

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

Country report: Brazil

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This report is one of seven on the opportunities for exports to, and direct investment and joint ventures in, the markets for environmental goods and services (EGS), carbon abatement technologies (CATs), renewable energy and carbon finance in selected countries (see Annex A for definitions of these sectors). It should be noted that the nuclear sector was excluded from the review. The other countries are Australia, China, India, South Africa, Turkey and the USA – representing a mix of emerging/high growth and developed overseas markets in these sectors.

The findings from the reports have been fed into an overview report which:

- provides an assessment of the UK's competitive advantage in EGS, CATs, renewable energy and carbon finance;
- maps this onto the market opportunities as revealed from the case studies; and
- suggests the opportunities for UK exporters and direct investors by market and sector.

The report considers the general market opportunities presented in the selected countries. It is based on desk research that drew on the most readily available and accessible information sourced from within the country concerned and from international agencies.

It provides background designed to be helpful in focusing the more detailed investigations that will need to be carried out by anyone interested in selling to or investing in the relevant markets and countries.

The report does not assess specific opportunities for UK exporters and/or investors – or their appropriate route to market. However, it shows where there are significant market opportunities in environmental goods and services, renewable energy, carbon finance and CATs.

Summary of market opportunities in environmental goods and services, renewable energy, carbon finance and CATs

Opportunities

1 There are, and over the short to medium term will be, significant opportunities in Brazil in the water provision, wastewater treatment, solid waste disposal, air pollution technology and environmental consultancy markets, as well as in low carbon fuels and alternative energy including hydroelectricity and wind. Carbon finance also presents a significant opportunity. The table below presents a ‘map’ of current and future opportunities in the various environmental and low carbon markets in Brazil.

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

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 information

* 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. A variety of sources, methods and time-frames was drawn on to assess future opportunities – covering the next five-ten years based on government policies and/or budget allocations and/or independent forecasts and projections.

MARKET ENTRY OPTIONS

- 2 The trade and inward investment regime in Brazil is generally liberal and favourable to the possible market entry routes. 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 the markets reviewed in this report. The availability of possible market entry strategies is summarised below:

Route to market	Availability	Comment
Export	•	Trade liberalisation has opened up opportunities to export to Brazil.
Foreign direct investment (FDI)	•	FDI is amongst the highest in the world.
Joint venture (JV)	•	Joint venture is a possibility with Brazilian firms.

Source: SQW Consulting

Gaps in the evidence base

- 3 A thorough trawl of readily available reports, studies and policy statements with regard to the markets under review and a limited set of consultations with stakeholders found little evidence on the opportunities in Brazil in the following markets:

- Marine pollution (EGS)
- Noise and vibration (EGS)
- Carbon capture and storage (CAT)
- Generation technologies (CAT)
- Asset management (CAT)

Note: Information on the opportunities in CATs was only readily available for low carbon fuels. Consequently, it was not thought appropriate to provide an overall score against CATs as a whole in the summary map.

- 4 This is not to say that this evidence is unavailable. More information could undoubtedly be found on specific market opportunities and constraints from specialised and technical policy statements/guidance, journals and trade press. However, it was beyond the terms of reference for this review to investigate the opportunities in this degree of detail.
- 5 The report should be read as an introduction to the most significant opportunities in the Brazilian markets. It has been designed to provide a focus for the more detailed investigations that will need to be carried out by anyone interested in selling to or investing in the markets.

1: Introducing the Brazilian market

This section provides background information on the Brazilian economy and the drivers and international legal dispositions affecting the growth of the market for environmental and low carbon technologies, goods and services.

Key facts

- 1.1 Brazil is one of the largest developing countries in the world. It is the world's fifth largest country and the tenth largest economy. In 2006 its population was 189 million – an increase of about 12 million since 2001 – with an average life expectancy of 71 years. The country had a GDP of US\$1.1 trillion in 2006. It is the world's largest producer in agriculture and minerals, sugar and bioethanol. It has vast natural resources including the world's largest reserves of fresh water and forests. Key facts about the Brazilian economy are presented below:

BRAZIL – KEY FACTS (2001-2006)

	2001	2002	2003	2004	2005	2006
GDP growth (annual %)	1	3	1	6	3	4
Gross capital formation (% GDP)	18	16	16	17	16	17
Total Primary Energy Supply	186.9	191.4	193.7	204.8	209.5	—
Energy imports – net (% energy use)	21	15	11	14	—	—
Carbon dioxide emissions per capita	2	2	2	—	—	—
Imports of goods/services (% GDP)	13	13	12	13	12	12
FDI – net (current US\$ billion)	22.5	16.6	10.1	18.2	15.2	18.3

Source: World Bank Group (2007) World Development Indicators; OECD (2008) Country Statistical Profiles

Drivers of environmental goods and services, renewable energy, carbon finance and CATs

- 1.2 A combination of economic reforms, privatisation, urbanisation, a growth in environmental policies and awareness of the environment has supported the growth of environmental markets in Brazil since the 1980s.
- 1.3 In the mid 1990s Brazil adopted an economic stabilisation plan (the Real Plan) and embraced trade liberalisation, de-regulation and privatisation. Import tariffs were reduced from over 40 per cent to approximately 14 per cent and, since 2001, imports have been about 13 per cent of total GDP, which has grown rapidly albeit with some wide fluctuations. Brazil receives a significant amount of foreign direct investment (FDI). In July, according to UNCTAD, Brazil was one of the largest recipients of FDI in the world (99.3 per cent) from US\$18.8 billion in 2006 to US\$37.4 billion in 2007. In 2002 it was estimated that US\$3 billion of direct investment was made by foreign businesses in Brazil in environmental technologies alone.
- 1.4 The right to a healthy environment was added to the Brazilian constitution as early as 1988 and this has since been reinforced by policy and institutional changes. An Inter-ministerial Commission for Sustainable Development (CIDES) has now been established, which supports the government in decision making on matters relating to the environment. Steps have been taken to strengthen and enforce environmental control. In 1998 the Environmental Crimes Law was introduced and the Institute for Environment and Natural Renewable Resources (IBAMA) increased the stringency of environmental regulation through tougher fines and enforcement procedures.
- 1.5 The growth of the economy has seen a significant increase in primary energy consumption – by 128 per cent since 1980. Energy supply has increased from 186.9 in 2001 to 209.5 in 2005, however energy imports as a percentage of energy use declined from 21 per cent in 2001 to 14 per cent in 2004. Carbon dioxide (CO₂) emissions have been steady at 2 per cent per capita over 2001-2003. The government has made a significant effort to promote the production of non carbon fuels and to reduce levels of energy waste.

International legal dispositions

- 1.6 Brazil is party to a number of international legal dispositions. It was the first country to sign up to the UN Framework Convention on Climate Change. Brazil's status against other key international conventions is summarised below:

Table 1-1: Brazil's status against major international legal dispositions relating to the environment

International convention	Brazil's status
1992 UN Framework Convention on Climate Change	Ratified
Kyoto Protocol	Ratified
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	Ratified
1990 Montreal Protocol on substances that deplete the ozone layer	Ratified
1985 Vienna Convention for the Protection of the Ozone Layer	Accession
Convention on Biological Diversity	Ratified
Ramsar Convention on Wetlands	Ratified

Source: SQW Consulting

2: The market for environmental goods and services in Brazil

This section describes the growth market for environmental goods and services (EGS) in Brazil and outlines the drivers of this growth. It then provides more information on those segments presenting significant market opportunities.

Market growth and its drivers

Growth

- 2.1 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. Table 2-1 presents a breakdown of this figure into the various EGS sectors.

Table 2-1: The market for environmental goods and services, Brazil

Sub-sector	Market Size 2007 (US\$ billion)	% Growth next 5 years
Water/Wastewater	2.3	15%
• water utilities	2.0	
• industrial sector	0.3	
Solid Waste Management	2.5	15%
• urban cleaning and public waste management	2.0	
• private sector investments	0.5	
Air Pollution Control	0.4	20%

Source: US Commercial Service (2008) *Brazil: overview of the Environmental Sector in Brazil*

- 2.2 The value of the market in 2007 has significantly increased since 2005 when it was estimated at US\$2.1 billion by the US Commercial Service¹.
- 2.3 Foreign direct investment (FDI) in EGS was estimated at approximately US\$3 billion in 2002. Investments in the sector are expected to grow significantly over the coming years. Growth projections for environmental services range from 5-10 per cent to 10-15 per cent per year.

Drivers

- 2.4 Rapid urban development is taking place in Brazil and has put increasing demand pressure on the local environmental goods and services sector. This has been reinforced by the introduction and strengthening of environmental policies and regulations. The Environmental Crimes Law increased fines and other punishments for failure to comply with environmental regulations.
- 2.5 This and other influences are increasing the demand by businesses for environmental prevention and control. A survey carried out by the Brazilian-German Chamber of Commerce in 2002 found that out of 1,012 companies asked, over 90 per cent felt that environmental issues were either 'very important' or 'important' to their company (AHKBRASIL 2002). In 2007, Brazil had 2,800 companies with ISO 14001 certification (an environmental quality standard). New industry policy is being developed for the finance sector, health and construction. The industry policy developments for construction are significant for EGS because all projects will need to have an environment survey undertaken before construction.
- 2.6 Evidence of Brazil's increasing attention to the environment is in the increase in funding it has contributed to the United Nations Environment Programme. This figure almost doubled to US\$192,670 in 2007. New industrial policies are being developed for the finance sector, health and construction.

¹ However other sources estimate the market in 2005 at up to US\$4.0 billion per year and project a rise to US\$5 billion by 2010. These estimates include equipment, engineering, consultancy services and instrument inspection (UKTI, 2008).

- 2.7 Significant investment is required in all areas in order to keep up with demand. Urbanisation has outpaced service provision and large areas of unplanned settlements have developed in urban peripheries. These settlements are densely populated and often lack formal services. Public investment in EGS is not great enough to support adequate provision of services. This is partly due to the fiscal austerity of the government and partly because of rapid urban development and industrialisation in the country.
- 2.8 Brazilian companies involved in EGS are regarded as competent but lacking in the technological advancement of industrialised nations. Companhia de Saneamento Basico do Estado de São Paulo (SABESP), a state owned company in Brazil, is the only company from a developing country which is in the world's top 50 environmental companies. Brazilian companies are often willing to invest and are looking for new technologies in EGS – especially in water supply and waste.
- 2.9 The economic stabilisation, trade liberalisation and privatisation that have taken place in Brazil have opened up opportunities for overseas companies to supply the increasing demand that cannot be provided from indigenous sources in environmental good and services – through imports, FDI and joint ventures.

Project financing

- 2.10 The Ministry of Environment has set up an environment fund called Fundo Nacional do Meio Ambiente (FNMA). This provides financial support to small to medium sized projects in the environment sector which aim to either make use of Brazil's natural resources in a sustainable way or to preserve and improve the natural environment. The two main agencies that fund the environmental sector in Brazil are the National Development Bank (BNDES) and the Companhia de Tecnologia de Saneamento Ambiental (CETESB) – the state environment agency. There are several international development banks, including the World Bank and the Inter-American Development Bank, which provide an important source of finance in Brazil.

Market segments

- 2.11 The largest market segments in EGS in Brazil are **water supply and management, waste management, and air pollution**. There is also a small emerging market in the **remediation of contaminated land**. The opportunities in each of these segments are explored below.

OPPORTUNITIES IN ENVIRONMENTAL GOODS AND SERVICES IN BRAZIL

Water supply and wastewater treatment and management

Water provision and wastewater treatment receive the largest share of environmental investment in Brazil. In 2002 US\$1.3 billion was invested in the sector, this was 0.2 per cent of Brazil's GDP (Lucon, O & Cardoso Fernandes Rei, F (2004)²). However this is well below World Health Organisation (WHO) recommendations of 1 per cent of GDP. The investment required for maintaining water and sewage is estimated at US\$4 billion a year for the next 20 years at least. The market size was estimated to be US\$2.3 billion in 2007 with a predicted growth rate of 15 per cent.

There is a serious need for wider provision of the public water supply and of wastewater collection even though there has been an increase in the proportion of the population that have access to an 'improved water source' and that are using 'improved sanitation' – (in 2004, 90 per cent of the population had access to an improved water source, and 75 per cent were using improved sanitation, an increase from 83 per cent and 71 per cent in 1990 respectively (UNDP, 2007)). In 2001 there were nearly ten million households which did not have access to the public water supply; wastewater collection or septic tanks covered 62 per cent of households in 2000 (Lucon et al, 2004). There is also a serious lack of proper disposal of industrial effluent. Only 30 per cent is adequately treated. The demand for these services has not been met due to rapid urbanisation and poor urban management.

Provision of water and wastewater management is largely guided by the 1971 National Sanitation Plan, which supported each state in Brazil to set up a public enterprise to provide services. New policy has enabled private sector companies to provide services alongside the state. However, the state owned Environmental Sanitation Technology Company (SABESBE) stills dominates the water supply and wastewater treatment market. In 1999 there was a government initiative to privatise the water companies; however the initiative fell apart. There are currently five key states that are considering public private partnerships but this is at a very early stage.

² This paper is not explicit in stating that the amount invested was state investment only

In 2005 the Federal Government presented a bill to Congress in order to establish a regulatory framework for the water sector to support its development. At the same time, a programme called 'Sanitation for All' was introduced which enabled municipal and state governments, concessionaires and PPP sanitation companies to bid for resources. A new Law 11455, approved in 2007 as well as the Public Consortium Law 11107/05 and funding from a Programme for Accelerated Growth (PAC) are expected to contribute to a rise in investment in sanitation.

There are 374 sanitation companies in the country, 27 are state owned and 342 are local companies run by the municipal government (UKTI (2008) Environment Sector – Brazil).

There are specific opportunities in measuring and monitoring equipment for water and waste treatment stations, chemical and non chemical water treatment, filtration processes, laboratory equipment, pipe cleaning and leakage detection, water reuse and industrial effluent system (UKTI (2006) Water Sector Report – Brazil).

Waste management

In 2007 the market size for solid waste management was estimated to be US\$2.5 billion. Solid waste treatment is estimated to have a business potential of US\$330 million a year. Estimates of the amount of domestic solid waste that is produced daily range from 59,000 tonnes to 90,000 tonnes. Only 70 per cent of municipal waste is currently collected and only 23 per cent of this is disposed in controlled or sanitary landfills. The remaining 76 per cent is disposed of in untreated landfills.

There is a lack of landfills constructed in Brazil and the quality of existing landfills varies and includes open dumps. There have been cases of waste contamination of drinking water and children being hospitalised due to poor sanitation. States are the main provider of solid waste disposal. However, they lack the capacity to provide treated waste disposal across the country and there is limited environmental enforcement. Consequently, the state is seeking the services of private companies. The public sector is prepared to pay a fee to private companies in exchange for the provision of solid waste services. The government is interested in incineration and there is a possibility that legislation will be developed to support this.

Recycling is supported by the state. Out of the 5,507 municipalities in Brazil, 3,593 have some form of recycling service programme. 400,000 tonnes of glass out of 1,297,000 tonnes produced were recycled in 2006. Some 10.3 billion aluminium cans out of 10.7 billion produced were recycled in 2006. Similarly, 24 million tyres out of 54.5 million produced were recycled in 2006. There is a particular issue with used tyres. Although imports of used tyres is currently illegal, there is an illegal supply arriving through Paraguay and Uruguay. The country has 100 million used tyres that require safe disposal. Three recycling units have been established for this purpose.

Legislation on the environment is being developed. This legislation will cover all aspects of waste from generation. The producers of waste will be made to take responsibility for its generation.

There is already competition in Brazil from companies with the capabilities of constructing landfill. Opportunities exist in the design and construction of waste to energy plants especially with regard to equipment supply and the development of new technologies – recycling technologies for waste electrical/electronic equipment.

Hazardous waste

Three million tonnes of hazardous waste are generated in Brazil each year. There is insufficient capacity to dispose of this waste safely. There is currently no legislation on electronics waste, but once a framework for this is in place there will be good opportunities for UK companies.

Air pollution

In 2004 the market for air pollution control products was estimated to be US\$70 million. It has been predicted that there will be an increase in the size of the market by 20 per cent each year (Globe-Net, 2004b).

Transport is by far the largest contributor to air pollution in Brazilian cities. For example, in Sao Paulo 80-90 per cent of emissions are caused by motor vehicles. A national programme to reduce air pollution from new vehicles called PROCONVE (started in 1989) has led to a reduction in air emissions. However, the problem persists and there is a growing problem with emissions from motor bikes. A programme to control the latter called PROMOT based on EU standards was approved by the government in 2003. The country has undertaken significant efforts to curb air pollution through the development of alternative fuels, particularly the development of ethanol as a transport fuel.

There is a growing market for air monitoring mainly to the south east of Sao Paulo, which is heavily industrialised.

A specific opportunity has been created for companies that provide air pollution control technology to the transport sector to provide technology to limit motorcycle emissions. There is specific potential for suppliers of NOx and VOC control equipment, CEM analysers and fugitive emissions monitoring equipment.

Remediation of contaminated areas

The remediation of contaminated areas was estimated to be worth US\$100-200 million in 2004 (if including direct and non direct services, equipment and laboratory products), a 20 per cent increase from 2003. There are 30 companies in Brazil providing remediation services as reported by the US Commercial Service in 2005.

The scale of remediation of contaminated lands has been limited to date. There are no funding mechanisms from the government for the remediation of contaminated land. However, there is some interest from the private sector as firms are increasingly prepared to pay for the cost of the decontamination process.

In Sao Paulo state alone there are 2,272 contaminated sites identified by CETESB – the state Environment Agency. The non profit organisation Ekos argues that there are 30,000 potentially contaminated sites in Sao Paulo state (US Commercial Service, 2005). Seventy seven per cent of the contaminated sites in Sao Paulo are a result of pollution from petrol stations and there is some local expertise in remediation of this type. There is also a particular issue of contamination related to the production of ethanol, caused by the use of fertilisers on the sugar cane plantations.

Although there is currently no legislation on land remediation in Brazil, opportunities in the sector are available and will become greater in the future. There is opportunity here for overseas businesses to demonstrate their expertise and efficiency in project management, monitoring strategies and providing cost effective solutions.

Source: SQW from various sources

3: The market for carbon abatement technologies, renewable energy and carbon finance in Brazil

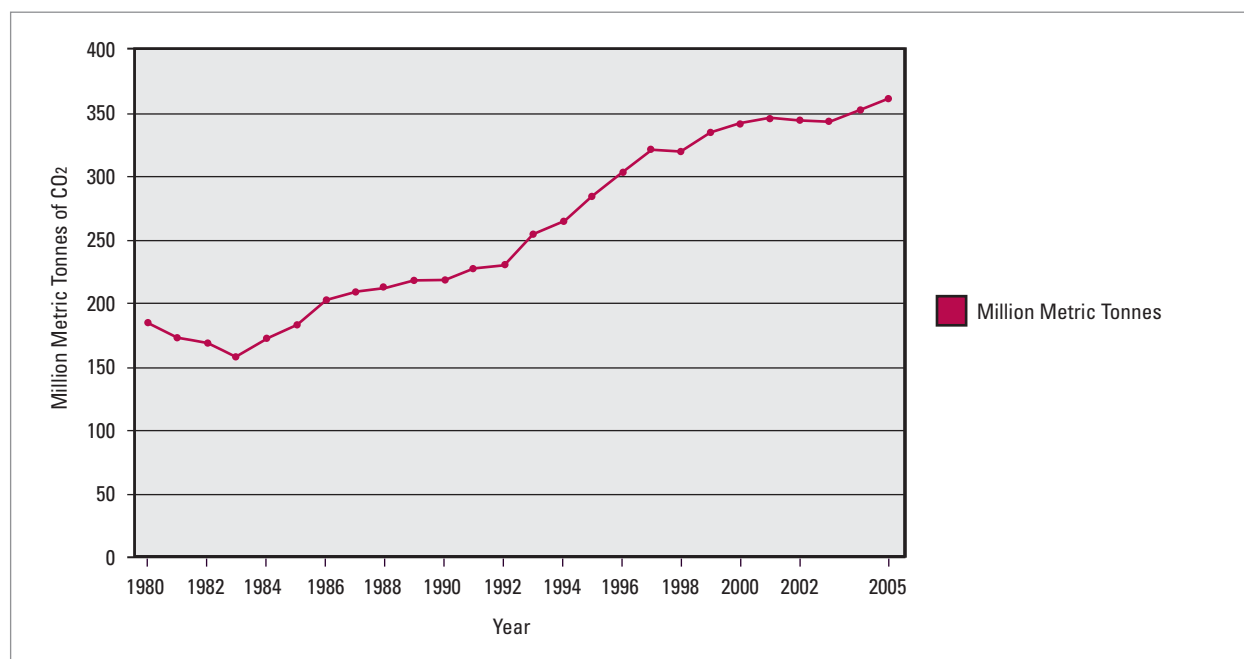
This section summarises the readily available evidence on the market for carbon abatement technologies (CATs), renewable energy and carbon financing in Brazil. It describes the general growth in the sectors and its drivers and presents information on those segments within the sectors where there are significant opportunities.

Market growth and its drivers

Growth

- 3.1 Total energy consumption in Brazil in 2000 was 142,078 Ktoe (thousand metric tonnes oil equivalent). This is a 128 per cent increase from 1980 consumption levels and is a much greater increase than the world average of 37 per cent from 1980–2000. In 2004, 48 per cent of Brazil's total energy consumption was from oil, 35 per cent from hydroelectricity, 7 per cent from natural gas, 5 per cent from coal, 2 per cent from other renewables and 1 per cent from nuclear.
- 3.2 The electricity market alone is expected to grow by 4.5 per cent annually until 2010 and will require annual investment of US\$34 billion. Provision of electricity does not extend fully across the country; currently approximately 12 million people in Brazil lack formal access to electricity.
- 3.3 The level of fossil fuel consumption in Brazil is relatively low due to a significant effort to develop low carbon fuels. Electricity sources in the country are primarily from non carbon based sources. In 2004, 387 terawatt hours (TWh) of electricity were generated in Brazil of which 83 per cent was hydro power. The remaining sources are conventional thermal, nuclear and renewables (mainly wind and biomass). Brazil only utilises a quarter of its 1,268 TWh/year hydroelectric potential.
- 3.4 Total oil production in 2006 was 2.2 million barrels a day and is dominated by one state controlled company Petrobras which, until 1997, was a monopoly. The government has opened up the sector to competition but Petrobras still dominates with control over 95 per cent of the crude oil production in the country.
- 3.5 Brazil's energy market is exceptional as it is largely sustained with alternative energy sources in particular hydroelectric power and ethanol. Brazil is the world's leading producer of ethanol and produces approximately 13 billion litres a year, which is 54 per cent of the world's total production.
- 3.6 There has been a growth in demand for natural gas by 154 per cent from 2000–2006. The government want to increase natural gas from 9.4 per cent of the energy matrix to 13.4 per cent by 2010. Natural gas imports are mainly from Bolivia, a dependency which the government wants to reduce. There have been recent discoveries of gas in several locations in Brazil and Petrobras plans to invest US\$6.7 billion in the pipeline network.
- 3.7 Levels of CO₂ emissions in Brazil have been increasing despite the development of low carbon fuels. The fastest growing industries in Brazil are also the most emission intensive ones. According to the UN Statistics Division, Brazil produced 331.79 mio tonnes of CO₂ (MtCO₂) in 2004, which was a 58.2 per cent increase since 1990. The sector with the highest emissions is transport, responsible for 90 per cent of total emissions. The production and use of ethanol has led to a reduction of carbon dioxide, as well as sulphur, particulates and aldehydes.

Figure 3-1: CO₂ emissions in metric tonnes from 1980-2005



Source: EIA (2008) Brazil Energy Profile

Drivers

- 3.8 Rapid industrialisation, urbanisation and a growing population are leading to increases in the consumption of energy and increases in emissions.
- 3.9 The Brazilian government has made a significant effort to promote the production of renewable energy and to reduce levels of waste. It has introduced several initiatives to support this. In 1975, as a response to international oil shocks the Government set up a National Alcohol Programme called Proalcohol. It encouraged the production of ethanol from sugar cane for use in automobiles. Ethanol production has a dual advantage of both reducing the amount of CO₂ emissions and consuming much less energy than it produces. From 1975-2000 approximately 5.6 million vehicles were manufactured that run on hydrated alcohol. The government has further encouraged the development of renewable energy through the introduction of incentives. For example small hydro firms are exempt from paying ‘royalties’ to the state.
- 3.10 Although Brazil is already a leader in the production of non-carbon based fuels, it is currently seeking out further alternatives. In 2001, the country faced an energy crisis. In response to the crisis the government set up a programme supporting the development of alternative fuels called the Programme of Incentives for Alternative Electricity Sources, commonly known as PROINFA. This has created investment opportunities in the energy sector. The government also adopted energy rationing. They introduced the National Electrical Energy Conservation Programme, and the National Programme for the Rational Use of Natural Gas and Oil products.
- 3.11 The electrical energy sector has undergone significant changes in recent years, with restructuring and privatisation and a new regulatory framework. In order to jumpstart new power generation projects in Brazil, an Electricity Law has been introduced. This encourages investments in new power production capacity by providing for auctions for the purchase of electricity from existing plants which have significant sunk losses, and auctions for the purchase of electricity from new plants.

Market segments

Carbon abatement technologies

OPPORTUNITIES IN CARBON ABATEMENT TECHNOLOGIES, RENEWABLE ENERGY AND CARBON FINANCE IN BRAZIL

Carbon capture and storage

There have been some early moves towards the adoption of carbon capture and storage (CCS) in Brazil but information on developments is limited at present. The country is a member of the Carbon Sequestration Leadership Forum (CSLF). CSLF is an international climate change initiative that works to promote and improve technology for carbon capture and storage. Capacity building workshops to help enable the development of CCS have taken place in Porto Alegre in the Rio Grande do Sul state in Brazil.

Petrobras, the major Brazilian government energy company, has teamed up with the Pontifical Catholic University to create the Energy and Carbon Storage Research Centre in Porto Alegre. Petrobras has proposed CCS projects in Recôncavo Basin, Campos Basin, Potiguar Basin, and Paraná Basin to be implemented until 2014. They aim for these projects to allow almost ten million tonnes of CO₂ to be avoided in emissions per year.

Low carbon fuels

Brazil is the world's leading producer of ethanol. The demand for the product is growing and it is estimated that US\$10 billion is required to be invested by 2012 to meet this demand. Seventy three new mills need to be built and 2.5 million hectares of sugar cane need to be planted.

The development of ethanol production emerged as a response to international oil shocks in the 1970s. The government introduced a national alcohol programme in 1975 which supports the production of hydrous ethanol for use in automobiles and the adding of anhydrous ethanol to gasoline. Since then approximately 5.6 million vehicles have been produced that run on hydrated alcohol.

The government continue to give incentives to private companies working in ethanol production. There is a shortage of equipment and a need for technological improvements. The industry is seeking to find new varieties of sugar cane, to use modern inputs and to use fewer chemical inputs in the production of the ethanol.

Source: SQW from various sources

Renewable energy

OPPORTUNITIES IN RENEWABLE ENERGY IN BRAZIL

Seeking alternatives

The federal government is actively promoting the use of alternative fuels due to the energy crisis in 2001. The Programme of Incentives for Alternative Electricity Sources (PROINFA) was set up in 2002 in response to the crisis. The programme encourages the development of hydroelectricity, wind power and biomass. The programme creates opportunities for renewable energy. However it also creates a difficulty for overseas companies because one of the rules of the programme is that 60 per cent of the equipment must be nationalised. A second stage of the PROINFA programme is expected to be introduced by the government. It is also expected that this second stage will not have this 60 per cent nationalisation rule. In addition to the PROINFA programme overseas companies have the option of selling directly to companies in Brazil.

Market opportunities exist in the development and provision of alternative energy sources including hydro electric power, wind power, tidal power and biomass. There is a need to develop all potential sources of energy supply to address constraints on and shortages in current energy capacity. The Brazilian authorities have already shown their willingness to back radical innovations in energy supply. This presents significant opportunities to those advisers and suppliers who can design and deliver practical and innovative solutions.

Hydroelectric power

Eighty three per cent of Brazil's electrical energy consumption is hydroelectric power. Brazil has an abundance of water resources including eight drainage basins, such as the Amazonas river basin, the Tocantins river basin and the South Atlantic basin. The capacity of the country to provide hydro power is enormous, for example the Amazonas alone has a potential of 105,550 MW of which only 0.5 per cent is being utilised. The government is supporting small hydroelectric plants through the PROINFA programme.

Wind

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. Wind energy is currently very expensive in Brazil due to a lack of competition. A kilowatt of energy produced by one wind generator can be charged at R\$2,000 (US\$ 1,150)³. Equipment is also very expensive for renewable energies due to the lack of competition. The government currently bids for renewable energy at unrealistically low prices leading to companies being unable to sell their energy. The Brazilian Association of Wind Energy is currently campaigning in parliament to make the government introduce more realistic bids.

Brazil is developing wind power but does not yet have adequate technological capacity. There is a demand for low cost equipment and there is also a need for consulting and project design for wind power.

Ocean

The use of tidal power is just emerging in Brazil. There is a pilot project taking place in the northeast state of Ceara. This project is funded by the company Eletrobras and by the Ceara state. Other companies including Petrobras are considering developing tidal power.

There are currently pilots for tidal power being developed in Brazil. This presents opportunities for overseas companies with the appropriate consultancy and equipment supply capacity.

Waste to energy

There is growing interest from the government in waste to energy. There are projects being developed by local agricultural producers that are being supported by the Clean Development Mechanism (CDM) to produce energy from animal waste. Equipment for this is required by the producers. They do not have local control equipment.

Other innovative approaches have been developed. Sugar cane left over from the production of ethanol is being used as biomass to fuel further production of ethanol in a self sustaining process. Monitoring equipment is needed for this.

There are major opportunities in this sector including equipment as well as engineering and consultancy services

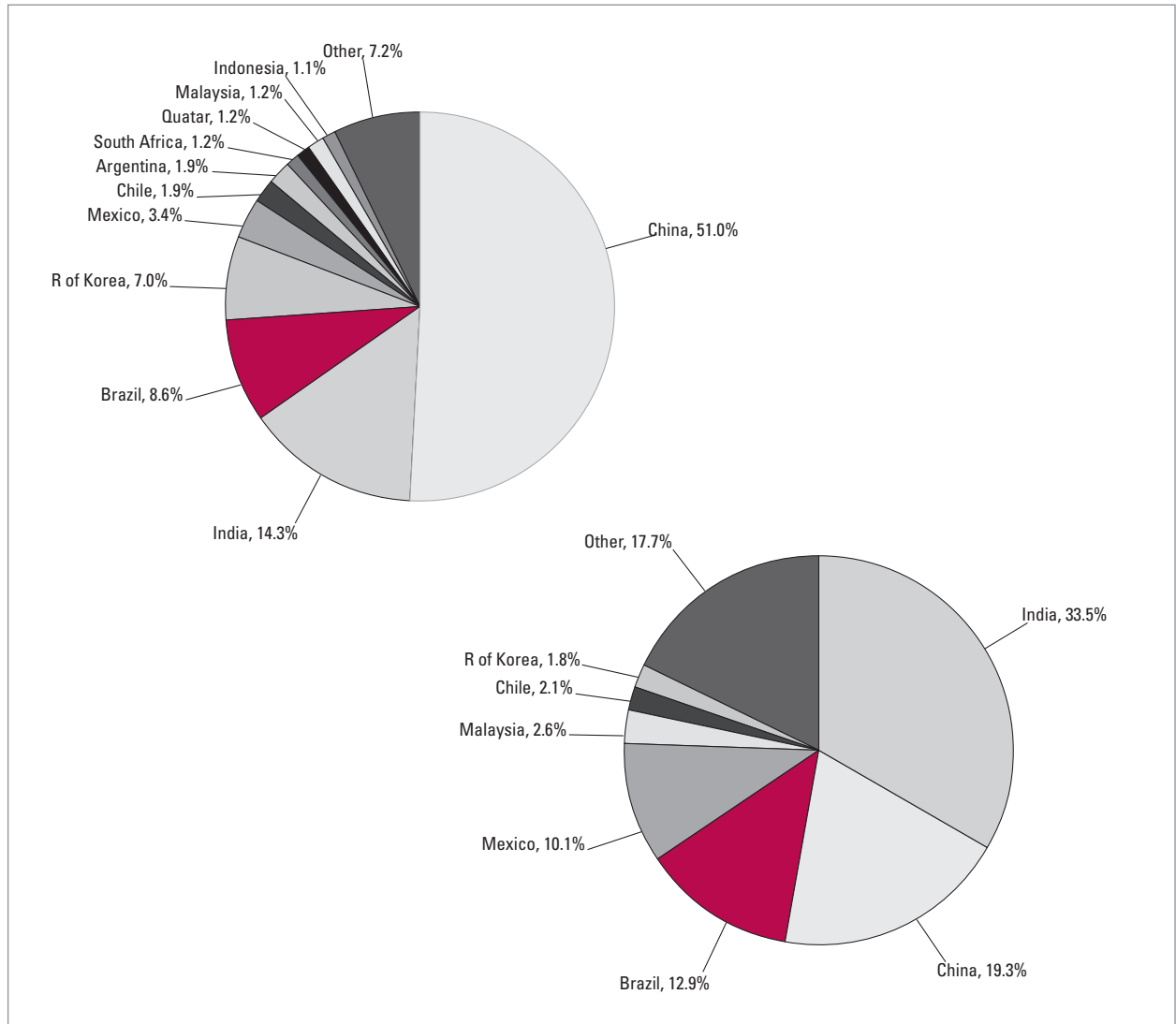
Source: SQW from various sources

Carbon finance

- 3.12 Brazil is closely involved in the Clean Development Mechanism (CDM) of the Kyoto Protocol. It has the third largest expected average annual Certified Emission Reductions (CERs) from registered projects at 9.2 per cent and also has the third largest total number of registered project activities out of the CDM host countries at 12.9 per cent (Figure 3-2 opposite).
- 3.13 The Brazilian National Development Bank (BNDES) has created a specific fund for CDM projects. Brazil has had a significant role in developing the Clean Development Mechanism and is recognised by the Inter-ministerial Commission on Climate Change as a leading host country for CDM projects.
- 3.14 A detailed list of registered CDM projects in Brazil, including technology type and project scale can be found at <http://cdm.unfccc.int/Projects/index.html>
- 3.15 As a host country Brazil has a framework which outlines the requirements for a project to be accepted as a CDM. The priority indicators that CDM projects in Brazil must achieve are set out below:
 - Contribution to the Mitigation of Global Climate change
 - Contribution to Local Environment Sustainability
 - Contribution to Net Employment Generation
 - Contribution to Sustainability of the Balance of Payments
 - Contribution to Macroeconomic Sustainability
 - Cost Effectiveness
 - Contribution to Technological Self Reliance

³ Exchange rates are valid as of 08/09/2008. This approximates to 1 US Dollar = 1.73 Brazilian Real.

Figure 3-2: Brazil's share of global CDM activity by volume of CERs (top) and number of projects (bottom), April 2008



Source: UNFCCC (April 2008)

4: Policy and regulatory frameworks

This section describes: a) the policy and regulatory regime as it relates to the treatment of importers, inward investment and joint ventures with overseas suppliers; b) the extent to which environmental policies and regulation have become more demanding – and the nature of the requirements; and c) the governance institutions responsible for trade, investment and environmental policy and regulation.

Trade and investment policies and routes to entry

- 4.1 Brazil has undergone significant economic reforms over the past two decades. It has introduced economic stabilisation plans which has reduced inflation. It has introduced trade liberalisation plans, reducing import tariffs. It has also taken steps towards privatisation.

TRADE AND INVESTMENT POLICIES IN BRAZIL

Trade

Brazil has been vulnerable to international shocks due to a high dependency on external finance. However, in recent years it has carried out many actions to help stabilise the economy. It introduced an economic stabilisation programme which has reduced inflation. It has also carried out fiscal reforms including introducing a Fiscal Responsibility Law limiting the amount of spending by the government and it has made reforms of the tax code and public pensions. These changes have built up international investor confidence. On 30 April 2008 Brazil's foreign currency sovereign rating was raised from 'BBB-' to 'BB+' and its long term local currency sovereign credit from 'BBB' to investment grade 'BBB+' by 'Standard and Poor'.

Brazil has undergone a transformation through trade liberalisation. In 1995 an amendment was made to the 1988 Federal constitution which removed foreign investment restrictions to a number of sectors. There have been significant changes to the level of import tariffs. They have been dramatically reduced from over 40 per cent down to approximately 14 per cent opening up opportunities for international trade. However taxation remains high. It is possible to request for specific reductions in tax but this is analysed on a case by case basis. Brazil signed a joint agreement with the UK in 2006 called JETCO to increase bilateral trade.

Attempts have been made to promote privatisation and public private partnerships. However this is at an early stage. There was a government initiative in 1999 to privatise water companies but this initiative fell apart. At that time there had been overseas companies working in the Brazilian water market. At present there are five major states interested in water development and they are considering public private partnerships, but the majority of state companies are under resourced in comparison.

Foreign direct investment

Foreign investment in environmental technologies in Brazil was estimated at approximately US\$3 billion in 2002 by the Brazilian-German Chamber of Commerce. Total FDI inflows in the country in 2000 amounted to US\$33 billion. In 2000 Brazil was the third highest destination for FDI in the world according to the A.T. Kearney FDI Confidence Index 2000. FDI has been high in response to the trade liberalisation and privatisation processes which have been taking place in the country.

Source: SQW from various sources

- 4.2 Opportunities through public procurement have been increased with the introduction of a number of programmes to encourage environmental goods and services and the production of energy and alternative fuels. Where there is limited public sector procurement, UK companies can look to private sector companies that are seeking to invest in new technologies.
- 4.3 Joint ventures are common in Brazil and are often set up in order to compete in the government public procurement market or in regulated markets. Foreign firms use local representation to enable them to compete for contracts issued by the government. There are no discriminatory restrictions for customary import channels. Brazil has not signed the plurality agreement of government procurement of the WHO so may not use the same procedures as developed countries.
- 4.4 Brazil is a member of the Southern Common Market (MERCOSUR), within which there are no import duties. The country is keen to develop trade within this market. Member countries apply a common external tariff that can range from 2-20 per cent. The UK and Brazil have signed a joint agreement called the Joint Economic and Trade Committee Agreement (JETCO) to increase bilateral trade.
- 4.5 Despite new opportunities in Brazil there are some issues that require consideration. There are still many problems with private sector provision of services, including political groups that oppose privatisation. A number of states have not yet granted concessions to private companies to run their services such as water supply. There are still issues of corruption and bureaucracy; however the Brazilian Procurement Law introduced in 1993 has been adjusted over time to address these issues.

Environmental regulation and policies

- 4.6 Since the 1980s Brazil has developed a range of regulations and policies relating to the environment. The turning point was in 1988 when the right to a healthy environment was added to the Brazilian constitution. The government has gone to significant lengths to support the protection of the environment, developing alternative forms of energy and improving energy efficiency.
- 4.7 The country has strong environmental legislation compared to other emerging markets. However there is a lack of enforcement of this legislation due to the human and financial costs of doing so. There is currently new legislation being developed for the construction sector which will have an impact on the EGS market; there is also environmental legislation being developed in waste and hazardous waste.

ENVIRONMENTAL REGULATIONS AND POLICIES

Renewable energy

Proalcool – National Alcohol Programme – promotes the production of ethanol for use by automobiles as an alternative to gasoline.

PROINFA – Programme of Incentives for Alternative Electricity Sources - a programme started in 2002 promotes the use of alternative sources of energy.

Brazilian Energy Initiative – In 2002 Brazil held the World Summit on Sustainable Energy and introduced the Brazilian Energy Initiative. This is an initiative to increase the share of renewable resources to at least 5 per cent of energy use in all countries in the world.

National Water Resources Policy – this policy was introduced to improve management of water resources for example encouraging the multiple use of water.

Environmental Laws and Policies

In 1998 the Environmental Crimes Law was introduced, which was designed to strengthen control on environmental crime. It imposes heavy fines on polluters and possible imprisonment of repeat offenders. However poor co-ordination of environmental agencies has meant enforcement of this law has been inadequate.

The leading financial organisation of Brazil BNDES has taken a stand on environmental issues. It has signed up to the United National Environment Programme and all projects that it funds are subjected to environmental impact assessment.

PRONAR – National Programme for Air Quality Control.

PROCONVE – Control Programme for Air Pollution from Automotive Vehicles.

PRODES – The Project for Gross Deforestation Assessment – an ambitious programme based in the Amazonia using satellite imagery.

PROARCO – Programme for the Prevention and Control of Burning and Forest Fires.

Energy Efficiency

Energy conservation programmes have been introduced in Brazil in response to the international oil shocks in the 1970s. In the 1980s the Programme 'Conserve', the National Electrical Energy Conservation Programme, and the National Programme for the Rational Use of Natural Gas and Oil products were introduced with the purpose of reducing levels of waste.

CONPET – National Programme for the Rational Use of Natural Gas and Oil Products.

Source: SQW from various sources

Key institutions

KEY GOVERNMENT DEPARTMENTS AND AGENCIES INVOLVED IN TRADE, INVESTMENT AND THE ENVIRONMENT

The **Inter-ministerial Commission for Sustainable Development (CIDES)** was set up in 1994 in order to advise the federal government on environmental policy.

The **Brazilian Institute for Environment and Natural Renewable Resources (IBAMA)** is Brazil's national environmental protection agency. The IBAMA has increased its control on environmental issues in recent years with the introduction of the 1998 Environmental Crimes Law.

Companhia de Tecnologia de Saneamento Ambiental (CETESB) is a state environment agency which is one of the main sources of state funding for the environment sector.

The **National Environment Council (CONAMA)** is the legislation body under the Ministry of the Environment. CONAMA comprises of representatives of all states, the private and voluntary sectors.

The **Ministry of Development, Industry and Foreign Trade** is responsible for developing policy on industry, commerce and services, and foreign trade. It is also responsible for co-ordinating and implementing programmes to promote foreign trade.

The **Brazilian Trade and Investment Promotion Agency** was set up in 1997 in order to co-ordinate and implement trade promotion policies, and expand the presence of Brazilian companies in the world market.

Source: SQW Consulting

Annex A: Definitions of environmental and low carbon technologies, goods and services

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
Remediation and Reclamation of Land	Defined as products, systems and services for the identification, assessment and remediation/reclamation of land and buildings, including prevention of contaminant dispersal	Absorbents and injection equipment, monitoring systems and proprietary treatment processes and sampling/analysis and site investigation/engineering
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: <ul style="list-style-type: none"> • 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 consumed 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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	Defines 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

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