**David Eyton, Petrotech, Delhi, January 2009**

**Expanding wings in the hydrocarbon sector – the era of collaboration**

## Introduction

Thank you for inviting me here today. As BP's Head of Research and Technology, it is exciting to be in India, where technology is at the forefront of the economic leaps this country is making.

I'd like to start with a personal comment. It was exactly one hundred years ago, in 1909, when BP's forerunner — the Anglo-Persian Oil company — came into being, thanks to the discovery of a huge oil field a year earlier in what is now Iran.

Over the last 100 years BP, like other international oil companies, has continued to operate at the frontiers — of geography and technology and in collaborative ventures on a massive financial scale. The fact that BP is still here today, operating in over 100 countries including India, is a testament to the perseverance of many generations and their ability to integrate capabilities and manage risk.

My intention today is not to dwell on the past but to draw confidence from the industry's achievements in looking at future energy challenges — and to outline how collaborative efforts hold the key to meeting these challenges.

## Energy challenges & solutions

I'm sure you are familiar with the energy challenges of the 21st century so I will not linger on this topic. In simple terms people all around the world want **secure, low-cost and low-carbon energy,** with the emphasis on energy security having grown with energy prices.

The reality is that there is tension between these different objectives. The distribution of fossil hydrocarbons around the world does not coincide exactly with the major populations, and equally, the natural advantages for alternative energies are not distributed on this basis. This has created energy winners and losers, with significant financial consequences, and can be expected to continue to do so in the future.

There has been much debate about if and when we will reach ‘peak oil’. BP’s viewpoint is that there is no shortage of fossil fuels: we estimate that the world has already demonstrated the commercial viability of around 40 more years of conventional oil resources, 60 years of gas and 130 of coal at current consumption rates. Technology can extend all of these timelines well into the next century, in particular through the development of more unconventional resources. In our view, the more pressing challenge in the next decade is likely to be environmental — and more about the ‘peak carbon carrying capacity’ of our atmosphere than the availability of fossil fuels.

There is little doubt that demand for energy will continue to grow, driven by population growth and economic development. According to the International Energy Association (IEA), the world needs up to 50% more energy by 2030 on a business-as-usual basis or at least one third more if current policies are implemented.

In its 2008 publication, called *Energy Technology Perspectives*, the IEA has identified a range of supply-side and demand-side opportunities for reducing carbon dioxide concentrations in the atmosphere, shown here in order of decreasing significance, with supply- and demand-side options being roughly equal in magnitude. **Together these comprise a possible, global, technical solution.**

Our atmosphere does not, however, recognise national boundaries. Tackling climate change requires all nations to play their part, as both suppliers and consumers of energy. It falls to policy-makers to determine the **financial mechanisms** by which we will mitigate the risks associated with climate change in the short to medium term, and to define the trajectory to a more sustainable energy system in the longer term. And just to be clear, as fossil fuels are a finite resource, their combustion as our primary source of energy cannot, by definition, be maintained indefinitely, however efficiently or cleanly this is done.

**The future for oil & gas companies**

This scenario could be viewed as threatening the very existence of those whose businesses are concentrated in the oil and gas industry. However, this way of thinking fails, in my view, to appreciate many of the fundamentals of our industry:-

1. To start with, all the **carbon** in fossil fuels came from our atmosphere in the first place. It has been transformed over time and under the action of subterranean forces into everything from methane to anthracite. *Our* expertise is in the sourcing, processing, storing and transporting of hydrocarbons. Carbon itself is not the enemy — indeed it is fundamental to life on Earth — the issue is reducing carbon dioxide emissions from the combustion of fossil fuels.

2. Secondly, under the IEA's BLUE Map scenario, in which $CO_2$ emissions halve by 2050 relative to today's levels, the demand for oil and gas will still be 92% of today's level in 2050. Over the last century, changes in the supply mix have occurred slowly, and the **timeframe** over which oil and gas demand will change is going to be long. Meanwhile natural production decline will continue to need offsetting with new investment and supplies.

3. Thirdly, the **power** sector accounts for twice the global emissions of $CO_2$ of the transportation sector. The long-term solution for the power sector will be nuclear and renewable energy. However around 75% of the currently-installed power base consumes hydrocarbon fuels and is not likely to be retired quickly. Carbon capture and sequestration (CCS) can decarbonise a proportion of the power sector, provided that technology can drive down the cost of capturing $CO_2$ from dilute flue gases. The oil and gas industry already has the skills to conduct CCS.

4. Fourthly, **transportation** fuel infrastructure has been optimised over the past century to use carbon-based fuels. Consumers have chosen carbon-based fuels over the alternatives because they are liquid at atmospheric pressure, have a high energy density and are cheaper than the alternatives — such as hydrogen or electricity. For the foreseeable future carbon-based fuels will still be required in long haul and heavy goods transportation. In the long term it remains to be seen whether or not renewable carbon-based fuels sourced from the atmosphere, for example biofuels, will be preferred in passenger vehicles over the alternatives.

5. Finally**, petrochemicals** need not be burned at all; they can be recycled and are likely to be sourced from fossil hydrocarbons for a very long time due to their low cost of supply.

In short, our current skills as an industry will be needed for many decades to come. It is already clear that we need to reduce the environmental footprint of our operations. Pure economics drive us in this direction not least because the business case for improving energy efficiency grows with energy prices.

## Role of IOCs

The International Oil Companies (or IOCs) comprise a subset of the oil and gas industry and some commentators have suggested that the days of the IOC are

numbered. On the contrary, I believe that IOCs, such as the one I work for, have a critical role to play in addressing the energy challenges of the 21st century. Of course I would say that, wouldn't I? But let me explain why I do believe this, using some BP examples to illustrate the points.

1. IOCs are **global energy vehicles**, forming a bridge between producing and consuming nations. They have large market-facing businesses and are involved in the energy policy dialogue with many of the key resource-holding governments and consuming nations.

2. They work at the **frontiers** of the energy industry, often beyond the known operating limits and sometimes in wilderness with delicate ecosystems, such as BP's Prudhoe Bay development in Alaska.

3. They learn from their global activities and use this 'know-how' to raise standards and increase the **efficiency** of their operations — in terms of safety, the environment, reliability and cost. This has been made clear in recent stock price movements during the fall in the price of oil — there has been a flight to quality and the IOCs have been relative beneficiaries. BP's Wytch Farm oilfield, which lies under the south coast of England — a World Heritage Coastline and site of special scientific interest — perhaps exemplifies many of these features. In respect of cost efficiency, the field extends many miles offshore. It has been developed from the shore using extended reach drilling, avoiding the significant expense of construction of offshore platforms or islands, with step-out wells up to 11 km already drilled. We are now looking at a new 15-km step-out well, which would set yet another world record and provide cost effective access to what would otherwise be uneconomic resources. We are also applying this expertise to developments in other parts of the world, such as the Liberty field, offshore Alaska.

4. IOCs have the **scale** to integrate across sectors to execute multiple, complex and risky projects backed by strong balance sheets. For example, the Baku-Tbilisi-Ceyhan oil pipeline and the South Caucasus gas pipeline were constructed as a single, BP-operated project between 2002 and 2006 at a cost of $5bn.

5. And finally, they are pioneering investors into **alternative** energy solutions. BP's Alternative Energy business is currently investing at a rate of around $1 billion per annum. In India, we have been an investor in the manufacture of photovoltaic solar cells and panels for more than 15 years. There are more than seven million people here using Tata-BP Solar products, providing them with light, power and fresh water supplies, mainly in rural areas.

**Research and technology**, my own area of responsibility, underpins many of these activities. Most of BP's capital expenditure of over $20 billion per annum currently goes into oil and gas production and transport fuels. Two thirds of our R&D spend also supports this business, but the remaining one third goes into new energy value chains. This is consistent with both the importance of fossil fuels today and our expectations for the future as we move towards more sustainable energy supplies.

## Collaboration in the energy sector

Joint ventures are a common feature of our industry. Providing secure, low-cost and low-carbon energy to all nations is unlikely to happen without new forms of collaboration in the energy sector, among the existing players but also including some new ones, for example in the auto, appliance and agricultural industries. We need to raise our game to meet this grand challenge. Competition has always provided us with the motivation to innovate, and collaborative ventures have yielded new solutions. We already have a track record of collaboration, and this gives me confidence that we can succeed.

In the oil and gas sector, collaboration occurs between many different players — resource owners, suppliers of goods and services, the scientific community and, of course, operators themselves. The objectives of these players vary, but in working together they can achieve common goals. I have already spoken about the role of IOCs and would now like to talk about the *nature* of our relationships with these players and how they appear to be developing.

1. **Resource owners** want to maximise the societal contribution from their resource extraction. Sometimes National Oil Companies (or NOCs) act for the resource owner — and some are becoming increasingly international in their disposition. Some would say that they are beginning to compete with the IOCs, although our ownership structures will always differ and each NOC is different in terms of its emerging needs. This drives the form of collaboration.

   For example in Angola, Sonangol and BP have developed a new way of working together on deep water block 31, by agreeing that BP and its co-venturers can develop discoveries — of which there have been 15 to date — in a programme using a standardised facility concept. This is the first time that Sonangol has approved a programme of contracts in this way, the objective of which is to drive cost efficiency.

   We are probably all familiar with the role of resource ownership in relation to fossil fuels. But, I would also like to point out is that this philosophy can also apply to renewable resource exploitation on a large scale.

   In Abu Dhabi BP is participating in a hydrogen energy joint venture with Rio Tinto and the sovereign alternative energy initiative Masdar. The plan is for natural gas to be processed to create hydrogen and $CO_2$. The hydrogen fuel will generate low-carbon electricity, while the $CO_2$ will be

captured and injected back into one of the fields managed by Abu Dhabi's ADNOC to enhance oil recovery.

Finally, the agreement BP signed last month in China is another interesting manifestation of progressive resource ownership. The Clean Energy Commercialisation Centre is a $75 million joint venture between BP and the Chinese Academy of Sciences (CAS). As its name implies, the primary goal of the joint venture is to commercialise new technologies which will reduce the environmental impact of energy production, focusing in the first instance on coal. In creating the centre, CAS gains access to BP's skills in developing and managing new technologies and BP gains access to Chinese technologies.

2. **Suppliers of goods and services** tend to operate in a sub-sector of the energy industry. This is a mature and competitive industry and suppliers have been investing increasing amounts into research and development to differentiate themselves. BP partners with many major service providers in the form of long-term contracts, to secure access to capability and provide investment confidence; and occasionally we conduct joint technology development programmes. One of our longest standing global agreements is with Sumitomo for the supply of pipe for drilling and transportation. This been in place since 1999 and has provided not only competitive pricing, but also mutual benefits such as the development of new, leading products required for harsher applications, and optimization of manufacturing processes to provide the highest quality pipe available to the industry.

   Recent trends which are further enhancing the technology suppliers offer include digital, nano and even bio-technology.

Digital is the more mature of these trends. The application of digital technology is changing the way people work, both inside BP and at the interface with BP. This change process is a sophisticated collaborative endeavour. In our Exploration and Production business, we have had a major technology programme addressing this since 2003, called Field of the Future™. As part of this programme we have installed sensors on wells and facilities in our high rate offshore fields, such as in the Gulf of Mexico, together with high bandwidth fibre to the beach; and onshore we have created what we call Advanced Collaboration Environments in which teams integrate and analyse the data to optimise production, using proprietary software and algorithms. This increased production in 2008 by 30mboed, with payback on our investment measured in months rather than years.

Not all of the work in the Field of the Future™ programme is being done inside BP: we partner with a number of IT companies to help develop the software products. Some of those companies are here in India, boasting highly structured processes and systems to create these products that help us codify our corporate know-how systematically.

3. In my current role I am perhaps closest to another community with which we collaborate, the **Science** community. For the past 100 years, oil and gas reservoir management has been largely about physics — of drilling wells and fluid displacement in porous media. The ability to observe and measure actions and reactions on a molecular scale is comparatively new and is opening up a whole range of new possibilities. The application of advanced chemistry to conversion in surface process equipment is not new, but its application to resource extraction is still in its infancy and has significant potential to increase recovery factors.

BP's Bright Water™ technology is a good example of the application of chemistry to oil recovery. The technology has been developed with Nalco and Chevron. It comprises polymers which travel into reservoirs with injected water and expand to block pore throats in swept zones, thereby diverting the water into unswept zones. BP has conducted 26 field trials in Alaska and South America and 75% have to date yielded incremental recoveries at a cost of less than $5/bbl.

Beyond chemistry is biology. We believe that the potential associated with the application of biology to supplying energy is enormous. That is why we are investing $500 million over 10 years to establish the **Energy Biosciences Institute** at Berkeley, which combines the strengths of the Universities of California and Illinois and the Lawrence Berkeley National Laboratory. The EBI is bringing together talented biotechnologists to explore a wide range of options to apply bioscience to energy — from ligno-cellulosic conversion to make fuels, to the use of bacteria to help recover oil and gas.

These examples underscore the critical role of technology development and fundamental scientific research in rising to the energy challenges of today and tomorrow. The openness and collaborative nature of BP's technology relationships is perhaps one of its distinguishing features. One potential disadvantage of this approach could be a lack of control over intellectual property, but we believe that this is far outweighed by other factors. With collaboration, the company is less insular and has access to leading science. The flow of ideas is accelerated and R&D can achieve greater productivity and effectiveness.

## Conclusion

Let me conclude by saying that as a technologist I am optimistic about the future of energy despite the immense challenges we face. The risks associated with

climate change have obliged the human race to learn how to confront its own sustainability on Earth. There will be other challenges and these learnings will stand us in good stead.

The scale of the challenges facing the world calls for action across the energy industries on a global scale. It is simplistic to say that the objective is to de-carbonise the energy landscape; rather it is about progressively reducing the emissions from fossil fuels — and there is a difference. I believe that we as an industry have many of the skills needed to support the transition to a sustainable energy future, and that we can continue to thrive, provided that we collaborate, innovate, and engage constructively in the national and international energy debate. I hope what I have said today assures you that BP plans to play its part.

Thank you for your time.