



The frontiers of the energy industry and BP's distinctive role

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Good morning everyone and thank you for inviting me to take part in this discussion.

I want to share some thoughts about the frontiers of the energy industry and the distinctive role that international oil companies such as BP play at those frontiers.

- So first I want to look at what the current frontiers are and why IOCs are relevant to them;
- Then I want to take a brief look at two examples of how we are applying technology to operate at the frontiers.
- And I'll close with what I regard as the X factor which underlies all of this - and that is the frontier mind-set.

So what do we mean by frontiers? I think of them as physical frontiers of geography and geology, but also the environmental and geo-political frontiers that are created by risks such as climate change and energy security.

There is an exploration challenge – we are looking for oil and gas in ever more testing and complex conditions – greater subsurface depths, higher pressures, hotter temperatures.

There is a recovery challenge – the challenge of extending the life of mature reservoirs.

There is an environmental challenge – the challenge of working in a way that minimises the footprint of our operations.

And then there is the sustainability challenge – which is about addressing climate change by developing a more diverse energy mix that incorporates more low carbon fuels.

Different companies are able to address these challenges in different ways as a result of their history and evolution. National oil companies all face particular challenges in their geographies and have developed distinctive expertise in relevant areas. Many of them have now taken that expertise to new locations as they've expanded beyond their countries' borders.

International companies such as ours have had a more wide-ranging experience. The events of the 1970s meant we were obliged to leave countries where production was nationalised and go in search of tougher opportunities – more remote locations; more complicated formations.

We had to sink or swim. And those of us who swam did so by evolving and we did by developing and integrating the qualities that are needed to operate at those difficult frontiers.

Those qualities include the leading-edge technologies that can identify and unlock resources, as well as the ability to build and deploy world-class capabilities.

IOCs have also created mechanisms to transfer capabilities and learning, and replicate their best practice around the globe.



And because we deal with a host of other parties in multiple jurisdictions -governments, other businesses, civil society groups – our success depends on forming partnerships that are based on a mutuality of interests.

This is the combination of qualities that has enabled IOCs to succeed – we have become conditioned to frontier activity – to pushing back the limits of exploration, development and production. And we each have our own approaches and specialisms.

In BP, our strategic intent is to focus on the largest fields and build leadership positions in a limited number of the world's most prolific basins. And as our results have showed, we have made good progress in delivering that strategy, with 17 years of a reserve replacement ratio over 100% and a record of big finds. Over the last year we've continued that record and delivered strong safety and operational performance.

But we can never afford to stand still. Each of these frontiers requires a step change in innovation and capability that only a very few companies can bring to bear.

Let me illustrate that by looking at two examples of frontier technologies starting first with exploration and then moving to production.

A significant portion of the world's yet-to-find oil is beneath the ocean bed, and in ever deeper water and subsurface depths.

Forty years ago BP discovered the Forties field in the North Sea. We were working at what was then the frontier, in water depths of around 400 feet and drilling to a total depth of 11,000 feet. In geological terms, that was reaching the upper tertiary layer.

Today, the new frontier is the lower tertiary or Paleogene, and as you may know BP made a major discovery last year at this level with the Tiber Prospect in the Gulf of Mexico. At Tiber, we found oil under four thousand feet of water and at a total depth of 35,000 feet, or six miles, below the sea floor.

Although a record, this was not a one-off. It represented the latest step in a journey that has taken us to progressively deeper waters and deeper wells – particularly in the Gulf of Mexico – but also off West and North Africa.

Deepwater has meant pushing our boundaries in several ways besides the sheer depth of water and wells. We've developed the capability to create advanced floating production facilities, complex riser systems and subsea equipment with the ability to integrate the elements to cope with extreme temperatures, pressures, and oceanographic conditions. And that has enabled BP to become the leading deepwater IOC.

But as many of you know from your experience, some of the most game-changing developments have been provided by information technology.

These include the breakthrough in seismic technology which has enabled us to access images of what lies beneath the salt layer.

For decades, salt had been a barrier which confounded our imaging, fogging our lenses, preventing us from seeing what lay under the deepest water. But advances in seismic technology have now enabled us to build up much enhanced pictures of the subsurface using seismic data acquired from multiple directions. The quantity of digital data produced is immense and creating the imagery depends on a data processing resource, that BP owns, that runs to 27,000 CPUs and 6,000 terabytes of storage.

It is one of the most highly powered processing centres in the US outside the Government, and is an example of what it takes to operate at the frontier.



The second example of a new frontier is actually in a sense a return to an old and rather stubborn frontier with new and better tools. This is the effort to improve recovery rates from mature, supergiant fields.

In the industry we have got used to an average recovery rate of around 35%. And leaving two-thirds of the oil behind has always been a frustration, especially in massive fields such as Prudhoe Bay in Alaska, Rumaila in Iraq, or Samotlor in Russia, where we know that huge amounts of oil remain under ground, untapped. If the average recovery rate were raised by just 5%, it would add around 170 billion barrels to world reserves, enough for five years supply.

In BP's portfolio, just a 1% improvement in the recovery factor of the original hydrocarbons in place across all our resources worldwide would equate to around 2 billion barrels of additional reserves.

Alaska has been BP's key test-bed for enhanced oil recovery. One breakthrough came about, for example, because we challenged the conventional wisdom that using water with low salt levels to sweep reservoirs would damage rocks and impede recovery. In fact, our trial at the Endicott field proved the opposite was the case as low salinity waterflooding increased recovery by around 20%.

Our LoSal Enhanced Oil Recovery process is now the default waterflood method for BP sandstone reservoirs worldwide, and we calculate it has the potential to improve recovery across our assets by more than 700 million barrels.

Another advance trialed in Alaska is the nanotechnology application known as Bright Water which we use in waterflooding. This uses tiny heat-sensitive particles which expand like popcorn to block well-swept areas of a reservoir and divert the water to areas where it can sweep out the most oil.

And we are transferring what we have learned in Alaska to our colleagues in our joint venture company TNK-BP as they work on Russian assets such as Samotlor.

At Samotlor, advanced waterflooding is increasing recovery from mature parts of the field. But even more dramatic things are happening because three dimensional seismic imaging has revealed seven new satellite structures and given the field a new lease of life.

This kind of progress has helped TNK-BP to achieve a five year average reserve replacement rate of around 200% and double its proved reserves over five years to 3.6 billion barrels of oil equivalent.

All these examples show that we prize technology, not for its own sake, but for the value it can add to our business. Our technology model is to achieve a leadership position in selected areas such as enhanced oil recovery or advanced seismic imaging, and then to continuously reinvent and apply that technology to solve real business problems and strengthen our portfolio. It is this relevance of technology being developed and deployed in a purposeful way to solve real business challenges that excites me the most.

Incidentally, one of the latest developments in terms of increasing recovery from a supergiant field is in the Rumaila field in Iraq – a world class oilfield by any definition – 65 bn barrels OIP and just 12 bn produced. BP is partnering there with CNPC of China and Iraq's South Oil Company to drive a major investment programme to increase overall recovery to around 29-30 bn barrels.

That conveniently brings me back to where I started, with the role of IOCs. And the fascinating thing today is that – as Iraq demonstrates – there are now new partnerships springing up all around the world in which IOCs are contributing what they have learned as governments and NOCs seek to push back the boundaries in their regions.



So the overall message of these examples is of an IOC community that has succeeded in extending the frontiers of the industry, constantly re-inventing the way in which business is done, not only through technology, but in how we are organised.

In BP we have been taking significant action in the last few months to ensure that we turn the momentum we have established in the past year or two into sustainable delivery for the next decade. We are now aiming for a new level of operational excellence and as part of that we are taking our upstream organisation through its biggest changes since 1998 when BP merged with Amoco.

There are two strands to this. The first is about strengthening our portfolio through improved allocation of capital and capability, in particular strengthening the linkage that I mentioned earlier between the opportunities in our portfolio and the technology to capture them: identifying the frontiers of tomorrow – today.

The second strand of the transformation is about sustainably driving efficiency through the organisation. That is largely to do with managing the scale of a 4 million barrel per day company. We have made good progress in replicating best practice but we can go a whole lot further in our efforts to make excellence the norm.

So we are creating a Centralised Developments Organisation to ensure that we prioritise the right activities, select the right concepts and continuously improve efficiency by leveraging standardization, global scale and capability. We are adopting a standard, functionally structured, model for our regional businesses to further accelerate learning. And we are embarking on a major capability programme, providing road-maps for the professional development of our people, starting with our 8,000 petro-technical professionals.

We have created a state of the art learning centre here in Houston to provide our professionals with world-class development. And they don't need to travel to Houston to get it.

The centre has been purpose built to fulfil the mission of standardizing excellence by transferring our top expertise rapidly around the world. So as well as being a centre of skills and knowledge, it is a also broadcasting platform with high-definition video classrooms. It allows the BP experts to teach the BP way globally.

At root, my experience tells me we that what is required for the industry of tomorrow is not only the physical, intellectual, technological and strategic qualities needed to work at the frontiers but also the right mind-set. A mind-set that wants to win, wants to lead and doesn't give up.

Energy companies equipped with that mentality will be constantly looking for the most innovative and efficient ways of doing business.

Like the best companies in other sectors, they will frequently reinvent and renew themselves in the search for even more efficient practices and technologies, going the extra mile to be the industry first mover.

Ultimately it is that frontier mentality that creates value for shareholders. It is that mind-set that delivers quality to customers and partners. And it will be that frontier spirit that enables the world to meet one of its greatest challenges – creating sustainable energy security.

Thank you.