

International Energy Workshop

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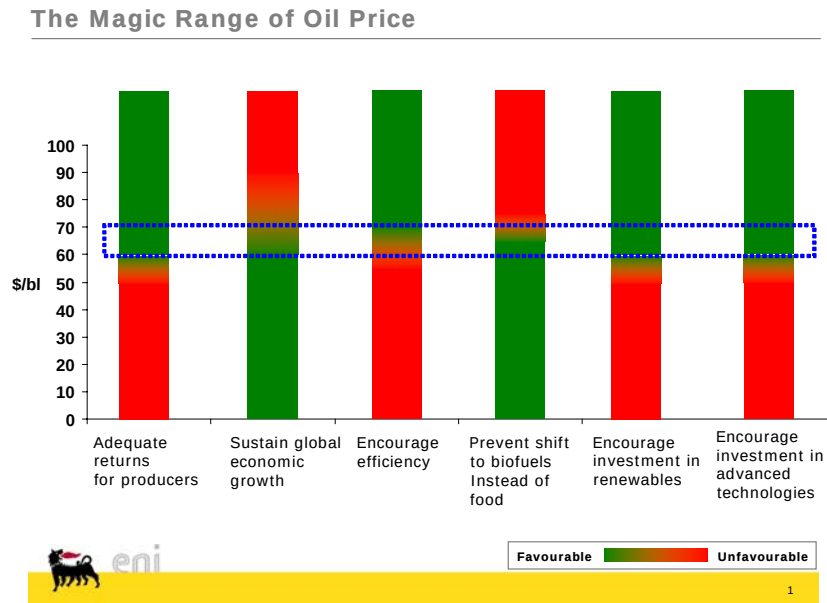
Oil Price Behaviour and the future of Energy

1. Importance of the oil price

Whatever energy future we have in mind, it will be strictly dependent on oil prices. In fact, the price oil doesn't impact only consumers and economies in general, but also affects the future of all other sources.

- Only in a reasonably **high oil price** environment there is room for development of energy of all types. Yet, we can not cheer to expensive oil, as it undermines economic growth and thus weaken consumers' capability of paying for more expensive energy bills. This implies that it's much more difficult in times of an economic crisis to burden those bills with environmental or climate taxes.
- **Low oil prices** are worst enemies of research, especially in low-carbon or carbon-free alternative energy sources. Whenever oil prices sink, development projects of alternative energy sources (including nuclear and renewables) become uncompetitive and vanish consequently. Actually, you have very catching examples of this uncomfortable truth in our days, with so many planned or announced investments in research, technology, and carbon-free renewables, that are going to be slashed – or that have already been slashed – in every part of the world. Moreover, low oil prices are strongest enablers of unacceptable energy consumption habits, those that have led all of use to waste energy in our daily life.
- Even worse is the **high degree of uncertainty** in medium- to long-term price per barrel as well as its instability, which might, at some point, upset the entire energy system, creating a sort of energy paralysis; blocking investments both in traditional and in alternative sources. An extreme volatility of oil prices renders long-term investments decisions for energy planners too much difficult to take.

- The price of petroleum must be the result of a complex and very delicate equation, which takes into account at least six fundamental elements, some in conflict with others.



- **The price must ensure adequate returns on investments for producers.** Taking into account the marginal projects, we believe the price should **not be lower than \$60**.
- **The price should not be too high, to avoid harming economic growth.** The experience of the last price cycle demonstrated that in order to ensure steady economic growth, the price should **not rise higher than \$75 per barrel**.
- **The price should be high enough to encourage a rational and efficient use of energy.** During low-price periods, all of us are induced to waste energy irresponsibly. To avoid this behaviour, the price should **not be lower than \$70 per barrel**.
- **The price should be low enough that bio-fuel production doesn't displace agricultural activity.** To keep away from this, it should **not exceed \$70 per barrel**.
- **The price should be high enough to spur the research and the development in alternative energy sources.** For this to happen, it should **not be lower than \$60 per barrel**.

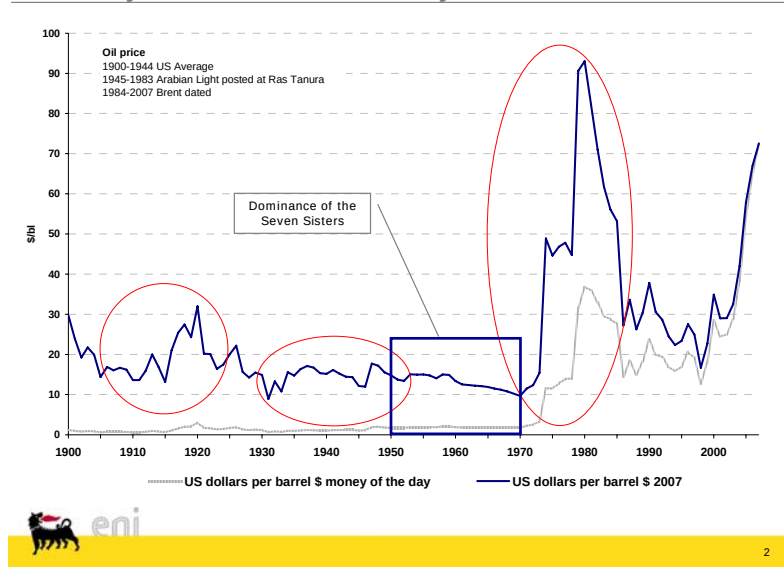
- **The price should be high enough to promote investments in new oil production technologies.** I refer most of all to those aimed at enhancing oil recovery and reducing the environmental footprint. In this case, the price should be **no lower than \$60 per barrel.**
- Considering all these issues, \$ 60-70 per barrel could be the “magic range” of the reasonable price. Of course, keeping prices within this range is neither an easy nor an immediate task.

2. Boom & Bust Cycles

Actually, understanding, forecasting and controlling the price of oil has always been impossible.

- The history of petroleum has always been cursed by cycles of boom-and-bust, with long stretches of falling prices and sudden, uncontrollable rebounds.

The oil cycles in the XXth century

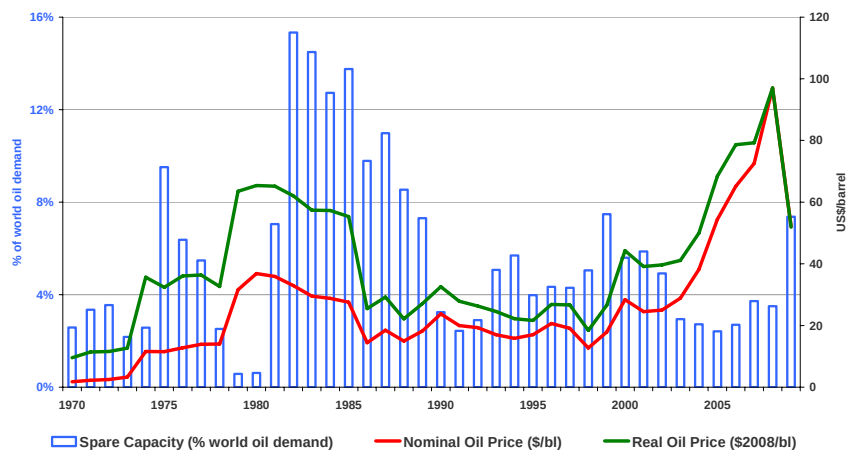


- Naturally, at different times, it has inspired **attempts to control fluctuations** through monopolies (Rockefeller's Standard Oil) or oligopolies (the Seven Sisters) or organizations (OPEC).
- The question remains, why is the price of oil subject to such extreme and unpredictable variations?
- There is an ironclad law in economics: if production of a commodity remains greater than its consumption for very long, the price of that

commodity will stay low until production capacity is resized. By means of cuts, closings and non-development, excess production capacity was reabsorbed, perhaps too much.

- In the petroleum sector, this drastic thinning of production capacity compared to demand was accompanied by another decisive phenomenon: the near-cancellation of all unused production capacity, the so-called “spare capacity.” This is where the problems began.
- In my opinion, the amount of **expected spare capacity** is the single most important element for understanding the cycles of oil prices.

The oil price volatility is linked to the level of effective spare production capacity



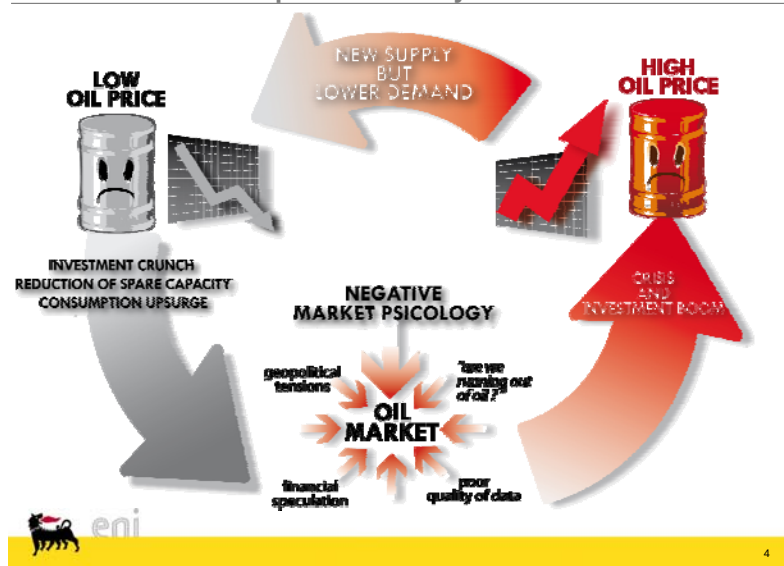
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- Spare capacity provides the safety cushion to face unexpected supply crises. Essentially it is the amount of available supply that can be activated when petroleum supplies are partially interrupted for political or natural reasons.
- Historical evidence indicates that spare capacity of less than 4% of world consumption can trigger a dramatic increase in prices. On the other and, spare capacity between 5% and 6% of world demand can provide a cushion capable of keeping prices under control. Finally, actual spare capacity greater than 6% can cause a rapid drop in prices, especially when demand is stagnant.
- The importance of a petroleum safety valve like spare capacity can be better understood by remembering that increasing the supply of

petroleum is not like increasing the supply of shoes or T-shirts. Discovering and developing a large deposit to bring it into production can take 8 to 12 years.

- When the demand for many basic goods took off again, dragged along mainly by emerging countries (China, India), production potential appeared too limited to meet it. As happens in any market that works, the prices of those goods began to rise tumultuously. In some cases, prices rose even without a particularly strong demand.
- This rise in prices fosters a new cycle of investment, from which new production will flow. However, that takes time. Besides, by the time that the new production arrives at the market, petroleum demand may have dropped, precisely because of the high prices of the previous years.
- This vicious cycle has been a feature of all oil crises of the past. It begins with a drastic reduction in spare capacity and ends with a petroleum overproduction crisis.

Vicious circle of oil price volatility



- In addition to market fundamentals – demand, supply, and stocks – to be considered are **market expectations**.
- Consider the example of **current market situation**. Limiting ourselves only to current market fundamentals – decreasing demand, abundant spare production capacity – the market should attain respectively low

prices per barrel, at around 50 dollars. However, today we still observe oil prices as high as 70 \$/bl.

- Mood of the market is influenced by the common fiction for the following years of a **sudden rise in oil demand**, as fast as the pre-crisis period, and of a **production crunch** – due to current delays and cancellations in projects – that follows the doomsayers’ theory of “peak oil”.
- The market believes that the availability of petroleum is about to drop and that spare capacity will not be able to rise. So, when oil demand starts to grow, crude oil prices will begin to rise without stopping.

3. The “uncommon” view

In my opinion, in the most likely future the oil demand will increase slower than the pre-crisis period and the supply will not be scarce.

- Why the common scenario could not necessarily be true? Probably because most of the analysts are trapped by following assumptions:
 - *Future economic and demographic growth will translate into a strong increase in oil demand.*
 - *Present and past statistics can be used to extrapolate future growth rates in demand on a straight line.*
 - *Petroleum reserves are limited, so sooner or later crude oil supplies will no longer be able to keep pace with demand.*

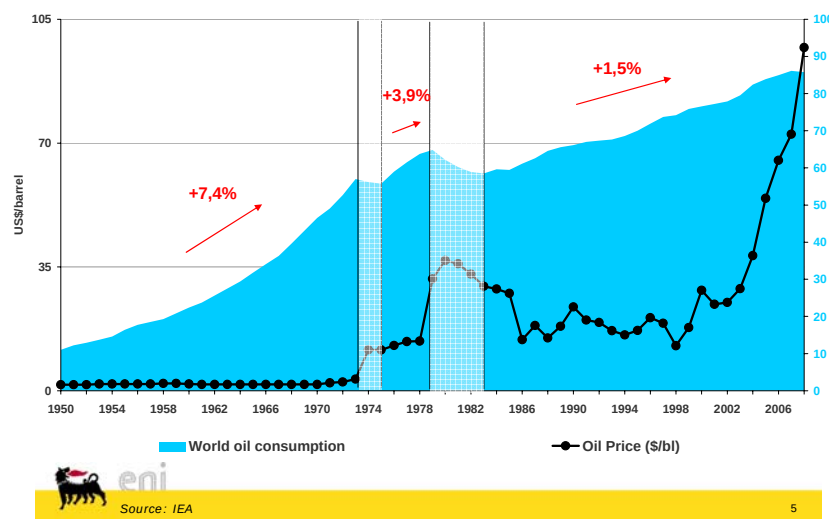
The traps in such an approach can be summarized thus:

- *Technology and energy efficiency have constantly reduced the ratio between economic growth and the growth in the demand for oil. In particular, each oil crisis has led to a jump in efficiency that has reduced the specific consumption of petroleum for each dollar of wealth created.*
- *The statistics of the past tell us nothing about future technology or efficiency improvements. Therefore, it is deceiving to extrapolate the future based on those statistics.*
- *Finally, as we have seen, no one knows the limits of petroleum reserves, but we do know that what is available is more than abundant.*

The future cannot be projected based on linear models, in which only demand rises while supply falls. This is the most common mistake that these forecasters have always made. They will probably continue to make it.

- Certainly, the **future demand for petroleum** will depend on the level of global economic growth, particularly in emerging countries. However, we have to avoid making the mistake of thinking that after the storm passes everything will go back to the way it was.
- History has shown us that industrial societies and emerging countries tend to introduce structural changes following an energy crisis, modifying their own consumption model and improving efficiency in the use of energy.

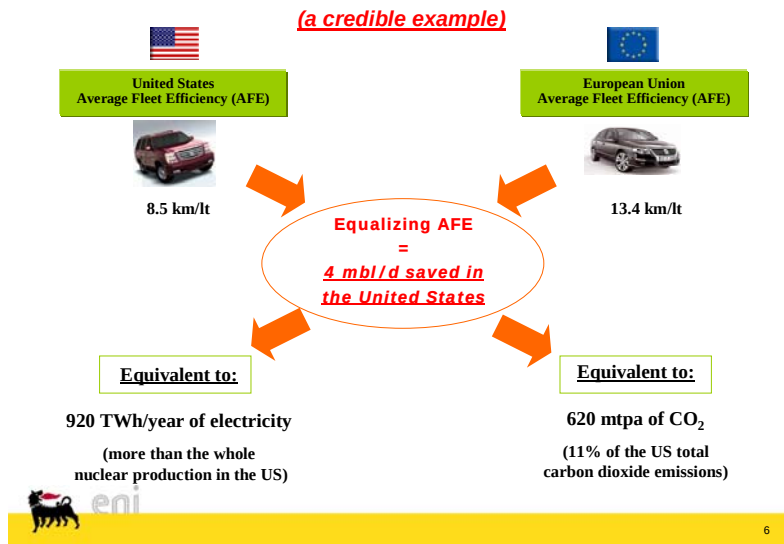
Each oil crisis has led to a jump in efficiency that has reduced the specific consumption of petroleum



- Pro capita consumption of petroleum and its impact on wealth formation in the industrialized countries is much lower today than in the 70s and Europe, Japan and Australia recorded a peak in petroleum consumption during the 90s.
- The most inefficient energy consumer in the developed world is the United States where the demand for petroleum has increased constantly from 1984 until today. Before the financial-economic crisis, each American citizen consumed about 26 barrels of petroleum per year, compared to 12 barrels for a Western European resident.

- Even the United States could experiment a reduction in consumption depending on the severity of the politics undertaken by the Obama administration. With a serious program for energy efficiency, it is realistic to expect that within 10 years US could reduce its own consumption by 4 mbd, equal to the total current production of Iran.

Energy efficiency meets Climate solutions

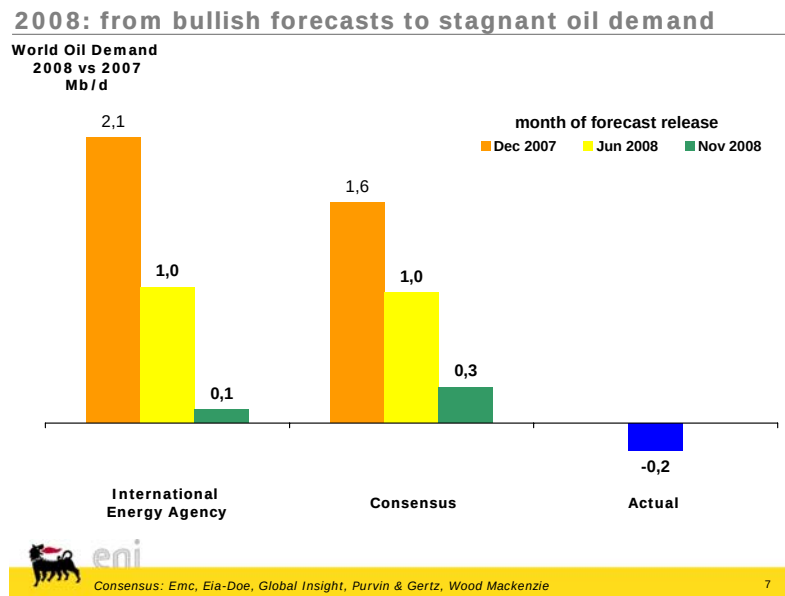


- At the same time, the European Policy on Energy (EPE), established at last in December 2008, could further cut European petroleum consumption in Europe, which was already diminishing.
- The demand for oil will continue to grow only in developing countries, starting with China and India. We need to understand how these countries and others like them can improve their energy efficiency, "generating" more energy by consuming it more effectively.

Considering all these elements, I would not be surprised to see an increase in global demand for petroleum that is much more contained than what we expect today, once we get past the current world economic crisis.

- Oil industry today lacks **complete and reliable data** on global production and consumption. This is one of the issues which make it so difficult to forecast oil-price trends. It also encourages speculation – the millions of paper barrels traded every day which magnify the underlying volatility.
- Beginning in 2005, the International Energy Agency routinely overestimated world demand for petroleum, creating a conviction that oil

production could not keep pace with consumption. By itself, such an outlook would explain a continuous rise in the price of crude oil. This does not mean that the IEA is the only one responsible for bad predictions. During the same period, almost everybody was wrong, and all in the same direction.



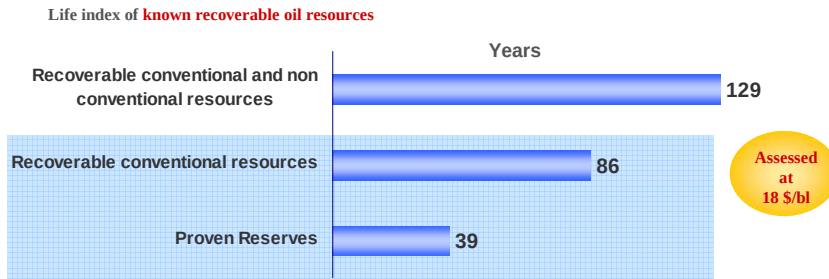
- Because of this, after 2004 the market was convinced that the world was living with a **demand shock** that would send prices sky-high. In reality, between 2001 and 2007, world demand for petroleum grew by a modest average annual rate of 1.7%, barely higher than the rate for the period 1991-2000 (1.4%), which was generally considered a decade of “sluggish demand.”
- The average rate of the increase in demand during this period was distorted by two specific years, 2003 and 2004. In 2003, the growth rate was 2.1% (equal to 1.6 million barrels per day [mbd]). In 2004, demand reached a peak of 3.7% (about 3 mbd), the highest annual increase since the 1970s. This was the only real year of "demand shock" recorded during the period in question.
- The higher demand, especially after 2003, was in part a reflection of strong global economic growth after many years of relative stagnation, but it was also influenced by two factors: the easy credit, which financial crisis demonstrated to be unsustainable, and the governmental subsidies on energy prices in many developing countries, encouraging consumption.

- At the same time, except for 2007, oil production increased in absolute terms faster than demand.

*Therefore, it is inappropriate to describe the crisis of the early 21st century as demand-driven. Rather, it was driven by **mistaken expectations about demand trends**.*

- The idea of **the end of petroleum** has accompanied the development of the modern petroleum industry, making its mark in some historic phases. It is good to remember that each phase in which this fear has re-emerged has coincided with a more or less pronounced oil crisis.
- Unfortunately, no one seems to remember the past (mistaken) predictions of the prophets of Peak Oil. For example, their principal exponent in our days, Colin Campbell, has revised his estimates of ultimate recoverable resources several times (in 1989, 1990, 1995, 1996 and 2002), always upward. When his predictions proved wrong, Campbell simply moved the peak point farther out in time. According to Campbell, the first oil peak should have happened in 1989. When the peak did not happen, Campbell then tried to move it to at least four different dates, always wrong.
- Unfortunately for the peak oil theorists, the subsoil of our planet remains a rather unknown universe. Even today, we still do not know how much oil there is under the earth. We can only hazard vague estimates. If we do not know the total amount of oil, we cannot determine future production trends. Therefore, predictions about the end of petroleum are completely unreliable.
- Currently the most important sources estimate total proven reserves of petroleum worldwide to be about 1.2 trillion barrels, enough to satisfy current consumption needs for 39 years. Adding the 1.4 trillion barrels of recoverable reserves extends the limit to 86 years. The figures on recoverable resources are based on a long-term oil price of \$18 per barrel. This underestimates their actual total, because it excludes resources that cost more to produce.
- In addition to familiar petroleum, there are the so-called "unconventional oils," such as ultra-heavy oils, tar sands and shale oils, which the USGC estimates total 8 trillion barrels, of which only 1.3 trillion barrels are recoverable.

Waiting for “Peak Oil”, but it never comes



Other factors in evaluating the resource stock:

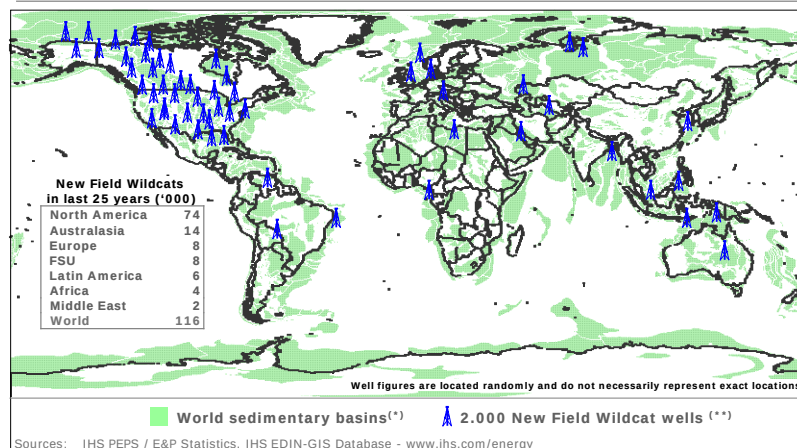
- Only one third of the world's sedimentary basins – those which may contain hydrocarbons – has been properly explored
- Exploration mainly focused in the United States (about 15,000 wells drilled in the last decade vs less than 100 in Middle East in the same period)
- On average no more than 35 percent of the oil in known oil fields worldwide can be recovered with the existing technologies



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- Furthermore, vast areas of the planet have yet to be explored in depth. As of today, only one third of the sedimentary basins of the world (which could potentially contain petroleum) have been properly explored. In addition, petroleum exploration has involved mainly the United States.

Little is known about the world's underground oil resources



(*) Basins: sedimentary depositions characterized by similar tectonic structures, petrography and geological history, in which such features differ significantly from those found in adjacent areas
 (**) New Field Wildcat: Exploration well drilled in a new area with unknown producing potential



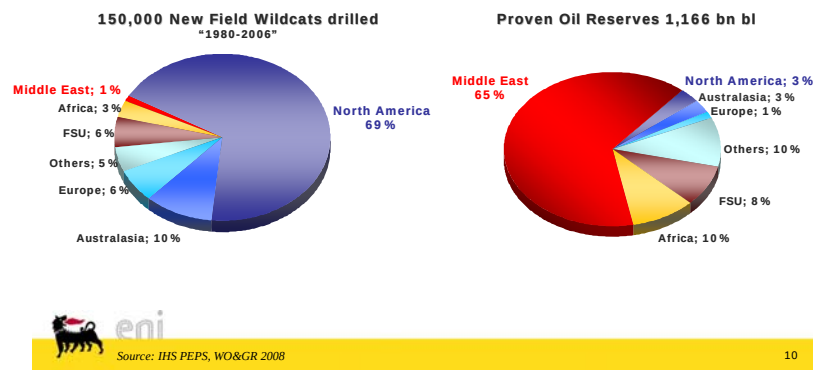
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- A few numbers can provide a snapshot of this relatively unknown phenomenon. Between 1980 and 2006, about 70% of the exploratory activity worldwide took place in the United States and Canada, mature areas that contain only about 3% of the proven world reserves of crude oil. On the other hand, the Middle East was involved in barely 1% of the

oil exploration, although it holds more than 65% of the proven reserves of crude oil. Exploratory activity is based on the number of new wildcats (exploratory wells) drilled during a given period.

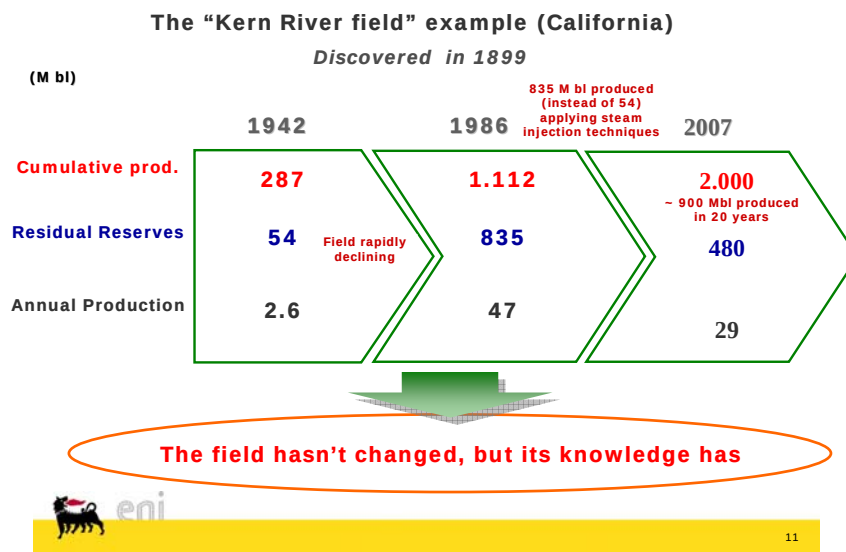
Only exploration and appraisal activities will help to understand the inner secrets of oil

- Since the 80s, almost 70% of worldwide exploration in North America (less than 3% of total proven reserves) whilst only 1% in Middle East, which holds about 65% of world proven reserves



- To complicate the picture, only one part of the known world reserves of black gold is being exploited. On average, no more than 35% of the oil in the known deposits of the world can be recovered with existing technology. This means that most of the crude oil already discovered remains trapped in its underground prison. In the past, the recovery rate was very low. For example, in 1980 it hovered around 20%.
- The use of **advanced technology** has revitalized petroleum basins that were previously considered headed for exhaustion. The petroleum literature is full of cases of "rebirth." One of the most impressive is the **Kern River field** in California, discovered in 1899. Initially, it was thought that only 10% of its heavy, viscous crude oil could be recovered. In 1942, after more than four decades of modest production, it was estimated that the deposits still contained 54 million barrels of recoverable petroleum. As Morris Adelman pointed out in 1995, "Over the next 44 years, it produced not 54 million barrels but 736 million barrels and sit till had 970 million barrels remaining." This estimate was also wrong. In November 2007, the American oil giant Chevron announced that total accumulated production had reached 2 billion barrels. Currently, the Kern River is still producing more than 80,000 barrels per day, and Chevron calculates that remaining reserves total 480 billion barrels.

Reserves increase with knowledge



These numbers indicate an important fact. As little as we know it today, worldwide petroleum resources are enormous, and proven reserves are only a small fraction of the overall total.

4. The Energy Paralysis can be prevented: the Blueprint

Oil market stability at a reasonable price is essential for sustainable development.

- Our sector is no stranger to cycles. But the turbulence we have experienced - with oil doubling in the 9 months to July 2008 and then losing two thirds of its value in the following 6 months – is unprecedented. This level of instability is something we cannot afford because it could well determine a sort of “energy paralysis”, where investments are scaled back across the board.
- Given this perspective, options for containing the volatility of crude oil prices to a "magic band" are few and difficult to realize. However, if we give up from the start on considering the problem and looking for ways to reduce oil price instability and unpredictability, many of the energy and environmental policy objectives that Governments are discussing today risk being no more than wishful thinking.

- Regulating the world’s biggest commodity market, where everyone has a vested interest in the price, is no easy task. But even a thousand mile journey has to start with a single step.
- So, in the past few months eni has developed a few ideas on ways to stabilise oil prices – ideas which we have collected in our “Blueprint for Oil-Price Stabilisation”. We presented these ideas in detail at the G8 meeting in Rome last month, in hopes of sparking off a lively and constructive debate in the industry.
- In brief, the Blueprint suggests creating a Global Energy Agency – which could develop from existing institutions such as the International Energy Forum – to ensure the collection and publication of timely and reliable global data. Such Agency could actually be the right answer to spot the most effective methodology to stabilize oil price; at a second stage it would also manage it.

The Mission of the Global Energy Agency

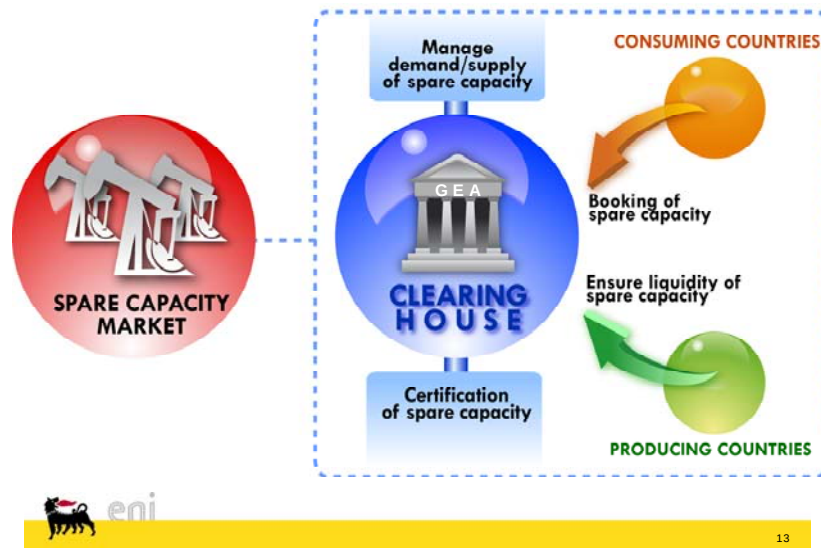


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- The Blueprint proposes mechanisms to smooth out the highs and lows of the cycle – such as a spare capacity market to remunerate investments in unused but available capacity (crucial to consumers, currently pointless for producers) and a global stabilisation fund to ensure a revenue floor for producers.
- The basic idea borrows from the Electric sector the management of spare productive capacity system through a specific unused capacity booking exchange, the Spare Capacity Market. This tool gives incentives to

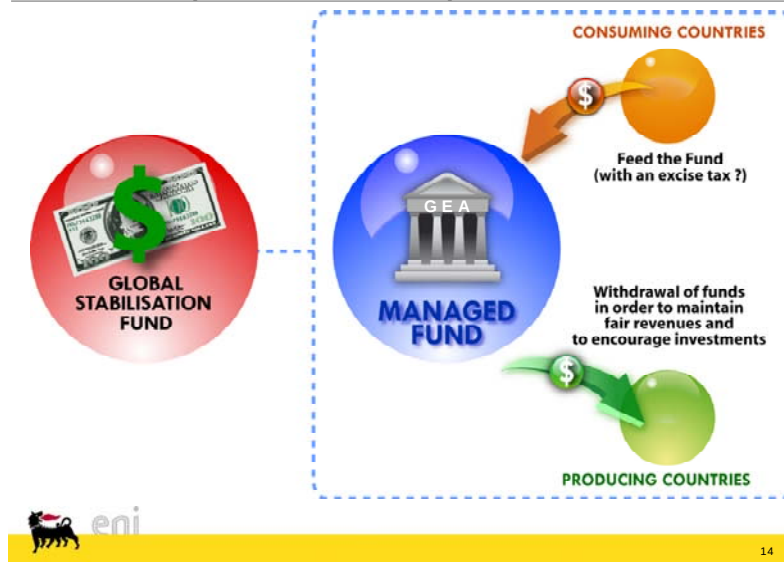
producers to maintain an adequate level of *spare capacity* production (certified by GEA), hindering sudden price spikes.

An adequate spare capacity level prevents high oil prices



- However, if prices were to plunge too suddenly, another mechanism would kick in: the Global Stabilization Fund (that would always be managed by the Global Agency) with the purpose of ensuring a minimum level of revenue to the producers.

When the oil price falls below a predetermined floor ...



- An additional tool might be a globally coordinated management of the oil and finished product spare capacity providing timely answers to emergency situation.

- With the new model we are supporting a new course of substantial co-operation among producer and consumer countries. That's because whatever smoothing mechanisms the world might eventually opt for, they will need to be underpinned by a broad consensus on objectives, and a wide collaboration on the means to achieve them.

A solid foundation of trust and cooperation between all industry players is essential to achieving the common goal of price stability. A stability that wouldn't just be in the interest of the oil industry but would also be crucial for the global economy.