance of these factors varies according to cleantech sub-sectors. For the more traditional EGS sectors (materials recovery and recycling, water and wastewater treatment), obtaining proof of product with a demonstrable prototype is most important followed by funding for R&D and contacts with customers/partners. Firms in the cleaner technologies and processes sub-sector had difficulty getting their technology to market, citing funding for certification and high capital costs as important factors. Funding for R&D is most important for firms developing low carbon energy technologies, followed by funding for commercialisation and proof of product.<sup>39</sup>

**Figure 11** Aggregate set of factors facing UK cleantech firms (n=73)

Funding for R&D, commercialisation and certification is difficult for some firms.



Improving the investment readiness of cleantech firms is critical to attracting finance.

The research also shows the importance of non-financial barriers affecting firm growth prospects. Improving investment readiness and significantly upskilling cleantech management is crucial to attract venture capital investment and ultimately deliver the technology to market successfully. This theme was reinforced in our consultations for this study, with UK investors continuously raising these issues.

<sup>37</sup> For example unpublished analysis by the DTI-Defra Environmental industries Unit

<sup>38</sup> Dee N & Ford S, Cambridge Institute for Manufacturing 'Insights into the challenges faced by environmental firms in bringing products to market' 2006 – commissioned by EIU

<sup>39</sup> Dee et al 'Development and Commercialisation of Eco-innovations by New Ventures', Conference paper, 2006

**Table 3 Non-financial barriers to investment**

Issue	Explanation	Potential solutions
<b>Management quality</b>	Many cleantech start-ups may have strong scientific expertise but little managerial experience. Cleantech management teams need a broad set of business skills to bring products to market.	Incubation support Mentoring Attract serial entrepreneurs Credible non-executive support
<b>Markets and business models</b>	Business models are often undeveloped and do not show verifiable market potential, especially in non-regulatory driven applications.	Incubation support Look for innovative market applications
<b>Route to market</b>	Many start-ups do not show a clear near-term route to market within the venture capital timeframe. Technologies may be too far away from market entry and revenues.	Incubation support Longer term grant support for commercialisation
<b>Technology and public policy risk</b>	Appetite for technology risk varies but most venture capital funds will prefer to back a proven technology.	Incubation Technology acceleration schemes
<b>Non commercial focus</b>	Many cleantech firms tend to emphasise environmental advantages instead of focusing on a sound commercial case and potential returns. Venture capital investors are driven by return and any environmental arguments are an add-on.	Incubation Investment readiness

Serial entrepreneurs need to enter the UK cleantech space.

The UK has far fewer serial entrepreneurs in the cleantech space than the US, where experienced entrepreneurs from IT and biotech are transferring their skills onto cleantech firms. This is a cultural issue to some extent but more support can be provided to raise awareness of cleantech opportunities, particularly to business schools and other relevant audiences. There is a need for stakeholder collaboration to establish more effective mentoring schemes, perhaps through alliances with industry associations and successful entrepreneurs from other high technology sectors such as IT, pharmaceuticals or biotech.

### Improving investment readiness and research commercialisation

A robust innovation pipeline is essential for strong start-ups

Many cleantech start-ups develop commercial products that build on previous fundamental and applied research in academia or industry. The UK innovation pipeline is a critical determinant of the quantity and quality of cleantech start-ups – both in terms of creating a robust research base and equipping researchers and others to create new ventures to commercialise technologies. Primary research funding is outside the scope of this project,<sup>40</sup> however there is a clear need for a joined up approach that examines financing activity across the innovation chain. This is now envisaged for the low carbon energy area, i.e. Research council funding then Energy Technologies Institute then Technology Programme funding – creating a continuum of financial support for promising technologies.

#### Cleantech investment readiness and networking initiatives

Targeted schemes to improve investment readiness and provide investor networking opportunities can provide cleantech start-ups with access to valuable advice and the chance to present to investors. A number of initiatives have recently emerged.

- **E-Synergy in partnership with the Carbon Trust** offers investment readiness workshops – offering diagnostics, training and mentoring support. This also includes access to early stage angels and venture capital funds.

- **The Clean Energy Investment Competition** run by the Centre for Sustainable Engineering takes a wide range of applications from researchers and companies. The 8 winners were allowed to present at an investment showcase in London in November 2006.

- **The London Stock Exchange** has organised a series of

cleantech themed **Capital Markets Days** to provide awareness of potential investors, run seminars and enable investor networking. Starting with the first Renewable Energy Day in October 2005, the fifth iteration is planned for March 2007.

- **The Cleantech Venture Forum** – run by a US company – had its first European event in London in June 2006. This offers pre-screened companies an opportunity to network with European and North American cleantech venture capital funds.

- **Future Energy Yorkshire** is developing a regional initiative, bringing together investors and technology developers involved in renewable energy in the Yorkshire and Humber region. An event in December 2006 offered fundraising seminars, raised awareness of different schemes and provided investor networking opportunities.

<sup>40</sup> Fundamental and applied research into cleantech was not the focus of this project and information reported here is based on preliminary desk research and limited consultation with practitioners and the strategy priorities identified by the DTI Technology Strategy Board.

High quality research with a strong commercial focus supported by an effective early stage support infrastructure for seeding new ventures are both crucial drivers for developing and bringing cleantech innovations to market. The UK is a leader in cutting edge science but has been less successful at turning technology breakthroughs into products and successful businesses.

### Improving the university spin-out route

Government has invested in developing a research commercialisation infrastructure through supporting Technology Transfer Offices (TTOs) in major UK universities and launching a series of challenge funds to improve entrepreneurship in academia. The flagship Higher Education Innovation Fund (HEIF) is set up as a permanent stream of funding for universities, providing pump-priming resources for technology transfer, entrepreneurship training, corporate spin-outs and seed venture funding. The University of East Anglia and a wide range of public and private partners were awarded £4.8 million in June 2006 for their 'Carbon Connections' project in the HEIF3 competitive round – one of 11 projects funded in total – which will focus on exploiting low-carbon technologies in the area of sustainable buildings and renewable energy.

University spin-outs from Cranfield, Cambridge and others are providing cleantech dealflow.

This investment is having an impact, with the university spinout route working to provide cleantech dealflow in the UK – around 18% of UK energy related cleantech companies stem from universities.<sup>41</sup> Imperial College, Cambridge, Cranfield and Lancaster are amongst the leading universities in this area, although most have had only limited numbers of cleantech spin-outs to date. However, the issues identified in improving spin-outs – including recruiting experienced management, funding proof of market and technology, understanding markets and end user needs and recognising venture capital requirements are being learnt.<sup>42</sup> These are all of particular relevance to cleantech start-ups. Many more universities are now alert to the opportunities in this sector and are investigating new ventures.<sup>43</sup>

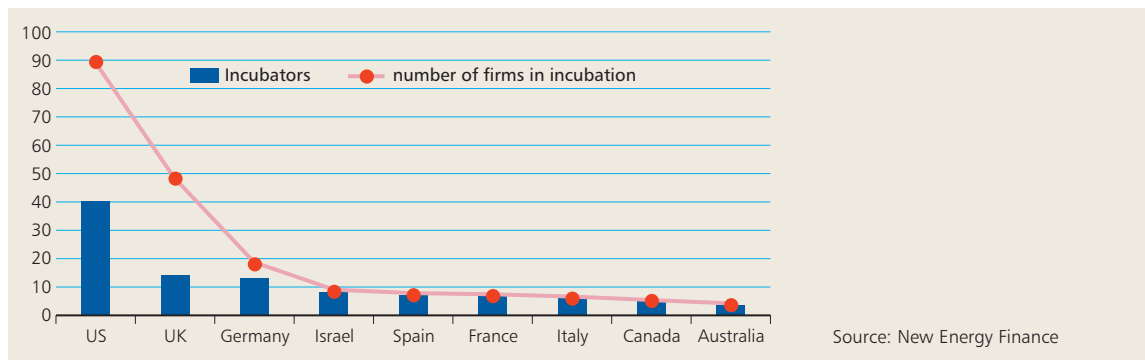
### Incubation is critical for cleantech start-ups

Incubation has a crucial role in overcoming many non-financial barriers and increasing the investment readiness of cleantech start-ups. Incubation provides a range of services – which vary from basic support on office space to consultancy, and providing access to mentors and early stage financing networks – to enable firms to commercialise technologies, develop business models and attract follow on investment.

UK incubation support for clean energy significantly improved since 2004.

There are no dedicated UK cleantech incubators that operate across a broad spectrum of technologies, but there has been a significant increase in clean energy incubation in the UK since 2004, when the Carbon Trust began the process of investing in start-ups through grants to existing incubators including Angle, Imperial, and Life-IC.<sup>44</sup> The UK is now second only to the US in both the number of incubators that support clean energy and the number of firms currently being incubated.

**Figure 12** The UK has a strong set of successful clean energy incubators



<sup>41</sup> Library House 'Warming to Cleantech', 2006

<sup>42</sup> BVCA/Library House 'Creating success from university spin-outs' 2006

<sup>43</sup> Environmental Industries Unit HEFCE workshop summary, 2006

<sup>44</sup> New Energy Finance 'Creating Clean Companies: white paper on incubation' 2006

Incubation support should be extended using the Carbon Trust model.

The Carbon Trust has had 36 companies go through its incubation program since 2004, which have gone on to raise £16.7 million in further financing (not including IPOs) on a total Carbon Trust investment of £1.7 million.<sup>45</sup> WRAP funds Imperial College to run a Recycling Commercialisation Centre. Incubation works and is an excellent return on investment. The most successful incubators tend to be based in universities, ensuring access to internal expertise as well as a source of the most robust R&D. There may be scope for further specific incubation initiatives in other cleantech sectors such as advanced materials and water technologies.

## New approaches and partnerships could improve commercialisation

VC-TTO partnerships can improve commercialisation if structured appropriately.

The focus on improving the entrepreneurial ability of universities and generating more commercial return from investment in research in recent years has led to the emergence of numerous hybrid approaches. Venture capital firms are entering into commercialisation partnerships with some UK universities. A typical deal involves the venture capital firm providing an upfront investment to the university in return for an agreed stake in any ensuing intellectual property generated. These new partnerships can significantly improve university-venture capital interaction, prompt research with more commercialisation potential and provide a clearer route to first round funding from the nominated venture capital firm. This introduces market discipline and new funds into university research institutes, which should have a roll on effect on improving the quality and fundability of cleantech start-ups emerging from UK universities.

## Successful UK cleantech spinouts

**Ceres Power**, which was spun out of Imperial College London and floated on AIM in 2004, has developed a fuel cell that will fit into a domestic central heating boiler instead of a pilot light, and can transform boilers into mini-generators that produce both heat and electricity. The cell would provide homes with a clean and cheap form of energy that produces significantly lower carbon dioxide emissions than conventional fossil fuels. The company now has a **stock market value of over £140 million**. Ceres Power has raised over £25 million of funding through two rounds of private equity and its AIM IPO in November 2004. The company enjoys the support of many blue chip City institutions as financial backers including **Fidelity, Morley** and **JP Morgan**. In January 2006, Ceres Power was selected as the only fuel cell company in the government's new Energy Research Partnership, contributing directly to national energy policy. Ceres has also entered into a partnership with British Gas to develop domestic combined heat and power using natural gas powered fuel cells. The contract was part funded by the DTI.

**Whitfield Solar Ltd** was established to develop and manufacture solar concentrators, a new approach to photovoltaic systems which offers significant cost savings (potentially 50%) over standard solar power generation. The company's novel technology is the product of over 30 years of academic research by the late Dr George Whitfield and colleagues at Reading University's School of Systems Engineering, and is now set to enter the UK's rapidly expanding renewable energy market. The team, whose original research was largely conducted with UK and European funding, first received investment in 2003 when

the **Cascade venture capital fund managers, Generics Asset Management Ltd.**, backed a study to establish the commercial potential of the technology. Subsequent investment from the Fund, with additional support from the University, has now enabled the team to set up the company, which will be based at Reading Enterprise Hub.

**Imperial Innovations** is an example of the emerging university based technology transfer model, based at Imperial College in London. In July 2006, it followed many of its incubatees onto London's Alternative Investment Market (AIM). It describes itself as a technology commercialisation and investment company. In addition to managing intellectual property and spin-outs from Imperial College, it also provides external incubation services for low carbon energy delivered through partnership with the Carbon Trust and a Recycling Commercialisation Centre funded by WRAP. Imperial Innovations is notable for two recent announcements outlining a new innovative approach to improve research commercialisation through signposting a scaleable funding path. Firstly, a **new £2 million Low Carbon Seed Fund endowed by the Shell Foundation and the Carbon Trust**, will invest between £50,000 and £250,000. Secondly, it has entered into an agreement with Consensus Business Group to establish a commercialisation centre that will work with corporate clients looking for next generation technologies, understand needs and source technology solutions. These will also have access to Consensus's \$250 million MAS-DAR Cleantech fund.

<sup>45</sup> New Energy Finance 'Creating Clean Companies: white paper on incubation' 2006

Access to public sector schemes can be improved.

## Navigating public sector funding

Despite the important role for public money, criticism has been levied at government for introducing too many over-lapping funding schemes making the public sector funding landscape difficult to navigate for companies constrained by limited time resource. Growth of incubation has overcome this problem to some extent as incubators provide support for sourcing of funding. The DTI has also made efforts to streamline funding support through organisations such as Carbon Trust and WRAP in order to address what one delegate at our workshop termed “initiative-itis”. Government is working with the RDAs and local government to review more than 3,000 support schemes, with a view to reducing these to around 100 strategic initiatives.

More can be done to improve the financial support landscape for cleantech firms in the UK. Grant schemes can be frustrating due to very strict ‘gatekeeping’ and require a considerable investment of time for potentially little return, putting a disproportionate resource burden on smaller firms. Information provision and the communication of clearer criteria can help to ease access to grant schemes. The provision of tailored follow-on funding models can also be improved to reduce the fundraising burden, which can trap many fledgling firms in the ‘valley of death’ between technology development and market entry.

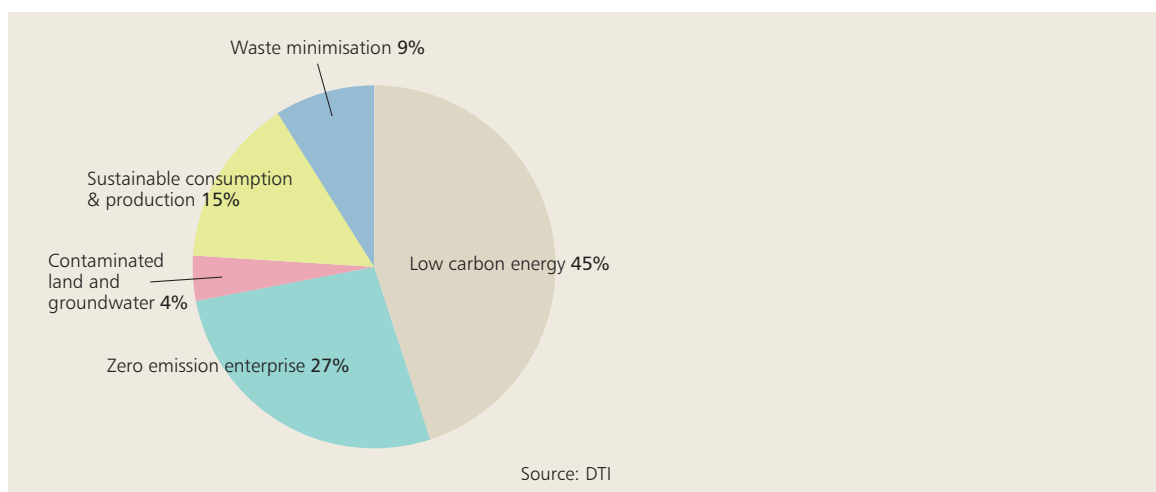
DTI technology strategies have an integrated approach to cleantech.

## DTI technology strategies can support cleantech R&D

The Government’s flagship R&D funding initiative is the Technology Programme which now supports over 500 projects worth around £750 million of business and government spending on R&D. Decisions on where money is to be directed are taken by an industry led Technology Strategy Board (TSB), which released six new technology priority areas for the UK in 2006 and will be set up as an independent agency.<sup>46</sup> There is a dedicated strategy on sustainable consumption and production but the cleantech thread runs through the other five strategy areas as well – including bioscience, advanced materials, intelligent systems for transport, sensors, lighting and lean manufacturing – providing a theoretically strong platform for exploiting technology synergies. Translating this into successful cleantech products and businesses will be a key test of the technology programme.

The TSB has a budget of £370 million over three years to support collaborative R&D and Knowledge Transfer Networks (KTNs) – which have been set up to improve communication between research and industry. The main KTNs related to cleantech are Resource Efficiency, IPM Net, Materials, Sensors. As relatively new interventions, it is too early to gauge their contribution but there is a clear need to ensure that the performance of these mechanisms in improving research commercialisation is monitored.

**Figure 13 DTI support for cleantech collaborative R&D (100% = £103 million)**



<sup>46</sup> See [www.dti.gov.uk/innovation/tech-priorities-uk/tsb/index.html](http://www.dti.gov.uk/innovation/tech-priorities-uk/tsb/index.html)

The DTI has made available £103 million for collaborative R&D through a series of cleantech-focused competitions (up to November 2006). Whilst low carbon energy technologies dominate the total, there is provision for innovative R&D collaborations in a wide range of other cleantech areas, including sustainable product design and the zero emission enterprise challenge, focusing on projects that improve resource efficiency as well as reduce waste streams. The DTI support of over £100m has also been matched by private sector contributions.

Private-sector driven knowledge transfer initiatives are also beginning to emerge in the UK cleantech space. The Sustainable Innovations Group, a project from the Centre for Sustainable Engineering (CSEng) aims to bridge the gap between technology innovators and corporate investors. Established manufacturing companies are often on the look-out for new technologies and the Sustainable Innovations Group pledges to help locate the relevant technology developers. CSEng vets a number of start-ups to ensure that corporate members of the Group only see technologies that are viable and in demand, and members might look to buy the business, acquire rights to the technology, or simply offer management skills or marketing expertise. CSEng also runs the EnviroDaq index of cleantech companies.

EU 7th framework programme set to provide significant funding in cleantech areas from 2007-2013.

The European Union's 7th Framework Programme for research and development is set to run from 2007 to 2013 and will provide €1,900 million to environmental (including climate change) research, €2,300 million to energy research (including renewables, carbon sequestration and energy efficiency) and €3,500 million to nanosciences and nanotechnologies.<sup>47</sup>

## Addressing wider barriers to investment

Apart from some of the financial and non-financial obstacles in financing UK cleantech firms discussed above, there are some wider barriers. The availability of finance will depend on the technology coming to market quickly enough to meet the funder's return targets. This in turn will depend on many factors, some of which are outside the control of the entrepreneur. Cleantech entrepreneurs and investors highlighted public procurement, more effective lobbying, streamlined certification procedures and tweaked fiscal incentives as important in enabling more start-ups to attract finance and successfully scale operations.

## The role of public procurement in creating cleantech markets

Procurement is an alternative strategy for supporting innovative technologies.

The Forward Commitment Procurement Project, an initiative instigated by the industry-led DTI /DEFRA Environmental Innovations Advisory Group, seeks to improve market conditions for the environmental industries sector by harnessing public spending. It is applying in the public sector the approach taken by business in using supply chain management and procurement to promote investment in new products.

In essence, the approach involves providing advance information of future needs, searching out and engaging with potential suppliers and, critically, incentivising them through a Forward Commitment – the promise of current and future business to promote investment in innovative new product development. It is a simple but powerful mechanism that EIAG believe will unlock private sector investment in delivering better, cheaper more sustainable products: by stating its future needs, the public sector can stimulate ideas and innovations; by forward committing to purchase, the public sector can enable ideas to become new products; by acting as an early adopter the public sector can accelerate the market entry of innovative products.

The approach is supported by the Sustainable Procurement Task Force, which has included Forward Commitment as one of the leading recommendations in its report to Government, and by the Corporate Leaders Group on Climate Change as being a tool Government should use to support new low carbon technologies.

A pre-procurement market consultation / stimulation exercise was announced in November 2006 by Her Majesty's Prison Service. HMPS has an 'unmet need' for a zero waste mattress system and is

<sup>47</sup> European Union. Data available at <http://cordis.europa.eu/fp7/budget.htm>

seeking innovative solutions and information to inform its procurement strategy. Supply arrangements for mattress and pillows are being reviewed by HMPS with a view to re-tendering in 2007/8. EIAG hopes this call will help to stimulate the supply chain to produce radical and more sustainable options for HMPS. The Knowledge Transfer Networks have played a key role in disseminating the call widely into the market.

## Streamlining Testing and Standards Regulations

One of the issues that clean technology companies face is that of obtaining performance verification (or, where appropriate, certification) for innovative technologies that may not fit with existing standards or product testing regimes, thereby severely stalling their efforts to prove the credibility, safety and other attributes of the technology they have developed. According to reports by entrepreneurs and EIU research,<sup>48</sup> UK cleantech start ups identified a number of reasons why they struggled to successfully navigate testing and certification procedures. These reasons included cost, a lack of testing equipment or standards, or the inability of companies to meet existing standards because their product was radically different.

Testing and certification need to be more innovation friendly.

Testing and certification timescales for new technologies can often take several years making it very difficult to attract time restricted early stage venture capital funding. Although many start-ups may have failed to accurately factor in the time and resources involved in technical assessments, there are difficulties in accessing the testing and certification regime, which is technically complex and not user friendly. There are several measures that could improve technical assessment and make it more conducive to innovation start-ups. Key EIU recommendations include providing more guidance, factoring in certification costs and timescales in grant schemes, and developing a staged assessment regime which can evaluate performance at key stages on the route to market. Testing and performance data is also necessary to build the investment case and reduce risk for venture capitalists and other potential customers. The EIU interviewed one company that had received a £45,000 grant for R & D, but folded because potential collaborators would not consider its product until it was tested to market standards.

Another issue for some firms is the lack of standard harmonisation across European borders and the lack of appropriate standards for innovative materials or products. In response, the DTI and BSI (British Standards Institution) have been working together to create standards that support innovation. Much of this work has been about engaging with innovative technologies at an earlier stage and using fast-track specifications in order to reduce the cost and time burdens on new clean technology ventures. In particular, the BSI has been working with WRAP to create pre-standards for recycled materials and promoting the use of Publicly Available Specifications (PAS), which can be ready in about 6 months, instead of formal standards. PAS can also be used internationally.

## More effective lobbying that unites entrepreneur and investor views

Small cleantech firms need a stronger lobbying voice to compete with established firms.

Smaller firms, particularly those with relatively conservative end user markets that have a strong safety and regulatory dimension such as waste and construction, often lose out to lobbying by incumbents that puts up barriers to the take up of innovative solutions. There are anecdotal reports of several UK examples where a delay in policy implementation has been the one remaining barrier for companies looking to take their product to market. In many instances, venture capital investors have done nothing to help remove this barrier as they do not see it as their role to intervene on policy issues, or they see the time required to reap benefits from such activities as too great.

Intervention in this area is complex. Some suggest a much stronger role for the venture capital community, who may have a more effective voice with government than a small, start-up venture. Venture capital funds do not necessarily support this view however, viewing lobbying activity as outside their jurisdiction and best left to the cleantech industry itself. Interestingly, some prominent venture capitalists in California, including names like Vinod Khosla, were active supporters of

<sup>48</sup> Myers, N 'Barriers to Commercialisation of Innovative Environmental Technologies in the UK. Impacts of Testing and Certification' Environmental Industries Unit. Unpublished March 2006

Proposition 87 to tax oil and gas producers and spend the revenues on clean energy. The Proposition ultimately failed a public vote in November 2006 but is an unusual precedent for more involvement. Other options to improve lobbying include bringing broader coalitions together, such as the recently formed Aldersgate Group, which involves NGOs, large business, the Environmental Industries Commission and government bodies like the Environment Agency and Natural England to provide a common lobbying position on consistent and innovation friendly environmental regulation.

### **Improving fiscal incentives**

Fiscal incentives can be tweaked to cover more technologies.

Some companies view the lack of fiscal measures adopted by government as a barrier to investment. venture capital firms, on the other hand, are wary of relying on fiscal incentives in calculations of financial viability because of the risk of policy changes. Preferential incentives for specific technologies do not create a climate for innovation and need to be used very carefully. More work needs to be carried out to assess the costs and benefits arising from the different approaches of other European countries in this respect. In the UK, the system of Enhanced Capital Allowances for clean technologies is a welcome scheme to provide incentives to companies to invest in the technologies which contribute to the Government's environmental targets. The Government can provide ECAs for further environmentally beneficial technologies where they would support additional investment and innovation.

## 3 Later stage financing, public markets and technology deployment

### Section summary:

- Exit activity for venture capital investors – trade sales and buyouts
- Cleantech firms on the public markets
- Exploring the cleantech space on London's Alternative Investment Market
- Asset finance for technology deployment – project finance and insurance

### Exit routes for venture capital investors

#### Trade sales and mergers and acquisitions is increasing

Sector consolidation is increasing opportunities for trade sales.

As some cleantech sectors mature and start to consolidate, this is increasing the number of potential buyers for smaller firms. In the wind sector for example, the shortage of turbine assemblies and the drive towards integrated supply chains has led to some high profile acquisitions. Hansen Transmissions, a Danish gearbox manufacturer, was purchased for US\$565 million by Suzlon Energy, an Indian wind turbine manufacturer. The deal netted an estimated 101% return for Apax Partners and Allianz Private Equity in just 22 months.<sup>49</sup> In the UK, according to Carbon Trust 'carbontech' definitions, mergers and acquisitions (M&A) activity accounted for £375 million between 2000 and 2004, with a total of 23 deals.<sup>50</sup> A long-term study of hundreds of liquidity events in the US, found that M&A deal count increased from 117 between 1990 and 1995 to 613 between 1996 and 2003.<sup>51</sup>

M&A activity expected to continue to increase due to strategic interest by large corporations.

Analysts expect to see continued growth in M&A activity as the sector consolidates and more large corporations come shopping for new technologies to add to their strategic portfolio. The growing interest in cleantech by industrial giants like GE, DuPont and Toyota could create a good exit market for those cleantech firms developing relevant technologies.

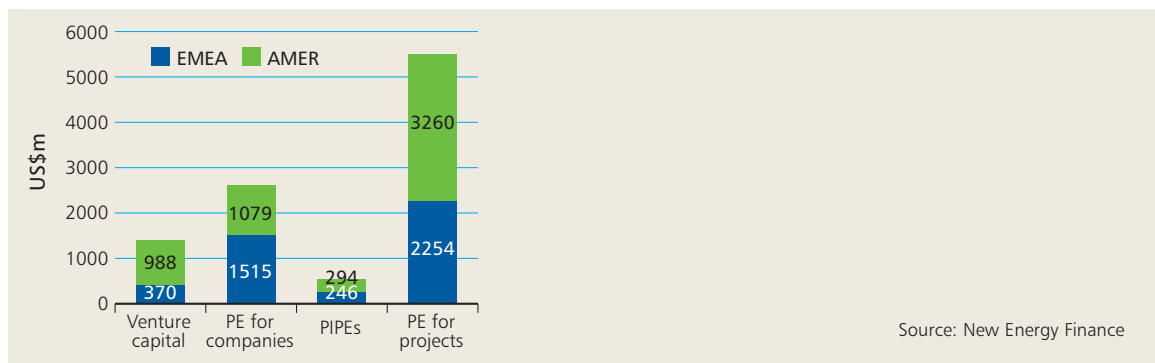
#### Private Equity firms are also active in the cleantech space

Private equity is providing later stage liquidity and infrastructure investment.

The private equity industry is also emerging as a strong player in later stage cleantech financing, accompanied by hedge funds as another set of well-capitalised investors seeking returns. These investors focus on taking stakes in later stage cleantech firms, even buying out the entire firm from earlier investors, providing much higher amounts of capital in fewer large scale deals. PIPEs (where private equity investors buy a large stake in smaller publicly listed firms) are also on the increase but investment in projects and infrastructure is the largest category of private equity investment, especially in clean energy infrastructure like wind farms and biofuel plants. Figure 14 illustrates the relative volume of private equity funding compared to the much smaller levels of earlier stage venture capital investing in the clean energy sector. Private equity firms may become more important in the cleantech landscape if returns can be maintained and sector consolidation continues. They may function to expand the investment horizon by acting as a bridge between the exit of a venture capital investment and eventual purchase or flotation. However, private equity business models rely on high returns and often leverage large debt loads, making them a mixed blessing for smaller cleantech firms.

<sup>49</sup> New Energy Finance 2006 H1 Roundup

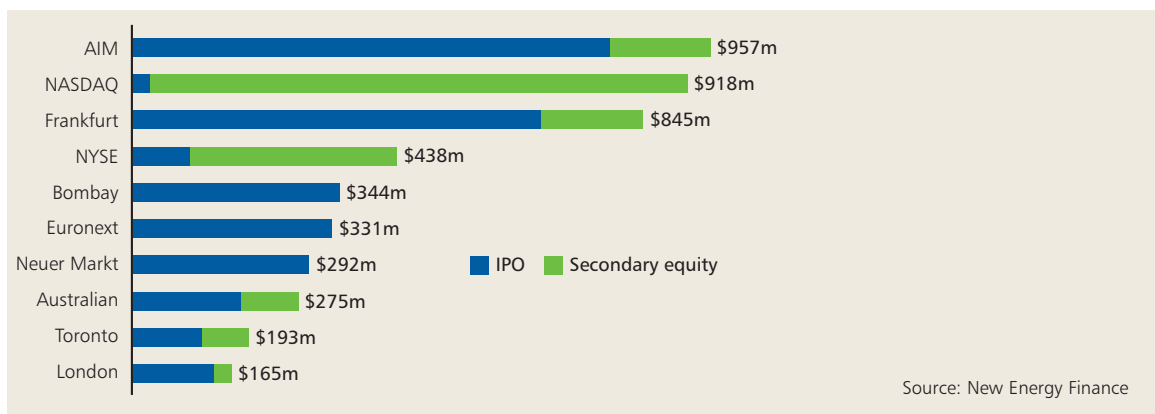
<sup>50</sup> Library House 'UK Investment in Clean Technology 2000-2004' 2005

**Figure 14 Private equity investment in clean energy Q1 2005 – Q2 2006**

Large IPOs in US and Europe particularly solar firms like REC, Q Cells and Suntech.

### Increasing IPOs and public market activity for cleantech firms

A select handful of the largest pureplay cleantech firms are listed on major global stock exchanges. Recent IPO activity includes some very large listings that provide an indication of the exit route for historic investors to cash in shareholder value in some of the most successful cleantech firms. Huge solar IPOs include the Norwegian firm Renewable Energy Corporation's (REC) raising \$1.1 billion on listing, valuing the company at \$7.7 billion. Suntech Solar's US\$2.2 billion IPO on the New York Stock Exchange was the largest US technology IPO in 2005.<sup>52</sup> Frankfurt has a strong set of solar stocks due to the very favourable feed in tariffs for solar that have led to a domestic solar boom.

**Figure 15 Clean energy total IPO and secondary equity per market 2001 – Q3 2005**

Global cleantech indices show outperformance but high volatility

Examining a set of three different cleantech stock tracking indices – Impax ET50 for the largest global cleantech stocks; CTIUS for US cleantech stocks and NEX for global clean energy stocks<sup>53</sup> – shows broadly similar trends of outperformance against the benchmark but high volatility. All three indices have been on an upward trend since 2003.

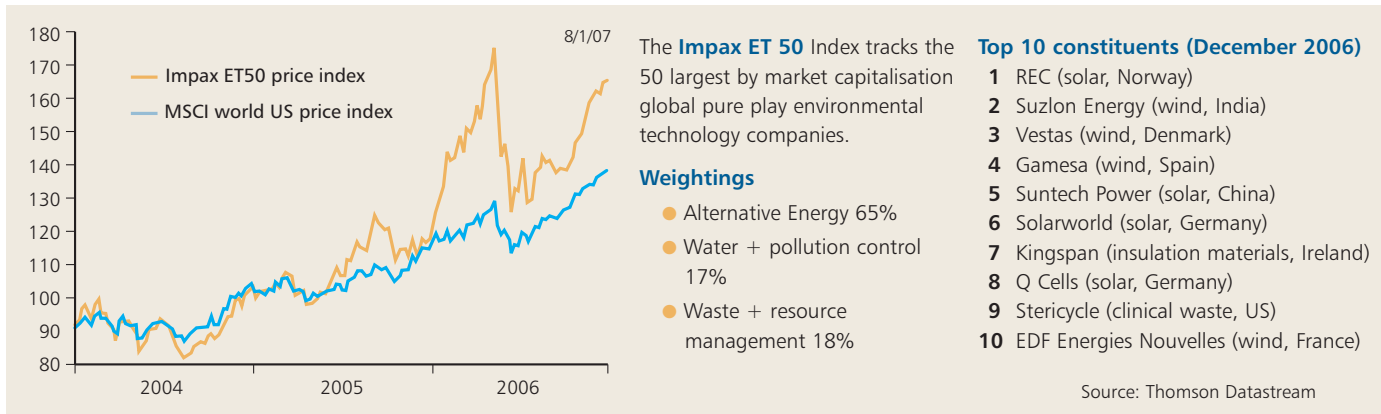
There are no UK based firms in the top ten ET50 constituents, demonstrating the UK's lack of globally competitive pureplay cleantech corporations. Although some UK based corporations are involved in the cleantech space, this is mainly as small business lines within established corporations, with no clear global leaders. The UK contribution lies in renewable divisions within BP and Shell, some investments in renewable generation by utilities such as Scottish and Southern Energy and the traditional waste management and water utilities. A notable exception is Johnson Matthey, a firm with significant revenues from automotive catalysts and a strong fuel cells division. This represents a critical innovation gap compared to peers and reveals the inability of UK plc to foster world-class cleantech companies from a strong research and technology innovation base. Nurturing the heavyweights of the future from today's crop of cleantech start-ups will be a key challenge.

<sup>51</sup> Cleantech Venture Network 'Cleantech Venture Investment :Patterns and Performance' 2005

<sup>52</sup> Source: New Energy Finance

<sup>53</sup> CTIUS (Cleantech Index US) information is available at [www.amex.com/?href=/othProd/prodInf/OpPiIndMain.jsp](http://www.amex.com/?href=/othProd/prodInf/OpPiIndMain.jsp)  
Product\_Symbol=CTIUS NEX information is available at [www.nexindex.com](http://www.nexindex.com)

Figure 16 Impax ET 50 Index performance 2003-2006



AIM offers a lightly regulated and accessible market for smaller cleantech firms.

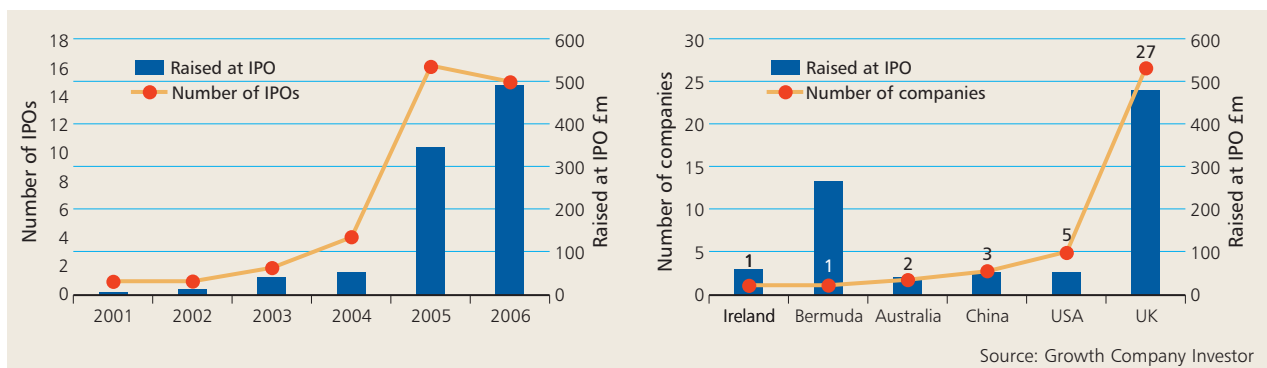
London's Alternative Investment Market (AIM) – the junior stock exchange in comparison to the main London Stock Exchange – is increasingly becoming the home for cleantech companies across the globe because it caters to small-to-mid-sized companies still cash strapped and building revenue streams. A relatively light regulatory touch compared to US exchanges that need to comply with Sarbanes-Oxley, lower size thresholds combined with expertise in financial advisory services from both boutique and mainstream firms and access to a large investor pool have made AIM the exchange of choice for smaller cleantech firms.

AIM is acting like late stage venture capital and raising relatively small amounts.

However, most AIM listings have acted to raise relatively small amounts, comparable to later stage venture capital investments, rather than allowing historic venture capital investors to cash in value.<sup>54</sup> Commentators suggest that it is relatively easy to get an AIM listing given an enterprise value of £10million and above and a good growth story to sell to investors. Many of the firms are pre-revenue and do not yet demonstrate a good track record. There are also concerns about the liquidity of some AIM cleantech stocks. Nevertheless, the emergence of AIM offers many smaller cleantech companies (and their investors) opportunities to get a public market listing and gain exposure to a much wider range of investors.

AIM listings have increased rapidly in the last few years and become more global. Some of the largest firms on AIM are based overseas but have chosen to list in London.<sup>55</sup> Around 50% of the fifty clean energy AIM quoted companies are non-UK based, but account for 63% by value.<sup>56</sup>

Figure 17 (a) Clean energy (including carbon trading) AIM listings 2000 – 2004  
(b) Listings by country of origin and total amount raised



<sup>54</sup> Library House 'Warming to Cleantech' 2006

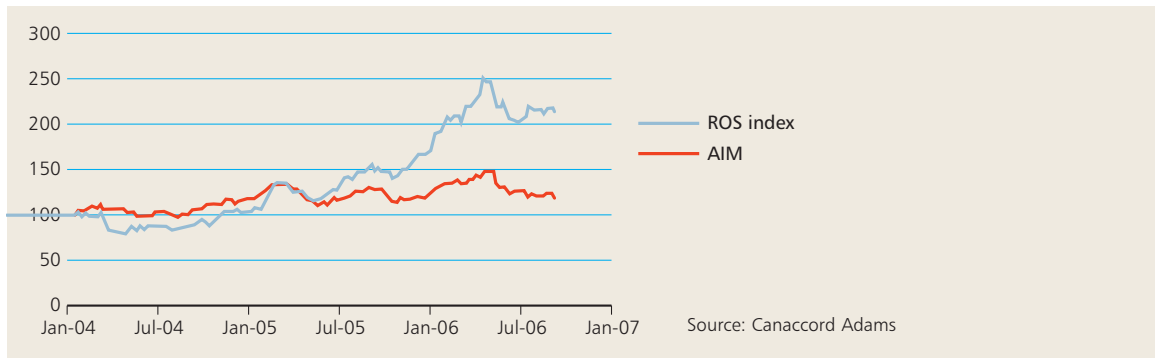
<sup>55</sup> Growth company investor 'renewable energy companies on AIM' 2006

<sup>56</sup> New energy finance 'AIM for the stars' 2007

AIM cleantech segment has 61 firms with a total market capitalisation of £4.1 billion.

There are no themed cleantech indices on the London Stock Exchange that offer an investable option for index tracking funds. FTSE should consider adding a specialised cleantech AIM index to its main index family or as a subset of the FTSE4GOOD indices for socially and environmentally motivated investors. Mark Thompson at Canaccord Adams tracks UK listed small-cap cleantech stocks via a proprietary index, which is reproduced below (Canaccord Adams calls the cleantech sector "Resource Optimisation and Sustainability (ROS)"). At the end of September 2006 the index covered 61 companies with a total market capitalisation of £4.1 billion, although the number of companies covered is growing rapidly. At present, the index is probably not investable due to liquidity, and the top ten companies account for 62% of its total market capitalisation, indicating a long tail of smaller companies.

Figure 18 Performance of cleantech stocks listed on AIM

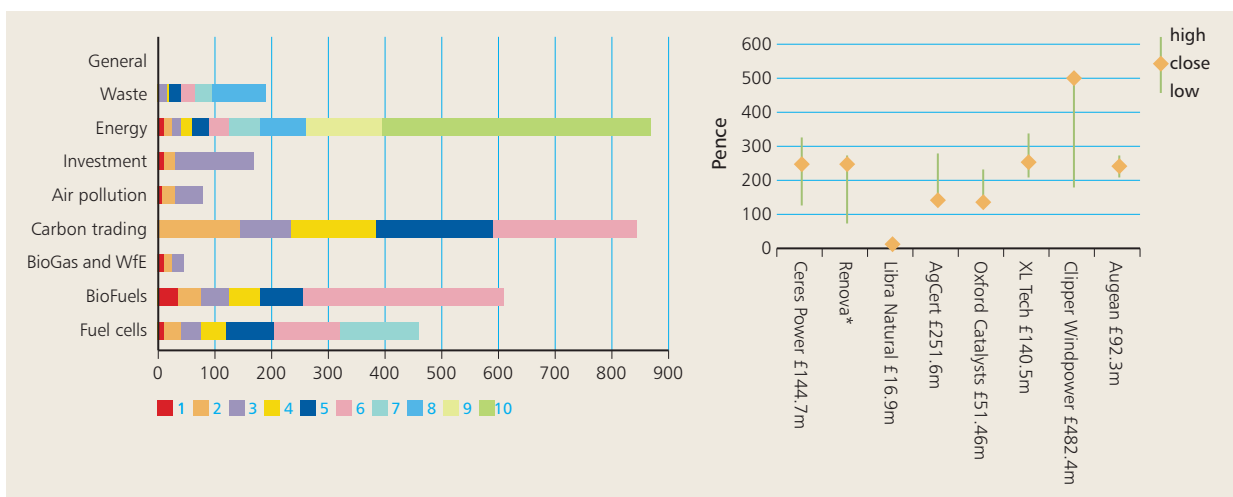


Informal index shows AIM outperformance but hides high volatility.

Energy and Carbon Trading dominate the AIM cleantech space but broad spread of firms and sub-sectors.

As the figure below shows, there is a broad spread of cleantech subsectors represented on AIM. However, the number of companies within a subsector as well as the relative size of companies varies widely. As with many small and mid cap companies, stock volatility is high, but there are concerns that AIM cleantech firms represent a particularly volatile set of stocks. Even the stocks of the largest firms in each sub-sector are volatile, particularly amongst renewable energy firms in wind, biofuels and fuel cells. Some of the largest AIM listed cleantech stocks are based overseas. Clipper Windpower is a Californian firm and Agcert is a carbon trader based in Ireland.

Figure 19 (a) AIM market capitalisation and number of firms by cleantech subsector (b) 52 week stock performance of largest AIM subsector firms



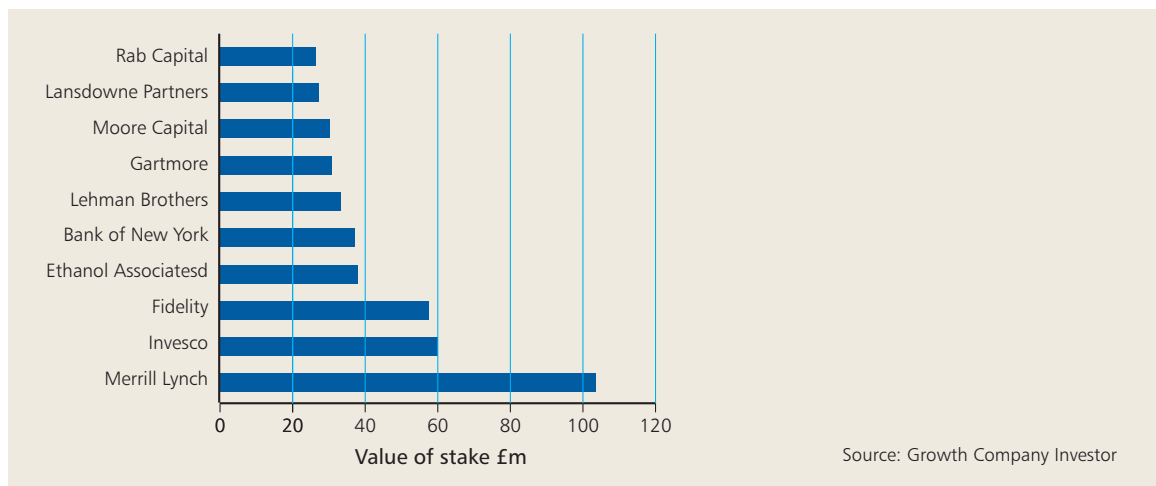
\*Renova replaces Infinity Bioenergy due to stock suspension during a merger. Data correct as of September 2006. Source AIM and DTI Environmental Industries newsletter September 2006

Estimated 165 investment vehicles in cleantech, largely in US and Europe.

## Cleantech investment vehicles are emerging rapidly

A new set of investment products are emerging to enhance investor exposure to the cleantech space. Mercer Investment Consulting estimates a global pool of around 165 publicly and privately quoted investment vehicles that invest in a variety of underlying asset classes – including venture capital funds, private equity funds (and fund of funds), listed equity, debt and infrastructure finance as well as carbon funds. This is in addition to exposure potentially offered through the various themed socially responsible investment (SRI) funds. General small and mid cap equity funds are also increasingly buying cleantech stocks for their portfolio.

**Figure 20** AIM Clean Energy Top Ten Institutional Investors (October 2006)



Mainstream equity funds are active investors. SRI funds are not well represented.

An analysis of investors in some of the AIM based cleantech stocks reveals some interesting trends. The majority of mutual fund investors are from mainstream equity funds that specialise in small and midcap stocks. Research in February 2006 identifies the leading mutual fund investors as Invesco Small Companies Growth Fund with 14 holdings, New Star Select Opportunities with 9 holdings, while Rathbone Special Situations and Invesco English and International are third with 8 holdings.<sup>57</sup> As figure 20 shows, large mutual fund companies like Fidelity and Invesco are lead investors, only surpassed by Merrill Lynch, which runs a themed New Energy Technology Fund.

Hedge funds are also active.

Hedge funds are also increasing their allocation in this space as part of a hedging strategy against oil prices or part of a broader play on macro factors. RAB Capital, Moore Capital and Lansdowne Partners are prominent AIM investors. Environmentally motivated investors from the SRI sector are relatively absent from the AIM market, perhaps due to high volatility, restrictions on purchasing small and mid cap stocks and a tendency for the bulk of the SRI funds to focus on investment in established companies rather than on disruptive technologies. The participation of mainstream investors is a welcome sign of cleantech's growing acceptability on the public markets, but also raises potential concerns about the mid-term commitment of this capital. If the cleantech hype story deteriorates, there could be a severe pull back from this investor class. Themed SRI funds have the mandate as well as the sector understanding to be more effective cornerstone investors, providing some stability, liquidity and patience in the cleantech AIM space.

## Is a bubble emerging?

Some signs of a bubble in solar, biofuels and carbon funds. Impact will depend on future growth trends.

A combination of high valuations (with high price/earnings ratios), a rise in pre-revenue early stage firms on the public markets and growing investor interest has led some analysts to raise concerns of a cleantech bubble. Many investments are speculative 'future plays' and the eventual success of many firms will depend on new business models and value chains being successfully developed to grow markets. One of the key issues is that the rate of customer adoption for cleantech is very unpredictable, making it difficult to accurately evaluate the growth prospects for many firms.

<sup>57</sup> Whitehouse & Miller 'Tapping into the mainstream' Environmental Finance March 2006

Some commentators we consulted as part of this project agreed that a bubble was emerging – particularly in sub sectors like solar and biofuels in the US as well as massive growth in carbon funds that invest in carbon credits and develop emissions reduction projects – but argued that hype cycles are normal during initial stages of rapid growth. The key issue is whether this matters and how to assist the cleantech market to mature and improve investor decision-making. There is a role for analysts and business school academics to improve their understanding of cleantech market dynamics and offer insights into successful business models and strategies. It is clear that new technologies are increasingly required to transform resource use in many areas of the economy and to reduce carbon emissions. With this as back-drop, the overall need is not in question, and more work is required to enable an effective analysis of which specific technologies will truly deliver

### Improved sell side research is needed

Analyst coverage of cleantech stocks needs to step up to improve investor decision-making.

In a rapidly booming sector with increasing presence on mainstream investment agendas, it takes some time for other actors in the investment chain to catch up. At the moment, sell side analysis of cleantech stocks – which forms the bedrock of investor decision-making – is not very advanced with few experienced analysts. A few small and mid cap specialist brokers such as Altium or Evolution provide cleantech research but coverage from more mainstream houses is patchy. There are now 18 analysts tracking solar stocks but only 2 have been doing this for more than 2 years.<sup>58</sup> Undoubtedly, analyst coverage will improve as the sector matures, builds a stronger track record and analysts develop sector specific expertise.

Mainstream research providers are improving sell-side analysis and this will continue to grow.

In the short to mid term, sell side analysis on the cleantech sector will improve (and is already improving) because strong market drivers are in place. This will lead to revised valuations for different technologies. In addition, better extra-financial analysis and transparency around the impacts of traditional technologies may affect consumer and investor preference and will help to inform public policy. Relevant programmes such as The Enhanced Analytics Initiative (EAI) – an international collaboration between asset owners and asset managers aimed at encouraging better investment research that takes account of the impact of extra-financial issues on long term investment – may provide support for this improved analysis.<sup>59</sup> Demand by analysts for improved information and disclosure by companies on their carbon intensity or resource efficiency will also be useful for identifying key areas of application for new technologies.

### Project and other asset finance

Significant long term debt finance needed to deploy technologies.

Some clean technologies require enormous amounts of up front capital to enable deployment at industrial scales. This is particularly important for infrastructure projects in renewable energy, water and waste sectors where significant amounts of debt finance are needed for long term projects such as wind farms or biofuel plants. This form of financing is very different to equity capital and brings in another set of financial institutions whose risk appetite and investment approach is completely different to venture capital firms or equity investors in publicly listed cleantech firms. Although technology developers will not often actively develop projects on their own – usually bringing in specialist project developers, independent power producers or industrial customers – the prospects for deploying their technology depend on its ability to attract long term debt finance from banks and other providers. This project did not focus on asset and project finance and the information reported here is based on limited desk research.

<sup>58</sup> Quote from Mark Thompson Canaccord Adams

<sup>59</sup> EAI total assets under management now exceed €800 billion (US\$1,000 billion). Members include BNP Paribas Asset Management (France), RCM (UK) Deutsche Investment Trust and USS. EAI members reserve 5% of broker commissions to encourage research into longer-term issues. See [www.enhancedanalytics.com](http://www.enhancedanalytics.com)

There are some important financing gaps that can potentially occur during project development. Providers of debt finance are driven by the project risk-reward profile and need certainty that a project can deliver stable cash flows throughout the financing period, which normally runs for over 10-15 years. Banks use quantitative risk management methodologies to help them characterise and value complex risk scenarios, determining acceptable risk reward profiles through the DSCR (debt service cover ratio).<sup>60</sup>

Cleantech risk profile requires high equity investment, leading to financing gaps.

Project finance relies on predictability and routine, where similar deals are conducted numerous times. Because many clean technologies are new applications there is less experience of how loans perform, and so the DSCR is usually set more conservatively with a focus on the numerous technology, regulation and market risks. This increases the cost of capital and the amount of equity demanded by debt financiers. Typical projects require 10-20% equity, with 80% coming from the much cheaper debt capital, but for many innovative cleantech projects this increases to 50% because of the higher credit risks involved.<sup>61</sup> Cleantech firms and project developers cannot usually provide this much equity, even if venture capital and private equity firms are increasingly investing equity in clean energy projects such as wind farms and biofuel plants. This leads to a debt-equity gap for some of the more innovative projects.

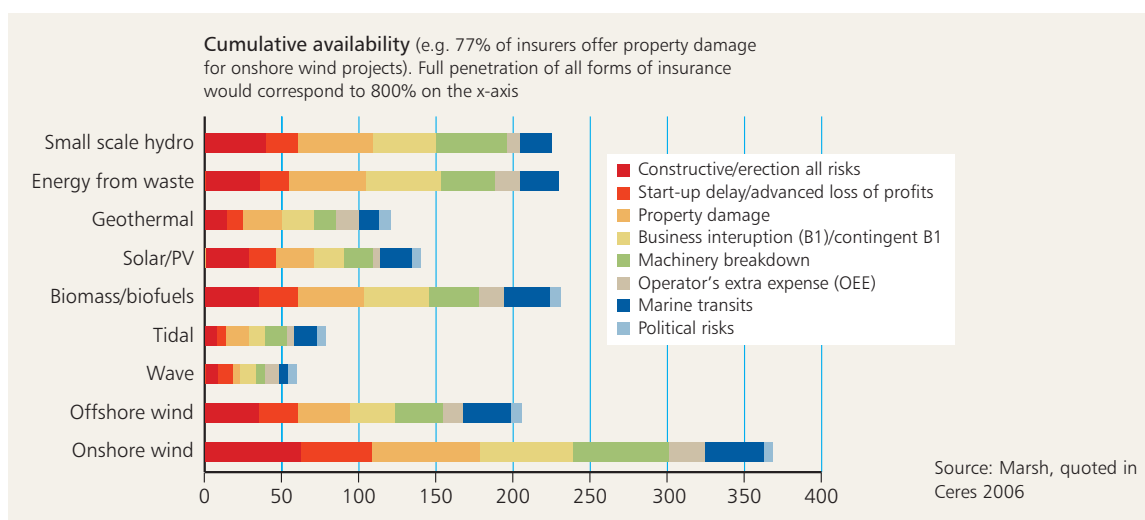
### Overcoming the debt-equity gap and mitigating technology risk

Public finance can help plug some gaps.

There are several initiatives where governments have sought to address some of the financing obstacles through providing direct support in the form of grants, soft loans and innovative mezzanine finance. Mezzanine finance uses quasi-equity instruments (which combine debt with convertible equity which can later be bought out) that lessen the risk for other equity investors and enable project providers to close the debt-equity gap.<sup>62</sup>

The role of risk management mechanisms is also crucial in lowering the risk threshold of projects and the subsequent cost of capital. Insurance companies and brokers offer a range of products that cover specific aspects of different clean energy technologies. Legacy issues from early wind farm installations, where insurers faced liability claims for malfunctioning parts across a series of wind farms and unanticipated equipment damage due to storms and other activity have held back development of insurance services. A recent survey of insurance provision across a range of clean energy technologies found adequate coverage of risks for mature technologies such as onshore wind, but significant gaps in availability for most other technologies.<sup>63</sup>

**Figure 21** Availability of insurance for risks across clean energy technologies



Insurance availability for innovative technologies is limited.

<sup>60</sup> UNEP FI 'Renewables CEO Briefing' 2004 Available at [www.unepfi.org/fileadmin/documents/CEO\\_briefing\\_renewable\\_energy\\_2004.pdf](http://www.unepfi.org/fileadmin/documents/CEO_briefing_renewable_energy_2004.pdf)

<sup>61</sup> UNEP/ SEFI 'Public Finance Mechanisms to Catalyze Sustainable Energy Sector Growth' 2005

<sup>62</sup> Ibid.

<sup>63</sup> Marsh 'Survey of Insurance Availability for Renewable Energy Projects' 2006

Insurers need to develop risk analysis and underwriting techniques.

The insurance industry will play a critical role in enabling the roll out of a broad set of clean technologies on a large scale. There is a need to invest in developing underwriting capacities, gain technical knowledge and innovate in product development. There is a role for new partnerships between technology developers, project developers, government, financiers and insurers to address information gaps through developing credible risk analysis datasets, to provide best practice tools and to share innovative techniques for managing and diversifying risk.<sup>64</sup>

European and American insurers have taken a lead in developing innovative cleantech products although Lloyd's brokers are also active market participants. For example, the London based firm WindPro is a major player in the wind insurance markets and uses Lloyd's syndicates. Royal & SunAlliance has recently announced a major renewable energy insurance offering across its global markets, building on the longstanding experience of Codan, its Danish subsidiary.<sup>65</sup>

Innovative techniques such as weather derivatives, securitisation and alternative risk transfer are being explored.

The potential of innovative alternative risk transfer (ART) techniques to improve project economics is also being explored. MunichRe is developing technical expertise, collaborating with technology manufacturers to provide risk management advice and is exploring the use of weather derivatives.<sup>66</sup> Many clean energy technologies, particularly wind, are dependent on weather conditions to meet return forecasts. By providing products to hedge weather risk, insurers can improve project economics and reduce risk – for instance using weather derivatives to reduce the interest rate when wind capacity dips below 80% of that in an average year. There is a whole range of evolving products including securitisation, credit derivatives and insurance linked securities amongst others that could significantly improve insurance cover<sup>67</sup> and enhance the financing profile of some clean energy projects.

### Addressing scale issues and tapping capital markets

Many projects fall below minimum size threshold.

Many cleantech projects are significantly smaller than mainstream project finance and associated insurance deals. This makes it more difficult to absorb the high transaction costs associated with structuring project finance deals and providing adequate return for the bank and premium income for the insurer. A potential solution being explored is bundling several small-scale projects with similar technology and other characteristics together into a larger entity that can then be financed affordably. There is significant potential in using complex bundling techniques to pool projects and tap capital markets for additional sources of finance. This applies both to debt finance for projects through issuing bonds and more esoteric techniques involving securitisation to tap increased capital for risk transfer.

Bundling techniques can increase access to bond markets.

Many wind farms have already successfully tapped the capital markets – such as Scottish Power's £300 million bond issue – but this has traditionally been restricted to large utilities with strong balance sheets and a good track record and not for smaller players. Recent success in bundling a pool of windfarms in Germany together for bond financing offers hope for developing mechanisms to provide capital to smaller projects. London's capital markets expertise is being used in this effort. Fortis, amongst the largest clean energy project finance banks, has a team of 8 based in London. Large project finance players like RBS, HVB and BNP Paribas are all involved in some elements of renewable energy finance, mainly onshore wind.

The City can do more to innovate in this area. Institutions like the ABI could take a leadership position for the UK industry in this regard.

<sup>64</sup> Marsh 'Survey of Insurance Availability for Renewable Energy Projects' 2006

<sup>65</sup> Royal & Sun Alliance is a corporate partner of Forum for the Future. Information obtained through personal communication with company representatives.

<sup>66</sup> MunichRe 'Renewable Energies – Insuring a technology of the Future' 2004

<sup>67</sup> UNEP/ Marsh 'Availability of Renewables Insurance' 2004

## 4 Improving cleantech finance in the UK

### Section summary:

- Recommendations for progress for government, cleantech firms and financiers

Although cleantech finance has improved considerably over the last five years, these gains are from a small base and are still fragile. At this stage in the cleantech investment cycle, a lot of activity is made up of speculative investments in pre-revenue firms. This is creating some signs of a bubble in certain subsectors like solar and carbon trading and possibly distorting valuations. Although the long-term macroeconomic drivers are robust, there may be some short-term corrections in the market cycle. Future cleantech firm performance and investor awareness will be critical variables in managing the successful evolution of cleantech as a mainstream investment space.

Actions are needed to maintain this growth trajectory and enable UK cleantech firms to offer solutions to sustainability challenges as well as provide future competitive advantage to UK plc. There are significant hurdles to be overcome before these firms can create, manufacture and sell products successfully. Current capacity shortages in wind turbines and silicon supply for solar cells illustrate the next round of manufacturing and supply chain challenges after the technology innovation phase is complete.

The UK faces strong global competition from established European firms, increased activity in the USA and emerging cleantech players from China and India. It is behind peers in creating successful pureplay cleantech corporations. We provide some recommendations to improve UK financing for government, cleantech firms and the financial sector.

**Government** is critical to supporting cleantech through setting a policy framework that addresses market failure and creates enabling conditions for cleantech deployment. Its most important role is to maintain a joined-up approach to policy and provide consistency for the private sector to develop and invest in new technologies. Apart from this role, there are several additional needs for public intervention to drive cleantech development. We provide some recommendations in specific areas:

- **Set robust mid- to long-term targets for sustainability outcomes.** This is critical to provide technology developers and financiers with a stable platform for innovation. Clear and consistent incentive regimes, providing support for carbon markets and regulatory certainty, are essential.
- **Target mechanisms to increase commercialisation.** The Carbon Trust model is a good example – providing technology acceleration, incubation and co-investment with the private sector in line with strategic priorities. This should be extended to the wider cleantech space, especially water and resource efficiency technologies.
- **Address early stage financing gaps.** Many firms have difficulties securing early stage funding, and some are unsuited to venture capital investment. Government should improve support from generic small business schemes, allow more accessible and scalable grant provision and ensure that fiscal incentives that increase business angel investment are effectively designed and communicated. Potential gaps in financing pre-commercial demonstrators for some technologies need to be analysed and addressed.
- **Capture emerging European opportunities over the next six years:** Government needs to assist the UK research base to access the significant European Union resources for R&D through the 7th Framework Programme (2007-2013), in order to start exploiting cleantech synergies. The Competitiveness and Innovation Programme (2007-2013) has allowances for 430 million Euros of support to cleantech SMEs and start-ups, which can be harnessed to address many of the funding gaps and significantly improve the UK financing landscape but must reflect market drivers, undertake targeted interventions based on comprehensive analysis and catalyse private investment where possible.

- **Leverage public procurement:** Government is piloting the Forward Commitment procurement model developed by the business-led Environmental Innovations Advisory Group to encourage private sector investment in delivering better, cheaper and more sustainable products. It should ensure this innovative approach is replicated. It can also do significantly more to drive demand through using public procurement strategies.
- **Address wider barriers to investment:** Testing and certification procedures should become more innovation friendly and significantly speed up the time to market for cleantech firms. Fiscal incentives such as Enhanced Capital Allowances provide welcome tax incentives for companies investing in environmentally beneficial equipment: the Government could provide ECAs for a wider range of technologies where this would support investment and innovation.

**Cleantech firms**, both start-ups and more established players, can improve investment readiness to gain increased investor confidence and support.

- **Identify and exploit verifiable routes to market:** Firms need to identify a clear market application, preferably not underpinned by regulation, and a viable business model to service that market demand. Environmental benefits should only be emphasised after strong commercial fundamentals and market potential are established.
- **Consider options to recruit external talent:** Many cleantech start-ups lack managerial and entrepreneurial skills and should consider options to recruit external talent, bring in credible non-executive support and access incubation schemes. Initiatives to raise awareness and encourage more serial entrepreneurs should be developed in partnership with industry associations and government.
- **Explore partnership options:** Partnership agreements with industry for R&D, manufacturing and distribution will also depend on the approach of larger corporations but mechanisms to improve collaboration should be actively supported. Cleantech firms and their trade associations need to increase lobbying capacity. Environmental pressure groups also have a role to play. A broader range of actors, including business, finance and academia, could support the recently formed Aldersgate Group. Lobbying should make Government aware of technology 'lock-in' issues and provide a balance to resist lobbying by incumbents who may 'lock out' innovations.
- **Pursue considered fundraising strategies and good investor relations:** Some firms may enter into unsuitable capital arrangements, either choosing the wrong investor who might want rapid returns or opportunistically seek a premature public listing. This can seriously affect firm development and investment readiness and awareness raising programmes should assist start-up innovators to identify and pursue the most appropriate financing options.
- **Improve reporting:** As more and more firms list on public markets, particularly AIM, the delivery of information to investors could be improved to maintain confidence, enable better analysis and promote investor commitment to the cleantech space.

**Financial institutions** have a crucial role to play in supporting cleantech and must be encouraged to allocate capital across the spectrum of cleantech space. The successful development of UK cleantech will require the involvement of a broad range of financial actors – from venture capital funds and banks through to insurers, investors and brokers.

- **Venture capital firms should support long-term growth of the cleantech sector:** Venture capitalists that have a strategic interest in cleantech should ensure that they invest in building up the necessary technology and market intelligence to add value to portfolios. Early stage investors should also examine opportunities to provide hands on support to cleantech firms. The industry will need to work together to accommodate growing capital influx, manage an emerging hype bubble and invest in supporting a robust innovation pipeline.
- **Banks and insurers should innovate in creating products:** Commercial banks can improve their sector support skills through improving the ability to offer tailored small business advice on cleantech issues. More importantly, banks will be a key source of debt capital for financing cleantech projects. There is scope for banks to work with insurance companies in devising innovative risk management mechanisms including increasing coverage and using risk transfer techniques to diversify risk across the capital markets.

- **Asset managers should expand investment products:** At the moment there is a restricted, but growing, set of investment vehicles. New products will be needed to bring in more capital across asset classes – including listed equity, debt and infrastructure funds. SRI managers with themed funds should explore options to increase cleantech exposure and act as cornerstone investors in some areas. Asset managers can also do more to assess the extent to which companies in their portfolios are making use of clean technologies across the range of their activities, and to encourage the development and take-up of energy-efficient, water-efficient or waste-efficient processes. They can also consider and report on the carbon intensity of their portfolios. An index of cleantech companies would also be a useful tool.
- **Improve sell side analysis:** At the moment, analyst coverage of cleantech stocks is restricted to a few specialist firms. Much broader sell side analysis is needed to improve investor information and decision-making. Many larger fund managers are reluctant to invest in a little understood and volatile part of the market. The strong and growing macro drivers will create momentum for greater quality of analysis, and with this will come revised valuations of different technologies. Improved sell-side analysis of “traditional” technologies which highlights their negative environmental impacts, and their potential exposure, will also help.
- **UK institutional investors can play a stronger role:** Large UK investors can do more to allocate capital to cleantech and provide more liquidity in the market. Large funds like CalPERS and the Environment Agency Pension Fund have shown a lead that should be picked up by a much wider range of institutional investors. Although cleantech will not dominate portfolios, even as a satellite investment, the volume of institutional money that can flow to venture capital, listed equity, debt and infrastructure funds can help propel the sector to maturity.

Cleantech development and deployment will not only be necessary to address increasing environmental challenges but also a source of future competitive advantage for UK plc. Although a base for progress is slowly emerging, a lot more action is needed to ensure that technological innovation can translate into flourishing businesses that offer environmental solutions, job creation and financial returns.

## Appendix 1 List of organisations consulted

Representatives of the following organisations contributed to this study either through speaking at workshops or participating in interviews. In addition, over a100 delegates from finance, business and government attended workshops convened in May and September 2006.

Barclays

Canaccord Adams

Carbon Trust

Centre for Sustainable Engineering

Climate Change Capital

E-Synergy

Exosect

Henderson Global Investors

Impax Asset Management

Library House

Life IC

Mercer Investment Consulting

Natural Building Technologies

NESTA

New Energy Finance

Oxford Capital Partners

Royal & SunAlliance

QBE Insurance

South East Growth Fund

WHEB Ventures

Z/Yen Consulting



**Forum for the Future**

We face a resource-constrained future in which societies across the world will grapple with accelerating global consumption, growing population and climate change.

Clean technologies will play a central part in bringing about a revolution to help us survive these challenges. Our future depends on them.

This report explores the current financing landscape for UK firms developing clean technologies. It is intended for a broad audience including finance providers, policymakers, entrepreneurs and others with an interest in this rapidly expanding area.

**Forum for the Future** is the UK's leading sustainable development charity. Our aim is to show that a sustainable future is both possible and desirable. We work with forward-looking organisations in business and the public sector to find practical ways to build a future that is environmentally viable, socially just and economically prosperous.

The Sustainable Financial Markets programme at Forum for the Future works in partnership with a range of organisations to develop ways in which profit-seeking capital can be allocated to activities that support sustainable development. In particular, we focus on:

#### **Innovation**

We explore how new financial instruments and ways of structuring financial products can address social justice and environmental protection within a market framework.

#### **Valuation**

We work to increase awareness of the impact of extra-financial issues (such as environmental degradation, climate change, supply chain management, customer relations, labour standards) on a company's financial performance, in order to encourage better analysis of these issues by the financial sector.

#### **Partnerships**

Forum for the Future works in partnership with a range of financial institutions including banks, investment managers and insurers. We also work with venture capital and private equity firms, pension funds, international financial institutions, development banks and trade associations.

For more information visit [www.forumforthefuture.org.uk](http://www.forumforthefuture.org.uk)

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