

**Oil Sands and Orimulsion
The Fourth Fossil Fuel
Oil and Gas Reserves
Conventional and Non-
Conventional Oil**

Edition 2–2007



Oil Sands and Orimulsion

Ed 2 2007

Introduction

- Debate about the extent of the world's remaining oil reserves and their rate of depletion is ongoing, following a spate of shock devaluations of reserves by many oil majors
- There is increasing pressure to include non-conventional oil in reserves, by far the largest being the Canadian oil or tar sands, and Venezuelan bitumen
- Although recognised they were for a long time largely ignored
- The technology needed to extract them was a late development and the cost of cleaning them environmentally was prohibitive
- This has changed - immense strides have been taken to resolve these problems
- Since 2003 Canada has included non-conventional oil & tar sand in national reserves
- The Canadian oil sands received less prominence than Venezuelan Orimulsion but the reserves in Canada far exceed those of Venezuela and production volume is growing

Report Scope

- This report, successor to "The 4th Fossil Fuel", examines the current debate about the definition and measurement of fossil fuel reserves and depletion, following a spate of devaluations of reserves by oil and gas majors
- Historical definitions are examined and explained
- The report looks at Non-Conventional Oil, the Canadian Oil or Tar Sands, Venezuelan bitumen, Orimulsion - the 4th Fossil Fuel
- The large oil companies are acquiring rights in the Canadian Oil Sands and increasing including them in their portfolios, Shell made a major acquisition in 2006. Venezuelan Orimulsion is owned by the state-owned utility Petróleos de Venezuela S.A., PDVSA

Key Research Findings

- The global energy community is currently engaged in debate about the extent of the world's remaining oil reserves and the rate of their depletion
- Traditional orthodoxy is being challenged and the actual definitions of the resource itself and of the term "reserves" are under scrutiny
- Environmental considerations are being debated - pollution resulting from combustion and the threat of spill during transportation, as well as the cost of producing clean fuel for bitumen
- The Canadian oil sands may require expensive technology to exploit but they have two huge advantages: the reserves are immense, and unlike Middle East oil, they are in one of the safest countries of the world
- Is the 4th Fossil Fuel shifting the geopolitical balance of oil and gas?
- The Fourth Fossil Fuel is a resource for the future and anyone who is concerned with the energy markets should be aware of its potential and likely development

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2. World Oil and Gas Reserves

The Oil & Gas Journal (OGJ) estimates that at the beginning of 2004, worldwide reserves were 1.27 trillion barrels of oil and 6,100 trillion cubic feet of natural gas. These estimates are 53 billion barrels of oil and 575 trillion cubic feet of natural gas higher than the prior year, reflecting additional discoveries, improving technology and changing economics.

The countries with the largest amounts of remaining oil reserves are: Saudi Arabia, Canada, Iran, Iraq, Kuwait, United Arab Emirates, Venezuela, Russia, Libya, and Nigeria. The largest reserves of natural gas are found in: Russia, Iran, Qatar, Saudi Arabia, United Arab Emirates, United States, Algeria, Nigeria, Venezuela, and Iraq.

Discovered (or known) resources can be divided into proved reserves and prospective or unproved (probable and possible) resources. "Proved reserves" are the quantities of oil or gas from known reservoirs and expected to be recoverable with current technology and at current economic conditions. Prospective resources are those that may be recoverable in the future with advanced technologies or under different economic conditions. The application of these distinctions is becoming blurred. For example, in 2003, Canada restated its reserves including its enormous non-conventional oil or tar sands with its conventional oil reserves.

The global energy community is currently engaged in debate about the extent of the world's remaining oil reserves and the rate of their depletion. Traditional orthodoxy is being challenged and the actual definitions of the resource itself and of the term "reserves" are under scrutiny.

Some experts argue that worldwide conventional oil production will peak within the next few years. This prediction is based on a methodology advanced by M. King Hubbert, which concludes that while the production of oil can increase for some period of time, it eventually reaches a maximum and then declines until the resource is totally depleted. In 1956, Hubbert used this methodology to predict correctly that US oil production would peak in the early 1970s.

However, others argue that, while conventional resources may be limited, the world has enormous resources of unconventional oil which are increasingly competitive with conventional crude. One outstanding example is the case of Canada's oil sands. Canada's resources of oil sands or crude bitumen lie almost exclusively within three regions in the province of Alberta known as Athabasca, Cold Lake and Peace River. The Alberta Energy and Utilities Board has estimated the ultimate volume of crude bitumen in place to be 2.5 trillion barrels, although the World Energy Council quotes a slightly lower figure. About 370 billion barrels of this volume are believed to be economically recoverable at current prices and with current technology. Of the economically recoverable reserves, about 15% can be recovered using surface mining where the bitumen deposits are dug from the earth, while the remaining 85% require the use of in situ production processes, in which a well is drilled and the bitumen is extracted, often using unconventional technologies.

Definitions of Reserves

The investment community and the petroleum industry were shocked in 2006 with announcements of significant petroleum reserves reductions by several major oil and gas producers. The first of these was by Shell. On the 9th of January 2006, Shell shocked the market by downgrading proven reserves by 20%, leading to the departure of Chairman Philip Watts and the Head of Exploration and Production in March, followed by the replacement of a Group Chief Financial Officer, Judith Boynton. The company has been accused of using aggressive techniques in assessing reserves.

This was followed by Forest Oil, which announced that, following a thorough geological study of its Redoubt Shoal Field in Alaska, it had reduced its estimate of proved reserves for the Redoubt Shoal Field in Alaska by no less than 88%, from 57 MMBbls to 8 MMBbls. The company also projected that it would be writing down reserve estimates at several other properties, by up to as much as 150 Bcfe.

In January 2006, Repsol YPF announced expected downward revisions in its proved reserves of 1,254 million BOE. These revisions related primarily to natural gas reserves. The majority are located in Bolivia (52%) and Argentina (41%), along with smaller amounts in Venezuela and elsewhere. The revisions were mainly driven by changes in the applicable legal framework in Bolivia, due to the new Hydrocarbon Law and greater knowledge of certain fields in that country and Argentina.

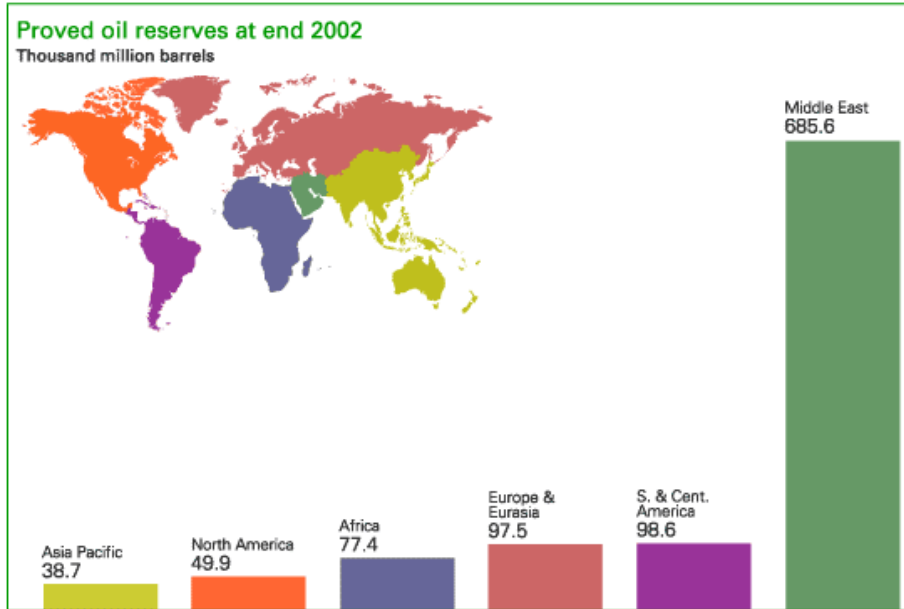
Other oil companies have since devalued their reserves.

The statement of reserves is of paramount importance because they are the principal assets of the oil and gas companies.

4. What are the Oil Reserves of the World?

Using the traditional method of calculation of conventional oil reserves, the world total is 1,048 billion barrels, of which 65% are situated in the Middle East, 14% in the Americas and 9% in Europe and Central Asia.

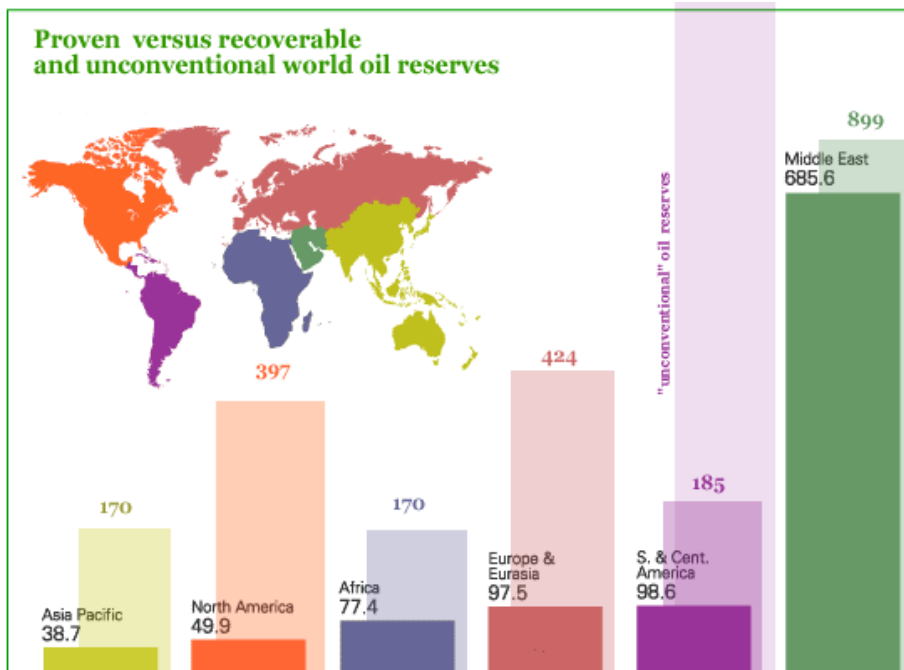
Figure 4-1: Proved Conventional Oil Reserves Using Traditional Calculation



Source: BP

If however this definition is expanded to include non-conventional oil and identified and recoverable reserves the picture changes totally. The total of 1,048 billion barrels is increased to 2,273 billion barrels with addition of identified and recoverable reserves and the Middle East share declines from 65% to 40%. With the addition of non-conventional oil the share of the Americas grows to 36% and that of the Middle East declines to 34%.

Figure 4-2: Proven Versus Recoverable and Unconventional World Oil Reserves



Source: BP

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