CARBON DISCLOSURE PROJECT

Carbon Disclosure Project Report Global Oil and Gas

Building business resilience to inevitable climate change

The Adaptation Challenge

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acclimatise
managing your climate risks

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IBM Viewpoint

IBM's view of the oil and gas industry is:

- That it is an important contributor to society and the economy
- Despite recent events, the outlook for oil and gas in the long-term remains unchanged. And the outlook includes the need to respond to the challenges posed by climate change
- The industry faces challenges which are well understood by most leaders, but priorities may differ
- Companies have a tradition of managing risks, but there is room for improvement, and one such area could be adaptation to climate change.

Oil and gas as a contributor

Oil and gas products enable us to generate heat and light, and move by air, sea and land. Petroleum products also act as feed stock to other key industries such as chemicals, petrochemicals and agriculture. And, despite the challenges posed by exploration in hostile environments, and the logistical challenges posed by moving 85 million barrels of crude and oil products around the globe each day, we can enjoy the benefits of a litre of gasoline at a cost (pre-tax) which is less than the price of a bottle of mineral water.

Major oil companies contribute significant funds to our economies. By way of example, between 2002 and 2007, one of the larger oil companies contributed $65 billion in taxes to the US Government and paid out $118 billion in dividends and share buy-backs in the same period.[1]

In addition to providing essential products and sources of income, a considerable proportion of funds are directed to Research & Development, which can span technologies for extracting conventional oil and gas in ultra-deep water, to new materials for solar panels or fuel cells.

Given the track-record of the oil and gas industry and its ability to innovate, we see no reason why it will not continue to be a major contributor to society and the economy in the future.

Consequently, if anything adversely impacts the oil and gas industry, this in turn would impact all of us.

Outlook long-term

Recent events have surprised many people and placed considerable pressure on governments, organisations and individuals to perform and prosper.

In the near-term, there is uncertainty about how and when economies will recover.

Our experience with our oil and gas clients suggests that the outlook for the long-term future for the industry is not that different from what it was in 2007, for example. More specifically:

- We don't expect the world to deplete all its natural resources, but we do expect there to be concerns with security of supply if above ground infrastructure and supply chains are unable to keep pace with the growing demand for oil, gas, water, and treatment of wastewater
- The world's population is projected to reach 7 billion early in 2012, up from the current 6.8 billion, and surpass 9 billion people by 2050. The population living in urban areas is projected to reach 6.4 billion in 2050[2]
- The rate of economic growth in the future may be less than it was in the past decade if people constrain their borrowing and spending, but we expect the global economy to eventually recover and lead to increasing levels of prosperity and demand for cars and appliances requiring energy
- As a consequence of the above, we expect the total demand for all sources of primary energy, including alternative energy, to grow by 40% between now and 2030, but the major share of primary energy will be coal, gas and oil in that order. Note: to deliver this growth, it has been estimated that the total investment required will be in the order of $26 trillion[3]
- Despite volatility in oil, gas and carbon prices (all of which impact investments in alternative energies), we think concerns for climate change have gained traction and will continue to do so, and that the solutions will lie with the actions of man.

Whilst the outlook for the long-term future has not changed significantly (including the challenges we've always known about) there are considerable uncertainties for the near term, and we think there are some challenges worthy of consideration in this report.

Challenges

The following challenges are not intended to be an exhaustive list, but we think four challenges are relevant:

- The first thing to acknowledge is that not all companies are the same or have the same priorities: 12 of the world's 150 largest oil and gas companies[4] are state-owned and can have different sources of funding, asset footprints, and approaches to strategy and operations versus international oil companies (IOC). Given these differences, it may well be that an IOC could be more concerned with adaptation if it were to operate in Alaska (with the risk of permafrost thaw), has to comply with strict HSE legislation (with the risk of non-compliance leading to the loss of a licence to operate or litigation) and having to generate greater levels of profitability to cover a cost of capital which is higher than that of a national oil company (NOC) funded by a state.

[1] CERA conference 2009. Houston, USA.
[2] United Nations (2008) Department of Economic and Social Affairs. Population Division. *World Urbanization Prospects: The 2008 Revision*. United Nations 2008.
[3] Tony Hayward BP CERA conference 2009 opening address. Houston, USA.
[4] CIEP (2009) Clingendael International Energy Programme. Clingendael Institute of International Relations. The Netherlands.

- The oil and gas industry faces a continual 'Trilemma' – as taxpayers and consumers we expect the industry to always fund and provide secure sources of energy supply, meet our ever increasing demand for energy, and reduce emissions in the process. Whilst the NOCs hold the majority (~90%) of proven oil and gas reserves globally[5], it tends to be the IOCs which have more extensive supply chains for moving crude and oil products. In this regard IOCs are probably more exposed than others to the impact of climate change, such as sea levels and weather on their supply chain infrastructure and operations. On the other hand – the international Supply & Trading divisions of some IOCs have world class capabilities, which can monitise volatility in the physical and paper markets to generate opportunities and profit.

- Owners and investors expect robust economic returns in an industry where capital projects for exploration, production and manufacturing are getting larger and more complex, and whilst rivalry for access, people and markets remains intense. The business cases for large capital projects are usually comprehensive, but they tend to be based on an assumption of an asset operating in an environment (physical, legal, societal) which is not significantly different from current conditions. The uncertainties of how climate change will directly or indirectly impact the environment, introduces a source of risk, which may not be fully factored. Oil and gas companies that have world class capabilities in Asset Lifecycle Management (design to decommission of an asset) and apply this capability via a disciplined model (usually a functional model) can achieve an advantage over their competitors.

- Non-market forces such as policy, regulations, and the activities of interest groups may not always be based on sound science or economics, but they can significantly impact where and how a company operates. The Brent Spar incident is a well known case where a workable technical solution for decommissioning an asset was adversely impacted by lobbying and direct action by protestors, whose facts were less than completely sound. In regard to adaptation, the importance of oil and gas companies to always do the right thing is an obvious requirement, but they also need to proactively provide accurate facts and contribute to debates relating to energy policy, particularly in its formative stages. And this is happening increasingly in regard to access to resources and energy policy in Europe and the USA.

Opportunities to improve

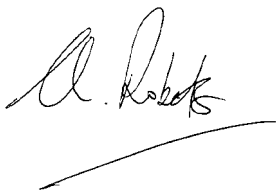
Oil and gas companies employ very capable people and share long histories characterised by success. They also have processes for managing enterprisewide risk and ensuring controls – all of which are usually independently checked on a regular basis.

In recent history, however, some companies have been exposed to: aggressive accounting practices, misreporting of reserves, missed production targets, major delays in capital projects, litigation in association with trading practices, acquisitions which did not deliver expected returns, and failures in process safety which have led to fatalities.

It is possible, therefore, that a lot has already been done to address how oil and gas companies adapt to the impact of climate change. But it is also possible that opportunities exist to improve further. More specifically, companies may wish to consider:

- A high-level assessment of how climate change could impact their business model – see questions on pages 19 and 20
- A deep dive in the areas, which if impacted, could have the greatest material impact on performance – two areas of consideration could be Non-Market Strategy and Asset Lifecycle Management
- Adapting reporting and performance management to incorporate risks arising from climate change – this could vary by business area and geography.

We are confident the oil and gas industry will continue to make progress in adapting to the impacts of inevitable climate change. The precise nature of changes and the pace will vary by company, and is very much in the hands of its shareholders, leaders and employees.



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[5] Baker Institute Energy Forum (2007). *The Role of National Oil Companies in International Energy Markets*. Houston, USA.

Executive Summary

The increasing global demand for energy, along with declining oil and gas reserves, and the urgent need to reduce greenhouse gas (GHG) emissions, are combining to create strategic challenges for the future of oil and gas companies. Companies are faced with strategic choices which may change their business models. It is clear however, that these are not the only challenges.

Climate change is underway. Whatever we achieve in reducing greenhouse gas emissions, we are now faced with further inevitable changes in our climate and in our social, economic and environmental systems. In our analysis of the responses made by oil and gas companies to the Carbon Disclosure Project (CDP) and drawing on other published material and resources, it is clear that companies do not fully recognise that:

1 The risk landscape for the world's oil and gas companies is changing. Companies should consider assessing their current and future strategies and reviewing their business models and supply chains to check their resilience to the new risk landscape created by inevitable climate change.

Companies do not appear to recognise that the risk landscape is changing, for example only 6% reported potential civil and geo-political risks and only 3% identified adverse risks for local communities.

2 The impacts of increasing global temperatures, changes in precipitation, rising sea levels and other climatic changes are already evident. The impacts will become more severe creating new and enhanced risks for the oil and gas sector, for example:

- Increasing stress on water resources will create operational problems for companies and conflicts with local communities and other water users
- Communities and nations under increasing stress will change the geo-political risk landscape. New challenges will arise for companies' operations in new at-risk areas
- Any failure to monitor and report on the impacts of climate change on social and ecological resources is likely to harm a company's reputation
- Changes in regulations in response to the impact of climate change could increase the operating and compliance costs for existing assets
- Business process failures, for example contractual relationships that do not adequately foresee and manage risks driven by climate change, may increase the risk of parties turning to litigation
- Operating existing assets under changing conditions presents new and changing health and safety risks and challenges for employees
- Current balance sheets may underestimate decommissioning liabilities by failing to recognise the climatic changes that have taken place since the decommissioning costs were assessed at the time assets were first created
- Existing plant and equipment were designed on the basis of historic climatic conditions. Their performance may be impaired under changing conditions, increasing the risk of downtime and system failures with HSSE and regulatory implications. Operational costs may increase.

These impacts add up to significant challenges for the oil and gas sector against a backdrop of global energy demands, reserve depletion, emissions controls, ageing assets, new reserve development in harsh environments, new technologies, rising oil prices, the growing importance of national oil companies and prescriptive regulation.

The percentage of companies reporting that they were investing in more water efficient assets in the face of increased shortages affecting their reserves now and in the future was low – 3%.

19% of respondents considered that a changing climate may have additional health and safety implications for company employees. Whereas only 1.5% gave evidence of actions being taken to manage these risks.

3 The current reported value of proved reserves may not be taking into account the full impact of a changing climate. Any changes to the disclosed value of reserves will have major financial implications. This report provides examples of the potential impacts on proved reserves and other assets.

4 Most companies are tending to focus their risk management activities on extreme (acute) events and may not be recognising the risks posed by incremental (chronic) climate change. Asset disruptions from recent extreme events (for example, Cyclone Gonu in Oman) serve to illustrate vulnerability to events greater than the industry's current asset design, engineering and operational standards. Chronic (incremental) changes however,

are more subtle and their impacts on business models and assets may pass undetected until critical thresholds are breached (for example changes in ambient air temperature and their impact on turbine and generator performance). The responses may result in 'step-changes' for a company, increasing operational costs beyond forecasts, unplanned capital investment and additional balance sheet financing to manage the consequences.

76% of companies reported that their physical assets would be compromised by extreme events.

Far fewer companies (19%) recognised the risks associated with chronic changes to their physical assets and disruptions to essential infrastructure, utilities and supply chains.

Only 6% indicated that they were taking actions to manage disruptions to offsite utilities (energy, communications, water and waste treatment).

In this report we provide some guidance on the actions companies should consider to manage the risks and realise the potential opportunities associated with a changing climate. For example:

1 Oil and gas companies could more fully assess and manage the risks and opportunities arising from inevitable climate change, in addition to taking essential action to reduce emissions. The focus so far, as evidenced by responses to the Carbon Disclosure Project, has been primarily on oil and gas companies reducing emissions. Companies should recognise the need for action in the near term to build business resilience to manage the risks and capitalise on the opportunities that inevitable climate change brings.

2 Although there is uncertainty in the knowledge we have about the extent and rate of future climate change, there is sufficient information to assess impacts on business models and enable robust decisions to be taken as a result. The existence of uncertainties regarding the business risks arising from climate change, should by itself act as a catalyst for companies to quantify the risks, monitor the impacts as they arise and be prepared for changes to their business models. The baseline climate is changing, and business decisions and practices will need to evolve as a result. Oil and gas assets have been designed on the basis of historic climate data and a period of relatively stable weather. These design assumptions, together with those thresholds and margins set for regulatory, operational and financial performance requirements, may constrain the future effectiveness of assets to deliver under climate change.

20% of companies reported taking action to manage the impacts of acute events through new research, use of climate models, and the development of internal design standards.

3 Oil and gas companies should consider acting now upon the clear signals that climate change is underway. A fully integrated approach to the challenges of reducing emissions **and adapting** to climatic change is required. Companies should use the lessons gained from the present financial crisis to avoid the even greater and entirely 'predictable surprise'[6] created by climate change. Acclimatise and IBM have jointly prepared a set of Prepare-Adapt questions on pages 19 and 20 to help oil and gas companies take the right steps towards building corporate resilience to inevitable climate change.

Although 83% of respondents reported that they assign responsibility for climate change to an executive body, it is not clear if the responsibility includes adaptation. The responses provide little evidence of companies taking action to integrate adaptation to climate change into risk management processes and decision making.

[6] M. Bazerman and M. Watkins (2004) 'Predictable Surprises: The Disasters You Should Have Seen Coming, and How to Prevent Them'.

Contents

1 Introduction

We are in uncharted waters. Climate change is underway. Whatever we achieve in reducing emissions of greenhouse gases (GHG) we still face inevitable changes in our climate and in our social, economic and environmental systems. If we fail to reduce emissions, then the changes in these systems will be even greater.

Mitigation efforts to reduce emissions are vital if we are to keep climate change from surpassing a dangerous, and rapidly approaching threshold. This has been called avoiding the unmanageable. However, the effects of climate change are already upon us and are growing rapidly. A significant reduction in emissions is essential, but we must also prepare for and respond to the impacts – we must adapt to manage the unavoidable.

Drawing upon an analysis of the responses from global oil and gas companies to the 2008 Carbon Disclosure Project (CDP), together with other published material and resources, this report provides an overview of some of the challenges that inevitable climate change brings. Although the report concentrates on publicly listed international oil companies (IOCs), the potential impacts identified are applicable to national oil companies (NOCs).

This report provides an overview of the issues facing companies and sets out clear guidance for senior executives on the business imperative to manage the unavoidable, and adapt their businesses to the impact of a changing climate.

The risk landscape for the world's major oil and gas assets and operations is changing. For both new and existing assets it is essential that the likely impacts of inevitable climate change on natural resources, asset performance, workforce, decommissioning, regulation, litigation, geo-politics and reputation/brand, examples of which are considered in this report, are assessed and managed.

In this report we explain why companies need to understand the implications of both extreme (acute) events and incremental (chronic) climate change and the direct and indirect effects operating through their business models. Acute events like Cyclone Gonu (Oman) in 2007 and Hurricane Katrina (USA) in 2005 grab the headlines, but are companies recognising the warning signs of chronic changes?

Given these impacts it is clear that there are potential financial risks to companies and, in particular, with regard to assets and resources, such as their reserves. This report identifies areas where these risks may be significant, for example with regard to issues such as decommissioning liabilities.

Most companies are focussing their climate change activities primarily on reducing GHG emissions (and many companies have yet to understand the urgency for action in this area). By failing to build resilience to the impacts of a changing climate they could incur new costs and miss significant business opportunities.

Acclimatise and IBM have prepared a series of Prepare-Adapt questions on pages 19 and 20 to help senior oil and gas company executives identify the actions to build corporate resilience to inevitable climate change.

The Carbon Disclosure Project

CDP is an independent not-for-profit organisation which holds the largest database of corporate climate change information in the world. The data is obtained from responses to CDP's annual Information Requests, issued on behalf of 475 institutional investors, to more than 3,700 corporations across the globe. Since its formation in 2000, CDP has become the gold standard for carbon disclosure methodology and process, providing primary climate change data to the global market place. CDP plays a vital role in encouraging companies to measure, manage and reduce emissions and climate change impacts.

The CDP Information Requests include a series of questions seeking disclosure on the physical impacts of climate change on existing and future company performance and the management responses. (A copy of the questions is available on the CDP website: www.cdproject.net together with a list of the investors). The 2008 Information Request was sent to the world's largest 128 oil and gas companies globally (based on market capitalisation) of which 49% provided detailed responses. Acclimatise has analysed the responses to assess the business resilience of companies to a changing climate.

Acclimatisation Index

The analysis of the responses to the CDP Information Request has been undertaken using our **Acclimatisation Index** methodology. This enables a semi-quantitative analysis of the responses recognising the scope of the questions. The Index can also take into account information from other sources to provide a more comprehensive analysis.

The **Acclimatisation Index** has been used to analyse the resilience of global oil and gas companies to climate change in response to questions contained within sections 1 and 4[7] of the CDP questionnaire.

[7] Excluding question b 'Individual Performance' of section 4 which focused on performance towards GHG targets.

2 Climate change is underway

The world's climate is changing due to human activity and whatever steps we take to limit GHG emissions we are now faced with several decades of increasing global temperatures and a far longer period of rising sea levels.

In 2007, the Intergovernmental Panel on Climate Change (IPCC) – the most authoritative scientific body on climate change – confirmed the scientific evidence that climate change is already under way[8]:

- "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level"
- "At continental, regional, and ocean basin scales, numerous long-term changes in climate have been observed. These include changes in Arctic temperatures and ice, widespread changes in precipitation amounts, ocean salinity, wind patterns and aspects of extreme weather including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones."

Figure 1 shows the observed and future changes in temperature for the main regions of the world. The results from the climate models developed by governments and research institutions show a strong correlation with the observed changes.

The IPCC has recommended that urgent action is required to limit the concentration of GHGs in the atmosphere and prevent global average temperatures rising above 20°C. A temperature rise above 2°C will be difficult for contemporary societies to cope with, and will cause major social, economic and environmental disruptions through the rest of the century and beyond. There are also concerns that increases above 20°C significantly increase the risk of large scale, irreversible system disruption.[9]

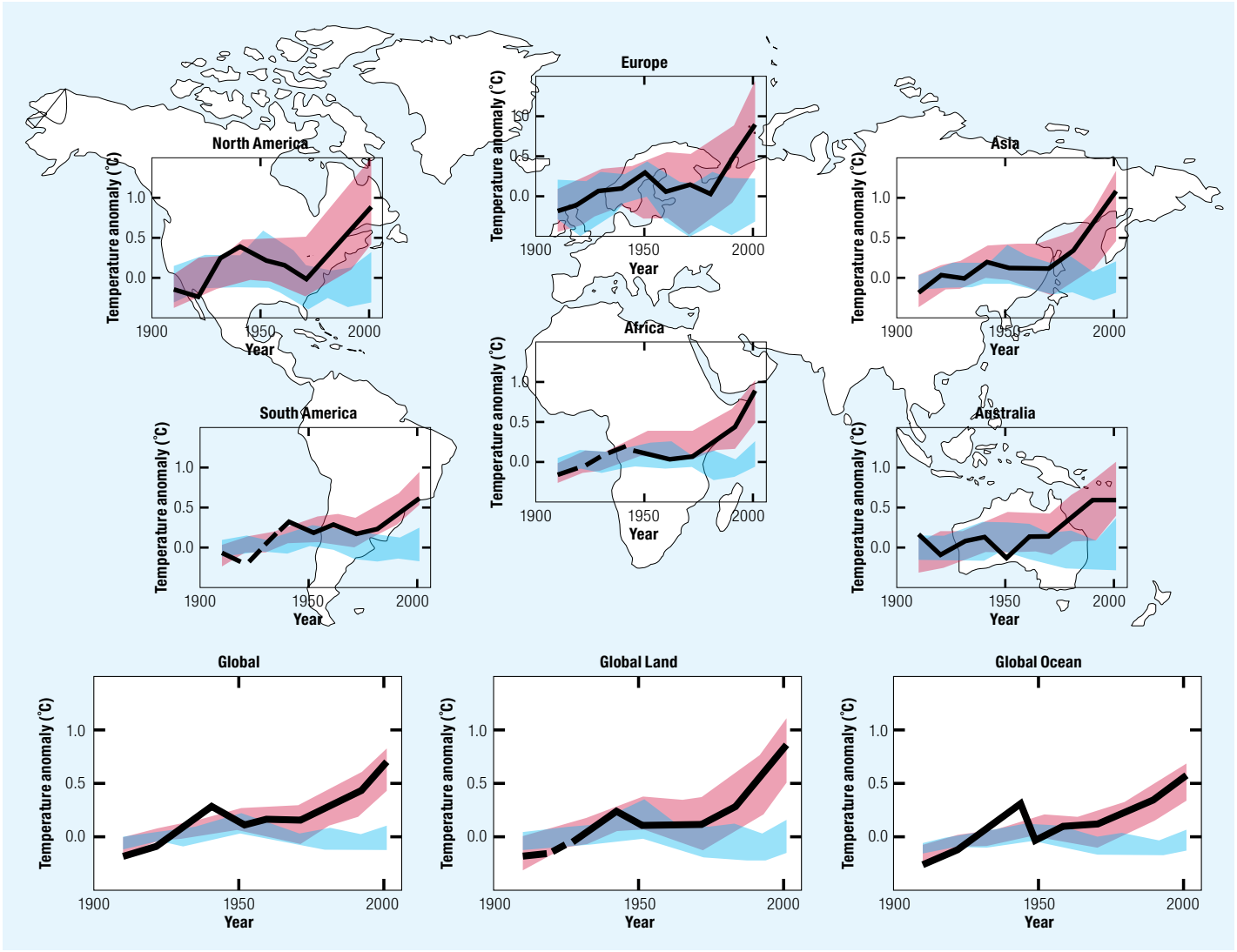
We are now faced with two climate challenges – we must reduce our emissions to avoid the unmanageable and adapt to the changes already underway to manage the unavoidable – now.

"Even a 'moderate' warming of 2°C stands a strong chance of provoking drought and storm responses that could challenge civilized society, leading potentially to the conflict and suffering that go with failed states and mass migrations. Global warming of 2°C would leave the Earth warmer than it has been in millions of years, a disruption of climate conditions that have been stable for longer than the history of human agriculture. Given the drought that already afflicts Australia, the crumbling of the sea ice in the Arctic, and the increasing storm damage after only 0.8°C of warming so far, a target of 2°C seems almost cavalier."

David Archer Real Climate
www.realclimate.org

[8] IPCC 'Climate change 2007: synthesis report'.
[9] *Scientific Symposium on Stabilisation of Greenhouse Gases – Avoiding Dangerous Climate Change Exeter February 2005*. Executive Summary of the Conference Report.

Figure 1: Comparison of observed continental- and global-scale changes in surface temperature with results simulated by climate models using either natural, or both natural and anthropogenic forcings[10]



[10] IPCC 'Climate change 2007: synthesis report'.

3 A new risk landscape created by inevitable climate change

It is important that any consideration of the impacts of climate change be set against the context of the other challenges already faced by global oil and gas companies:

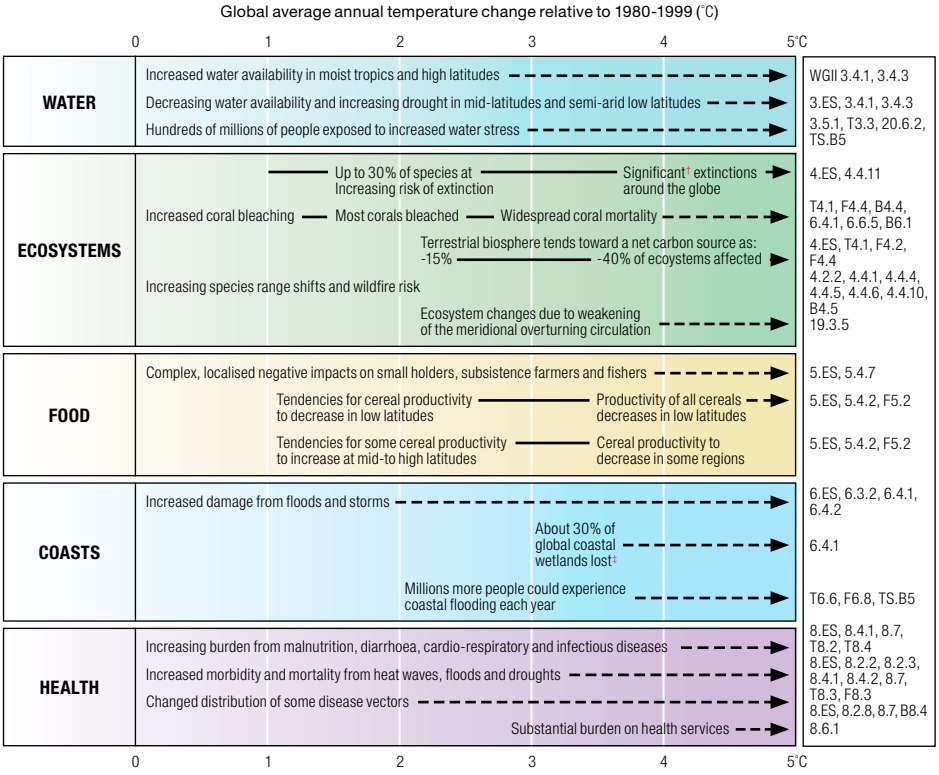
- This century is likely to see unprecedented urbanisation, shortages of food and water, and intense competition for scarce resources, driven by population growth and economic development. Climate change is being driven by the use of carbon based energy sources to meet these challenges
- Our increasing demand for energy and the urgent need to reduce GHG emissions, and their concentrations in the atmosphere, is driving the urgent imperative to develop alternative sources of energy and fuel
- Oil and gas reserves are a finite valuable resource and will be increasingly depleted
- There are important questions to be asked about the desirability of burning a resource that has other valuable uses.

Oil and gas companies are faced with making strategic choices about their business models in order to respond to these challenges. These choices must be made with a clear understanding that climate change is underway.

The direct and indirect impacts of climate change (see figure 2) will create new risks and opportunities for oil and gas companies in addition to the strategic challenges they now face.

The IPCC Synthesis Report provides examples of the impacts associated with global average temperature change (see figure 2). The black lines link impacts; broken-line arrows indicate impacts continuing with increasing temperature. Entries are placed so that the left-hand side of text indicates the approximate level of warming that is associated with the onset of a given impact.

Figure 2: Examples of impacts associated with global average temperature change



†Significant is defined here as more than 40% ‡Based on average rate of sea level rise of 4.2mm/year from 2000 to 2080.

The risk landscape is changing

Continued access to the world's current oil and gas reserves will be impacted by significant social, economic and environmental challenges. Companies have developed their business models to manage these challenges in order to maximise the commercial viability of their assets. How will these challenges change in response to the climatic changes we now face?

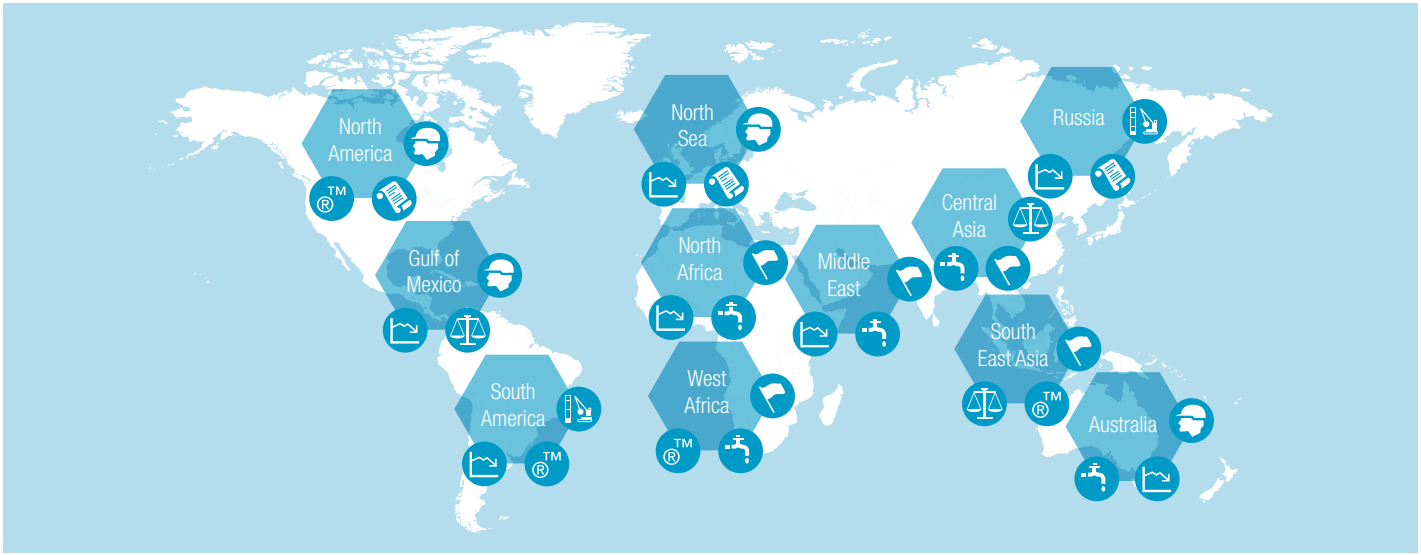
Figure 3 provides an overview of some of the possible risks facing oil and gas companies and their potential impact.

Companies operating in these regions should be assessing their current and future strategies and reviewing their business models and supply chains to check their resilience to inevitable climate change.

Proved reserves. Proved reserves are usually defined as "the estimated quantities of oil and gas which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under current economic and operating conditions".

The location and size of proved reserves is shown in figure 4. A comparison with figure 3 will give an indication of some of the potential risks in accessing these reserves created by a changing climate.

Figure 3: Global risk landscape (see Appendix for examples)



Risk	Impacts
Resource stress	Increasing stress on water resources particularly in central Asia and the Middle East will create operational problems for companies and possible conflicts with local communities and other water users.
Geo-political	Communities and nations under increasing stress will change the geo-political risk landscape. New challenges will arise for companies operations in new at-risk areas.
Reputation	Any failure to monitor and report on the impacts of climate change on social and ecological resources is likely to harm the reputation of a company.
Regulation	Changes in regulations in response to the impact of climate change could increase the operating and compliance costs for existing assets.

Risk	Impacts
Litigation	Business process failures, for example contractual relationships that do not adequately foresee and manage risks driven by climate change, could increase the risk of parties turning to litigation.
Workforce	Operating existing assets under changing conditions presents new and changing health and safety risks and challenges for employees.
Decommissioning	Current balance sheets may underestimate decommissioning liabilities by failing to recognise the climatic changes that have taken place since the decommissioning costs were assessed at the time assets were first created.
Asset performance	Existing plant and equipment were designed on the basis of historic climatic conditions. Their performance may be impaired under changing conditions, increasing the risk of downtime and system failures with HSSE and regulatory implications. Operational costs may increase.

Whatever the regulatory disclosure provisions, the markets are likely to take into account a wider set of performance indicators to assess proved, probable, and possible reserves.

Understanding the size of proved reserves has a significant influence on the market value of a company. Changes in economic viability, current economic conditions, geological certainty, technology, operational experience and project status can all affect the status of reserves over time.

One of the key measures of companies in the oil and gas sector is the size and value of their 'legacy assets'. Our review of publicly available documents has failed to provide evidence that either rating agencies or analysts have considered the potential impact of climate change on asset value when assessing company legacy. The physical impacts of climate change are now being felt across the world.

Within the life of many current legacy assets (and particularly those in the early stages of development) these impacts will become more severe, leading to increasing operational costs and additional capital investment requirements.

Natural resources under stress.

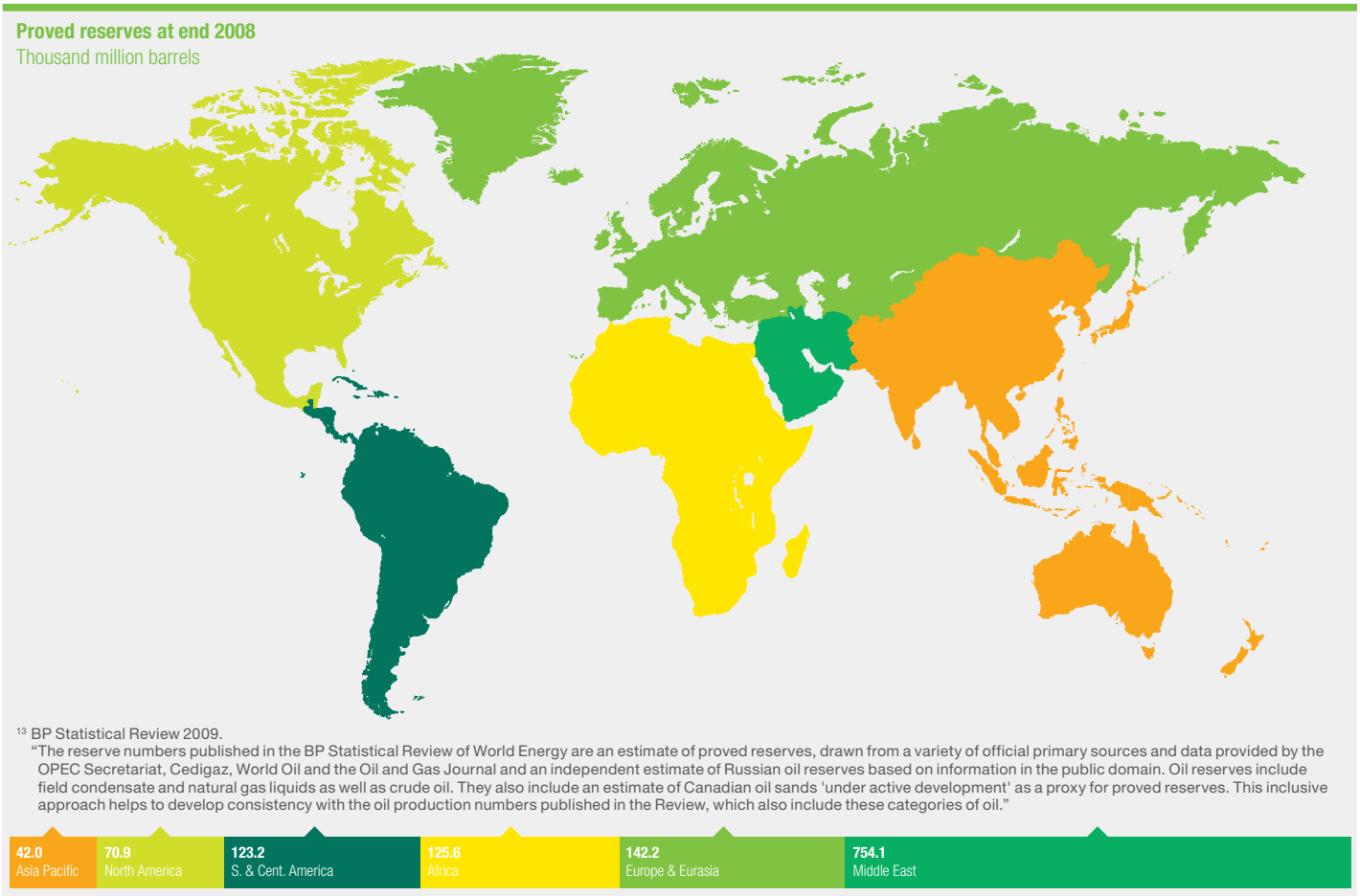
Global fresh water resources are under increasing stress. Less water, declining water quality, and growing water demand are creating immense challenges to the oil and gas sector which is a major user of water. The sector has historically taken clean, reliable and inexpensive water for granted. These trends are creating operational issues, restrictions on abstractions, more stringent water quality regulations, pressure to move towards full-cost water pricing, and increased public scrutiny of corporate water practices.[11] The availability of adequate water supplies in the Middle East and Central Asia is becoming a major factor in project development.

The IPCC Synthesis Report released in 2007 states[12]: "Climate change is expected to exacerbate current stresses on water resources from population growth and economic and land-use change, including urbanisation. On a regional scale, mountain snow pack, glaciers and small ice caps play a crucial role in freshwater availability. Widespread mass losses from glaciers and reductions in snow cover over recent decades are projected to accelerate throughout the 21st century, reducing water availability, hydropower potential, and changing seasonality of flows in regions supplied by melt water from major mountain ranges (e.g. Hindu-Kush, Himalaya, Andes), where more than one-sixth of the world population currently lives."

"Changes in precipitation and temperature lead to changes in runoff and water availability. Runoff is projected with high confidence to increase by 10 to 40% by mid-

[11] Ceres, Pacific Institute 'Water scarcity and climate change: growing risks for businesses and investors' 2009.
[12] IPCC 'Climate change 2007: synthesis report'.

Figure 4: Location of global proved reserves[13]



[13] BP Statistical Review 2009.
"The reserve numbers published in the BP Statistical Review of World Energy are an estimate of proved reserves, drawn from a variety of official primary sources and data provided by the OPEC Secretariat, Cedigaz, World Oil and the Oil and Gas Journal and an independent estimate of Russian oil reserves based on information in the public domain. Oil reserves include field condensate and natural gas liquids as well as crude oil. They also include an estimate of Canadian oil sands 'under active development' as a proxy for proved reserves. This inclusive approach helps to develop consistency with the oil production numbers published in the Review, which also include these categories of oil."

century at higher latitudes and in some wet tropical areas, including populous areas in East and South-East Asia, and decrease by 10 to 30% over some dry regions at mid-latitudes and dry tropics, due to decreases in rainfall and higher rates of evapo-transpiration. There is also high confidence that many semi-arid areas (e.g. the Mediterranean Basin, western United States, southern Africa and north-eastern Brazil) will suffer a decrease in water resources due to climate change. Drought-affected areas are projected to increase in extent."

Global demand for oil and gas. The demand for oil is continuing, despite the current economic environment. In June 2009, China consumed 33.35 million metric tons of crude, up nearly 2.6% from the corresponding month of 2008.[14]

China is expected to account for 43%, and the Middle East and India 20% each, of the total projected increase in oil consumption from between 2007 to 2030 (see figure 5).

The projected quadrupling of oil imports by 2030 in India and China[15] will require significant investments in infrastructure in order to supply their needs. This growth may inflate costs for exploration and production, natural gas and refining, and squeeze margins.

There is no evidence from the analyses of energy demands and oil and gas reserves estimates developed by organisations such as the International Energy Agency that the additional energy needs driven by climate change impacts and adaptation responses have been included in demand and reserves estimates.

We may be underestimating the demand for energy at the same time as adding further confusion to the already unclear estimates of oil and gas reserves.

Decommissioning liabilities. A report from Standard and Poor's[16] sets out the concerns regarding disclosure by oil and gas companies of their future decommissioning liabilities. The report refers to the lack of information provided by companies. An assessment of leading companies indicates that decommissioning provisions equate to about 45% of the overall future balance sheet liabilities for oil and gas companies. Decommissioning provisions represent a significant part of their financial risk because the majority of cash flows occur at the end of the project's life.

[14] Platts analysis of official data.
[15] Ibid.
[16] Poor Disclosure By Europe's Chemicals, Oil and Gas, And Metals & Mining Companies Gives Limited Insight Into Decommissioning And Environmental Provisions, Standard and Poor's 27 September 2007.

"My job in part, involves thinking about the consequences of what might come to pass rather than just what we wish would happen. And it's apparent that even if global warming is tackled aggressively now – something that's far from certain – a substantial degree of rapid change is already inevitable and that rapidity, alongside the size of the global population and the complexity of today's society leaves us particularly vulnerable. Even if we are able, over time, to limit its effects and to mitigate its consequences, it seems to me, bound to present substantial security challenges of one kind or another so this is a debate to which I feel bound to contribute."

Air Chief Marshal Sir Jock Stirrup, Chief of the Defence Staff, United Kingdom

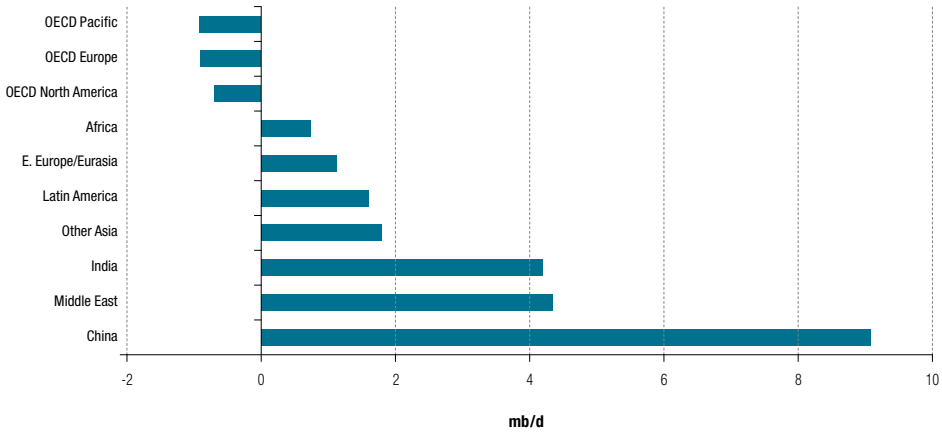
"Physical risks as a result of climate change as described by the Intergovernmental Panel on Climate Change relative to Harvest's operations include drought, forest fires, floods, changes in temperature, increased storm and hurricane activity and global sea level rise."

"Winter warming trends… may have an impact on Harvest's NE BC property where in winter months ice roads are built for access. Harvest has since completed the construction of an all-weather road which reduces the risk of increasing temperatures having an impact on our operations."

"In addition, Harvest follows risk strategy planning in all of its operations which includes identifying hazards, risk ranking all hazards, and developing effective hazard controls to reduce the overall risk to the company."

Harvest Energy Trust

Figure 5: Change in primary oil demand by region by 2030 (2007 baseline)[17]



The accounting rules for such provisions under IFRS (IAS 37) require a company to recognise a liability as soon as the decommissioning obligation is created, which is normally at the time facility is constructed. Standard and Poor's found that the scale of decommissioning provisions tends to be based on management judgment rather than independent third-party appraisals.

There is no evidence from the review of published reports that oil and gas companies are assessing and reporting the impacts of changing climatic conditions on the decommissioning costs for their existing and planned assets. If this is correct, then it is likely that companies are underestimating their future liabilities and may not meet reporting obligations.

There are new and emerging risks to be considered: increased sea levels and changes in sea conditions (temperature and acidity), coastal erosion, permafrost thaw and changes in precipitation. All of these have the potential to create challenges for the decommissioning of assets, for example:

- Saline intrusion and rising groundwater levels may create new source-pathway-receptor relationships increasing pollution risks associated with contaminated land
- Increasing flood levels will result in enhanced risks to decommissioned sites requiring higher levels of flood protection
- Environmental site protection and reinstatement plans agreed during the licensing and consenting process may not be appropriate in view of the changes in species and habitats during the life of the project.

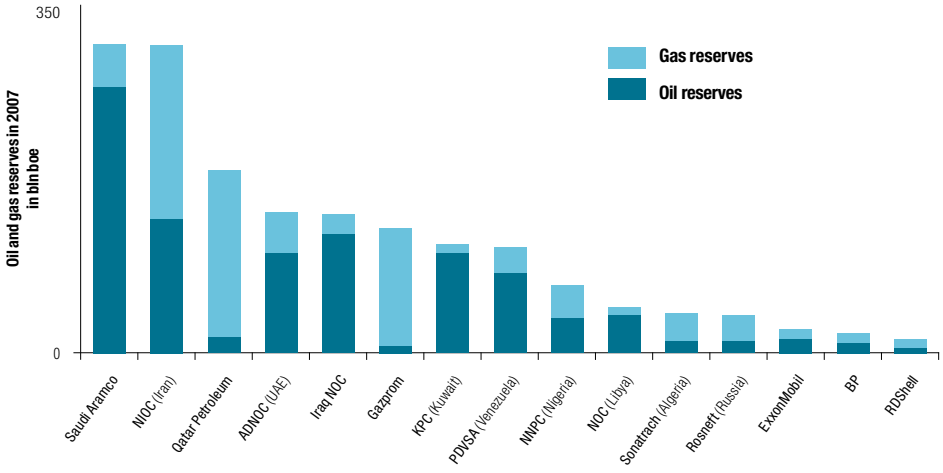
Bonds based on risk assessments that have failed to take climate change into account may prove to be inadequate and not protect companies from further liabilities and litigation risks.

Each asset type, the area in which it is located, and the intended after-use of the site, may need to be examined and the decommissioning costs reassessed.

Robust climate change information is available to help calculate the impacts on asset decommissioning costs. Failure to do so raises questions regarding the corporate governance credentials of individual companies and their fiduciary responsibilities to their shareholders. It may also raise questions regarding reporting procedures and compliance with IAS 37.

[17] IEA WEO 2008.

Figure 6: Oil and gas reserves held by IOCs and NOCs 2007[19]



International oil companies may be more vulnerable to climate change than national oil companies. IOCs own less than 10% of the world's proven oil and gas reserves, although they make up 20% of global production, through contractual arrangement with the NOCs[18]. When ranked on the basis of proven oil and gas reserves, the first 12 of the top 15 oil and gas companies in the world are NOCs and control access to three quarters of the world's oil reserves (figure 6).

Many NOCs are expanding and moving away from their previous role as licensing agencies and passive partners to IOCs. They are becoming active in developing and acquiring equity positions and assets outside their national boundaries, both upstream and downstream. Some NOCs are now present in more than 20 countries and are dealing with each other on a government to government basis. This trend is set to continue, with 80% of the projected increase in output coming from NOCs. This is changing the energy markets and will continue to impact the earnings of IOCs.

The increasing dominance of the NOCs is limiting access to reserves and resulting in IOCs investing in regions with higher geo-political risks or with harsh operational environments and climatic conditions. IOCs may have to maintain longer and more complex supply chains, increasing their exposure to the impacts of the global risk landscape outlined in figure 3.[20]

Reducing GHG emissions, a strategic challenge to business models. Current actions to reduce emissions are insufficient to limit average global temperature increase due to anthropogenic (human activities) climate change to 20°C. Reducing the greenhouse gas (GHG) emissions arising from the use of fossil fuels is central to achieving a low-carbon economy and restricting global average temperature increases.

Oil and gas companies are faced with strategic challenges to their long term business models. Companies, if they are to be sustainable in the long term, should plan for and actively manage the transition from fossil fuel dependent growth to one based on a portfolio of fuels and alternative sustainable sources. This involves the need to develop commercially viable technologies.

High oil prices will create new adaptation challenges. Recent oil prices have been well above historic averages and will continue to influence how quickly the sector can access, develop and bring to market new reserves. High prices make marginal and technically challenging reserves more attractive. Maintaining profits and returns on investment with high reserve costs will be a challenge.

"In 2005 the integrity of our operations was severely challenged by the two hurricanes Katrina and Rita that struck some of our US assets."

"…BP invests heavily in engineering structures that could be vulnerable to modest changes in local climate. The size of our exposure and the changing risk to both our future operational integrity and our current facilities is not yet well understood. In adapting to a world in which extreme weather might be more common there is also a risk of over-engineering solutions and consequently increasing our construction and abandonment costs."

"In addressing these issues we are carrying out research, jointly with Imperial College London, to understand better the potential impacts on BP's operations posed by a changing climate. The initial focus of this work is in the arctic region where melting permafrost could have a significant impact on our operations."

BP

"Extreme weather events have both a safety and financial value. They affect the safety of staff with further economic costs associated with insurance premiums and plant operations. For example, during November 2007 Cyclone Sidr caused the closure of the drilling rig offshore Bangladesh for four days at a cost of around £1 million."

"There are other impacts which… may indirectly affect operations. Effects may include flooding, erosion and salinification of farmland in coastal regions. Further, climate refugees, displaced by the environmental impacts of climate change, are likely to increase. There may also be more illnesses from disease."

Cairn Energy

[18] Baker Institute Energy Forum (2007).
[19] CIEP (2009).
[20] Bozon et al., 2007.

High oil prices may incentivise oil and gas companies to develop more challenging reserves, however, it will be important for companies whose asset portfolios contain a high proportion of reserves in technically challenging areas to recognise that climate change will have impacts on exploration, development and production costs.

Conversely, higher oil prices will also create a commercial incentive to accelerate the development of alternative sources of energy and fuel. The growth in the production and development of biofuels in 2006 in response to high oil prices particularly in the USA provides an example. In 2009 ethanol production is expected to make up about 10% of total gasoline consumption in the US.[21] Biofuels are not immune from the impacts of climate change and not least with regard to water stress. These impacts will also add to price and market volatility and the complex relationship with oil and gas prices.

Aging assets, increasing risks. Older assets can be less productive and can give rise to a number of other challenges and costs, including health and safety considerations. Assets designed to historic climate conditions and nearing the end of their asset life are being required to work longer and sometimes in more challenging environments.

The asset design standards for existing assets may no longer be sufficient to meet the impact of a changing climate, for example, the current design maximum probable storm and wave heights may not provide sufficient risk headroom on offshore platforms. The combined effect of asset age and a changing climate should be considered in operational and health, safety and environment risk assessments.

Asset maintenance and monitoring regimes should be reviewed in the light that the impacts of a changing climate may require:

- Changes in the frequency of maintenance and monitoring procedures
- New and/or revised maintenance and monitoring procedures.

Exposures increase due to the size, complexity and technical challenges in new reserve development and production. Exploration and production project risks associated with conventional resources have risen due to their size and complexity. Margins are becoming tighter and are dependent on high oil and gas prices to be economic. Downtime, outages and delays driven by more adverse weather conditions will increase costs particularly during exploration, placing great financial stress on company cash flows.

New regulatory landscapes. Although new regulatory policies are being developed in many countries in response to these challenges, there remains a great deal of uncertainty regarding the scope, content and format of future legislation on emissions. Greater certainty about the future regulatory landscape is required to encourage companies to invest in alternatives to fossil fuels and develop cleaner and sustainable energy sources. New regulatory pricing structures may be required in some countries to encourage greater energy efficiency and demand management measures.

New geo-political risks. The oil and gas sector has traditionally found itself working in areas of the world where geo-political considerations play a major role. At a strategic level the implications for national and international security arising from climate change have been identified by a number of security 'think-tanks' and military organisations across the world. Military leaders and security advisors recognise that there are substantial security challenges arising from climate change that will feature increasingly in the planning of military defence and homeland security strategies.

The UN Security Council held its first ever debate on the impact of climate change on international peace and security in June 2007.

This step recognised that climate change will have significant impacts on resources in many countries and that there are new threats arising from social, environmental and political factors that do not necessarily fall under conventional notions of military defence.

NOCs are moving outside their normal geographical regions to secure reserves and supply security in response to their increasing national energy demands. This may create future security tensions.

The scale of the potential problem is enormous. International Alert[22] identified 46 nations and 2.7 billion people at high risk of being overwhelmed by armed conflict and war because of climate change. A further 56 countries will face political destabilisation, affecting another 1.2 billion individuals.

International boundary disputes. Changes in Arctic sea ice conditions and the melting of the Greenland ice cap may open up mineral, oil and gas reserves which were previously inaccessible. Sea level rise will affect the international maritime boundaries between some nations. In both cases international territorial disputes are likely to arise as nations contest and lay claim to territories and reserves, for example, Canada and Denmark have both staked their claim to Hans Island, off the coast of Greenland.

Opportunities to open up new shipping routes and to exploit oil and gas reserves are leading to territorial disputes. Oil and gas companies will need to review their strategies and assets to understand the implications of potential changes in maritime boundaries. Existing licences may be the subject of international disputes as boundaries change.

[21] Pew Center on Climate Change, 2009.
[22] International Alert (2007). *A climate of conflict: the links between climate change, peace and war.* London.

4 Understanding climate change adaptation risks

Successful oil and gas companies already cope with historic climate risks, ranging from day-to-day and seasonal changeability in weather and extreme events. Assets have been designed to operate within historic thresholds and margins to:

- Meet the climatic differences across the various regions in which they operate
- Maintain environmental and health and safety regulatory requirements
- Deliver against financial performance standards
- Meet operational performance and service delivery standards.

Most companies have practical strategies in place to manage climate uncertainty and minimise disruption, including taking out insurance, maintaining updated contingency plans, and hedging oil and gas prices.

These strategies continue to be important in coping with natural climatic variability. However, the baseline climate is changing, and business decisions and practices will need to evolve as a result. Oil and gas assets have been designed on the basis of historic climate data and a period of relatively stable weather.

"As part of our Environmental Expectations Standard we include mandatory requirements governing climate change adaptation which set out how we assess the risks to our operations from foreseeable environmental changes arising from climate change, together with our approach to risk mitigation."

BG Group Sustainability Report 2008

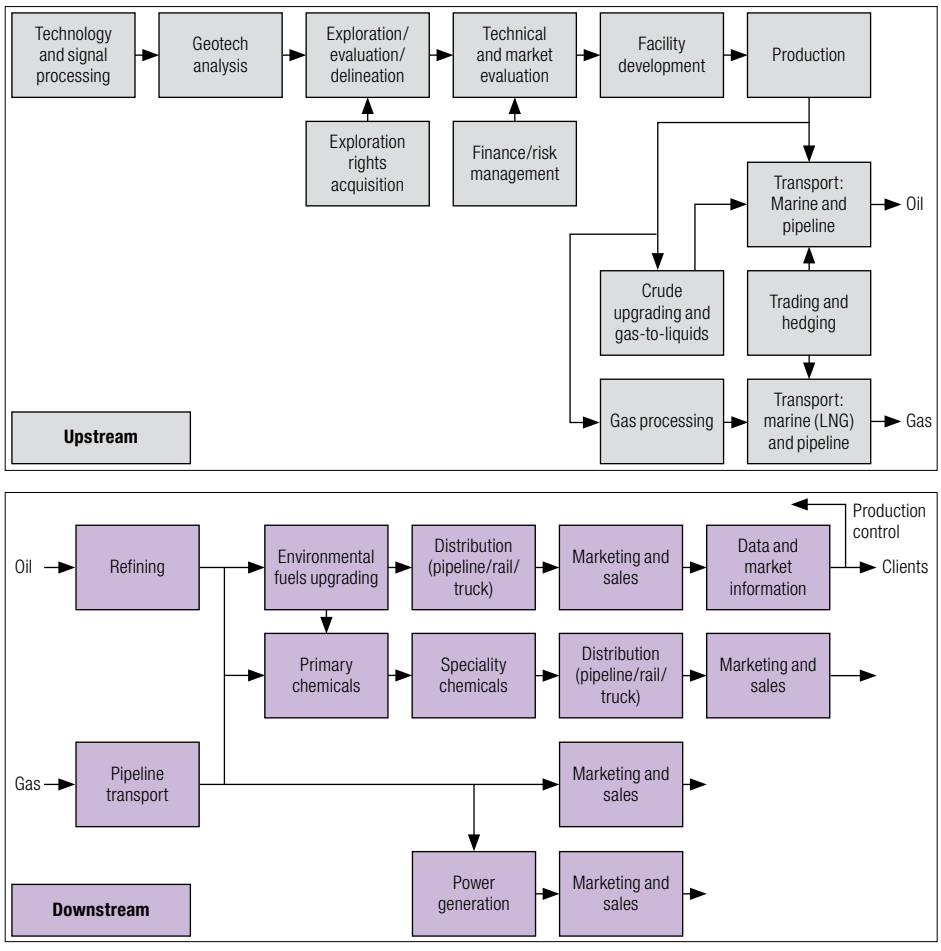
"Anadarko has physical risks to its operations in the offshore Gulf of Mexico and other areas. These risks are primarily related to extreme weather events (e.g., hurricanes) which research indicates may increase in intensity in accordance with a warmer climate."

"The 2005 hurricane season in the Gulf of Mexico demonstrated the potential damage and business impact that severe weather can have on the oil and gas industry."

"Overall, severe weather is most likely to affect offshore operations, but we are aware that onshore weather patterns may also change in ways that affect our operations."

Anadarko Petroleum Corporation

Figure 7: Upstream and downstream value chain[23]



[23] Abraham et al, 2008.

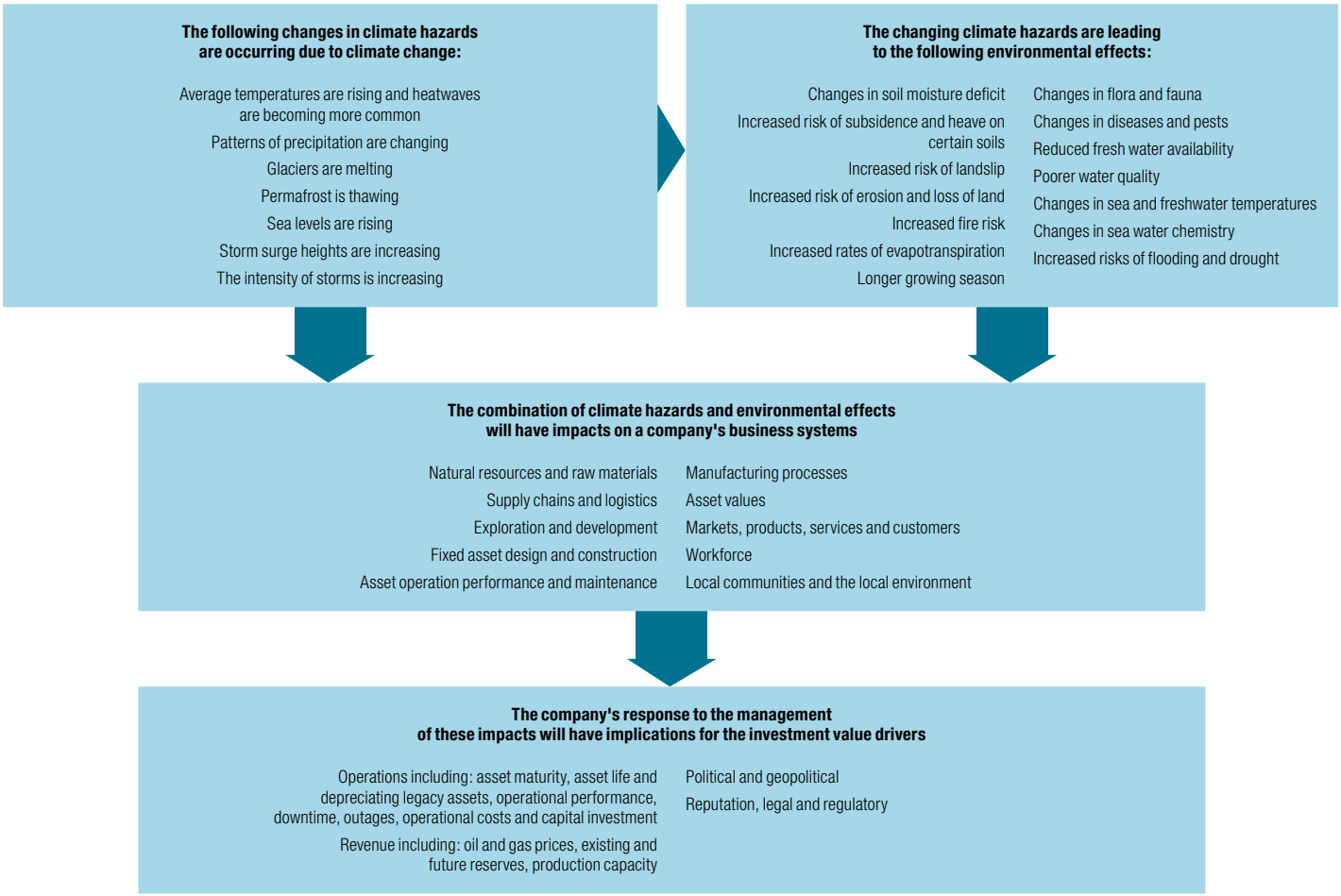
These design assumptions together with those thresholds and margins set for regulatory, operational and financial performance requirements will constrain the future effectiveness of assets to deliver under climate change.

Companies should recognise that climate change will have both direct and indirect impacts across their value chains (see figure 7). It is vital that companies do not limit their risk assessments to the direct physical impacts of climate change. The compound impacts are likely to reverberate through a company's business model – creating a 'pinball machine effect' as the impacts in one area rebound and have consequential impacts elsewhere within a company's business systems, for example:

- Access and availability of natural resources and raw materials
- Procurement supply chains and logistics
- Asset design and construction
- Asset operation, performance and maintenance
- Markets and customers
- Products and services
- Workforce
- Local communities and the environment.

Most reports on climate change impacts focus on direct climate hazards and environmental effects due to extreme events. They concentrate on analysing a one-to-one mapping of hazard to impact, for example, flood risk. This oversimplifies the complex cause and effects that exist as the climate hazards and environmental effects manifest themselves within a company's business systems. It also ignores the effect of incremental climate change and under-estimates the potential costs of the impacts and the adaptation responses by the company and by its stakeholders. Figure 8 sets out the relationships between climate hazards, environmental effects, business systems and investment value drivers from an investor's perspective.[24] Different key drivers will be important for other stakeholders and companies.

Figure 8: Relationships between climate hazards, environmental effects, business systems and investment value drivers



[24] Investment value drivers identified by Société Générale see Acclimatise (2009). Understanding the investment implications of adapting to climate change – oil and gas.

Extreme (acute) events and incremental (chronic) climatic change

Both 'acute' and 'chronic' climate change effects will impact the bottom lines of oil and gas companies by influencing, for example:

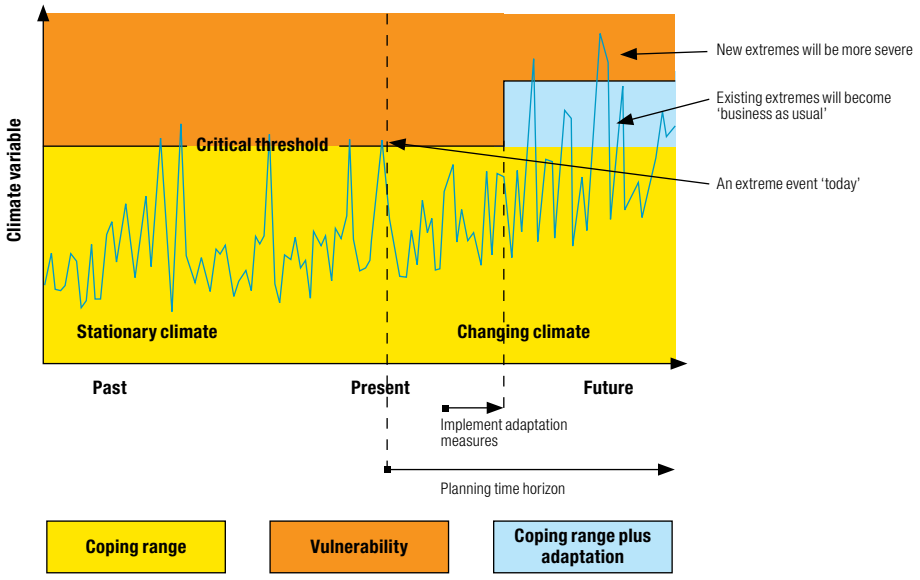
- Operational performance as a result of degraded site conditions, damage to assets, decreased efficiencies of operations, reduced availability and quality of raw materials and natural resources, effects on workforce health and safety
- Social performance because of increased competition with local communities for access to climate-sensitive natural resources and changes in socio-economic conditions
- Environmental performance through changes in habitats, flora and fauna, impacts of discharges and use of natural resources.

Disruptions to oil and gas extraction processes from recent extreme events (for example, Hurricanes Katrina and Rita) serve to illustrate the vulnerability of assets to events greater than the industry's current asset design, engineering and operational standards.

These events, combined with the availability of increasingly sophisticated climate change models, have generated greater interest in planning for more severe and frequent climatic events. In contrast the 'creeping' average changes are much harder to recognise and are more likely to be overlooked.

Figure 9 illustrates the importance of identifying climatic sensitivities and critical thresholds for assets and business systems. These provide the boundaries between tolerable and intolerable levels of risk. Information and data on current and future climate conditions can then be assessed against the asset thresholds, to evaluate the likelihood of their being exceeded.

Figure 9: Impact of extreme events and incremental change on critical asset (or business system) thresholds[25]



Acute (extreme) events. Setting the critical thresholds for asset design and operation is essential, but there is always an event (for example Hurricanes Ike and Gustav in the US Gulf Coast which caused around $40 billion in economic losses) greater than that for which protection has been provided. Climate change (as indicated by figure 9) is predicted to increase the risk of extreme events exceeding critical thresholds. Companies should assess their risks and develop strategic plans to expand the 'coping range' of their assets through adaptation measures.

Business continuity and crisis-management responses are appropriate to manage the impacts of extreme events but have little relevance to incremental change. The latter requires companies to carry out fundamental reviews of their business models and check that processes are resilient new operating conditions created by climate change.

Chronic (incremental) changes. These changes to our climate are more subtle and their impacts on business models and assets may pass undetected until critical thresholds are breached (for example changes in ambient air temperature affecting asset performance). The responses may result in 'step-changes' for a company, increasing operational costs beyond forecasts, falling revenues, unplanned capital investment and additional balance sheet financing to manage the consequences.

Assets and operational processes designed without an appropriate allowance for incremental change may fail to meet design criteria, operational performance targets, key performance indicators (KPIs) and future regulatory standards. Understanding the incremental changes in the climate and a company's current thresholds, sensitivities and vulnerabilities are significant issues to be considered in any analysis of a company's future financial performance. They should feature in corporate assessments of strategic, operational and project risks. This is a particularly important area for companies to focus on when undertaking asset and capability optimisation actions.

[25] Willows, R.I. and Connell. R.K. (Eds). (2003). *Climate adaptation: Risk, uncertainty and decision-making*. UKCIP Technical Report. UKCIP. Oxford.

5 Change drivers for corporate action

Inevitable climate change will have impacts for all companies, but oil and gas companies can be particularly vulnerable.

The key drivers for adaption will be found in regulatory and legal liabilities, changes in cost and revenue profiles, market transformations, stakeholder interest and governance (figure 10).

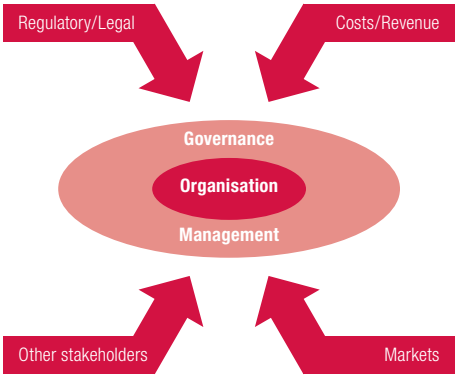
Some examples of how these drivers are beginning to affect oil and gas companies and how they are anticipated to change over the next few years are outlined on pages 13 and 14.

Regulatory and legal drivers

As the impacts of climate change become more direct, we are likely to see governments resort to prescriptive regulation and statutory controls to ensure that oil and gas companies providing essential infrastructure take appropriate action on adaptation. Early indications of action by governments are already evident. In the United Kingdom the Climate Change Act 2008 gives the government the power to require oil and gas companies to assess and disclose the impacts climate change might have on their business.

The wealth of information on the impacts of climate change from the scientific community, academia, research institutions, government, trade associations, and NGOs is so great that it would be difficult for a senior executive or professional advisor to claim ignorance when challenged. As the financial impacts of climate change are further recognised, we are likely to see litigation used to recover costs incurred as a consequence of failures to account for changing climatic conditions.

Figure 10: Change drivers for corporate action[26]



There is increasing pressure for companies to disclose how much the decommissioning of oil and gas infrastructure will cost the company. The UK government recently updated the Petroleum Act, tightening the laws on decommissioning, making it compulsory for companies to take the impacts of climate change into account in their activities. This is bolstered by 70 countries that have mandated the use of the IFRS (International Finance Reporting Standards), which includes obligations on decommissioning.

More stringent design standards from regulatory bodies are likely to continue to arise. An example of where this is already underway is in the design standards of offshore platforms which have been reviewed by the American Petroleum Institute following the 2005 hurricane season.[27]

Cost/revenue drivers

All of the impacts identified in this report have a potential cost implication. For example, operational costs at refineries are likely to increase in response to changes in asset efficiency and resilience with higher ambient air temperatures. Disruptions to transport links due to permafrost thaw is already having significant impacts with companies having to hold and maintain larger onsite spare parts and materials stores. Increasing water resource issues has become a major incentive for companies to introduce water management measures.

Operational costs could increase in response to changes in design standards for offshore platforms. Hurricanes Ivan, Katrina and Rita all produced conditions that exceeded the offshore platform design wave height requirements. Previous standards in fixed platform designs need to be re-evaluated.[28] Companies are noticing an increase in frequency of employee evacuations and downtime as design thresholds are being breached more frequently.

Climate change will put more pressure on insurance for oil and gas companies. This year one of the world's leading brokers (Marsh) stated that primary insurance cover had dropped by 30% and companies were faced with price increases of up to 100%. Marsh advised that a severe hurricane season would place great pressure on the oil and gas companies operating in the Gulf of Mexico as many producers had been left with little or no insurance cover.[29]

As noted previously in this report, decommissioning liabilities may be understated and create significant project cash flow challenges and financial risks.

[26] Adapted from the "Energy & Efficiency Framework", IBM Climate Change Centre of Excellence.
[27] Brown, 2006.
[28] Laurendine, 2007.
[29] Financial Times article 'US energy braced for hurricane pressure' June 2009.

Stakeholders

Investors and other stakeholders, including market and financial analysts, governments and regulatory agencies, research institutions, consumers, local communities and NGOs – are already starting to place greater pressure on oil and gas companies to address climate risks and opportunities.

Corporate operations are increasingly scrutinised in the context of climate change, for example:

- There are signs that there could be increasing numbers of lawsuits filed against oil and gas companies due to their activities
- Recent analysis has been conducted by CERES on companies' climate related risk disclosures in their SEC filings. This report identified that over 50% of oil and gas companies did not disclose any information about their actions to address climate change[30]
- Banks are looking at the lending risks associated with project finance. The International Finance Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD) are both assessing the implications. The EBRD has launched a twelve-month assignment with the objective of developing a methodology for understanding these risks, and their likely impacts on its operations, so that projects can be made climate resilient where appropriate. This assignment will develop guidance and practical tools for integrating climate risk assessment and climate change adaptation into EBRD's project cycle management.[31] Other IFIs and commercial banks are already considering how best to respond to the impacts of climate change and may develop approaches similar to those of EBRD and IFC.

Market drivers

Energy underpins our social and economic systems. Access to reliable and increased supplies of low-carbon energy are essential to meet the adaptation needs arising from, for example, increasing urbanisation, agriculture (to improve yields and manage drought), transportation, the built environment (to cool buildings), potable water supplies, drainage and waste water treatment.

Peak demands will increase in summer months in response to increasing temperatures and the need for energy for cooling. Changes in energy demands for space heating, transportation and other climate-sensitive processes such as pumping water for agricultural irrigation and other industrial and domestic uses are already taking place. Oil and gas consumption has fallen in the USA, Europe and Australia with warmer winters reducing the need for energy for heating.

Governance

The impacts of inevitable climate change and the drivers for change will place increasing pressure on companies to demonstrate that their system of governance is adequately assessing and managing the risks and capable of taking advantage of the opportunities.

Investor groups are challenging companies, through initiatives such as:

- Carbon Disclosure Project (CDP), Global Framework for Climate Risk Disclosure and the Global Reporting Initiative (GRI)
- The Investor Network on Climate Risks (INCR) and Ceres in the USA
- The Institutional Investors Group on Climate Change (IIGCC) in Europe
- The Investor Group on Climate Change (IGCC) in Australia and New Zealand
- The Association for Sustainable and Responsible Investment in Asia (ASrIA).

Ceres, Standard and Poor's, and GRI have all issued reports aimed at the oil and gas sector. The disclosure requirements in these reports cover issues such as:

- Climate change strategy and processes for managing climate change risks and opportunities
- Impact of regulation
- Quantitative data (both historical and projected) related to their exposure to climate change.

In each of these reports the importance of communications and disclosure in financial reports, sustainability reports, analyst briefings and mandatory reports to securities regulators such as the U.S. Securities and Exchange Commission is emphasised. The use of shareholder resolutions to encourage companies to address climate change risks has increased dramatically. Ceres noted that a record high of 57 climate-related resolutions were filed with US companies during the 2008 proxy season. Of that figure, almost half were withdrawn because the businesses positively addressed the issues involved in the resolutions.

The external challenge for greater disclosure should act as a catalyst for internal action by companies to assess, manage, integrate and engage on the consequences of climate change. If investors believe there are questions to be answered then clearly senior executives should be ensuring that the correct questions are being asked within their own companies.

[30] The Corporate Library, 2009, 'Climate risk disclosure in SEC filings' prepared for CERES http://www.ceres.org/Document.Doc?id=473

[31] Emerging work on climate change adaptation at EBRD, July 2009. Briefing note prepared by EBRD.

6 How are companies responding?

"For offshore facilities, European practice also considers extra extreme conditions by consideration of the 10,000 year return environmental conditions. The 10,000 year conditions are addressed by ensuring that there is a positive airgap (>0) between the underside of the topsides structure, and that the platform will not collapse under the 10,000 year environmental load."

"Onshore sites are developed to take into account the possibility of flooding due to inundation from flash floods, extreme tides or tsunamis. Normally the 100 year event is considered but in extreme cases where tsunamis may be more prevalent, this event period may be higher."

BG Group

"Extreme weather events and changes in weather patterns affect project and region-specific issues and require a collaborative approach to identifying and implementing solutions. Extreme weather events and changes in weather patterns can affect our operations."

"Warmer winters can mean a shorter winter drilling season for our Canadian Conventional operations. As a result, companies may be challenged to complete drilling and other operations when conditions are amenable. Our North Sea operations may be affected by changes in climate and related storm patterns and sea conditions."

Canadian Natural Resources

Companies are beginning to identify risks

Respondents most often identify both 'acute' impacts to assets and natural resources as well as disruptions to supply chains from extreme events. These risks are understandably important to companies in view of the large physical asset base and extreme working conditions.

Table 1: The most frequently mentioned risks identified by companies and those that are being managed (Source: CDP Information Requests 2008)

Top risks identified	Top risks managed
1. Assets compromised by extreme weather events	1. Assets compromised by extreme weather events
2. Increased fuel and/or equipment delivery interruptions (e.g. pipelines damaged by extreme weather events)	2. Disruptions to offsite utilities (energy, communications, water and waste treatment)
3a. Companies will continue to be the subject of adverse media, stakeholder and customer comment 3b. Markets for fossil fuels may shrink due to legislation and/or shifts in public attitudes	3. Companies will continue to be the subject of adverse media, stakeholder and customer comment
4. Changes in sea level and flooding will compromise assets (e.g. risk of increased water depths for offshore assets)	4. Increased fuel and/or equipment delivery interruptions (e.g. pipelines damaged by extreme weather events)
5a. Disruptions to offsite utilities (energy, communications, water and waste treatment) 5b. The impact of climate change may have additional health and safety implications for company employees	5a. Changes in sea level and flooding will compromise assets 5b. The impact of climate change may have additional health and safety implications for company employees 5c. Warmer winters can mean a shorter winter drilling season 5d. Wholesale and retail energy prices will remain volatile 5e. Insurance costs could rise because of greater chances of physical plant damage due to weather events and climatic changes
6. Wholesale and retail energy prices will remain volatile	
7. Higher maintenance and construction costs	

Companies' responses show that the risk that they are most aware of and are assessing relates to their assets being compromised by acute events. ExxonMobil noted that the company's "operations around the world include remote and offshore areas that present challenges from existing climate extremes and storms. These severe weather events may disrupt supplies or interrupt the operations of ExxonMobil facilities".

76% of companies reported that their physical assets would be compromised by extreme events.

Far fewer companies (19%) recognised the risks associated with chronic changes to their physical assets and disruptions to essential infrastructure, utilities and supply chains.

Oil and gas companies are also aware of the reputational implications associated with climate change. This risk features strongly in the responses; both in the risk of customers becoming more aware of climate change issues potentially altering demand patterns, as well as in terms of their social license to operate in more remote regions. BG Group noted that "…failure to effectively manage regulatory, commercial and physical issues and opportunities associated with climate change… could have potential to harm… company reputation".

Some companies do not appear to recognise that the risk landscape is changing – 6% reported potential civil and geo-political risks and only 3% identified adverse risks for local communities.

The number of companies reporting health and safety impacts was lower than might be expected, given the recent renewed focus on this issue by many major companies.

19% of respondents considered that a changing climate may have additional health and safety implications for company employees. Whereas only 1.5% gave evidence of actions being taken to manage these risks.

Few companies mentioned insurance risks in their responses. As noted earlier in this report there are significant challenges facing companies. OMV, saw this as a major concern noting that, "increasing insurance fees due to re-insurance pools affected by hurricanes in recent years are already impacting our business".

Only 10% of companies reported that insurance costs could rise because of greater chances of physical plant damage due to weather events and climatic changes.

Legal risks are rarely reported in company responses. Changing stakeholder perceptions and expectations towards energy security, affordability and sustainable development relating to climate change are most often absent from responses. The impact of climate change on natural resources (and in particular water) was not reported as a significant risk even though current water resources issues are recognised as a problem for the sector in many parts of the world. In several North American states concerns about water supply have led to new laws being implemented to limit the amount of water available for the sector (e.g. in Texas and Alberta).[32]

Actions to manage risks

Companies aim to address risks from 'acute' climatic events to their assets by investing in more climate-resilient materials and designs, such as offshore platforms and onshore sites designed and insured to higher standards. As well as this, companies are investing in coastal sea defences and are practising emergency response drills to reduce the impacts of extreme events on their personnel. Eni states that it is reducing operational risks by investing in "quickly disconnectable Floating Production, Storage and Offloading (FPSO) vessels" to reduce the risk from extreme weather events while at sea.

20% of companies reported taking action to manage the impacts of acute events through new research, use of climate models, and the development of internal design standards.

The number of companies reporting that they were investing in more water efficient assets in the face of increased shortages in the future was lower than expected (3%).

Only 6% indicated that they were taking actions to manage disruptions to offsite utilities (energy, communications, water and waste treatment).

Some companies reported managing reputational risks through efforts to enhance transparency and reporting of climate change risks to investors and stakeholders. However, companies on the whole, failed to disclose how they are managing the risks to their reputations arising from increased contact with local communities.

A surprisingly low number of companies (5%) reported taking action to manage potential reputational risks driven by concerns regarding the impact of climate change on their business.

Opportunities remain to be exploited

Table 2 presents the opportunities that companies most frequently recognise and address through assessment and management actions. Companies report fewer opportunities in comparison to the number of risks reported. This is consistent with other business sectors and reflects the early stages of adaptation to climate change where the focus is on risk.

Companies most often identify opportunities that relate to their downstream processes, such as those that arise from the legislation and taxes encouraging the development of new fuels. Opportunities in this area were mainly recognised by companies involved in refining and marketing.

13% recognised that future taxes and other government policies and incentives may have positive effects on markets and the commercial viability of new products.

[32] CAPP, 2005.

"One example of weather related risk mitigation is the use of wooden mats. Wooden access mats have enabled EnCana and other producers to drill during the warm weather months in muskeg and wet areas, thanks to the safe and durable base they provide, which distributes the weight of drilling equipment and minimizes environmental disturbance."

EnCana

"EOG has offshore operations in the Gulf of Mexico and Trinidad and interest in properties operated by third parties in the United Kingdom North Sea."

"These facilities are subject to environmental risks, including sea level changes and extreme weather conditions (e.g. hurricanes), which may cause a loss of production from temporary cessation of activity or lost or damaged equipment."

"Extreme weather conditions could also impact other areas of our operations, including access to our drilling and production facilities for routine operations, maintenance and repairs, and the installation of new facilities."

EOG Resources

Table 2. The most frequently mentioned opportunities identified by companies and those that are being managed (Source: CDP Information Requests 2008)

Top opportunities identified	Top opportunities managed
1. Taxes and other government policies may make previously-unaffordable and new fuels, technologies and processes available	1a. Increased demand for products and services related to enhanced fuel transmission/transport system 1b. Companies investing in more water efficient assets in the face of increased shortages in the future
2. Increased demand for products and services related to enhanced fuel transmission/transport systems	2a. Increased demand for energy because of extreme weather events 2b. Market opportunities for more efficient and bio-based technologies 2c. Taxes and other government policies may make previously-unaffordable and new fuels, technologies and processes available 2d. In the event of an extreme event, the resistance to it by the company will improve its reputation 2e. Company seen as more environmentally friendly through marketing campaigns and improved building standards 2f. Enhanced biomass growth may result in new bio-energy production opportunities
3a. Increased demand for energy because of extreme weather events 3b. Market opportunities for more efficient and bio-based technologies 3c. Enhanced biomass growth may result in new bio-energy production opportunities	
4a. Company seen as more environmentally friendly through marketing campaigns + improved building standards 4b. Increased demand for energy because of seasonal changes and/or increased overall surface temperatures 4c. Companies investing in more water efficient assets in the face of increased shortages in the future	

Another opportunity area that companies identified was that climate change will increase demand for products and services related to enhanced fuel transmission and transport systems. Companies such as BP are developing "products that offer attractive energy saving opportunities for our customers such as improved transport fuels and advanced lubricants". ChevronTexaco also saw opportunities in this area as they have "established strategic alliances to research and develop new process technologies for converting non-food biomass into second-generation biofuels and to study the feasibility of large-scale production".

11% of companies saw opportunities for new and improved products and services related to fuels for transport.

Companies also realise that extreme events will create price volatility. Eni see that "some extreme events could force up oil and gas prices, and therefore increase revenues for the industry". It should also be noted however that costs also increase during extreme events and in their aftermath, and probably more than account for any increase in revenue.

Increased demand for energy in the aftermath of extreme weather events was recognised by 8% of companies.

Companies reported far fewer upstream opportunities. Total did state that "climate change is going to allow access to hydrocarbon reserves in the Arctic area, which offers new opportunities to E&P companies with the relevant expertise".

A small number of companies 2% reported potential opportunities to operate in new areas because of climate change.

7 What actions should senior executives consider? →

A business will only sustain high levels of performance if its leaders are adept at weighing risks and making decisions that are robust in the face of uncertainty. The successful business of the future is taking climate risks into account today, and is developing adaptive strategies and actions to manage the uncertainties. Although there is uncertainty in the knowledge we have about the extent and rate of future climate change, there is sufficient information to enable robust decision-making to take into account the possible impacts on business models. The existence of uncertainties regarding the business risks arising from climate change, should by itself act as a catalyst for companies to quantify the risks, monitor the impacts as they arise and be prepared for changes to their business models.

If businesses are to become climate resilient they need to draw on the experience of the current economic environment. In our report exploring the FTSE350[33] we set out some of the key challenges for senior executives. These challenges apply equally to companies operating in the global oil and gas industry:

- The relevance of climate change to fiduciary responsibilities – Senior executives need to act in accordance with their wider fiduciary responsibilities to create sustainable business growth and return over a longer time scale. Senior executives, who focus on the response to immediate challenges at the expense of a balanced position on the risks facing their business, are not acting in the best interests of their shareholders, nor of those of their employees, customers and the communities in which they are located.
- Governance meeting the challenge – The scientific evidence that climate change is underway, that further climate change is inevitable and that impacts are already occurring in social, environmental and economic systems, is overwhelming. It is incumbent upon all senior executives to ensure that potential risks to their business models and value chains have been identified and assessed to understand the consequences of decisions and the factors affecting their company's future
- Risk disclosure – In most countries the regulation of companies under statute requires some form of disclosure of future risks, for example:
  - In the USA Item 303 in the Securities Exchange Commission Act of 1933 requires US publicly traded companies to disclose "where a trend, demand, commitment, event or uncertainty is both presently known to management or reasonably likely to have material effects" on the financial condition of the company
  - In the United Kingdom the Companies Act 2006 requires that Directors of listed companies understand the likely consequences of any decision in the long term, and disclose the main trends and factors likely to affect the future development, performance or position of the company's business.

Developing an integrated approach

Adapting to the impacts of a changing climate requires oil and gas companies to take an integrated approach. There is an urgent need to develop alternative sources of energy and fuels to meet the demand from both economic growth and that driven by the climate change adaptation measures of others (for example increasing urbanisation). This has to be achieved recognising that whatever decisions and choices are made, they need to be climate resilient. Senior executives in the oil and gas sector need to ensure they add the changing climate dimension to their decision making processes. Strategies and actions need to be set against moving baselines and changes in social, economic and environmental systems.

The risk of increasingly severe and frequent extreme events due to climate change has grabbed the media headlines and been the focus of most of the work undertaken by companies to assess their risks. This is clearly important; the effects of an acute event can have a significant effect on the future viability of a company. Senior executives however need to take a more balanced and informed view of the likely impacts of climate changes and understand the risks and opportunities resulting from both acute events and chronic change. Gradual changes to our climate are more subtle and their impacts on business models may pass undetected until critical thresholds are breached.

It is also important for companies to recognise that climate change will have both direct and indirect impacts. The 'pinball machine' effect and the compound impacts will create significant business risks (and opportunities) through value chains.

The direct and indirect impacts are particularly relevant for the supply chains of all companies. Increasing globalisation, outsourcing and just-in-time approaches to stock control already create significant risk exposure. Supply chain visibility – namely, being able to map out and understand linkages and relationships – as well as cost containment, will become more difficult under continuing climate change. Disruptions to global supply chains as the suppliers themselves become exposed in their own locations will become a major risk area for companies.

[33] Acclimatise (2009) 'Building business resilience to inevitable climate change' FTSE350.

The use of scenario planning and back-casting can be useful tools to help set out the challenges ahead and map out their relationships. A number of companies are using these tools, although there is little evidence that they have factored in the impacts of a changing climate and then included adaptation options.

Senior executives are advised to embed climate risk management into decision-making within their companies in order to:

- Take a wider long-term view of potential risks and opportunities
- Assess the impacts on business systems and value chains
- Manage the financial exposures associated with, for example, the implications for assets, proved reserves and decommissioning
- Ensure internal policies, processes and systems are climate resilient.
- Recognise and act upon the impacts for their employees, the local communities and the environment.

The successful oil and gas companies of the future will be those that act now upon the clear signals that climate change is underway. They will have a fully integrated approach to reducing emissions and adapting to climatic change.

Prepare-Adapt: 10 questions for senior executives in the oil and gas sector

Acclimatise and IBM have jointly prepared their Prepare-Adapt set of questions to help oil and gas companies take the right steps towards building corporate resilience to inevitable climate change. A simplified version drawing on a more comprehensive set of questions is provided below.[34]

Your risks

1 What are the operational impacts on your company of climate change?

- What are the implications for the operating performance and efficiency of your existing assets under changing climatic conditions?
- How will the impacts of climate change on the other operators in the oil and gas value chain affect your business?
- How will changes in water resources and water quality together with increased competition from other users affect your operational capacity?

2 Are your current and planned major operating assets located in areas vulnerable to climate change impacts and what are the implications?

- What steps are you taking to adapt existing, and design new assets, against future climate impacts? What costs would be involved to undertake remedial works to provide resilience to existing assets?
- What are the implications for decommissioning liabilities and depreciating, abandoning or writing-off assets or of extending asset life?
- How will the operational performance of your asset portfolio change over time?

3 How sensitive is demand for your products and services to climate change impacts?

- How will customer needs, buying behaviour and ability to pay change and over what timescale as they respond to the impacts of a changing climate?
- What are the implications of increasing urbanisation and changing energy demand profiles?
- How will the host governments of the countries in which you operate react to climate change?

4 How could current and future climate change regulations and industry standards affect your organisation and its reputation?

- What is your level of regulatory and financial exposure to the introduction of prescriptive legislation on adaptation, together with further legislation on urgent mitigation action, as the reality of climate change becomes more pressing?
- What are the potential impacts on your reserves?
- Which areas of your business are sensitive to media, NGO and local community concerns; how will their positions change over time?

[34] Please contact Acclimatise or IBM if you would like to know more about the 'Prepare-Adapt' questions.

Your opportunities

5 What new and enhanced existing products and services can you offer your customers?

- What steps are you taking to develop new or enhanced business opportunities that will create competitive advantage?
- How will you develop brand stretch to take advantage of changes in customer behaviours and develop climate related markets?
- Can you provide products and services that will help governments, business and retail customers predict, monitor, and adapt to the impacts of climate change, as well as enhance their efforts to reduce their emissions footprint?

6 What benefits could you realise from better managing your response to climate change?

- How can you improve the attractiveness of your company to investors, banks, credit rating agencies, exploration licensing agencies, employees and potential recruits?
- How will you use the current economic environment as an opportunity and an incentive to revisit your business model and respond to the growing social, environmental and economic challenges?
- What are the cost advantages if you can secure more favourable insurance cover by demonstrating strong operational risk management processes limiting potential consequential loss claims?

Your response

7 How clear and effective are your governance processes for dealing with climate change?

- To what extent are your internal climate change leadership and management roles clearly defined, supported and empowered to meet fiduciary responsibilities?
- How are you sharing information with and influencing governments, regulatory bodies, NGOs, consumer groups and the media to manage and forecast exposure?
- What actions are you taking to ensure that the investment community, your bankers and insurers understand and support the steps you are taking regarding climate risk?

8 How well structured is your approach for managing climate change?

- How effective is your process for exploring longer term scenarios and identifying risks and opportunity signals as they emerge?
- What actions are you taking to assess the exposures in your supply chains? Are your suppliers' operations climate resilient?
- What steps are you taking to ensure that climate change driven business risks and opportunities are integrated into your decision making processes?

9 How can you ensure that your approach is based on robust information and assumptions?

- How have you integrated the latest available climate science and climate change scenarios to inform your business planning and decisions?
- Are your management information systems for raw materials and resources, assets, supply chains, operations, markets and customers reporting on and monitoring climate change KPIs using realtime, interconnected and intelligent data?
- Can your information systems provide an early warning of climate change driven signals of changes in operational performance and demand profiles?

10 How can you demonstrate that your climate business resilience plans are realistic and financially viable?

- What actions have you taken to understand and manage future liquidity and ensure sufficient contingency funding in preparation for more intense and frequent extreme climatic events?
- How do your business continuity and crisis management plans reflect the changing risk profiles due to climate change and are they well-rehearsed?
- What steps are you taking to involve your employees, develop new skills and expertise to grow your internal capability?

Appendix 1

Examples of the impacts of inevitable climate change on the oil and gas sector

In the following tables a high level illustrative overview of examples of observed and potential impacts of climate change is provided.

Natural resource impacts due to climate change

Due to concerns over water shortages and access to safe drinking water, legislators in four states in the USA want to pass a bill regulating companies' use of hydraulic fracturing. According to a study undertaken by the American Petroleum Institute, US oil and gas production would drop 20.5% over five years if federal regulation of hydraulic fracturing becomes law. (PennEnergy (2009) Study finds that US production would dip under hydraulic fracturing law). Climate change would increase the likelihood of such bills being passed, though added pressure on water resources.

Water scarcity is resulting in increased competition with local communities throughout much of the world. The UN estimates that by 2030, 47% of world population will be living in areas of high water stress.[35] Increased awareness of this amongst consumers and NGOs is and will continue to be, harmful for the sector.

Oil sands extraction requires significant water resources. From the Athabasca River alone, water allocations by Alberta (Canada) to oil sands projects now add up to 359 million cubic metres per year.[36]

In 2005 PTT Exploration and Production, Thailand's largest oil and gas conglomerate acknowledged that its petrochemical facilities in Rayong and Chon Buri had been affected by water shortages.

Asset impacts due to climate change

Oil production is expected to switch to regions that are more remote as developed countries seek new reserves. This will entail building and maintaining longer and more complex supply chains, often in areas more vulnerable to extreme climatic events. This has the potential to add to price volatility and increase production and supply costs.[37]

Rising sea levels are likely to lead to direct losses, such as equipment damage from flooding or erosion, and indirect effects, such as the costs of raising vulnerable assets to higher levels or building new facilities farther inland.[38]

Hurricanes Ike and Gustav caused severe damage to refineries in Louisiana and Texas in 2008. At least 14 Texas refineries, representing nearly a quarter of the nation's refining capacity, were forced to shut for over a week, with three refineries in Louisiana sustaining flood damage.[39]

Cyclone Gonu in 2007 provides an indication of the changes taking place in our climate creating conditions that existing oil and gas assets were not designed to meet. Cyclone Gonu reached category 5 status and caused widespread disruption to oil and gas assets, shipping and to the essential infrastructure of countries in the Gulf region. The severity of the storm and its track into the Gulf of Oman were unexpected.

Permafrost thaw, and subsistence pose risks to the seasonal availability and safety of ice roads, and the structural integrity of overland roads, bridges, pipelines, and airstrips. Paved runways are likely to be among the structures most vulnerable to permafrost changes, as they readily absorb solar energy.[40]

The number of days in which oil exploration activities on the tundra are allowed, under the Alaska Department of Natural Resources standards, has halved over the past 30 years. This is due to permafrost thaw, which is disrupting transportation, damaging buildings and assets and increasing the risk of pollution. Operational costs are increasing for oil and gas companies.

The US Geological Survey states that about 30% of the undiscovered gas reserves and 13% of the world's oil reserves are situated in the Arctic Ocean.[41] Accessing these resources has been made simpler due to rising temperatures and permafrost thaw.

Port infrastructure is vulnerable to small changes in sea level rise, particularly if combined with storm events.

The North Atlantic 2005 hurricane season illustrated how vulnerable the sector is to extreme events greater than the industry's asset design and engineering standards.

The American Petroleum Institute has increased its design criteria several times. It requires offshore structures to withstand the forces generated by a hurricane with a return period of 1 in 100 years. This includes winds with a one-hour average of 80 knots (equivalent to a hurricane producing one minute of sustained 115-mph winds) and wave heights of 70 feet.

[35] UN World Water Development Report (2009).
[36] WWF Canada (2005) Implications of a 20c Temperature Rise for Canada's Natural Resources.
[37] McKinsey Quarterly (2007) Global trends in energy.
[38] USGCRP (2009) 'Global Climate Change: Impacts in the United States'.
[39] New York Times (2008) 'Gas Prices Climb Quickly as Refineries Remain Closed'.
[40] Lemmens et al. (2008) From Impacts to Adaptation: Canada in a changing climate 2007.
[41] USGS (2009) 'Assessment of Undiscovered Oil and Gas in the Arctic'.

Some hurricane experts say this corresponds to little more than a Category 3 hurricane. 37 hurricanes since 1900 have passed through the Gulf of Mexico oil leases with maximum sustained wind speeds of 100 knots or more.

In Autumn 2007 storms in the North Sea resulted in Norwegian oil production being cut by 10%, or 220,000 barrels per day.

Offshore platforms are at a greater risk from changes in marine conditions. The risks are greater for older assets nearing the end of their life. Recent hurricanes in the Gulf of Mexico – Ivan, Katrina and Rita – all produced waves that exceeded the offshore wave height deck requirements for many platforms. Remedial works will be very expensive, although they may be forced to do this to ensure insurance cover.[42]

Existing flood management and drainage systems may be compromised by sea level rise, storm surges, coastal erosion, changes in precipitation, and greater intensity and frequency of flooding events. This will lead to asset damage, disruptions to offsite utilities (energy, communications, water and waste treatment), disrupted transportation links, more downtime.

Rising temperatures will affect efficiency and performance of plant and equipment such as compressors, gas turbines, pumps, generators. Consequences include increasing energy consumption, decreased output, more maintenance, reduction in asset performance and life, higher depreciation costs, earlier asset write-off.

Delays in asset development, disruption to oil and gas pipelines, potential loss/reduced production, greater pollution risk, increased site storage or supplies and equipment, reduced asset life (leading to changes to depreciation rates and premature asset write-off). Additional unplanned capital investment may be required.

Damage to third party utilities and infrastructure can further delay returning facilities to full production. Production capacity may be comprised.

Regulatory impacts due to climate change

Early indications of action by governments are evident: In the UK, the Climate Change Act 2008 gives government the power to require companies to assess and disclose the impacts climate change might have on their business.

The UK government recently updated the Petroleum Act, tightening the laws on decommissioning, making it compulsory for companies to take the impacts of climate change into account in their activities.

Workforce

Many oil and gas companies have operations in extreme climates, such as the Arctic, and this work can pose a number of hazards, including extremes of temperature, wind and humidity. These can lead to serious health problems in an exposed individual.[43]

The impact of climate change on operational processes (increasing temperatures for example) may have additional health and safety implications. Assets and operational processes designed according to past climate data will be used under different climatic conditions.

Employer and public liability insurance cover may be compromised if companies fail to take climate change into account during health and safety risk assessments.

Decommissioning impacts due to climate change

The costs of decommissioning oil and gas assets are high, particularly for offshore installations. This is partly because of the environmental concerns raised by environmentalists around the sinking of the Brent Spar in 1995 by RDShell. The UK Government estimates that over the next 40 years, the decommissioning costs in the North Sea will be as high as £23 billion[44] – these figures do not take into account the impact of climate change.

In Alberta, Canada, companies are required to return the land to a sustainable landscape with productivity equal or greater to that prior to oil sands development. There are strict requirements for ongoing reclamation, including regulations to establish financial guarantees to ensure all reclamation is completed. Partly as a result of climate change, water shortages are becoming an increasing concern. This may result in large financial impacts to a company if they cannot meet their financial guarantees.

A report from Standard and Poor's (S&P)[45] sets out the concerns regarding disclosure by oil and gas companies of their future decommissioning liabilities. The report refers to the lack of information provided by companies. An assessment of leading companies indicates that decommissioning provisions (which are treated as additions to debt) equate to about 45% of the overall future debt burden for oil and gas companies. Decommissioning provisions represent a significant part of their financial risk because the majority of cash flows occur at the end of the project's life.

The accounting rules for such provisions under IFRS (IAS 37) require a company to recognise a liability as soon as the decommissioning obligation is created, which is normally at the time a facility is constructed.

[42] Liberty International (2007) 'Underwriters weigh design, construction of offshore oil platforms'.
[43] IPIECA 2009: Health aspects of work in extreme climates: A guide for oil and gas industry managers and supervisors.
[44] House of Commons (2009) UK Offshore Oil and Gas: First report of Session 2008-2009.
[45] Ibid.

Standard and Poor's found that the scale of decommissioning provisions tends to be based on management judgment rather than independent third-party appraisals.

There is little evidence that the impacts of climate change on decommissioning have been taken into account by companies.

Legal impacts due to climate change

Canada and Denmark have both staked their claim to Hans Island, off the coast of Greenland. Opportunities to open up new shipping routes and to exploit oil and gas reserves are leading to territorial disputes.

Oil and gas companies will need to review their strategies and assets to understand the implications of potential changes in maritime boundaries. Existing licences may be the subject of international disputes as boundaries change.

Changes in Arctic sea ice conditions and melting of the Greenland ice cap may open up previously inaccessible oil and gas reserves. Sea level rise will affect some international maritime boundaries.

International territorial disputes are likely to arise as nations lay claim to oil and gas reserves.

Release of new licences may be delayed until international disputes are settled.

Companies with existing licences in areas where there are potential changes in international maritime boundaries may have to renegotiate licences or find that licences are revoked.

Companies with legacy assets in these areas are most at risk.

Changes in environmental conditions may be used to revoke exploration and production licences by governments as the price of oil and gas increases.

Legacy assets secured under advantageous terms may be at particular risk.

Revocation or re-negotiation of licences (in particular those for legacy assets) will have significant implications for oil and gas companies.

Geo-political impacts due to climate change

Changes in rainfall patterns, reduced water resources, poorer water quality combined with increasing risk of heat wave, drought and flooding will significantly increase water demands and competition for available resources. Competition for water resources with local communities and the wider environment may lead to social and political conflict.

Areas under severe stress are likely to face social unrest and political instability.

Social and political conflict will create problems for local workforce, community relationships and may interfere with licensing and permitting of oil and gas reserves.

Civil disturbance and military conflict may result.

Reputation impacts due to climate change

As knowledge and awareness of climate change grows, companies' operations are going to be increasingly scrutinised. The environmental and social impacts will be looked at in more detail and could give rise to reputational risks. Partly due to the rise in oil and gas prices, companies are producing oil from reserves located further afield. This is increasing the social, environmental and reputational risks that oil companies face. Failure to address this issue can cause damage to a company's reputation with its stakeholders.

A 2001 UN report affirms that, if the rate of Arctic industrialisation continues, more than 40% of wildlife will be 'critically disturbed' by 2050. The projected disturbance in seal and bear population would also have a negative impact on the livelihood of indigenous communities. Companies are likely to face increasing opposition to expansion in this area for these environmental and social reasons.

Working in extremely sensitive areas will create major reputational issues.

NGOs will vigorously oppose opening up the Arctic. This is likely to become the most sensitive environmental conflict of the last 100 years. Oil and gas companies should also be mindful of the pressure retail customers (particularly in Europe and the USA) can exert (for example the effect on the disposal of Brent Spar).

NGOs may resort to litigation and in extreme cases environmental activists may attempt to disrupt exploration activities.

The reputational implications for major companies of the above would be significant.

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Acclimatise specialises in climate change risk management. We have a portfolio of tools that enable businesses and governments to adapt to inevitable climate change. We bridge the gap between the scientific community and the corporate world, reviewing the latest science, providing clear guidance on the business and financial threats and the opportunities arising from inevitable changing climate. We provide strategic and project-specific climate change advice to the private and public sectors.

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