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# Implications of Peak Oil for Industrialized Societies

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The world passed the halfway point of oil supply in 2005. World demand for oil likely will severely outstrip supply in 2008, leading to increasingly higher oil prices. Consequences are likely to include increasing gasoline prices, rapidly increasing inflation, and subsequently a series of increasingly severe recessions followed by a worldwide economic depression. Consequences may include, particularly in industrialized countries such as the United States, massive unemployment, economic collapse, and chaos.

**Keywords:** economy; Hubbert's peak; oil; peak oil; recession; sustainability

In 1956, a petroleum geologist employed by Shell Oil Company described a typical pattern of oil production. Marion King Hubbert indicated oil supply follows a bell-shaped curve (Hubbert, 1956). Regardless of the level of observation—individual field, county, country, or even world—oil extraction begins slowly after discovery, proceeds rapidly until the inexpensive easily obtained oil is exhausted, and then plateaus before finally falling sharply. The halfway point of production often is called peak oil or Hubbert's peak (Deffeyes, 2001). Herein, we use the term *peak oil* to refer to worldwide production, but a similar phenomenon exists for regions or individual countries. It is important to note that when world oil production peaks, there will still be large reserves remaining in the ground: Peak oil means that the rate of world oil production cannot increase; it also means

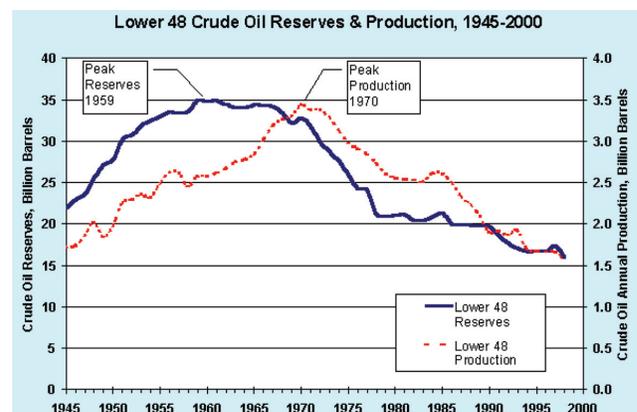


Figure 1. Crude Oil Reserves and Production for the Lower 48 States of the United States Between 1945 and 2000

Source: U.S. Energy Information Administration.

that production will thereafter decrease with time (Hirsch, 2005).

Along with describing the shape of the oil-supply curve, Hubbert predicted that oil production in continental United States would peak in 1970 and that oil production in the world would peak near the turn of the 21st century (Hubbert, 1956). Although Hubbert was widely scorned at the time, his predictions proved stunningly accurate for the United States (Figure 1) and for the world (Figure 2) (Duncan & Youngquist, 1999).

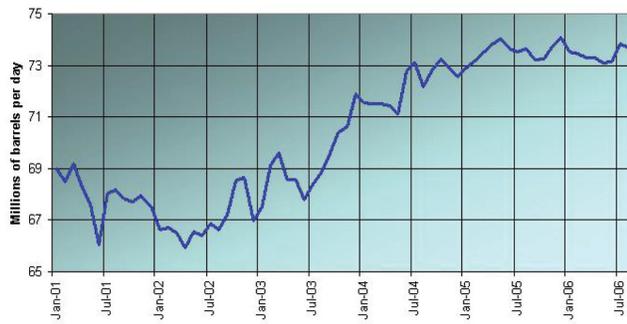
Three years after the continental United States passed Hubbert's peak in 1970, Middle Eastern countries took advantage: An oil embargo on the United States, which

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**Figure 2. World Crude Oil Production, 2001-2006**

Source: U.S. Energy Information Administration.

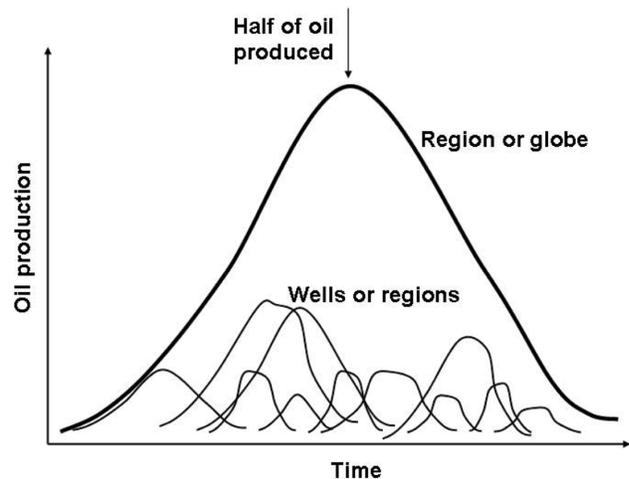
until 1970 had been the world leader in oil production, caused the price of oil to quadruple by 1974. Inflation skyrocketed and supply disruptions led to implementation of conservation strategies at the national level. The United States fell abruptly into a recession that ended only when oil supplies were secured from the Middle East.

According to Hubbert's model of oil supply, the world passed the oil-supply peak in 2005 (Deffeyes, 2006). The model is supported by data indicating that the peak month of world production was May 2005 (Deffeyes, 2007). If Hubbert's model is correct and oil-supply data from the world's countries are accurate, the world likely will fall off the oil-supply cliff in 2008. Some geologists and scientists predict that shortly thereafter, an economic depression will grip the world (Campbell & Laherrère, 1998; Heinberg, 2005).

### Historical Review: Passing Hubbert's Peak

Oil discovery and production tend to follow bell-shaped curves, as described by Hubbert (1956) (Figure 3). The easily reached, light oil is extracted first. Heavier oil, often characterized by high sulfur content, is found at greater depths on land and also offshore. This heavier oil requires more money and more energy to extract and to refine than light oil. Eventually, all fields and regions become unviable economically and energetically. When extracting a barrel of oil requires more energy than contained in the barrel of oil, extraction is pointless.

Ample empirical evidence supports Hubbert's concept of bell-shaped curves for oil discovery and production (see, e.g., Figure 1). For example, the Somotlar and Romashkino fields in Russia peaked in 1981 and 1973, respectively, at 42% and 47% of projected production (Simmons, 2005). Similarly, the Oseberg and Gullfaks fields in Norway both peaked in 1994 at 45% and 50%



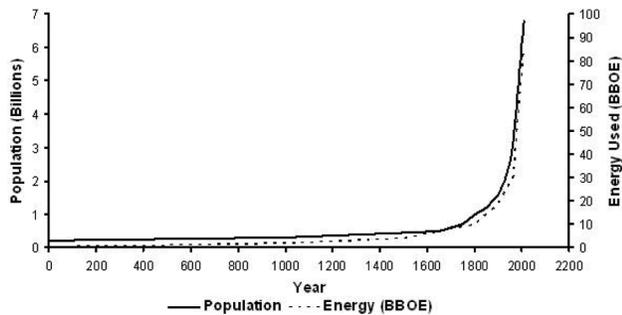
**Figure 3. Oil Production Curves From Individual Wells or Regions Scale to Form a Bell-Shaped Curve of Oil Production at Larger Scales**

Note: Empirically, when about half the oil has been extracted from a given well, region, and so on, oil production peaks and then falls thereafter, forming a peak in oil production.

of projected production. Oil production in the North Sea peaked in 1999, and has been declining since then (U.S. Energy Information Administration, 2008). In fact, 54 of the 65 largest oil-producing countries have also reached and passed their peak in oil production. Thus, global oil production is predicted to exhibit the curve typical of individual wells, countries, and regions, with post-peak oil production declining at a rate driven by both supply and consumption (Government Accountability Office, 2007).

Human populations, civilization, and society have developed commensurate with the development of energy (Figure 4). With energy, societies flourish, but developing civilizations require energy. In a recent speech, U.S. Secretary of Energy Samuel W. Bodman stated the following.

By 2030, [the U.S. Department of Energy] estimates that global energy consumption will grow by over 50 percent, with 70 percent of that growth coming from the world's emerging economies. For electricity specifically, [DOE] estimates that U.S. demand will increase by about 50 percent by 2030, with global demand nearly doubling. To meet this demand . . . the U.S. . . . would require 285,000 megawatts of new base load capacity . . . that represents roughly the total capacity of all the coal-burning power plants now operating in the U.S. and almost three times the capacity of the existing fleet of nuclear plants.

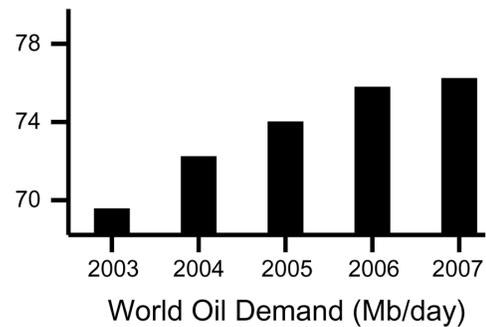
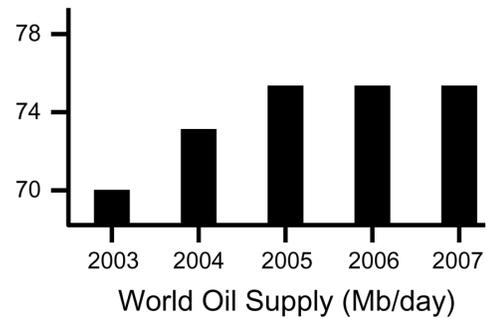


**Figure 4. Change in Human Populations on Earth (in Billions of Individuals) Over the Last Two Millennia, Contrasted With Energy Consumption (Billion Barrels of Oil Equivalent)**

Unfortunately, without energy, societies collapse. In contemporary, industrialized societies, virtually all energy sources are derived from oil. Even renewable energy sources such as hydropower, wind turbines, and solar panels require an enormous amount of oil for construction, maintenance, and repair. Extraction and delivery of coal, natural gas, and uranium similarly are oil-intensive endeavors. Thus, the decline of inexpensive oil spells trouble for industrialized countries. Demand destruction, caused by high energy prices, is already affecting developing countries in Africa and Asia.

Ultimately, economic collapses result from an imbalance between demand and supply of one or more resources (Diamond, 2005) (Figure 5). When supply of vital resources is outstripped by demand, governments often print currency, which leads to hyperinflation. In recent history, the price of oil and its refined products have been primary to rates of inflation and have played central roles in the maintenance of civilized societies. Consider, for example, the economic collapse of the former Soviet Union, which was the planet's *other* superpower between World War II and the early 1990s.

The economic collapse of the former Soviet Union has been attributed to several factors. As with most economic collapses, several interrelated factors, no doubt, contributed to the fall of the Soviet Union. Chief among these was the decline in Soviet oil production concomitant with a decline in world oil prices (Sutela, 2003). Schweizer (1994) argues that a primary component of the Reagan administration's secret strategy to hasten the demise of the evil empire was collaboration with Saudi Arabia to flood the world oil market, thereby reducing the price of oil and consequently reducing Soviet revenues. Already, the Soviet Union was having



**Figure 5. World Oil Supply (Top) and Demand (Bottom), in Million Barrels Per Day Between 2003 and 2007**

Source: Adapted from Energy Information Administration (<http://www.eia.doe.gov/ipm/>; February 8, 2008).

great difficulty paying for its social programs and its expansive military; in particular, the war in Afghanistan and the buildup of high-tech military equipment needed to keep pace with the United States were eroding the Soviet economy (Clark, 1995; Schweizer, 1994; Strayer, 1998; Sutela, 2003). The reduction in foreign currency from oil sales could be viewed as a fatal blow to the Soviet economy. Many economists attribute the recovery the Russian economy to the dramatic and sustained recovery of world oil prices, which has coincided with Russia overtaking Saudi Arabia as the world's leading producer of crude oil (Osborn, 2006). Thus, although cheap oil contributed to the economic collapse of the Soviet Union, with or without Reagan's secret strategy, the resurgence of Russia has been fueled by expensive oil.

### Whither Industrialized Society?

How do we address declining energy supplies? How do we address the urgent issue of peak oil while also controlling emissions of carbon dioxide, and therefore reducing the prospect of *runaway greenhouse* on planet

Earth? These are the greatest challenges humanity has ever faced. Tackling either challenge, without the loss of a huge number of human lives, will require tremendous courage, compassion, and creativity.

James Kunstler, author of *The Long Emergency* (2005), laid out the agenda in a recent post to his Web log (Kunstler, 2007). This is not a 10-step plan in the usual sense. Rather, we must initiate all of these steps simultaneously.

Step 1: We need to expand our horizons beyond the question of how to run the cars by means other than gasoline. Our obsession with keeping the cars running threatens our lives and our species. The cars are not part of the solution, regardless of the fuel they use. Rather, they are very clearly part of the problem, and a large part at that. It's time to abandon the car, time to make other arrangements for nearly all the common activities of daily life.

Step 2: We must produce food differently. Industrial agriculture is destined for disaster, and will leave in its wake sterile soils and an agricultural model at a grossly inappropriate scale. Within the next decade or so, farming will return to the center of American life. This situation presents many business and vocational opportunities for creative, hard-working people. First, though, we will have to retrieve considerable knowledge from the dustbin of history. Then we will have to apply the knowledge at a scale unimaginable to most people.

Step 3: We must inhabit the terrain differently. The American suburbs and the interstate highway system are designed for a culture that is coming to an end: the misguided car culture. The suburbs in particular represent perhaps "the greatest misallocation of resources in the history of humanity" (Kunstler, 2005). We will have to learn to inhabit differently, or not inhabit at all, most areas currently dominated by asphalt, concrete, and tall buildings. These include, for example, most of the area currently occupied by Los Angeles, Las Vegas, and Atlanta. Our cities must contract. Our towns must be reinhabited and the areas around them must be restructured to accommodate small farms and the manufacture of goods to serve the towns. This entire process will require enormous demographic shifts and is likely to be turbulent.

Step 4: We must move people and things differently. A common bumper sticker on American 18-wheelers proclaims, *Without trucks, America stops*. The trucks are going to stop within the next half decade or so, as disruptions in diesel supply and increases in the price of oil obviate distillation into fuel for automobiles. The interstate highway system likely will collapse, and we should

not waste our time trying to prop up our fatal dependency on cars and trucks. Rather, we should restore public transit, starting with our railroads. We should electrify our rail system so the trains can run on renewable energy.

Step 5: We need to transform retail trade. The demise of large national chain stores is at hand. The national chains have used inexpensive oil as the foundation for predatory economies of size, and therefore as the springboard for killing local economies. We can no longer afford the *warehouse on wheels* approach to the delivery of cheap plastic household goods, most of which we do not need. Internet shopping will not replace small, locally owned shops in every town because of its reliance on inexpensive delivery. Further, Internet shopping depends on reliable electric-power systems, which likely will fade away as the end of inexpensive oil dictates the demise of the electrical grid.

Step 6: We have to start making consumer products. We will have far fewer choices when we go to the store, but we still will need clothes and household goods. Countries such as the United States produce few consumer goods and even fewer clothes, so there is much potential in this arena.

Step 7: We will need artists again. When the power goes out, we won't have to decide between listening to Britney Spears and watching the latest rendition of *American Idol* (a minor silver lining in a threatening bank of clouds). We are going to need playhouses and live performance halls, albeit without high-tech light and sound systems. And we will need musicians, actors, playwrights, stagehands, and theater managers.

Step 8: We must reorganize the educational system. Yellow fleets of school buses are on their way out. We have invested heavily in centralized systems of primary and secondary school—most recently and disastrously in the form of the federal No Child Left Behind Act—and we will undoubtedly continue to invest in that centralization at the expense of true education. This will slow the transition to a reasonable system of education that perhaps will grow, in fits and starts, from the home-schooling movement. Higher education likely is doomed to fail for myriad reasons, including terminal indifference of the academy to societal needs.

Step 9: Our medical system must be completely reorganized. Without power-hungry high-tech tools, we will need real doctors again: people who understand how the body actually functions. If the future economy is based on barter, these doctors might make house calls and exchange their services for a meal or a place to sleep.

Step 10: Our entire socioeconomic and political system will become much more local as every large system fails. Local politics will assume increasing importance as first the federal government, then the state government, simply fade from relevance.

There is little question that the decades ahead will differ markedly from the recent past. From this point forward, *Homo sapiens* will lack the supply of inexpensive energy necessary to create and maintain a large, sustainable civilization. We are deeply concerned about the fate of humanity, given our inability to sustain high levels of energy production. We fear the planetary human population will fall precipitously when the exponential energy-production curve illustrated in Figure 4 turns down. We believe the relevant question for the coming decades is, "Do we possess sufficient courage, compassion, and creativity to stave off chaos in defense of a just, sustainable civilization?"

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