ENERGY INSECURITY

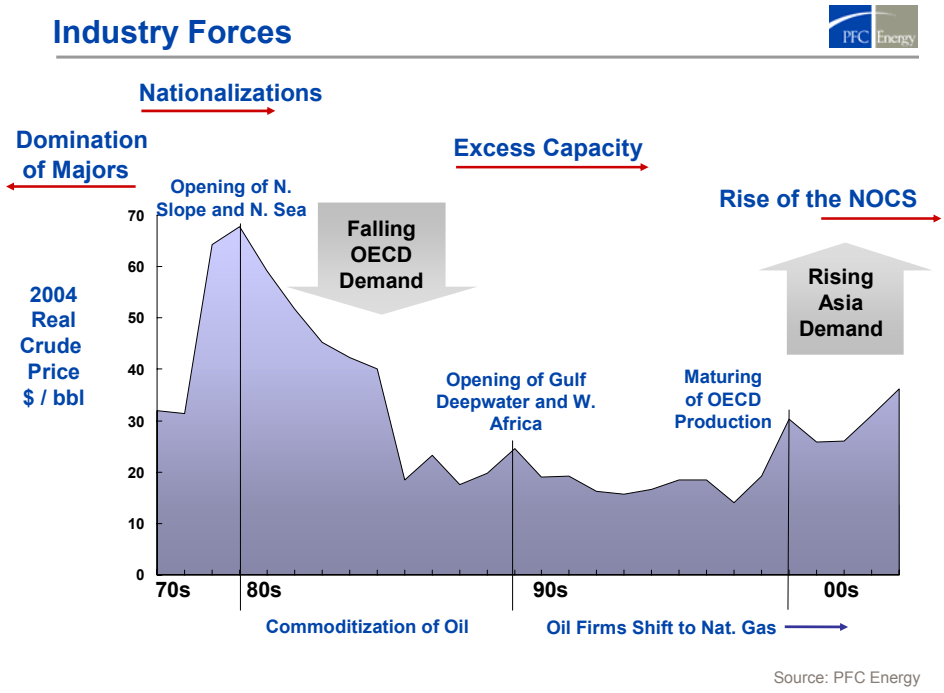
Hurricane Katrina was a natural disaster of unprecedented proportions. It not only demolished a swath of the Gulf Coast and destroyed thousands of lives, but with the ensuing rise in energy prices, there was also a fear that it would demolish the economy as well.

Katrina has brought home the realization that Americans have entered a new age, the age of Energy Insecurity. For the last twenty years, we have lived in a period of energy security where we had ample and reliable supplies at a reasonable cost. Those days are over. Supplies are tight, may not be reliable, and fears of shortages have sent oil and gas prices skyrocketing.

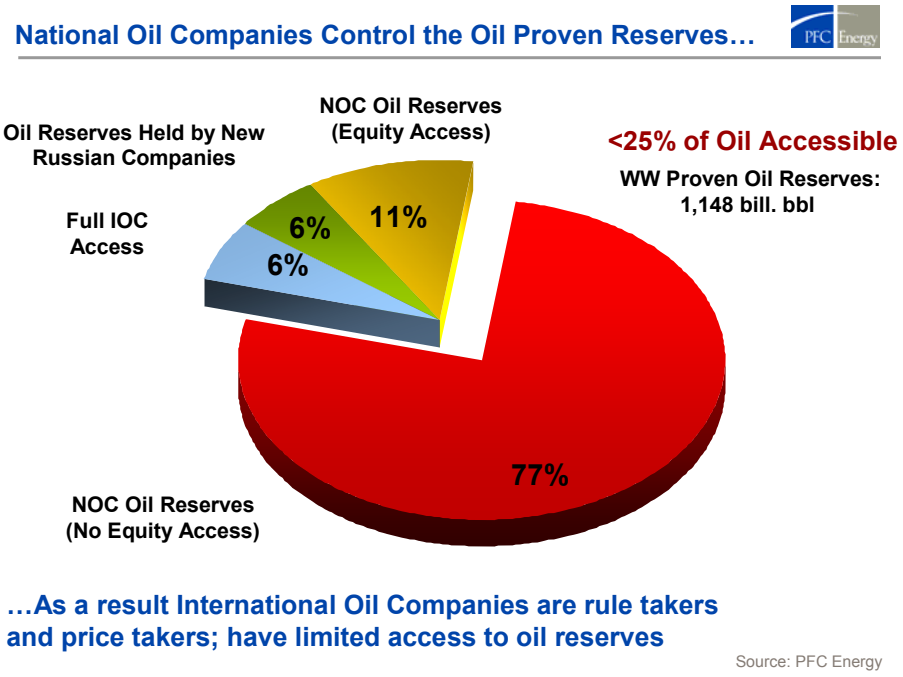
To understand oil and gas markets, one must examine the fundamentals of supply and demand, which have radically changed in the last twenty years, together with two trends: nationalization and financialization in the industry.

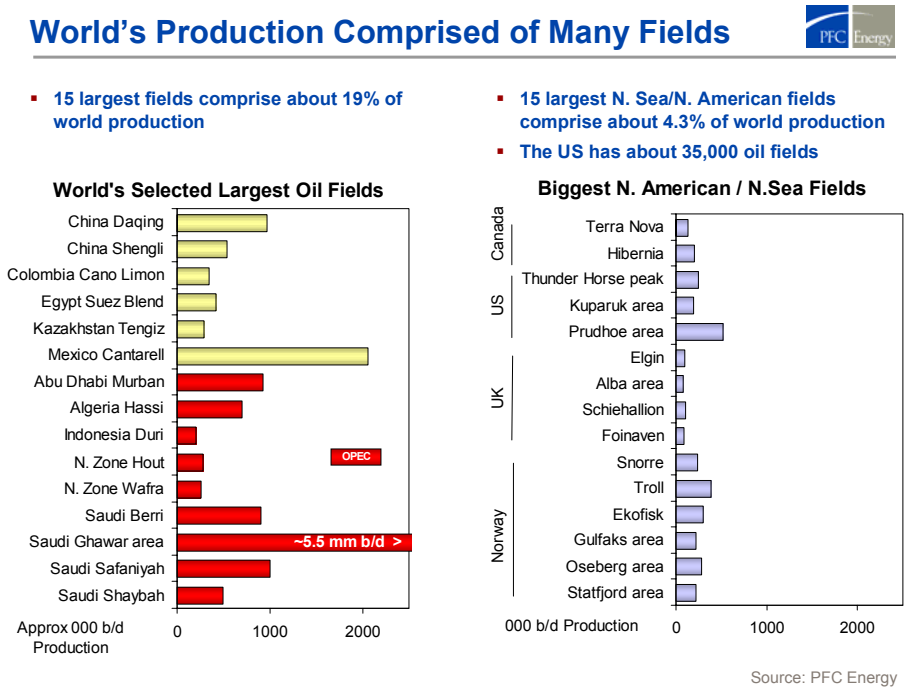
For much of the twentieth century, the oil markets were managed by the large vertically integrated (from oil well to gas pump) "Majors." Until the early 1960s, the Majors explored and produced oil virtually everywhere with the exception of Russia and Mexico. By the 1960s, however, major oil producing countries felt that they had not received their fair share of the oil revenues from the international industry, and began to nationalize their oil and gas resources, creating National Oil Companies (NOCs) to manage these resources. This process was completed by the late 1970s as the Majors were pushed out of the Middle East, the primary source of cheap crude oil, and other important producing areas, such as Venezuela.

OPEC member states came to control their own supply of oil and spent the next twenty years trying to engineer higher oil prices. Successful at first (the first and second oil shocks of the 1970s), they later failed as many new areas (the North Sea, Gulf of Mexico, Alaska's North Slope and West Africa notably) produced substantial quantities of oil and most developing countries introduced conservation measures. The oil markets crashed and consumers and their governments were lulled into a feeling of complacency – i.e. excess production capacity and competition among suppliers driving prices down.

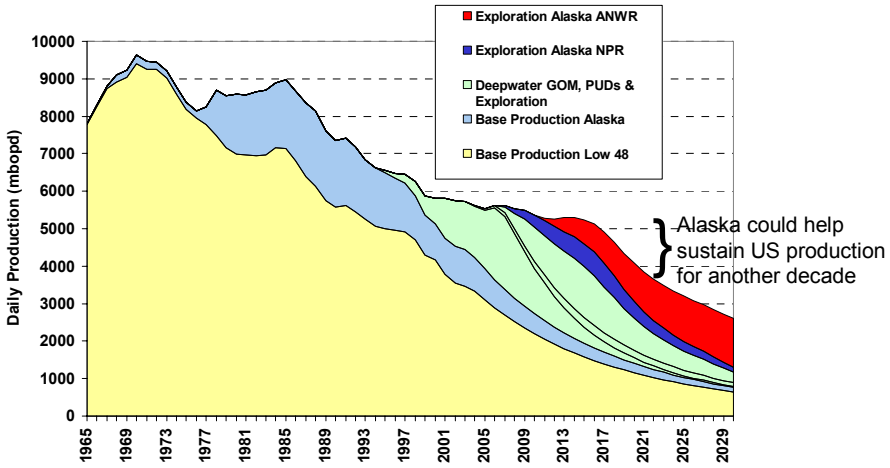


But this era has now come to an end – non-OPEC countries are nearly tapped out. International oil companies are finding fewer new places to look for oil and there is less oil in those areas that are not controlled by national oil companies. Today NOCs control 77% of the world's oil resources. The Majors are no longer the rule makers – now they are rule takers.





US Production with Alaska Additions



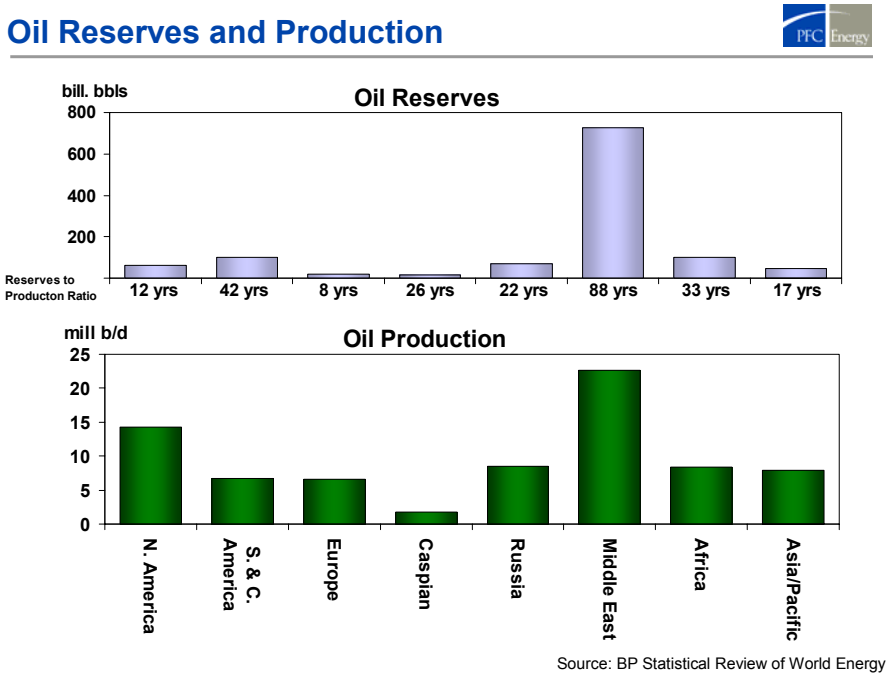
Source: PFC Energy

The low oil prices of the 1980s and 1990s forced oil companies to become more efficient users of capital. This process of financialization was driven by their shareholders. Capital markets are ruthlessly efficient. They demand short term profits, delivered quarterly. Investors punish underperforming companies, and companies will thus not invest in underperforming sectors.

The impact on the industry has been severe. The oil and gas industry is a risky, capital intensive, long lead time business. Many oil companies, including some of the largest companies in the U.S. – Mobil, Amoco, Arco, and Texaco – could not compete effectively and went out of business. Likewise, the worst performing sector, downstream received less investment since returns were lower. The companies did not ignore their refineries and marketing operations, spending billions to upgrade and de-bottleneck for efficiency and higher fuel standards, but they did not invest in new refineries because they would be punished by investors and an increasingly powerful environmental movement. Also, government regulations made construction of new refineries virtually impossible in the U.S.

Major oil discoveries were made in the 1960s and 1970s, with over 80% of all global reserves (just over 2 trillion barrels) having been found before 1980. Since the mid 1980s, however, discovery sizes had clearly begun to decline, although the exploration efforts of the industry continued aggressively where they were permitted. We are now consuming about three times as much conventional crude oil as we are discovering through exploration. Even counting unconventional oil, natural gas liquids and enhanced oil recovery, the ratio of production to new reserves is still greater than two-to one.

One success has been the deep offshore, where oil is produced in water depths of over a mile. This requires tremendous levels of technology and capital. A single field can cost over $3 billion to develop. The industry deserves credit for developing and producing so much oil in the areas where is does have access.

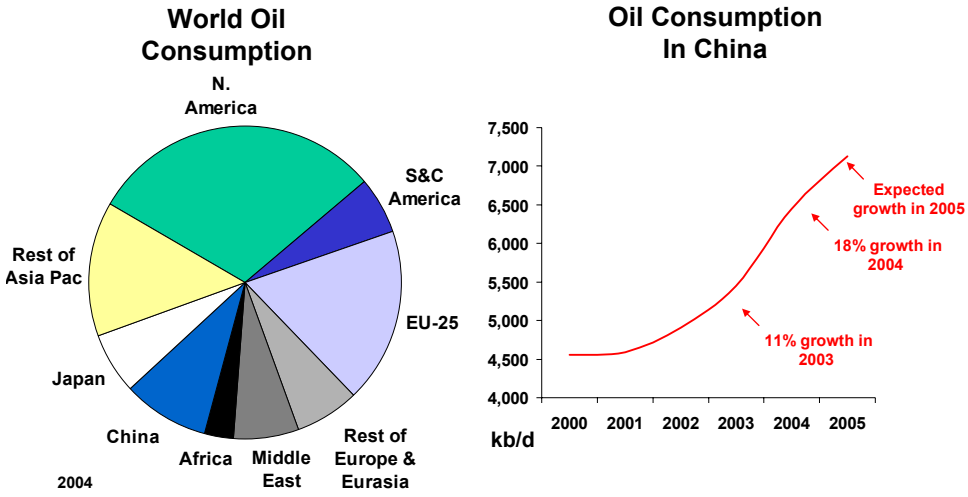


While the industry was struggling with reserve replacement, low prices and political barriers, consumers in America happily guzzled cheap gasoline. This was an explosive combination. Consumers benefited from a 58% decline in real gasoline prices from a peak 1981 to the low point in 1998. Americans became richer and spent an ever smaller percentage of their growing incomes on energy, driving more and more. Gasoline consumption in the U.S. rose 38% from 1981 to 2004.

The expansion of suburbia and now exurbia on the back of cheap gasoline, land and credit became the crucial social phenomenon of the last 20 years. This is symbolized by Americans driving the world's largest SUVs to Wal-Mart, the world's largest company.

At the same time, across the Pacific, an economic giant has begun to stir. By the early 1990s the Chinese economy began to become market based, organized for exports. The Chinese economy began expanding, wealth was created, and expectations soared. Its demand for oil started growing just as its oil production began to mature. Market experts, ourselves included, were slow to recognize China's rocketing demand, in part because of inadequate data. The oil markets were shocked in 2003 when Chinese oil consumption leapt by 11%, and again in 2004, by 18%.

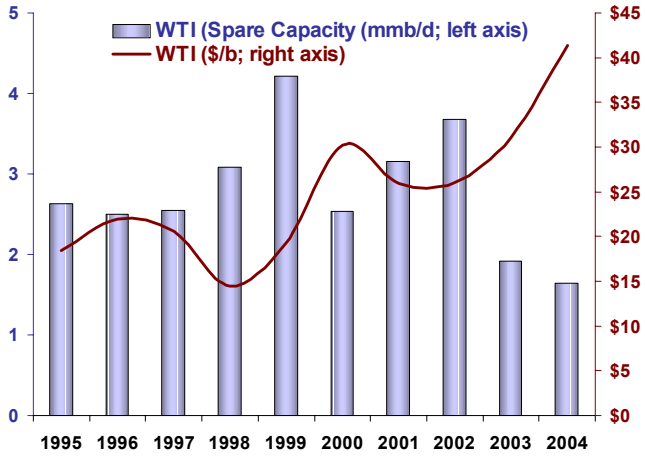
Oil Demand



Source: PFC Energy

In the autumn of 2005, the world economy is confronted with surging demand and low supply growth. Refining capacity is tight. The international petroleum system produces about 84 million barrels of oil per day (b/d), with very little excess capacity to provide a cushion from shocks such as Katrina or insurgency in Iraq. Any spare oil production capacity we have is in the Persian Gulf, particularly Saudi Arabia.

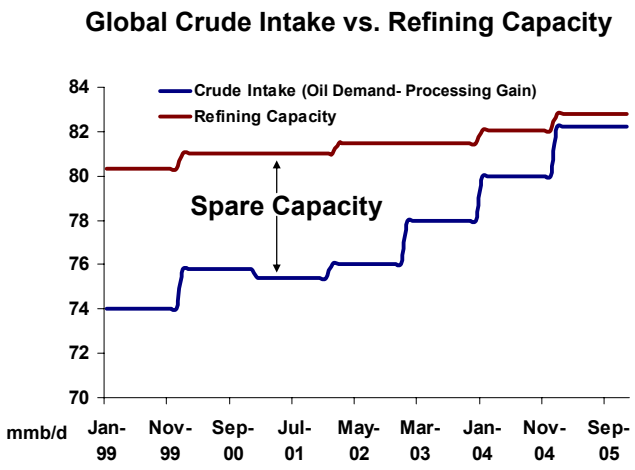
OPEC Spare Production Capacity Virtually Gone



- The Gulf holds virtually all of global spare capacity
- Of that, 85% is located in Saudi Arabia which had over 2.0 mmb/d of spare capacity back in 2002
- Saudis have been the central bank of oil – swing producer – requires excess capacity

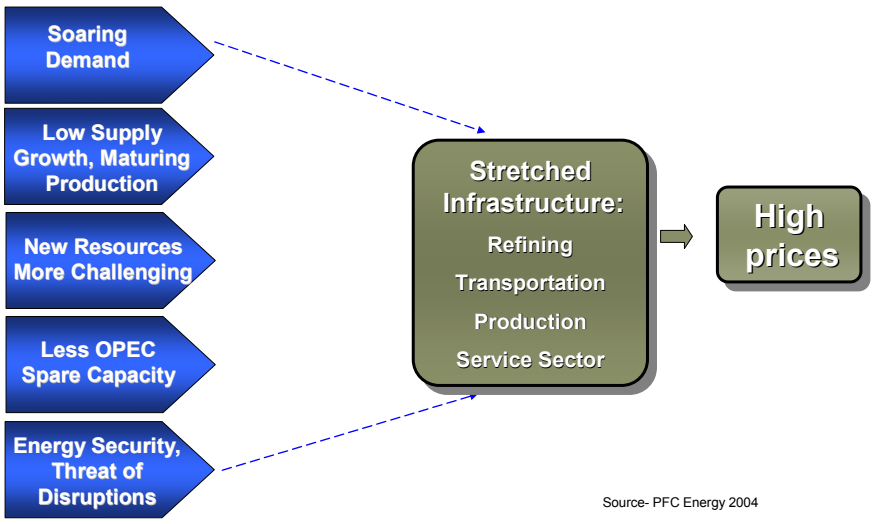
Source: PFC Energy

Stretched Infrastructure: Lack Of Global Spare Refining Capacity



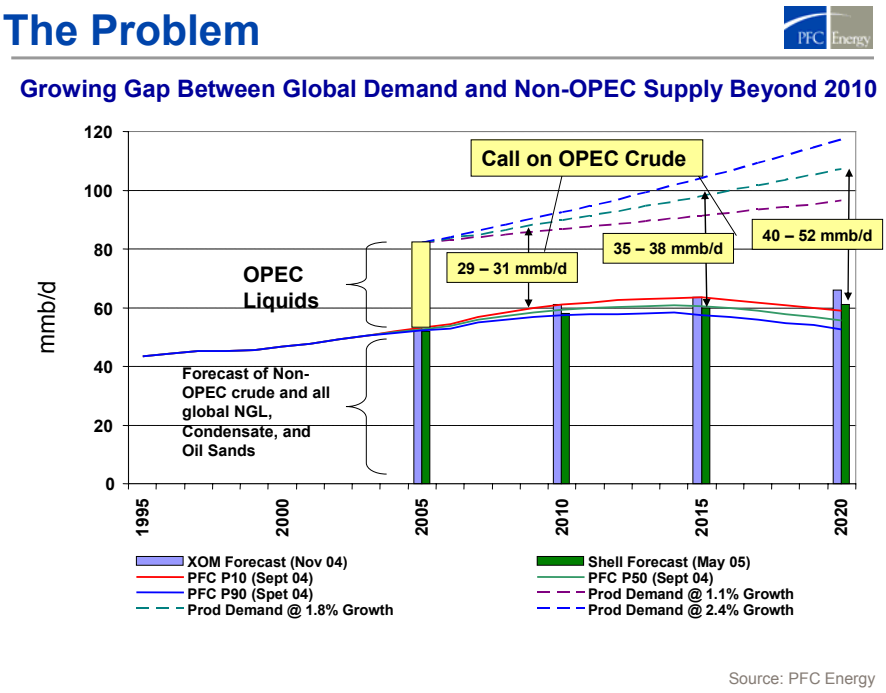
Source: PFC Energy

Forces Driving Oil Prices Higher



Source: PFC Energy

But wait, the longer-term the picture is even bleaker. PFC Energy projects that the world petroleum system can generate peak production of 95 to 100 million b/d by 2015-2020. Beyond that period, the industry will not be able raise output significantly and we are likely to see a plateauing of supplies followed by a slow decline. Crude oil production outside of Russia and OPEC reached a plateau in 1998 which persists to this day. Non OPEC production will face serious growth challenges beyond 2010. Beyond 2015 OPEC reserves will face similar growth challenges. To get to 100 million b/d, in spite of shrinking discovery sizes, enhanced recovery technology must be employed along with growing exploitation of heavy oil, oil shale, natural gas liquids, gas to liquids and tar sands.



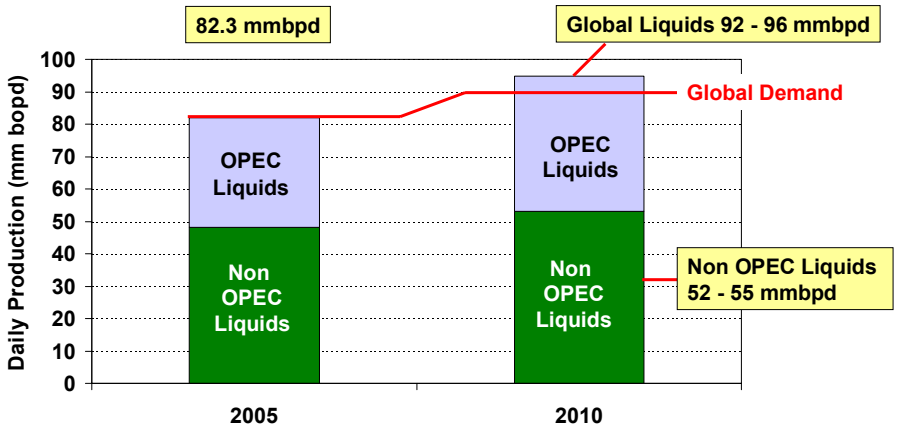
Source: PFC Energy

Certain respected experts believe that Saudi Arabia will not be able to increase its output or even worse that its output will decline. However, we think there is a reasonable probability that Saudi sustained production can increase from about 10 million b/d now to 12.5 million b/d, with a surge capacity of another 2 million b/d. The Saudis are committed to spending nearly $50 billion to help meet rising demand for crude oil. When it comes to oil, Saudi Arabia has been a part of the solution, not the problem. Saudi Aramco, the NOC, is highly professional, and the Saudis have played the role of central banker for oil, seeking to provide liquidity and stability to the market.

There is not very much that can be done to increase supply. Some optimists say that we have always found technical solutions to increase production before, and will again. Our response is that if breakthrough technology is not in the pipeline now it will have no impact for years. Likewise, the fact the NOCs control 77% of the oil resources means that the ability of international companies is seriously constrained since they cannot get access to those resources. With high prices, however, many oil producing countries cannot absorb the money they are already receiving, and have little incentive to expand production.

PFC Energy's model of all planned projects over the next five years indicates that there is still some breathing room in the near term. By 2010 there may again be some excess oil production capacity in the global industry. While this may buy us some extra time to confront the future crisis, it is crucial that we not be lulled into a false sense of energy security. Most of the new production expected by 2010 will come from the former Soviet Union, West Africa and the Middle East, much of it flowing to Asia.

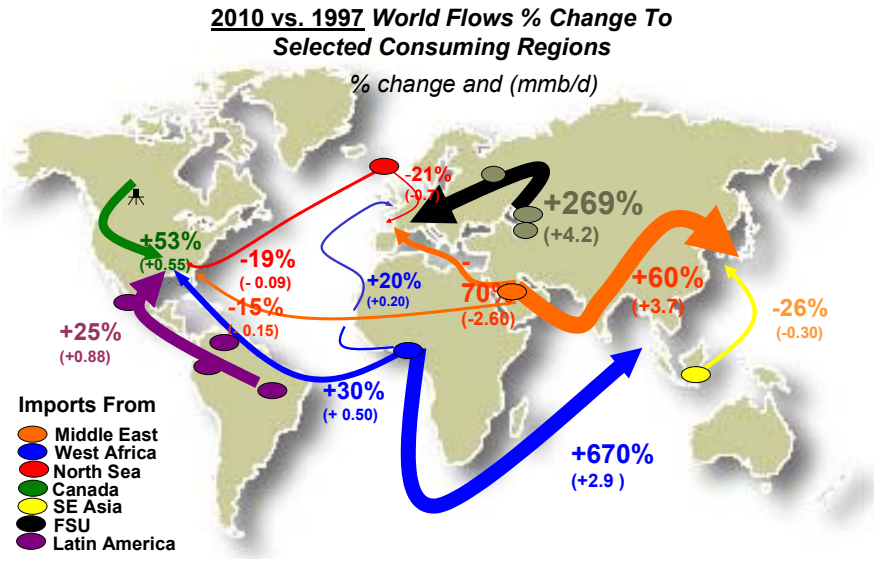
Possible Surplus Capacity by 2010



PFC Energy Expects Some Spare Capacity by 2010
Assuming Average Demand Growth of 1.8%

Source: PFC Energy

Increasing Dependency From Less Stable Areas



Do Not Include The Totality of Suppliers. Only the Most significant flows are shown.
The Map Includes Exports from Canada, Latin America, Middle East, North Sea, West Africa, West Africa, FSU to Selected Regions

Source: PFC Energy

Welcome to the Age of Energy Insecurity. Worldwide production will peak. The result will be skyrocketing prices, with a huge, sustained economic shock. Jobs will be lost. Key sectors of the economy, from agriculture to home building, will be hit hard. Without action, the crisis will certainly bring energy rivalries, if not energy wars. Vast wealth will be shifted, probably away from the U.S.

We must confront the issue of demand, primarily in the U.S. and Asia. Politicians in the U.S., from both sides of the aisle and both ends of Pennsylvania Avenue, are loathe to come between Americans and their cars – part status symbol, part toy, part necessity. Solutions

must be found, but if the wrong solutions are proposed, the economy as a whole and the suburban economic model in particular – the basis of the American consumers' wealth – will come to a screeching halt. The key is to engage critical stakeholders to come together and push for the political will for change.

For the last 20 years U.S. policy has discouraged production and encouraged consumption. This policy is simply not sustainable. If we dither any more, as we have for so long, we will pay a terrible price, the economic equivalent of a Category Five hurricane. Katrina was a Category Four.

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