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Guidelines

on climate change and corporate social responsibility

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This book of guidelines forms part of a series of publications developed jointly by the United Nations Industrial Development Organization (UNIDO) and the China Society for Promotion of the Guangcai Programme (CSPGP). It aims to strengthen the awareness of Chinese enterprises on issues surrounding climate change, the options that are readily available to mitigate it, and the opportunities that Chinese enterprises could access by adopting appropriate energy efficiency and other greenhouse gas emissions reduction solutions under the framework of the United Nations Global Compact and its Caring for Climate initiative.

Other titles in the series currently include:

- Climate change investment and financing guide for Chinese enterprises
- Best practice guide on energy efficiency and greenhouse gas emission mitigation for Chinese enterprises

UNDP—Spain Millennium Development Goal Achievement Fund
China Climate Change Partnership Framework
United Nations Business Climate Change Partnership—A Business Partnership for Sustainability

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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Foreword

Climate change is perhaps the defining issue facing the global community today. If left unchecked it has the potential to present humanity with disastrous consequences in terms of negative social impacts, significant economic losses and extreme global environmental degradation.

China has arguably always been one of the main focus countries when considering the role of developing countries in regard to climate change due to China's high energy demand and consumption, combined with the fact that most of its energy is derived from coal. This situation has resulted in China becoming the world's largest emitter of carbon dioxide although, in terms of per capita emissions, China ranks ninety-fifth in the world.

China is also a country which is at high risk in terms of the future physical impacts that will likely result from climate change. China's particular vulnerability to the impacts of climate change results from a number of environmental, social and economic factors. In light of this fact the Government of the People's Republic of China has released a series of laws, instructions and initiatives in order to address climate change through the promotion of increased industrial energy efficiency, and cleaner energy production and utilization.

Industry is one of the most important sectors to consider in regard to climate change mitigation as it is directly responsible for approximately one third of global energy consumption and 36 per cent of global greenhouse gas (GHG) emissions. Over the past 20-30 years or so, much of the industrial growth and hence growth in industrial energy demand has been in emerging economies. China alone accounts for about 80 per cent of the growth in industrial energy usage in the past 25 years. Therefore, industry and business in general must be properly engaged, incentivized, and assisted, where necessary, to adopt new low-carbon technologies and production methods.

Climate change and the international policies and regulations that are likely form part of the eventual overall response to mitigate it will impact Chinese industry and business, both domestically and within the international market place. UNIDO hopes these guidelines on climate change and corporate social responsibility can assist Chinese enterprises, both large and small, to better prepare for the challenges and responsibilities that climate change and its mitigation policies will bring about.

Edward Clarence-Smith
Representative and Head of UNIDO's Regional Office China.

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Executive summary

Climate change has become the defining challenge of our time, given its broad implications on socio-economic development, poverty alleviation, the environment, global security and global society in general. Industry and business play a critical role with regard to climate change, accounting for approximately one third of the world's energy consumption and 36 per cent of carbon dioxide (CO_2) emissions. Therefore, industry and the global business community have a responsibility to join national and international efforts to lower their greenhouse gas (GHG) emissions. Although GHG mitigation measures will alter business-as-usual scenarios, there are significant potentials for flexible companies to lead innovation, reduce long-term production costs and capture an increased market share in a future carbon-constrained global economy.

The United Nations Industrial Development Organization (UNIDO), the United Nations Development Programme (UNDP) and the China Society for Promotion of the Guangcai Programme (CSPGP) have initiated the United Nations-Business Climate Change Partnership. This project forms a part of the UNDP-Spain Millennium Development Goal Fund (MDG-F) funded China Climate Change Partnership Framework (CCPF) programme and aims to increase climate change awareness and foster corporate social responsibility (CSR) amongst private Chinese businesses, through the provision of best-practice GHG emissions mitigation options and methodologies. Ultimately, this partnership project aims to support international efforts to encourage the active involvement of all levels of industry and business in the global response to climate change under the framework of the United Nations Global Compact.

The United Nations Global Compact is a voluntary participation corporate policy initiative under which committed businesses can align their operations and strategies with 10 universally accepted principles in the areas of human rights, labour standards, environment protection/sustainability, and anti-corruption. These guidelines on climate change and corporate social responsibility aim to provide a practical guide on climate change issues related to Chinese enterprises. This publication describes the business challenges and opportunities associated with climate change; the relevant government laws, policies and initiatives; as well as the enterprise benefits associated with CSR and participation in the United Nations Global Compact and its Caring for Climate initiative as a possible framework within which companies can design and operationalize their environmental CSR and climate change mitigation activities.

Part I. Background to climate change

These guidelines begin by looking at the issue of climate change; firstly by examining the science of anthropogenic climate change and its contributing factors before moving to highlight the potential impacts climate change could have on human society and China in particular. This is followed by a discussion on the policy response to climate change both at the international level and at the Chinese national level.

Introduction to climate change

1. *The science of anthropogenic climate change*—The international scientific community has reached a clear consensus regarding the science of climate change and its effects. In 2007, the

Intergovernmental Panel on Climate Change (IPCC) concluded that "warming of the climate system is unequivocal", and that there is a greater than 90 per cent probability that the warming observed since the mid-20th century has predominantly been caused by human activity. This is demonstrated by increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea levels.

2. *The human impact of climate change*—Climate change is intricately linked to human development through its potential impact on the environment, global security and poverty alleviation. A global increase in temperatures between 1.1° C and 6.4° C by 2100 will have serious and potentially devastating consequences for the world, including rising sea levels, changes in precipitation patterns, and threats to biodiversity.

3. *China's growing contribution to climate change*—The Chinese Government regards climate change mitigation as a national priority. China has already become, and will continue to be, one of the most important players in the field of global climate change, and its mitigation. Although China has a population of over 1.3 billion people, CO_2 emissions per person are relatively low and as scientists have pointed out that in the period before 2002, when over 90 per cent of human carbon emissions were released, China accounted for only 7 per cent of the global total. However, due to China's rapidly growing economy over the last two decades national energy demand has been increasing rapidly. The portion of total annual global GHG emissions that China is responsible for has now reached over 24 per cent—and this portion continues to grow. In 2006, China surpassed the United States to become the world's largest aggregate emitter of carbon dioxide.

The global climate change response

4. *United Nations Framework Convention on Climate Change*—Intergovernmental climate change action can be traced to the Rio Earth Summit in 1992 with the signing of the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC establishes the common international objective of stabilizing atmospheric concentrations of GHGs at a level that will "prevent dangerous anthropogenic [human] interference with the climate system."

5. *The Kyoto Protocol*—The Kyoto Protocol commits the world's developed countries (except the United States, which did not ratify the protocol) to reduce average emissions of GHGs by 5.2 per cent below 1990 levels by 2008–2012. The Protocol provides parties with the flexibility to meet reductions cost-effectively, setting out key provisions for three market-based mechanisms: international emissions trading; Joint Implementation; and the Clean Development Mechanism. The Kyoto Protocol was internationally endorsed in 1997 and came into force in February 2005, 90 days after Russia's ratification.

6. *Environmentally focused corporate social responsibility (CSR)*—CSR is essentially a form of self-regulation which is increasingly being adopted and promoted by numerous industrial and manufacturing companies across a wide-range of sectors worldwide. Effectively, CSR is where business itself voluntarily adopts corporate policies that institutionalize better standards of operation, sectoral best-practices and publicly reporting against clearly defined sustainability and social development criteria. The issues which drive and are covered by CSR are often

varied, complex and constantly evolving but typically include issues that relate to human rights, good labour practices, limiting environmental impacts and damage resulting from company operations, increasing access to basic services and products as well as establish partnerships for socio-economic development and environmental protection.

7. *The United Nations Global Compact*—The United Nations Global Compact is a corporate policy initiative for businesses committed to aligning their operations and strategies with 10 universally accepted principles in the areas of human rights, labour standards, environmental protection/sustainability, and anti-corruption. Through voluntary participation, business participants commit themselves to enacting these core principles, by taking collective corporate action on social and environmental issues. Formally launched in 2000, the United Nations Global Compact now includes over 7,700 corporate participants, from over 130 countries. The United Nations Global Compact has been strengthened and expanded with the addition of the Caring for Climate initiative. This initiative provides a platform for business and governments at the global level to promote practical climate change solutions and better help in the shaping of public policy. When endorsing the initiative, companies pledge their commitment to reducing their enterprise's GHG emissions and publishing their yearly GHG emissions, thereby demonstrating leadership on the issue of climate change. The project, under which this publication has been produced, promotes the United Nations Global Compact as a potential framework with which companies can develop, operationalize and publicize their climate change mitigation CSR actions.

8. *China's response to climate change*—The Chinese Government has actively accepted its role in addressing climate change, based on the international principle of common but differentiated responsibilities, by linking climate mitigation and sustainable development strategies. The Chinese Government's eleventh Five-Year Plan (the Plan) particularly emphasized the need for GHG emissions reductions, stating that the Government will "make every effort in succeeding to control greenhouse gases", marking a major shift in the strategic policy of the Chinese Government. In June 2007, the Government announced that China would be focusing its efforts on cutting energy use in energy-intensive industries, such as the steel and non-ferrous metals industries, construction materials industries, and the chemical processing industries. Over the past few years the Government has released a series of laws, instructions and initiatives in order to address climate change and to promote increased industrial energy efficiency, and cleaner energy production and utilization. These policies and standards provide a clear direction for Chinese enterprises to pursue in relation to energy conservation and emissions reductions, defining specific public, private and third sector responsibilities regarding climate change mitigation.

Part II. The economic impacts of climate change and business in China

Part two of these guidelines begins by discussing the potential threats and opportunities that climate change and its possible mitigation policies presents to the industrial, manufacturing and business community with a special focus on Chinese enterprises. The section then moves on to present practical options, both managerial and technical, for enterprises to consider when thinking about addressing their GHG emissions. The section closes by discussing potential possibilities for securing financing to undertake energy efficiency and GHG emissions reduction investments.

Challenges arising from climate change

The 2006 Stern Review on the Economics of Climate Change, determined that if no action is taken to control GHG emissions, "the overall costs and risks… will be equivalent to losing at least five per cent of global GDP each year, now and forever." The review noted that delays in cutting emissions would increase the risk of more severe climate change impacts, dramatically increase the cost of dealing with climate-related damages, and potentially reduce global GDP by 5-20 per cent per annum. Although the impacts will vary, businesses in all sectors are likely to be affected both by climate change itself and the policies enacted to address it. However, the transition to a low-carbon economy does not mean a decline in living standards, but rather the furthering of sustainable development through low-carbon intensities and higher productivity. Enterprises are awakening to the fact that significant opportunity lies in the continued growth of emerging low-carbon economies. Climate change will potentially impact business in some of the following ways:

1. *Cost and availability of inputs*—Without mitigation, climate change will most likely lead to increased heat waves, heavy precipitation, increases in the intensity and frequency of tropical cyclones. This will in turn lead to decreased agricultural yields, while at the same time the possible slowing of the meridional overturning circulation (MOC) of the Atlantic Ocean and the melting of the Greenland Ice Sheet will transform ocean currents affecting fishery resources vulnerable to depletion as a result of these changes in ocean temperature and currents. Due to these impacts on natural resources, climate change will likely affect the supply of raw materials for a significant number of operations in value-added industries.

2. *Government responses*—Businesses must begin considering how future climate change regulatory requirements will impact their operations. Firms that will prosper in a carbon-constrained world will tend to be those that foresee potential implications for their industry and take appropriate adaptation and risk minimization steps well in advance.

3. *Stakeholder pressures*—In addition to government regulation, businesses will face requirements from stakeholders, forcing a re-imagining of production, management, sales and marketing strategies. Stakeholders include shareholders (investors), government managers, consumers, non-governmental organizations and businesses in upstream and downstream supply chain markets.

Opportunities arising from climate change

4. *Early investment in clean energy*—Given the need to mitigate climate change coupled with rising energy costs, the support for energy conservation and emissions reductions as well as demand for energy-efficient technologies and products, provide commercial opportunities for enterprises at the forefront of innovation. In China, several categories of clean renewable and non-renewable alternative energy technologies currently hold a great deal of commercial potential for Chinese businesses.

5. *Energy efficiency products and services*—Public concern related to carbon-intensive production is causing consumers to increasingly demand goods that are climate friendly. Such concerns will go a long way to promoting the development and application of energy-efficient products and technologies by putting upwards pressure on demand, and therefore revenue. In addition, the Chinese Government under its Green Procurement Policy is taking action to support

companies that produce energy efficient equipment and appliances by committing all government agencies to purchase environmentally sound products.

6. *The Clean Development Mechanism (CDM)*—The Kyoto Protocol under the United Nations Framework Convention on Climate Change (UNFCCC) has established a framework for international cooperation in low-carbon technology transfer. One of these mechanisms is the Clean Development Mechanism (CDM) which is an instrument that effectively enables developed countries to voluntarily support developing countries in emissions reduction projects by providing financial and technical assistance to developing countries.

7. *Enhancing corporate social responsibility (CSR)*—Corporate social responsibility initiatives are corporate policies that aim to improve and promote business ethics, occupational health and safety, workers, fundamental rights, protection of vulnerable groups in society and, particularly in recent years, environmental sustainability projects often with a focus on improving energy efficiency and achieving GHG emission reductions.

Practical steps for GHG emissions reduction

8. *Environmental Performance Assessments (EPAs)*—Environmental Performance Assessment (EPA) are designed to identify non-compliance with environmental performance standards within an organizational structure. Also known as Environmental Performance Evaluations (EPE), EPAs are a formal process of measuring, analyzing, reporting and communicating an organization's environmental performance against criteria set by its management. Increasingly, GHG accounting methodologies and mechanisms are being made available to assist enterprises in determining the environmental and climate impact.

9. *Management practices*—Management commitment and understanding is crucial if an enterprise is going to be successful in reducing its energy consumption and GHG emissions. The structures that management puts in place to firstly determine potential options and initiatives are also vital and there are a number of generally accepted steps that an enterprise can consider. Enterprise energy management, as a distinct area of focus, can be a particularly viable mechanism with which a company can realize substantial savings in energy and operational costs. Increasingly, energy management is becoming a topic which will receive formal standardization—namely in the form of the International Organization for Standardization's (ISO) coming ISO: 50001 Energy Management Standard.

10. *Power technology options*—Enterprise electricity consumption-related GHG emissions in China are considered to be relatively high as China's electricity system is dominated by coal-based generation and the fact that currently, Chinese coal-fired plants are based on models that are inefficient by international standards. Enterprises can often reduce their electricity-related GHG emissions and their energy bills, through on-site power generation using more energy-efficient, renewable and other climate-friendly electricity generation methods.

11. *Supply chain carbon management*—Chinese businesses that depend on carbon intensive up and down stream production inputs and service provision need to take into account the impact that such arrangements have on a product's embedded energy and carbon content when considering relevant GHG emission reduction CSR strategies.

International financing for climate change

12. *China's position on climate cooperation*—China's position in regard climate change mitigation remains based on the principle of common but differentiated responsibilities, the importance of knowledge and skill sharing between the developed and developing countries. Increasingly China itself is becoming a source of funding and technical assistance in regard to climate change mitigation options as it is increasingly becoming a world leader in the production of environmentally friendly renewable energy technologies while at the same time expanding its role as a provider of donor funding to other developing countries.

13. *Sources of international finance*—While China is rapidly becoming a supplier of clean energy technology and a source of international funding to other developing countries, China itself is still a major recipient of international climate change donor funding assistance. This comes from both the public sector, either bi-laterally and multilaterally (e.g. GEF grants and developmental banking loans) as well as from the private sector in the form of CDM projects.

Part III. Case studies: green success stories within Chinese business

Part three of this publication presents a small number of case studies from major Chinese enterprises that have adopted GHG emission reductions and CSR strategies. These case studies seek to demonstrate the effectiveness of such strategies, and to provide solid examples of possible frameworks from within which business leaders can better understand and implement climate change mitigation strategies themselves.

1. Case study one: China National Offshore Oil Corporation (CNOOC)
Strategies for Environmental CSR and Carbon Management
Example: waste gas re-injection project at Luda Oil Field Refinery

2. Case study two: China National Materials Group Corporation
Strategies for environmental CSR and carbon management
Examples: Lafarge's Chongqing cogeneration plant and Taishan Fiberglass Company's cogeneration project

3. Case study three: Hanergy Holdings Group Company Ltd.
Strategies for environmental CSR and carbon management
Example: power generation at Rudong Wind Farm

Where to go from here

After studying the CSR information and different climate change mitigation options presented in this publication on climate change and corporate social responsibility, if you feel that your enterprise/company would like to further investigate the possibility of joining the United Nations Global Compact and its Caring for Climate initiative by implementing managerial and/or process changes in order to reduce your energy consumption and contribution to climate change, you should contact the following institutions. These institutions can arrange direct access to teams of qualified energy, environmental, and CSR experts, who can assist your enterprise to identify possible energy efficiency options within your company and develop robust energy management procedures. They will also assist your company in developing internal CSR policies, employing sectoral best practices

and preparing the materials required to join the United Nations Global Compact and successfully operationalize its principles.

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Should you feel that your company already has the technical and management capacity to successfully develop its own CSR and climate change mitigation internal policies, and the capability to put them into practice, the United Nations Global Compact still offers your company a robust and internationally respected framework within which to conduct your activities. Further information on the United Nations Global Compact and its application requirements and procedures can be found at:

www.globalcompact.org/languages/chinese/index.html

Introduction to climate change

The science of anthropogenic climate change

The international scientific community has reached a clear consensus regarding the science of climate change and its effects.[2] In 2007, the Intergovernmental Panel on Climate Change (IPCC) concluded that "warming of the climate system is unequivocal",[3] and that there is a greater than zero per cent probability that the warming observed since the mid-twentieth century has predominantly been caused by human activity.[4] This is demonstrated by increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea levels.[5] The latest predictions from the IPCC estimate that global temperatures will rise a further 1.2 ° C to 6.4 ° C during the twenty-first century.[6] This is likely lead to the continued rise of global sea levels; the retreat of glaciers and shifts in the amount and location of precipitation, therefore increasing the incidence of droughts and changes in agricultural yields. Likely secondary effects include amplification of the intensity of extreme weather events, species extinctions and an increase in vector borne diseases, such as malaria and dengue fever.

There are six principal greenhouse gases (GHGs) that contribute to climate change: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF_6). These gases differ in their ability to trap heat in the atmosphere. This global warming potential (GWP) is calculated using CO_2 as a baseline unit[7] and is used to compare the environmental impact of each gas. For example, the GWP of CF_4 is 21 times that of CO_2 and SF6 is 23,900 times as potent as CO_2. However, due to the sheer volume of CO_2 emissions from the combustion of fossil fuels (natural gas, oil, and coal), it can be argued that emissions of CO_2 are the main cause of the climate change effects that are beginning to be observed globally.

Electricity generation is one of the major sources of GHG emissions because it presently depends overwhelmingly on the burning of fossil fuels, which produces carbon dioxide. Fossil fuels burnt within internal combustion engines used to power vehicles are another major source of GHG emissions. Other significant sources of different GHG emissions include deforestation and forest fires (CH_4 and CO_2), agriculture (N_2O and CH_4), landfills (CH_4), air conditioning (HFCs) and electrical transmission and distribution (SF_6).

The human impact of climate change

Climate change is intricately linked to human development through its impact on the environment, global security and poverty alleviation. A global increase in temperatures of between 1.1° C and 6.4° C by 2100[8] will have serious consequences for the world including rising sea levels, changes

[2] IPCC, 2007: Summary for Policymakers. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S.D, Qin, M.Manning, Z.Chen, M.Marquis, K.B.Averyt, M.Tignor and H.L.Miller (eds.)] Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, p.5

[3] Ibid

[4] Ibid, p.3

[5] Ibid, p.5

[6] Ibid.

[7] A benchmark measurement with the value of 1.

[8] Ibid, p.13

in precipitation patterns and threats to biodiversity.[9] For example, long-term trends in precipitation from 1900 to 2005 already show significant increases in eastern areas of North and South America, Northern Europe and Central Asia, while drying has been observed in the Sahel, the Mediterranean, Southern Africa and parts of Southern Asia.[10] The frequency of heavy precipitation events (such as floods and storms) have also risen as a result of warming temperatures and increases in concentrations of atmospheric water vapour.[11]

The impacts of these kinds of changes will be felt particularly in coastal areas affected by rises in sea level, and in agricultural communities whose economic livelihoods may be impacted by more frequent flooding, or more severe instances of drought. Warming temperatures will increase storms and flooding in tropical areas, and consequently the infection rate and distribution of some diseases. Natural disasters and extreme weather will potentially have serious consequences for physical infrastructure and human resilience, particularly in developing countries. For example, in the wake of floods the ability of governments to provide adequate health services to meet the needs of affected populations can be seriously compromised. This was apparent during the months following the 2001 floods in Mozambique where, according to the IPCC, approximately 8,000 additional cases and 447 deaths from diarrhoeal disease were recorded.[12]

China's growing contribution to climate change

The Chinese Government regards climate change mitigation as a national priority. China has already become, and will continue to be, one of the most important players in the global climate change mitigation process.

Although China has a population of over 1.3 billion people, CO_2 emissions per person are relatively low, and scientists have pointed out that in the period before 2002, when over 90 per cent of human carbon emissions were released, China accounted for only 7 per cent of the global total, compared to 26 per cent and 29 per cent for the European Union and United States respectively. Since the turn of the century-however, China's economy has grown rapidly having experienced a 7-10 per cent annual increase in GDP over the last two decades. This economic expansion has been accompanied by a large increase in energy consumption, with China alone accounting for approximately 80 per cent of global growth in industrial energy use in the past 23 years.[13] The portion of present global emissions that China accounts for globally has now reached over 24 per cent of the annual total and this proportion continues to grow.[14] According to the Netherlands Environmental Assessment Agency, this has resulted in China surpassing the United States as the world's largest

[9] Ibid, p.5

[10] Ibid, p.7

[11] Ibid, p.8

[12] IPCC, 2007: Summary for Policymakers. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S.D, Qin, M.Manning, Z.Chen, M. Marquis, K.B.Averyt, M.Tignor and H.L.Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, p.399

[13] International Energy Agency (EIA), "Tracking industrial energy efficiency and CO_2 emissions", 2007
[See www.iea.org/textbase/nppdf/free/2007/tracking_emissions.pdf]

[14] Netherlands Environmental Assessment Agency (PBL) (Netherlands), "China contributing to two-thirds increase in CO_2 emissions" (2008/06/13)
[Accessed at www.pbl.nl/en/news/pressreleases/2008/20080613ChinacontributingtwothirdstoincreaseinCO2emissions.html]

aggregate emitter of carbon dioxide, having done so in 2006.[15] The 2006 Stern Review on the Economics of Climate Change, led by former Chief Economist of the World Bank Sir Nicholas Stern, has proposed a target of two metric tons of CO_2 per capita for all countries by 2050. Based on this standard, while China's carbon intensity[16] per person is barely above the world average, it is still far above where it needs to be by mid-century.

The increase in energy usage can be attributed to expanding industrial production and increased demand for goods and services whose manufacture and operation require energy. China is now ranked within the top two countries in the world in terms of overall primary energy consumption. Industry currently accounts for approximately 70 per cent of total energy use; to put this figure in perspective, China's industrial carbon emissions are greater than the total emissions from any country in the world except for the United States.[17] Coal continues to be the dominant energy source in China, with demand for oil also increasing sharply as car ownership rises. In addition, demand for natural gas is growing and has already surpassed China's own supply capacity.

Therefore, traditional paths of industrial development, based on heavy industry, high levels of energy consumption, inefficient production technology and high levels of pollution, are no longer sustainable in national and global environmental terms. As a developing country with a large population, a low-level of economic development and complex national climate conditions supporting fragile ecosystems, China is highly susceptible to the harmful impacts of climate change. At the same time, China is in the midst of an accelerated period of development, and is therefore faced with the task of managing a growing economy whilst balancing the imperatives of eliminating poverty and reducing GMG emissions. As heavy industry and associated resource use continue to increase, there is a clear imperative to alter this trajectory, in order to ensure that China achieves a sustainable and low-carbon path of economic growth.

The global climate change response

United Nations Framework Convention on Climate Change

Intergovernmental climate change action can be traced to the Rio Earth Summit convened in 1992 with the signing of the United Nations Framework Convention on Climate Change (UNFCCC).

The UNFCCC has 192 parties[18] and establishes the common international objective of stabilizing atmospheric concentrations of GHGs at a level that will "prevent dangerous anthropogenic [human] interference with the climate system".[19] Recognizing national variations in historical

[15] Netherlands Environmental Assessment Agency (PBL), "China now no.1 in CO_2 emissions, USA in second position" (2007/06/19) [Accessed at www.pbl.nl/en/news/pressreleases/2007/20070619Chinanowno1inCO2emissionsUSAinsecondposition.html]

[16] Carbon intensity refers to the carbon emitted for every unit of GDP.

[17] For example, in 2006 industrial CO_2 emissions in China were approximately 4, 272, 445 tones. In the same year, the United States was the only country with a higher level of total emissions, emitting 5, 753, 289 tones of CO_2. Carbon Dioxide Information Centre, see http://cdiac.ornl.gov/

[18] The term "parties" refers both "Contracting States" and "Parties". Contracting States are those States and entities with treaty-making capacity which have expressed their consent to be bound by a treaty but for which the treaty has not yet entered into force, whereas the treaty has already entered into force for "Parties". See the United Nations Treaty Collection Treaty Reference Guide: "Signatories and Parties", at http://untreaty.un.org/English/guide.asp#signatories

[19] Article 2, United Nations Framework Convention on Climate Change (UNFCCC), 1992 [See http://unfccc.int/essential_background/convention/background/items/1349.php]

contributions to climate change and in the capacity to address it, States have agreed to respect the principle of "common but differentiated responsibilities".[20] In keeping with that principle, developed countries, specifically Annex II countries,[21] have an obligation to assist developing countries to combat climate change by providing financial and technological support.[22] Developed countries, listed in Annex I of the Convention, have also agreed to nonbinding emissions reductions targets.[23] The terms Annex I and Annex II countries are the classifications given to countries under the Convention. The Annex I countries are comprised of the 40 industrialized countries and countries with economies in transition. Annex II countries are a sub-group of the Annex I countries comprised of the OECD member countries excluding those countries that had economies in transition in 1992 (namely countries in Eastern Europe). Annex II countries are supposed to pay mitigation costs for developing countries. Developing countries may volunteer to become Annex I countries when they feel that they are sufficiently developed to take on Annex I commitments.

The Kyoto Protocol

In 1995, recognizing that this voluntary target was an insufficient instrument with which to push forward long-term reductions, the Berlin Mandate was adopted, calling for the negotiation of binding targets for developed countries. Subsequent negotiations led to the adoption of the Kyoto Protocol, under which developed countries agreed to reduce average emissions of GHGs by 5.2 per cent below 1990 levels by 2008–2012 (the "first commitment period").[24] The Protocol provides parties with flexibility mechanisms to better meet reductions more cost-effectively, setting out key provisions for three market-based mechanisms: international emissions trading; Joint Implementation; and the Clean Development Mechanism. The Kyoto Protocol was internationally endorsed in 1997 and came into force in February 2005, 90 days after Russia's ratification of the treaty.

The document has now been ratified by 182 countries; however it has attracted considerable criticism for its failure to include all major GHG-emitting countries, most notably the United States, China and India. The 37 industrialized countries with binding targets under the Protocol account for 64 per cent of developed country emissions and approximately one third of global emissions. However, besides the United States, which has not ratified the Protocol, developing countries account for the remainder of global emissions. Without the commitment of large developing countries such as China and India, the capacity of the international community to lower global emissions will be severely hampered.

Meeting in Montreal in 2005, at the eleventh Conference of Parties (COP11/MOP1) the parties to the Kyoto Protocol and UNFCCC opened the negotiation process for a climate change agreement that will succeed the Kyoto Protocol when its first commitment period expires in 2012. This was followed with the adoption of the Bali Roadmap at the UNFCCC 13th Conference of Parties (COP13/MOP3) meeting held in Bali, Indonesia in 2007. The Bali Roadmap, in which the United States has participated, included the Bali Action Plan which envisages a number of

[20] Article 3(1) UNFCCC

[21] OECD members, excluding those that were economies in transition.

[22] See Article 4(3)-(10) UNFCCC

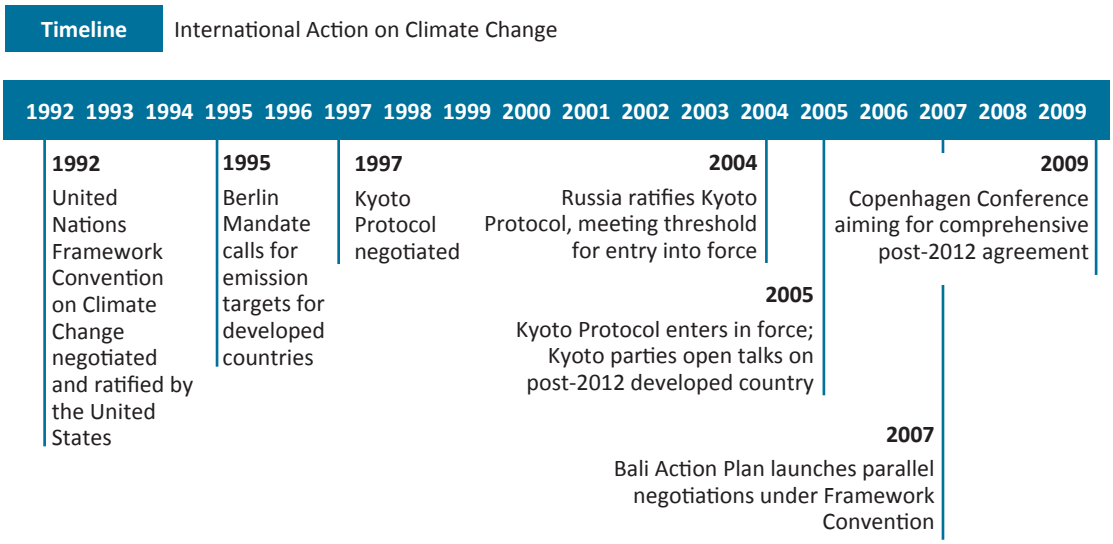
[23] The targets were a reduction of emissions to 1990 levels by the year 2000, either individually or as a group. See Article 4(2)*(a), (b)* UNFCCC

[24] UNFCCC Executive Secretary Yvo de Boer, opening day of the June Bonn talks, [Accessed at http://unfccc.int/meetings/sb30/items/4842.php]

commitments. Firstly, it aims to achieve "measurable, reportable, and verifiable" mitigation actions or commitments by developed countries.[25] In essence, it requires a global political commitment for States to implement domestic law and policy, creating tangible instruments for the reduction of carbon emissions by specified quantities through mechanisms, such as domestic carbon trading schemes and renewable energy targets. Secondly, developing countries are also asked to undertake mitigation actions, which are aimed at curbing the growth rate of emissions rather than returning to fixed historical baselines. Thirdly, it establishes the climate change Adaptation Fund. Lastly, an important agenda for all members of the negotiations has been the provision of support for developing countries in the form of technology transfer, financing, and capacity-building.

It is hoped that negotiations under both the Kyoto Protocol and the UNFCCC will converge in a new comprehensive post-2012 (post-Kyoto) agreement in the very near future. The previous UNFCCC Executive Secretary Yvo de Boer identified four political prerequisites in this regard:[26] *(a)* clarity on industrialized countries emission reduction commitments for 2020; *(b)* clarity regarding the means by which major developing countries will limit their own GHG emissions growth; *(c)* clarity on stable and predictable finance for climate change adaptation and mitigation; and *(d)* clarity regarding governance issues, particularly where finance and technology are concerned. While national positions differ, different negotiations have contributed to progress in regards to prerequisites *(a)* and *(b)*.[27] Currently, important debates are ongoing in regards to prerequisites *(c)* and *(d)*, particularly relating to capacity-building[28] and a proposed review of the supporting financial mechanisms.[29] Figure 1 shows the timeline of the different milestones reached in regard to international action on climate change.

Figure 1. International climate change milestones



[25] United Nations Development Programme (UNDP), Bali Action Plan: Key Issues in the Climate Negotiations—Summary for Policy Makers, Environment and Energy Group, September 2008, p.3 [accessed at www.undp.org/climatechange/docs/UNDP_BAP_Summary.pdf]

[26] Ibid.

[27] Ibid.

[28] See http://unfccc.int/cooperation_and_support/capacity_building/items/1033.php

[29] See http://unfccc.int/cooperation_support/financial_mechanism/review/items/3658.php

Corporate social responsibility (CSR) and climate change mitigation

Corporate social responsibility (CSR) is a proactive policy initiated by business itself in order to improve the adherence to, and the promotion of, ethical standards and global best-practices within the global business community. Effectively, CSR is a form of self-regulation having developed less from direct government pressure, but rather more from the side of business's own interest in adhering to better business practice standards of conduct. This is done in order to satisfy stakeholder concerns regarding the potentially negative aspects of a company's operation as well as to promote the principle that business can engage in activities intended to foster such things as socio-economic development. While the terminology and concept of CSR has been around for a number of decades, the pace of CSR penetration into the corporate behaviour and activities has been rapidly accelerating over the past decade and now often includes complex, multi-dimensional and global issues.

The issues which drive, and are contained within, CSR are varied, complex and constantly evolving with particular factors varying significantly from one industrial/manufacturing sector to another as well as between countries. However, CSR typically focuses on aspects relating to:

- Human rights, conflict prevention, business and social ethics, and anti-corruption measures.
- Addressing environmental impacts of business operations and new investment projects.
- The implementation of global labour standards, and responsible management of supplier relationships.
- Limiting negative social impacts of corporate activities and increasing access to basic products and services for people currently excluded for reasons of poverty, ethnicity, gender or disability, etc.
- Efforts to establish local and community-level initiatives as well as for the creation of multi-stakeholder global policy alliances.

The specific CSR-related issues of greatest relevance to a particular company will vary depending in which sector it is in and in which countries it is operating but public and other stakeholder pressure relating to concerns such as those listed above means that business leaders are increasingly facing new challenges to ensure that they:

- Restore trust and credibility in their business operations.
- Manage new, and often unfamiliar, risks.
- Respond to rising stakeholder expectations.
- Remain profitable, productive and competitive.

Therefore, business leaders of large high-profile companies are under unprecedented pressure to demonstrate good performance not only in terms of their competitiveness, market growth and financial results, but also in their corporate governance and their ethical, social and environmental performance. In response to this challenge, the concept of CSR is becoming a central factor in determining corporate success and credibility and it is increasingly being used as a new approach in planning and managing corporate activities.

While it is a significant undertaking for a company to develop and operationalize a successful CSR policy, there are a number of existing CSR mechanisms and formats currently available to assist

both global and local companies in establishing their own CSR functions and publicizing their subsequent performance. For example, the Global Reporting Initiative (GRI) has produced the world's most widely used standard for CSR reporting with a number of Chinese companies already being members to this standard and using it to publicly report their performance. The GRI is a networked-based organization which developed a sustainability reporting framework through a consensus-seeking process with global participation from business, civil society, labour and professional institutions. The framework sets out the principles and indicators that companies/organizations can use to measure and report their economic, environmental and social performance against. For further information on the GRI go to: www.globalreporting.org. The International Organization for Standardization (ISO) is also developing a specific standard for giving advice on CSR with the designation ISO 26000. The standard will be voluntary and will only contain guidance and therefore unlike ISO 9001:2000 and ISO 14001:2004 it will not be used as a certification standard. ISO 26000 will however present globally relevant understanding of what CSR is and what companies need to do to operate in a socially responsible manner.

While CSR can potentially encompass many of the different aspects described above, this publication primarily focuses on the environmental side of CSR, namely how company climate change mitigation actions can be framed under the CSR umbrella. Companies can choose whether to address climate change mitigation functions as part of a wider CSR policy or they can select to address energy and carbon reduction and a standalone policy. If a company chooses the latter option, there are still international frameworks/initiatives that are available for them to adopt; one such initiative is the Carbon Disclosure Project (CDP).

This initiative was launched in 2000 and aims to help accelerate solutions to climate change by assisting member companies on how to measure and disclose their GHG emissions and establish internal climate change mitigation strategies in order that they can set reduction targets and make performance improvements. CDP performance reports are made publicly available for use by a wide audience including institutional investors, corporations, policymakers and their advisors, public sector organizations, government bodies, academics and the public. The CDP now operates in most of the major economies of the world, having some 2,500 members in approximately 60 countries. For further information on the CDP, go to: www.cdproject.net

Another CSR framework that is available to help companies establish their CSR policies and actions within is the United Nations Global Compact. As described in the following section, the United Nations Global Compact now also includes a specific initiative in regard to corporate performance on climate change mitigation, the Caring for Climate initiative. The project under which this guidelines publication was produced has promoted the United Nations Global Compact and its Caring for Climate initiative as the central framework under which Chinese companies can develop their climate change mitigation (and wider environmental and non-environmental) CSR company policy and report their progress.

United Nations Global Compact

Background to the United Nations Global Compact

The process of globalization has brought opportunities as well as posed challenges to the development of an integrated, well-functioning world economy. In particular, the international community has

been concerned with the growing gap in living standards between countries of the North and those of the South; widening overall disparities between rich and poor; rising unemployment as previously secure jobs are transferred overseas; and the depletion of natural resources and environmental degradation. As a result, States have established common goals for the implementation of international labour standards, the protection of other intrinsic human rights and "sustainable" development".[30] At the annual meeting of the Davos World Economic Forum in January 1999, then United Nations Secretary-General Mr. Kofi Annan put forward the concept of a "Global Compact." The United Nations Global Compact (hereafter referred to as the Compact) officially launched at the headquarters of the United Nations in New York one year later.

Goals and principles

The Compact is a voluntary corporate citizenship initiative with two complementary objectives: *(a)* to promote and develop the principles of the Compact so that they become integral elements of business strategy; and *(b)* to promote cooperation between the primary stakeholders, so that the cooperation is of a character that will support the objectives of the United Nations. While the participating companies vary in terms of business structure, sector and region, they share two important characteristics; firstly, they are leaders in their respective sectors and secondly, they are committed to approaching economic development responsibly. In this sense, it is inclusive of a broad range of stakeholders, such as employees, investors, consumers, the media, business partners and community groups. The Compact aims to support a new development model that will benefit global society at large.

The Compact's 10 principles fall within the areas of human rights, labour rights, the environment and anti-corruption. The principles are based on universal consensus and are derived from: The Universal Declaration of Human Rights;[31] The International Labour Organization's Declaration on Fundamental Principles and Rights at Work;[32] The Rio Declaration on Environment and Development,[33] and; The United Nations Convention Against Corruption.[34]

The 10 United Nations Global Compact Principles

Human rights

Principle 1: Businesses should support and respect the protection of internationally proclaimed human rights;

Principle 2: Make sure that they are not complicit in human rights abuses.

[30] For a fuller understanding of "sustainable development", see *Rio Declaration on Environment and Development* (1992) [Accessed at www.unep.org/Documents.Multilingual/Default.asp?documentID=78&articleID=1163]

[31] See *Universal Declaration on Human Rights* (1948) [Accessed at www.un.org/en/documents/udhr/]

[32] See *ILO Declaration on Fundamental Principles and Rights at Work* (1998) [Accessed at www.ilo.org/declaration/lang--en/index.htm]

[33] See *Rio Declaration on Environment and Development (*1992) [Accessed at www.unep.org/Documents.Multilingual/Default.asp?documentID=78&articleID=1163]

[34] See *United Nations Convention against Corruption* (2003) [Accessed at www.unodc.org/unodc/en/treaties/CAC/index.html]

Labour standards

Principle 3: Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;
Principle 4: The elimination of all forms of forced and compulsory labour;
Principle 5: The effective abolition of child labour;
Principle 6: The elimination of discrimination in respect of employment and occupation.

Environment

Principle 7: Businesses should support a precautionary approach to environmental challenges;
Principle 8: Undertake initiatives to promote greater environmental responsibility;
Principle 9: Encourage the development and diffusion of environmentally-friendly technologies.

Anti-corruption

Principle 10: Businesses should work against corruption in all its forms, including extortion and bribery.

The Compact asks companies to "embrace, support and enact", within their particular sphere of influence, a set of core values drawn from these principles.

The United Nations Global Compact's Caring for Climate initiative

The United Nations Global Compact has been strengthened and expanded with the addition of the Caring for Climate initiative. Drafted by the Global Compact, the United Nations Environment Programme (UNEP) and the World Business Council for Sustainable Development (WBCSD), the initiative was announced in Geneva, Switzerland, 2007, at the Global Compact Leaders Summit hosted by the United Nations Secretary-General Mr. Ban Ki-moon.

Caring for Climate establishes a voluntary platform for Global Compact participants to cooperate and demonstrate leadership on the issue of climate change, and a framework within which business leaders may promote practical solutions to assist in the formation of public policy. Businesses supporting the declaration are expected to set objectives and develop GHG reduction strategies, publicly sharing their progress through the publication of yearly evaluations.

The first General Assembly of the Caring for Climate signatories convened more than 200 entrepreneurs, government officials, United Nations officials and climate experts with an aim to design a post-Kyoto framework on 21 October 2008 at the United Nation's Geneva headquarters. Currently 368 enterprises have become signatories, including the Chinese enterprises China Mobile, Broad Air Conditioning, China International Marine Containers (Group) Co., Ltd., China National Offshore Oil Corporation, China Ocean Shipping (Group) Company, Haier Group, Lee and Fung Limited. It is the aim of the programme to increase the number of signatory enterprises by inviting all parties who have joined the Global Compact to participate in the "Caring for Climate" programme.

During climate negotiations in Copenhagen during December 2009, Caring for Climate under the Global Compact aimed to harness the leadership of the private sector and the different business leaders participating in the Caring for Climate initiative by calling on Governments to reach an international consensus on climate change. The priorities outlined included: universal participation, with mechanisms that support GHG emission reductions in developing countries and a recognition between the different constraints that each nation faces in mitigating GHG emissions;

visionary government leadership beyond national agendas; and establishing workable mechanisms, such as improving and extending the Clean Development Mechanism (CDM).[35]

Business requires certainty so that individual enterprises can plan ahead, more so now than ever given the recent events of the global economic crisis. The voluntary CSR standards espoused by the Global Compact are self-imposed corporate parameters. Given that, in the context of a highly competitive commercial environment, such parameters can operate as constraints thus increasing the risk of a short-term reduction in profit, the extent to which voluntary standards adopted in the long term will be highly contingent upon business sentiment. This sentiment is most clearly indicated by the behaviour of the largest and most influential enterprises.

In this respect, intergovernmental climate change negotiations depend to a significant degree upon the engagement of the private sector with government. Where business leaders can publicly acknowledge the link between mitigation and adaptation,[36] and agree on the most important aspects of an international policy response, an assurance will be conveyed to the private sector and a credible platform erected upon which national Governments may meet to reach a realistic international climate agreement. For this reason, the "Caring for Climate" initiative has provided valuable support to the inter-governmental effort, and will continue to do so as the international negotiations continue.

China's response to climate change

The Chinese Government has actively accepted its role in addressing climate change, based on the international principle of common but differentiated responsibilities, by linking climate mitigation and sustainable development strategies. The Government has committed itself to establishing resource and energy efficiency, a safe living environment and a culture of innovation with economic development as the driving force of future national GDP development. Reductions in energy consumption, the establishment of an efficient energy sector and improvements in ecological conservation and regeneration will also be pursued, again within an overall process of economic development as the driving force. With technological advancements, China aims to reduce GHG emissions and it is continuing to strengthen its climate change mitigation capacity.

The "scientific approach" to sustainable development

The energy and environmental policy of the Chinese Communist Party (CCP) is grounded in the "Scientific Development Concept",[37] first espoused by current Chinese President Hu Jintao and his

[35] Global Compact, UNEP, Globescan: Best Practices and Policy Expectations, 2009 Caring for Climate Signatories [Accessed at www.unglobalcompact.org/docs/issues_doc/Environment/Best_Practices_and_Policy_Expectations.pdf]

[36] For the full statement from the Buisness Leaders of the United Nations Global Compact Caring for Climate Change initiative see: United Nations Global Compact, "Caring for Climate: The Business Leadership Platform" A Statement by the Business Leaders of the United Nations Global Compact [Accessed at www.unglobalcompact.org/docs/issues_doc/Environment/CLIMATESTATEMENT_revised_postsummit.pdf]

[37] The "Scientific Approach to Development" is a philosophy that has been adopted by the current administration emphasizing the human element of economic growth. For further explanation, see for example: Xinhua, "China to adhere to scientific development philosophy" in China Daily (2003/11/07) at www.chinadaily.com.cn/en/doc/2003-11/07/content_279693.htm], www.chinadaily.com.cn/en/doc/2003-11/07/content_279693.htm, and Xinhua, "China embraces new scientific development concept" in People's Daily Online (2006/04/23) http://english.peopledaily.com.cn/200604/22/eng20060422_260256.html

administration in 2002. According to this concept, the State is responsible for the establishment of a harmonious society, which can be secured by expanding democratic processes, emphasizing social welfare and the individual, as well as adopting sustainable development models. Within this paradigm, success in climate change mitigation is dependent upon the establishment of a resource efficient economy, ongoing scientific and technological innovation, particularly the development of renewable energy and energy-efficient technologies, as well as the cultivation of a strong entrepreneurial spirit amongst a well-educated general public.[38]

Chinese Government laws and regulations

The Chinese Government's eleventh Five-Year Plan has particularly emphasized the significance of making GHG emission reductions. The Plan states that the party will "make every effort in succeeding to control greenhouse gases",[39] marking a major shift in the strategic policy of the Chinese Government. In order to effectively strengthen leadership in this area, the State Council has established the National Leading Group to Address Climate Change and Energy Conservation and Pollutant Discharge Reduction. Headed by Premier Wen Jiabao, with Vice Premier Zeng Peiyan and State Councillor Tang Jiaxuan as Deputy Leaders, the Committee is constituted by the heads of each governmental department and agency represented in the State Council. In June 2007, the group announced that China would be focusing its efforts on cutting energy use in energy-intensive industries, such as the steel and non-ferrous metals industries, construction materials industries, and the chemical processing industries.

Over the past few years the Government has released a series of laws, instructions and initiatives in order to address climate change and to promote increased industrial energy efficiency, as well as cleaner energy production and utilization. These policies and standards provide a clear direction for Chinese enterprises to pursue in relation to energy conservation and emissions reductions, defining specific public, private and third sector responsibilities regarding climate change mitigation. The most significant are listed below:

The Renewable Energy Law—The Renewable Energy Law of China[40] was designed to promote the development and uptake of renewable energy by restructuring the energy sector, diversifying energy supply, and applying the principles of sustainable development.[41] The law requires power operators to purchase power resources from registered renewable energy producers. The law also offers financial incentives, such as a national fund to foster renewable energy development, discounted lending and tax preferences for renewable energy projects. The original renewable energy supply mix target set by the Government in 2005 was to reach 10 per cent by 2020—the target has now been revised upwards to 20 per cent by 2020. China is now the world's leading renewable energy producer with over 150 GW of installed capacity.[42]

Energy White Paper—In December 2007, the Government issued an Energy White Paper. The paper set forth a number of policy positions in regard to its redirected efforts to foster a more

[38] China's National Climate Change Programme, June 2007, p.25 [Accessed at www.ccchina.gov.cn/WebSite/CCChina/UpFile/File188.pdf]

[39] The Eleventh Five-Year Plan [Accessed at www.gov.cn/english/special/115y_index.htm]

[40] *Renewable Energy Law of the People's Republic of China* (2005) [See www.asianlii.org/cn/legis/cen/laws/rel177/]

[41] Article 1 *Renewable Energy Law*

[42] Howard, S., and Wu Changhua, "China's Clean Revolution", The Climate Group, China [See www.theclimategroup.org/news_and_events/china_unleashes_clean_revolution/]

sustainable energy future for China. The White Paper places emphasis on the conservation and efficient use of energy resources through education, optimization and the development of new technologies.

Twenty per cent reduction in the energy intensity of national GDP (and the Top 1,000 Energy Consuming Enterprise Programme)—In 2005, the Government announced the ambitious goal of reducing national energy intensity as a unit function of GDP by 20 per cent between 2005 and 2010. One of the main initiatives for realizing this goal is the "Top-1,000 Energy Consuming Enterprise Programme". The energy consumption of these 1,000 enterprises accounted for approximately 33 per cent of national and 47 per cent of industrial energy utilization in 2004. Under the programme a series of initiatives were put in place which included benchmarking, energy auditing, development of energy-saving action plans, information and training workshops, and the annual reporting of energy consumption. China is presently on course to achieve approximately 65 per cent of the overall goal, or an approximate 13 per cent reduction in the energy intensity per unit of GDP. In addition, the programme aims to achieve a decrease of per unit industrial consumption of [quality] water by 30 per cent; raise the treatment rate of domestic sewage to above 70 per cent, and foster an increase of 60 per cent in the re-use or recycling of industrial solids wastes.

China's National Climate Change Programme—In June 2007, the Government published its National Climate Change Programme. In doing so, China became the first developing country to publish a national strategy to address climate change and its potential impacts. While the plan does not include specific targets in terms of GHG emission reductions (although this year, the Government announced that it would reduce national carbon intensity by 40-45 per cent of 2005 levels by 2020),[43] it does include plans to increase the proportion of electricity generated by renewable resources and from nuclear power, as well as increasing the efficiency of coal-fired power stations, increasing the use of cogeneration, and the development of coal-bed and coal-mine methane resources. According to the Government, between 2006 and June of 2009, the number of small coal-fired plants that were closed accounted for 54.07 GW, or approximately 7 per cent of national generating capacity. In addition, advanced Clean-Tech research and development is being adopted by the energy sector. For example, the national GreenGen project[44] is a 250 MW large-scale integrated coal gasification combined cycle (IGCC) power plant and carbon capture and storage scheme in Tianjin that started its first phase in 2009 and will be hopefully commissioned in 2011.

The Programme also emphasizes the importance of stabilizing industrial nitrous oxide emissions at 2005 levels; expanding forest coverage to 20 per cent of the national territory, and increasing the capacity of carbon sinks by 50 million tons of CO_2.

China's policies and actions for addressing climate change White Paper—In October 2008, the Government issued a White Paper further setting out China's strategies for and objectives for addressing climate change. It included topics such as potential impacts, policies and actions to adapt to climate change, enhancing public awareness on climate change, enhancing international cooperation on climate change, and building institutions and mechanisms for coping with the mitigation of and adaption to climate change.

Local government—The high level focus of the central Government has encouraged initiatives from local government departments. Initiatives range from the rating of government officials on

[43] Fu Jing, Li Jing and Sun Xiaochua, "China targets massive 40-45 per cent carbon cut" (2009-11-27 07:03) [Accessed at www.chinadaily.com.cn/china/2009-11/27/content_9060284.htm]

[44] See the GreenGen Project website at www.greengen.com.cn/en/index.asp

performance against energy efficiency targets, to the elimination of tax incentives for energy-intensive enterprises and new central government-backed investment funds. Local governments have also launched their own initiatives. For example, during 2007 the Governments of Shandong, Shanxi and Jiangsu provinces provided RMB 2.1 billion (US$ 300 million), RMB 1.5 billion (US$ 215 million) and RMB 500 million (US$ 72 million) respectively in subsidies and grants to energy efficiency-related projects.

China's economic stimulus package—Unveiled by China's State Council on 9 November 2008, China's stimulus package has since invested more than 15 per cent (US$ 88 billion) of the total RMB 4.0 trillion (US$ 56 billion) package (to be spent over two years), in measures aimed at emissions reductions. Approximately 10 per cent will be spent on "environmental protection projects" coordinated by relevant government ministries. Energy efficiency will be improved by an additional RMB 370 billion (US$ 54 billion) of investment in the technological upgrading and restructuring of energy-intensive industries.

PART II

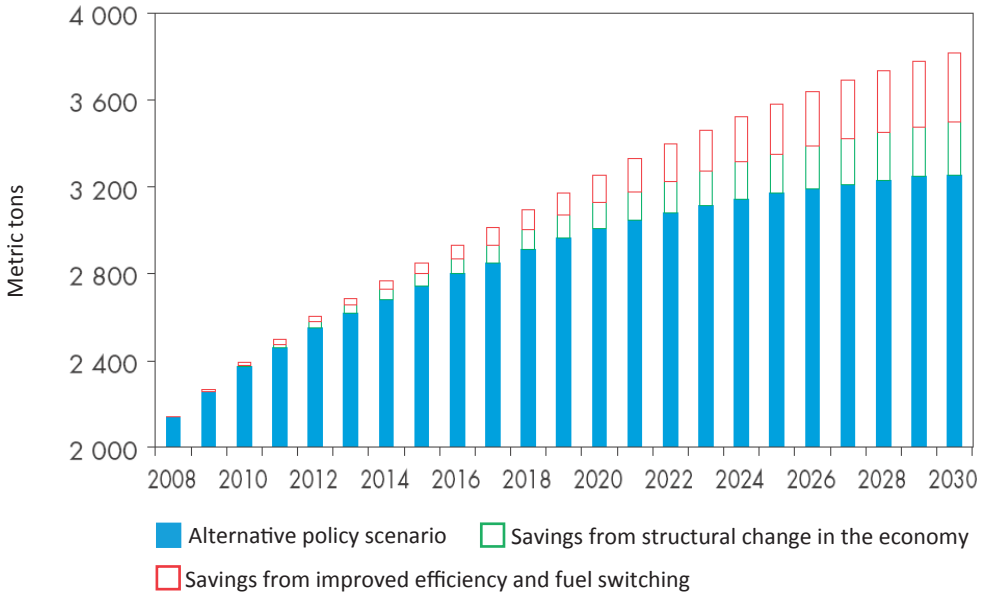
The economic impacts of climate change and business in China

Introduction

According to the 2006 Stern Review on the Economics of Climate Change, led by former chief economist of the World Bank Sir Nicholas Stern, if no action is taken to control GHG emissions, "the overall costs and risks… will be equivalent to losing at least five per cent of global GDP each year, now and forever." The review noted that delays in cutting emissions would increase the risk of more severe climate change impacts, dramatically increase the cost of dealing with climate-related damages, and potentially reduce global GDP by 5-20 per cent per annum.[45] Although the impacts will vary, businesses in all sectors are likely to be affected both by climate change itself, and the policies enacted to address it.

The good news is that the GHG reductions required can be achieved at a reasonable cost. A 2008 report by the International Energy Agency estimated that an annual investment of just 1.1 per cent of global GDP would be enough to cut worldwide emissions in half, by 2050. The transition to a low-carbon economy does not mean a decline in living standards, but rather the furthering of sustainable development through low-carbon intensity production and higher productivity.

Figure 2. China's primary energy demand in the alternative policy scenarios and savings relative to the reference scenario



Source: World Energy Outlook: China and India Insight, IEA, 2007, P365

[45] HM Treasury Department (United Kingdom), Stern Review: The Economics of Climate Change, Executive Summary (Short), p.6 [Accessed at www.hm-treasury.gov.uk/d/CLOSED_SHORT_executive_summary.pdf]

Enterprises are awakening to the fact that significant opportunity lies in the continued growth of emerging low-carbon economies. However, many struggle to understand what they need to do to save money on energy costs, access government incentives, prepare for imminent regulatory requirements and reduce their climate change impact. Within each sector, some firms will fail to adapt, while others will find ways of turning climate related challenges to their advantage.

Challenges arising from climate change

Cost and availability of inputs

Industries dependent on primary materials/natural resources

Without mitigation measures, the 2007 IPCC fourth Report has estimated that it is very likely heat waves and heavy precipitation will continue to become more frequent. An increase in the intensity and frequency of tropical cyclones is also likely. These changes will mean that agricultural yields become more vulnerable to damage from extreme weather events. In addition, the IPCC estimates that it is very likely that the meridional overturning circulation (MOC) of the Atlantic Ocean will slow down during the twenty-first century, and the Greenland Ice Sheet will continue to melt, transforming ocean currents.[46] Fishery resources are vulnerable to depletion as a result of these changes in ocean temperatures and currents. Businesses operating in the travel and tourism sector may also face economic losses as a result of further deterioration of the natural environment.

Value-added industries

Due to its impact on natural resources, climate change may affect the supply of raw materials for a significant number of operations in value-added industries. Abnormal temperature changes or extreme weather events are likely to alter crop quality or encourage the adoption of new growth models so that the supply of raw materials to manufactured food products could be affected. Rising temperatures and changing weather patterns may reduce water supplies in the short term, so that industries with heavy water demands, such as food and beverage industries, may be faced with supply constraints. As sea levels rise, increased salinity levels may affect operations based in coastal areas. Costs will accrue where desalination is necessary, or alternatively factories may be forced to relocate or cease production.

Government responses

Businesses must begin considering how future climate change regulatory requirements will impact their operations. Firms that will prosper in a carbon-constrained world will tend to be those that foresee potential implications for their industry and take appropriate adaptation and risk minimization steps well in advance.

[46] Ibid, p.16

Domestic emissions standards

As a developing country, China is not legally required to reduce its GHG emissions levels; however, pressure is mounting on China to take stronger action.

Internationally, market-based instruments (MBI) are already being widely applied through targeted taxation, and subsidies are applied to encourage the development and deployment of climate-friendly technologies, and domestic carbon markets have been established with the aim to reduce mitigation costs for business. In 2009, the United States Congress passed a bill committing the nation to carbon emissions reductions of 17 per cent from 2005 levels by 2020 and 83 per cent by 2050.[47] The European Union Emissions Trading Scheme (EU ETS) utilizes an alternative market mechanism aimed at reducing emissions by setting emissions allowances for energy-intensive industries. Carbon taxes are already in place in Sweden, Canada and the United Kingdom, with the United Kingdom Government opting to introduce further regulations to accompany the EU ETS.

Many countries have been calling on China to similarly commit to clear targets and mechanisms for emissions reductions. China recently surpassed the United States as the world's largest GHG emitter, and now accounts for 24 per cent of global emissions.[48] Coal-related GHG emissions alone totalled 4.9 billion metric tons in 2006, and are projected to reach 9.3 billion metric tons (or 52 per cent of the world total) by 2030.[49] While China is not bound to reduce emissions under the Kyoto Protocol, the Government has committed to implementing the Bali Roadmap,[50] and reducing energy intensity by 20 per cent of 2005 levels by 2010.[51] This was followed by China signing a memorandum of understanding with the United States in order to further enhance cooperation in the areas of climate change, energy and environment.[52] Furthermore, at the end of 2009 the Government announced the voluntary target of a 40-45 per cent reduction in carbon intensity of national GDP relative to 2005 levels by 2020. This carbon intensity reduction target was further enshrined by China when it included this target within its Copenhagen Accord commitments. The Copenhagen Accord was agreed at the UNFCCC COP 15 Copenhagen Climate Change Summit held in December 2009 and it is where for the first time both developed and developing countries agreed to reduce their emissions as well as register the national commitments by the end of January 2010. China, in addition to its carbon intensity reduction target also committed to increase its use of non-fossil fuels to meet approximately 15 per cent of its energy needs by 2020 and increase forest cover by 40 million hectares and forest stock by 1.3 billion cubic metres by 2020 relative to 2005 levels.

Currently, environmental emissions costs are not accurately reflected in the price of energy, transport or construction, which is where the majority of these materials are used. The choices made by consumers and producers are therefore not guided by incentives that lead to the efficient management of these resources. For businesses, it is important to note that government responses to climate change, while valuable in the long term, may cause short-term deterioration in economic

[47] S.Goldenberg, "Barack Obama's United States climate change bill passes key Congress vote" in Guardian.co.uk (2009/06/27) [Accessed at www.guardian.co.uk/environment/2009/jun/27/barack-obama-climate-change-bill]

[48] In 2006 China released approximately 6,017 million metric tons of CO_2 emissions. See International Energy Agency, International Emissions Data: Total Emissions www.eia.doe.gov/pub/international/iealf/tableh1co2.xls

[49] See International Energy Agency, www.eia.doe.gov/oiaf/ieo/emissions.html

[50] National Development and Reform Commission (NDRC) (P.R.C), "Implementation of the Bali Roadmap: China's Position on the Copenhagen Climate Change Conference" (2009/05/20) [Accessed at http://en.ndrc.gov.cn/newsrelease/t20090521_280382.htm]

[51] National 11th Five Year Plan for Environmental Protection (2006-2010) [Accessed at http://english.mep.gov.cn/Plans_Reports/11th_five_year_plan/200803/t20080305_119001_2.htm]

[52] Ministry of Environmental Protection (P.R.C), "China, United States sign MOU on Energy, Environment" (2009-07-29 [Accessed at http://english.mep.gov.cn/News_service/media_news/200907/t20090729_156906.htm]

conditions for exposed sectors, such as mining, oil refining and the steel and aluminium smelting industries. Where taxes are placed on fossil fuel inputs, production and processing costs will rise, and as fuel prices increase, so too will the price of transportation services. It is clearly to the advantage of Chinese business to prepare for substantial GHG emissions reductions in order to minimize potential threats, cost increases and the loss of business revenue.

Barriers to international trade

In 2008, studies showed that China's export market accounted for approximately one third of its GHG emissions total.[53] China is currently the world's second largest export economy, having recently overtaken Germany, and is now only behind the European Union. Exports in 2008 were valued at approximately RMB 9.96 trillion (US$ 1,465 billion).[54] In addition to exporting manufactured goods, China is also a major supplier of carbon-intensive raw materials.[55]

As a consequence of the global economic crisis and environmental concerns, many countries are seeking to erect additional import barriers. A "carbon tariff" is essentially an imposition of an import tax on products that have a carbon-intensity above a specified level. While this mechanism has been credited as a potential solution to inequalities that result from differing emissions reduction obligations between States, it can also function in terms of trade protectionism and a number of European countries have already imposed carbon tariffs on imported consumer products. In addition, European countries have begun to enforce domestic carbon emissions regulations on their own industries, making those businesses more vulnerable to competition from foreign imports. Consequently, European domestic policies may give rise to further import barriers in the region having the effect of creating effective export taxes on major export economies around the world.

In an economic climate that makes protectionism a potentially attractive option, Chinese exports may be exposed to carbon tariff related trade risks. Energy-intensive Chinese products have already been subject to the carbon tariffs imposed by a number of European countries. The United States is currently debating a national climate change bill that will incorporate similar provisions.[56] There is also the possibility that certain products may eventually be completely banned in some of these countries.

Finally, in recent years the Chinese Government itself has imposed export barriers on energy-intensive products, placing upwards pressure on prices. China's 2001 entry into the World Trade Organization (WTO) and the subsequent growth of manufacturing and energy-intensive industries compromised China's ability reduce national energy intensity by 20 per cent relative to 2005 levels by 2010. Taxes on metals, oils and steel were increased in order to discourage over-investment in energy-intensive sectors. In November 2006, the Ministry of Finance applied an additional 15 per cent export tax on copper, nickel, aluminium and other metal products; a 10 per cent tax on primary steel products; and a 5 per cent tax on petroleum, coal and coke.[57] Because these industries

[53] Weber, C.L., Peters, G.P., Guan, D. and Hubacek, K. (2008) "The contribution of Chinese exports to climate change." Energy Policy, 36(9): 3572-3577

[54] CIA World Factbook, China [Accessed at www.cia.gov/library/publications/the-world-factbook/rankorder/2078rank.html?countryName=China&countryCode=ch&regionCode=eas&rank=3#ch]

[55] CIA World Factbook, China: Geography [Accessed at www.cia.gov/library/publications/the-world-factbook/geos/ch.html]

[56] Goldenberg, S., "Barack Obama's United States climate change bill passes key Congress vote"

[57] Howard, S., and Wu Changhua, "China's Clean Revolution 0148, The Climate Group, China, p.15 [Accessed at www.theclimategroup.org/assets/resources/Chinas_Clean_Revolution.pdf]

have difficulty passing on costs to domestic consumers due to government pricing regulation, production costs can be high and sales revenues low. Should international demand decrease due to the introduction of carbon tariffs by China's trade partners, profit margins will be further eroded, severely weakening an industry that has until recently been lauded as a major driver of China's growth.

Stakeholder pressures

In addition to government regulation, businesses will face additional requirements from stakeholders, forcing a rethinking of production, management, sales and marketing strategies. Stakeholders include shareholders (investors), government managers, consumers, NGOs, and businesses in upstream and downstream sectors.

The following examples illustrate the multiple directions from which stakeholder pressure may be brought to bear:

- Shareholders may demand that companies take measures to address the economic impact of climate change.
- Enterprises that lack green credentials may be more vulnerable to criticism in regards to corporate social responsibility, which in turn may damage corporate image. Within this context, civil society organizations may be empowered to investigate environmentally suspect enterprises, and release damaging reports.
- Exposed businesses, such as those supplying raw materials, energy, and transportation, will pass on price rises, affecting the operations and optimal production levels of downstream enterprises.
- Managers of publicly owned companies may attach greater significance to the implementation of climate related policy.
- Consumers may regard the energy-efficiency rating of a product as a factor in their purchasing decisions, or consider steps taken in relation to climate change mitigation in their overall evaluation of a company and its products.

Opportunities arising from climate change

According to estimates by the international scientific community, in order to avoid the worst impacts of global warming, global emissions must peak no later than 2020, and decrease by at least 50 per cent of 1990 levels by 2050. As stated previously, the cost of climate mitigation can be likely contained at 1 per cent of global GDP per annum, compared to a cost of 5-20 per cent of global GDP per annum for inaction.[58] Commercial opportunities for businesses are present both in the short and long term.

[58] *The Stern Review*, Executive Summary (Short), p.6

Early investment in clean energy

With China's strengthening public support for energy conservation and GHG emissions reduction, increased demand for energy-efficient technologies and products provides commercial opportunities for those enterprises at the forefront of innovation. Whether an entrepreneur is looking to start a new business, a growing business is hoping to expand, or a successful enterprise is charged with diversifying its assets, several categories of clean renewable and energy-efficient technologies present a great deal of commercial promise for Chinese businesses.

Renewable energy

China is already a world leader in renewable energy, second only to Germany in terms of investment, with it attracting RMB 82 billion (US$ 12 billion) of investment for small hydro, solar water heating, solar PV and wind power in 2007 alone.[59] China is now also a leading producer of wind turbines, solar water heaters and solar panels, and is the leading renewable energy producer in terms of installed generating capacity, with the largest hydro-electric installed capacity in the world. Currently, global demand and government policy continue to stimulate China's renewable energy industry. While China has not set national renewable energy targets past 2020 (with existing 2020 targets aiming for 20 per cent of national energy to be derived from renewable energy), based on its current strategy it could meet 30 per cent of energy needs from renewable energy by 2050.[60] With the added advantage of low production costs and investor certainty, Chinese businesses are well-placed to capture both national and international renewable energy markets. Businesses could benefit in the long run by investing in this market now, before the market becomes saturated.

Wind energy

China's wind power industry has been significantly supported by the government in recent years, causing the sector to expand rapidly—the wind power market grew by approximately 125 per cent in 2007 alone. It is expected that China will exceed the initial target of 30 GW of installed wind capacity by 2020, potentially reaching 20 GW by 2010 and 100 GW by 2020.[61] Wind power systems manufactured in China now rank alongside those made in the United Kingdom and Australia in terms of price competitiveness[62] and the Chinese market operators have further potential to continue their growth trajectory through additional technological advancement.

Domestic policy is geared towards fostering the growth of local renewable energy companies. In 2005, regulations were issued to ensure that at least 70 per cent of each wind turbine installed is locally manufactured, and import taxes have been applied to pre-assembled turbine systems. Since that time, more than 50 local wind power technology companies have been established, accounting for over half of the domestic market.

Goldwind Science and Technology Company (Goldwind) is amongst China's largest wind turbine producers, constituting 33 per cent of the market in 2006. It started in 1986 as a joint-project with

[59] Ibid, p.108

[60] "China's Clean Revolution", p.42

[61] Ibid, p.45

[62] Ibid, p.56

the Dutch Government and by 1995 had expanded to include the German Government. Wind technology was imported from these two countries, and tested in China and in 1999 the Chinese Ministry of Science and Technology began to provide additional financial support. Goldwind's headquarters are located in the Xinjiang Autonomous Region, an area geographically advantageous due to its large areas of open, windswept land. The company has benefitted from the strong domestic market in China, and protective policies, as noted above. Goldwind's local Chinese competitors—including Haurui (Sinovel), Zhejiang Windey and Dong Fang—have also profited and it appears very likely that this sector will continue to grow rapidly in China.

Solar energy

Solar energy is produced through the conversion of the sun's rays into two forms of energy, thermal or electric. Solar technology refers to technologies that harness sun light and convert it into useful energy. Solar thermal absorbing materials, such as stone, concrete and water, store energy during the day and release heat during cooler periods. This can be used for water heating, space heating, and space cooling. Solar energy can be converted into electricity by using photovoltaics (PV), concentrated solar power (CSP) and various other technologies, for example, solar panels that are commonly attached to the roof of a home or office to supplement base-load electrical supply. Photovoltaics have gained widespread acceptance due to their convenience and increasing economies of scale.

China's solar manufacturing industry is positioned to become a leader in the expanding international low-carbon economy. In terms of manufacturing volume, it is second only to Japan, with an annual production capacity of 1,300 MW and a planned expansion to 4,000 MW by 2010.[63] While in many developed countries, governments financially support solar technology, in China, the phenomenal growth of the sector is backed by strong demand from European countries such as Germany, Spain and the United States rather than by domestic demand. Given that solar still accounts for only 0.2 per cent of energy consumption in China, expansion of this market to meet the Government's renewable targets will provide further opportunities for low-cost solar PV manufacturers.

Four of China's 400 solar PV companies are already valued at over RMB 13.6 billion (US$ 2.0 billion)[64] and exhibit growth rates of over 100 per cent per annum, as do many of their domestic competitors. Suntech was founded in 2001 and launched production in 2002. In March 2005, PHOTON International ranked Suntech as one of the world's top ten PV cell manufactures in the 2004 and Suntech's PV cell production capacity reached 540 MW by the end of 2007. Suntech Power applied "Pluto Technology", which is a solar cell production technology that has been found to outperform both conventional screen-printed solar cells and semiconductor finger technology to produce 34 MW's worth of solar cells in 2008 and 300 MW by the end of 2009. After receiving certification from the International Energy Commission in 2003 in order to enter the lucrative European and United States markets, Suntech floated on the New York Stock Exchange, generating the capital necessary for further development. Suntech's success has been attributed in part to its clear business strategy, focused on becoming the world's lowest cost solar producer, and its excellent record of corporate social responsibility.[65]

[63] This figure is more than entire global production was in 2007. See "China's Clean Revolution", p.44

[64] Suntech Power Holdings; LDK Solar; JA Solar Holdings; and Yingli Solar

[65] "China's Clean Revolution", p.44

Biomass

China's biomass power generation capacity is growing steadily. Existing installed biomass power capacity is 2.0 GW, with over 1,600 industrial scale biogas plants and over 18 million household biogas digesters being in place for cooking, heating and power generation.[66] In 2007, the Government implemented a subsidy of RMB 0.25 (US$ 3.2 cents) per kilowatt-hour in order to support business in contributing to the national biomass energy target of 30 GW by 2020.[67] Businesses investing in this area will therefore benefit from government subsidies in the short term.

Further opportunities exist in traditional biomass. Rural bio-wastes such as agriculture and livestock waste are still predominantly discarded in China due to logistical constraints. For example, cellulosic ethanol, which would allow crop residues to be converted to liquid fuel to replace oil, is still some years away from commercialization. However such future liquid fuels will be in high demand as will be the relevant technologies for converting biomass into these fuels. Opportunities therefore exist for services that may assist in the commercialization of such under-exploited renewable energy resources.

Geothermal energy

Geothermal energy originates from the heat generated by the slow radioactive decay of materials at the centre of the earth. This heat rises up towards the earth's crust through magma intrusions and groundwater circulation, and can subsequently be harnessed to produce energy. It is non-polluting and potentially renewable as reserves are far in excess of current human demand.

Geothermal technology takes a variety of forms. During power generation, high-temperature geothermal sources are used to produce steam that then drives large turbines powering electrical generators. There is no need to burn fossil fuels, as the geothermal source provides the necessary heat. Geothermal energy can also be used directly for space and water heating in place of electricity or gas.

Geothermal heating is already used in manufacturing, such as in the drying of cereal, as well as being applied, experimentally with success, to the processing of wood, paper, leather and textiles, as well as in brewing and sugar production industries and China is currently developing successful geothermal heating and hot-water systems in the Beijing-Tianjin municipalities. Geothermal energy is also potentially applicable to a wide-range of agricultural applications. For example, geothermal energy is also used in agriculture in order to increase the yields of certain crops. Water from geothermal reservoirs is used for heating greenhouses in the production of flowers and vegetables. When heating greenhouses it's not only the air that is heated, but also the soil in which the plants grow. This method of production has been used for centuries in central Italy and Hungary and it is able to cover 80 per cent of the energy needs of greenhouses that exploit geothermal energy in this way.[68]

While geothermal energy provides a low GHG emissions source of energy, it is important to note that China's medium- to long-term programme for renewable energy development favours wind

[66] Ibid, p.52

[67] Ibid, p.51

[68] www.our-energy.com/geothermal_energy.html

power and biomass sources. Geothermal does not enjoy the same investor protections in its start up phase, and it can therefore be a riskier investment although it offers potentially high returns on investment.[69]

Non-renewable alternative energy

Coal-bed methane

Coal-bed methane is a form of natural gas stored within the solid matrix (the pores) of coal, produced through a process of adsorption.[70] The methane is in a close to liquid state and is extracted from coal seams by drilling. Coal-bed methane is a hydrocarbon and therefore a contributor to global warming if released directly into the atmosphere. However, if safely collected, it can be used in energy production at a lower level of emissions intensity than alternative fossil fuels. Coal-bed methane can be used as fuel for power generation both in municipalities and in on-site industrial settings and can also be used as a fuel for vehicles once liquefied or compressed.

Municipal waste

Waste-to-energy technology is becoming more attractive in China's urban areas, as the energy content of city refuse rises proportionate to increases in plastic and paper content. There are currently more than 50 municipal solid waste (MSW) incinerators in Chinese municipalities, producing approximately 1,000 GWh of electricity from some 3.0 million metric tons of garbage each year.[71] Where the volume of waste continues to rise, as is likely with China's high rates of urbanization, there will be scope for further commercial opportunity in waste-to-energy technology.

According to McKinsey and Co., the full utilization of coal-bed methane and municipal solid waste, along with other sources such as agricultural waste and fly ash, would allow China to replace significant quantities of coal in industrial processes, reduce GHG emissions and lower local pollution levels. While such opportunities are beyond the scope of current government policies, they do however offer significant commercial opportunities independent from public sector support.[72]

Energy-efficient products and services

Public concern related to carbon intensive production is causing consumers to increasingly demand goods that are more climate friendly. In a recent survey by Accenture, approximately 86 per cent of respondents reported that they were either extremely or somewhat concerned by climate change.[73] In emerging economies, this percentage rose as high as 93 per cent.[74] Globally, approximately

[69] Ibid, p.8

[70] Not to be confused with absorption, adsorption is the accumulation of atoms or molecules on the surface of a material. This process creates a film of the adsorbate (the molecules or atoms being accumulated) on the adsorbent's surface. It is different from absorption, in which a substance diffuses into a liquid or solid to form a solution. The term *sorption* encompasses both processes, while desorption is the reverse process.

[71] Ibid, p.53

[72] J. Woetzel, M.Joerss, "China's Green Revolution: Prioritizing Technologies to Achieve Energy and Environmental Sustainability", McKinsey & Co., p.103. [Accessed at www.mckinsey.com/clientservice/ccsi/pdf/china_green_revolution.pdf]

[73] Accenture, *End-Consumer Observatory on Climate Change*, 2009. Published at www.accenture.com

[74] Ibid, p.20

59 per cent of consumers would accept higher prices for products and services with lower carbon footprints.[75] In developing countries this sentiment rose dramatically, with approximately 75 per cent of respondents claiming that they frequently or sometimes avoid taking the car and buying food transported by air.[76] If an energy provider was proposing products or services that would reduce emissions, 96 per cent of respondents in emerging economies, compared to 86 per cent in developed countries, would switch supplier if it were an option.[77] Such concerns will go a long way to promoting the development and application of energy-efficient products and technologies by putting upwards pressure on demand, and therefore revenue.

In addition, the Chinese Government is taking action to support companies that produce energy efficient equipment and appliances by committing all Government agencies to purchase environmentally sound products. The Government's Green Procurement Policy[78] is applicable to vehicles, photocopiers, printers and construction materials. As market demand for products with environmental benefits expands, companies able to respond will have the opportunity to engage with these new markets.

Energy-efficient appliances and buildings

China's economic growth and the subsequent rise in national energy consumption are particularly concentrated in the buildings and appliances sectors. According to McKinsey and Co, this sector will account for 25 per cent of energy consumption in China by 2030—if technology does not advance. GHG emissions from this sector are expected to grow by an average of 80 million tons a year—the equivalent of eighteen 1,000 MW coal-fired power stations—reaching 3.2 Gt of CO_2e by 2030. However, taking into account the incentives offered by the Chinese government for businesses to produce energy-efficient appliances and the new building efficiency codes, McKinsey and Co estimate that GHG emissions abatement could be limited to 1.9 Gt of CO_2e by 2030 when combined with more efficient power generation and fuel efficiency in the same sectors.

The Chinese Government has recently introduced a set of new building codes: the Design Standard for Energy Conservation in Civil Buildings. The United States has a similar system of certification for buildings, developed by the United States Green Building Council.[79] The Chinese Building Code requires that all new buildings have an in-use energy consumption level at least 50 per cent lower than the national average. In some cities, such as Beijing and Shanghai, a reduction of as much as 65 per cent is required. As construction companies begin implementing these standards, and renovating existing buildings, demand for green building design and materials will inevitably grow. This unexploited market is estimated to be worth approximately RMB 1.5 trillion (US$ 230 billion), between now and 2020.[80] For example, over 10 per cent of Chinese homes use solar water heaters, with a market worth of approximately US$ 2.6 billion (accounting for about 60 per cent of the global market).[81] With the Government's renewable energy targets and new building codes, demand

[75] Ibid, p.13.

[76] Ibid, p.22.

[77] Ibid, p.23.

[78] Howard, S., and Wu Changhua, "China's Clean Revolution", p.16

[79] K. Butner, D. Geuder, and J. Hittner, "Mastering Carbon Management: Balancing trade-offs to optimize supply chain efficiencies", IBM Institute for Business Value, 2008 [Accessed at www.usgbc.org/DisplayPage.aspx?CategoryID=19]

[80] Ling Li, "China Pushing for Energy-Efficient Buildings" (2007/01/25), Worldwatch Institute [See www.worldwatch.org/node/4874]

[81] "China's Clean Revolution", p.19

for solar hot water systems is set to grow further. For construction enterprises and subsidiaries, as well as businesses involved in building design and infrastructure, this creates an excellent commercial opportunity that will stand out as a major contribution to climate change mitigation.

VANKE is China's largest residential property developer, and one of the companies leading China's efforts to improve building energy efficiency. The company has invested more than RMB 100 million (US$ 15 million) in environmentally friendly construction techniques, last year completing two buildings in Shanghai that cut construction waste by 91 per cent. The success of these buildings has encouraged VANKE to further explore green opportunities, and it is now in the process of constructing over 1 million square metres of green buildings, which will be completed in 2010. This demonstrates opportunities for businesses to expand into such areas successfully, taking advantage of the current policy environment to establish themselves as the green business leaders of tomorrow.[82]

In addition to building codes, mandatory energy efficiency standards for consumer appliances (refrigerators, washing machines, air conditioners etc) were issued by the Government in 2005, with corresponding certification requirements. The sale of unlabeled products has been prohibited, and green procurement policies for Government offices and state-owned companies have been put in place. Further standards are under development for water heaters, electric fans, rice cookers and other appliances.[83] This will place businesses that produce inefficient appliances at a commercial disadvantage, as they will either be forced to invest in new designs and equipment, or liquidate their assets. It is therefore an opportune time for businesses to invest in upgrading their technology.

Hybrid and electric vehicle technology

In developed countries emissions from transport are amongst the highest contributors to total national GHG emissions, and vehicles often release other chemicals that are harmful to human health such as nitrogen oxides (NO_x) and particulate matter. As China's middle class expands, so too will conspicuous consumption, including demand for private vehicles. Domestic electric and hybrid vehicle technologies, as well as bio-fuel production, are cleaner than vehicles powered by diesel and petrol, and they have been shown to be very commercially promising.

Despite a dependence on fossil-fuel generated sources of energy, vehicles that are powered by electricity in whole or in part could reduce overall national emissions. Smart metering, smart charging devices and batteries could, as a result of the wide variations in time and location of the electricity that would be drawn by motorists from the grid throughout the day, allow for the possible powering of private vehicles without necessarily increasing the overall load on the national grid. The domestic low-carbon vehicle market is growing, with 1.64 million energy-efficient compact cars, 21 million electric bicycles and 79 million bicycles being produced in 2007 alone. Furthermore, the Government has placed an excise tax of up to 20 per cent on SUVs[84] and established a 36 mile per gallon (mpg) fuel economy standard for passenger vehicles. This should have the effect of reducing relative fuel costs and encouraging wider acceptance of electric and hybrid cars amongst the public.

[82] Ibid

[83] Zhou Nan, "Status of China's Energy Efficiency Standards and Labels for Appliances and International Collaboration" in *Lawrence Berkeley National Laboratory Report*, Clean Energy Group, 2008 [Accessed at http://china.lbl.gov/publications/status-chinas-energy-efficiency-standards-and-labels-appliances-and-international-colla]

[84] Ibid, p.81

A number of local companies have recently started production of hybrid vehicles in China. This has been made financially viable by the Government's "863" research programme, which has provided financial support for the development of such car models. Chang'An's first hybrid model was unveiled in 2007 at a cost of RMB 150,000 (US$ 23,000) (half that of the internationally popular Toyota Prius hybrid). Chang'An's model increases fuel efficiency by 20 per cent, and this figure is expected to rise rapidly along with increased research and development.[85] Build Your Dreams (BYD) is the largest manufacturer of cell phone batteries in China and the second largest in the world. Five years ago it began investing in the auto sector, and it has since created the world's first plug-in hybrid car, which has proven to be very popular.[86]

The bio-fuel market still has many unexploited opportunities. Bio-fuel most commonly appears as ethanol. Ethanol is produced from renewable biomaterials such as corn and sugar cane, and when replacing petrol, reduces CO_2 emissions by approximately 13 per cent and particulate matter by 50 per cent. The growing of crops themselves also has a carbon offsetting effect. China has 100 million hectares of marginal land that could be used to produce bio-fuel, without competing with crops for food production. The Government has already begun the utilization of this land, planting bio-fuel forests estimated to be capable of producing 6 million metric tons of bio-diesel per year by 2020.[87] Businesses would be advised to investigate commercial opportunities in this area in partnership with government.

Energy management services

Energy management services are often provided by a contracted service company to a contracting party through a performance-based programme, with the aim of either reducing energy consumption, or improving its efficiency. Programmes generally include an analysis of the contracting company's current production and energy practices, as well as the efficiency credentials of building construction, equipment and any other technology utilized.

Throughout this process, the contracting party is under no obligation to bear the cost of energy-saving measures, which will be paid by the servicing company. The servicing company is rewarded financially in direct proportion to their overall reduction in energy expenditure. Prompted by this incentive, the most optimal energy-efficiency services will be provided in order to maximize energy savings and, by default, the companies own revenues.

This service provides effective means by which to break through financial and human capital bottlenecks to achieve benefits for both the community and the private sector. As the availability of energy-saving technologies increases, this sector will provide a growing number of opportunities for such energy consultation services.

Implementing projects under the Clean Development Mechanism

International agreements such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol have established a framework for international cooperation in

[85] Howard, S., and Wu Changhua, "China's Clean Revolution", p.22

[86] Ibid

[87] "China's Clean Revolution", p.82

low-carbon technology transfer. The Clean Development Mechanism (CDM) is an instrument established under the Kyoto Protocol that enables developed countries to support developing countries in their emissions reduction efforts by providing financial and technical assistance. In return for a verified amount of emissions reductions generated by domestic projects, developing countries receive certified emissions reduction (CER) credits, which may then be purchased by a developed country that is party to the Kyoto Protocol. These credits may be counted by the developed country as a domestic carbon reduction under the Protocol in order to satisfy their emissions reduction obligations.

For many developing countries, including China, CDM projects have resulted in GHG emissions reductions, whilst attracting significant foreign direct investment and technology/skills sharing. According to conservative estimates made by the World Bank, if developed countries actually fulfil their obligations under the Kyoto Protocol, more than 2.5 billion tons of emission rights will have been generated within developing countries by 2012.

China has played an active role in the CDM, and currently accounts for 54 per cent of the total amount of CER's issued, primarily from hydrofluorocarbon destruction/reduction projects. Moreover, the number of industrial energy efficiency CDM projects in China is expanding rapidly, having experienced a growth of 10 per cent since 2006.[88] This trend highlights the potential for energy conservation measures in developing countries, through appropriate technology transfer. In addition to improving production methods and international competitiveness, technology transfer has a vital role to play in mitigating the growing GHG emissions from developing countries. Chinese companies would be well advised to consider entering this evolving energy efficiency sub-sector of the CDM market while it remains under-developed. See Sources of international finance, page 44, for more detail on the CDM.

Enhancing Chinese CSR in terms of climate change

Increasing public concern regarding climate change presents Chinese corporations with a clear opportunity to improve their status as good social citizens. Corporate social responsibility is an important aspect of brand power because climate change mitigation reflects contemporary social values, and green products are likely to gain increasing market value. Therefore, as a first step progressive Chinese companies can opt to publicly disclose their carbon/GHG emissions and set reduction targets against the reported values while at the same time publicizing their achievements in energy and process related emissions reduction initiatives. This can be done under the United Nations Global Compact or under such initiatives as the Carbon Disclosure Project for example.

Other benefits that will ultimately affect a company's bottom line include recruitment of valuable human resources and profitable business partnerships. For example, highly talented individuals seeking the respect of their community will likely consider a company's CSR commitments when choosing an employer. Chinese companies that attract high-performing individuals who can contribute to long-term development and growth will no doubt benefit. Through CSR activity, businesses are also able to develop collaborative partnerships with other leading enterprises, building

[88] EU-China CDM Facilitation Project, "The Pre 2012 CDM Market in China: Policy Context and Current Developments" (2009/04/15) [See www.euchina-cdm.org/media/docs/EU-China per cent20CDM per cent20Project per cent20The per cent20Pre_2012 per cent20CDM per cent20Market per cent20in per cent20China per cent2020090415.pdf]

capacity and best-practice standards within the scope of climate change action. The United Nations Global Compact is an excellent example of such a forum. Due to a growing acknowledgement of such benefits, more and more Chinese companies/enterprises are adopting CSR strategies and improving their sustainable development capacity.

Beyond joining the United Nations Global Compact or other industry-wide CSR and/or GHG mitigation initiatives, companies in certain sectors can also call on the support from global sectoral sustainability initiatives. Two such examples are firstly the Cement Sustainability Initiative (CSI) from the World Business Council for Sustainable Development (WBCSD); and secondly, the World Steel Association's Sustainability Review Initiative. The CSI is 10 years old and now incorporates 18 of the world's largest cement producers accounting for approximately 30 per cent of global cement production, making it the world's largest sustainability programme ever undertaken by a single industrial sector. While the CSI has focused on issues ranging from environmental performance, both at the locallevel and at the global-level, to employee health and safety; climate change mitigation has received continued and increasing attention. For more information on the CSI and its recommendations for realizing GHG emission reductions in cement production go to: www.wbcsd.org.

The World Steel Association's sustainability initiative, like the CSI, has focused on promoting a range of CSR areas and principles—with the environmental considerations of steel production featuring prominently in the initiative's objectives. The initiative promotes the optimization of eco-efficiency of steel products through their life-cycle, including increased resource and energy efficiency in the production process and in the use of steel products, with a focus on the recovery, re-use and recycling of steel. Over 50 major global steel producers are now participating in the initiative and in 2008, the Association launched "Climate Action", under which steel producers can report their on-site and/or company-level CO_2 emissions. For further information on the World Steel Association's sustainability initiative go to: www.worldsteel.org.

CSR developments in China

Launched in May 2008, the Shanghai Stock Exchange's Social Responsibility Notice (SRN) highlights the mounting focus on CSR within the Chinese business community. The scheme provides incentives for companies demonstrating commitment to CSR, simplifying the verification of their temporary announcements and their election into the corporate governance sector. The initiative encourages all listed companies to develop CSR strategic plans, which are subsequently published on the Shanghai Stock Exchange website and in each company's annual report. The Stock Exchange has also introduced the concept of "Social Contribution per Share", which measures the wider societal contribution made by listed companies.[89] For example, enterprises can disclose the added social value per share of energy efficiency initiatives or improved environmental performance, allowing participating businesses to highlight CSR activities to shareholders, customers and employees alike. As CSR becomes more integrated with the market, community expectation of businesses acting in a socially responsible manner will continue to grow.

Below are two brief examples from Chinese firms that have demonstrated leadership in environment-specific CSR:

[89] Shanghai Stock Exchange, "SSE Social Responsibility Index Released Today" (2009/08/05) [See www.sse.com.cn/sseportal/en_us/ps/home.shtml]

1. *Baoshan Iron and Steel Co (Baosteel)—Energy and GHG emissions reductions:*

In accordance with the national eleventh Five-Year Plan, China's average energy consumption reduction must reach 20 per cent relative to 2005 levels by 2010. As a large steel producer, Baosteel made a commitment to reduce energy consumption per ton of finished steel by 40 per cent from 1.176 tons of standard coal to 0.7056 tons, by 2010. To achieve this goal, Baosteel created a business strategy for the term 2007 to 2012 (corresponding to the Government's eleventh Five-Year Plan) and allocated RMB 1 billion (US$ 146 million) annually to reducing energy consumption and carbon emissions.

To implement this plan, Baosteel is taking the following steps:

- Eliminating approximately 5 million tons of surplus steel smelting capacity and 5 million tons of steel-rolling capacity;
- Ensuring a steady supply of quality scrap steel through a long-term procurement agreement replacing the need for new steel, and thereby reducing carbon emissions;
- Employing waste heat recovery technology, solid waste recovery technology and post-production flue gas desulphurization to capture waste heat energy and reduce pollution;
- Applying technology aimed at controlling smoke, dust and waste water emissions;
- In order to combat air pollution, Baosteel is on track to completing total flue gas desulphurization in all sintering units by 2010;
- Developing production capacity for high value added steel[90] in order to reduce the energy-to-production ratio;
- Finally, Baosteel has begun to implement internal energy audits, and plans to establish a more systematic approach to energy accounting and auditing in the long term.

Baosteel is currently listed on the Shanghai Stock Exchange as a member of the Corporate Governance Index due to its election to the 2009 Corporate Governance Board.[91]

2. *China Industrial Bank—China's green bank*

China Industrial Bank (CIB), in cooperation with the International Financial Corporation (IFC), has been the first to participate in China's green capital markets. CIB issues loans to pilot projects that aim to reduce emissions or increase energy efficiency. As a government-owned bank, CIB was able to offer loans of RMB 10 billion (US$ 1.4 billion) under the auspices of the eleventh Five-Year Plan. Despite global credit contractions and a stricter domestic fiscal policy, CIB continues to provide green credit. At present, the CIB provides several forms of green credit including energy conservation and technological transfer project loans, as well as providing financing for energy or energy service provider contract management projects and for carbon financing options.[92]

It is significant to note that CIB's expansion of green credit has been motivated by the growth of market opportunities in this area. According to the Mid to Long-term Energy Efficiency Strategy

[90] For example, the steel used in the "Shenzhou V" and "Shenzhou VI" spacecraft, the steel used for minting coins, and steel for large Chinese aircraft.

[91] See the Shanghai Stock Exchange website at www.sse.com.cn/sseportal/webapp/datapresent/queryindexcnpe?indexCode=000019&indexName=]

[92] China Industrial Bank (CIB), "Environmental and Social Risk Management: Sustainable Finance Policy" (2009/07/21) [Accessed at www.cib.com/cn/netbank/en/Sustainability/Environment_and_Social_RIsk_Management/Sustainable_Finance_Policy/20090721_1.hml]

Paper published by the National Development and Reform Commission (NDRC), investments in energy efficiency could total more than RMB 600 billion (US$ 87.7 billion) between 2007 and 2012. Assuming 50 per cent is in the form of direct bank loans, capital markets could total RMB 3,000 billion (US$ 438.7 billion). It is expected that this funding will be extended from technology transfer related projects to carbon financing, and other emerging green service sectors.

Participation in the United Nations Global Compact and its caring for climate initiative

As mentioned before, the United Nations Global Compact is a policy initiative for businesses committed to aligning their operations and strategies with 10 universally accepted principles in the areas of human rights, labour, environment and anti-corruption. The Global Compact's Caring for Climate initiative aims to mobilize the business community to reduce climate change risks, whilst also providing a framework for business leaders to promote practical solutions that assist in the fostering of public opinion and policy. Companies must pledge their commitment to reduce their own GHG emissions and to publicizing yearly emissions statistics. Through voluntary participation, business participants are gradually adopting international CSR codes of conduct, and reporting back in form of social responsibility and sustainable development reports.

Participation in the United Nations Global Compact offers numerous benefits:

- Adopting an established and globally recognized policy framework for the development, implementation, and disclosure of environmental, social and governance policies and practices;
- A platform to share and exchange best and emerging practices to advance practical solutions and strategies to common challenges;
- The opportunity to advance sustainability solutions in partnership with a range of stakeholders, including United Nations agencies, Governments, civil society, labour, and other non-business interests;
- The opportunity to link business units and subsidiaries across the entire value chain within the United Nations Global Compact's Country Networks, many of which are located in developing and emerging markets;
- Access to the extensive knowledge of and experience of the United Nations with sustainability and development issues;
- Utilizing United Nations Global Compact management tools and resources, and the opportunity to engage in specialized environmental, social and governance work streams.

Today, the Global Compact is one of the world's largest global corporate citizenship initiatives; for example 175 of the world's most influential financial institutions, accounting for 10-15 per cent of global capital, have recently become signatories to the Global Compact. These institutions include JP Morgan Chase and Co (United States), Deutsche Bank AG (Germany), Bank of Shanghai (China) and Barclays Group plc (United Kingdom) among others.[93] In addition to their commitment to the principles of the Compact, these enterprises have established best-practice principles for financial institutions on behalf of insurance, securities, banking and investment companies and institutions. These principles are intended to guide investment decisions, and therefore provide an incentive for enterprises seeking capital to adopt best-practice standards. The same financial institutions are

[93] For the full list, see www.unepfi.org/signatories/index.html?&no_cache=1

engaged in an active dialogue with the World Association of Securities in preparation for the application of the principles to world financial markets.

Significantly for China, the Compact maintains deep relationships with the majority of developing countries—half of the Compact's corporate members are based in developing countries, while two-thirds of its state members are developing countries. Many Chinese enterprises remain unaware of the benefits associated with participation in the United Nations Global Compact. This may impede their growth potential, particularly those enterprises aiming to expand overseas, and certainly if the principles of the United Nations Global Compact become binding standards for companies in the future.

In order to join the Global Compact, businesses are expected to undertake the following:

- The president or CEO (where possible, with the approval of the board of directors) communicates organizational support for the Global Compact and its principles by mail. This statement amounts to a corporate commitment. Because of this, the statement must include an undertaking to submit to a basic corporate social responsibility assessment.[94]
- The integration of the Global Compact and its principles into corporate strategy, culture and day-to-day internal operations.
- Aim to raise public awareness and promote the Global Compact and its principles through press releases, speeches and other public medium.
- Publish an annual communication of progress (COP) report, containing a statement expressing ongoing support for the Compact's principles, a description of practical actions taken by the company, and a measurement of outcomes.[95]

This last obligation aims to instil accountability, drive continuous improvement, safeguard the integrity of the United Nations Global Compact as a whole and contribute to the development of a repository of corporate practices.[96] The COP must be submitted to the Global Compact office and will immediately be made public, and therefore subject to the scrutiny of human rights organizations, environmental organizations, consumer associations, and relevant state ministries. Participants failing to submit COPs for two consecutive years will be regarded as inactive up until the time that they choose to submit. The majority of participants have expressed a desire to develop this system further, establishing it as a requirement of ongoing participation.

Practical steps for emissions reduction

While Part II of this publication on climate change and CSR has so far considered commercial climate change related challenges and opportunities for Chinese businesses, it is necessary to consider in detail the actual measures that a company can be take in order to reduce its carbon and

[94] See United Nations Global Compact: How to Participate at www.unglobalcompact.org/HowToParticipate

[95] See United Nations Global Compact: Communication on Progress at www.unglobalcompact.org/COP/

[96] Ibid

other GHG emissions. While commercial opportunities in the green sector will contribute to a reduction in long-term GHG emissions, there is a significant overlap between the market shifts and the individual technical changes that businesses can make in order to mitigate an enterprise's climate change impact based on present production methods and the financial opportunities that can be realised by implementing energy efficiency and production process changes. Irrespective of the intentions that business may have to reduce their energy consumption and their GHG emissions, the following practical steps can provide a basic indicative guide on how to realize such goals.

Environmental performance assessments (EPA)

An Environmental Performance Assessment (EPA) is designed to identify non-compliance with environmental performance standards within an organizational structure. Also known as Environmental Performance Evaluations (EPE), EPAs are a formal process of measuring, analysing, reporting and communicating an organization's environmental performance against criteria set by its management. Businesses wishing to evaluate the environmental impact and energy efficiency of existing processes will benefit from such an assessment. The EPA will generally identify internal weaknesses in management, provide suggestions for immediate and long-term corrective measures, as well as identifying necessary resources for implementation.

Ideally, an EPA will be carried out with reference to environmental management and evaluation guidelines issued by the International Organization for Standardizaton (ISO). Using the ISO Best Practice Guidelines enables businesses to make positive environmental changes without being commercially disadvantaged, as the organization simply codifies what is accepted as standard for the maintenance of a level commercial playing-field in the international marketplace. The Environmental Management ISO 14000 series is specifically concerned with organizational environmental management and performance. For example, ISO 14001 identifies Environmental Management Standards, and may be applied as a form of certification where these requirements are met. On the other hand, ISO 14031 provides guidelines for the application of environmental evaluation procedures.[97] This includes guidance on the design and application of environmental performance evaluation tools, identification and selection of related performance indicators regardless of the type, location or organizational complexity of the enterprise. For further information on this aspect of ISO 14031 see the article by David Putnam ISO 14031: Environmental Performance Evaluation.[98]

Environmental performance assessments and evaluations include energy efficiency indicators, such as energy conserved (MJ), raw material used per unit of product (kg/unit), and energy used annually per unit of product (1000 kg). An energy efficiency audit can be used to set targets, and evaluate current energy efficiency strategies. Given China's emphasis on energy efficiency, this is an essential aspect of evaluating the emissions reductions capacity of an enterprise. For more energy efficiency indicators and an introduction to the process, guidelines can be purchased from the ISO's website.

EPAs should also be conducted with reference to domestic policy goals and legislation. In China, government targets for renewable energy and energy efficiency (see China's response to climate change,

[97] International Organization for Standardization at www.iso.org

[98] David Putnam, "ISO 14031: Environmental Performance Evaluation", CEA Altech Environmental Consulting Ltd., September 2002, [Also available at www.aipa.org/Adobe_Files/Conservation_Efficiency_Productivity_Etc/2002_09_ISO_14031_Environmental_Performance_Evaluation_David_Putnam.pdf]

page 11) will provide direction, and in some cases offer financial support. Chinese organizations that undertake regular EPAs will eventually accumulate comparative data, enabling the effectiveness of environmental and energy-efficiency initiatives to be tracked, and a database of resources to enable future managers to develop further innovation.

An interesting new development in the international effort to promote increased energy efficiency is the ongoing development of a dedicated energy management standard established by ISO, this being the ISO 50001 Energy Management standard. ISO has identified energy management as one of its top five priorities for standards development and the new ISO 50001 standard will establish an international framework for industrial, commercial, institutional facilities, and for entire companies to manage their energy use. The standard is expected to be published in 2011, and once established it is expected that it will achieve major long-term increases in energy efficiency (by 20 per cent or more) and reduce GHG emissions worldwide.

The purpose of an energy management standard is to provide an organizational framework for industrial facilities to integrate energy efficiency into their management practices, including fine-tuning production processes and improving the energy efficiency of industrial systems. Energy management seeks to apply to energy use the same culture of continual improvement that has been successfully used by industrial firms to improve quality and safety practices. An energy management standard is needed to influence how energy is managed in an industrial facility, thus realizing immediate energy use reduction through changes in operational practices, as well in creating a favourable environment for the adoption of more capital-intensive energy-efficiency measures and technologies.

ISO 50001 will have a big impact in developing countries and emerging economies where there is still a lack of national energy management standards as well as the supporting policies and enforcement mechanisms to achieve improved energy efficiency in the industrial and manufacturing sectors. Past experience with ISO standards have shown them to major drivers in fostering national policy and regulatory conditions as well as being a considerable prerequisite for successful international trade and market access.

A number of countries now have their own national energy management standards and China is in the process developing its own energy management standard under the guidance of the China National Institute of Standardization (CNIS). This national standard will be compatible with ISO 50001. For further information on ISO 50001 go to: www.iso.org and for further information on the development of the Chinese energy management standard go to: www.cnis.gov.cn.

Management practices and energy management

The following elements of internal management may be identified as potential means for reducing and managing business GHG emissions.

Establishing an environmental officer or department

Establishing a department or position that is responsible for managing GHG emissions, environmental CSR programs and stakeholder engagement is a good first step to reducing the GHG emissions of a business. This position or department may be charged with the responsibility to manage

carbon accounts, conduct energy audits, and craft new strategies for improving environmental impacts and energy efficiency. The creation of such a role will often be a matter for higher levels of management and may be subject to approval by the board of directors or shareholders, or if state ownership is relevant, the decision-making process may equally depend on a level of administrative involvement by related state ministries.

Carbon accounting

The volume of global trade has more than doubled in the last 10 years, partly facilitated by low-cost energy. Estimations of approximately RMB 578 (US$ 85) for the external cost to society of each ton of CO_2 emitted has led some countries, particularly those in the EU, to introduce carbon taxes and emissions trading schemes. Essentially, these schemes apply taxes to large GHG-omitting industries, including those in trading partner countries. Long-distance airfreight and energy-intensive production in countries with lower standards of environmental regulation may become too costly to maintain for many enterprises if they continue to be taxed by trade partners.[99]

"Carbon accounting", in combination with regular auditing, provides a means by which enterprises can self-monitor and manage their GHG emissions in order to bring them in line with domestic and international requirements and CSR standards. Such accounting involves monitoring the level of GHG emissions that can be attributed, in a given period or for a given unit of production, to overall business practice or to a final product itself. To account for carbon, an estimation of a company's periodic aggregate or unit (per product/RMB) emissions is made. This includes emissions that are attributable to inputs (such as the extraction and refining processes of natural resources such as metals) and processes (such as the electricity used in power generation, or the fuel burnt in transportation of an input), as well as any offsets that have taken place. This may be quantified in a similar manner to the accounting models used for the revenue and costs of a company.

There are a number of mechanisms that are available to companies to help them to successfully undertake carbon accounting. For example, the Carbon Disclosure project (as described in United Nations Global Compact, page 9) contains formats and guidance on how to conduct carbon accounting. ISO has also produced a specific carbon accounting standard as part of its ISO 14000 series, this being the carbon offset protocol: ISO 14064. This standard is a voluntary and policy-neutral GHG accounting standard and therefore does not offer specific guidelines on what tools and accounting methods a company should use to determine GHG footprints, rather it gives advice and guidance on what to do while not spellingout exact requirements. Therefore, ISO 14064 is intended to be used in conjunction with other GHG related regulations and/or standards and it can be used as a building block for a full-fledged offset standard. As such, it is a useful tool and has been used by many regulatory and voluntary schemes. ISO 14064 consists of three parts. The first part (14064-1) specifies requirements for designing and developing organizational or entity-level GHG inventories. The second part (14064-2) details requirements for quantifying, monitoring and reporting emission reductions and removal enhancements from GHG projects. The third part (14064-3) provides requirements and guidance for the conducting of GHG information validation and verification. For further information on ISO 14064, to go to: www.iso.org.

[99] K.Butner, D.Geuder and J.Hittner, "Mastering Carbon Management: Balancing trade-offs to optimize supply chain efficiencies", IBM Supply Chain Management, Global Business Services, IBM Institute for Business Value (2008)

Product life cycles

Due to the diffuse nature of modern production processes, there is increasingly an expectation that supply chain emissions will be approximated in carbon accounting. Product Life Cycle Assessment (LCA) or Life Cycle Analysis (LCA) is also known as "eco-balance" or "cradle-to-grave analysis". There are internationally recognized tools used for assessing the environmental impacts of a particular product or service, taking into account all phases of its production, consumption and/or disposal. This is done in a number of steps, the first being to define the product/service itself, drawing conceptual boundaries for the analysis of that product based on available market information. The next step is to collate technical and environmental data related to the product system. This includes the input and output quantities of materials, energy, chemical and wastes—such as air pollution, water effluent and waste solids. Targeted software products are employed to calculate the environmental impact of raw material production, manufacture, distribution, consumption and/or disposal as well as necessary contingent activities such as transportation of materials and equipment. Also see the definition of LCA in the Glossaries and Terms section of this publication.

Definitions of life cycle, and the criteria by which lifecycle GHG emissions are quantified, will in reality differ between methodologies. Often LCAs will use basic market research to inform assumptions regarding the carbon intensity of inputs and processes. For example, a computer manufacturer might assume that the most energy-intensive computer components would be the silicon chips, the battery and screen, and they could therefore contact the component manufacturers for specific information. Alternatively, others may use industry-relevant statistics and economic modelling to approximate emissions. The methodology used is highly dependent on the specific product and the company, as it can involve a great degree of discretion. For this reason, LCA often courts controversy.

For greater certainty businesses may also refer to international LCA standards. The International Standard on Life Cycle Assessment has also been developed by ISO as part of the Environmental Management (ISO 14000) series. The published LCA standards consist of ISO 14040 (Principles and framework), ISO 14041 (Goal and scope definition and inventory analysis) and ISO 14043 (Life cycle interpretation). In addition, ISO/WO TR 14047 (Examples of application of ISO 14042) has yet to be published as a technical report, ISO/CD 14048 (Life cycle assessment data documentation format) and is currently in the form of a committee draft, and finally ISO/TR 14049 (examples of application of ISO 14041 to goal and scope definition and inventory analysis) is currently under publication. See the ISO website for more details.[100]

Stakeholder engagement

For any commercial venture, it is extremely important to cooperate and engage with stakeholders in order to determine whether a CSR programme is having the intended effect, and whether there is awareness amongst stakeholders as to the effects of the programme and if there are opportunities for further engagement. Environmental stakeholders may include: companies that could be impacted by carbon management strategies, consumers, government agencies and relevant international organizations.

Accountability mechanisms can be used to facilitate engagement with the public and commercial stakeholders. By demonstrating transparency in disclosing all emissions statistics (i.e. publishing them on the company's website and listing emissions in annual business reports), public

[100] International Organization for Standardization (ISO) at www.iso.org

confidence in CSR initiatives is likely to increase. Establishing a public liaison position within an organization, through which the company can be contacted and can initiate public consultations, will further strengthen stakeholder engagement and corporate understanding. This contributes to informing consumer decision-making, with positive ramifications for the profits of those enterprises involved (as noted in Enhancing Chinese corporate social responsibility, page 27), as well as maybe encouraging other businesses to adopt similar practices.

In addition, transparency and accountability mechanisms can improve business certainty in an uncertain environment. Where emissions are disclosed and consultation in the private sector is undertaken, companies which are likely to be impacted by carbon emission restriction strategies will have access to clear indicators of the strategies that they themselves must adopt in order to remain in business. Moreover, such mechanisms are likely to be more effective if standardized throughout the industry. For example, entering into cooperative agreements with industry specific up- and down-stream enterprises can facilitate skills and knowledge sharing and reduce asymmetric information[101] and transaction costs[102] associated with identifying market opportunities and collaborating on joint projects.

Finally, it is important to actively seek information from stakeholders directly engaged in setting policy or informing public sentiment so that business practice does not fall foul of new environmental standards and or fail to exploit fresh opportunities for green corporate action. Consultations can be conducted by soliciting submissions from stakeholders for a range of perspectives on pertinent issues through public announcements through the national media and/or on a company's website. Sending a company representative to attend relevant conferences with topics related to environmental CSR and energy efficiency is another means of engagement that may supplement formal industrial consultations by establishing more enduring professional relationships. Government and non-governmental organizations/institutions are excellent sources of the latest developments in government policy, and in the standards espoused to by international and domestic civil society. The international scientific community is a significant determinant of political and commercial responses to climate change, the opinions of which are largely available through subscription to academic journal Science[103] or through commercial publications such as the New Scientist.[104] Willingness to actively participating in the formulation process of new policy is also an important way in which a company can remain informed of developments, and remain responsive to new commercial opportunities and threats.

[101] "Asymmetric information" is a term that is used in economic and contract theory to describe business transactions in which one party or several parties have information relevant to the transaction that the other/s do not. This results in an inefficient allocation of costs and benefits due to the imbalance of power. Examples include "adverse selection" (where asymmetric information makes it more likely that lower quality products/customers will be selected for at a higher cost than would otherwise be the case in a market with perfect access to information) and "moral hazard" (where the party with more information has an incentive to act to its own advantage at the expense of the other party). For a general introduction to the history of information economics, see J.Stiglitz, "Information" in the *Concise Encyclopedia of Economics* [www.econlib.org/library/Enc/Information.html]. For more detail on this topic see S.S.Izquierdo and L.R. Izquierdo, "The impact of quality uncertainty without asymmetric information on market efficiency" in Journal of Business Research, (2007) 60 (8), pp.858-867; G.J.Stigler, "The Economics of Information" in *Journal of Political Economy* (1961) 69 (3), pp.213-225; D.Aboody and B.Lev, "Information Asymmetry, R&D, and Insider Gains" in *Journal of Finance*, (2009) 55 (6), pp.2747–2766.

[102] "Transaction cost" is a term used in economic theory to describe the costs associated with market exchange other than the cost of the benefit obtained. For example, search and information costs accrue when undertaking an evaluation of market conditions in order to ascertain the product with the lowest price. Bargaining costs include the costs each party incurs during the process of negotiating. See R.Coase, "The problem of social cost" in *Journal of Law and Economics* (1960) 3, pp.1-44; J.Niehans, "Transaction costs" in *The New Palgrave: A Dictionary of Economics,* (1987) 4, pp.677-80; P.Milgrom and J.Roberts, "Bargaining costs, influence costs, and the organization of economic activity" in J.E. Alt and K.A Shepsle (eds.), *Perspectives on Positive Political Economy,* University of Cambridge, 1990, pp.57-89.

[103] *Science* is the academic journal for the American Association for the Advancement of Science and is considered one of the world's most prestigious scientific journals. See www.sciencemag.org/journals/

[104] See www.newscientist.com/section/science-news

Corporate culture

Changing the culture of an enterprise is an important determinant of long-term success in carbon related CSR and management. Educating both management and staff in regard to international and domestic mitigation efforts, including treaties, agreements and ongoing negotiations, will support permanent change in the daily administration and the underlying culture of the business, thereby better facilitating the implementation of future CSR strategies. For example, employees can simply be encouraged to integrate CSR principles in day-to-day office practices; for example, the principle of "reduce, re-use, recycle" can be cultivated through staff training, and incentives (such as bonuses) can be awarded for best-practice behaviour.

Power technology options

GHG gas emissions from the electricity sector come primarily from power plants burning fossil fuels for electrical generation. Currently, Chinese coal-fired plants are based on models that are inefficient by international standards. For example, in Japan on average 418 grams of CO_2 is emitted per kilowatt-hour, while in the United States the figure is 625 grams.[105] In contrast, it is estimated that China's top ten coal-fired plants, which provide almost 60 per cent of China's total electricity, emit approximately 752 grams of CO_2 per kilowatt-hour.[106]

On-site power generation

GHG emissions from the electricity and building sectors can be reduced through on-site power generation using renewable and other climate-friendly energy resources. Examples include: rooftop solar panels, solar water heating, small-scale wind generation, stationary fuel cells powered by natural gas or renewable hydrogen, and geothermal heat pumps. For more on renewable and other alternative energy technologies, see Early investment in clean energy, page 20. For examples of on-site power generation, see the Lafarge Chongqing Nanshan Cement Company and Taishan Fibreglass Company's Cogeneration Project Case Study in Part III of these guidelines which looks at the application of residual heat technology.

Alternative sources of energy overwhelmingly rely on technologies that require significant capital investments in their start-up phase and therefore, while start-up costs are gradually decreasing, alternative energy remains more costly than energy generated from fossil fuels. This is in part due to the market power of many coal and oil companies keeping fossil fuel derived energy prices artificially low through unseen subsidies. Incentive programmes such as consumer rebates and tax credits for specific clean-technology can however be very effective in supporting the use of alternative energy (see Chinese Government laws and regulations, page 12).

Businesses investing in renewable energy systems will benefit from higher-efficiency, lower emissions as well as having the opportunity of supporting a major source of national growth. Private enterprises with less potential for on-site power-generation and therefore power generation-related

[105] SBS World News Australia, "China power firms emit more carbon than whole of United Kingdom" (2009/07/29) [Accessed at www.sbs.com.au/news/article/1061332/China-power-firms-emit-more-carbon-than-whole-of-UK]

[106] Greenpeace, "Polluting Power: Ranking China's Power Companies" (2009/07/28) [Accessed at www.greenpeace.org/china/en/press/release/ranking-power-china]

GHG emissions can however minimize their power-related GHG emissions by choosing to purchase energy from cleaner sources where possible.

Carbon capture and storage (CCS)

While not yet commercially available, technologies that can capture carbon dioxide from the combustion or gasification of coal and other fossil fuels, rather than allowing it to be released into the atmosphere, are currently under development. Once captured, carbon dioxide produced from fossil fuel use can be injected into underground geological formations and stored on a long-term basis (potentially for thousands of years). Because CCS requires expensive equipment and infrastructure to capture, transport, and store carbon dioxide, it is most cost-effectively applied to large stationary sources of carbon dioxide, such as coal-fuelled power plants. CCS could prove to be a major source of GHG emissions reductions. Modelling conducted by the International Energy Agency (IEA) forecasts that CCS could provide 20 per cent of total global GHG emission reductions in 2050 under a global climate agreement.[107]

Around the world, several small-scale CCS demonstration projects are underway and larger projects are planned. However, government incentives are required to spur investments in large-scale CCS projects in order to reduce costs and develop the technology further.

In China, two full-scale pilot projects are under construction and will be completed by 2014. The first is an integrated gasification combined cycle (IGCC) coal, hydrogen production, fuel cell and CCS power station in Tianjin named Green-Gen. It is a multi-stage project, with CCS technology to be added by 2012. Green-gen is managed by the Huaneng Group with support from the Chinese Government, and has received investments from seven of China's key energy companies. The second project is a planned 300 MW CCS coal power station known as near zero emission coal (NZEC) power station that was launched in November 2007 by the United Kingdom Government and it is due for expected completion in 2014.[108]

Energy management and systems optimization

Energy management begins with a strong commitment to continual improvement of energy efficiency. A first step once the organizational structure (management representative and cross-divisional/functional team) has been established involves assessing the major energy uses in the facility in order to develop a baseline of energy use and set targets for improvement. The selection of energy performance indicators and objectives help to shape the development and implementation of an action plan. The effectiveness of an action plan depends on the involvement of personnel throughout the organization, who need to be aware of energy use and performance objectives. Staff and those who work on behalf of the organization need training in both skills and day-to-day practices to improve energy performance. The results should be regularly evaluated and communicated to all personnel, recognizing high achievements. The emergence over the past decade of better integrated and more robust control systems can play an important role in energy management and in reducing energy use.[109]

[107] International Energy Agency (IEA), "IEA Work for the G8: 2008 Messages", 2008, pp.9-10 [accessed at www.iea.org/g8/2008/g8_iEAwork_2008.pdf]

[108] "China's Clean Revolution", p.13

[109] Related ACEEE 2009 Industrial Summer Study paper: Automated Demand Response: The Missing Link in the Electricity Value Chain

Energy management requires a facility to develop an energy management plan. In organizations without a plan in place, opportunities for improvement may be known but may not be promoted or implemented because energy management is not part of the organizational culture and the normal planning process. This failure to plan reinforces traditional barriers, which include: a lack of communication among sites, poor understanding of how to create support for an energy efficiency project, limited finances and financial data, poor accountability for measures, and perceived risk from changing the status quo. In addition, business metrics such as energy performance indicators that relate energy use to production output are typically not utilized, thus making it difficult to document improvements in energy performance. A successful programme in energy management provides an organizational framework for a company to respond effectively through a programme of continuous technical and management improvement that establishes energy intensity reduction and/or GHG reduction targets.

An integral part of good energy management is the optimization of an enterprise's production line and contained industrial energy systems. An industrial energy system encompasses everything from the supply of energy into the system to the production end uses. While equipment manufacturers generally continuously improve the performance of individual system components (such as motors, steam boilers, pumps and compressors) to a high degree, these components however only provide a service to the users' production process when operating as part of an overall system. Industrial electric motor and steam systems consume huge amounts of energy, and while individual components can be energy efficient, the overall system configuration can be very inefficient.

System optimization seeks to design and operate industrial systems (i.e.—motor/drive, pumping, compressed air, fan and steam systems) to provide excellent support to production processes using the least amount of energy that can be cost-effectively achieved. The process of optimizing existing systems includes:

- Evaluating work requirements;
- Matching system supply to these requirements;
- Eliminating or reconfiguring inefficient uses and practices (throttling, open blowing, etc);
- Changing out or supplementing existing equipment (motors, fans, pumps, compressors) to better match work requirements and increase operating efficiency;
- Applying sophisticated control strategies and variable speed drives that allow greater flexibility to match supply with demand;
- Identifying and correcting maintenance problems;
- Upgrading ongoing maintenance practices.

It should be noted that a system that is optimised to both energy efficiency and cost effectiveness may not use the absolute least amount of energy that is technically possible. The focus is on achieving a balance between cost and the energy consumption that applies energy resources as efficiently as possible.

System optimization cannot be achieved through simplistic one-size-fits-all approaches. Both industrial markets and policymakers tend to focus on equipment components (motors and drives, compressors, pumps, boilers), which can be seen, touched and rated rather than overall production systems, which require engineering and measurement. As previously stated, the presence of

energy-efficient components, while important, provides no assurance that an industrial system will be energy-efficient and misapplication of energy-efficient equipment (such as variable speed drives) in these systems is common. System optimization requires taking a step back to determine what work (process temperature maintained, production task performed, etc) needs to be performed and only when these objectives have been identified can analysis be conducted to determine how best to achieve production in the most energy-efficient and cost-effective manner.

Improved energy systems' efficiency can contribute to an industrial facility's bottom line while at the same time improving the reliability and control of these systems. Increased production through better utilization of equipment assets is frequently a collateral benefit. Maintenance costs may decline because better matching of equipment to demand needs results in less cycling of equipment operation, thus reducing wear. Optimizing the efficiency of steam systems may result in excess steam capacity that can be used for cogeneration applications. Payback periods for system optimization projects are typically short—from a few months to three years—and involve commercially available products and accepted engineering practices.

If system optimization is so beneficial, why isn't industry already doing it? There are several factors that contribute to a widespread failure to recognize the opportunity that systems optimization presents. This lack of awareness is a global phenomenon—including for example; the European Union, the United States, Canada, China and Australia. Contributing factors include the complexity of modern industrial systems and the institutional structures within which they operate. Industrial systems (motor-driven and steam systems) are ubiquitous in the manufacturing environment, but their applications are highly varied. They are supporting systems, so facility engineers are typically responsible for their operation, but production practices on the plant floor (over which the facility engineer has little influence) can have a significant impact on their operational efficiency.

For more information on systems optimization, go to module 17 of the Training Manual on Sustainable Energy Regulation and Policymaking for Africa, which can be found at: www.unido.org/fileadmin/user_media/Publications/Pub_free/training_manual_on_sustainable_energy_regulation_and_policymaking_for_Africa.pdf

Supply chain carbon management

Chinese businesses that depend on carbon intensive up- and down-stream production inputs and service provision should be mindful of the impact that such arrangements have on an organization's life-cycle analysis, carbon auditing outcomes and other relevant CSR strategies. Where enterprises have the scope to expand or acquire subsidiaries, this section provides a brief introduction to investment opportunities in the green sector. Where such inputs and services are provided on a contractual basis, the section simply identifies the industrial sectors which should be considered when undertaking an environmental evaluations or audits to be included when considering supply chain-related GHG emissions.

Construction and buildings

China's construction sector is growing rapidly, with 20 billion square metres of planned construction to be completed by 2020—equivalent to Europe's entire building stock. Currently, buildings in

China account for approximately 18 per cent of national energy consumption.[110] Between 2006 and 2025, the domestic urban population will double, increasing by 330 million. Along with this process of urbanization, demand for buildings and energy will expand. It is expected that, energy consumption attributable to buildings will rise to approximately 25 per cent of national energy use by 2030.[111]

The energy efficiency of a building in which a business is located will go a long way in determining the emissions of that business. Businesses should be aware of new government building codes (see Energy-efficient appliances and buildings, page 24) when obtaining properties from which to operate. Either obtaining a property that conforms to these regulations, or undertaking renovations to become compliant prior to the commencement of business operations will pay off in the long run.

The recently opened PepsiCo beverage factory provides a good example of energy-efficient building design. Opened in the city of Chongqing in Western China, the plant will enable PepsiCo to reduce annual GHG emissions by 3,100 tons, water usage by 100,000 tons and overall energy use by 4 million kWh hours. In order to conserve energy, natural lighting is used for approximately 75 per cent of indoor areas. A roof garden provides insulation; saving energy that would otherwise be spent on heating and cooling. To save water the plant utilizes a high-pressure cleaning system, water-conservation fixtures and recycled water for landscaping and general cleaning. These measures will reduce long-term energy and water costs for the company. The site also serves as an educational centre for the community, providing a learning tool through which local students can engage with climate change issues and observe good environmental practice.

Manufacturing

In 2004, an estimated 23 per cent of energy demand (and CO_2 emissions) in China came from making products for export markets.[112] The export market continues to grow, reaching a value of RMB 8.2 trillion (US$ 1.2 trillion) in 2007.[113] In response, the Government is requiring those factories with energy efficiencies in the lowest quartile of their respective sectors either improve efficiency or shut down.[114] It is essential that manufacturing enterprises ascertain their efficiency rating and if in the lower quartile, evaluate the relative benefits of improving efficiency and continuing to operate, scaling down, or closing down their business. In addition, businesses seeking to produce energy efficient technologies will find that, due to the sharp upturn in current demand for such products, the climate is suitable to rapid growth or expansion into this area.

In 2005, the Government issued mandatory energy efficiency standards and labelling for consumer appliances. The sale of unlabeled products has been prohibited, and green procurement policies for government offices and state-owned companies were established. Further standards are under development for water heaters, electric fans, rice cookers and other appliances.[115] Businesses

[110] S.Howard and Wu Changhua, China's Clean Revolution, The Climate Group, China, p.16 [Accessed at www.theclimategroup.org/assets/resources/Chinas_Clean_Revolution.pdf]

[111] J. Woetzel, M.Joerss, "China's Green Revolution", p.58.

[112] S.Howard and Wu Changhua, "China's Clean Revolution", p.16.

[113] Ibid

[114] Ibid

[115] Zhou Nan, "Status of China's Energy Efficiency Standards and Labels for Appliances and International Collaboration" in Lawrence Berkeley National Laboratory Report, Clean Energy Group, 2008 [Accessed at http://china.lbl.gov/publications/status-chinas-energy-efficiency-standards-and-labels-appliances-and-international-colla]

purchasing such appliances should consult their procurement agent to ascertain whether they conform to government standards. According to the Lawrence Berkeley National Laboratory, China has the potential to mitigate over 10 million metric tons of CO_2 emissions per year as a consequence of these measures.[116]

Agriculture

Between 1990 and 2005 the contribution of agriculture to global GHG emissions has grown from 10-12 per cent to 17 per cent and it is expected that this number will rise further, in proportion to increases in food production.[117]

Agriculture can also be a part of the solution. Less productive agricultural lands can be reforested, creating carbon sinks. Farming practices can be altered to absorb and retain carbon in agricultural soils. Changing farming practices and land use has multiple benefits as not only will it have an impact on emissions reductions, it may have other positive effects that benefit the local environment, such as contributing to improvements in soil, water and air quality, regenerating wildlife habitat and providing a healthier environment for outdoor recreation and tourism.

Businesses should be mindful of the source from which they obtain primary inputs such as raw grain or other agricultural materials, the relative emissions data for these input materials and the sustainability of their production practices.

Transport

Because more energy-efficient modes of transport, such as public transport, bicycles and motorcycles are still favoured by the majority of the population, China has one of the world's least carbon-intensive transport sectors. Transport makes up less than 10 per cent of total energy use, compared to 25-30 per cent in developed countries.[118] Car ownership in China only accounts for approximately one person in 70,000 opposed to the United States where it is one in one. However, China's on-road vehicle numbers will more than triple by 2035 to over 400 million as the middle class continues to expand.[119]

Businesses managing upstream and downstream carbon emissions should consult transport providers, or make estimations based on reliable industry data, in order to ascertain the levels of emissions per kilometre for the relevant mode of transportation. For an introduction to electric and hybrid vehicles see Hybrid and electric vehicle technology, page 25.

[116] "China's Clean Revolution", p.70

[117] Executive Secretary UNFCCC Yvo de Boer, Address at UNCCD Land Day, Bonn [Transcript], (2009/06/06) [Accessed at http://unfccc.int/files/press/news_room/statements/application/pdf/090606_speech_bonn.pdf]

[118] "China's Clean Revolution", p.85

[119] Ibid, p.87

International financing for climate change

China's position on climate cooperation

China's stance in regard to climate change mitigation remains based on the principle of common but differentiated responsibilities, the importance of knowledge and skill sharing between North and South and more recently, recognition that around one third of China's emissions results from the manufacture of export products—with the majority of these products being consumed by developed countries.[120] China therefore supports a post-Kyoto framework under the UNFCCC, with strict targets for developed countries that are binding on both Kyoto and non-Kyoto parties, but it does not support the adoption of binding targets for developing countries.[121] In recent years, both China's President and Premier have taken this position in G8 negotiations, multilateral and bilateral negotiations in the Asia Pacific Economic Cooperation, the East Asia Summit, and the Boao Forum for Asia.

At the bilateral level, China has established climate change dialogues and cooperative mechanisms with numerous countries and regions. The Chinese Government has also recently signed a Memorandum of Understanding with the United States, for the purpose of strengthening cooperation on climate mitigation between the two countries.[122] These dialogues often facilitate China's own scientific research into mitigation and adaptation, and the development of appropriate policy for Government. China has also been actively assisting various regions in their adaptation to climate change; for example, China's African Policy White Paper clearly identifies the promotion of China-Africa cooperation on climate change as a national priority.

China is an active participant in multilateral cooperative initiatives concerning the calculation of mitigation costs and risks, the drafting of climate change international policy, as well as clean technology research, development and demonstration. One such initiative is the World Climate Research Programme (WCRP) under the Earth Science Systems Partnership (ESSP) which aims to improve climate predictions and understanding of the anthropogenic causes of climate change through the modelling of the earth system and the policy-relevant assessment of climate conditions.[123] Another initiative in which China participates is the International Human Dimensions Programme on Global Change (IHDP), which is an international interdisciplinary science programme directed at initiating, coordinating and supporting research, knowledge sharing and capacity-building specifically in regard to the human dimensions of global environmental change.[124]

The Chinese Government is committed to strengthening cooperation with relevant international organizations and agencies by undertaking coordinated joint research and development projects and by sharing information and resources.

[120] Ministry of Foreign Affairs (P.R.C), H.E. Ambassador Xie Hangsheng, "Climate Change—China's Perspective" Transcript of Address at Local Government Climate Change Leadership Summit in Copenhagen, Denmark (2009/06/05) [Accessed at www.fmprc.gov.cn/eng/wjb/zwjg/zwbd/t566228.htm]

[121] Xinhua, "China to continue active role in addressing climate change: official" in People's Daily Online (2009/09/03) [Accessed at http://english.people.com.cn/90001/90776/90785/6747851.html]

[122] Bureau of Public Affairs, Office of the Spokesman (U.S.A), Secretary for Public Diplomacy and Public Affairs, Press Release: "United States-China Memorandum of Understanding to Enhance Cooperation on Climate Change, Energy and the Environment" (2009/07/28), [Accessed at www.state.gov/r/pa/prs/ps/2009/july/126592.htm]

[123] World Climate Research Programme at http://wcrp.wmo.int/wcrp-index.html

[124] International Human Dimensions Programme on Global Environmental Change at www.ihdp.unu.edu/

Sources of international finance

Carbon trading and the Carbon Development Mechanism (CDM)

Emissions trading

Carbon or emissions trading centres around the premise that to achieve greater economic efficiency within the scope of reducing global GHG emissions. It is often cheaper for an entity under an emissions reduction commitment, such as a company or country, to purchase emission rights or permits rather than to actually conduct emissions reductions themselves. Thus, the underlining principle to international emissions trading is the different marginal pollution abatement costs experienced by different countries. Countries with higher abatement costs (usually developed countries) will have an incentive to buy emission permits from countries with lower abatement costs (usually developing countries), thereby creating an incentive for trade between the two types of parties.

The Kyoto Protocol flexible mechanisms (CDM)

Under the Kyoto Protocol, the Annex I countries (37 industrialized countries) are committed to reduce their collective emissions of the six GHG gases included in the Kyoto Protocol (CO_2 CH_4 N_2O HFCs PFCs and SF_6) collectively by 5.2 per cent relative to 1990 levels by the end of the first commitment period from 2008-2012. The protocol allows Annex I countries to meet their obligations through a number of "flexible mechanisms" such as: (1) emissions trading; (2) Joint Implementation (JI); and (3) the Clean Development Mechanism (CDM), the latter being of the most relevance to China. The CDM allows entities in Annex I countries to purchase emissions rights generated by certified emissions reduction projects (e.g. industrial energy efficiency projects) carried out in developing countries, such as China, where GHG abatement costs are far lower. These emissions reduction projects generate Certified Emission Reductions (CERs) which are the equivalent of the reduction of one metric ton of CO_2e (i.e. CO_2 or its equivalent if the reduction is based on one of the five other GHGs covered by the Kyoto Protocol).

The CDM therefore is intended to provide a mechanism to lower Annex I country commitment costs through the supplementary purchase of lower cost emission rights while at the same time promoting greater technology and capital transfers to developing countries in order to strengthen the sustainable development of the CDM project host countries. The CDM is supervised by the CDM executive board (CDM EB) and is under the guidance of the Conference of the Parties (COP/MOP) of the UNFCCC.

The central condition of the CDM is that all CDM projects should be "environmentally additional". Environmentally additional means that the GHG emissions reduction that a project produces must be in addition to those that would have occurred in the absence of the project under a business-as-usual scenario (referred to as the baseline scenario).

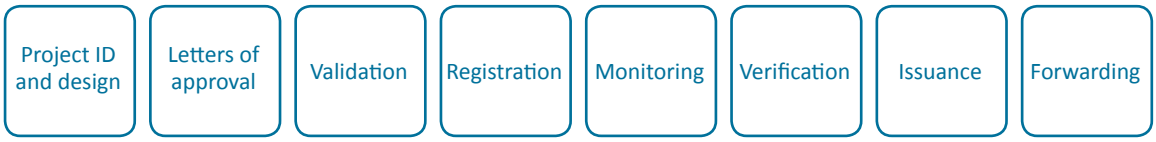
The main mechanism for all CDM projects to demonstrate that they are environmentally additional, is to determine the financial additionality of a proposed project. To be financially additional a proposed CDM project generally must demonstrate that it is the potential sale of the generated Certified Emissions Credits (CERs) that makes the project economically attractive and viable, and

without the added revenue that the CDM will bring the proposed project would not be economically/financially viable. The financial additionality of any proposed project is usually determined by applying an internal rate of return (IRR) cut-off value to the proposed investment (without taking the CDM revenue into consideration). For example, the IRR cut-off for industrial waste heat recovery power generation CDM projects in China is 12 per cent, as set by the Designated National Authority (DNA)/Chinese Government. Therefore, the proposed project must have an IRR of below 12 per cent to prove that the investment is not commercially viable without the additional revenue that the CDM would bring to the project.

The CDM project cycle

The CDM project cycle can be considered to be relatively complex, costly and more often than not lengthy. Figure 3 shows the eight main steps to the project cycle:

Figure 3. The CDM project cycle steps



1. Project identification and project design document preparation

A potential GHG mitigation opportunity/project is identified and initial agreements between the relevant parties are obtained. The CDM project design process is then begun culminating in the development of the Project Design Document (PDD). PDDs are prepared by the CDM project developer and submitted to the national DNA. PPDs are extremely detailed in nature, being thoroughly reviewed by external bodies during the subsequent stages of the CDM project cycle.

2. Letters of approval

Written approval (LoA) for the project must be obtained from the Government of the host country. This comes from the DNA, indicating that the Government believes that the proposed project will assist the country by contributing to greater national sustainable development in terms of complementing national economic and environmental strategies as well as promoting technology and finance transfer and poverty alleviation where relevant. This letter must be submitted to the selected Designated Operational Entity (DOE) prior to any DOE submission of the validation report to the CDM EB.

3. Validation

Validation is the process of independent evaluation of the CDM project activity by a designated operational entity against the requirements of the CDM. Validation confirms that the proposed project meets the requirements of the CDM (according to the CDM EB), thus determining the eligibility of the project for registration as a CDM project. This part of the project cycle process is outsourced to private DOEs, or "validators".

4. Registration

Registration is the formal acceptance by the CDM executive board of a validated project as a CDM project activity. Registration is the prerequisite for the verification, certification and issuance of CERs relating to that project activity. Therefore, registration is a key stage in the CDM project cycle, representing the point where a project activity is accepted as a CDM project, making it eligible to generate certified emission reductions (CERs).

5. Monitoring

Monitoring refers to the collection and archiving of all relevant data necessary for determining the baseline, measuring anthropogenic emissions by sources of GHGs within the project boundary of a CDM project activity. Therefore, monitoring refers to the measurement and analysis of GHG emissions from a project within its boundary to determine the volume of emission reductions that are attributable to the project. Monitoring is implemented through the monitoring plan, which is included as part of the project design document (PDD) submitted for registration.

6. Verification

Verification is the periodic independent review and ex-post determination, by the designated operational entity, of the monitored reductions in anthropogenic emissions by sources of GHGs that have occurred as a result of a registered CDM project activity during the verification period. Essentially, verification is the process of confirming the authenticity of reductions in GHG emissions by a CDM project over a defined period of time (the verification period). In order to do this, a CDM project's emission reductions are monitored, and the monitoring data for a verification period is reviewed and assessed by the DOE. In brief, the key elements of verification are: (1) a periodic independent review and ex-post determination; (2) reduction in GHG emissions by sources which have been monitored; (3) the process is performed by an independent designated operational entity (DOE).

7. Issuance

Issuance refers to the creation of certified emission reductions equivalent to the number of GHG emission reductions which have been generated, verified and certified in respect of a CDM project activity. CERs are issued by the CDM registry administrator on behalf of the CDM EB. Upon being instructed by the executive board to issue CERs for a CDM project activity, the CDM registry administrator issues the specified quantity of CERs into the pending account of the executive board in the CDM registry, ready for forwarding to the project developer.

8. Forwarding

Forwarding is the process by which the CDM registry administrator transfers certified emission reductions from the executive board's pending account into the accounts of the parties involved and project participants, as well as to the accounts in the CDM registry relating to the share of proceeds.
Source: The CDM Rule Book: www.cdmrulebook.org

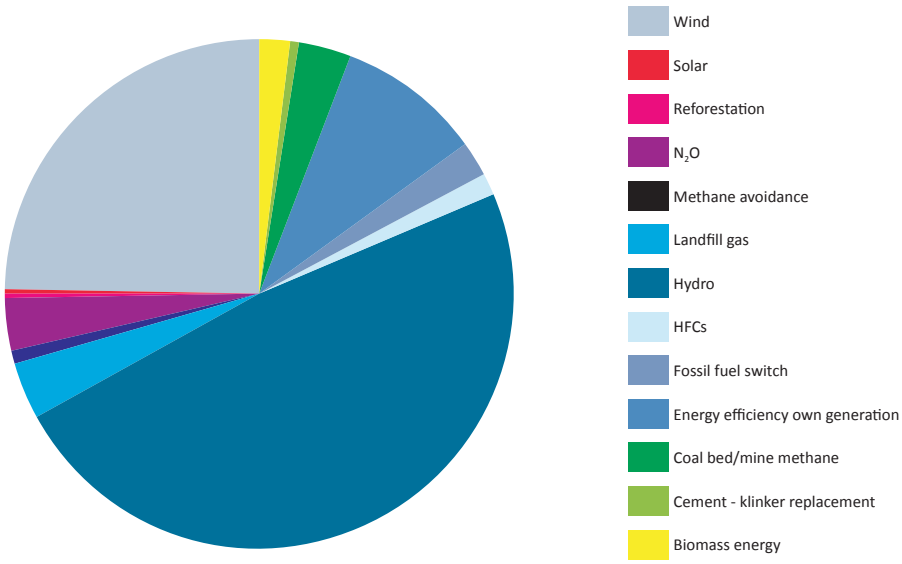
The CDM market

While the first, and to date only, commitment period under the Kyoto Protocol is from 2008-2012, the CDM sector itself has been active since the late 1990s. The first CDM project was registered

with the CDM EB on 18 November 2004 (a landfill gas project in Brazil). The CDM market began its first main period of growth in 2005 after the entrance into force of the Kyoto Protocol with Russia's ratification.

As of May 2010, there were 2,211 CDM projects registered with the CDM EB with a further approximately 2,000 in the pipeline. China accounts for approximately 38.5 per cent of the total number of registered CDM projects in the global market, with 851 projects being registered as of May 2010, and China's CDM projects produce approximately 60.3 per cent of the total annual amount of CERs generated by the CDM. Figure 4 shows the registered makeup of the Chinese CDM portfolio by project type.

Figure 4. Chinese registered CDM projects by type as of May 2010



Data Source: UNEP Risoe CDM/JI Pipeline

To date the main buyers of CDM CERs have been large companies, such as utilities and industrial enterprises in the Annex I countries. Some Annex I country Governments also buy CERs from CDM project developers themselves, this being usually achieved through national or agency funds as well as through collective multilateral CER funds such as the World Bank's Prototype Carbon Fund.

Barriers to increased CDM diversification and expansion

The CDM cycle, due to its complexity and the need for monitoring and verification, can be considered to be relatively expensive in terms of investment financing. Projects typically take a number of years before they reach the point where the CDM EB begins to issue CERs. Moreover, projects can cost anywhere between US$ 50,000 and US$ 150,000 to develop, US$ 20,000 and US$ 75,000 to

validate and US$ 10,000 and US$ 50,000 each year to verify depending on the nature and type of the project. This is exclusive of fees that also need to be paid to the CDM executive board when submitting for registration and every year after that for issuance of credits.

This situation, along with risks inherent within the carbon market (uncertainty in regard to the future post-2012 nature of the CDM and the lack of predictability in regard to the CDM executive board), has resulted in most CDM projects being designed within sectors that offer large-scale opportunities to generate CERs. These sectors include high capacity waste heat recovery power generation plants within industrial sectors (e.g. cement and iron and steel) or large-scale renewable energy sectors such as big wind farms and hydropower projects. The development costs associated with CDM projects is one of the main barriers that have prevented the CDM from expanding and diversifying into smaller industrial and non-industrial sectors.

The future of the CDM is intrinsically linked to the intergovernmental climate change negotiations that take place within the scope of the UNFCCC COP/MOP process. At the time of drafting these guidelines, a decision on what will happen at the end of the first Kyoto Protocol commitment period had not been reached and therefore the future of the CDM beyond the end of 2012 had not been clarified. However, most people active within the sector and the UNFCCC COP/MOP process are working under the impression that the CDM will continue beyond 2012 in some extended or renewed form.

Beyond the issue of what exactly will happen with the CDM after 2012, there is an increasing need and desire for the CDM to evolve, expand its project scope and diversify the sectors and the scales at which it presently operates. This is due in part to the fact that for the CDM to fulfil its intended role of supporting sustainable development in the non-Annex I project host developing countries, the CDM needs to target smaller industrial installations as well as also fostering more developmental style projects in rural areas (e.g. biomass cooking stoves) and housing sectors (e.g. energy efficient lighting options). While the high costs of developing CDM projects present a significant barrier to achieving this diversification, CDM project developers, international development organizations and governments are increasingly beginning to turn their attention to developing methodologies that will better facilitate CDM diversification.

The two approaches that are intended to facilitate CDM project diversification into sectors where possible individual site potentials for CER generation are at a scale too small to be financially viable are; (1) Bundled CDM and (2) Programmatic CDM (P-CDM). Bundled CDM refers to the bringing together of several smaller scale CDM project activities into a group, with the CDM project application being based on the entire group, thereby reducing the overall project development cost per individual project site contained within the group. Bundling must occur on or before the registration stage and projects cannot subsequently be added or debundled at a later stage. While, the concept of bundled CDM has been in use almost since the beginning of the CDM, it has only been applied very occasionally. One possible reason for this is that while bundling helps to mitigate the transaction cost threshold barrier, if one project in the bundle is rejected, all the projects in the bundle could be rejected, meaning the registration risk of each project is effectively increased. The risk of failure attached to each project is not pooled, it is in fact aggregated and therefore there needs to be complete confidence in the success of all of the projects in a bundle to justify taking this additional risk.

Programmatic CDM by contrast involves registering the project concept (referred to as the Programme of Activities document (PoA) and then, once approved, applying the concept to an unlimited number of eligible project installations (CDM Programme Activities—CPAs). This

approach brings together a number of CDM project activities under a programmed structure, where there is no limitation on project scale, thereby bringing down the transaction costs per project and shortening project development time scales for CPAs once the PoA has been approved. The programme will contain many similar projects to be registered with the CDM EB, and additional CPAs can be added at any point in the life of the PoA without undertaking the validation process afresh (and thus is differentiated from bundled CDM). P-CDM requires registration and ongoing management at both the programme level and for each individual project level, with a coordination entity being required to manage the programe at both levels.

In theory, P-CDM offers greater flexibility for CDM development within a sector and providing benefits to smaller scale projects; however in practice there are still many barriers to overcome. Guidance for the development of P-CDM has been provided by the UNFCCC, but the approach is yet to be put in to wide-scale practice. There are currently only two registered P-CDM projects in the world (both in Latin America) with nine more projects presently in the validation stage. Six of these projects are in China but it is unclear whether they have been granted LoA approval by NDRC.

Non-Kyoto Protocol voluntary carbon markets

In addition to the CDM CER market, there are emissions trading mechanisms outside of the realm of the Kyoto Protocol—these are often termed "voluntary emissions reductions markets", where the unit of carbon currency per ton of CO_2e is the Voluntary Emission Reduction (VER).

Voluntary emissions reductions are sold as part of an over the counter, voluntary carbon offset market, which operates alongside of regulated compliance markets. The voluntary carbon offset market is highly fragmented, with many diverse buyers, sellers, projects developers and project types. No one industry definition exists for a VER, and no one set of standards exists to ensure the quality of credits. As a result of this, VERs cannot be sold into compliance markets such as the European Emissions Trading Scheme (EU ETS). As the conditions surrounding the VER market are generally less stringent than those of the CDM, voluntary emissions reductions projects are cheaper and simpler to develop than their CDM equivalents and therefore VERs sell at a lower prices than CERs.

CDM summary

GHG emissions trading and the CDM have proven themselves to be a valuable tool in promoting increased industrial energy efficiency and renewable energy deployment in China. While the exact nature of the CDM beyond the expiry of the first Kyoto Protocol commitment period at the end of 2012 has not yet been clarified, the CDM is likely to continue to offer project developers and enterprise operators in China with a mechanism with which to make industrial energy efficiency and renewable energy investments more commercially viable while at the same time achieving GHG emission reductions.

However, successfully developing CDM projects is a complex, lengthy and often expensive undertaking and therefore most CDM projects in China have so far generally focused on large-scale renewable energy and industrial energy efficiency projects where there are opportunities to generate large volumes of CERs from each project site.

While programmatic CDM offers potential in terms of expanding and diversifying the CDM into sectors (and project size scales) not presently targeted by project developers, the rules and methodologies that will govern and guide this process have not yet been fully clarified at the national and international level. However, once programmatic CDM does become fully developed it will have the potential to greatly enhance the potential of the CDM to fund GHG mitigation investments in the smaller industrial and manufacturing sectors as well as in sectors like housing and rural communities.

Other sources of international funding

The following agencies provide financial and technical assistance to China within the area of energy-conservation and GHG emissions mitigation:

- International Development Bank: The Asian Development Bank, the World Bank and other banking institutions;
- The United Nations and the Global Environment Facility (GEF);
- Bilateral donors: The United States Environmental Protection Agency and the Department of Energy, the European Union, the Government of Spain, the Government of the United Kingdom, and development agencies of other countries;
- NGOs and Civil Society: the International Union for the Conservation of Nature and Natural Resources (IUCN), the Energy Foundation, the World Wide Fund for Nature (WWF), Greenpeace International and other international NGOs.

For example, the project under which these climate change CSR guidelines were funded is part of the wider China Climate Change Partnership Framework (CCPF) programme. The CCPF is funded by the United Nations-Spain Millennium Development Goal Achievement Fund (MDG-F), which is financed by the Spanish government. The objective of the MDG-F is to support the development of projects that will contribute to achievement of the MDGs by 2015 around the world. In China, nine United Nations agencies, in cooperation with the Chinese Government, are implementing 16 individual but connected activities specific to climate change policy, mitigation and adaptation.

PART III

Case studies: green Chinese business success stories

Introduction

China's economic success and its recent introduction of a series of laws and regulations directed at improving energy efficiency, primarily through technological progress, has presented Chinese businesses with commercial challenges as well as opportunities. In acting on these opportunities, businesses will need to consider individual commercial constraints and advantages rather than simply applying all strategies. This section presents real examples of businesses in China adopting specific climate change mitigation action strategies in order to improve environmental performance and strengthen profits. These case studies seek to demonstrate the effectiveness of such strategies, and to provide examples of profitable frameworks from which business leaders can better understand and implement climate change mitigation strategies as part of a wider CSR policy.

Case study 1. China National Offshore Oil Corporation (CNOOC)

The China National Offshore Oil Corporation (CNOOC), founded in 1982, is one of China's state-owned oil giants and its largest offshore oil and gas producer. It has its headquarters in the Chinese mainland and subsidiary operations in more than 10 countries. CNOOC is also authorized to cooperate with foreign partners for oil and gas exploitation in China's offshore areas. Its principal business portfolios are: oil and gas exploration, development, upstream production and sales of gas and power, chemicals, oil refining, fertilizer production (mid and downstream), as well as technical and financial services, and alternative energy.[125] Headquartered in Beijing, CNOOC has a total staff of 53,000 and a registered capital of RMB 94.9 billion (US$ 14 billion).[126]

CNOOC recognizes that the impacts of climate change will undermine long-term economic growth and stability, particularly in developing countries. CNOOC subscribes to the belief that large businesses should lead by example, adopting practices that will set industry standards. Consequently, CNOOC promotes CSR best practices by undertaking environmental protection projects and other community development initiatives, in order to become a good corporate citizen both internationally and domestically.

[125] "China's Clean Revolution', p.107.

[126] See the CNOOC Homepage at http://en.cnooc.com.cn/index.php?id=110

Strategies for environmental CSR and carbon management

External approach: stakeholder engagement—Government

CNOOC aspires to building a world-class energy company with robust sustainable development credentials. The company recognizes that the domestic policy of the "Scientific Approach to Development" refers to a real process of transformation through which sustainable development practices and innovative business management can be achieved by the application of environmental CSR at the decision-making, investment and management levels.

The company is committed to upholding principles of "harmony",[127] both externally and internally. In this respect, it regards environmental considerations and corporate social responsibility as a paramount consideration. Internally, the company regulates the pace of development and the sharing of financial benefits amongst each department of the company. It also emphasizes harmony in the workplace, and endeavours to strengthen relations between management and employees by investing in human resource development.

External approach: stakeholder engagement—United Nations Global Compact

On 25 June 2008, the General Manager of CNOOC Fu Chengyu, sent a letter to United Nations Secretary-General Mr. Ban Ki-moon, submitting an application to join the United Nations Global Compact.[128] Shortly thereafter, CNOOC's application was accepted by the United Nations Secretary-General.

Joining the United Nations Global Compact has enabled CNOOC to further its engagement in corporate social responsibility and sustainable development initiatives by integrating the United Nations Global Compact principles into its business practices. CNOOC's industry chain is at present undergoing a series of mergers, and its overseas business is expanding. CNOOC regards its membership of the Global Compact as an important means of demonstrating the company's willingness to take on new CSR responsibilities, and display its credentials as a global corporate citizen. CNOOC is required to submit a yearly Sustainable Development Report to the United Nations Global Compact outlining its achievements in this area.

Managerial approach

CNOOC regards energy conservation and emissions reduction as central to its CSR strategy; such characteristics are a key commercial strength that has allowed the company to develop a competitive core business. Environmental principles have been integrated into corporate strategy in such a way as to cultivate awareness amongst all its employees, so as to foster a habit of conscious application of these principles by staff and management in their execution of daily tasks.

[127] First proposed by the Chinese government during the 2005 National People's Congress, the Chinese vision for a harmonious society is one in which Hu Jintao's Scientific Approach to Development culminates in the realization of a socially and economically "harmonious" nation focused not only on wealth accumulation but also societal balance. This signifies a shift in Chinese ideology from a focus on economic growth, which prevailed after Deng Xiaoping declared, "rang yibufen ren xian fuqilai"(let some get rich first) on his tour of Southern China in 1992, to one that also values a smaller gap between rich and poor, and more holistic indicators of human well-being.

[128] See www.unglobalcompact.org/data/join_letters/Global_Compact_Join_Letter_7801.pdf

In 2008, CNOOC developed and implemented the Interim Measures for the Management of the Special Fund for Energy Conservation and Emission Reduction under which it evaluated energy-conservation and emissions reductions outcomes for each of the company's subsidiaries against these targets. Expert groups and individuals were invited to participate in a forum where four corporate standards for energy conservation were developed and adopted. These standards were then successfully applied to the monitoring and supervision of 15 company subsidiaries.[129] In the same year, CNOOC organized a training workshop on cleaner production auditing with a total of 59 company employees participated, 53 of which passed the final examination and gained clean production auditor qualifications.[130]

That year, CNOOC achieved energy savings of the equivalent of 382,000 tons of coal (equivalent to roughly 1 million tons of CO_2) through its emissions reduction programme. This is an increase in savings by 49.8 per cent from the previous year. SO_2 emissions reductions of 836.4 tons and an organic material emission reduction of 373.1 tons with respect to 2007 levels were also achieved in the same period.[131]

Example: waste gas re-injection project at CNOOC's Luda Oil Field Refinery

Project overview

The aim of this project was to maximize the value of oil reserves by developing new technologies and processes that would increase energy efficiency and lower GHG emissions. Ultimately, the project resulted in a reduction of GHG and other pollutant emissions through the discovery and utilization of excess natural gas in an offshore oil field. The project was initiated on November 2006 by the CNOOC Tianjin Branch, and brought together an operational team and an investment of more than RMB 60 million (US$ 8.7 million) of CNOOC's own capital.[132]

Pre-project implementation

During CNOOC's conventional oil refining process, natural gas is separated from the crude oil that is being extracted and is used to drive a gas turbine on the carrier's oil platform to generate power, with the excess natural gas being flared. Prior to September 2006, approximately 205,000 cubic metres of natural gas was being produced in the Luda oil field,[133] while only 90,000 cubic meters was being used for power generation, with 115,000 cubic meters being flared, resulting in 250 tons of carbon dioxide emissions every day.

[129] CNOOC, Annual Report, 2008 (Chinese), p.62 [Accessed at http://en.cnooc.com.cn/data/upload2/xiazai/nv106171310.pdf]

[130] CNOOC, Sustainability Report, 2007 (Chinese), p.25 [Accessed at http://en.cnooc.com.cn/data/upload2/xiazai/2007CNOOC_Sustainability_Report.pdf]

[131] CNOOC, Annual Report, 2008 (Chinese), p.63, [Accessed at http://en.cnooc.com.cn/data/upload2/xiazai/nv106171310.pdf

[132] CNOOC Annual Report, 2006 [Accessed at http://en.cnooc.com.cn/data/upload2/xiazai/nb30617.rar]

[133] CNOOC, Corporate Social Responsibility Report (2006—2007), p.26 [Accessed at www.cnoocltd.com/encnoocltd/shzr/shzrbg/images/200933088.pdf]

Post-project implementation

On 31 March 2007, the excess natural gas was re-injected into the oil field at a daily gas injection capacity of 110,000 cubic metres, thereby sealing the methane underground. As of 10 December 2007, the accumulated volume of gas re-injected reached 26.85 million cubic metres, resulting in a total reduction of carbon dioxide emissions of 75,210 tons. Due to its success, the project's period of operation is expected to be extended by another one and a half years.[134]

Observations

The project is highly transferable due to its use of widely available domestic equipment and technology, as well as the relatively low level of funding required.

However, CNOOC is aware that the project model is only one of the various methods available for the application of natural gas in energy conservation and GHG emissions reduction measures. CNOOC has recently been involved in extensive research regarding natural gas utilization in the Bohai Sea, where natural gas reserves are expected to provide further energy savings in the oil exploration sector.

Case study 2: China National Materials Group Corporation

China National Materials Group Corporation (SINOMA) was established in 1983, as a state-operated enterprise directly administered by State-owned Assets Supervision and Administration Commission (SASAC) under the state Council. It is the only enterprise that manages the production and innovation of the nation's core technologies in the non-metallic materials industry. The SINOMA Group has been listed among China's top 500 enterprises for a number of years and its cement production technology is now amongst the most advanced in the world.[135]

SINOMA integrates research and development, manufacturing and export of non-metal materials and their products. Activities are directed towards six national priority technologies, namely, glass fibre technology, composite material technology, synthetic crystal technology, industrial ceramics technology, new dry-process cement production equipment, and technology/equipment for downstream processing of non-metallic minerals.

SINOMA recognizes that efficiency demands are having a significant impact on the terms of international trade, to the extent that certification requirements have become an environmental non-tariff barrier to trade. As a national leader in construction and engineering materials technologies, SINOMA has committed itself to tackling the major issues of energy-saving and GHG emissions reductions.

[134] Ibid

[135] SINOMA Website, "Outstanding Achievement" at www.sinoma.com.cn/en/yjzs.asp

Strategies for environmental CSR and carbon management

Technological approach—carbon management

SINOMA has significantly contributed to reducing carbon emissions by designing a unique residual-heat power generation system and applying it to its own production process. After achieving breakthrough results in the research and development of residual heat/pressure technology within energy-intensive industries, SINOMA patented its own low-temperature residual-heat recovery power generation system. SINOMA's innovative use of residual heat and pressure from industrial processes has given rise to one of China's top 10 energy saving projects.

In addition, SINOMA has pursued a business strategy of investment in and development of GHG emissions reduction projects through its subsidiaries. The Lafarge Chongqing cogeneration plant, a project of SINOMA Energy Development, and the Taishan Fibreglass Company's cogeneration project are two examples considered below.

Managerial approach—corporate culture

The SINOMA Group does not only appreciate the global nature of the climate change process, it is aware that carbon management often requires paradigm shifts within business itself.

While investing in equipment, technologies and energy conservation projects, SINOMA recognizes that employee participation and engagement will continue to be crucial in achieving energy-efficiency targets and benchmarks. Consequently, it has repeatedly invested in strengthening environmental awareness amongst its employees. A variety of approaches have been utilized to improve staff knowledge of energy conservation, including group activities and meetings, operations analysis, office bulletins and basic education. SINOMA has drawn energy efficiency guidance from relevant Chinese national laws (Energy and Resources Conservation Laws of the People's Republic of China) as well as SINOMA's internal company policy (SINOMA Group Guidelines for Energy Conservation and Emissions Reduction). The guidelines specify practical energy saving measures, such as utilizing natural lighting, switching off lights and appliances during periods of non-use, choosing the standby option on computers and other office equipment and taking the stairs rather than using elevators.

To support these measures, SINOMA has established internal incentive and monitoring mechanisms. For example, a car-sharing system has been organized, facilitating multi-occupant commuting to the workplace and meetings thereby reducing transport-related emissions. In addition, any energy wasting behaviours observed by other employees can now be published on the SINOMA internal website. The possibility of exposure, and the exposure itself, provides a strong moral incentive for behavioural change. The above measures have strengthened the commitment of employees to the company's CSR objectives, firmly embedding energy conservation within the corporate culture.

Managerial approach—monitoring and accountability

Finally, strengthening monitoring and accountability has been a significant factor in SINOMA achieving its energy conservation goals. Energy management has been incorporated into existing

internal institutions by developing energy management regulations where these regulations establish a system for the calculation of total energy resources, and an administrative mechanism for their implementation.

Examples—Lafarge's Chongqing cogeneration plant and Taishan Fibreglass Company's cogeneration project

Project overview—Lafarge's Chongqing Cogeneration Plant

The Lafarge Chongqing Nanshan Cement Company cogeneration plant utilizes heat from cement production for power generation. The power generated is used in the treatment and disposal of municipal waste. The project therefore not only provides a much-needed service for the community, it also reduces coal consumption and carbon dioxide emissions by utilizing the cement process waste heat energy that would be otherwise lost to instead power municipal waste treatment facilities that would otherwise have to be powered by fossil fuels or fossil-fuel-derived power. The project has a total investment of RMB 6.5 million (US$ 952,000) and estimated annual slurry disposal capacity of 36,000 tons.

Pre-implementation

While Lafarge is the principal underwriter, the Chongqing cogeneration plant was the first Engineering, Procurement and Construction (EPC) project attempted by SINOMA Energy Development. The project was initiated by SINOMA Energy Development on 27 September 2008 and vetted by Lafarge, using a process that included a 72-hour trial at full load, a 15-day industrial performance evaluation and a 30-day stability assessment. The municipal waste disposal project in particular was jointly developed by Lafarge and the local government's Chongqing Environmental Protection Bureau.

Post-implementation

When the Nanshan cogeneration plant began operations, the annual power generation was approximately 45 million kWh, delivering annual carbon dioxide emission reductions of more than 70,000 tons. In addition to extensive official evaluations, the project has also withstood two major natural disasters: the snow storms that swept China in February 2007 and the 2008 earthquake in Sichuan.

Project overview—Taishan Fibreglass Company's cogeneration project

Taishan Fibreglass Company, a subsidiary of the SINOMA Group, has designed a number of combined heat and power projects in response to China's national energy conservation policy and the Taishan Fibreglass cogeneration project started operations in May 2007. The cogeneration system utilizes surplus steam from the power plant to power advanced wastewater treatment technology,

recycling effluents by transforming pollutants into solid material. This process has the advantage of firstly "zero waste creation" as the solid waste produced by the process is reused by the company; and secondly, lower-cost energy production by utilizing residual steam from the plant's fibreglass production processes compared to traditional treatment methods, as it eliminates the need for additional steam production through the burning of fossil fuels.

Observations

The models considered above are easily transferable and the cogeneration technique is itself already widely applied within China. Companies that are able to procure such technology will find that municipal waste treatment as well as the treatment of industrial effluents can be a highly efficient means of recycling resources where residual forms of energy can be harnessed.

Case study 3: Hanergy Holdings Group Company Ltd.

Incorporated in 1997, Hanergy Holdings Group Company Ltd. (Hanergy) is the largest and one of the most targeted clean energy technology businesses in China. It focuses on developing advanced energy technology, such as hydro power and wind power, as well as providing energy efficiency and GHG emission reduction services.

Hanergy operates a dozen subsidiaries in China, and has established overseas subsidiaries in the United States and the Netherlands. For example, Cleanergy is a leading Chinese consulting firm specializing in energy conservation and emissions reductions (EC/ER). Cleanergy provides consulting services related to the CDM and the Voluntary Carbon Market (VCM), as well as energy auditing, energy contract management (ECM) and emission reductions investment advice.

In the last decade, Hanergy has built a number of hydro and wind power stations in Guangdong, Zhejiang, Jiangsu and Ningxia. Jin'an Qiao Hydro Power Station in Yunnan province is a project currently under construction. When it begins operation, the station will have a 2.4 GW capacity. The All China Federation of Industry and Commerce has recognized this project as a model example of private commercial activity in a sector usually dominated by state enterprises.

Strategies for environmental CSR and carbon management

Managerial approach—long-term business strategy

The Hanergy Holdings Group has developed a business plan focused on one principal and two subsidiary products, labelled the "One Body Two Wings" strategy. This business model incorporates the development of renewable energy technologies such as hydro and wind power, the production of fourth generation energy sources such as fuel cells, methanol and di-methyl ether, and consultation services related to energy efficiency, GHG emission reductions and the CDM.

Hanergy is determined to become the most influential clean energy business in the world. Apart from making the air cleaner, and mitigating climate change, Hanergy's overarching goal is to build a learning-oriented enterprise and prepare employees for long-term careers in the field. Hanergy has worked to establish internal institutions, regulations and dependable financing in this regard.

External approach: stakeholder engagement—Government

Hanergy's stakeholders include Government, employees, customers, down-stream and upstream businesses, NGOs and other relevant institutions. Hanergy's successful development is closely linked to the support of each of these stakeholders. Government support is essential to the smooth development of Hanergy's operations and this support is largely dependent upon corporate social responsibility initiatives, particularly where laws and regulations clearly stipulate the need for sectoral best practice policies to be put into place.

Hanergy implements state environmental best practices by adhering to environmental protection laws and regulations, conducting environmental impact assessments and ensuring that environmental protection facilities are included in the construction of all projects. Hanergy's management reserves the right to exercise an "Environmental Protection Veto Rule", thereby refusing the approval of construction projects that do not meet national industrial policies and environmental standards. In addition, indicators on pollution treatment, environmental protection and energy savings form an important performance benchmark in the evaluation of subsidiary companies.[136]

When constructing hydropower and wind power projects, Hanergy actively utilizes the most advanced energy saving and environmental protection equipment in the world. For example, utilizing Danish VESTAS 2.0 MW wind turbines has improved the efficiency of wind resources, reduced the area of land occupied by wind farms, and reduced the energy consumption of the wind farm itself. Hanergy is also constructing the Jin'an Qiao Hydro Power Station where the company actively protects river fish by discharging fish fry downstream of the dam installations every year, maintaining the ecological balance in the local river system. These measures ensure that all projects of Hanergy Group adequately satisfy the standards set down by Chinese environmental laws and regulations.

Example—power generation at Rudong Wind Farm

Project overview

Rudong Wind Farm is located in Jiangsu Province, generating approximately 240 million kWh annually. With investments in the company reaching RMB 950 million (US$ 139 million), it is China's largest single wind farm project. Hanergy Holdings Group is the principal underwriter, with investments of RMB 8.14 million (US$ 1.2 million).

Pre-implementation

The Rudong project was successfully registered with the United Nations CDM Executive Board[137] on 6 November 2006. Substantial human and material resources were mobilized in order for the project to be approved, particularly in meeting the challenges of monitoring during the

[136] "Environmental Protection Veto Rule" means construction projects which do not meet any one of the national industrial policies and environmental standards will not be approved.

[137] The CDM Executive Board supervises the CDM, under the authority and guidance of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP), and is fully accountable to the CMP.

implementation process. In December 2006 after two years of construction, the first power was supplied to the grid, with the fiftieth and last generator being put into operation in May 2008.

Post implementation

The project was issued with its first annual batch of CERs equivalent to 23,607 tons of CO_2, in November 2008. These CERs were purchased by the Netherlands Coöperatieve Centrale Raiffeisen-Boerenleenbank B.A., earning Hanergy approximately EUR 160,000 (US$ 190,800).

The Rudong project has recently initiated the second phase of verification and expects to be issued approximately 80,000 tons of CERs in this second phase. The project has received further funding, this time from the Chinese Government, in order to pursue energy-saving and emission reductions projects. This demonstrates that businesses, even in the case where they do not initially attract Government support, may do so at a later stage by proving their commercial viability and the potential to contribute to climate change mitigation during the pilot phases of operation.

Observations

Geographical and environmental factors play a decisive role in the competitive advantage of wind power projects. Given China's abundant wind resources, wind power projects present themselves as a potentially profitable investment for local Chinese entrepreneurs. This particular project model is also highly replicable and while Rudong project utilized Danish wind power generation equipment, and benefited from the technical support and training received during the implementation process, China's own domestic wind power equipment production has grown considerably with the quality of its products also improving greatly in recent years. It is therefore feasible now to develop wholly domestic wind power projects based on the experience of Rudong Wind Farm.

Case study summary

These successful Chinese green business initiatives demonstrate that emissions reductions and energy efficiency can be achieved through the establishment of clear goals, a realistic strategy, and close cooperation with like-minded stakeholders. Moreover, the examples considered indicate that socially responsible outcomes are fully compatible with commercially sustainable business models. They also show that given the right model, projects of this type may attract additional public funding if successful, and that such opportunities for green investment currently exist in China in abundance.

Glossaries and concepts

Bali Road Map

The UNFCCC Bali Conference of the Parties 13 (COP 13) was held in Bali in December 2007, with the purpose of negotiating a post-Kyoto agreement on international climate change mitigation targets and schedules under the UNFCCC framework. On 15 December, the Conference produced the Bali Road Map, which sets out a guide for further negotiations.

The Bali Road Map has acknowledged that, in order to prevent further human induced climate change, global society must significantly reduce anthropological GHG emissions. The document proposed 25-40 per cent reductions based on 1990 levels by 2020 as a target for the international community as a whole. However, specific targets for individual countries have not been identified. In order for a post-2012 scheme to come into effect by the end of 2012, a clear agreement must be reached as soon as possible.

Capacity-building

For a business the aim of capacity-building is to increase the effectiveness of the organization through the development of knowledge, internal business management, staff skills and production efficiency through technological change, acquisitions, and managerial approaches such as training and incentives for employees. Ultimately the capacity that is developed should incorporate mechanisms that facilitate internal development and transformation.

Carbon footprint

Carbon footprint refers to the per capita measurement of GHG emissions, generally CO_2 equivalent emissions. It is derived from the sum of the primary and secondary footprints. The primary carbon footprint is one that we have direct control over. It is based on direct emissions, such as from the use of electricity or transportation. The secondary footprint is based on CO_2 emissions arising from the entire lifecycle of the product (for more on this see the definition of "Life cycle assessment" on page 65 of this glossary).

Carbon offset

Where GHGs are released as a result of human behaviour, offsets may be purchased from certified emissions reduction companies or projects, in order to reduce emissions in a global sense by an equivalent amount. The GHG that is offset is generally carbon, hence the phrase "carbon offset." Certified projects may include reforestation and regeneration, or energy efficiency projects amongst others.

Carbon trading

This is the exchange which takes place when one party purchases from another party the "right" to release CO_2, the second party having obtained this right by reducing their own emissions below a certain benchmark for emissions levels. For example, the Kyoto Protocol places emissions reduction obligations on developed countries. Through the Kyoto Protocol's Clean Development Mechanism (CDM), developed countries may purchase Certified Emissions Reduction (CER) credits from approved projects in developing countries, earning the right to emit 1 ton of CO_2 for every credit. Carbon Trading is used colloquially to refer to all forms of GHG emissions trading.

Cleaner production

The term cleaner production refers to the reduction of pollutants and improvement in efficiency during production processes, so as to reduce or eliminate the negative impact of commercial operations on human health and the environment.

Climate change

Climate change refers to a significant change in average climate indicators, or a change in climate that lasts for 10 years or longer. The UNFCCC has defined climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability over comparable time periods".

Corporate culture

Corporate culture relates to the mission and values of a particular enterprise, or group of enterprises. External to formal codes of conduct, corporate culture refers to the values that are emphasized and shared by a company's management and staff, which are often reinforced through informal incentives and social signals. Environmental values can be introduced to a prevailing corporate culture through staff education and example setting by management.

Corporate social responsibility (CSR)

Corporate social responsibility (CSR) is also called corporate ethical responsibility, meaning that while simultaneously seeking to create profits, a corporation is accountable to the general public for observing certain accepted standards, for example upholding the rights of employees, investing in environmental protection and supporting vulnerable groups through donations to charitable causes. CSR has the practical value of providing a self-regulatory mechanism for transnational corporations, which are often unregulated economic agents in the context of an international market.

Communication on Progress (COP)

The Communication on Progress (COP) is a summary report that must be submitted to the United Nations by all members of the United Nations Global Compact annually, including a description

of all plans implemented in order to integrate the Global Compact's CSR principles with the existing business strategy. It may be included in the annual financial report, released in a sustainability report, or in any other form that is deemed appropriate.

Ecological footprint

The ecological footprint is similar to the carbon footprint in the sense that it is a per capita measure of anthropogenic environmental impact. The measurement is based on the gap between human demand and supply of environmental and ecological resources.

Emissions reduction target

This is the term used for an identified emissions reduction goal. The Chinese central government's eleventh Five-Year Plan proposes that emissions of major pollutants be reduced by 10 per cent of 2007 levels by 2012.

Environmental impact assessment (EIA)

An environmental impact assessment (EIA) is a method by which potential negative environmental impacts are identified and evaluated prior to the commencement of an industrial project, such as large construction projects or activities within the extractive industries. Conducting EIAs may assist an enterprise to identify and manage potential environmental risks, and make reasonable estimations of the costs involved.

Environmental performance assessment (EPA)/evaluation (EPE)

Environmental performance is the standard at which a company meets its environmental obligations. It is measured against benchmarks based on emissions indices, resource and energy efficiency, and the ecological impacts of products and services. The environmental obligations of an enterprise may be defined either externally or by the company itself. An evaluation of an organization's performance is called an environmental performance evaluation (EPA) but is also known as an environmental performance evaluation (EPE).

Environmental risk assessment (ERA)

Environmental risk assessments (ERAs) assess the risks of environmental damage as a result of a company's activities. Risks include the leakage of poisonous, hazardous, flammable or explosive substances during construction and/or operations. In addition to identifying and assessing risks, ERAs generally propose prevention and emergency response solutions. The risks of intentional damage or damage from natural disasters are not included in environmental risk assessments.

As with EIAs, ERAs can assist a company to estimate potential costs involved in undertaking environmentally risky projects, and the measures that may be adopted in order to mitigate these risks.

Global compact

The United Nations Global Compact is a policy initiative for businesses that are committed to aligning their operations and strategies with 10 universally accepted principles in the areas of human rights, labour, environment and anti-corruption. Through voluntary participation, business participants voluntarily commit to enacting these core principles, with the aim of advancing sustainable business models and markets. The Global Compact was formally launched in 2000, and now includes approximately 5,100 corporate participants and stakeholders from over 130 countries.

Greenhouse gas (GHG)

Greenhouse gas is a term used to refer to man-made anthropogenic or naturally occurring gases that accumulate in the atmosphere, capturing heat that would normally be reflected or reemitted back out into space by the earth's surface. The Kyoto Protocol defines six green house gases: CO_2, N_2O and CH_4, SF_6, HFCs and PFCs.

The Intergovernmental Panel on Climate Change (IPCC)

The Intergovernmental Panel on Climate Change is the leading body for the assessment of climate change, established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) to provide the world with a clear scientific view on the current state of climate change and its potential environmental and socio-economic consequences.

The IPCC is a scientific body. It reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. It does not conduct any research nor does it monitor climate related data or parameters. Thousands of scientists from all over the world contribute to the work of the IPCC on a voluntary basis. Review is an essential part of the IPCC process, to ensure an objective and complete assessment of current information. Differing viewpoints existing within the scientific community are reflected in the IPCC reports.

The IPCC is an intergovernmental body, and it is open to all member countries of United Nations and WMO. Governments are involved in the IPCC work as they can participate in the review process and in the IPCC plenary sessions, where main decisions about the IPCC work programme are taken and reports are accepted, adopted and approved. Because of its scientific and intergovernmental nature, the IPCC embodies a unique opportunity to provide rigorous and balanced scientific information to decision makers. By endorsing the IPCC reports, Governments acknowledge the authority of their scientific content. The work of the organization is therefore policy-relevant and yet policy-neutral, never policy-prescriptive.

The Kyoto Protocol

The Kyoto Protocol (the Protocol) is a binding legal instrument that was adopted on 11 December 1997 by the parties to the UNFCCC convention, and came into effect on 16 February 2005. The Protocol stipulates that by 2010, developed countries must reduce GHG emissions by 5.2 per cent compared to 1990 levels. These are the first binding targets to have been adopted by the international community.

Under the Convention, countries are encouraged to meet obligations by adopting national schemes. However, under the Protocol, three market-based mechanisms were created to assist countries in meeting these targets through international trade and commerce:

1. Emissions trading (or the carbon market)
2. Clean Development Mechanism (CDM)
3. Joint Implementation (JI)

Emissions trading[138] practices allow countries and/or enterprises that have reduced emissions below their respective target limit to sell the excess emissions reductions to countries or enterprises that have not met their target obligations. In addition to actual emissions units, certificates which have been granted to approved emissions reduction projects may be traded: a removal unit (RMU) on the basis of land use, land-use change and forestry (LULUCF) (i.e. reforestation); an emission reduction unit (ERU) created through JI projects; and a certified emission reduction (CER) granted to a CDM activity. Transfer and acquisitions are tracked through an international registry system and an international transaction log ensures secure transfer.

Secondly, the CDM[139] allows Annex II countries (developed countries with emissions reduction or limitation commitments under the Protocol) to implement an emission-reduction project in developing countries. These projects, subject to verification and monitoring processes, are able to obtain certified emission reduction (CER) credits, each equivalent to 1 ton of CO_2 equivalent. These CERs may be traded once registered. The CDM provides a measure of flexibility to developed countries as to how they meet their emissions reduction obligations. Projects must be "a reduction in emissions by sources, or an enhancement of removals by sinks", or in other words "additional to what would otherwise have occurred."[140]

Thirdly, under Article 6 of the Protocol, any Annex II country may earn ERUs from an emission-reduction or removal project in another Annex I country, each equivalent to 1 ton of CO_2. This can be applied to Kyoto reductions targets in the same way as CERs. Projects must be "a reduction in emissions by sources, or an enhancement of removals by sinks", or in other words "additional to what would otherwise have occurred".[141]

Life cycle assessment (LCA)

Life cycle assessment (LCA) or life cycle analysis (LCA), also known as "eco-balance" or "cradle-to-grave analysis", is an internationally recognized tool used for assessing the environmental impacts of a particular product or service, taking into account all phases of its production, consumption and/or disposal.

[138] Article 17 Kyoto Protocol (adopted 1997, entered into force 2005) [Accessed at http://unfccc.int/kyoto_protocol/items/2830.php]

[139] Article 12 Kyoto Protocol

[140] See UNFCCC Website: Kyoto Protocol: Joint Implementation at http://unfccc.int/kyoto_protocol/mechanisms/joint_implementation/items/1674.php

[141] See UNFCCC Website: Kyoto Protocol: Joint Implementation at http://unfccc.int/kyoto_protocol/mechanisms/joint_implementation/items/1674.php

This is done in a number of steps, the first being to define the product itself, drawing conceptual boundaries for the analysis of that product based on available market information. The next step is to collate technical and environmental data related to the product system. This includes the input and output quantities of materials, energy, chemical and wastes—such as air pollution, water effluent and waste solids. Targeted software products are employed to calculate the environmental impact of raw material production, manufacture, distribution, consumption and/or disposal as well as necessary contingent activities such as transportation of materials and equipment.

Low-carbon economy

Low-carbon economy refers to an economy that is based on clean technology, with high energy-efficiency and low levels of pollution. The central task of a government seeking to establish such an economy is technological innovation and institutional reform.

As early as in February 2003, the United Kingdom Department of Trade and Industry issued an energy White Paper entitled Our Energy Future—Creating a Low-Carbon Economy.[142] With growing international attention focused on climate change, the concept of a low-carbon economy has become accepted by developed and developing nations alike.

Stakeholders

A corporation's stakeholders include any person or group that may affect corporate activities or whose rights and interests may be affected by its activities. They may be, for example, government regulators, stockholders, banks or other creditors, employees and sub-contractors, consumers and public interest groups.

United Nations Framework Convention on Climate Change (UNFCCC)

On 22 May 1992, the United Nations Intergovernmental Negotiating Committee reached consensus on the existence of climate change as a threat to humanity, and adopted a common strategy focused on controlling the growth of anthropogenic GHG emissions. On 4 June 1992, it was approved at the United Nations Environment and Development Conference in Rio de Janeiro, Brazil, and came into effect in March of 1994.

It is the aim of the Convention to stabilize atmospheric GHG concentrations at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system. Parties to the Convention agreed to develop domestic programmes in response to this goal, setting voluntary emissions reductions targets with 1990 as the base year. The Convention acknowledged that as a framework document, it was to be amended or augmented over time through a series of annual ministerial-level conferences. Based on these guidelines the UNFCCC has for almost two decades provided a legal framework within which the international community has negotiated joint climate change action, including the Kyoto Protocol in 1997.

[142] Department for Environment, Food and Rural Affairs and Department for Transport (United Kingdom), *Energy White Paper*, February 2003[Accessed at www.berr.gov.uk/files/file10719.pdf]

The Convention distinguishes the obligations of parties that are Organisation for Economic Co-operation and Development (OECD) members with non-transitional economies and classifies them as Annex II countries (developed countries) from those of non-OECD countries [developing countries and countries with economies in transition (the latter being included under the Annex I country classification on the convention)], relying on the principle of "common but differentiated responsibilities". Under the UNFCCC, developed countries were encouraged but not required to adopt clear emissions reductions targets. They were also encouraged to provide financial and technical support for developing countries in the implementation of their own GHG emission mitigation policies, thus reflecting present inequalities and historical responsibilities. The Kyoto Protocol further defined many of these obligations and made them binding on the parties.

China signed the UNFCCC on 11 June 1992, and ratified it on 5 January 1993.

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