



The role of oil and gas in promoting development

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For several past millennia, civilisation derived its energy mostly from wood and from human and animal labour. With the advent of the industrial revolution, growth of the global population and higher per capita consumption of goods and services, new sources of energy were required at unprecedented pace and scale.

The solution rested on the abundance of fossil fuels, plentiful around the globe, which have been stored by nature in geologic strata for many millions of years. Initially based mostly on coal and, from the middle of the 1900s, increasingly on oil and natural gas, fossil fuels currently account for more than 80 per cent of the global primary energy supply.

150 Years of energy delivery

The petroleum industry has so far been able to find and develop both the oil and natural gas resources that, except for brief disruptions caused by natural disasters or political unrest, met the market demands in an affordable and reliable manner. Furthermore, in spite of increasing demand and production, annual reserve additions have consistently been above depletion, thus resulting in a steady growth of the world's reserve base of both oil and natural gas.

The world oil reserves, according the latest BP Statistical Review, reached 1.65 trillion barrels at the end of 2011. It is important to notice that this now includes substantial volumes of extra heavy oils from Venezuela and Canada, which are now deemed technically and economically recoverable due to technological developments and the current oil price level. Other important new oil plays, like the pre-salt offshore Brazil and, more recently Angola, and shale and other ultra-low permeability oil reservoirs, will certainly add significant volumes to the global oil reserve base in the near future.

Even though the historic data are not very precise, it is estimated that the world consumed its first trillion barrels of oil (tnbo) the year of 2000. At that time the remaining reserves were assessed at 1.25 tnbo, with estimated remaining total resources to be discovered and developed of another 1 tnbo. Remarkably, just over a decade later the world consumed an additional 0.4 tnbo and yet total reserves grew by another 0.4 tnbo. Furthermore, the most recent estimates indicate that remaining resources of about 1.7 tnbo are still to be discovered and developed, not including the non-conventional hydrocarbon plays. Three main factors made this possible: new technologies in seismic, drilling and reservoir management, massive allocation of capital

to exploration and development of new plays and, most importantly, innovative approaches to finding and developing oil resources in ever more complex geologic settings and harsher operational environments.

Natural gas evolved in a similar way. While the world consumption increased by a factor of 2.3 times in the last 30 years, in the same period natural gas reserves grew by a factor of 2.56, to a total of 7,360 trillion cubic feet (tcf) at the end of 2011. And this does not take into account the potential resources of undeveloped gas shales, which contain producible resources, according to some estimates, of over 6,000 tcf in the US only.

Future oil and natural gas supply challenges

Projecting future energy demand is a very complex exercise. Many factors influence consumption trends, among them population and economic growth, improving living standards and per capita consumption, regulatory requirements and technological developments. Nevertheless, projections prepared by various research entities coincide in two main conclusions: steady growth of energy demand and continuation of fossil fuels, particularly oil and natural gas, as the main components of the global energy matrix. The International Energy Agency, in its latest World Energy Outlook 2012, projects a 30 per cent increase in global energy demand from 2010 until 2035, with most of the consumption growth occurring in the developing countries.

Even though it has been demonstrated that the reserves and resources are available, bringing them on stream in order to meet future demand of oil and natural gas poses huge challenges, and opportunities.

In a recent study the Energy Information Administration of the US Department of Energy projected a steady growth of the consumption of liquid fuels reaching, in their base case, approximately 112 million barrels a day (mb/d) in 2040 with the most significant supply growth coming from non-OPEC countries. Non conventional liquids, including gas-to-liquids (GTL), coal-to-liquids (CTL) and biofuels, would still remain minor sources although steadily increasing as well.

The main challenge is not only to meet the demand from incremental consumption but also to offset the inevitable decline of the currently producing reservoirs. Even at fairly conservative decline rates of 2-3.5 per cent per year the industry will have to bring on stream an additional 35 to 50 mb/d just to compensate for current reservoir depletion.

A significant amount of new liquid fuels production will

most certainly come from existing reservoirs through advanced oil recovery and reservoir management new technologies. Shale oil and natural gas liquids will also increase significantly with the expansion of the development of gas shales, particularly in the US.

There is no question that the oil reserves and potential resources are sufficient to meet the market demand for the next several decades. However, delivering sustainable production in the long term will demand huge sums of capital, constant technological advances and innovative approaches to exploration and development.

Natural gas demand is also expected to continue growing at a steady rate, particularly in developing countries. As in oil, reserves and resources are plentiful to meet the demand, but bringing additional production on stream will also require deployment of huge amounts of capital, innovation and technology.

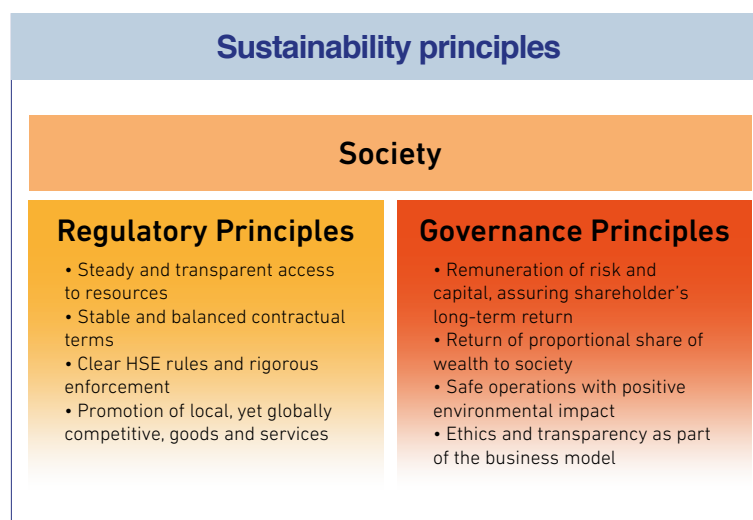
Of particular relevance to natural gas developments is that they require huge investments in pipelines or in industrial Liquefied Natural Gas or GTL plants and, in the case of shale gas, enormous numbers of wells. And planning for such large and long term investments is extremely challenging in view of market and regulatory uncertainties. A good example of such uncertainties is the complete reversal of the supply/demand scenario that occurred in the USA in the short period of less than ten years where, with the advent of the shale gas revolution, the balance changed from a domestic market being significantly dependent on LNG and GTL imports to self sufficiency and most likely a net exporter.

Future sustainable supply of oil and natural gas

In the last 20 years, resource availability analyses have more or less oscillated between resource scarcity theories (the “peak oil” view) and the total substitution before resources are depleted (the “stone age ended before the end of the stones” view). In all probability, the long-term energy supply balance will be in between these extremes, with economic and environmental constraints dictating a gradual transition out of the fossil fuel era.

Meanwhile and for the foreseeable future, innovative approaches, new technological developments and huge capital allocations will continue ensuring the discovery, development and production of oil and natural gas to ensure the world’s economic growth.

More than ever, though, the long-term sustainability of



the petroleum industry requires that the objectives of all stakeholders involved should be balanced and satisfied.

From an holistic perspective the petroleum industry may be characterised as an economic activity where several stakeholders, including governments, regulators, oil and services companies and their shareholders, must achieve their goals while earning from society the right to perform their activities in the long term.

In order to earn such rights, certain key sustainability principles must be delivered by all those involved in a balanced and consistent way. Two main groups of sustainability principles can be identified:

- **Regulatory Principles:** a set of rules, practices and conditions which must be transparent, stable and rigorously enforced, applicable to all stakeholders involved in the industry, designed to promote a fair sharing of the wealth and the people’s wellbeing;
- **Governance Principles:** a set of policies, practices and conditions which must be implemented by stakeholders while performing their activities, designed to maximise results while meeting the expectation of all stakeholders affected by the industry.

In conclusion, the petroleum industry has huge challenges to continue finding and developing new oil and natural gas reserves, in a profitable and sustainable way. In the long term these challenges represent just as big opportunities for those players that allocate their resources, capital and human, to the wellbeing of all of their stakeholders. □