The technical edge – how science and technology will transform the way we find, produce and use energy

David Eyton
Group Head of Technology

World Petroleum Congress, Moscow
18 June 2014

I am a civil engineer by degree and have spent most of my career in BP's Upstream business

Over the past 15 years I have led multi-billion dollar developments in Trinidad (gas) and the deep water Gulf of Mexico (largely oil) before taking on my current role as BP's Head of Technology.

As BP's Head of Technology, you won't be surprised to hear that I believe that technology is transforming the way we find, produce and use energy

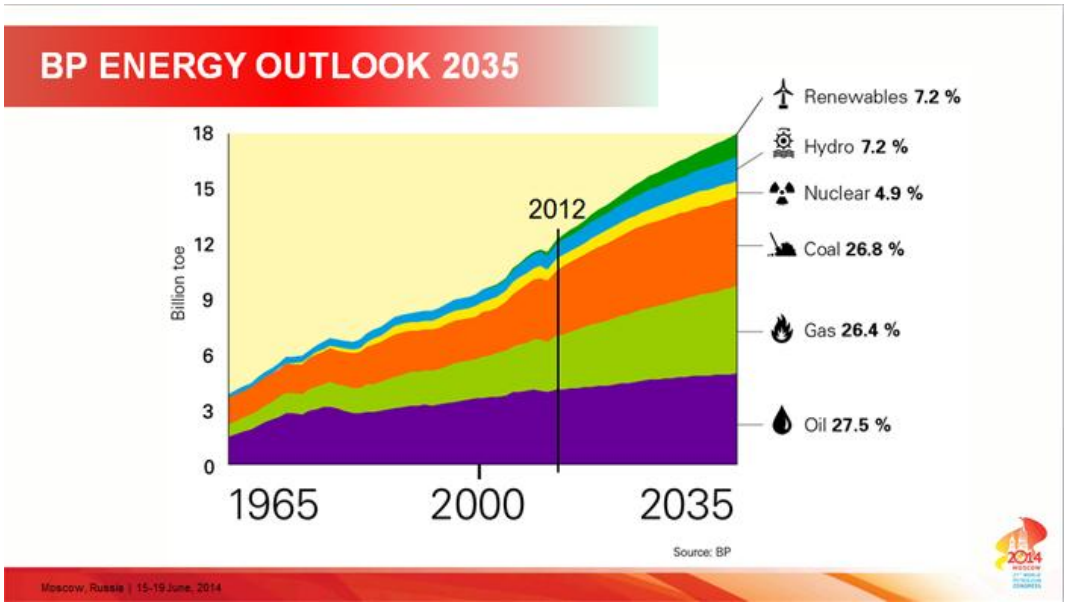
Oil and gas is a technology-driven business – as it always has been. I could argue that we integrate a wider diversity of technologies into our businesses than any other industrial sector.

I will start by briefly reviewing energy demand – and hence the need for technology.

I will then look at the challenges to be overcome.

And I will conclude with an overview of technology in BP, with some examples.

The need for technology

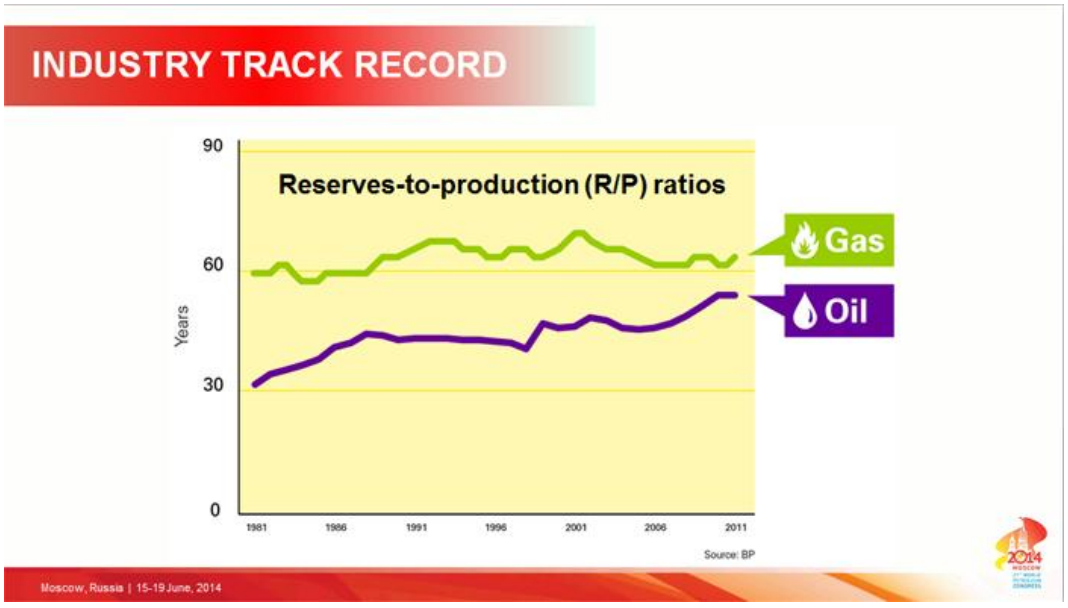


Looking first at demand growth, BP's Energy Outlook projects growth in energy demand of around 1.5% on average each year for the next two decades.

That amounts to demand in 2035 being 41% greater than in 2012 – equivalent to about six times current Russian demand.

We also expect fossil fuels to continue as the dominant provider of energy – with coal, oil and gas converging on a 27% share each by 2035.

Industry track record



There have been doubts about the sufficiency of oil and gas to meet this demand growth – the so-called peak oil theory – but these are not supported by the facts.

This chart illustrates the industry's track record in replacing produces reserves, using data from the BP Statistical Review, which provides a record of demand, consumption and reserves going back over 60 years.

It indicates that, despite growing demand and consumption of resources, the oil and gas industry has more than replacing reserves – enabled by the evolution of technology and price signals.

For example, in 1981 it showed global oil reserves at 700bnboe.

In 2012 oil reserves had increased to 1.67bnboe – more than double the reserves of three decades ago despite consumption of 0.85bnboe during that time.

Technology challenges

The challenges our industry faces, in meeting society's energy needs are fourfold – safety; capturing new resources – through both discovery and recovery; improving energy efficiency; and of course sustainability.

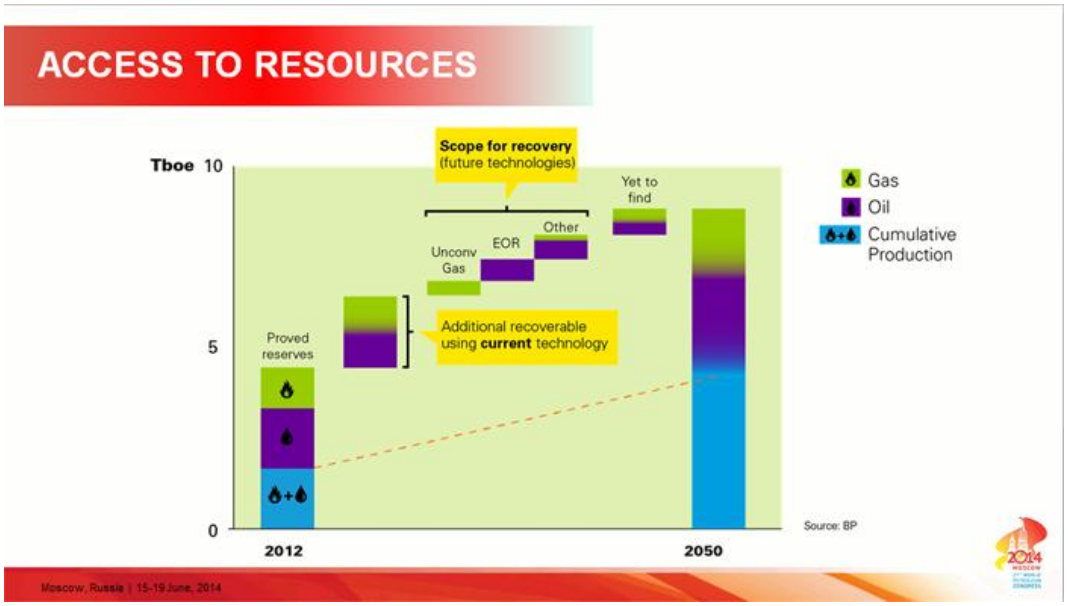
The most basic challenge, which is fundamental to maintaining the energy industry's licence to operate, is finding and producing the resources we need safely. This underpins everything else. Managing operating risk is increasing in complexity, as the industry operates in more remote locations, deeper water, with more sophisticated operating systems, and external threats – cyber, terror and even extreme weather conditions.

Technology has to enable access new resources, and realise greater recovery from existing resources.

It has to improve the efficiency with which we convert energy captured at source into useful heat light and motion – which todays sits at a mere 12% .

And lastly, it has a critical role to play in the transition to a more sustainable energy landscape.

I'd like now to return to our analysis of the world's oil and gas reserves' base and the role international energy companies can play in growing reserves.



This chart shows BP's internal analysis of the potential to add oil and gas reserves out to 2050, through exploration and enhanced recovery, all in today's price environment.

It indicates that recoverable reserves from discovered fields today could be almost twice as large as reported reserves using best available technology; and that there is the potential for a similar increment through to 2050.

Notwithstanding environmental concerns, we conclude that technology can enable any reasonable forecast of energy demand to be supplied by fossil fuels at least through to 2050.

Shale and tight gas resources comprise the most significant change in this picture over the past decade.

Prospectively we see exploration, unconventional gas and EOR on conventional oil resources as having the greatest potential to add quantitatively to today's resource base through to 2050.

In fact, we have probably reached a point globally when the potential for enhanced recovery from known hydrocarbon resources exceeds the potential from new discoveries.

Innovation takes many forms and is increasingly a global activity. It is collaborative, multi-disciplinary, systems-based, sometimes taking decades to reach maturity.

The IOCs have world-leading engineering, geoscience and chemistry capabilities, and leverage capabilities developed in other industries, such as those based on information technologies, advanced materials and biosciences.

IOCs such as BP orchestrate global innovation ecosystems, and know-how developed in one location can be redeployed globally.

In BP our technology strategy is aligned with our business goals – which means a focus on our recognised strengths in exploration, deep water, giant fields, gas value chains and a high quality downstream.

We invest in these areas to maintain and enhance our leadership.

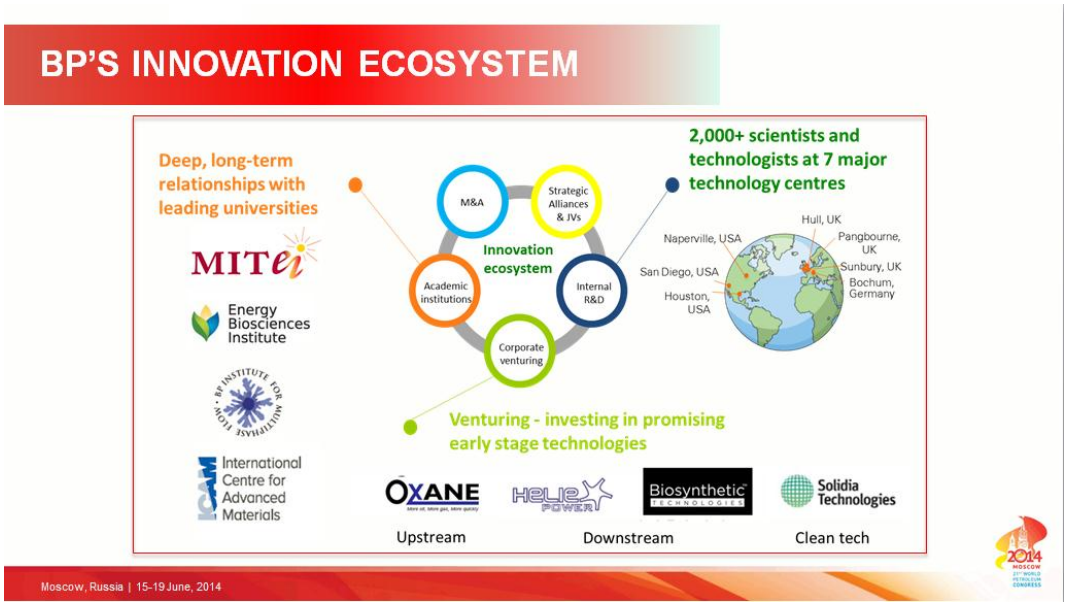
A prerequisite of any investment is that it must enhance the safety and reliability of our operations. Beyond that we look to create competitive advantage in our areas of strength.

Flagship upstream technology programmes include advanced seismic imaging, enhanced oil recovery.

Downstream the focus is on processing difficult crudes in our refineries, world-leading conversion technologies in petrochemical plants and on creating better fuels, lubricants.

And we collaborate with partners and suppliers so that each can bring the best of its capabilities to the benefit of all. For example, here in Russia, Rosneft – among its many distinctive capabilities – is a world leader in horizontal drilling, having set a world record of 12.7km for a horizontal well at the Odoptu field in the Sea of Okhotsk, close to Sakhalin Island.

Technology in BP



BP has an external innovation ecosystem comprising universities, national labs, SMEs, major suppliers and industry partners, all linked to our central technology teams in-house.

We directly employ approaching 3,000 scientists and technologists – many of whom are based at a one of seven major BP technology centres around the world – three in the UK, two in the US and one in Germany.

This in turn drives our business performance.

The BP Institute for Multiphase Flow, Energy Biosciences Institute and International Centre for Advanced Materials are all major hubs in this ecosystem – open research institutes in which some of the world's best researchers chose to work on some of our most valuable problems.

In 2013 we spent $707m on R&D – around half of this externally – and as much again in demonstrating and deploying new technologies.

In addition our BP ventures is investing in and partnering with entrepreneurial companies around the world, looking for the technologies that will either enhance what we are doing today or create new business opportunities.

To illustrate how innovation works in practice for BP, I have some examples…

Firstly, seismic imaging is a mature BP capability and underpins our competitive capability in oil and gas.

Our Center for High-Performance Computing in Houston is our 'laboratory.' It is the world's largest commercial research computer at around 2 petaflops.

Two thousand trillion calculations per second gives us the ability to process huge amounts of physical data and generate even more precise images than we've ever had.

BP scientists now have the computing power to complete an imaging project in one day that would have taken four years using computing technology from just 10 years ago.

And the improved electrical and cooling systems have reduced power consumption by 30 per cent over our previous facility.

Seismic imaging is an area where we have, over the years, built up expertise and capability recognised as world leading – and we chose to invest substantially to continue building our internal capability.

Secondly, Enhanced Oil Recovery is a technology coming of age. EOR accounts for a growing component of our production.

We believe the EOR technologies have the potential to deliver a billion more barrels of net production from our giant fields than would otherwise be possible.

Only recently have we been able to understand interactions between oil, water and rock at an atomic level due to the advance in microscopy – with help from a network of universities including the BP Institute.

This is enabling us to improve recoveries, not just in late life, but by designing EOR into new projects from Day 1 – .we are deploying our proprietary LoSal.®EOR at Clair Ridge West of Scotland in the UK and expect to start production in 2016.

Two decades ago, in-house research produced the unexpected result that low salinity water would be more effective at displacing oil than higher salinity. That led us to develop this breakthrough waterflood technology injecting water at salt levels around 500ppm compared with seawater at around 35,000ppm.

We estimate deploying LoSal® from Day 1 will provide an extra 42m barrels of production over the lifespan of Clair Ridge at an estimated additional cost of $3 a barrel.

BP received the Distinguished Achievement Award at the May 2014 Offshore Technology Conference in Houston for LoSal® at Clair Ridge.

Bright Water is another of our breakthrough EOR technologies – a long-chain, ball-shaped polymer for addition to cold water injected into the reservoir. It's designed to 'pop open' in contact with warm, unswept rock creating blockages that selectively divert injected water into less well swept areas.

For virtually no capital investment we estimate an additional cost of around $6 a barrel for oil production from Bright Water deployment in a well.

Thirdly, the use of advanced materials is at this stage largely more an idea than reality. But we see huge potential.

Hence ICAM – the International Centre for Advanced Materials – to which we have committed $100m over a 10-year period.

ICAM is a research collaboration that we established in 2012 to identify the advanced materials of the future, to provide us with stronger, lighter material for deepwater applications, and enhance facilities' integrity, flow assurance, fluid separation, and energy efficiency.

It is a networked partnership on a hub and spoke model that brings together leading experts on advanced materials from around the world.

The hub for the network is the Faculty of Engineering and Physical Science at the University of Manchester – chosen because it is a world leader in the field.

The spokes include teams of similarly high quality at University of Cambridge, Imperial College London and the University of Illinois at Urbana-Champaign.

The final example – again at the early innovation stage – is the UNIHEAT.

The UNIHEAT programme research programme we are funding will look at improving understanding of thermodynamics and fluid dynamics of oil flow, and the interactions with surfaces.

Ultimately that will improve a range of technologies in pipelines, heat exchangers, and petrochemical reactors.

It is a research collaboration between the Skolkovo Foundation here in Moscow, along with the Boreskov Institute for Catalysis at Novosibirsk State University, as well as Imperial College in London.

Concluding remarks

In summary:-

Advanced technology capability is a core component of BP's strategy.

We have developed a sophisticated innovation ecosystem that supports our global businesses.

We look to collaborate with many external partners – and to do so in ways that are mutually advantageous.

And through collaboration we connect our partners to this wider ecosystem.

Emerging technologies are already transforming how we discover, recover use energy more efficiently.

My job is to ensure we maintain that technical edge.

Thank you.