



# Intelligent energy comes of age

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Good morning and thank you for the opportunity to address you today.

I'd like to start with a personal story, a bit of my own history with intelligent energy. Back in 2002, I was the Business Unit Leader for BP's deepwater assets in the North Sea. One day, a small group of my staff called me into a meeting seeking my endorsement for a small investment in doing something with real time information and promising me a thousand barrels a day in return. I gave them the OK and, 6 months later, they came back with a live demo and that bunch of excited folks showing me what they had done – and I got my thousand barrels per day. That was my first opportunity to see what has subsequently become known around the industry as the Digital Oilfield. It was one of the events that kicked our internal intelligent energy effort - Field of the Future™ into action.

So, having been there in the early days, it's a great pleasure for me to be here and open what I believe is an important event – where I think you'll see that the Digital Oilfield, or Intelligent Energy, has truly "come of age" – and is now delivering solutions to some of the pressing challenges facing our industry.

So, to expand on a couple of the great points made in the excellent opening video, I'm going to talk about some of the challenges our industry faces and what role Intelligent Energy can play in addressing them.

One of the biggest challenges the world will face in the next several decades is meeting the significant growth in global energy demand, growth driven by rising population and a growing global economy.

The next challenge is how to meet this growing demand in a way that meets a changing set of expectations. We must recognize the macro environment in which we operate. Governments are now stepping up the pace and scope of their policies to reduce greenhouse gas emissions and diversify energy supplies. Carbon, climate change, energy security, energy efficiency and the footprint of our operations are all key issues which we must respond to.

Finally comes the challenge to drive efficiency, which will be increasingly important as the sources of hydrocarbons become more technically and geographically challenging. Getting more from our existing operations while delivering new production more efficiently will be critical to our industries long term success.

2009 was an unusually volatile year for the world economy which had an impact on the energy industry. In the short term the global downturn reduced energy demand, but over the longer term, the demand trend is increasingly upwards. Global energy consumption will continue to rise driven by modernization in the developing economies and a growing population. It is startling to realize that today over 1.5 billion people still do not have access to electricity, something I suspect we all take for granted.

The outlook for the energy industry is fundamentally robust. Despite what you may have read or heard, you are part of one of the world's great growth businesses. We anticipate that the world will consume around 45 per cent more energy in 2030 than it does today, and that fossil fuels will remain the dominant source supplying approximately 80 per cent of energy requirements in 2030.



To meet this growing need for energy will require major new capital investment - an investment of some \$25 to 30 trillion - that's more than \$1 trillion a year for the next 20 years.

Of course, we face some big challenges in responding to this growth, especially in the realm of policy, where the question of how to meet rising demand in an affordable and sustainable way has risen to the top of the global political agenda.

For a long time, BP has advocated a proactive approach to climate change and supported action to curb carbon emissions. We continue to believe that the world needs a diverse energy mix that incorporates all available sources – from heavy oil to solar – and that leverages investment in technology. There is no one single solution and it would be foolish to put all of our eggs in one basket.

Central to this is a need to promote efficiency.

We believe that encouraging free and open energy markets is the best way to induce change. A carbon price, preferably created by capping emissions, would provide a strong incentive for energy efficiency and encourage investment in alternatives. Today at BP we include a carbon dioxide price of \$40 per tonne in all of our new projects to ensure that they will be robust to the world we will likely face in the future and to drive the right behaviors through our organization.

It's daunting to realize that the underlying decline rate in our current oil and gas resource base is estimated to be between 3 and 5 per cent per year. In oil terms, that's roughly the equivalent of adding a new BP every year, some 4 million barrels per day.

Much of the new production will come from operating at the frontier. Whether that be the frontier of geography, geology, water depth, or temperature and pressure.

These frontiers will be all about the application of technology.

Today we are looking for oil and gas in ever more challenging and complex conditions.

Just looking at BP's resources and reserves shows the trend. Deepwater, unconventional gas and heavy oil are making up a growing share of our resource base.

A significant portion of the world's yet-to-find oil is beneath the ocean bed in ever deeper water and subsurface depths. The Forties field in the North Sea was discovered 40 years ago in water depths of around 400 feet and drilling to a total depth of 11,000 feet, which was the frontier of the day. Today, the new frontier is the Tiber field in the Gulf of Mexico which sits in 4,000 feet of water and at a total depth of 35,000 feet below the sea floor. Tiber represents the latest step in a journey that has taken us to progressively deeper waters and deeper wells.

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, and the ability to integrate these elements to cope with extreme temperatures, pressures, and oceanographic conditions.

But, as many of you know from your own 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. The quantity of digital data produced is immense, and creating the imagery depends on a data processing resource, which BP owns, that runs to 27,000 CPUs and 6,000 terabytes of storage. This is one of the



most powerful processing centres in the world and is an example of what it takes to operate at the frontier.

A similar magnitude of technology challenge exists in unconventional gas & oil. In unconventional gas the EIA's Energy outlook for the North American Gas market shows the market share of tight gas and shale gas increasing from 10 per cent to 40 per cent between 1990 and 2030, effectively transforming the North American gas market – by some estimates a 50 to 100 year supply. Technology advances in horizontal drilling and hydraulic fracturing are making this possible. In our own experience in the Woodford shale, we have increased production rates on new wells by more than 60 per cent in the last year by applying technology and systematic learning.

Looking at BP's resource base, what excites me is that it is clear that technology will play a critical role in accessing future hydrocarbons. This is technology to solve real business problems which strengthen our portfolio.

From an industry perspective, my experience tells me energy companies will be constantly looking for the most innovative and efficient ways of doing business. Like the best companies in other sectors, we will frequently reinvent and renew ourselves in the search for even more efficient practices and technologies, going the extra mile to be the industry first mover.

It will be this frontier spirit that enables the world to meet one of its greatest challenges – creating sustainable energy security.

Many technologies will have a role to play in meeting these industry challenges. So let's now look at some of the ways intelligent energy is having, and will continue to have, an impact.

Application of intelligent energy can improve production and reserves growth from both existing fields and new projects through improved recovery factors and improved efficiency.

However it is not purely about efficiency: As fields become more complex, in remote areas, intelligent energy can make the difference between having a development or not. For example, intelligent completions which reduce well count and capital investment can convert an uneconomic development to an economic development. Globally at BP we have installed over 20 intelligent completions for downhole flow control for, reducing well count on new fields, eliminating future intervention costs and accelerating production.

In the area of recovery factors the potential is massive. The current industry average recovery factor is around 35 per cent. If the average recovery factor were raised by just 5 per cent, it would add approximately 170 billion barrels to world reserves, enough for more than five years supply.

In the Prudhoe Bay field in Alaska we have new and better tools to improve recovery rates from a mature super giant field. To understand more than 30 years of production history we need a great set of tools to manage and integrate massive amounts of data – both old and new. So far we have increased the recovery factor from approximately 40 per cent to more than 60 per cent since we initially sanctioned development. Some of the technologies that have been invented, developed, perfected, or applied include extended reach drilling, coil tubing drilling, horizontal drilling, massive gas cycling with the world's largest gas plant, miscible injectant enhanced oil recovery (EOR), gas cap water injection, multilateral drilling techniques and wellbore junction technologies. Constantly integrating real time field performance data with predictive tools has and will continue to play a significant role in Prudhoe's development.

In Clair, BP and our partners have invested in life of field seismic to provide 4D seismic which enhances reservoir understanding in a very challenging, fractured reservoir. This is beginning to have



an impact on our understanding of the reservoir, how we manage it, and in improving the planning and delivery of new wells, all in service of increasing the ultimate recovery from this huge field.

In BP, we now look to design in the deployment of digital oil field capabilities from day one in our new developments. Our recent start-ups in the Gulf of Mexico, Angola, and Indonesia are proving up the value of this decision with measurable impacts on production, start-up efficiency, and faster understanding of reservoir behavior. For example, we believe we have increased Thunder Horse production by 10,000 barrels per day from optimizing well rates based on real time information. At Tangguh in Indonesia we implemented real time collaboration with our onsite drilling team and the drilling engineers who were some 3000 kms away so that they were able to see the same real time information saving millions of dollars in lost productive drilling time.

In the area of efficiency it is almost certainly true to say that today no-one has achieved 100 per cent efficiency and perfectly optimized production. In some of our older fields, optimization is an important contributor to managing production decline and driving efficiency.

Additional barrels through real time monitoring, diagnosing and addressing performance issues, and better optimization, tend to be amongst the lowest cost barrels available – often more efficient than the most efficient well intervention work we do.

It's not simply about equipment. How we improve the decision making and capability of our people will also be a significant source of future value. Effective decision making is about getting the right data and information, as quickly as necessary, to the people with the skills to analyze and act, wherever they might be in the world.

To access this potential we are applying Advanced Collaboration Centers at scale. To date we have built 35 Advanced Collaborative Environments where the office support teams are directly tied to the field with live data and communication links in a dedicated center.

As we invest in ever more complex and expensive wells that produce at very high rates – in many cases over 20,000 barrels per day - it is critical we optimize these wells in real time. In BP we now have real time surveillance data on more than 80 per cent of our top 100 wells.

And finally we must develop and use these new tools and systems to codify expert knowledge and automate the routine – enabling us to alert our experts in real time and use their time efficiently.

Many companies now have Intelligent Energy or Digital Oil field programs in place which have delivered real benefits. This is no longer about theory. As an industry this means we now have established a global footprint in the application of Intelligent Energy.

The benefits can be significant. Cambridge Energy Research Associates have for some time reported estimates that the digital oilfield could add 2 to 8 per cent to production and 1 to 6 per cent in additional recovery across the industry.

In BP, we have seen Intelligent Energy add roughly 50,000 barrels per day of gross production across our portfolio in each of the last 3 years. This has been based on the deployment of solutions in 25 different areas of functional capability, including the 35 collaborative environments previously mentioned, over 2000km of proprietary fiber optic network, and enabling access to over 2 million individual data tags on thousands of pieces of equipment and over 700 wells. And, all of this only covers about a third of our portfolio – there is so much more to do.



Many of our operations now have these capabilities built in at the very core of how they operate – it is becoming intrinsic to the way they operate – aligned to business strategy and supporting the organisation tasked with delivering that strategy.

We have been systematic in applying some of these technologies. For example, our proprietary well surveillance system has now delivered over 100 separate instances of incremental value creation since we began deployment. The benefits include increasing production typically 1-2 per cent, supporting reserves pull through based on improved reservoir management decisions, reduced costs through better targeted interventions and infill drilling decisions, and improvements in staff efficiency of up to 25 per cent.

If you'd like to learn more I encourage you to go by our booth where you can touch some of this technology and see the results.

This is why I said in my introduction that Intelligent Energy has “come of age”. This is no longer an event dominated by innovators trying to sell the ideas. Many IOCs and NOCs now have experience with the digital oilfield in a variety of settings, and have very similar stories to tell of real business value that has been delivered.

Now that we are past the getting started phase it is critical that we reflect on what we've learned and what is required to fully capture the benefits.

Intelligent energy investments must be targeted and deliver clear benefits. The investments must compete with the other investment choices companies have and the benefits be of material size – it must matter.

The technologies must be reliable. They must be robust to the oil industry environment and they must provide quality information.

And, from our experience, you need a team of experts who can guide both your technology program but, just as importantly, a team who can guide the organization in appropriate application of these technologies.

I am convinced that if we all meet back here in 10 years we will be amazed at what we will have achieved, and be amazed by the new uses and benefits from intelligent energy.

I thank you for the opportunity to address you this morning and I wish you a very successful and productive conference.

Now if we have a few minutes I'd be happy to take questions.