<u>Peak Oil Task Force</u>

What is Peak Oil and why do we care about it?

Peak Oil is based on two concepts. The first is that production from any oil field approximates a classic bell curve over time. Though the production curves of the individual wells may not be exactly bell-shaped, when you add them up the sum looks bell-like. Or, put another way, what goes up must come down, and it doesn't matter how many new wells you drill in the same field, the curve will be about the same. You can postpone the peak slightly by various enhanced recovery techniques, but the only way to really prevent production declines is to find a new field.

Which brings me to the second concept: You can only pump oil that's been found. And guess what? The discovery of oil follows a jagged, but recognizable bell shape. The big discoveries were made 30 years ago and earlier. What are called "big" new fields, such as the recent deep-water find off Brazil, would hardly have been blips in those days. The world has been using more oil than we've been finding since 1981.

The list of countries whose oil production is in decline is long and scary. According to a country by country analysis by the *Energy Watch Group*, a think tank based in Stuttgart, Germany, there is no chance that new production coming on line can make up for the many fields that are in decline.

If you consider the United States, discoveries peaked in the 1930s. US oil production peaked in 1970, and has moved downward ever since, despite all the "enhanced recovery" efforts.

Turning to the world, discoveries peaked in the 1960s. Do the math. The peak could be happening now or maybe it's five or ten years off. Even the optimists only give us twenty-odd years.

In a way, the exact date of peak doesn't matter. The key issue is that oil production is struggling to meet demand. We aren't running out of oil; there just isn't enough to go around. Oil production has stayed flat at about 84-86 million barrels per day for the past 2½ years. Think what has happened to oil prices in that time. What will happen when -- not if, when -- oil production starts to decline?

We get more than1½ times as much energy from oil as from our entire electricity grid. Given the scale of the problem, we need to start getting ready *now*.

Other countries are busy preparing for expensive oil. Europe and Japan are developing wind and solar power, high-speed rail, bicycle travel, and low-fuel-use autos. Meanwhile in the US, the attitude of the state and federal governments ranges from outright hostility to grandstanding without meaningful action.

The mandate of this task force is to assess the impact of expensive and increasingly scarce oil on the City of San Francisco, and to recommend policies to ameliorate its negative impact on this great city.

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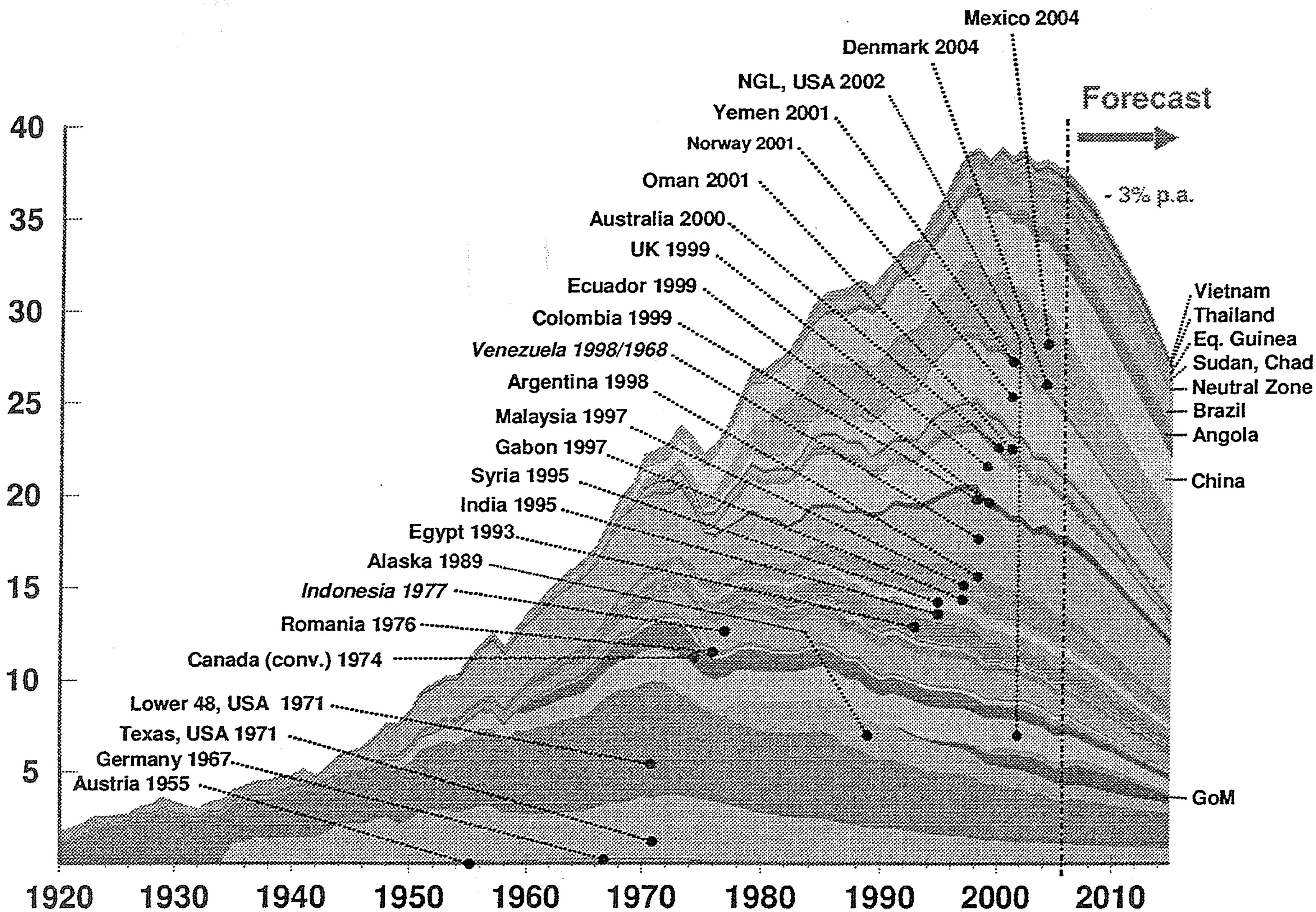
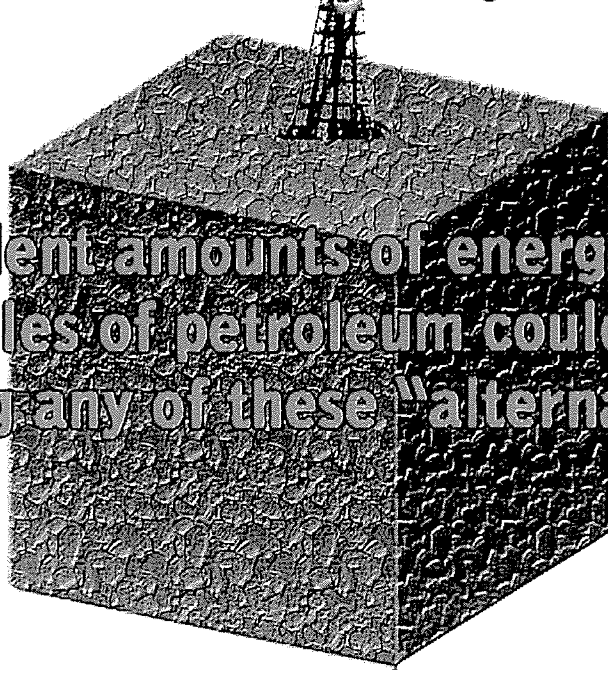
re 5: Oil producing countries past peak

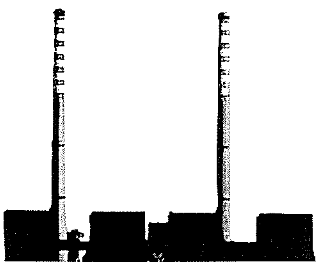


Ludwig-Bölkow-Systemtechnik GmbH, 2007
Source: IHS 2006; PEMEX, petrobras ; NPD, DTI, ENS(Dk), NEB, RRC, US-EIA, January 2007
Forecast: LBST estimate, 25 January 2007

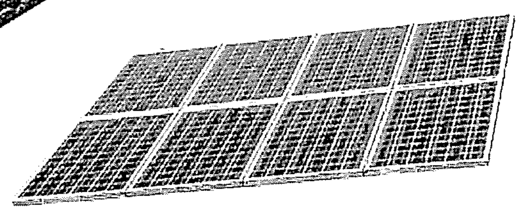
The approximate volume of one year's worth of production is 1.2 cubic miles of oil, which is approximately equivalent to the 86 million barrels of oil per day used worldwide.



Equivalent amounts of energy found in 1.2 cubic miles of petroleum could be generated using any of these "alternatives":



6240 coal-fired plants



5,475,000,000 solar panels

4,800,000,000 acres of corn for use as ethanol

240 three gorges dams

3120 nuclear power plants

6,570,000 wind turbines

1.2 Cubic Miles of Oil vs. Alternatives to Petroleum

This graphic is based on one originally published by the IEEE (Institute of Electrical and Electronics Engineers) in their journal *IEEE Spectrum* in January 2007. They rounded one year of oil production to 1 cubic mile, which is equivalent to about 57,000,000 barrels per day. Current consumption is about 86,000,000 barrels per day.

The IEEE graphic did not include total numbers of dams, panels, turbines, etc. needed to produce the alternative energy, but how many would have to be produced each year over a 50 year period in order to create the equivalent energy return of one cubic mile of oil that the world uses each year.

The IEEE assumptions were: The Three Gorges Dam is rated at its full design capacity of 18 gigawatts. A nuclear power plant is postulated to be the equivalent of a 1.1-GW unit at the Diablo Canyon plant in California. A coal plant is one rated at 500 megawatts. A wind turbine is one with a 100-meter blade span, and rated at 1.65 MW. A solar panel is a 2.1--kilowatt system made for home roofs. In comparing -categories, bear in mind that the average amount of time that power is produced varies among them, so that total energy obtained is not a simple function of power rating.

While these are equivalent in energy, they aren't in function, as we don't have an electricity-based transport system.

We've also added ethanol from corn to the equation.

Assumptions are:

Corn ethanol: 2.8 gallons bushel/150 bushels acre (which is only possible with commercial fertilizer)
Total yield: 420 gallons/acre
Ethanol contains only 65% of the energy of gasoline, so output is discounted by 35% to calculate oil equivalency.

Total yield : 6.26 barrels oil equivalent per acre, so rounded, it would require 4.8 billion acres of land growing corn for ethanol to create the energy used from one year of worldwide oil production.

There are a total of 350 million acres of active cropland in the US.

The IEEE did not adjust the load factor of the wind turbines (averaging 30%, so the number here is higher than on the IEEE graphic).