Achieving Scale in Investment

Global Risk and Opportunity from Climate Change

April 2010
University of Cambridge Programme for Sustainability Leadership
Dr Aled W Jones & Bradley T Hiller

This piece of work was commissioned by Foresight in the Government Office for Science - for the International Dimensions of Climate Change Project, the aim of which is to improve the understanding of how climate change occurring in other parts of the world may affect the UK. The output of the project will be used principally to augment the evidence base of the UK's First Climate Change Risk Assessment (CCRA), and is due to deliver in November 2010. Further information on Foresight and the project can be found at:
http://www.foresight.gov.uk/index.asp

Contents

Introduction 3

Climate Science Confirmation & Response Options 3

Role of Private Investment 3

Institutional Investors 4

UK Institutional Investors 4

Opportunities & Risks 6

UK Market 8

The Emerging Markets 8

Current Status of Climate Solution Investments 11

Overview of Climate Solutions Investment Status 11

Climate Solutions Investment Sub-Sectors 11

Sub-Sector Case Studies 12

Carbon Intensity 12

Carbon Demand 13

Carbon Sinks 14

Opportunities for Investment 16

Carbon Intensity Sub-Sector 16

Carbon Demand Sub-Sector 18

Carbon Sink Sub-Sector 19

Risks for Investment 20

Physical Risks 20

Policy Risk 23

Market Risk 24

Security Risk 25

Fiduciary Risk 25

Lessons for the Future 26

Conclusions 28

References 29

Introduction

Climate Science Confirmation & Response Options

The Intergovernmental Panel on Climate Change 4th Assessment Report 2007 (AR4) noted that 'warming of the climate system is unequivocal, as is now evidenced from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level'. The alteration in frequencies and intensities of weather systems, together with sea level rise, is expected to have mostly adverse effects on natural and human systems (IPCC, 2007).

Responses to predicted climatic changes include both mitigation (reducing the severity of climate change by limiting greenhouse gas (GHG) emissions) and adaptation (taking measures that help people adjust to changed conditions) actions (Rippey, 2009).

Mitigation efforts can delay, reduce or even avoid many climate impacts and will have a large influence on the opportunity to achieve lower climate stabilisation levels (CPSL, c2008). The AR4 report indicated that GHG emissions need to fall by 50-85% (from 1990 levels) by 2050 to prevent dangerous climate change. This is expected to require emission cuts of 80-95% in developed countries as well as substantial deviations from business as usual projections in many developing economies (UNEP FI, Apr 2009).

The array of potential adaptive responses available to society is extensive and ranges from the technological, through the operational (including behavioural and managerial) and into the political arena (CPSL, c2008). Adaptation will be crucial for dealing with the unavoidable impacts of climate change, but to date has been under-emphasised (Henderson et al, 2008).

Both climate mitigation and adaptation actions will require significant financial investment.

Role of Private Investment

According to the International Energy Agency (IEA), the total investment necessary to avoid dangerous climate change is more than US$1 trillion per annum (£650 billion[1]) (UNEP & Partners, 2009). UNEP FI (Apr 2009) expects 86% of the investment required to decarbonise and adapt the global economy will need to come from private sources. Such scale of private capital investment will only occur with a range of public policy measures and financial support mechanisms (UNEP FI, Apr 2009).

Furthermore, the World Bank Group estimates that approximately US$475 billion (£305 billion) of the total annual investment must occur within developing countries, 85% of which will be required

[1] All conversions from USD to GBP at: 1.00 GBP = 1.54474 USD (Live rates at 2010.04) http://www.xe.com

for mitigation and the remainder for adaptation investment (UNEP & Partners, 2009). It is estimated that existing contributions to developing world climate-change investment amount to less than 2% of the required amount (*Ibid.*).

As part of the Copenhagen Accord, which was developed at the 15th Conference of the Parties (COP15) under the United Nations Framework Convention on Climate Change, a High Level Advisory Group has been set up which will report on potential sources of revenue, 'including alternative sources of finance' (Parker, Mar 2010). These alternative sources of finance will inevitably involve the private sector and new partnerships are needed to support the emerging and developing countries along a low carbon trajectory (UNEP & Partners, 2009). Specifically, UNEP FI (Oct 2009) recommends greater private investor attention to the large transition economies (Brazil, Russia, India, and the People's Republic of China (PRC)); to opportunities and risks associated with adaptation; and to product supply chains. A particularly important segment of the private sector to mobilise is institutional investors.

Institutional Investors

Institutional investors include insurance companies, mutual funds, pension funds, sovereign wealth funds, investment banks and hedge funds. Through the allocation of capital, and by engaging and investing in both private and public companies, institutional investors can strongly influence the global response to climate change. Their wide range of interests and diversified portfolios extend across a variety of assets, companies, sectors, markets and regions.

The common characteristic of these investors is that they have the capacity to pool large sums of money for investment, making them influential market actors and potential agents of change (CPSL, Oct 2009). As an indication of their market share, the pension fund sector alone is regarded as being the largest asset holding class worldwide (The Economist, 2008), controlling assets worth more than US$12 trillion (£7.8 trillion) (UNEP & Partners, 2009).

Hence, institutional investors have the potential financial capacity to provide much of the capital required to transition the global economy. However, to stimulate their engagement the expected returns on climate-change investments need to be commensurate with the perceived levels of risk (UNEP & Partners, 2009). This is currently not the case, however the sector is dynamic and emerging (CPSL, Oct 2009).

UK Institutional Investors

UK institutional investors are significant global market actors. At the end of 2008, total institutional assets under management in the UK were £2.25 – 2.4 trillion (Office for National Statistics, Dec 2009; IMA, Jul 2009). Reflecting broader global market characteristics, the UK's largest institutional investors are pension funds, which comprise almost 45% (approximately £1 trillion) of assets under management chiefly through corporate pension funds and local authorities (IMA, Jul 2009). The major institutional investors in the UK are displayed in Figure 1.

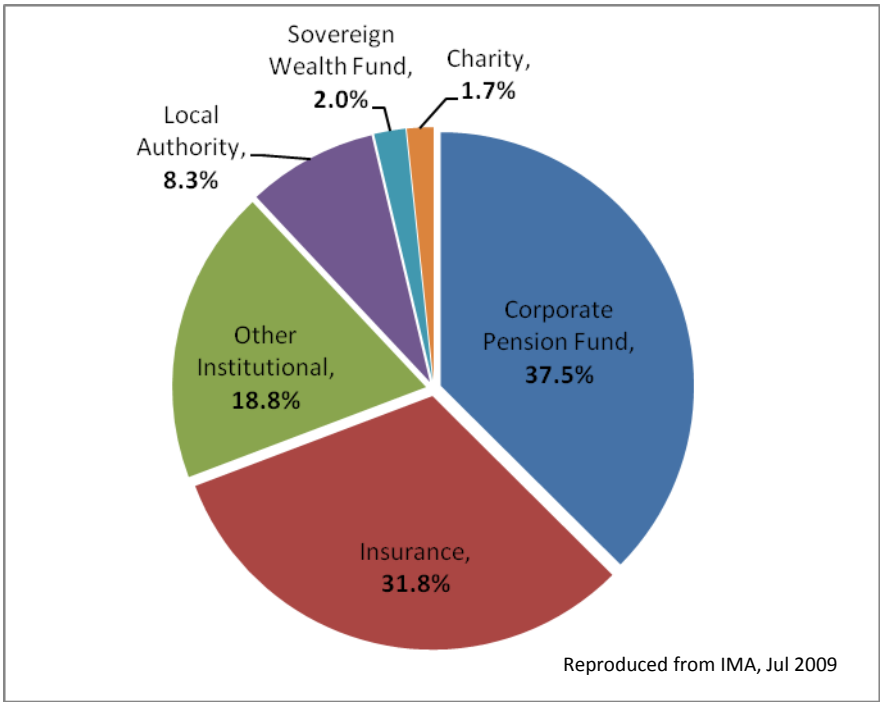

Figure 1 – Institutional Assets Managed in the UK (Client Type, 2008)

Figure 2 demonstrates that the majority of UK institutional asset allocations are in Bonds and Equities. The predominance of investment in these two asset classes indicates particular sector performance exposure to Bond returns and Equity valuations.

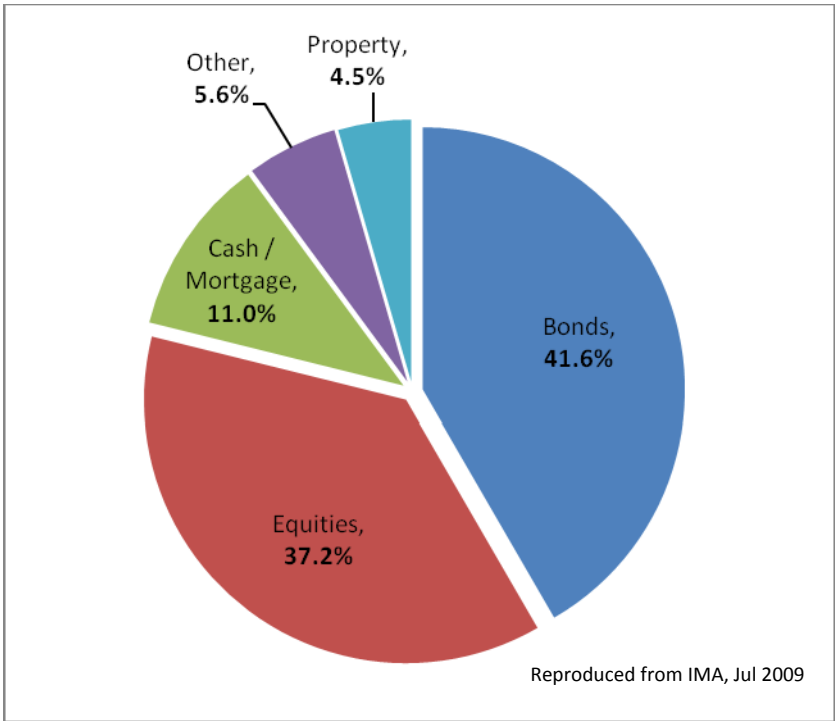

Figure 2 – Asset Allocation (Institutional Assets, 2008)

As an indication of sub-sector institutional investor trends, UK Pension Funds are demonstrating reduced asset allocation in Equities (75.2% in 1999 down to 49.8% in 2008) and increased asset

allocation in Bonds (16.7% in 1999 up to 34.7% in 2008) and Alternatives (0.7% in 1999 up to 7.5% in 2008) (IMA, Jul 2009).

The current status, and recent trends, of institutional asset allocations offers both opportunities and risks for UK-based investors in relation to climate change.

Opportunities & Risks

Climate change will require investors to undertake careful examination of the sensitivity of both their assets and liabilities to forecast conditions (RAILPEN et al, 2009). Most leading companies (~80%) currently recognise climate change as both a risk and opportunity (UNEP FI, Oct 2009) and strategic investors may discriminate between sectors and companies (The Carbon Trust, 2008) based on their cognizance of, and preparedness for, climate change implications.

The weather, science, changes to regulations, the disclosure of new information, product markets, emissions trading, companies themselves, consumers, shareholders, and financial markets are all potential catalysts that might crystallise opportunity and risk in the context of climate change (UBS Investment Bank, 2007). The problem faced by investors when dealing with climate change is that several of the catalysts could cause share prices to go both up and down, depending on as yet unpredictable circumstances and conditions (*Ibid.*).

Hence, to date investors and asset owners have generally reacted in a traditional way to the opportunities and risks facing them. Those who have taken action have generally been cautious, diverting only a small proportion of their assets into 'satellite' portfolios, with the main core of existing high carbon assets remaining intact (RAILPEN et al, 2009).

As an indication of specific opportunities and risks, Figure 3 and Figure 4 provide estimates of the global funding required in 2030 for mitigation and adaptation measures respectively.

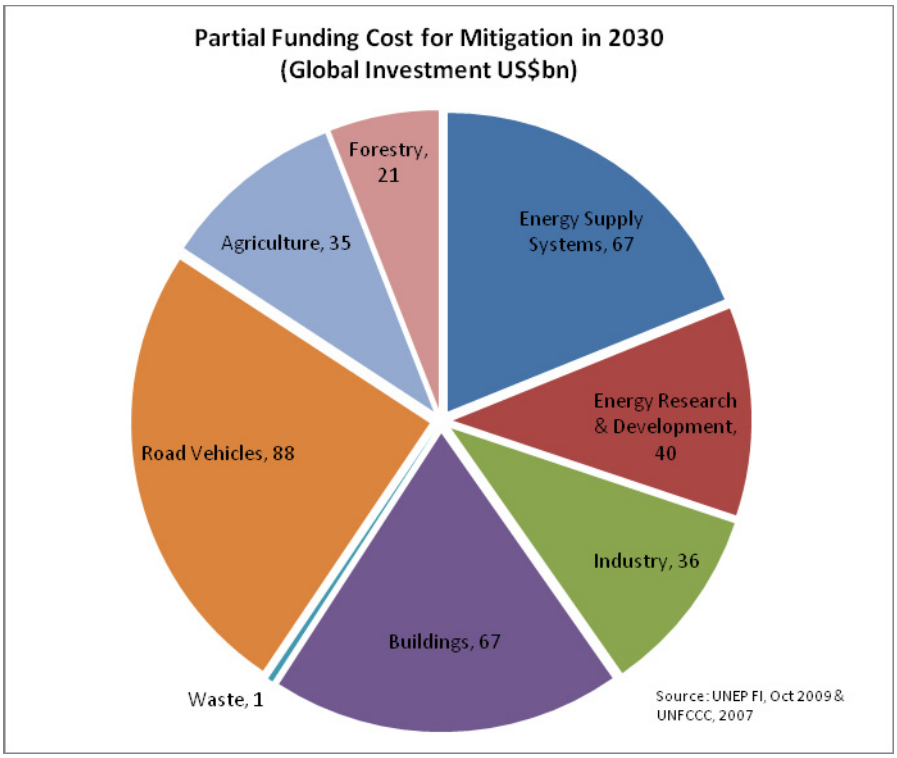

Figure 3 – Partial Funding Cost for Global Mitigation in 2030

Of the eight sectors identified in Figure 3, six have greater than 50% share in Non-Annex I countries (developing and emerging economies) and some are expected to require significant private finance.

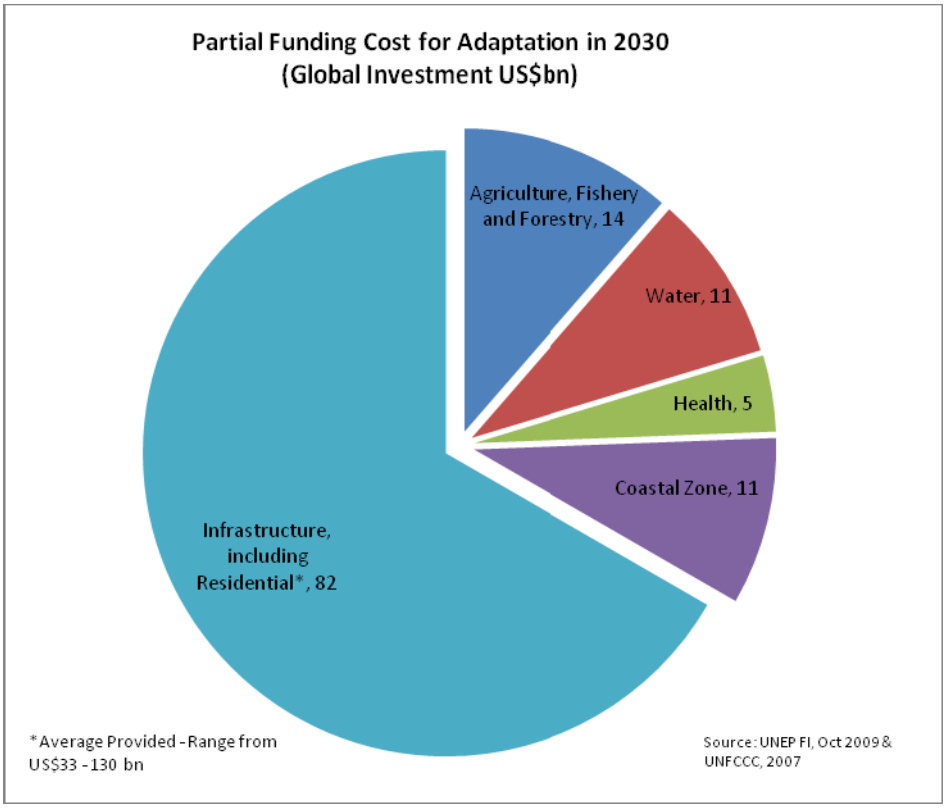

Figure 4 – Partial Funding Cost for Global Adaptation in 2030

In relation to adaptation (Figure 4) private sector funding will be particularly significant in the Agriculture, Fishery and Forestry Sector and the Infrastructure (including Residential) Sector (UNEP FI, Oct 2009).

Given the opportunities in mitigation and adaptation, a study by the Carbon Trust (2008) estimated that tackling climate change could create opportunities for a company to increase its value by up to 80% if it is well positioned and proactive, whilst up to 65% of its value could be threatened if it is poorly positioned or a market laggard.

UK Market

Total clean energy investment in the UK during 2009 was US$11.2 billion (£7.3 billion) (comprising both institutional and non-institutional investors), the third-largest amount of the G-20 countries (The Pew Charitable Trusts, 2010). UK clean energy investment between 2005-2009 has focused chiefly on wind (57%); other renewables (20%); biofuels (11%); and efficiency and low carbon technologies / services (10%) (*Ibid*.).

The key incentives for clean energy investment in the UK are:

- Renewable energies being exempt from a climate change levy;
- A renewable energy standard, with permit trading; and
- Mandatory procurement of 3.5% of all fuel consumption from biofuels through Renewable Transport Fuel Obligation.

(The Pew Charitable Trusts, 2010)

The UK Climate Change Act 2008 has set a long-term target to 'ensure that the net UK carbon account for the year 2050 is at least 80% lower than the 1990 baseline' (OPSI, Nov 2008). The Act makes the UK the first country in the world to have a legally binding long-term framework to cut carbon emissions. Fulfilling this commitment will require significant investment in coming decades.

The Emerging Markets

Of the emerging markets, Brazil, India and the PRC demand special attention. Together they currently emit one-quarter to one-third of the world's GHGs (UNEP FI, Oct 2009); continue to grow rapidly; and during 2009 the PRC (1), Brazil (6), and India (10) ranked in the top 10 countries in clean energy investment (The Pew Charitable Trusts, 2010). However, despite their increasing importance, there is currently little information on these economies for external investors (UNEP FI, Oct 2009). A brief synopsis of investment risks and opportunities in each of these economies is provided in Table 1.

Table 1 – Select Investment Risks and Opportunities in Brazil, India & PRC

Country	Risks	Opportunities
Brazil	• Greatest climate impacts in agriculture, livestock-raising and hydropower generation.	• Invested US$7.4 billion (£4.8 billion) in clean energy during 2009 and contained 9GW of total renewable energy capacity as at 2009. • Important to preserve carbon in tropical forests. • High potential renewable energy markets, particularly bio-energy – has set ambitious targets for ethanol fuel. • Significant biomass and small-hydropower capacities. • Significant gains yet to be realised in energy efficiency. • Key clean energy targets in wind (1422MW), ethanol (25% of total gasoline consumption), and biodiesel (5% of total diesel consumption) for 2012. • Generation-based subsidies / preferential loans for wind, small-hydropower, and biomass.
India	• Quite vulnerable to climatic impacts such as monsoon variability, cessation of glacier-fed rivers, migration of coastal communities and exposure to flood and drought risk. • Corporate attention to climate change is low.	• Already spending 2.6% of GDP on adaptation to climate vulnerability. • Invested US$2.3 billion (£1.5 billion) in clean energy in 2009. • Leading in wind (11GW) and hydropower and biomass (5GW total for both) installed capacities. • Good prospect for companies in the renewables sector. • Estimated US$150 billion (£97 billion) investment to be made between 2008-2017 in carbon intensity and carbon demand. • Key investment incentives: wind and solar feed-in tariffs; accelerated depreciation of 80% in 1 year for small hydropower and biomass; and preferential tax rate of 15% (instead of standard 30%) for all renewable energy projects.
PRC	• Corporate management inattentive to climatic risks. • Threat of reduced agricultural production chiefly from water shortages, shrinking of glaciers, drought and degraded land. • Uniquely challenging for PRC to continue its economic development and concurrently reduce its GHG emissions. • Majority of multinational investments and assets at risk are in coastal regions prone to damaging floods, tsunamis, typhoons, earthquakes, and land subsidence (Marsh, 2006 in UNEP FI, Oct 2009).	• 52.5GW of installed capacity of renewable energy as at 2009, 2nd only to the USA. • Clean energy investments increased by more than 50% in 2009 (to US$35 billion (£22 billion)) – highest globally. • Stringent regulations in energy efficiency and renewables well understood and driving action. • Up to 2015, half of the world's new buildings will be constructed in China (Hanson & Martin, 2006 in UNEP FI, Oct 2009). • PRC has set ambitious targets for wind (30 GW by 2020), biomass (30GW by 2020) and solar energy (1.8GW by 2020) and, for the first time, took the top spot within the G-20 and globally for overall clean energy finance and investment in 2009. • Adopted national renewable energy and energy efficiency standards, feed-in-tariffs, carbon reduction targets and/or financial incentives for investment and production. • Leads G-20 in small hydropower capacity. • Key investment incentives include: fixed feed-in tariff for wind; renewable energy surcharge and subsidy scheme generally; rooftop and building integrated photovoltaic tax subsidies in solar.

Information compiled from UNEP FI, Oct 2009; The Pew Charitable Trust, 2010.

The growing significance of emerging economies to private investors can be illustrated by the following example, related to the PRC. More than 90% of multinational companies say that the PRC is important to their global strategies, with 52% calling it critical (Chartered Insurance Institute, Feb 2009). Despite this strong reliance, disaster planning and business interruption have been seriously neglected and the physical impacts of climate change have been largely ignored (UNEP FI, Oct 2009).

In addition, the emergence of Mexico (£1.4 billion clean energy investments in 2009), Turkey (£1.0 billion clean energy investments in 2009), Indonesia (£229 million clean energy investments in 2009) and South Africa (£81 million clean energy investments in 2009) signify substantial climate solutions investment opportunities following in the footsteps of the Brazilian, Indian and Chinese economies.

However, whilst G-20 countries currently dominate the clean energy landscape – accounting for more than 90% of worldwide finance and investment (The Pew Charitable Trust, 2010) – the effects of climate change are likely to be most harshly felt in the least-developed global regions and there is a danger that institutional investment could by-pass these markets. Finding innovative solutions and long-term responses will require thinking of climate change and poverty as intricately linked and mutually reinforcing (Rippey, 2009). There are increasingly important roles for private sector investors to help promote low carbon development in such economies. For example, institutional investors could contribute to large-scale microfinance initiatives in forestry and clean energy projects (*Ibid.*) and to government investments in advanced technologies as a form of pre-emptive humanitarian intervention.

Current Status of Climate Solution Investments

Overview of Climate Solutions Investment Status

The Carbon Trust (2008) states that, to date, 'climate change has not been a significant investment theme in most sectors'. At present, the private sector is not motivated to undertake the level of investment needed, particularly in the developing world, as expected returns on low-carbon investments don't match the risks (UNEP & Partners, 2009). Whilst this can be rationalised, the conditions for a change in sentiment are rapidly approaching (The Carbon Trust, 2008) and some encouraging investment initiatives are emerging. In 2009, US$162 billion (£105 billion) was invested in clean energy globally - representing a 230% increase from 2005 (The Pew Charitable Trust, 2010). A further US$200 billion (£129 billion) of investment is expected for 2010 (*Ibid.*).

Climate Solutions Investment Sub-Sectors

Within the climate solutions sector, there are 3 sub-sectors of investment opportunity:

- ***Carbon Intensity*** – also referred to as clean energy, constitutes carbon saving through reduced intensity of energy production. These are typically infrastructure-related investments but can also include technology investments.
- ***Carbon Demand*** – also referred to as energy efficiency, constitutes an improvement in the energy efficiency of existing infrastructure, products and transportation.
- ***Carbon Sinks*** – can be defined as processes that remove more carbon dioxide from the atmosphere than they release, as part of the carbon cycle. The chief carbon sink option currently is forestation. Future additional opportunities may utilise the capacity of soil and ocean systems as well as reforestation / afforestation.

(CPSL, c2009; CPSL Nov 2008)

Recent studies (such as CPSL, Oct 2009) have confirmed the importance of current market policy barriers and incentives in determining levels of investment in each of these sub-sectors. Regional or national markets with strong, transparent policies and long-term guarantees have generally provided the surety required by institutional investors. Such conditions have been most encouraging in niche markets in North America and Europe with sound representation in parts of East Asia and South America (CPSL, Oct 2009). The absence of such conditions in Africa and Central Asia has seen significant investment deficiencies, which need to be addressed.

Case studies of the more innovative and progressive investment projects demonstrate policy and/or market conditions which promoted investment where it may not otherwise have occurred (CPSL, Oct 2009). These serve as examples for future development in the sector.

Sub-Sector Case Studies

Carbon Intensity

As the global economy moves towards decarbonisation, carbon-intensive sectors will be disproportionately affected. These industries will face challenges with both short-term competitiveness and long-term paradigm changes (UNEP FI, Oct 2009).

This short-term urgency is perhaps evidenced by the clear focus to-date from institutional investors in the carbon-intensity sub-sector (CPSL, Oct 2009). Much of the recent growth in clean technology sector investment reflects greater interest in the advancement of next-generation technologies and renewable energy capacity in emerging and developing nations (Deutsche Asset Management, Apr 2009).

The relatively high levels of investment in this sub-sector have reflected corresponding policy and market progress. Policy incentives have included long-term feed-in-tariffs, regional renewable energy targets, long-term inflation-indexed power purchase agreements, and certified emission reductions (under the Clean Development Mechanism in developing countries) (CPSL, Oct 2009). Additionally, there is a multitude of technologies within this sub-sector that are at varying stages of development which provides institutional investors the opportunity to balance their portfolios with a mixture of risk exposures (*Ibid.*).

Two case-studies in this sub-sector are presented below.

The case study in Table 2 involves a UK-based institutional investor. While the scheme is based in Europe (due to attractive policy and market conditions) there is significant potential for similarly diversified renewable energy schemes emerging in developing and transition economies.

Table 2 – Carbon Intensity Case Study 1: UK-Based Institutional Investor

Institutional Investor	**Universities Superannuation Scheme (USS)**
Country / Region of Investment	Europe
Description	This investment scheme defines the core of the new energy sector as comprising solar, wind, and other commercially proven renewable power generation (such as hydropower and biomass-to-energy) and infrastructure assets related to renewable energy transmission and distribution.
Policy Environment	This fund targets the significant investment opportunities arising from the legally binding European targets for renewable energy supply (USS, 2009).
Innovation & Incentives	This case outlines a diversified renewable energy investment fund and demonstrates the effectiveness of legally binding targets for renewable energy supply.

The case study in Table 3 provides an example of a clear policy incentive promoting investment where it would otherwise likely not have occurred. The fixed lifespan feed-in-tariff provided some of the key characteristics required by institutional investors – predictable investment returns; long-term stability; and large-scale of investment. It also demonstrates that strong national policy support can promote large-scale institutional investment irrespective of global policy conditions.

Table 3 – Carbon Intensity Case Study 2: Clear National Policy Incentive

Institutional Investor	APG (ABN AMRO Infrastructure Capital Equity)
Country / Region of Investment	Spain
Description	This project consists of two solar thermal power plants and will be the largest solar power plant in Europe.
Policy Environment	Under Spanish regulations, the electricity generated by the plants will be subject to a fixed tariff for their entire life – an estimated 40 years. This policy incentive was promoted by the Spanish Government at the national scale.
Innovation & Incentives	APG (May 2009) believes that 'this is a clear case of a strong policy incentive driving renewable energy development'.

Carbon Demand

A recurring theme in current investor research into climate change is the need for higher operational standards in key areas such as energy efficiency (UNEP FI, Oct 2009). The Stern Review on the Economics of Climate Change (2006) also identified energy efficiency as a highly effective strategy which, unlike carbon intensity does not require leaps of technology, simply acts of will (UNEP FI, Oct 2009).

Carbon demand schemes offer some of the lowest cost GHG emission reduction opportunities. In fact, the bulk of options leading to savings (as opposed to additional costs) relate to carbon demand. These include measures such as lighting systems, insulation retrofits (commercial and residential), HVAC (heating, ventilation and air-conditioning), motor system efficiencies, efficiency improvements in industry, residential appliances and electronics, and fuel-efficient vehicles (CPSL, Oct 2009).

However, despite the apparent financial attraction of these GHG reduction opportunities, significant improvements on a large-scale have in practice proved elusive (APG, May 2009). Given this, the IIGCC et al (2009) believe that 'particular attention should be paid to energy efficiency as the most cost effective medium-term GHG mitigation option' (CPSL, Oct 2009). However this is unlikely to occur without support from regulators (UNEP FI, Oct 2009).

As demonstrated in the innovative and encouraging approach outlined in Table 4, carbon demand opportunities may be greatest in regions where baseline energy efficiencies are low and investment scales are large; particularly the world's transition economies (CPSL, Oct 2009).

Table 4 – Carbon Demand Case Study 1: Integrated System Efficiency Improvement

Institutional Investor	APG
Country / Region of Investment	People's Republic of China (PRC)
Description	This fund brings together technology providers and energy efficiency specialists in a structure that allows international investors and local banks to provide financing to energy users to upgrade their plants and facilities. Cost savings generated by reductions in energy use will be shared between the energy user and the fund. Innovation in business models and financial structuring has led to the development of a fund that will make far larger volumes of capital available for energy efficiency as well as highly attractive investment opportunities for institutional investors.

Policy Environment	No specific policy incentive but has received strong national government support from PRC.
Innovation & Incentives	This investment represents an innovative approach involving a number of stakeholders. Additionally, perhaps the opportunity for great efficiency improvements (from a baseline of high inefficiency) coupled with the scale of the project, helped make this project viable for institutional investment.

Additionally, the case study in Table 5 illustrates the significant opportunities within institutional investors' own real estate portfolio assets. Improved efficiencies of real estate holdings can achieve significant cost savings (in operation and maintenance) through energy savings, water efficiency, carbon emissions reduction, and improved indoor environmental quality. To date, such efficiency improvements seem to have been driven by longer term internal cost saving incentives as well as certification schemes such as Leadership in Energy and Environmental Design (LEED[2]).

Table 5 – Carbon Demand Case Study 2: Real Estate Portfolio Efficiency Improvement

Institutional Investor	**California Public Employees' Retirement System (CALPERS)**
Country / Region of Investment	USA
Description	In 2004, CALPERS Investment Committee adopted a voluntary energy efficiency goal of 20% energy reduction in the US$20 billion (£13 billion) core real estate portfolio over a 5-year period. Additionally, the fund promotes development / redevelopment of commercial buildings to qualify for LEED certification.
Policy Environment	No formal policy incentive, however LEED certification
Innovation & Incentives	Strong direction provided internally by institutional investor committee. Real estate efficiency investments have short payback periods and lead to reduced energy costs and emissions in the medium to long term.

Whilst the example in Table 5 relates to asset holdings in a developed country, similar opportunities for immediate cost-savings and the associated environmental benefits may be emerging in other economies.

Carbon Sinks

The amount of carbon locked up in trees and other parts of forest ecosystems is greater than that in the atmosphere, and hence the preservation of forests is one of the most cost-efficient strategies for reducing worldwide emissions. However, emissions from the destruction of forests currently constitute about one-fifth of global emissions of GHGs (Stern, 2006).

Lack of investments in carbon sinks to date may be at least partially related to inadequate internal rates of return, the volatility of pulp / timber prices, the difficulty of measuring GHG emissions sequestration, the potentially poor reputation of monoculture tree crops, or insurance risks (CPSL, Oct 2009). Despite these barriers, this sub-sector has significant potential to deliver climate solutions, reverse environmental damage and, if implemented in a socially responsible manner, stimulate livelihood development. However, without strong policy direction, this sub-sector may continue to receive little financial investment from institutional investors (CPSL, Oct 2009).

[2] LEED is an 'internationally recognised green building certification system, providing third-party verification' (USGBC, 2009).

Two case studies illustrating the institutional investment opportunities in this sub-sector are provided below.

Primary forests in many developing economies require external investment to compensate local communities for preserving existing forest resources and utilising them sustainably. Innovative schemes, such as that outlined in Table 6, demonstrate how such investment may be channelled to local communities and how the preserved carbon values may be incorporated into global markets.

Table 6 – Carbon Sink Case Study 1: Tropical Forest Management

Institutional Investor	Merrill lynch
Country / Region of Investment	Indonesia
Description	The investor buys carbon credits derived from the conservation of a large swathe of natural forest. Funds will be used to simultaneously address climate change, support local communities and conserve biodiversity while mitigating risks to investors and increasing funding opportunities for the project developers. The credits will be sold on voluntary carbon trading markets.
Policy Environment	This is an example of a REDD project. It is accredited by the Climate, Community and Biodiversity Alliance. However, there is uncertainty relating to avoided deforestation credits in carbon trading schemes in a post-Kyoto policy environment.
Innovation & Incentives	The investor is betting that the market for credits from forest conservation will expand. This is the investor's first entrance into the market for carbon credits derived from 'avoided deforestation', indicating the infancy of this market.

Similar to the real estate portfolio energy efficiency case study for Carbon Demand, Table 7 demonstrates an investment utilising a certification scheme (namely the Sustainable Forestry Initiative[3]) promoting responsible resource management.

Table 7 – Carbon Sink Case Study 2: Plantation Forest Management

Institutional Investor	British Columbia Investment Management Corporation (BCIMC)
Country / Region of Investment	Canada
Description	This investment comprises greater than 300,000 ha of third-party certified (Sustainable Forestry Initiative) managed timberland. The Sustainable Forestry Initiative program is a rigorous system of environmental and conservation practices for sustainable harvesting practices and a wide range of other forest management goals.
Policy Environment	No specific policy incentives.
Innovation & Incentives	The certification scheme provides the investment with credibility and assurance of responsible management.

Certification schemes appear to promote some level of investor confidence in markets which may otherwise have limited policy incentives, and hence could be helpful in encouraging similar types of investments in emerging markets.

[3] The Sustainable Forestry Initiative (SFI) provides rigorous, third-party certification / audit of wood and paper products from well-managed forests (SFI, 2009).

Opportunities for Investment

Government regulation, economic and market trends, and the development of new technologies are acting in concert as drivers of mitigation of, and adaptation to, the impacts of climate change (Deutsche Asset Management, Apr 2009). Hence, including climate solutions in an investment portfolio through proper asset allocation can improve the risk / return profile for investors while giving them exposure to a transformation of the economy that has the potential to be on the level of the Industrial Revolution (*Ibid.*).

In particular, the climate solutions sector offers institutional investors short-term and long-term opportunities in both mitigation and adaptation measures in transition and developing economies:

- *Short-term:* climate-friendly stocks may lead the economic recovery due to the support of governmental regulations and fiscal stimuli. This could also diversify institutional investors portfolios; and
- *Long-term:* climate change is a mega trend that will persist.

(Deutsche Asset Management, Apr 2009; UNEP FI, Oct 2009; RAILPEN et al, 2009)

In support of this, the robustness of the clean energy sector was recently evidenced by just a 6.6% decline in investments during the financial downturn of 2009, outperforming the oil and gas industry, which experienced investment declines of 19% (The Pew Charitable Trusts, 2010). Additionally, in an encouraging sign for the future, many governments prioritised clean energy within economic recovery funding (*Ibid.*).

Carbon Intensity Sub-Sector

Demand for energy will continue to increase, driven by fundamental causes such as growing populations and economic development aspirations. Additionally, historical under-spending on public infrastructure in energy, water and transportation, coupled with future climate change regulations, will make the supply / demand imbalance more acute (Deutsche Asset Management, Apr 2009). The IEA predicts a 70% increase in worldwide energy consumption from 2000 to 2030, and whilst fossil energies will continue to play an important role, renewable energy sources will also increase in importance. Table 8 outlines the suite of possible carbon intensity technologies in a future energy mix.

Table 8 – Carbon Intensity Technologies: Barriers & Opportunities

Technology	Barriers	Opportunities
Nuclear	• Politically contentious and needs clear government support. • Long-term returns uncertain.	• Base-load, commercially-ready technology. • Increasingly considered as an (interim) solution to global GHG emissions reduction.

Technology	Barriers	Opportunities
	• Waste management.	• Reactors under construction and others proposed in PRC and India. Also, Eastern Europe and Central Asia prospects.
Alternative Uses of Coal & Gas (Chiefly Carbon Capture and Storage (CCS))	• CCS is the only technology that demands a carbon price (it uses energy and there is no other reason to store emissions underground). • CCS requires a new political framework to manage emissions once captured and stored. Heavily dependent on political support. • CCS long-term storage and leakage concerns to be addressed. • Development could be seen as countenancing intensified use of oil and gas resources.	• CCS could be an important interim solution as coal is anticipated to continue to remain an important energy source globally. • Opportunities for gasification and coal-to-liquids (indirect or direct coal liquefaction). • CCS is location-specific depending on underlying geology.
Wind Power	• Intermittent energy production. Best used as part of an integrated grid network.	• Primary recipient of clean energy investment in 2009, reflecting its mature status as a large-scale power generation source. Today, 1 in 3 countries generates a portion of its electricity by wind. • Significant installations and growth in India and PRC. High potential in Brazil.
Solar Power	• Remains expensive except in limited applications. • Solar thermal power uses direct sunlight, so is suitable only for areas with high solar insolation.	• Photovoltaic cells are currently the fastest growing energy technology in the world. Prices have declined and new, thin-film technologies positions solar for significant growth. • Most promise in developing regions of Central and South America; Africa; Middle East; Iran; Pakistan; India; former Soviet Union; and PRC.
Biomass Energy	• Biofuels debate over energy used versus energy generated. • Competition with food crops and land clearing of natural ecosystems.	• Biomass can provide a steady and uninterrupted supply of electricity and heating. • Many developing countries have forest products, agricultural residues and organic matter that could be utilised sustainably. • Brazil is the chief producer of biofuels in the developing world. Also PRC, India and other biomass-rich developing countries.
Geothermal Energy	• Conventional geothermal reservoirs are location specific. • Significant exploration and up-front capital costs for conventional geothermal.	• Conventional resources generally greatest near Tectonic plate boundaries. • Ground-Source Heat Pumps very economical and can be used anywhere. • Engineered Geothermal Systems (EGS) in research and pilot scale stage.
Wave Power	• Wave power energy harvesting is difficult – highest concentration of wave power found in areas of strongest winds on eastern sides of oceans.	• Waves contain highest energy density of all renewable sources. • Greatest potential between latitudes of 40° and 60° in both northern and southern hemispheres.
Tidal Power	• Practically, difficult to fully exploit for technical and economic reasons.	• Reliable predictability and scale of tides in some areas makes attractive opportunity. • Greatest energy potential at macro-tidal locations.
Hydroelectric	• Large-scale systems can have associated social and	• Most widely used form of renewable energy.

Technology	Barriers	Opportunities
Power	environmental problems. • Highly prone to climate change impacts (e.g. glacier-fed systems, altered rainfall regimes and evaporation rates).	• Highest global growth rates expected to be in developing and industrialising nations such as Eastern Europe, Russia, South Asia, South America, PRC, and India.
Hydrogen (Fuel Cell Technology)	• Technologies to produce hydrogen remain expensive.	• As a chemical fuel, hydrogen can be used in a much wider range of energy applications than electricity. • Can be produced from multiple sources. • Produces very low emissions (depending on generation source).
Electrified Transportation Systems	• May require improved battery technology. • Inertia in transition from fuel-powered to electric-powered vehicles.	• Hybrid electric vehicles may help transition to electric-only vehicles. • May encourage development of smart-grid systems with more efficient energy utilisation. • Electric vehicles approximately 5 times more energy efficient than fossil-fuelled vehicles.
Landfill Energy Recovery	• Potentially limited energy generation period. • May rely on historically well-managed waste disposal systems. • Limited scale.	• Energy generation sites may be close to urban energy demand centres. • Direct gas usage, electricity generation and/or condensate opportunities.

Adapted from CPSL, Nov 2008. Additional information from Sprott Asset Management, c2009 & Oddo Securities, Apr 2008; Mackay, D., Nov 2008.

Carbon Demand Sub-Sector

Despite its current status of under-investment, Lloyd's (2009) believes that energy efficiency will become an increasingly important financial and reputational driver and hence will influence market competitiveness. The need to increase the energy efficiency of existing infrastructure, products and transportation is highly evident, particularly in economies starting from an inefficient base. Regulation will drive much of the efficiency, however as an indication of what could be expected, some new ventures have been set up in markets with a carbon price that actively manages the energy use of end users in return for their 'carbon permits' (CPSL, Nov 2008).

Table 9 outlines the major barriers and opportunities to carbon demand investments.

Table 9 – Carbon Demand: Barriers & Opportunities

Target	Barriers	Opportunities
Building Efficiency	• Up-front capital outlay with short-to-medium term payback period.	• Can lead to both cost-savings and GHG emissions reductions. • Both retrofitting and new-build opportunities available. • Certification schemes evolving. • Opportunities in any developing economies.
Electricity Distribution Network Efficiency	• Requires coordinated approach. • Up-front capital outlay and payback period may be less certain.	• Large-scale savings for distributors and end-users. • Significant opportunities in large-scale, low-efficiency systems such as many of the emerging economies.

Carbon Sink Sub-Sector

Beginning from a low base-level, the emerging investment opportunities in carbon sinks relate chiefly to the United Nations Reducing Emissions from Deforestation and Forest Degradation (REDD) framework. Additionally, voluntary carbon markets have acted as an experimental space in this sub-sector and may continue to play an important role. If sufficiently well established, the long-term nature of forest and/or timberland investment should match the investment goals of longer term institutional investors (Deutsche Asset Management, Apr 2009).

Table 10 outlines the major barriers and opportunities to carbon sink investments.

Table 10 – Carbon Sinks: Barriers & Opportunities

Approach	Barriers	Opportunities
Preservation of Standing Biomass (Avoiding Deforestation)	• Current markets generally not effective in sufficiently valuing standing carbon more than timber products. • Some difficulty in quantifying GHG emission reduction benefits from natural forest systems. • Current rates of investment return in voluntary carbon markets unpredictable.	• Avoid emissions created during deforestation and continue to sequester carbon in standing biomass. • Compensate local communities for preserving forest ecosystems and incorporate livelihood diversification opportunities. • Certification schemes emerging. • Particular opportunity in regions with primary tropical forest, including Central and South America, Africa and South-East Asia.
Rehabilitation of Standing Biomass	• Potentially poor reputation of monoculture tree crops. • Insurance risks. • Volatility of pulp / timber prices. • Some difficulty in quantifying GHG emission reduction benefits from non-monoculture systems.	• Recover carbon sequestration capacity of landscapes due to reinstatement of standing biomass. • Particular opportunity in recently deforested areas (such as the regions listed above) as well as areas degraded due to agricultural or pastoral use (including more sub-humid and semi-arid environments).
Reduced Emissions from Agriculture	• Not currently integrated into national or international policy. • Difficult to quantify GHG emission reduction benefits.	• Promote practices encouraging soil carbon sequestration, such as conservation agriculture. • Applicable in many developing nations which are primarily agricultural and/or forestry based.

Risks for Investment

Lloyd's (2009) foresees that 'sudden and perhaps irreversible shifts in what have been seen as 'normal' conditions may be anticipated' due to climate change, and hence resilience should be a high priority for investors. Businesses are likely to be affected both by climate change itself and by actions put in place to address it through: physical exposure; regulatory exposure; competitive exposure; and reputational – including litigational – exposure (Lehman Brothers, Sept 2007).

Here we explore five key areas of risk that institutional investors need to take account of: (i) physical, (ii) policy, (iii) market, (iv) security, and (v) fiduciary risk.

Physical Risks

The direct exposure of conventional market sectors to the impact of climate change is most obviously related to the relationship between the physical environment and what firms actually do 'for a living' (UBS Investment Bank, Jun 2007). The sectors and firms most vulnerable to the chiefly weather-related impacts of climate change will tend to be those relying directly on physical inputs to the business, as well as those relying on human capital, which could be physically affected by climate change (*Ibid.*). Specific sectors dependent on large fixed assets, such as tourism, water, property, construction, energy, and infrastructure, as well as other climate-sensitive sectors, including health care, agriculture, forestry and insurance are at greatest risk (Henderson Global Investors et al, 2008).

Table 11 outlines the chief physical climate change phenomena and their potential implications on infrastructure and human capital for investors.

Table 11 – Potential Investment Implications Related to Physical Climate Change Phenomena

Climate Change Phenomenon	Degree of Certainty*	Potential Investment Implications	
		Infrastructure	Human
Warmer over most land areas with fewer cold days and nights	Virtually Certain	• Retrofitting of facilities to cope with higher temperatures. • Reduced demand for heating infrastructure; increased demand for cooling infrastructure. • Permafrost melting could lead to unstable ground and extensive infrastructure damage. • Adaptation of local agricultural production systems to altered local climate regimes. • Increased crop pests and decreased yields in warmer environments but increased yields in currently colder environments. • Adaptation of some water supply systems may be required.	• Potential change in work practices to reduce exposure to higher temperatures. • Changing consumption patterns may emerge from changing weather patterns. • Adaptation of local employment sectors to changing conditions i.e. tourism, agriculture. • Increased range (and health threat) of pests such as mosquitoes and other disease vectors. • Reduced human mortality from decreased cold exposure; increased human mortality from increased heat exposure. • Reduced temperature differentials may lead to reduced air quality in cities.

Climate Change Phenomenon	Degree of Certainty*	Potential Investment Implications	
		Infrastructure	Human
			• Reduced disruption to transport from snow and ice.
Increased frequency over most land areas of warm spells / heat waves	Very Likely	• Requirement for industrial and power generation facilities to cope with warmer surface waters and reduced flow volumes. • Adaptation of agricultural and forestry infrastructure to sustain / improve yields during drier periods. • Increased exposure of infrastructure and forestry and agriculture sectors to fire. • Increased demand for water infrastructure (potable and irrigation) and likely shift to water sources independent of rainfall i.e. desalination. • Increased demand for buildings (housing) appropriate for hotter local conditions.	• Increased demand for heat stress-related hospital services, particularly for the elderly, the very young, and the poor. • Potential for increased water scarcity and subsequent food insecurity. • Increased number of days exceeding permissible outdoor working temperatures.
Increased frequency of heavy precipitation events over most areas	Very Likely	• New infrastructure or adaptation of existing infrastructure to adequately protect from increased flood peaks. • Requirement for agricultural, forestry and water source / supply infrastructure to manage increased heavy rainfall and associated water contamination, soil erosion and water logging. • Change in new-build and retrofit designs / standards to reflect increased storm intensities. • Change in agricultural production systems to cope with increased likelihood of crop damage.	• Increased disruptions to settlements, transport systems, production systems and commerce. • Property losses due to increased flood levels. • Potential for increased disease from water pooling and stagnating.
Increased drought-affected areas	Likely	• Increased exposure of sectors to the effects of fire and dust storms. • Increased demand for water infrastructure independent of rainfall and development of auxiliary sources. Infrastructure to address increased vulnerability of livestock, forestry and crop production systems (such as irrigation). • Productivity from increasingly degraded lands may reduce without changing practices and / or the addition of significant fertility and water supplements. • Increased restrictions on activities consuming large amounts of water, such as power generation, semi-conducting, metals and mining, beverages, agriculture, and biotechnology processes. • Greater demand for urban infrastructure as	• Increased risk of food and water shortages. • Increased likelihood of mass migration from marginal lands to more productive lands and / or cities – increased potential for conflicts over land and other resources. • Increased risk of water- and food-borne diseases as people utilise any available water sources. • Increased frequency of fires and dust storms may cause increased respiratory problems. • 75% of people living on less than $1/day rely on agriculture for their livelihood; hence increased drought will affect these communities severely.

Climate Change Phenomenon	Degree of Certainty*	Potential Investment Implications	
		Infrastructure	Human
		rural populations seek more secure conditions.	
Increased intense tropical cyclone activity	Likely	• Increased risk of large-scale and sudden loss of infrastructure, in particular water and power supply infrastructure as well as local forestry and agricultural production systems. • Change in new-build and retrofit designs / standards to reflect increased cyclone intensities. • Increased risk to sea transportation and both onshore (particularly coastal) and offshore infrastructure. • More pressure on urban infrastructure if populations migrate.	• Increased disruptions to settlements, transport systems, production systems and commerce. • Increased risk of injury, disease and death. • Insurance withdrawal for high-risk areas, leaving governments responsible. • Potential for loss of property and population migration in aftermath of cyclone. • Increased risk of water- and food-borne diseases in aftermath of cyclone.
Increased incidence of extreme high sea levels (highest 1% of hourly values of observed sea levels at a given station and for a given reference period)	Likely	• Increased risk of salinization of potable, agricultural and industrial water sources. • Increased vulnerability of coastal and other low-lying infrastructure to storm surges, particularly in coastal mega-cities (22 of the world's 50 major cities). • Increased need for coastal land protection infrastructure. • Accelerated salt-corrosion of coastal infrastructure.	• Potential for loss of property and population migration due to displacement by rising ocean and river water levels. • Increased drowning risks. • Tourism impacts on coastal and low-lying areas • Land use reallocation could be source of localised conflicts. • Likelihood of forced relocation of populations from low-lying island states.
Ecosystem change, disease vectors and pests	^	• Atmospheric carbon fertilisation may increase plant growth, which could benefit selected forestry and agricultural operations. • Increased pests may reduce crop yields – through infestations and infection. May require increased fertiliser application. • Potential for reduction in native pollinators could reduce food production. • Lower biodiversity could impact agricultural and pharmaceutical sectors.	• Increased disease vectors associated with degraded environments may increase health concerns.
Ocean warming, acidification and reduced salinity	^	• Change in productivity of fisheries, with potential for collapse if not well-managed. • Reduced ocean salinity could affect ocean currents leading to reduced warm winds inland, and to severely cold climates in certain high latitude regions. • Mobile sea ice extends into major shipping lanes. • Increased ice-free sea routes may improve sea transport opportunities in northern hemisphere.	• Potential change in diet for many reliant on fisheries. • Threat to coral ecosystems and the communities and tourism dependent on those. • Increased security risk in northern hemisphere due to new sea routes opening up.

*Likelihood based on projections for 21st century using SRES scenarios. Classifications: Virtually Certain = >99% probability of occurrence; Very Likely = 90-99% probability of occurrence; Likely = 66-90% probability of occurrence.

^ Additional to the SRES scenarios and hence no classification provided.
(Information and ideas in the table were sourced from CPSL, c2009; Henderson Global Investors et al, 2008; Lloyd's, 2009; Rippey, 2009; Sprott Asset Management, c2009; IPCC, 2007; CPSL, c2008).

A 2008 survey revealed that Asian companies are now viewing weather risks from a climate change perspective and are reporting a pattern of unmistakable risk which will require mitigation and adaptation (ASRIA, Sept 2008). In particular, extreme weather events present a material business risk to both facilities and supply chains (*Ibid.*).

Policy Risk

Uncertainty arises from climate change itself, but also from uncertainty about the policy responses that may arise (taxation, regulation and associated costs, and shifts in consumption) (UBS Investment Bank, Jun 2007).

For example, there currently remains considerable uncertainty regarding expiration of the Kyoto Protocol and the introduction of the Copenhagen Accord. This is particularly relevant to carbon markets, which may or may not exist in regional or globalised forms, and hence means that the potential value of carbon may not be fully reflected into earnings and valuation models (CPSL, Nov 2008). Carbon markets will only exist if there is a desire to set a limit, or a cap, on the amount of GHGs companies, or other entities, are allowed to emit (Rippey, 2009). Such a global cap is not proposed under the Copenhagen Accord. As such, there is also significant uncertainty about the choice of technologies to which to commit (CPSL, Nov 2008) and a risk that policies underpinning low carbon investments could be reversed (UNEP & Partners, 2009). Case studies from Asia suggest that while carbon reporting and mitigation is progressing, regulatory risk remains high and companies with more limited policy resources are struggling to detect changing policy directions (ASRIA, Sept 2008).

The Carbon Trust (2008) believes that investors' current outlook on climate change primarily reflects regulatory weakness. This outlook reflects a number of prevailing views including: (i) uncertainty as to the nature and timing of regulatory initiatives to drive the transition to a low carbon economy; and (ii) the potential for policy to mitigate value-at-risk through concessions to existing industrial players (*Ibid.*).

However, investors are now requesting greater intervention from regulators – they can promote greater transparency and disclosure of corporate information for investors, support mitigation technologies through public procurement practices, and mandate operating standards that accelerate climate-friendly technologies and resilience to climatic stresses (UNEP FI, Oct 2009). Already, it is evident that nations with strong, national policies aimed at reducing global warming pollution and incentivising the use of renewable energies are establishing stronger competitive positions in the clean energy economy (The Pew Charitable Trust, 2010).

Market Risk

Currently, there is a general absence of market drivers based on a belief that climate change is a long-term issue and that companies will have time to react when necessary, or that solutions will be found by the actions of others (CPSL, Nov 2008).

However, different industries will undergo periods of high pressure on cash flows at different times and both value-at-risk and opportunity are likely to be highest in certain specialist niches of each value chain, where players are more exposed to shifts in regulation, technology or consumer demand than are integrated manufacturers (The Carbon Trust, 2008). In response, companies will need to build increased uncertainty of supply into their planning assumptions (Lloyd's, 2009).

Henderson et al (2008) do not see climate change as a 'stand-alone risk' for business, but rather one of many risks that should be assessed and managed in a similar manner to other business risks. The risk assessment process is dynamic and climate change risk needs to be reviewed and updated on a regular basis. However, there is considerable difficulty in estimating the impact increased uncertainty from climate change will have on financial risk. It seems unlikely that any sector will experience a reduction in risk premiums as a result of climate change (at least, not to a meaningful degree), so there is likely to be a net increase in risk, with a net deleterious impact on trend growth in the global economy (UBS Investment Bank, Jun 2007).

The chief market risks related to climate change are outlined in Table 12.

Table 12 – Major Market Risks

Market Risk	Description
Carbon Cost	• Incorporation of the pricing of carbon into the economic cycle will impact operating expenses, the operating lifetime of existing facilities etc. which will, in turn feed through to market valuations.
Substitution Risk	• Risks may include: investing in early stage low carbon processes which are exposed to rapid technological change; investing into new or existing high carbon businesses; changes to purchasing patterns and consumer rejection of less efficient (and less 'green') products and services.
Insurability	• Location of operating assets and access to cover will increasingly become an issue as insurers re-evaluate their risk; appetite and desire to provide cover; increasing premiums and / or withdrawal of insurance cover.
Volatility	• Markets, such as fossil fuel energy markets, are likely to become more volatile and unpredictable. • Clean-energy markets may be less volatile, but there is much uncertainty related to carbon markets etc.
Scale of Investment	• Minimum investment scale required by large institutional investors
Technology risk	• Some technologies emerging quickly but unproven at scale.
Experience	• Lack of general experience in emerging markets. • Difficult to be highly knowledgeable in dynamically emerging markets.
Currency risk	• Exchange rate fluctuations make returns volatile. • Potential to undermine profitability of investments.
Deal flow problems	• Insufficient number of commercially attractive, easily executable deals.
Evaluating multiple, overlapping risks	• With limited time and numerous alternatives, private sector finds it difficult to fully evaluate risks of low carbon investments.

Information sourced from RAILPEN et al, 2009; CPSL, Oct 2009; UNEP & Partners, 2009; Lloyd's 2009.

In addition to direct market effects, indirect effects on industry can be just as critical. It is therefore essential, when assessing the impact of climate change, to analyse effects beyond the industry under investigation (The Carbon Trust, 2008).

Security Risk

Increasing stress on food, water, and energy supplies caused by climatic changes may worsen national and international political climates (Sprott Asset Management, c2009). In turn, this could increase the level of violence and disruption in the global economy (Schwartz, P. & Randell, D. in Sprott Asset Management, c2009) threatening procurement and supply chains.

In response, Lloyd's (2009) believe that 'governments will become increasingly dependent on the creativity and skills of the private sector in tackling the security challenges that climate change will bring' and concurrently political stability will be important for promoting investor confidence.

Fiduciary Risk

Recently, legal cases have been filed by some community groups against energy companies in the belief that such companies are ultimately responsible for climate changes adversely impacting their communities. A current case in Alaska accuses a suite of companies of 'creating a public nuisance' related to potential submersion of a coastal community and subsequent relocation costs (CPSL, c2009). Such companies are also being accused of 'conspiracy' – a similar allegation that eventually led to tobacco-based settlements in the mid-late twentieth century (*Ibid.)*. However, the diffuse nature of climate change makes it difficult to link defendants' behaviour directly to the harm being caused. Nevertheless, if such lawsuits succeed, it could set a precedent for similar accusations from island nations, ski resorts, drought-stricken communities, and hurricane victims, amongst others (*Ibid.*).

Additionally, Quayle Watchmen Consulting (in UNEP FI, Jul 2009) state that it is '***necessary*** for investment management agreements or the equivalent contract between pension funds and asset managers to use environmental, social and governance language in order to clarify the expectations of the parties to the contract'. Furthermore, they state that 'it is an ***obligation*** on pension fund trustees not simply a right or option to state in their Statement of Investment Principles what the fund's guidelines are on responsible investment and to what extent social, environmental or ethical considerations are taken into account' (Hansard, H.L., Oct 2008 in UNEP FI, Jul 2009).

Hence, this is a risk that merits close observation and proactive action on behalf of institutional investors.

Lessons for the Future

Policy, investment and business experts alike have noted that the clean energy economy is emerging as one of the great global economic and environmental opportunities of the 21st century (The Pew Charitable Trust, 2010). Encouraging findings from the Carbon Trust (2008) suggest that climate change 'risks can be almost entirely mitigated with sufficient preparation, whilst opportunities can be seized more readily'. However, climate solutions sector investment is a fairly recent concept for many institutional investors and they are still in the process of learning more about this dynamic and emerging sector.

The risks associated with climate change: physical, policy, market, security and fiduciary are constantly changing and hence getting a better handle on these risks is vital for long term institutional investors. Additionally, these risks can be correlated and result in a number of indirect risks such as capital constraints on insurance and increased risk premiums associated with investments. When judging long term returns on investments it is also important to consider the macro economic measures that may also be impacted by climate change, including inflation, interest rates and the sovereign debt credit rating for certain countries hardest hit by climate change.

Building a better understanding of future markets, and the competitive drivers within those markets, will allow institutional investors to better manage their risk exposure. This is certainly true for long term planning but increasingly true in the short and medium term. For example, the pricing of carbon, and how companies respond to carbon markets, will impact their cash flows, earnings and valuations. Conducting a review of the carbon risk in investment portfolios is an increasingly urgent task, both at individual asset level and in aggregate (Mercer, June 2009).

Table 13 provides detail on potential policy and market features which may play an important role in future investment.

Table 13 – Potential Policy & Market Features to Promote Future Institutional Investment

Opportunity	Description
Public Finance Mechanisms (PFMs)	• PFMs should be used to increase returns and/or reduce risk. They should complement, not substitute for private investment. Instead the public sector absorbs risks or undertakes activities that the private sector is not prepared to do. PFMs need to be directed at funds and large-scale projects to encourage institutional investors. Initiatives to promote this include: ○ Make country risk guarantees more explicit to institutional investors; ○ Offer low carbon policy risk cover; ○ Establish currency funds offering foreign exchange hedging products; ○ Create low carbon project development companies; ○ Public sector takes 'first loss' equity position in funds; and ○ Private sector institutions could access support to encourage establishment of large-scale infrastructure, real estate, private equity or energy efficiency funds in climate change mitigation and

Opportunity	Description
	adaptation.
Climate Solutions Sub-Sector Based Policy Needs	• Carbon Intensity – Current policy and market incentives may require only extension and expansion. • Carbon Demand – Large-scale opportunities and policy incentives required to promote investment. Great potential in transition economies. • Carbon Sinks – Offer opportunity to deliver integrated climate solutions in developing regions, however urgent long-term policy direction required. REDD+ may provide some investment surety.
Public Sector Support	• Public sector funding of basic research & development in key technologies to bring them towards commercialisation, particularly carbon capture and storage, and solar and marine power. • Public sector support for technology transfer and adaptation projects in developing countries.
Clean Development Mechanism (CDM) or equivalent	• Greater scale and reform of the CDM mechanism (or an equivalent under the Copenhagen Accord) with special attention given to remediation of current failures in particular sectors, regions or scales.

Information sourced from UNEP & Partners, 2009; Arnold & Porters in UNEP FI, Oct 2009; CPSL Oct 2009; UNEP FI, Oct 2009.

Leading groups are being established in various institutional investment sub-sectors to advance thinking on climate change and on the positive actions industry can take to position themselves ahead of the curve in creating sustainable jobs and cleaner economies. Engagement between the public and private sectors on sustainability and financial performance in relation to climate change is being led globally by groups such as the United Nations Environment Programme Finance Initiative (UNEP FI), the Institutional Investors Group on Climate Change (IIGCC), the Investor Network on Climate Risk (INCR), and the Investor Group on Climate Change (IGCC) (CPSL, Oct 2009). More specifically, in the pension fund sector for example, the Prince of Wales's P8 Group acts as a forum through which the experiences and sentiments of its members can be communicated to policymakers and governments, whilst it also supports formal communications from wider investor networks (*Ibid.*).

The importance of clear policy direction cannot be overstated. Through networks outlined above, investors must engage in serious dialogue with policymakers to ensure the implementation of mitigation and adaptation policies that will harness the power of the markets. Such dialogue can build the capacity of investors themselves whilst also helping markets to evolve more rapidly and in a more predictable fashion.

Conclusions

Predicted climatic changes will impact all sectors of the global community. The transition to a low-carbon economy must take place over a comparatively short period and this enormous challenge affords both opportunities and risks for asset owners. Well-directed private capital will be essential in achieving this. As significant market players active across many global sectors and regions, institutional investors now have a unique opportunity to consider their broader fiduciary duty in the management of their entire portfolios, and to be at the forefront of a new wave of low-carbon investments.

Whilst climate change is a fairly recent concept for most institutional investors, it is clear that only with investment in all 3 carbon sub-sectors (intensity, demand, and sinks) will the massive amount of required private capital be mobilised (CPSL, Oct 2009). Many of these investment opportunities will emerge in developing and transition economies where investment can help to drive responsible economic and social development, but where UK-based investors currently have less familiarity. The unique investment opportunities must also be tempered by the realisation that a multitude of physical, policy, market, security and fiduciary risks may be triggered by the impacts of, and the response to, climate change and which may impact all assets owned by institutional investors.

The dynamic nature of climate change, and all associated risks, will require careful monitoring and active participation on behalf of investors so that they can remain ahead of the curve in capturing market share.

References

All Pensions Group (APG), May 2009, *Investing in Climate Solutions: Opportunities for Pension Funds,* APG.

Association for Sustainable and Responsible Investment in Asia (ASRIA), September 2008, *carbon Disclosure Project Report 2008 – Asia ex-Japan,* Research Institutions Carbon Disclosure Project, in UNEP FI, Oct 2009.

Cambridge Programme for Sustainability Leadership (CPSL), October 2009, *Climate solution investments made to date,* The Prince of Wales's P8 Group.

Cambridge Programme for Sustainability Leadership (CPSL), c2009, *Transformational Change Model, Achieving a Low Climate Risk Economy.*

Cambridge Programme for Sustainability Leadership (CPSL), November 2008, *Market barriers and signals (deal flow) – Mapping research summary (draft),* The Prince of Wales's P8 Group.

Cambridge Programme for Sustainability Leadership, c2008, *Climate Science and Impacts*

Chartered Insurance Institute, February 2009, *Coping with climate change,* in UNEP FI, Oct 2009.

Deutsche Asset Management, April 2009, *Investing in climate change,* in UNEP FI, Oct 2009.

Hansard, H.L., October 2008, in UNEP FI, October 2009.

Henderson Global Investors, Universities Superannuation Scheme, RAILPEN Investments & Insight Investment, January 2008, *Managing the Unavoidable: Understanding the Investment Implications of Adapting to Climate Change,* Briefing Paper.

Institutional Investors Group on Climate Change (IIGCC), Investor Network on Climate Risk, Investor Group on Climate Change, & UNEP FI, 2009, *2009 Investor Statement on the Urgent Need for a Global Agreement on Climate Change,* Combined Statement.

Intergovernmental Panel on Climate Change (IPCC), 2007, *Climate Change 2007 The Physical Science Basis,* Cambridge University Press, UK.

Investment Management Association (IMA), July 2009, *Asset Management in the UK 2008, The IMA's Seventh Annual Survey,* London, UK.

Lehman Brothers, September 2007, *The business of climate change II – Policy is accelerating, with major implications for companies and investors,* in UNEP FI, Oct 2009.

Lloyd's, 2009, *Climate Change and Security: Risks and Opportunities for Business,* Authored by Dyer, G. for Lloyd's and the International Institute for Strategic Studies.

Mackay, D., November 2008, *Sustainable Energy – without the hot air,* Version 3.5.2, UIT, Cambridge, UK.

Mercer, June 2009, *Carbon risk and carbon trading: Investment considerations*.

Oddo Securities, April 2008, *Climate change – To store or not to store?,* in UNEP FI, Oct 2009.

Office for National Statistics, December 2009, *Investment by insurance companies, pension funds and trusts, 3rd Quarter 2009,* Statistical Bulletin, Newport, UK.

Parker, C., March 2010, *The Copenhagen Accord: a significant 'first step' or a disastrously missed opportunity?,* Darwin College Green Committee Lecture, University of Cambridge, UK.

RAILPEN Investments, HSBC & Linklaters, November 2009, *Climate Change Investment Risk Audit, An Asset Owner's Toolkit.*

Rippey, P., 2009, *Microfinance and Climate Change: Threats and Opportunities,* Focus Note 52, Washington D.C., CGAP, February.

Sprott Asset Management, c2009, *Investment Implications of an Abrupt Climate Change,* Toronto, Canada.

Stern, N., 2006, *Stern Review of the Economics of Climate Change,* HM Treasury, London, Chapter 18: Understanding the Economics of Adaptation.

Sustainable Forestry Initiative (SFI), 2009, http://www.sfiprogram.org/index.php, Accessed 28th August, 2009.

The Carbon Trust, September 2008, *Climate change – a business revolution? How tackling climate change could create or destroy company value.*

The Economist, December / January 2008, Pension Fund Returns, Article not accessed but reference to article used.

The Pew Charitable Trusts, 2010, *Who's Winning the Clean Energy Race? Growth, Competition and Opportunity in the World's Largest Economies,* G-20 Clean Energy Factbook.

UBS Investment Bank, June 2007, *Q-Series: Reacting to climate change – How are climate change reactions driving opportunity and risk?,* in UNEP FI, Oct 2009.

Office of Public Sector Information (OPSI), November 2008, *Climate Change Act 2008,* http://www.opsi.gov.uk/acts/acts2008/ukpga_20080027_en_1, Accessed 16th April, 2010, United Kingdom.

United Nations Environment Programme (UNEP) and Partners, October 2009, *Catalysing low-carbon growth in developing economies, Public Finance Mechanisms to scale up private sector investment in climate solutions.*

United Nations Environment Programme Finance Initiative (UNEP FI), October 2009, *The materiality of climate change, How finance copes with the ticking clock,* A report by the Asset Management Working Group of the UNEP FI.

United Nations Environment Programme Finance Initiative (UNEP FI), July 2009, *Fiduciary responsibility, Legal and practical aspects of integrating environmental, social and governance issues into institutional investment,* A report by the Asset Management Working Group of the UNEP FI.

United Nations Environment Programme Finance Initiative (UNEP FI), April 2009, *Green Paper on Financing a Global Deal on Climate Change,* Draft Version, Produced by the UNEP FI Climate Change Working Group.

United Nations Framework Convention on Climate Change (UNFCCC), August 2007, Working paper 8. Dialogue on long-term cooperative action to address climate change by enhancing implementation of the Convention. Fourth workshop, Vienna, 27-31 August 2007.

United States Green Building Council (USGBC), 2009, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1988, Accessed 28th August, 2009.

University Superannuation Scheme (USS), 2009, Investments Overview Document.