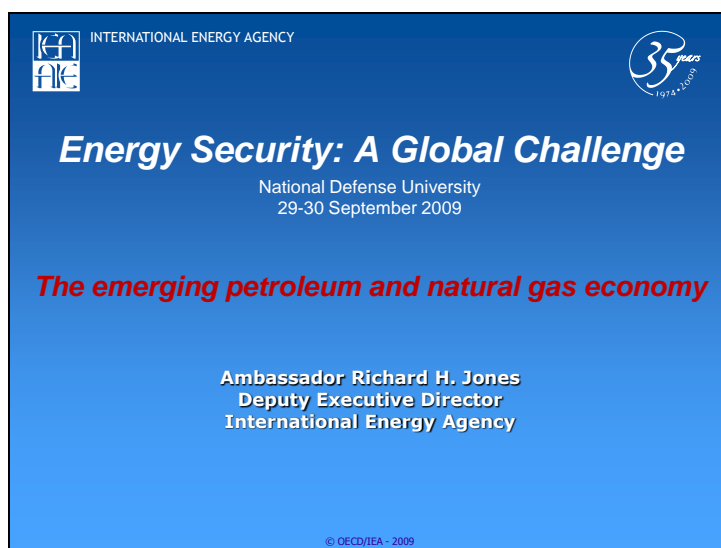


Slide 1



Distinguished guests, ladies and gentlemen, it is an honour for me to address you this morning at the National Defence University.

I thank the Institute for National Strategic Studies for organising this event.

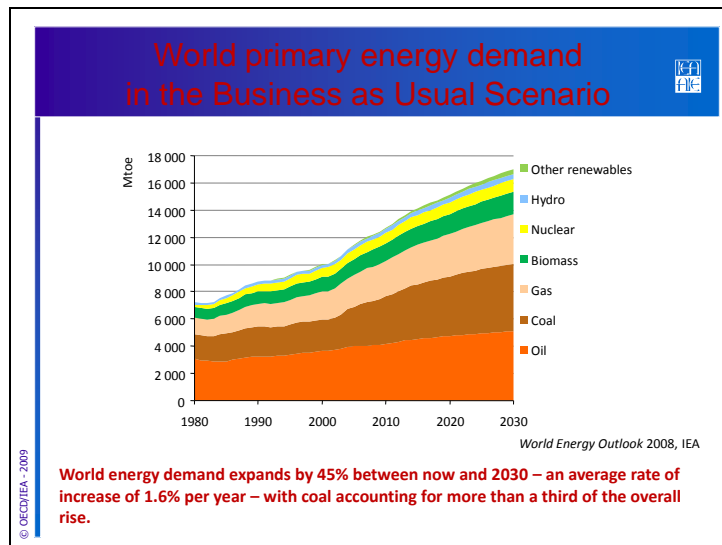
Before I get started, please allow me to introduce the International Energy Agency to those in the audience who may be unfamiliar with the Agency. The IEA acts as energy policy advisor to 28 developed Member Countries in their efforts to ensure reliable, affordable and clean energy for their citizens.

It was founded by members of the OECD during the oil crisis of 1973-74. The IEA's initial role was to co-ordinate measures in times of oil supply emergencies, like Hurricanes Katrina and Rita. The IEA's member countries are required to hold oil stocks equal to 90 days of net imports, which they may be required to draw upon if there is a supply emergency.

But as energy markets have changed, so has the IEA: its mandate has now broadened to cover the 'three Es' of balanced energy policy making - Energy security, Economic Development and Environmental Sustainability. We also practice a fourth "E": Engagement worldwide.

So, with this brief introduction, let us now turn to the topic that I've been asked to address today.

The emerging petroleum and natural gas economy



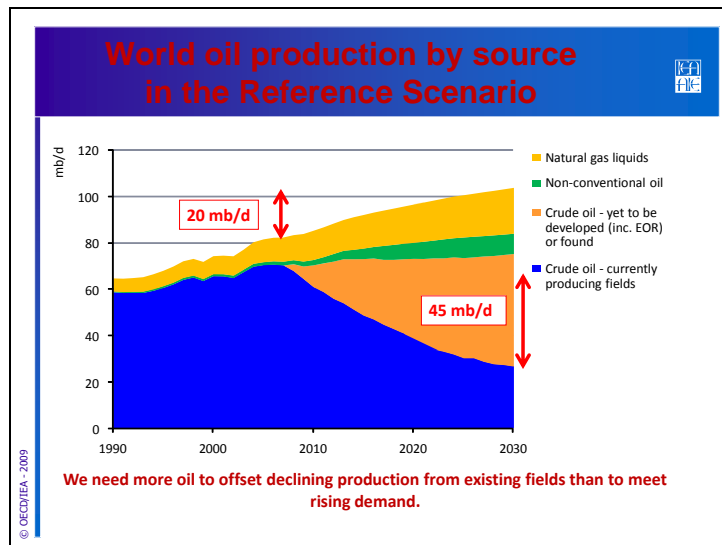
Let me start with world energy demand.

This graph shows world primary energy demand to 2030 in the 'business as usual' scenario, as published in the IEA's *World Energy Outlook 2008*.

The analysis for this scenario was undertaken before the full scope of the current financial economic crisis was known so don't worry too much about the absolute numbers, which will soon be revised. However, the general trends are unlikely to change significantly. The graph shows primary energy demand growing by 45% from 2006 to 2030; with an average annual growth rate of 1.6%. This is based on an average annual economic growth assumption of 3.3% worldwide.

Non-OECD countries will account for 87% of global energy demand growth.

Fossil fuels will account for around 80% of the overall increase in energy demand between now and 2030, with coal solidifying its position as the second most important energy source after oil. These developments are primarily the result of rapid growth in the use of coal in China and India.



How are we going to produce all the energy that this scenario suggests we will need to keep the world economy growing? Let's take a look at World oil production by source. This chart shows that energy security is not only about finding oil to meet growing oil demand.

The light orange section of the slide shows that – in our 'business as usual scenario' - we must also invest to offset declining production from current fields.

The red arrows on the graph highlight that - because of declining production in mature fields – the gross additions needed to maintain existing production levels to 2030 (45 mb/d) will far exceed the net additions needed to meet demand growth (20 mb/d).

In other words, just to keep the current level of production, we will need gross additions of **five times the current production of Saudi Arabia**. If we are to also meet increasing demand, we will need gross additions of **seven times the current production of Saudi Arabia**.

In fact, by 2030, two-thirds of world oil production will come from new fields that are either awaiting development today or are yet to be found.

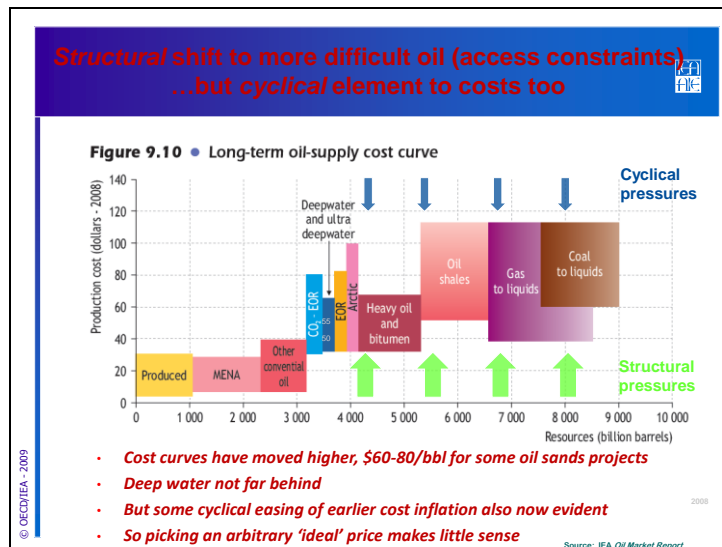
This is enormous challenge, one that most of us feel is impossible.



You hear a lot about peak oil these days. Is that what I'm talking about? Well, the term "peak oil" as commonly understood refers to a point in time at which physical resource constraints signal the imminent and irreversible decline of global oil production. Traditionally, this has been estimated to occur at the point at which around 50% of the recoverable resource base has already been produced. That has not yet happened. So, the IEA does not believe that physical scarcity will be a global issue anytime soon. In fact, most geological studies show oil resources to be plentiful, but the question is: will they be developed? To answer such a question, one needs to consider the prices, technology, infrastructure availability and fiscal and regulatory regime needed to bring new supplies to market.

With a shift towards growing reliance on National Oil Companies, a trend towards greater resource nationalism, and a backdrop of increasingly difficult, remote and costly oil developments for the foreseeable future, it does seem plausible that oil capacity **expansion could lag the growth in demand** once the global economy recovers

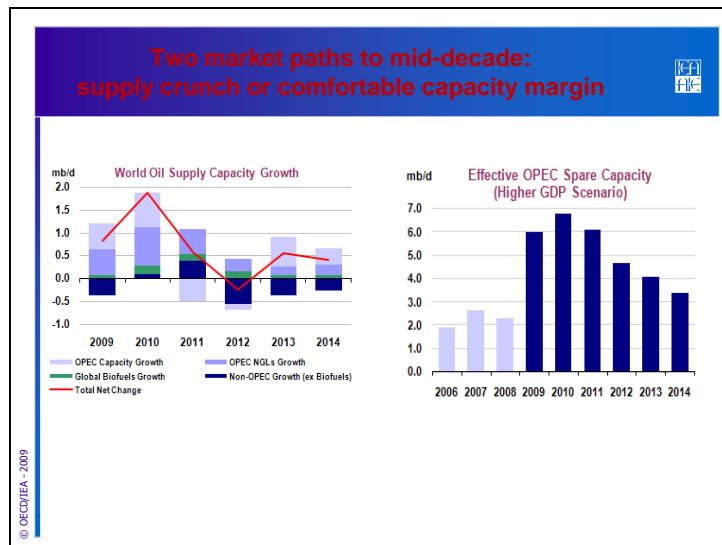
However, it seems to us that above-ground factors will place a tighter constraint on supply growth than below ground depletion for the foreseeable future.



So, I'm arguing that we have ample resources, but we may fail to bring them to market.

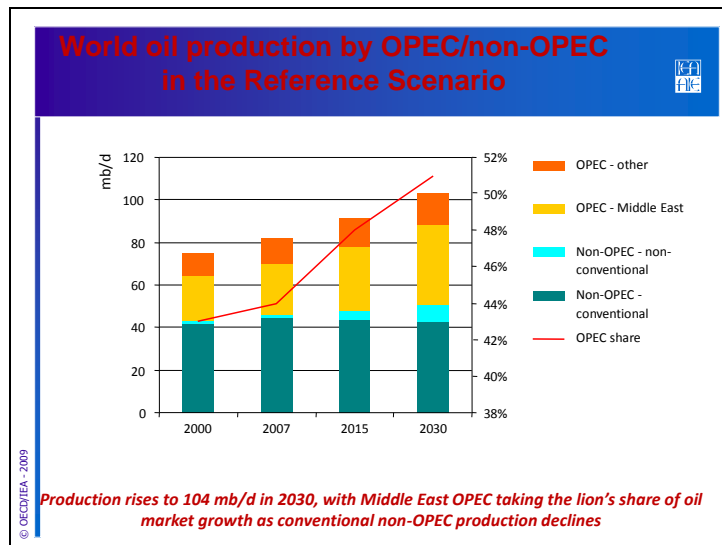
Why? Many say that current prices are insufficient to justify new investments in difficult or remote oil. However, there are reserves in resource-rich regions that can still be developed at \$50/bbl. In addition, some of the intense cyclical pressures driving cost inflation in recent years have begun to ease as demand growth has weakened.

On the other hand, opportunity constraints are real. Spending cuts and project delays intensified this year, despite easing cost pressures. And, international companies today are relying on more capital-intensive development projects (such as ultra-deepwater wells) which need higher prices to proceed. Of course, as demand recovers, prices will likely rise gradually in response.



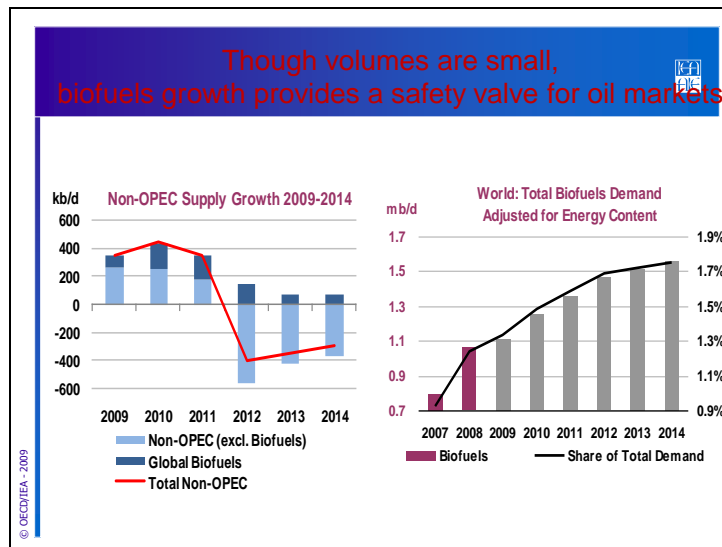
This slide is from our June MTOMR. It shows that oil supply growth now looks anemic post-2010. However, whether we see a supply crunch mid-decade depends on economic trends and efficiency. Here we see the impact of two different growth assumptions on future spare capacity. Consumer and government choices can also affect future spare capacity. By the way, if we experience annual efficiency gains of 3.2% (instead of an assumed 2.4%), we could replicate the lower demand case, and higher spare capacity, even under the higher GDP scenario

Slide 7



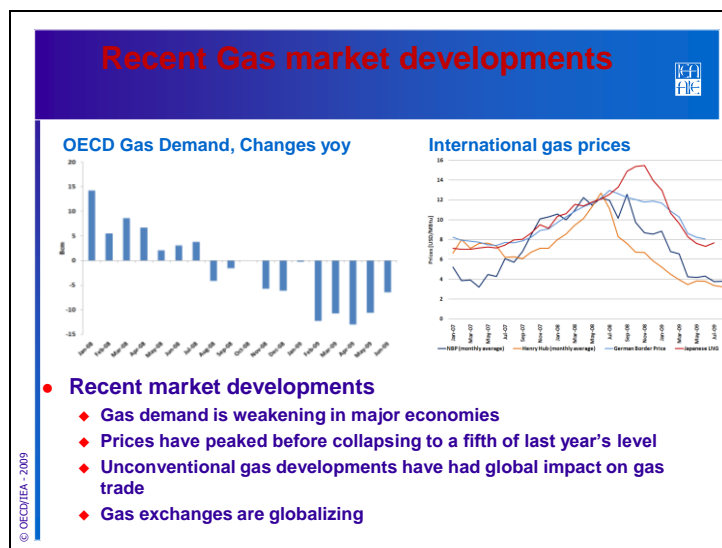
Net of processing gains, this slide shows that world oil production is projected to rise from 82 mb/d in 2007 to 104 mb/d in 2030 in the Reference Scenario.

The slide also shows that the bulk of the increase in world oil output is expected to come from OPEC countries, mainly in the Middle East. Their collective share rises from 44% in 2007 to 51% in 2030 [CLICK TO REVEAL LINE]. Their reserves are large enough (and development costs low enough) for output to grow even faster than this, but in practice investment by these countries is constrained by several factors, including conservative depletion policies and geopolitics. In other words, we see more oil coming from fewer places, possibly with less investment. It's no wonder that many don't find our reference scenario compelling.



Biofuels is another topic in the news. This slide is also from the IEA's Medium Term OMR of June 2009. It shows that 120 kb/d annual output growth in biofuels from 2008-2014 will partially offsetting sluggish non-OPEC growth in oil production.

As a result, new biofuels production should satisfy, on an energy content basis around 15% of gasoline and gasoil demand growth over the next five years. That sounds like a lot, but growth is so gradual that biofuels as an absolute component of global oil demand remain small, only reaching about 1.7% of consumption on an energy equivalent basis by 2014.



Another major fuel is natural gas. Let's have a look at what that market has been through over the past two years. Like oil, up to mid 2008, increasing gas **prices hit record levels**. The **global gas supply and demand balance was relatively tight**, and there were fears that a lack of investment in the upstream could lead to an even tighter market.

The economic crisis and financial crisis changed all of this: **demand has been weak, spot prices are low, and gas is now in oversupply, at least in some regions**

The graphic on the left shows that gas demand in OECD countries was still increasing quite strongly up to mid 2008, but started declining in August 2008. In 2009 gas demand in **OECD countries declined by 6.5% over the first six months** compared to the same period in 2008. This represents **50 bcm**, slightly more than Argentina's annual gas demand. January demand was high but this was essentially due to cold weather in Europe and North America. Although figures for June gas demand seem to show a relatively slower decline than the previous months, it is still early to say that demand recovery has begun.

The economic crisis is also affecting demand for gas in many non-OECD countries. Gas supply to Russian consumers fell 6% year-on-year over the first 6 months. However we still see growth in China or India. In total, we expect the **world gas demand** to decline by around 3 to 4% in 2009 – around **100 bcm in absolute terms**, with the decline more pronounced in OECD countries - around 5% compared to a 1% decline in non OECD countries. We also anticipate that global electricity demand will fall for the first time since 1945.

In the United States, by contrast, while industrial gas demand plummeted by nearly 13%, gas demand in the power sector actually increased even as power demand fell by nearly 5%, so the total fall in gas use was muted to only just over 4%. Can you guess why US demand for

gas increased? I'll tell you the answer in a moment. The main victims of this surprising increase in US gas demand have been coal fired plants whose generation has declined by 13%. (producing a BIG improvement in US greenhouse outcomes).

A primary reason for the different performance of different markets is of course **the different price regimes and hence their marked differences in actual price outcomes.**

International gas prices have been declining from 13-15 \$/Mbtu last year but at different speeds depending on the regions so that they are now at quite different levels.

On the graphic on the right, we can distinguish two groups of prices.

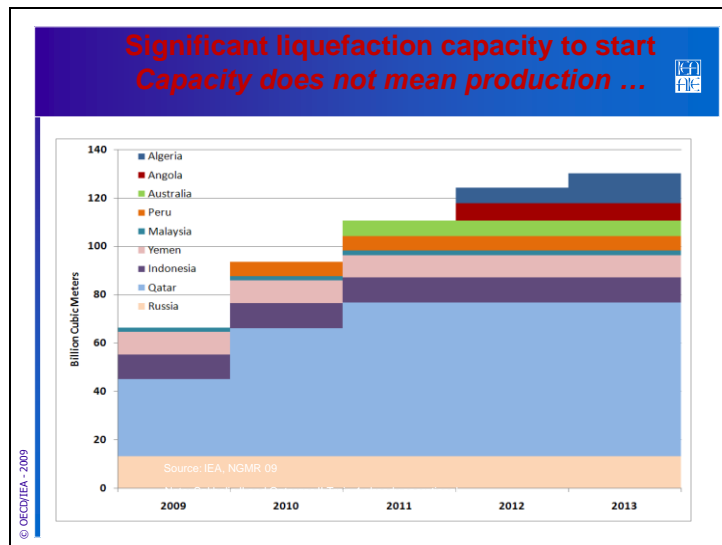
The highest ones are the contract oil-linked prices – the border prices in Japan and Germany.

The lowest ones are the spot prices in the US and the UK. Henry Hub gas prices fell well below \$3MMBtu early September, levels that they had not seen since 2002. Oil-linked gas prices have been declining as well although with a lag and far less than spot prices. This is why US demand for gas increased while demand in Europe fell.

There are 2 remarkable observations that I want to highlight:

Oil linked gas prices have been twice as high as spot prices. With oil-linked gas prices expected to increase over the coming months, incorporating rising prices seen since February, this gap may become even wider. This is likely to have consequences on the European gas markets in particular. European buyers will prefer to import cheaper spot gas but are de facto limited by their take or pay obligations. In particular will the UK may become an entry point for cheaper LNG to the European markets.

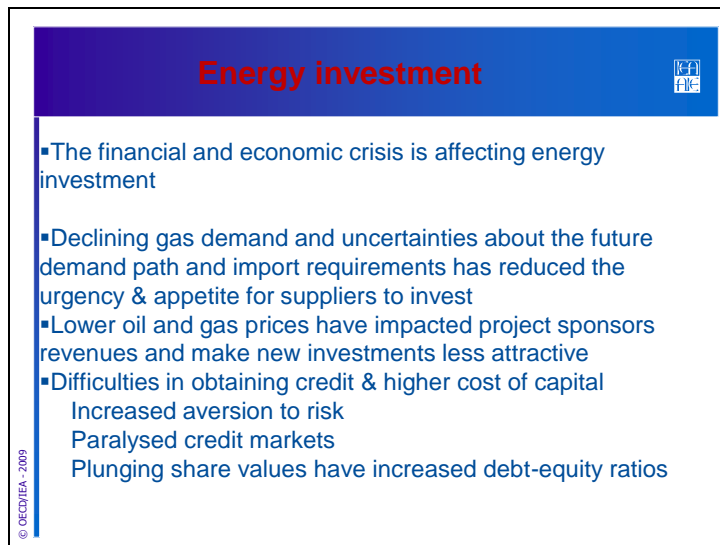
2) It has not escaped such an attentive audience that the two lines representing spot prices are parallel and indeed **spot prices have been converging over the past 6 months.** This price convergence is a direct consequence of major changes happening on the supply side. Unconventional gas developments in the US have completely changed the supply picture and have dramatically lessened the LNG imports requirements of the United States. LNG that would otherwise have gone to North America has been freed up to find higher value markets, if they are available.



The last gas market development I want to mention is the globalization of gas markets: we have seen an increase of LNG exchanges between the Atlantic and the Pacific over the past years. Furthermore, LNG capacity will increase by 50% between early 2009 and 2013. New players are appearing on the supplier side: Russia with Sakhalin, Yemen, and next year Peru. Also new countries have started or will start importing LNG like Canada, Kuwait, and the Netherlands.

But looking ahead new challenges are appearing for gas investment.

In the near term, there is likely be surplus on global gas markets. As this slide indicates, we have around 100 bcm of liquefaction capacity coming on line by 2013 plus the startling growth in US unconventional gas production combined with weaker demand in OECD markets. There's no question that this combination: low spot prices combined with uncertainties on future demand requirements in the traditional importing regions of Europe and North America, will act as a deadweight on investment activity in this field.

A presentation slide titled "Energy investment" in red text on a blue background. The slide contains a bulleted list of factors affecting energy investment. A small logo is in the top right corner, and a vertical copyright notice "© OECD/IEA - 2009" is on the left side.

Energy investment

- The financial and economic crisis is affecting energy investment
- Declining gas demand and uncertainties about the future demand path and import requirements has reduced the urgency & appetite for suppliers to invest
- Lower oil and gas prices have impacted project sponsors revenues and make new investments less attractive
- Difficulties in obtaining credit & higher cost of capital
 - Increased aversion to risk
 - Paralysed credit markets
 - Plunging share values have increased debt-equity ratios

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The financial and economic crisis has impacted future investments in several ways.

1. Uncertainties about future energy demand have increased. US domestic production had been expected to decline this decade and this had triggered the construction of many regasification terminals in the United States. Today, the US has more than 120 bcm of regasification capacity. This compares to US imports of 9 bcm last year. Thanks largely to the development of unconventional shale gas, last year's US production increased by 40 bcm, to a level 50-60 bcm higher than could have been expected a few years ago, equivalent to more than 1 million barrels a day oil.

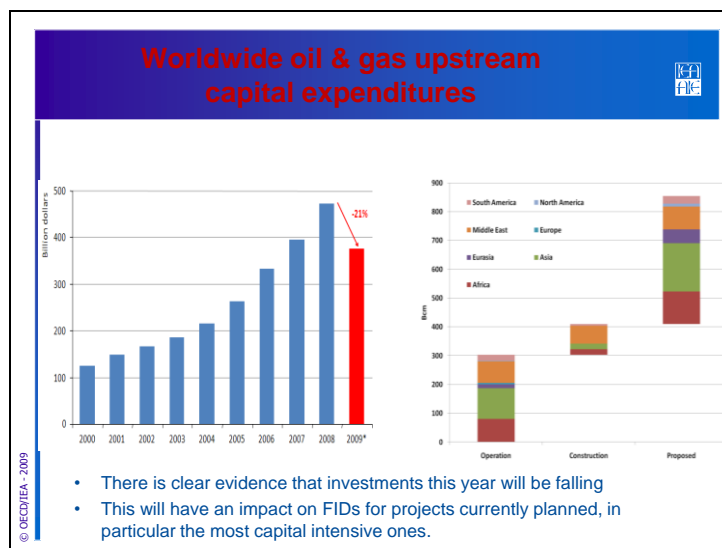
Tremendous technological progress has also led to falling costs. It was common wisdom that 6-8 \$/Mbtu was necessary to produce unconventional gas, now these costs have fallen by up to \$3.

2. Lower oil and gas prices are affecting producers' revenues, reducing their capacity to invest and forcing them to choose the least risky projects. They also make new investments less attractive, as costs are still relatively high. Although the Upstream Capital Costs Index (UCCI), fell 8.5 percent between the third quarter of 2008 and first quarter of 2009, it remains almost twice as high as the 2002-2005 levels.

As I noted earlier, gas prices in the United States in early September reached levels that have not been seen since 2002. The weakness of gas prices both in the US and the UK and the gap between them and the oil-linked gas prices is causing European consumers to question the oil linkage, which may be a good thing in the long run.

3. Project financing is extremely important for the long-term future of the gas industry, due to the high capital intensity of most gas supply and infrastructure projects. Whether we are

looking at pipeline, liquefaction projects, field developments that are currently in the planning stage, the demand for finance is expected to be high in the next couple of years. However, there is now a **general reluctance to lend**, and there are also fewer financial institutions still involved in the energy sector after the global financial crisis. This is likely to lead to higher costs and lowered availability of project finance from commercial banks. There are some early signs of improvements, but things are still far from ideal.



We have seen reduced investment all throughout the energy supply chain, from production to end use. The graphic on the left comes from the IEA's input to the Rome G8 Energy Ministers Meeting in May this year. There was a steady stream of announcements of cutbacks in capital spending on oil and gas projects and delays and cancellations throughout the spring, mainly as a result of lower prices and cash flow. Despite some signs of economic recovery in recent months, it still looks like energy investment in most regions and sectors will drop sharply in 2009. In May, we estimated that global upstream oil and gas investment budgets for 2009 had already been cut by around 21% compared with 2008 – a reduction of about USD \$100 billion. If you remember my third slide, it won't take long for such investment declines to translate into reduced productive capacity and tight markets.

There has been some good news though: **Gorgon LNG** project sponsors took a FID on September 14, which is the first LNG FID since 2008. Nine companies from 4 countries committed to take volumes from Gorgon, all in the Pacific region.



Trends in energy efficiency should also be taken into account when considering the balance of supply and demand in coming years. This graphic shows that there are still important differences among world regions in the intensity with which they use energy in producing economic output. Recent gains in road & air transport efficiency, and inter-fuel substitution (gas) in the power sector may prove long-lasting. Extra impetus for increased efficiency will come from airline rationalization, the spread of CAFE standards, auto-industry restructuring, cap & trade etc.

Overall, we see global oil intensity declining by 2.4% per year (vs. 2.1% previous decade), despite regional differences – e.g. Mid.East

Technological breakthroughs or new policy initiatives (gasoline tax increases?) could of course *accelerate* the pace of efficiency improvements.

Conclusions

- There is cause for concern with regard to the future of both the oil and gas markets.
- On the oil side, although spare capacity is comfortable now, the rapid growth in demand for transportation fuels, is putting us on a path where we need ever more production from ever fewer countries. Investment remains problematic.
- On the gas side, a combination of weak demand and surprising advances in non-conventional production have produced a glut that could undermine investment in supply and change the structure of the market. However, demand could bounce then back quickly and produce a tight market again in a few years.
- Although not the topic of today's talk, environmental sustainability is another serious concern. Even if there were no constraints on supply we would not want to use the amounts of oil and gas (not to mention coal) implied by IEA scenarios.
- In addition to investing in oil and gas, we must also invest in new technologies for a cleaner energy future. Such investments will lower energy bills and promote energy security as well as alleviate global climate change concerns.

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There is cause for concern with regard to the future of both the oil and gas markets.

On the oil side, although spare capacity is comfortable now, the rapid growth in demand for transportation fuels, is putting us on a path where we need ever more production from ever fewer countries. Investment remains problematic. Current excess capacity could fade away quickly if the recovery is V shaped.

On the gas side, a combination of weak demand and surprising advances in non-conventional production have produced a glut that could undermine investment in supply and change the structure of the market (which might not be all bad if it broke the price link with oil). However, deliquification plants and gas power stations can be built quickly. Demand could bounce back and produce a tight market again in a very few years.

Although not the topic of today's talk, environmental sustainability is another serious concern. Even if there were no constraints on supply we would not want to use the amounts of oil and gas (not to mention coal) implied by IEA scenarios.

In addition to investing in oil and gas, we must also invest in new technologies for a cleaner low-carbon energy future. Such investments will lower energy bills and promote energy security as well as alleviate global climate change concerns.

Thank you.

