

## **Going Deeper: China's Offshore Oil and Gas Industry**

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In this paper, we introduce the challenges of deepwater oil and gas development in the South China Sea, and we detail the technology strategies of the China National Offshore Oil Corporation (CNOOC). The CNOOC presents measures and other key deepwater technologies for overcoming specific challenges in deepwater equipment operation. In addition, it seeks possible cooperative arrangements with all oversea entities and is trying all means of establishing close relationships with research institutions from other countries.

**KEY WORDS:** South China Sea, deepwater, oil and gas industry, subsea equipment, semisubmersible unit, pipeline-laying barge, flow assurance.

### **INTRODUCTION**

With the great development of China's economy, especially in the petrochemical and automotive industries, shortages of oil and gas have become increasingly frequent. Since 1993, China's crude oil supply has not met domestic market demand, and the country has turned from a net oil-exporting country to a net oil importer. In 2005, China's crude oil imports reached 90 million tons, and the shortage of the oil resource became a major factor constraining China's economic development. Thus in 2006, in order to meet the demands of its economic and social expansion, China proposed the 11th Five-Year Program; this intends to strengthen the exploration for and development of oil and gas resources, increase backup reserves, and reverse the stagnant oil and gas production.

China's offshore oil resources are far from being fully exploited; its coastal waters are still a blue territory full of rich resources. In waters under China's jurisdiction, oil and gas resources have produced more than 40 million tons oil equivalent and offshore oil and gas production has become a major part of China's oil and gas incremental production. Given the country's rapid economic growth, however, the development of offshore oil and gas resources alone has been unable to satisfy domestic demands. It has become more and more urgent for China's oil and gas industry to march toward deeper water.

The South China Sea is one of the 4 largest oil and gas accumulations in the world and the largest sea area in China, with the deepest average

depth. However, because of the country's late involvement in the offshore oil and gas industry, its exploration and development (E&D) technologies and independent intellectual property rights are still underdeveloped, and the key technologies used in deepwater equipment are behind those of the countries advanced in offshore E&D by 15 to 20 years. Domestic production of the high-technology equipment required for deepwater development is at a low level. As a result, the most urgent and continuing task of the CNOOC has been to use China's deepwater oil and gas resources in an efficient way, to bring about a continuing energy supply, and to solve the growing energy crisis.

### **TODAY'S GLOBAL DEEPWATER INDUSTRY**

#### **Characteristics of E&D in Deep Water**

The characteristics of oil and gas E&D in deep water are as follows:

- Great risks, high technical requirements, large investment.
- Large scale of oil and gas discovery, high yield and short development cycle.
- High drilling success rate, i.e., Brazil's deepwater drilling success rate is over 50%; the GOM's is 33%, Norway's and the Russian Arctic's is 42%; and the North Sea region's is over 24%.
- Low cost for unit reserve and high returns.

#### **Oil and Gas Resources**

For a long time, the continental shelf deeper than 300 m was defined as the deepwater area for oil and gas development. The development of offshore drilling and production units, subsea technologies and other engineering techniques have redefined the deepwater concept and scope. At present, waters deeper than 500 m are called deep waters, and those deeper than 1500 m are called ultra-deep waters (Kang, 2005). According to statistics in the *Oil and Gas Journal*, as of 1 January 2006, global offshore oil resources were about 135 billion tons, and the proven reserves about 38 billion tons; offshore natural gas resources were about 140 trillion cubic m, and the proven reserves about 40 trillion cubic m (Hongliang, 2006). At present, global offshore proven reserves are still dominated by shallow water reserves. Proven deepwater oil and gas reserves are approximately 10 billion tons oil equivalent, mainly distributed in the U.S. Gulf of Mexico (GOM), the Brazil Sea and West Africa. Since the 1990s, it is estimated there are close to 100 global deepwater oil and gas reservoirs, in which the reserves at the level of 100 million tons exceed 30%. In 2000, deepwater oil and gas reserves comprised 12.3% of total offshore oil and gas reserves, an increase of about 8% over a decade ago. In 2004