Sustainability Watch

Peak Oil

December 2010

Polarized Discourse on the Status of World Oil Supplies Abounds

Watch List

- Many experts believe worldwide production of conventional crude oil will peak and begin a permanent decline sometime before 2040.
- Worldwide demand for oil is expected to continue growing, driven in large part by high demand in developing nations such as China and India. Demand growth could accelerate the timing of peak oil production.
- Other factors such as an increase in government regulations aimed at combating climate change could curb demand for oil and therefore delay the peak.

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Key Takeaways

- Peak oil refers to the point in time at which worldwide production of conventional crude oil peaks in volume.
- The peak oil debate is often divisive and emotional with one side predicting the end of civilization as we know it and the other convinced that technology and capitalism will save the day.
- A more moderate position calls peak oil "an unprecedented risk management problem" with "viable mitigation options" that will have substantial impact if they are initiated 10 to 20 years before the peak.
- It is difficult to predict the timing of the peak because many factors including oil prices, economic growth rates, technological developments, environmental policies and natural- or human-caused disasters have powerful effects on supply and demand.
- As oil production nears or passes its peak, businesses are apt to experience rising energy costs, higher energy taxes and energy shortages that could compromise their ability to develop, produce and transport products.
- While the timing of peak oil production and the severity of its consequences are largely beyond the control of any given business, steps can be taken to prepare for a world in which fossil fuels are no longer abundant and economical. Energy usage should become a primary factor in key business decisions. Reducing the carbon footprint of existing products and services should be another top priority.

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Executive Summary

A ready supply of low cost oil has fueled economic growth for generations. But because oil is a nonrenewable resource, its supply is finite. Many experts agree that the production of conventional oil resources will reach a peak sometime before 2040, then enter a state of permanent decline. As global oil production slows, the ramifications may be severe. Individuals and societies, as well as businesses, will be forced to adjust to a new reality in which oil is scarce and expensive.

Unconventional sources of oil, including oil sands and oil shale, are abundant, particularly in the United States. While these resources could help replenish the worldwide oil supply after conventional production peaks, they are difficult to extract in a cost effective and environmentally friendly manner. Optimists believe that market forces will drive innovation in extraction and processing technologies so as to blunt the effects of declining supplies of conventional oil. They also argue that rising oil prices will encourage development of renewable energy resources, making a global energy shortage even less likely. Pessimists are convinced that neither extraction technology nor renewable energy resources can be developed and made commercially viable in time to offset major shocks to the transportation and agriculture sectors. They envision a future characterized by famine, resource wars and declining civilization.

While no one knows when the production of conventional oil resources will peak and what the consequences will be, it makes sense for businesses to focus on reducing energy usage as a way to lower costs, strengthen competitiveness and enhance sustainability.

Understanding Peak Oil

The term "peak oil" was coined in the 1950s by M. King Hubbert, a geologist working for Shell Oil. He theorized that the production rate for any given oil resource could be plotted in a bell-shaped curve (Figure 1). According to Hubbert, whether the resource is a single oil well, a field of wells, a nation's reserves or the entire worldwide oil supply, its production rate always starts at zero, increases exponentially over time, reaches a peak and enters a permanent state of decline. This is referred to as the Hubbert Curve.

Based on this idea, Hubbert predicted in 1956 that US oil production would peak by 1970. Although he was ridiculed at the time, his prediction proved to be accurate. Since then, the Hubbert Curve has gained popularity with some in the oil industry and scientific community. While few dispute the notion that conventional oil resources are finite, there are many conflicting opinions about the timing of peak production and the slope of the curve as production declines.

Timing of Peak

Scientists, oil industry executives, consultants, journalists and others disagree about when oil production will reach its peak. Some say the peak has already passed. Others expect it to occur within a decade, while the most optimistic believe it will not happen for a century or more. A 2007 report issued by the US General Accounting Office indicates that most predictions put the peak somewhere before 2040 (GAO, 2007).

Slope of the Curve

The speed at which production declines after the peak is also debated. Pessimists foresee a swift, sudden drop similar to the Hubbert Curve, while optimists predict a slow, steady taper or a series of "undulating plateaus," a concept articulated by an international energy consulting organization called Cambridge Energy Research Associates.

Life beyond the Peak

Because both the timing of the peak and the rate of decline are unknown, it is not possible to predict exactly how life will look when oil production slows down. The most vocal participants in the debate tend to fall into two schools of thought, both of which are quite extreme.

- Pessimists, sometimes referred to as "Doomers," contend that oil supplies will decline sharply, setting the stage for a global depression. The transportation sector will break down, destroying the global business model. Food production (which is heavily dependent on fossil fuel) will drop off dramatically causing famine and death. Cities and suburbs will stagnate, and citizens will retreat to rural areas to hunt, gather or grow food. Wars will flare up around the world as people and nations fight for limited resources, and within several decades, the population will decline to a just a few hundred million people.
- Optimists at the other of the spectrum are sometimes called "Cornucopians." Named for their steadfast belief in a plentiful supply of resources, this faction is convinced that market forces and technology will solve any problems that arise after the peak. In their view, as fossil fuel supplies decline, prices will rise, creating a favorable climate for innovation. Emerging technologies will allow unconventional oil resources to be extracted and processed cleanly and economically. Alternative fuels will also be developed to fill the gap, so that civilization will continue to flourish.

Between these two extremes lies a somewhat more moderate position articulated in a 2005 report commissioned by the US Department of Energy. Robert L. Hirsch, (2005) primary author of the report and

an energy expert from Science Applications International Corporation, calls peak oil a "daunting risk management problem" (p.8). He states that no matter when oil production peaks, the impact on global economies will be severe. However, the economic upheaval envisioned by Doomers is not inevitable as long as governments move quickly and aggressively to mitigate the risks. Actions must be taken to simultaneously curb demand for fossil fuel and stimulate development of alternative liquid fuels. Effective mitigation will be costly and time consuming and should begin at least 20 years prior to the peak in order to avoid a catastrophic shortfall in the liquid fuel supply (Hirsch, 2005).

Why the Controversy?

There are many reasons why scientists and industry experts cannot agree about the timing of peak oil production and its impact on world economies. Following are some of the major factors that contribute to the uncertainty.

- **Differing opinions about unconventional oil sources.** Oil resources are divided into two categories, conventional and unconventional (or nonconventional). Generally speaking, conventional resources are lighter-weight, lower-viscosity oils that can be extracted and produced cost effectively with current technology. Unconventional resources are heavier and more viscous. They are difficult to extract and costly to produce from both an economic and environmental perspective. Unconventional sources include extra-heavy oil (found in Venezuela), oil sands (located primarily in Alberta, Canada) and oil shale (located in the western United States). Polar oil, deepwater petroleum, synthetic oils and natural gas liquids are also classified as unconventional resources. This oil is far more abundant than conventional petroleum, yet whether it is actually recoverable is open to debate. Much of the uncertainty surrounding peak oil stems from differing opinions about whether unconventional resources can be extracted and processed in large enough quantities to meet rising demand and replace declining conventional supplies—given the high economic and environmental costs.
- **No standard oil reserve reporting process.** In order to estimate the size of the worldwide oil supply (a key factor in projecting the timing of peak oil production), scientists and industry representatives use oil reserve data provided by oil producing countries. However, there is no standard process or terminology for reporting reserve information. Many countries report "proved" reserves, which are considered reasonably likely to be recovered (90 to 95 percent probability) using current technology at current prices with current commercial terms and government consent. Others include "probable" reserves in their totals which have a 50 percent probability of recovery. Some report "possible" reserves which have about a 10 percent chance of being developed under favorable conditions. Because there are no internationally agreed upon reporting standards; countries can simply report their "reserves" without specifying the type, and therefore the certainty, of the information. This makes it difficult to assess the true size of the worldwide oil supply (Graefe, 2009).
- **Imprecise reserve estimates open to interpretation.** No matter which terminology is used (proved, probable or possible), reserve information is always imprecise. Oil resources are located so far underground that it is challenging to determine their actual size and recoverability. New technologies have improved the accuracy of today's estimates, but there are always uncertainties. Consequently, reserve estimates tend increase over time. They are usually reported in terms of a range of numbers, as opposed to a discrete number. Data within the range can be interpreted in a variety of ways and manipulated

to support either side of the peak oil debate (Graefe, 2009).

- **Lack of transparency.** Some countries like the United States consider oil reserve data public information. Others, like Saudi Arabia, maintain a high level of secrecy. As a result, there are questions about the accuracy of global oil reserve data. Many industry experts believe an independent auditing or verification process is necessary in order to ensure transparency and improve the accuracy of oil reserve data (Graefe, 2009).
- **Production estimates based on assumptions.** As challenging as it is to determine the size of the worldwide oil supply, it is also difficult to predict how demand for oil will change over time, and therefore, how rapidly existing reserves will be produced and depleted. Demand estimates and production rates are only as valid as the assumptions upon which they are based. Some of those assumptions include:
  - The rates at which world economies will grow, particularly in China and India;
  - The extent to which oil conservation efforts in developed countries will offset demand growth in developing nations;
  - The effects of changing oil prices on overall demand, production rates, capacity investment and technology development;
  - The pace at which technology will advance to allow economical, environmentally responsible recovery of unconventional resources;
  - The impact of public policies, especially those related to climate change, on energy costs, demand growth and production rates;
  - The potential for resource-based conflicts within and between oil producing nations;
  - The likelihood that major oil producers in predominantly Muslim countries will collaborate with Western oil companies to improve resource recovery rates;
  - The impact of natural disasters (such as hurricanes) and human-caused disasters (like the BP oil spill) on deepwater exploration and drilling;

Given all these unknown factors, it is easy to understand why experts cannot agree when oil production will peak and how devastating the consequences will be.

Business Impact

Businesses will be affected when oil production peaks, regardless of when that happens. Some of the most direct effects could include the following:

- **Higher energy costs.** Supply shortages following the peak would cause oil prices to increase, driving up costs.
- **Higher energy taxes.** Governments may raise energy taxes to encourage conservation and fund alternative energy research and development, further increasing the cost of doing business.
- New regulatory requirements. Businesses may also face new regulatory requirements, enacted by governments to curb energy usage.
- **Transportation challenges, supply chain and production disruptions.** Without a ready supply of competitively priced fuel, businesses will find it increasingly difficult and costly to procure production parts, manufacture quality products and deliver finished goods to the marketplace.
- **Localization of business models.** As oil supplies shrink and prices rise, organizations may transition away from the global business model and move toward locally based supply chains, production facilities and marketing channels.

Preparing for the Peak

While the timing of peak oil production and the severity of its consequences are beyond the control of any given business, steps can be taken now to prepare for a world in which oil is scarce and expensive.

- **Make conservation a strategic priority.** In a post-peak economy, successful organizations will be those that use the least amount of fossil fuel. To cut oil consumption dramatically, it is essential to make conservation one of the critical factors driving every major business decision. Whether a decision involves a new product, service, process, facility or market, no strategic move should be made without a thorough understanding of its impact on energy usage. Ideally, every key business decision would contribute to a reduction in total energy usage (Reynolds, 2010).
- **Calculate and reduce carbon footprint of existing products and services.** Carbon footprint refers to the amount of greenhouse gas emissions associated with the production, distribution and sometimes disposal of a product or service. It is usually expressed in terms of equivalent tons of carbon dioxide. Every product and service a company offers has a unique carbon footprint. Increasingly, businesses are expected to calculate each footprint and take steps to reduce it. In fact, some large retailers like Wal-mart require suppliers to meet carbon footprint standards. Many consumers are also interested in this information. If a product or service has a small carbon footprint, it is being produced and distributed in an energy-efficient manner. That means companies that take steps now to reduce their carbon footprints will be in a stronger position to compete, no matter when oil production peaks (Reynolds, 2010).
- **Develop new products and services for a low-carbon economy.** Forward-thinking organizations will consider investing in research projects aimed at developing new, low-carbon products and services. Creating products that are produced with less energy than competitive alternatives or that help consumers to use energy more efficiently can be an effective strategy for competing in a post-peak economy (Reynolds, 2010).

Regulatory Environment

In the United States, oil drilling is regulated by a variety of agencies. Generally speaking, projects located on public lands and in the outer continental shelf (off shore) are regulated by the US Minerals Management Service, a bureau of the Department of Interior. Drilling on private lands is normally the responsibility of state and local regulatory agencies.

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