UK TRADE & INVESTMENT

Market opportunities in environmental goods and services, renewable energy, carbon finance and CATs

Overview report

October 2008

Fast track to the world UK

Contents

Executive summary

Review purpose

1 UK Trade & Investment (UKTI) commissioned SQW Consulting in March 2008 to review opportunities in the markets for environmental goods and services, renewable energy, carbon finance and CATs (excluding nuclear) in Australia, Brazil, China, India, South Africa, Turkey and the USA.

2 The review was to:

- demonstrate the extent to which there were significant opportunities in terms of market scale and/or growth in the countries,
- help in focusing the more detailed investigations that businesses would need to carry out before selling to or investing in the relevant markets and countries, and
- identify significant market opportunities for the UK given its relative strengths in the different sectors and technologies.

Review findings

Key opportunities in each country

3 The key opportunities identified in each of the countries are summarised in Table 1.

Country	Key opportunities
Australia	Current opportunities include: air pollution control, solid and hazardous waste management, wastewater and water treatment, environmental monitoring and advanced fossil/clean coal technology. Future opportunities are likely to lie in additional sectors such as cleaner technologies and carbon capture and storage (CCS), low-carbon transport fuels and renewable energy.
Brazil	Current opportunities include: water provision, wastewater treatment and air pollution technology markets, low carbon transport fuels and renewable energy including hydroelectricity and wind, and carbon finance. Future opportunities are also likely in environmental consultancy and waste management.
China	Current opportunities include: waste management, water and wastewater treatment, low-carbon energy generation capacity and renewable energy, and carbon finance. Future opportunities are likely to be presented across all sectors except land remediation.
India	Current opportunities include: water and wastewater treatment, waste management (solid waste and hazardous waste), renewable energy and carbon finance – the same sectors are likely to present future opportunities.
South Africa	There are limited opportunities at present. However, future opportunities are likely to be in waste and energy management, environmental consulting and water and wastewater treatment with some potential for carbon finance and renewable energies.
Turkey	Current opportunities include: hazardous waste management, solid waste management, water and wastewater treatment, advanced conventional energy generation and renewable energy. There are opportunities in the future in air pollution control, cleaner technologies, generation technologies and asset management.
USA	Current opportunities include: solid waste management, water utilities and wastewater treatment, air pollution abatement, cleaner technologies, low-carbon fuels and renewable energy. Future opportunities are likely to be in environmental monitoring, land remediation, CCS and generation technologies.

Source: SQW Consulting

Market drivers in the countries

4 The review found that the countries shared characteristics with regard to the environmental goods and services markets. These were generally mature markets but with good prospects for overseas exporters and investors. Regardless of the stage of development each of the countries might have reached, there appear to be common drivers in these markets. These include:

- increasingly demanding regulations, especially with regard to air quality and pollution control
- inadequate or strained infrastructure facilities for the management of water supply and wastewater and solid/hazardous waste treatment.

5 These drivers have fostered market growth in: water and wastewater, waste management, generation technologies, air pollution control and environmental consultancy.

6 The relatively more infant markets for carbon abatement technologies, renewable energy and carbon finance are generally growing fast and represent major trade and investment opportunities. Market growth in excess of 10 per cent per annum is not unusual, especially in the markets for renewable energy, carbon finance and advanced generation technologies.

7 However, the balance of priorities between these markets in each of the countries varies significantly. Comparing, for instance, the USA and Brazil, the GDP of Brazil is about 8 per cent of the USA, but its market for environmental goods and services is only just over 1 per cent of that in the USA. Nevertheless, Brazil's consumption of renewable energy is much the same in absolute terms – about 350 terawatt-hours (TWh) compared with 370 TWh in the USA.

8 Despite the trade and investment opportunities in both the mature and more infant markets, it became evident from this review that it is not easy to access consistent and reliable information on the levels and growth trends in the market segments. This is likely to increase the perceived risk of selling to or investing in these markets and countries even though there are major opportunities to do so, now and in the future.

Making the most of UK strengths

9 The UK strengths in environmental goods and services, renewable energy, carbon finance and CATs are most pronounced in:

- Water and wastewater treatment
- Waste management
- Energy management
- Environmental consultancy
- Generation technologies
- Asset management
- Carbon finance.

10 The broad picture of relative UK strengths against the market opportunities in the reviewed countries can be summarised as follows:

- **UK strengths in scale/mature markets:** There are well established market opportunities in most of the countries covered in this report that match with UK strengths - waste management, water and wastewater management, generation technologies and asset management, environmental consultancy and energy management.

- **UK strengths in growing markets:** Rapidly growing opportunities for UK exports and overseas investment exist in different markets in each of the countries – eg energy and asset management in China, generation technologies in the USA, environmental consultancy and waste management in Brazil, carbon finance and environmental consultancy in Turkey, and a range of markets in South Africa.
- **UK potential in infant markets:** Growth markets where relative UK strengths have yet to be fully developed are in renewable energy, low carbon transport fuels, and cleaner technologies.

Review outputs

11 This overview report is supplemented by seven separate reports for each of the countries and a report on the relative strengths of the UK in environmental goods and services, renewable energy, carbon finance and CATs.

Review method

The review drew on the most readily available and accessible information sourced from within the countries concerned, from international agencies such as the World Bank and from specialised technical agencies and trade bodies.

It also benefited from consultations with UKTI officials in headquarters and overseas posts and business, trade and technology experts through a workshop and bilateral discussions. The draft findings from the review were circulated to a wide range of UK policy and industry experts whose comments have been incorporated in the outputs from the study.

The overview report and individual country reports refer to values of market size and other variables in national currencies at current prices. In order to make the reports more accessible to the reader, these values have been converted to US$ using exchange rates valid as of 8 September 2008.

Each country report contains a bibliography of the references used.

The co-operation of all whose opinions and experience were drawn on for the review was much appreciated.

1: Purpose of the review

1.1 UKTI commissioned SQW Consulting in March 2008 to review market opportunities in environmental goods and services, renewable energy, carbon finance and CATs in Australia, Brazil, China, India, South Africa, Turkey and the USA.[1]

1.2 The objectives of the review were to:

1) Identify the size and scale of the markets for environmental goods and services, renewable energy, carbon finance and CATs
2) Assess the characteristics of the relevant market drivers with a prime focus on the regulatory and policy frameworks in each target market
3) Identify which sub-sectors are likely to be serviced by importing low carbon technologies and foreign direct investment (FDI) including carbon finance
4) Identify which sub-sectors offer the best partnership opportunities for UK suppliers of low carbon technologies and Clean Development Mechanism project development
5) Map these opportunities against UK relative advantage in environmental goods and services, renewable energy, carbon finance and CATs.

1.3 Environmental goods and services, renewable energy, carbon finance and CATs are defined for the purpose of the review as environmental goods and services (EGS), carbon abatement technologies (CATs), renewable energy and carbon finance.[2]

1.4 This overview of the findings is supplemented by separate reports for each of the countries and a report on relative UK strengths in the markets. It is structured as follows:

- **Section 2: Market opportunities in selected countries:** individual country maps for opportunities in environmental goods and services, renewable energy, carbon finance and CATs
- **Section 3: Relative UK strengths** in environmental goods and services, renewable energy, carbon finance and CATs
- **Section 4: Mapping relative UK strengths on market opportunities** in the reviewed countries.

1.5 The report is supported by three annexes: Annex A defines the technologies and sectors; Annex B explains the assessment methods; and Annex C provides a bibliography of the sources used to map the UK strengths in the sectors and technologies.

[1] *These are amongst the target markets for UKTI. They were selected to test the review method on a range of countries with very different characteristics in terms of the scale and mix of market opportunities.*

[2] *See Annex A for definitions. It should be noted that the markets relating to nuclear energy were excluded from the review.*

2: Market opportunities in selected countries

2.1 The assessment of market opportunities in Australia, Brazil, China, India, South Africa, Turkey and the USA was based on the application of the following criteria and drew on the evidence from literature reviews and a limited range of consultations:[3]

- size of and activity in the sector;
- the extent to which regulatory policies are demanding[4];
- size and scale of public expenditure; and
- the extent to which the trade and investment regime is liberal.

2.2 The assessment was made with regard to the relative opportunities in the markets within each country and was depicted according to a 'traffic light' coding as set out below. A green coding indicates that there is a strong opportunity in the country concerned in the specific sector relative to other sectors within environmental goods and services, renewable energy, carbon finance and CATs. A red coding indicates that there are limited relative opportunities in that sector vis-a-vis other sectors.

Key		
	☺	Relatively large market size and activity, relatively demanding regulation, relatively high public expenditure in this sector and relatively liberal trade and investment regime
	😐	Mix of modest market size and activity, modestly demanding regulation, modest public expenditure and liberalising but still restrictive trade and investment
	☹	No or minimal market size and activity, no regulation, and restrictive trade and investment regime
		No or inadequate/limited information

2.3 Tables 2-1 to 2-7 provide maps setting out the traffic light coding of current and future opportunities in environmental goods and services, renewable energy, carbon finance and CATs in the seven countries.

2.4 The assessment of current opportunities is based on the most recent official data and information on market size and sector activity. In many cases this can refer to 2005 figures and, as such, certain conclusions in this report may not capture very recent developments in some sectors or announcements concerning the near future.

2.5 The time frames used in the evidence sources for assessment of future opportunities were generally over the next five-ten years. There were three sources of evidence for these assessments that incorporated a variety of projection methods:

- Policy statements and targets relating, for example, to the proportion of renewable energy in the total energy supply within a country
- Budget allocations directed, for example, at government plans for investments in wind technology
- Projections made by international agencies, trade associations and other bodies on the basis of commissioned research – eg the World Bank

2.6 The opportunity maps are accompanied by brief commentaries on the drivers of change and the potential opportunities in key markets. Each map provides an indication of the country scale in terms of its GDP (and its growth), the estimated market for environmental goods and services, its carbon intensity and its consumption of renewable energy.

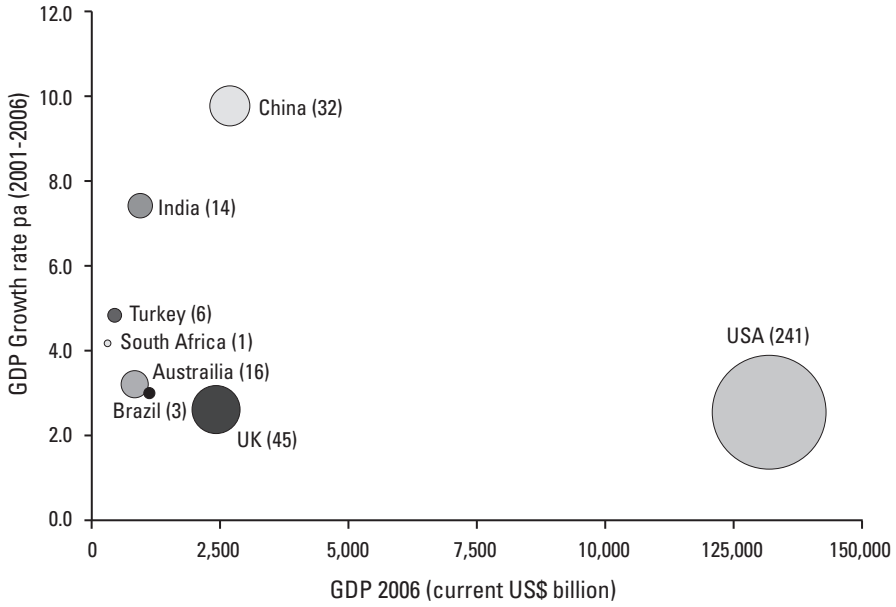
[3] *Annex B explains the assessment method.*

[4] *This refers to the strength of the requirement for environmental abatement/protection as written into the regulation compared with current practice. This can be indicated by the number of policy instruments, targets and strict enforcement and compliance.*

2.7 The individual country reports provide a fuller account of the evidence on market growth and its drivers and a more detailed assessment of the specific opportunities within each of the markets for environmental goods and services, renewable energy, carbon finance and CATs.

2.8 The following figures provide a brief overview of the countries in terms of their relative positioning on GDP and GDP growth, the scale of their environmental goods and services markets, the carbon intensity of their GDP and their consumption of renewable energy.

Figure 2-1: GDP, GDP growth and the market for environmental goods and services



Note: The size of the bubbles depicts the estimated scale of the market for environmental goods and services in each of the countries circa 2005 in US$ billion. This was estimated from a variety of different sources by SQW Consulting.

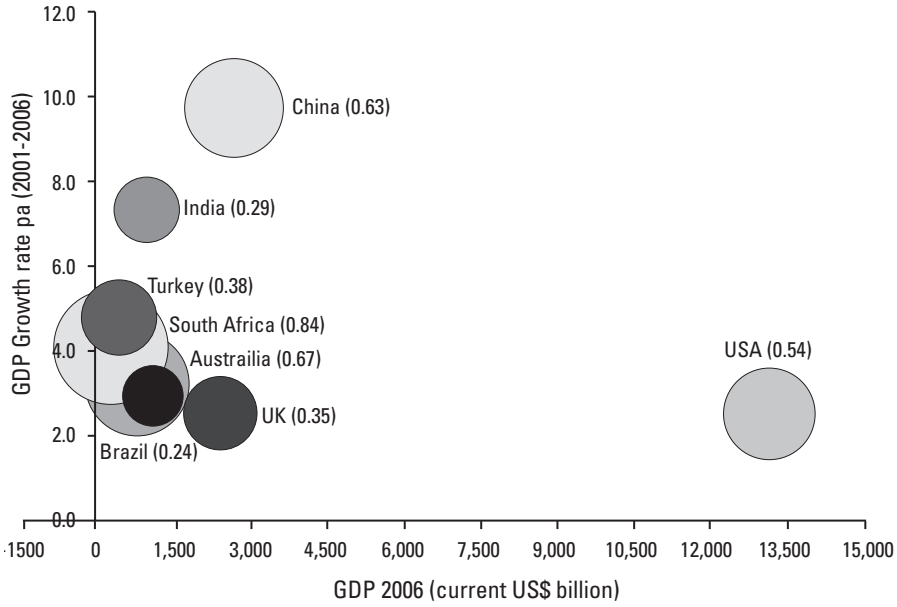
Source: Data from the World Bank - World Development Indicators (April 2008) for the GDP and GDP growth and a variety of sources for the scale of the market for environmental goods and services.

2.9 The figures suggest that the market for environmental goods and services (Figure 2-1) in each country is broadly in line with its GDP (although the market in Brazil seems to be relatively under-developed given its GDP level).

2.10 However, Figure 2-2 demonstrates that countries with GDP much lower than the US in 2006 could have higher carbon intensity. This is particularly the case with regard to China, South Africa and Australia.

2.11 The scale of renewable energy consumption is also not correlated with GDP as exemplified in the comparison between the USA and Brazil.

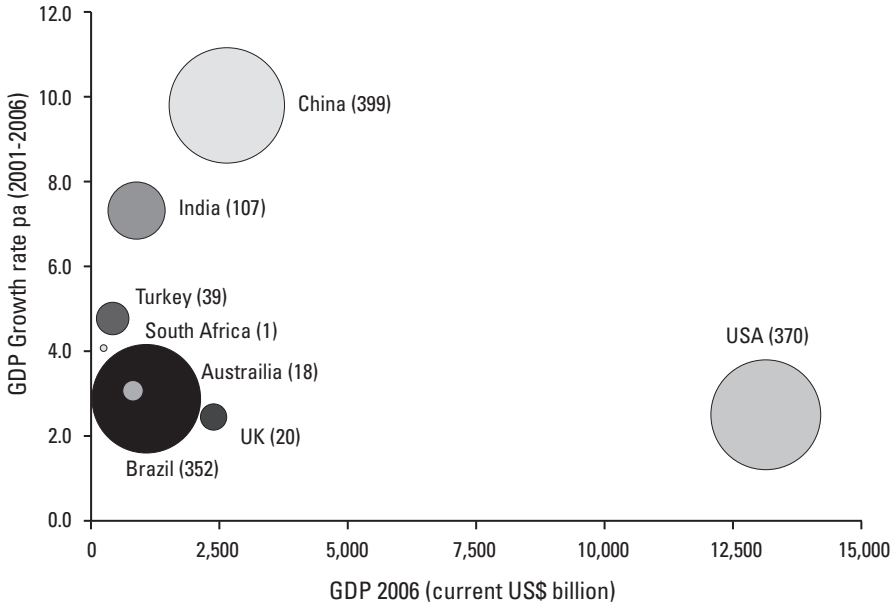
Figure 2-2: GDP, GDP growth and carbon intensity



Note: The size of the bubbles depicts the carbon intensity of GDP generation as measured by metric tonnes of carbon dioxide per thousand 2000 US$ GDP in 2005.

Source: Data from the World Bank - World Development Indicators (April 2008) for the GDP and GDP and the US Energy Information Administration for carbon intensity.

Figure 2-3 : GDP, GDP growth and consumption of renewable energy



Note: The size of the bubbles depicts the consumption of renewable energy in billion kilowatt hours in 2005.

Source: Data from the World Bank - World Development Indicators (April 2008) for the GDP and GDP and the US Energy Information Administration for consumption of renewable energy

Table 2-1: Australia opportunities map

Sector	Current opportunities*	Future opportunities	Policy framework (current)
Environmental Goods and Services (EGS)			
Air pollution control	☺	☺	Good
Cleaner technologies	😐	☺	Good
Energy management			
Environmental consultancy			
Environmental monitoring	☺	☺	Good
Marine pollution			
Noise & vibration			
Land remediation	😐	😐	Fair
Waste management	☺	☺	Fair
Water supply	☺	☺	Good
EGS overall	☺	☺	Good
Carbon Abatement Technologies (CAT)			
CCS	😐	☺	Good
Generation technologies	☺	☺	Good
Low carbon transport fuels	😐	☺	Good
Asset management			
CAT overall	😐	☺	Good
Other opportunities			
Renewable energy	😐	☺	Good
Carbon finance	😐	😐	Fair
Market entry options			
Australia and the UK have an extensive trade and economic relationship. In 2006/07, the UK was ranked as Australia's 5th top import source and is considered a major two-way trade partner by the Australian Department of Foreign Affairs and Trade. Moreover, UK companies dominate EU direct investment in Australia at approximately 53%.			
GDP 2006 (current US$ billion)			781
GDP growth rate % pa (2001-2006)			3.2
Environmental market US$ (billion) circa 2005			16
2005 Metric Tonnes of Carbon Dioxide per Thousand 2000 US$			0.67
Consumption of renewables (billion kilowatt hours) 2005			18
Percentage energy consumption from renewables 2005			5

Commentary

There are significant current opportunities in Australia for exporting and/or direct investment in air pollution control, solid and hazardous waste management, water and wastewater treatment, environmental monitoring and in advanced fossil/clean coal technology, low-carbon fuels and renewable energy. Future opportunities are likely to lie in additional sectors such as cleaner technologies, carbon capture and storage (CCS), low carbon transport fuels and renewables.

The Australian market for environmental goods and services was estimated at A$22 billion (US$18 billion) in 2006 with an annual growth rate of 7 per cent. Exports of goods (excluding services) are around A$2 billion (US$1.7 billion) per year and at least a third of environmental goods and services consumed in Australia are imported.

Australia's infrastructure for waste management and water supply has been under increasing pressure as a growing population continues to be housed in a relatively smaller number of urban areas.

Australian national government environmental expenditure rose from A$1.7 billion (US$1.4 billion) in 2001-02 to A$3.2 billion (US$2.6 billion) in 2005-06. Expenditure was primarily targeted at addressing the issues of salinity, water use, recycling, energy use, and natural resource management.

The demand for environmental goods and services in Australia has been driven by regulation and stricter environmental standards. Most recently, this seems to have advanced a step further as the new Australian Government made ratifying the Kyoto Protocol its emblematic first act of parliament.

This has spurred the improvement of Australia's air pollution monitoring systems in addition to providing further motivation to reduce greenhouse gas (GHG) emissions. Australia's National Pollution Inventory received A$5.2 million (US$4.2 million) of government funding to upgrade and continue its operation, whilst localised initiatives are also being highlighted, such as the A$1 million (US$0.8 million) pledged to improve the air quality in the Tamar Valley region of Tasmania.

Energy use in Australia has continued to increase, despite small offsets as a result of improved energy efficiency, and is expected to increase in the longer term, with transport and construction the chief consumers. The dependence on fossil fuels, mainly coal, has increased and led to large increases in GHG emissions, which in turn have spurred the government to take action and invest in the development of low emission technologies.

The government has set targets for generating energy from renewables, mainly from wind, biogas and biomass. Biofuels are seen as an alternative transport fuel, with targets to increase production. A number of large carbon storage projects have been planned or have begun in Australia, with individual project expenditure reaching up to A$4 billion (US$3.3 billion).

Australia also has experience of carbon trading through a state-led scheme in New South Wales and plans are underway for a national emissions trading scheme to commence in 2010.

Table 2-2: Brazil opportunities map

Sector	Current opportunities*	Future opportunities	Policy framework (current)
Environmental Goods and Services (EGS)			
Air pollution control	☺	☺	Good
Cleaner technologies			
Energy management	😐	😐	Good
Environmental consultancy	😐	☺	
Environmental monitoring	☹	😐	Poor/Fair
Marine pollution			
Noise & vibration			
Land remediation	😐	😐	Poor
Waste management	😐	☺	Fair
Water supply	☺	☺	Good
EGS overall	😐	☺	Good
Carbon Abatement Technologies (CATs)			
CCS			
Generation technologies			
Low carbon transport fuels	☺	☺	Good
Asset management			
CAT overall			
Other opportunities			
Renewable energy	☺	☺	Good
Carbon finance	☺	☺	Good
Market entry options			
The trade and inward investment regime in Brazil is generally liberal and favourable to the possible market entry routes. FDI into Brazil is among the highest in the world. However, it is possible that there may be specific terms and conditions which the Brazilian authorities might expect to be met with regard to imports, inward investment and/or joint ventures in Brazil.			
GDP 2006 (current US$ billion)			1067
GDP growth rate % pa (2001-2006)			2.9
Environmental market US$ (billion) 2007			4.9
2005 Metric Tonnes of Carbon Dioxide per Thousand 2000 US$			0.24
Consumption of renewables (billion kilowatt hours) 2005			352
Percentage energy consumption from renewables 2005			38

Commentary

There are significant current opportunities in Brazil for exporting and/or direct investment in the water provision, wastewater and air pollution technology markets, as well as in low carbon fuels and alternative energy including hydroelectricity and wind. Carbon finance also presents a significant opportunity in Brazil. Future opportunities are likely in environmental consultancy and waste management.

In 2007, the Brazilian market for environmental goods and services (EGS) (including equipment, engineering, consulting services, and instrumentation associated with water pollution control and clean up projects) was estimated at approximately US$4.9 billion by the US Commercial Service. FDI in environmental technologies was estimated at approximately US$3 billion in 2002.

The largest proportion of public spending on the environmental sector goes on water provision and wastewater treatment. The investment required for maintaining the water and sewage infrastructure is estimated at US$4 billion a year for the next 20 years at least.

The opportunities in waste management are primarily driven by the fact that less than a quarter of the waste is treated and the government lacks technological capacity for effective waste disposal. Landfill capacity is poor too. However, the public sector is prepared to pay a fee to the private sector for offering waste disposal services.

Brazil's energy market is exceptional as it is largely sustained by alternative energy sources, in particular hydroelectric power and ethanol. Brazil is the world's leading producer of ethanol. 93 per cent of Brazil's electrical energy consumption is hydroelectric power. The government estimates that US$800 million will be invested in wind technology over the short term in order to build up Brazil's wind energy capacity.

Brazil has a booming carbon finance market; of the Clean Development Mechanisms (CDM) host countries, it has the third highest total number of registered project activities at 12.6 per cent. Brazil also has the third largest expected average annual Certified Emission Reductions (CERs) from registered projects at 8.5 per cent.

Significant changes in Brazil including trade liberalisation, privatisation and a growing attention to environmental protection have created opportunities for overseas business in the environmental goods and services market. Public procurement has been increasing and the government has also played a key role in stimulating the renewable energies market. The Environmental Crimes Law increased fines and other punishments for failure to comply with environmental regulations.

The Brazilian government has made a significant effort to promote the production of renewable energy and to reduce levels of waste. The electrical energy sector has undergone significant changes in recent years, with restructuring and privatisation and a new regulatory framework. There is currently new legislation being developed specifying all projects to undertake an environmental survey before construction, and in waste and hazardous waste.

Table 2-3: China opportunities map

Sector	Current opportunities*	Future opportunities	Policy framework (current)
Environmental Goods and Services (EGS)			
Air pollution control	😐	☺	Poor
Cleaner technologies	😐	☺	
Energy management	😐	☺	Poor but improving
Environmental consultancy	😐	☺	Not developed
Environmental monitoring	☹	☺	Poor
Marine pollution	☹	☺	Poor
Noise & vibration			
Land remediation	😐	😐	Poor
Waste management	☺	☺	Fair and improving
Water supply	☺	☺	Fair
EGS overall	😐	☺	Fair and improving
Carbon Abatement Technologies (CAT)			
CCS	☹	☺	Not developed
Generation technologies	☺	☺	Fair
Low carbon transport fuels	😐	☺	Fair
Asset management	😐	☺	Fair
CAT overall	😐	☺	Fair to Good
Other opportunities			
Renewable energy	☺	☺	Good
Carbon finance	☺	☺	Good
Market entry options			
The trade and inward investment regime in China is reasonably liberal and favourable to the possible market entry routes. However, it is possible that there may be specific terms and conditions which the Chinese authorities might expect to be met with regard to imports, inward investment and/or joint ventures in the markets reviewed in this report.			
GDP 2006 (current US$ billion)			2645
GDP growth rate % pa (2001-2006)			9.8
Environmental market US$ (billion) circa 2005			32
2005 Metric Tonnes of Carbon Dioxide per Thousand 2000 US$			0.63
Consumption of renewables (billion kilowatt hours) 2005			399
Percentage energy consumption from renewables 2005			6

Commentary

There are significant opportunities in China for exporting and/or direct investment in waste management, water and wastewater treatment, as well as in low carbon energy generation capacity and renewable energy. Carbon finance is a key opportunity as China is the biggest player in the world in CDM, generating the largest volume of carbon credits (CERs).

In the longer term, most EGS sectors will present serious opportunities for sales, investment and joint venturing, with strong new entrants being air pollution and marine pollution. CAT will also offer excellent opportunities across all its sectors, including CCS and asset management.

Total environmental pollution treatment expenditure in 2006 was just over a quarter of a trillion RMB (US$37 billion), equivalent to over 1 per cent of GDP – a level sustained for the last five years. It is also reported that investment in pollution control hit a record high of around US$35 billion in 2006, an increase of 7.5 per cent from the previous year and equivalent to around 1 per cent of annual GDP.

China has the second largest power generation sector in the world (after the USA) at 622 GW installed capacity (2006). The market size was estimated at US$100 billion (applying an average installed cost of US$2,000 per megawatt (MW) capacity across all power generation technologies). The country's power industry is growing at an unprecedented rate, adding some 50-60 GW every year.

China has become a global leader in renewable energy – both in terms of investment and industry development. Investment in new renewables capacity (excluding large hydropower) exceeded US$12 billion in 2007, most of which was for wind, small hydro and solar hot water projects.

China is facing severe environmental problems stemming from its high consumption of natural resources, population density, rapid industrial growth, heavy reliance on soft coal, outdated technology, under-priced water and energy, insufficient infrastructure and ineffective enforcement of environmental protection laws.

China's rapid economic growth is underpinned by a massive increase in energy consumption, which in turn has given rise to an unprecedented rate of domestic fossil fuel extraction and the installation of power generation capacity. Energy intensity in China, measured in primary energy consumption per unit of GDP, is still very high compared with many developed countries, despite considerable improvements over the last 20-30 years.

Significant efforts are being made, however, to improve this situation and the EGS and CAT sectors are growing steadily. Along with a rapid liberalisation of its economy and markets, China is also bringing in new regulations relating to environmental protection and pollution prevention. Environmental legislation in China is being made more stringent and regulatory design being improved, although implementation in the various regions is slow and not always consistent.

Table 2-4: India opportunities map

Sector	Current opportunities*	Future opportunities	Policy framework (current)
Environmental Goods and Services (EGS)			
Air pollution control	😐	😐	Good
Cleaner technologies			Good
Energy management			
Environmental consultancy	😐	😐	Fair
Environmental monitoring	😐	😐	Poor/Fair
Marine pollution			
Noise & vibration			
Land remediation			Poor
Waste management	☺	☺	Fair
Water supply	☺	☺	Good
EGS overall	☺	☺	Good
Carbon Abatement Technologies (CATs)			
CCS	☹	😐	
Generation technologies	😐	😐	Fair
Low carbon transport fuels	😐	😐	Good
Asset management			
CAT overall	😐	😐	Fair
Other opportunities			
Renewable energy	☺	☺	Good
Carbon finance	☺	☺	Good
Market entry options			
The trade and inward investment regime in India is generally liberal and favourable to the possible market entry routes. This is especially the case for FDI as India has long allowed 100% FDI in environmental technologies, goods and services.			
GDP 2007 (current US$ billion)			1009
GDP growth rate % pa (2001-2006)			7.3
Environmental market US$ (billion) circa 2005			5.34
2005 Metric Tonnes of Carbon Dioxide per Thousand 2000 US$			0.29
Consumption of renewables (billion kilowatt hours) 2005			107
% energy consumption from renewables 2005			7

Commentary

There are significant current and future opportunities in India for exporting and/or direct investment in the water and wastewater treatment, waste management (solid waste and hazardous waste), as well as in renewable energy and carbon finance.

The total environmental market in India was estimated to be worth US$5.3 billion in 2004. Two of the largest segments were water and wastewater treatment and waste management.

India has vast renewable energy resources and has one of the world's largest programmes deploying renewable energy products and systems. Total installed capacity from renewables was 10, 620 MW, with wind power having the largest share. The renewable energy (RE) market is estimated to be worth US$500 million and investment in RE is expected to be in the range of US$3 billion. India was ranked third in the world in terms of existing wind power capacity and wind power added in 2006.

The markets have also experienced tremendous growth in the past few years; the EGS market is expected to grow at 10-12 per cent per annum and the renewable energy market is expected to grow at an annual rate of 25 per cent. Public expenditure on power is significant and large investments in the power sector are planned in the near future (to 2012) to meet the growing energy deficit. Seven ultra mega power plants that will reduce CO_2 emissions and enhance energy efficiency are planned to meet the demand for nearly 100,000 MW of power to 2012.

Carbon finance presents a significant opportunity in India. It is the world leader in terms of the number of CDM projects at present and there is clear potential to use CDM in a number of industry sectors. This is because achieved annual emissions reductions outputs from existing projects are relatively low and the share of CDM projects of some polluting sectors is low.

Pressures on basic infrastructure such as water supply and waste management are immense in India. India has a dominant 'Small Scale Industries' sector that is responsible for much of the industrial pollution. The sector also suffers from the lack of suitable and cost-effective technologies. India is also a net importer of energy and demand significantly outstrips supply at present. The government has a target to provide electricity to all in the next decade. A growing power sector is testimony to this drive – albeit reliant on coal.

There appears to be a substantial need, and potential demand, for enhanced technologies to address India's long term and significant energy demand. However, industry is currently poorly monitored for compliance with the plethora of existing environmental laws, and averse to adopting costly technologies. Efforts are being made by central and local governments and their agencies to improve monitoring and enforcement of regulations. There are various fiscal and financial incentives being introduced, mainly for renewables, to attract foreign investment.

Table 2-5: South Africa opportunities map

Sector	Current opportunities*	Future opportunities	Policy framework (current)
Environmental Goods and Services (EGS)			
Air pollution control	☹	😐	Fair/Good
Cleaner technologies			
Energy management	😐	☺	Good
Environmental consultancy	😐	☺	Good
Environmental monitoring			
Marine pollution	☹	😐	Fair
Noise & vibration			
Land remediation			
Waste management	😐	☺	Good
Water supply	😐	☺	Fair/Good
EGS overall	😐	😐	Fair/Good
Carbon Abatement Technologies (CAT)			
CCS	☹	😐	Poor
Generation technologies	☹	😐	
Low carbon transport fuels	😐	😐	Fair
Asset management			
CAT overall	☹	😐	Fair
Other opportunities			
Renewable energy	☹	☺	Fair
Carbon finance	😐	☺	
Market entry options			
Most of the provisions of the EU/South Africa Trade, Co-operation and Development Agreement came into force on 1 January 2000. The Agreement has boosted South Africa's trading prospects with Europe, and liberalisation towards a free trade area over the 12-year transition period will strengthen the UK's commercial position in South Africa. The UK is the second largest European trader with South Africa (after Germany).			
GDP 2006 (current US$ billion)			255
GDP growth rate % pa (2001-2006)			4.1
Environmental market US$ (billion) circa 2005			1
2005 Metric Tonnes of Carbon Dioxide per Thousand 2000 US$			0.84
Consumption of renewables (billion kilowatt hours) 2005			1
Percentage energy consumption from renewables 2005			0.3

Commentary

There are current and future opportunities in South Africa for exporting and/or direct investment in waste and energy management, environmental consulting and water and wastewater treatment, as well as potential for carbon finance – through the Clean Development Mechanism (CDM) – and potential for expansion of renewable energies to support the diversification of the energy sector.

The size of the South African EGS market in 2004 was between R14.6 billion (US$1.8 billion) and R23.2 billion (US$2.9 billion) (1-1.6 per cent of GDP) and is estimated to be growing at between 10 and 15 per cent pa. The major sub-sectors were focused on water and waste management and resource management.

The industry includes a strong presence of foreign subsidiaries, established small local companies and new and emerging players. The current focus of these companies is the domestic market, which is therefore extremely competitive. South Africa is a world leader in specific niche areas such as the management of mine waste and mine rehabilitation and conservation and biodiversity management.

The growing share of energy intensive industries in South Africa's economy, and the country's reliance on coal, has led to high and rising carbon emissions. Industrial activity is prominent and growing throughout the country, although concentrated in specific sites. The vast majority of South Africa's electricity (80-90 per cent) is generated in coal-fired power stations by Eskom (Energy Supply Commission, a public utility founded in 1923).

Environmental enforcement is also increasing, particularly with the formation of the Environmental Management Inspectors – dubbed the 'Green Scorpions' – in 2005, which is beginning to change the common perception in South Africa that government lacks the will to enforce its environmental legislation.

Currently the government is looking to encourage legislation to be backed up with robust research and enable industry buy-in. Passing environmental bills into legislation should be quicker in the future. However, there is a shortage of staff with relevant skills in government, and this presents significant capacity-raising opportunities (such as consultancy).

There is a very low baseline of renewable energy provision at present. In 2004, less than 1 per cent of the 200,000 GW of electricity generated annually in South Africa came from renewable energies (DME, 2004). South Africa has a potential output of 86,843 GWh from renewable energy sources. The building of gas-fired power stations and co-generation projects is being sped up to ensure that by 2010 the reserve margin with regard to spare capacity is closer to 15 per cent.

Although the take up of CDM has been slow, South Africa is a leader in Africa and a growing number of landfill gas to electricity projects are occurring (eg under the CDM), and this is likely to expand yet further. Although the CDM process can be complex, the Designated National Authority (DNA) in South Africa is considered to be well organised and is being used as a model to be implemented in other African countries.

Table 2-6: Turkey opportunities map

Sector	Current opportunities*	Future opportunities	Policy framework (current)
Environmental Goods and Services (EGS)			
Air pollution control	☹	☺	Poor
Cleaner technologies	😐	☺	
Energy management			Fair
Environmental consultancy	😐	☺	Good
Environmental monitoring		☺	Poor
Marine pollution	☹	☺	Poor
Noise & vibration			
Land remediation			
Waste management	☺	☺	Fair
Water supply	☺	☺	Fair
EGS overall	😐	☺	Good
Carbon Abatement Technologies (CAT)			
CCS	☹	😐	
Generation technologies	☺	☺	Good
Low carbon transport fuels	😐	😐	
Asset management	😐	☺	Fair
CAT overall	😐	☺	Fair
Other opportunities			
Renewable energy	😐	☺	Good
Carbon finance	☹	😐	
Market entry options			
The trade and inward investment regime in Turkey is generally liberal and favourable to the possible market entry routes. This is being further improved by Turkey's efforts to join the European Union. It is possible, however, that certain specific terms and conditions are imposed by the Turkish authorities regarding imports, inward investment and/or joint ventures in these markets.			
GDP 2006 (current US$ billion			403
GDP growth rate %pa (2001-2006)			4.8
Environmental market US$ (billion) circa 2005			6
2005 Metric Tonnes of Carbon Dioxide per Thousand 2000 US$			0.38
Consumption of renewables (billion kilowatt hours) 2005			39
Percentage energy consumption from renewables 2005			13

Commentary

There are significant current opportunities in Turkey for export and/or direct investment in hazardous waste management, solid waste management, water and wastewater treatment, as well as in advanced conventional energy generation and renewable energy. There are opportunities in the future in air pollution control, cleaner technologies, generation technologies and asset management.

Total environmental expenditure in 2003 was 1.6 per cent of GDP. Total environmental expenditure by the public sector in Turkey in 2005 was 5.45 billion YTL (US$4.42 billion) of which 3.41 billion YTL (US$2.77 billion) was current expenditure and 2.04 billion YTL (US$1.66 billion) investment. There are some 150 companies in the Turkish environmental market whose capabilities are mostly in contracting with limited capacity to undertake comprehensive environmental projects.

Up to 50 per cent of the long-term investment planned, between €50 billion and €100 billion (US$74 billion – US$148 billion) over the period to 2024, for reaching EU environmental standards, is expected to be in the areas of air pollution control, water supply, wastewater treatment and waste management. Upgrading the drinking water supply systems to EU standards alone is estimated to require approximately £10 billion (US$18.5 billion) over that period.

Despite it being energy hungry (demand has increased by about 4 per cent annually), primary energy production in Turkey fell between 1990 and 2004 and the country had to rely on imports. The total investment required for electricity generation and distribution up to 2010 is estimated at around US$45 billion of which US$19 billion is to be provided under the build-operate-transfer (BOT) and build-own-operate (BOO) models.

Renewable energy has a sizable share of the total primary energy market – 13 per cent in 2005. Electricity generated from renewables was 31 per cent in 2004 - dominated by hydropower and biomass. The contribution of wind and solar is limited but is expected to increase in the future.

A key driver in Turkey is its aspiration to join the EU. Turkey has been pursuing a structural reform agenda in which deregulation is being prompted in a wide range of activities – trade liberalisation, financial management and control, public procurement, the opening up of key markets to competition (especially in the electricity, natural gas and petroleum markets) and improving the investment environment (including foreign direct investment). At the same time as Turkey is liberalising its economy and markets, it is also bringing in new regulations relating to environmental protection and pollution prevention.

Joint ventures with foreign partners are commonly pursued to undertake larger projects, especially established companies. Local firms provide civil works and basic technological provisions for many projects in industrial wastewater treatment systems, flue gas desulphurisation systems in power and composting plants, incinerators and remediation technologies. However, they generally lack project financing.

To meet financing requirements for BOO (build-own-operate) type projects in the public sector, as well as for technical project implementation, local suppliers often have to import the required technology, equipment and services, and have to team up with foreign partners.

Table 2-7: USA opportunities map

Sector	Current opportunities*	Future opportunities	Policy framework (current)
Environmental Goods and Services (EGS)			
Air pollution control	☺	☺	Good
Cleaner technologies	☺	☺	Good
Energy management			
Environmental consultancy	😐	😐	
Environmental monitoring	😐	☺	Good
Marine pollution			
Noise & vibration			
Land remediation	😐	☺	Fair
Waste management	☺	☺	Good
Water supply	☺	☺	Good
EGS overall	☺	☺	Good
Carbon Abatement Technologies (CAT)			
CCS	😐	☺	Good
Generation technologies	😐	☺	Good
Low carbon transport fuels	☺	☺	Good
Asset management	😐	😐	
CAT overall	😐	☺	Fair
Other opportunities			
Renewable energy	☺	☺	Good
Carbon finance	😐	😐	Fair (by state)
Market entry options			
Apart from a few import quotas and strategic industry-ownership restrictions, British firms doing business in the USA face few barriers. It is Britain's largest single export market and is also the leading overseas destination for British investment.			
GDP 2006 (current US$ billion)			13164
GDP growth rate %pa (2001-2006)			2.5
Environmental market US$ (billion) circa 2005			241
2005 Metric Tonnes of Carbon Dioxide per Thousand 2000 US$			0.54
Consumption of renewables (billion kilowatt hours) 2005			370
Percentage energy consumption from renewables 2005			4

Commentary

There are significant current opportunities in the USA for exporting and/or direct investment in the markets for solid waste management, water utilities and wastewater treatment, air pollution abatement, cleaner technologies and with regard to low-carbon fuels and renewable energy. Future opportunities are likely to be in environmental monitoring, land remediation, carbon capture and storage and generation technologies.

In 2002, the US Government set a national goal to reduce the GHG intensity of the economy by 18 per cent by 2012. The US Clean Air Act has long been a driver of domestic demand. State governments have made clean energy, energy efficiency, and climate change initiatives high priorities. Regulatory regimes vary across the States but almost every State has enacted GHG emissions inventories and many have State-led clean energy programmes. California has the most demanding regulations, being the only State with a state-wide GHG emissions cap.

The US market for EGS was estimated at US$241 billion in 2004 - representing a 5 per cent growth on 2003 and comprising 38 per cent of the global environmental market. The largest sector was solid waste management. Major investment in the water utilities and wastewater treatment infrastructure has been highlighted by the US Environmental Protection Agency (EPA). Between 2003 and 2023, an estimated US$277 billion of spending is required to upgrade and maintain the nation's water systems. Large investments are also expected in landfill capacity within solid waste management.

Consultations with US based UKTI trade officers highlighted the growing demand from America's largest companies for EGS, particularly waste reduction. The example of Wal-Mart was used to illustrate the increasing awareness that US 'big-business' can achieve efficiencies and cost reductions through applying EGS.

A relatively large and growing market that typically falls into the clean technology category is the green building industry. A recent Frost and Sullivan report estimated the US green building industry revenues of US$12 billion in 2007, and this figure could rise to approximately US$42 billion by 2015.

Almost half of the electricity generated in the United States is from coal and US coal-fired plants have over 300 GW of capacity. Of these, approximately one-third date from 1970 or earlier, and most of the rest from 1970-1989. Only 12 coal-fired plants have been built in the United States since 1990.

Initiatives aimed at stimulating the deployment of renewable energy technologies have numerous drivers - a concern to address the growing energy demand, but also reducing the adverse effects on the environment, encouraging the economic development of domestic industries, and providing reliable and diversified energy sources. The largest renewable energy sources are hydroelectric (42 per cent), woody biomass (31 per cent) and biofuels (11 per cent). Renewable electricity has grown over the last five years with significant additions of wind capacity. The Government is backing the production of biofuels.

The US recently proposed a US$1 billion advanced 'clean coal' R&D project – FutureGen – but the project has currently stalled due to issues regarding escalating costs and geographical location.

3: Relative UK strengths

3.1 The assessment of UK strengths was based on a review of the available research and literature on UK advantage in environmental goods and services, renewable energy, carbon finance and CATs sectors and sub-sectors. Annex C provides a bibliography of the sources used in the assessment.

3.2 The review involved a quantitative and qualitative assessment of the evidence from these sources with regard to two broad characteristics of the sectors – its scale as measured by its current or most recent level of sales volumes (from ONS data or other sources) and the strength of the sector as indicated by its capacity in the following functions:

- financial and professional services
- engineering design and consulting
- manufacturing and supply
- project management and development and
- research and development
- policy development services.

3.3 The relative potential of the sectors to contribute to the growth of the UK, its exports and productivity was assessed to be high where the sector had strong capabilities and where it currently experienced high volumes of activity. The assessment of the relative strength and potential of the sector was depicted according to a traffic light colour coding in which green denoted a current relative advantage and red a relative disadvantage – as presented in the penultimate column of Table 3-1 for environmental goods and services and Table 3-2 for low carbon and carbon abatement technologies, goods and services.

3.4 The final column of these tables provides a summary statement of the extent to which the current UK policy framework was assessed to be supportive and positive – eg in the sense of explicitly defined national strategies (in terms of objectives, targets and budgets), clear legal and regulatory frameworks with well understood and agreed standards and enforcement procedures, and commitments to international treaties.

Table 3-1: UK strengths and capabilities map: Environmental goods and services

Sector	Sector strengths							Sector size	UK relative advantage	Supportive UK policy framework (current)
	Financial and professional services	Engineering design and consulting	Manufacturing and supply	Project development and management	Research and development	Policy development services	Overall strength of the sector	in 2005 (£ million)		
Air polution control		😐	😐		🙂	😐	😐	£583	😐	Good
Cleaner technologies	🙂	😐	😐		😐	😐	☹	£177	☹	Good
Energy management		🙂	🙂	😐	🙂	🙂	🙂	£2,650	🙂	Good
Environmental Consultancy	🙂	🙂				🙂	🙂	£1,230	🙂	Good
Environmental monitoring		🙂	🙂	🙂	🙂	🙂	🙂	£189	😐	Good
Marine pollution		🙂	🙂	🙂	🙂	😐	🙂	£22	😐	Good
Noise & vibration		🙂	☹		😐	😐	☹	£369	☹	Good
Land remediation		🙂	☹	🙂	😐	😐	😐	£494	☹	Fair
Waste management		🙂	☹	🙂		😐	😐	£8,100	🙂	Good
Water & wastewater	🙂	🙂	😐	🙂		🙂	🙂	£9,400	🙂	Good
All EGS	🙂	🙂	☹	🙂	😐	😐	😐	**£23,214**	😐	**Good**

Key:

Strengths		
	🙂	distinctive and comprehensive strengths
	😐	moderate or patchy strengths
	☹	poor or limited strengths
		not relevant or limited information

Sector size		
	🙂	> £1 billion
	😐	£200 million – £1 billion
	☹	<£200 million
		not relevant or limited information

Table 3-2: UK strengths and capabilities map: Carbon abatement technologies, renewable energy and carbon finance

Sector	Technology	Sector strengths							Sector size	UK relative advantage	Supportive UK policy framework (current)
		Financial and professional services	Engineering design and consulting	Manufacturing and supply	Project development and management	Research and development	Policy development and regulation	Overall strength of the sector	in 2005 (£ million)		
CAT – Generation Technologies	Supercritical boilers	☺	☺	😐	☺	☺	😐	☺			Good
	IGCC	☺	☺	☹	☺	😐	😐	☹			Good
	CCS ready	☺	☺	😐	☺	☺	☺	☺			Fair
	Co-firing	☺	☺	😐	☺	☺	😐	😐			Fair
	All Generation Technologies							☺	£1,600	😐	Fair
CAT – CCS	Capture	☺	☺	😐	☺	☺	☺	☺			Good
	Transportation	☺	☺	☹	☺	☺	☺	☺			Good
	Storage	☺	☺	☺	☺	☺	☺	😐			Good
	All CCS							😐	£4	😐	Good
Low carbon fuels		😐		☹	😐	😐	😐	☹	£51	☹	Fair
Asset management		☺			☺			☺		☺	Fair
CAT overall								😐	**£1,655**	😐	Good
Renewables	Offshore wind	☺	☺	☹	☺	☺	☺	😐			Good
	Marine	☺	☺	😐	☺	☺	☺	☺			Fair
	Solar PV		😐	☺	😐	☺	😐	😐			Good
	Biomass	☺	😐	😐	😐	☺	😐	😐			Fair
	Biogas	☺	☺		☺		☺	☺			Good
All renewables								😐	**£280**	😐	Good
Carbon finance		☺	☺		☺		☺	☺	**£1,500**	☺	Good

4: Mapping UK strengths on market opportunities

4.1 This section provides a mapping of UK relative advantage in the sectors of environmental goods and services, renewable energy, carbon finance and CATs onto the relative market opportunities in each country.

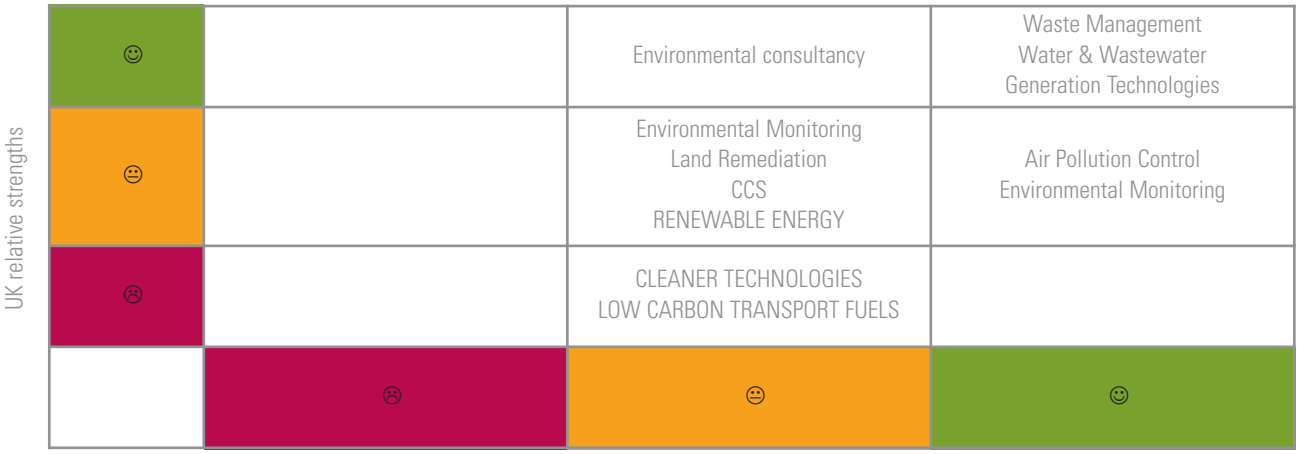
4.2 There are three points that should be emphasised about this mapping exercise:

- First, it involves a comparison of UK relative advantage in general terms against specific opportunities in the countries. It does not attempt to map the specific advantages of the UK in these markets.
- Second, the mapping is of relative advantage within the UK (ie this sector against that sector within environmental goods and services, renewable energy, carbon finance and CATs) rather than the comparative advantage of the UK in this sector against German or Japanese advantage in the same sector.
- Third, it also needs to be noted that the opportunity in each country with respect to one sector is relative to other sectors within the country – not as compared with the same sector in another country.

4.3 The mapping is presented in country matrices (Figures 4-1 to 4-7) in which the strength of current market opportunities is on one axis and the strength of UK relative advantage on the other. Therefore, the positioning of the sectors on the map denotes whether UK relative advantage coincides with market opportunity or not. Where the labelling of the sector is in upper case, this denotes that the market opportunities for that sector are thought likely to increase significantly over the medium term.

4.4 A textual summary is also provided in each figure of the overlaps between UK strengths and the scale/growth of the market opportunities.

Figure 4-1: General UK relative advantage mapped onto market opportunities in Australia



Note: Sectors that are in upper case are expected to experience significant growth in Australia over the medium term.

Current good opportunities in Australia that overlap with general UK advantage are in **water and wastewater, waste management** and **generation technologies**.

Future opportunities where market growth prospects are high and that overlap with UK advantage but to a lesser degree are in **CCS** and **renewable energy**.

Cleaner technologies and low carbon transport fuels offer good opportunities for UK suppliers; however the UK currently lacks strengths in these sectors.

Figure 4-2: General UK relative advantage mapped onto market opportunities in Brazil

UK relative strengths				
☺		ENVIRONMENTAL CONSULTANCY Energy Management WASTE MANAGEMENT	Water & Wastewater Carbon finance
😐	ENVIRONMENTAL MONITORING	Land Remediation	Air polution Control Renewable Energy
☹		CLEANER TECHNOLOGIES	Low Carbon Transport Fuels
	☹	😐	☺

Current market opportunities

Note: Sectors that are in upper case are expected to experience significant growth in Brazil over the medium term.

Current good opportunities in Brazil that overlap with general UK advantage are in **water and wastewater** and **carbon finance**.

Future opportunities where market growth prospects are high and that overlap with UK advantage are in **environmental consultancy** and **waste management**.

Note that although environmental monitoring presents limited opportunities at present, it has high growth prospects in the medium term.

Low carbon transport fuels, and to a lesser degree, cleaner technologies offer good opportunities for UK suppliers; however the UK currently lacks strengths in these sectors.

Figure 4-3: General UK relative advantage mapped onto market opportunities in China

UK relative strengths			
☺		ENVIRONMENTAL CONSULTANCY ENERGY MANAGEMENT ASSET MANAGEMENT	Water Management Water & Wastewater Carbon Finance Generation Technologies
😐	MARINE POLLUTION CCS	ENVIRONMENTAL MONITORING AIR POLLUTION CONTROL Land Remediation	Renewable Energy
☹		CLEANER TECHNOLOGIES LOW CARBON TRANSPORT FUELS	
	☹	😐	☺

Current market opportunities

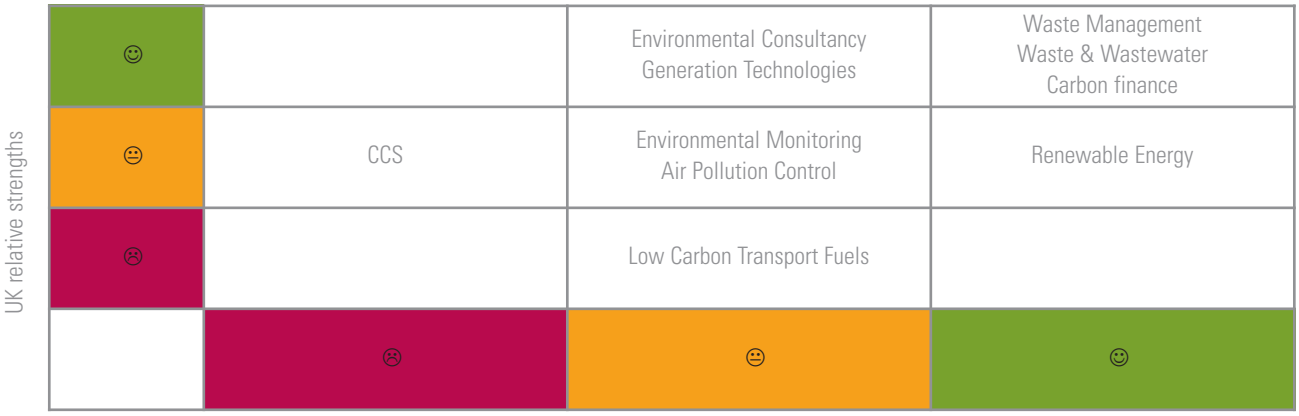
Note: Sectors that are in upper case are expected to experience significant growth in China over the medium term.

Current good opportunities in China that overlap with general UK advantage are in **waste management**, **water and wastewater, generation technologies** and **carbon finance**.

Future opportunities where market growth prospects are high and that overlap with UK advantage are in **environmental consultancy** and **energy management** and to a lesser degree in **environmental monitoring**, **air pollution control** and **asset management**.

Note that although CCS and marine pollution present limited opportunities at present, they have high growth prospects in the medium term. Cleaner technologies and low carbon transport fuels offer good opportunities for UK suppliers; however the UK currently lacks strengths in these sectors.

Figure 4-4: General UK relative advantage mapped onto market opportunities in India



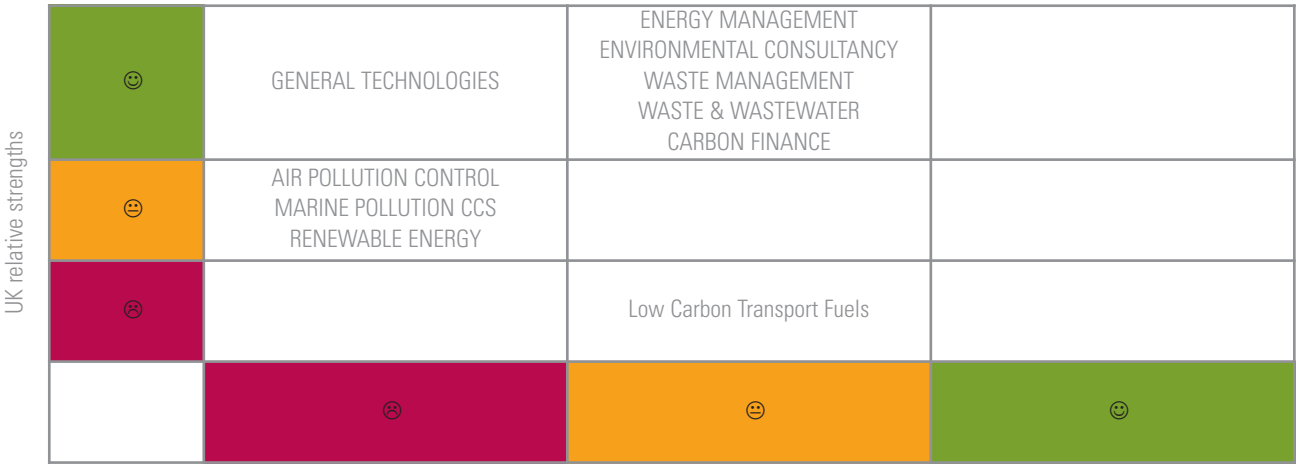
Note: Sectors that are in upper case are expected to experience significant growth in India over the medium term.

Current good opportunities in India that overlap with general UK advantage are in **waste management**, **water and wastewater** and **carbon finance**.

Future opportunities that overlap with UK advantage are in **waste management**, **water and wastewater** and **carbon finance**; all of these sectors are currently experiencing high growth and are expected do so in the future.

Note that although CCS presents limited opportunities at present, it has high growth prospects in the medium term.

Figure 4-5: General UK relative advantage mapped onto market opportunities in South Africa



Note: Sectors that are in upper case are expected to experience significant growth in South Africa over the medium term.

The environmental goods and services, renewable energy, carbon finance and CATs markets in South Africa are largely underdeveloped. However, current good but moderate opportunities that overlap with general UK advantage are in **energy management**, **environmental consultancy**, **waste management**, **waste and wastewater**, and **carbon finance**.

All of the above sectors are expected to have high growth prospects in the medium term.

Note that although generation technologies, air and marine pollution, CCS and renewable energy are not strong markets at the moment, they have high growth prospects in the medium term. Future opportunities where growth prospects are the highest and overlap with UK advantage are in generation technology.

Low carbon transport fuels offer good opportunities but this is not currently an area of relative strength in the UK.

Figure 4-6: General UK relative advantage mapped onto market opportunities in Turkey

UK relative strengths			
☺	CARBON FINANCE	ENVIRONMENTAL CONSULTANCY ASSET MANGEMENT	Waste Management Water & Wastewater Generation Technologies
😐	AIR POLLUTION CONTROL MARINE POLLUTION CCS	RENEWABLE ENERGY	
☹		CLEANER TECHNOLOGIES Low Carbon Transport Fuels	
	☹	😐	☺

Current market opportunities

Note: Sectors that are in upper case are expected to experience significant growth in Turkey over the medium term.

Current good opportunities in Turkey that overlap with general UK advantage are in **water and wastewater**, **waste management** and **generation technologies**.

Future opportunities where market growth prospects are high and that overlap with UK advantage are in **environmental consultancy** and **asset management** and to a lesser degree in **renewable energy**.

Note that although air and marine pollution and CCS, and to a lesser degree, carbon finance, present limited opportunities at present, they have high growth prospects in the medium term. Cleaner technologies and Low carbon transport fuels offer good opportunities for UK suppliers; however the UK currently lacks strengths in these sectors.

Figure 4-7: General UK relative advantage mapped onto market opportunities in USA

UK relative strengths			
☺		Environmental consultancy GENERATION TECHNOLOGIES Asset Management Carbon Finance	Waste Management Water & Wastewater
😐		ENVIRONMENTAL MONITORING LAND REMEDIATION CCS	Air Pollution Control Renewable Energy
☹			Cleaner Technologies Low Carbon Transport Fuels
	☹	😐	☺

Current market opportunities

Note: Sectors that are in upper case are expected to experience significant growth in the USA over the medium term.

Current good opportunities in USA that overlap with general UK advantage are in **waste management**, and **water and wastewater**.

Future opportunities where market growth prospects are high and that overlap with UK advantage are in **generation technologies** and to a lesser degree in **environmental monitoring**, **land remediation** and **CCS**.

Cleaner technologies and low carbon transport fuels offer good opportunities for UK suppliers; however the UK currently lacks strengths in these sectors.

Annex A: Definitions of environmental goods and services, renewable energy, carbon finance and CATs

A.1 The Defra/BERR Environmental Industries Unit has defined the individual EGS sectors as follows:

Table A-1: Constituent sub-sectors of the Environmental Goods and Services sector

Sub-sector	Description	Examples of types of activity
Air Pollution Control	Defined as products, systems and services for the prevention, reduction and removal of gaseous and particulate pollutants from air	External and internal emissions and odour control, filters and catalytic converters
Cleaner Technologies and Processes	Defined as products, systems or services for cleaner more resource efficient technologies, processes or products which are not covered elsewhere	
Decommissioning/decontamination of Nuclear sites	Defined as products, systems and services required for the decommissioning of existing nuclear liability sites and structures	Consultancy, decontamination, recycling and compaction technologies, waste collection and containment
Environmental Consultancy	Defined as services to provide assessment and advice relating to environmental issues	Environmental audits, environmental impact assessment, corporate environmental responsibility
Environmental Monitoring, Instrumentation and Analysis	Defined as products, systems and services for measuring and monitoring environmental parameters	Water, air and soil quality, meteorological conditions and flow rates
Energy Management/Efficiency	Defined as products, systems and services for energy management and energy efficiency	Energy consultancy/audits, building energy management systems, energy efficient products and efficiency advice
Marine Pollution Control	Defined as products, systems and services for controlling, clean up and minimising marine pollution	Products such as oil absorbents and booms and services such as marine pollution preventing techniques
Noise & Vibration Control	Defined as products, systems and services for monitoring and reducing noise and vibration	Noise meters, monitoring systems, acoustic buffers, enclosures and barriers and silencers
Recovery and Recycling	Defined as products, systems and services for waste segregation, recovery and recycling	Paper, organics, metals, plastics, glass, demolition and construction wastes, vehicles and white goods
Waste Management	Defined as products, systems and services for the minimisation, collection, treatment (not recycling) and disposal of waste	Advice on waste minimisation, landfill, mechanical and biological treatment, regulatory advice and technologies such as specialised containment, shredders, compactors and waste management vehicles
Water Supply and Wastewater Treatment	Defined as products, systems and services for the management of the fresh water environment, provision, treatment, distribution and storage of clean water and wastewater for industrial and domestic users	Resource development, demand management, manufacture of wastewater treatment equipment, design, construction, installation and operation of water and wastewater treatment facilities

Source: DEFRA, Sustainable Consumption and Production – Development of an Evidence Base: Annex 1, UK Government Definitions of the Environmental Goods and Services Sector (Draft Review September 2006)

A.2 Definitions for the individual CATs sectors are available from different sources including BERR's Strategy for CATs (2005), certain trade associations and prominent market leaders.

Table A-2: Constituent sub-sectors of the Carbon Abatement Technologies sector

Sub-sector	Description	Examples of types of activity
Carbon Capture & Storage (CCS)	Defined as a multi-stage process where carbon from power generation is captured either before or after combustion and transported to a long-term storage in geological formations. This approach can reduce emissions by up to 85 per cent depending on the type of non-capture plant displaced.	The entire supply chain for CCS technologies from R&D to demonstration and deployment. This includes manufacturing, as well as engineering and financial/business consulting services across the three main stages: • Carbon capture at plant • Transportation to a storage • Storage in a geological formation
Generation technologies that provide higher conversion efficiency	Defined as higher efficiency conversion processes, where the amount of fuel consume and the associated emission of CO_2 are reduced and the conversion processes are made more efficient (eg emission reductions of 10-30 per cent are possible depending on the performance of the old and replacement plant. Even higher levels can be attained by adding co-firing with biomass (typically a 5-10 per cent mix).	The entire supply chain for renewable technologies from R&D to demonstration and deployment. This includes manufacturing, as well as engineering and financial/business consulting services. Main technologies are: • Supercritical boilers • Integrated Gasification Combined Cycle (coal) • Combined Cycle Gas Turbine (gas)
Substitution to low carbon transport fuels	Defined as fuels used for transport based on the fermentation and distillation of replenishable organic matter, such as agricultural crops (eg sugar cane or beet, rapeseed) or woody material. Commonly known as biofuels, the main commercial varieties are bioethanol and biodiesel, where the former can be used as the main fuel and the latter is typically mixed with standard diesel in different proportions. Currently, there are second and third generation biofuels.	Production of crops and other organic matter to be converted into fuel. The design of technology and equipment for producing biofuels. The production of different types of low-carbon fuels including bioethanol and biodiesel.
Asset Management	Defined as planning, procurement and maintenance of energy generation facilities.	Business planning, condition assessment, data gathering, technical maintenance.

Source: BERR, British Biogen, Energy Asset Management plc

A.3 Renewable energy is defined broadly in all sources consulted and a generic definition is as follows.

Table A-3: Renewable energy

Sub-sector	Description	Examples of types of activity
Renewable energy	Defined as energy technologies that use natural resources such as sunlight, wind, flowing water, tides and waves, biomass and geothermal heat. The availability of these resources is either unaffected by energy capacity installed (eg solar and wind energy) or can be replenished in the short-term (eg hydro and biomass).	The entire supply chain for renewable technologies from R&D to demonstration and deployment. This includes manufacturing, as well as engineering and financial/business consulting services. Main technologies are: • Wind (onshore and offshore) • Solar (thermal and electric) • Hydro (smaller scale) • Biomass (heat and power) • Geothermal • Marine (wave and tidal)

Source: various sources

A.4 Carbon Finance is also a term which is not standardised across the literature and a definition reflecting the content attributed to it by several sources is as follows.

Table A-4: Carbon finance

Sub-sector	Description	Examples of types of activity
Carbon finance	Defined as the investments in greenhouse gas emission reduction projects, the creation (origination) of tradable commodities on the 'carbon market', and the provision of financial and business services associated with all of the above.	Trade in carbon commodities and derivatives on different markets and exchanges, such as CERs, EAUs, VERs and others. CDM and JI project assessment, registration, finance and development.

Source: various sources

Annex B: Review methods

Review purpose

B.1 UKTI commissioned SQW Consulting in March 2008 to review opportunities in the markets for environmental goods and services, renewable energy, carbon finance and CATs (excluding nuclear) in Australia, Brazil, China, India, South Africa, Turkey and the USA.

B.2 The review was to:

- demonstrate the extent to which there were significant opportunities in terms of market scale and/or growth in the countries
- help in focusing the more detailed investigations that businesses would need to carry out before selling to or investing in the relevant markets and countries
- identify significant market opportunities for the UK given its relative strengths in the different sectors and technologies.

B.3 The agreed review outputs are summarised in Table B-1.

Table B-1: Review outputs

A: Production of seven individual country reports to identify and, where possible, quantify market opportunities and provide an assessment of overall ease of market entry in terms of FDI, imports and partnership opportunities. Each report was to contain a bibliography of the sources used.
B: A review of the existing evidence on UK strengths and capabilities in environmental goods and services, renewable energy, carbon finance and CATs.
C: A mapping of B over A; identifying and mapping opportunities in the seven countries against UK strengths and capabilities.

Issues

B.4 The scoping stage of the study identified key methodological issues that had to be addressed and, as far as possible, resolved:

- **Sector and technology definitions** – For the purposes of the study, SQW coined the term 'environmental goods and services, renewable energy, carbon finance and CATs' to describe the relevant sectors and technologies - embracing environmental goods and services (EGS), carbon abatement technologies (CATs), renewable energy and carbon finance (see Annex A).
- **Indicators of market size, scale and growth** – The emphasis was to be on the scale of, and activity in, the demand side of the country markets. It was acknowledged that direct data on this might not always be available at all or in a consistent form. Where this was the case, inferences were to be drawn about current and future demand from the evidence on: turnover by domestic producers; levels and trends of imports; past and projected expenditure by governments on, for example, environmental protection and investment in renewable energy; and government declarations of strategic and regulatory intent with regard, for example, to GHG emission levels, air pollution control, supply and management of water, waste treatment, renewable energy production, and carbon finance.
- **Timescale for assessment** – The review was to be of future as well as current opportunities. The assessment of current opportunities was based on the most recent official data and information on market size and sector activity. In many cases this can refer to 2005 figures and, as such, certain conclusions in the report may not capture very recent developments in some sectors or announcements concerning the near future.

- The time frames used in the evidence sources for assessment of future opportunities were generally over the next five-ten years. There were three sources of evidence for these assessments incorporating a variety of projection methods[5]
  - Policy statements and targets relating, for example, to the proportion of renewable energy in the total energy supply within a country
  - Budget plans directed, for example, at government plans for investments in wind technology
  - Projections made by international agencies, trade associations and other bodies on the basis of commissioned research - eg the World Bank
- **Options for market entry and focus** – The review was only to comment on the general – and changing – liberal nature of the country regimes with regard to imports, inward investment and/or joint venturing. It has been noted in the country reports where there are clear restrictions imposed by such regimes on these entry routes. However, it is possible that specific terms and conditions may be applied by the potential host countries – formally or informally – to the entry routes in specific sectors and technologies. These have been identified where possible but the review was not able to explore how much devil there might be in the detail.
- **Assessment of UK strengths** – This is hampered by severe data gaps and limitations because standard official statistics are not currently designed to capture the scale of, and activity in, environmental goods and services, renewable energy, carbon finance and CATs. It was agreed that reliance should be placed for this assessment purpose on evidence from readily available sources (see Annex C). It is possible that this review might, therefore, miss strengths in niche and/or infant markets.

Methods

General approach

B.5 The review methods involved the following sequence of tasks:

- Review of the literature and policy on and in the selected countries and their markets
- Secondary data descriptions drawn from the individual countries or external observers and analysts
- Review of existing evidence on UK strengths and capabilities
- Consultations with UKTI overseas posts for confirmation or moderation of the evidence drawn from the available literature and data
- Consultations with UK policy and industry stakeholders to gather views and evidence on the market opportunities and UK capabilities
- Stakeholder workshop involving policy and industry representatives to discuss emerging findings in July, 2008
- Circulation of drafts of the seven country reports and the overview report to sixty industry and policy stakeholders
- Iterations with UKTI to ensure that the reports captured the direction of changing overseas market opportunities and UK capabilities.

[5] *It should be noted that the projections were not subject to any independent verification as part of this review. However, projections have only been reported or used where they appear to be from a reliable source.*

Review of market opportunities

B.6 A set of criteria was used to assess the market opportunities:– The current and prospective market scale and activity; the extent to which regulatory policies are currently, and likely to get more, demanding[6]; the scale and growth of public expenditure and commitments on environmental protection etc; and the current and prospective liberalised nature of the trade and investment regime.

B.7 The results of the assessment of the markets for environmental goods and services, renewable energy, carbon finance and CATs against these criteria have been presented in traffic coded 'maps' as follows:

- High opportunity (green coding): Relatively large market size and activity, relatively demanding regulation, relatively high public expenditure in this sector and relatively liberal trade and investment regime
- Medium opportunity (amber coding): A mix of modest market size and activity, modestly demanding regulation, modest public expenditure and liberalising but still restrictive trade and investment
- Low opportunity (red coding): Minimal or no market size/activity, indifferent regulation, and restrictive trade and investment regime
- No or inadequate information (blank)

B.8 The assessment in the individual countries has been based on the scale of opportunities in one sub-sector within environmental goods and services, renewable energy, carbon finance and CATs sub-sectors relative to other sub-sectors in the country reviewed.

Review of UK strengths

B.9 This review was based on existing evidence and assessments. But, it sought to draw inferences with regard to two broad characteristics of the sectors – their scale as measured by current or most recent level of sales volumes (from ONS data or other sources) and their strength as indicated by their capacity in the following functions:

- financial and professional services
- engineering design and consulting
- manufacturing and supply
- project management and development and
- research and development
- policy development services.

B.10 The relative potential of the sectors to contribute to the growth of the UK, its exports and productivity was assessed to be high where the sector had strong capabilities and where it currently experienced high scale and activity. The assessment of the relative strength and potential of the sector was depicted according to a traffic light colour coding in which green denoted a current relative advantage and red a relative disadvantage – compared with other sectors within environmental goods and services, renewable energy, carbon finance and CATs.

[6] *This refers to the strength of the requirement for environmental abatement/protection as written into the regulation compared with current practice. This can be indicated by the number of policy instruments, targets and strict enforcement and compliance.*

Mapping UK strengths on market opportunities

B.11 The review identified relative growth opportunities for suppliers in a range of environmental goods and services, renewable energy, carbon finance and CATs in seven overseas markets. It also depicted the relative strength of the UK in these sectors and technologies.

B.12 The mapping of general UK strengths against specific market opportunities suggested certain complementarities – ie a match between market opportunity and UK capacity (eg environmental consultancy and waste management in Brazil).

B.13 There are three points that should be emphasised about this mapping exercise:

- First, it involves a comparison of UK relative advantage in general terms against specific opportunities in the countries. It does not attempt to map the specific advantages of the UK in these markets.
- Second, the mapping is of relative advantage within the UK (ie this sector against that sector within environmental goods and services, renewable energy, carbon finance and CATs) rather than the comparative advantage of the UK in this sector against German or Japanese advantage in the same sector.
- Third, it also needs to be noted that the opportunity in each country with respect to one sector is relative to other sectors within the country – not as compared with the same sector in another country.

B.14 The maps of UK strengths against the market opportunities are summarised in Figures 4-1 to 4-7 in the main report.

B.15 They should not be taken to mean that UK suppliers will necessarily have an easy passage in entering the identified markets nor does it mean that alternative opportunities might not be available for UK investors and exporters. The maps are simply designed to demonstrate that significant opportunities for UK businesses are likely to be present in the seven overseas countries in environmental goods and services, renewable energy, carbon finance and CATs and where they are.

Annex C: Bibliography on UK strengths in environmental goods and services, renewable energy, carbon finance and CATs

World Bank (2008) World Development Indicators

US Energy Information Administration http://www.eia.doe.gov/emeu/international/contents.html

Environmental goods and services

CBI (2007) *'Climate change: Everyone's business'* A report from the CBI Climate Change Task Force, November 2007

Defra (2007) *'Commission on Environmental Markets and Economic Performance'* Report, November 2007

Defra (2007) *'Environmental Technologies and UK Productivity'*, SQW

Defra (2007) *'Exploring the relationship between environmental regulation and competitiveness'*, SQW

DTI (2006) *'Emerging Markets in the Environmental Industries Sector'*, UKCEED

DTI (2006) *'Environmental Innovation: Bridging the gap between environmental necessity and economic opportunity'* First Report of the Environmental Innovations Advisory Group, November 2006

DTI (2002) *'Global Environmental Markets and the UK Environmental Industry Opportunities to 2010'* Joint Environmental Markets Unit

Met Office (2007) *'Climate change adaptation for UK businesses'* A report from the CBI Climate Change Task Force, November 2007

UK CEED (2006) *Emerging Markets in the Environmental Sector*, DTI http://www.ukceed.org/downloads/files/31-DTIEmergingMarketsFullReport.pdf

Low carbon technologies, goods and services

AEAT/SQW (2008) *'The Value of Carbon Abatement Technologies to the UK Economy'*

BERR (2007) *'Digest of United Kingdom Energy Statistics'* National Statistics

Carbon Trust (2005) *'Biomass sector review for the Carbon Trust'* Paul Arwas Associates

CBI (2007) *'Climate change: Everyone's business'* A report from the CBI Climate Change Task Force, McKinsey analysis appendix

DTI (2007) *'Analysis of Carbon Capture and Storage Cost-Supply Curves for the UK'* Pöyry Energy Consulting

DTI (2005) *'A strategy for developing carbon abatement technologies for fossil fuel use'* Carbon Abatement Technology Programme

DTI (2005) *'The Role of Fossil Fuel Carbon Abatement Technologies (CATs) in a Low Carbon Energy System'* Future Energy Solutions

EEF (2008) *'Delivering the low-carbon economy – Business opportunities for UK manufacturers'*

NERA Economic Consulting (2005) *'Value chain/Supply chain issues - CATs'*

UKERC (2006) *'Energy Research Atlas'* (various technologies) UKERC

UK Trade & Investment (2007) *'UK Energy Excellence: An International Marketing Strategy for the UK's Energy Business'*

UK CEED (2006) '*Emerging Markets in the Environmental Sector*', DTI http://www.ukceed.org/downloads/files/31-DTIEmergingMarketsFullReport.pdf

Annex D: Case Studies

Case Studies for UK companies in Environmental Goods and Services, Renewable Energy, Carbon Finance, and CATs are available in a number of UKTI publications:

Guide to Environmental Consultants in the UK
https://www.uktradeinvest.gov.uk/ukti/fileDownload/Environ_consult.pdf?cid=421300

Environmental Industries Sector Unit Publications
http://www.eisu.org.uk/default.asp?V_ITEM_ID=308

Technology Partnership Initiative News
http://www.eisu.org.uk/default.asp?V_ITEM_ID=309

UK Energy Excellence Marketing Strategy
https://www.uktradeinvest.gov.uk/ukti/fileDownload/UKEnergyExcellenceBrochure.pdf?cid=412811

UK Trade & Investment is the Government organisation that helps UK-based companies succeed in an increasingly global economy. Its range of expert services are tailored to the needs of individual businesses to maximise their international success. We provide companies with knowledge, advice and practical support.

UK Trade & Investment also helps overseas companies bring high quality investment to the UK's vibrant economy – acknowledged as Europe's best place from which to succeed in global business. We provide support and advice to investors at all stages of their business decision making.

UK Trade & Investment offers expertise and contacts through a network of international specialists throughout the UK, and in British Embassies and other diplomatic offices around the world.

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