



## Statistical Review of World Energy 2006

### Oil reserves

#### Nobody knows or can know how much oil exists under the earth's surface or how much it will be possible to produce in the future

All numbers are, at best, informed estimates. Within the broad concept of oil 'reserves' there are several key distinctions: ultimately recoverable resource, proved, probable and possible reserves and oil in place.

#### Ultimately recoverable resource (URR)

URR is an estimate of the total amount of oil that will ever be recovered and produced. It is a subjective estimate in the face of only partial information. Whilst some consider URR to be fixed by geology and the laws of physics, in practice estimates of URR continue to be increased as knowledge grows, technology advances and economics change. Economists often deny the validity of the concept of ultimately recoverable reserves as they consider that the recoverability of resources depends upon changing and unpredictable economics and evolving technologies.

The ultimately recoverable resource is typically broken down into three main categories: **cumulative production, discovered reserves and undiscovered resource.**

**Cumulative production** is an estimate of all of the oil produced up to a given date.

Discovered reserves are an estimate of future cumulative production from known fields and are typically defined in terms of a probability distribution. Discovered reserves are typically broken down into proved, probable and possible reserves.

#### Proved reserves

Although there is no single, commonly accepted technical definition of proved reserves, a commonly used description is as follows: "the estimated quantities of oil which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under current economic and operating conditions".

A probability cut-off of 90% is sometimes used to define proved reserves, ie the proved reserves of a field are defined as having a better than 90% chance of being produced over the life of the field. In this sense, proved reserves are a conservative estimate of future cumulative production from a field.

Even taken together, proved, probable and possible reserves are only a proportion of oil in place since it is impossible to recover all of the oil and gas present in a given reservoir.

The ratio of reserves to oil in place for a given field is often referred to as the recovery factor. The recovery factor of a field may change over time based on operating history and in response to changes in technology and field economics. The recovery factor may also rise over time if additional investment is made in secondary recovery techniques such as gas injection or water-flooding that augment the natural pressures within a given reservoir.

There is an observed tendency for recovery factors to rise over time: another aspect of reserves growth and a major factor behind increases over time in estimates of ultimate recoverable resource made by organisations such as the US Geological Survey.

### **Probable reserves**

Probable reserves have been variously designated as 'indicated' or P50 reserves, the latter referring to reserves which are estimated to have a better than 50% chance of being technically and economically producible.

### **Possible reserves**

Possible reserves have been designated as 'inferred' reserves, sometimes referred to as P10 or P20 reserves – ie including reserves which, at present, cannot be regarded as 'probable', but which are estimated to have a significant, but less than 50 per cent chance of being technically and economically producible.

In general, a portion of a field's probable and possible reserves tend to get converted into proved reserves over time as operating history reduces the uncertainty around remaining recoverable reserves: an aspect of the phenomenon referred to as 'reserves growth' .

Like reserves, undiscovered resource is also defined typically in terms of a probability distribution. Estimates of 'yet-to-find' resource are made based on a range of geological, technological and economic factors.