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## The Outlook for Petroleum Liquids Production: A Peak or Rising Ground?

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### Abstract

A peak in petroleum liquids production, resulting solely from resource limitations, is unlikely in the next 25 years. Predictions of an imminent peak based on Hubbert's 1956 method do not adequately account for resource growth from application of new technology, knowledge, and capability, which combine to increase recovery, open new producing areas, and lower economic thresholds. Supplies from OPEC and non-OPEC countries, gas-related liquids, and unconventional resources are growing. Furthermore, nations with the largest remaining resources produce under long-term restraints not envisioned in Hubbert's method. The ultimate peak in petroleum production may result from factors other than resource limitations.

### Introduction

Demand for petroleum liquids is rising and forecast to increase from approximately 85 MBD in 2006 to 115 MBD in 2030 (ExxonMobil, 2006). Industry's ability to meet this demand growth will depend in part on its ability to obtain access to adequate petroleum resources. A debate has been underway for more than fifty years about the degree to which the size of the global resource base will impose limits on future production volumes.

The theory of peak oil states that global oil production will reach a maximum volume, and then begin to decline, when approximately 50% of the recoverable global oil resource has been produced. This theory originated in a publication by the American geologist, M. King Hubbert (1956). Hubbert predicted that U. S. production from the lower 48 states would peak in the early 1970s (Figure 1). He made an estimate of ultimate recovery, and forecast production using a bell-shaped curve, with the maximum

production corresponding to 50% depletion. Hubbert's prediction turned out to be right; lower-48 production peaked in 1970.

Success with the application of this simple approach to U.S. production spawned attempts to extend the method to the world, including one by Hubbert (1969) predicting a global peak in the year 2000. Over the last 25 years, many such predictions have been made (Figure 2), and, as a result, a popular view has emerged that the world faces an imminent decline in global liquids production resulting from depletion of resources. In addition, the peak oil theory has raised questions about the future of the oil and gas industry, how resources are estimated, the current supply situation, and the role of technology and other factors in determining future supply. These questions are addressed in this paper.

The fact that many predictions of an imminent production peak have been proved wrong by the passing of time (Figure 2) suggests that the extension of Hubbert's method to global production is not straightforward. Two key assumptions underlie the method: (1) the size of the resource base is known; and (2) peak production occurs at or near 50% depletion. An analysis of resource assessments and production history suggests that neither assumption is necessarily valid. In fact, there appears to be a systematic bias that underestimates the size of the resource base by ignoring the potential for future increase in recoverable volume. It does not follow that there is unlimited potential for production growth, rather that the eventual peak in global production is likely to be much further in the future than is commonly suggested. Moreover, it is possible that the peak, when it occurs, may result from a cause other than resource limitation (e.g., government policies, lack of access to existing resources, competition from alternative energy sources, improvements in energy efficiency).

Future petroleum consumption will depend on many factors in addition to the size of the resource base. For example, will politics or conflict prevent resource development? Can production grow fast enough to meet demand? Will society prefer to use an alternative source of energy? Are there viable alternatives? All of these questions are important, but this paper focuses on the link between production and the resource base because this linkage is a key consideration in approaching other