



## 5 April meeting

### A summary of remarks

#### Session 1: Peak Oil, Peak Supply, Peak Demand

The discussion started with a review of oil and gas supply and demand.

The big change in the industry today is the development of unconventional oil and gas, oil sands in Canada, and more specifically shale gas and shale oil. For shale hydrocarbons, the business model is quite different from the business model for conventional hydrocarbons, which is 80% Capex – 20% Opex, while for unconventional hydrocarbons it is 80% Opex – 20% Capex due to the very large number of wells that need to be drilled for NC production. However this is especially true for shale oil / shale gas while for oil sands the model remains close to the standard model.

In 2006, the CEO of a major oil company forecast that oil production would peak at 100 Mbd in 2020. Now the forecast is 100 Mbd plus or minus 5 Mbd in 2020 plus or minus 5 years. According to one participant, shale oil production is not likely to be more than 3 Mbd. The largest reserves can probably be found in Basenov (Russia), not in Bakken (North Dakota in the USA).

As regards demand, Eurozone GDP will be down 0.3% in 2013 (compared to earlier growth forecasts). The trend for demand in China is not entirely clear. The US 'Sequester' (\$85 billion spending cuts) could reduce GDP growth by ½ pc and limit oil consumption. Another key question regarding oil demand is a potential fuel switch to natural gas (in power generation and even in transport) due to the very low price of gas.

Supply is obviously being affected by the LTO (Light Tight Oil – tight oil and shale oil) revolution. But in addition to LTO, significant increases unconventional oil production are forecast in Iraq (up to over 10 Mbd if we add together production from all the fields under development) but these increases are subject to security and political concerns (how the other OPEC countries – especially Iran and Saudi Arabia – will deal with the substantial development of oil production in Iraq). The consensus is more in favor of an increase in production of a few million barrels per day.

However, supply is now being affected by record seasonal plant maintenance levels. Furthermore, it can be partially offset by US industrial renaissance and a breakdown in security in North Africa.

In Asia, oil consumption is still on the rise although GDP growth has fallen compared to 2012. Overall, strong non-OECD increases overwhelm OECD decreases.

In the refining sector, investments are set to add 7.5 mbd of net crude distillation capacity by 2017, 5.9 mbd of upgrading capacity and 5.4 mbd of desulphurization capacity. This will probably be more than enough to meet demand requirements.

The breakeven price for the production of North American Light Tight Oil (Shale Oil) – the price that gives a 10% IRR – is roughly between \$50 and 75/bl, depending upon the area. This price is very sensitive to the Estimated Ultimate Recovery (EUR), including initial production rates, decline rate and tolerance to increased infill drilling.

The question is: at which price are we ready to invest? The marginal cost is also determined by the cost of saving energy or by the cost of developing alternatives.

Forecasts regarding oil production and demand show that potential large overcapacities could develop in the short term and lead to a reduction in demand for OPEC products. The questions are: what will Iraqi production be in 2020? 6 Mbd? More? Will Saudi Arabia reduce its production? This is uncertain. The risk of oversupply is increased by the fact that oil is cheap in Iraq and EOR is developing in Abu Dhabi.

A number of key geopolitical issues will affect the future of oil supply: will Kurdistan become independent with the help of Turkey? What does the future hold for Venezuela? Will Saudi Arabia adopt a different strategy? We know that Saudi Arabia is currently building capacities to meet demand.

Nobody knows exactly what the spare capacities are. Oil reserves (and oil production capacities) depend on technology but also on political decisions, security concerns, etc. A variety of different opinions were expressed regarding reserves: for some participants, technology is changing reserves. Reserves are a dynamic concept. Reserves are Original Oil in Place multiplied by recovery factor. Recovery factor increases with time. As an example we have about 1700 billions oil resources in the Orinoco Belt in Venezuela OIP (Oil in Place) . But in 1980 “reserves” were nil since there was no technology to recover this oil in economical conditions. The recovery rate is 3-7% now, but we expect this to rise to 20%. According to other participants, the recovery rate is 35% now... but was already 35% 20 years ago. But of course fields are more difficult to find and to exploit.

There is a need for geoscientists.

Another question related to production is concerns the price required to keep countries stable. Six years ago the IEA asked OPEC to increase capacity. Now we have to manage capacities. Demand aimed at OPEC is around 29 Mbd.

The oil price is going down. We have to rethink our demand assumptions. Prices need to remain high for the USA (in order to allow for development of additional oil production) and also for OPEC countries (to enable budget requirements to be met). Even if there is a reduction in the USA’s reliance on foreign oil imports (some participants believe that thinking that the USA could become energy independent is a ridiculous notion), oil is a global market and the USA will remain involved in the Middle East.

For some participants, shale oil development will have no environmental impact but will have an impact on communities: traffic, use of water and sand. Typically, the people who benefit from shale gas are young truck drivers, while those who lose are retired old ladies who rent their homes.

The use of LNG for trucks was discussed. It costs only \$10,000 to adapt a truck and this cost is falling. It takes 24 months to obtain a return on this investment. Most of the traffic is over just a

few routes (for instance along the coast of California, for the transportation of goods imported from China through the Californian ports).

The Texas Railways Commission still plays a role in the control of oil and gas production in some states. The commission cannot sue operators who do not follow the rules. The situation is different in the North West.

A key question for the development of oil sands in Canada / shale oil in the north of the USA is the transportation capacity from Canada/North of the USA to the South (Gulf of Mexico) where the refineries are located. The Keystone pipeline project is a crucial issue. It was postponed before the presidential election in 2012. It is necessary to Keystone in order to transport crude oil from the North to the South. If it is not built, Canada will have to export its synthetic crude oil derived from oil sands by constructing pipelines running to its West Coast (Vancouver). At present, large quantities of crude oil are transported by rail in the USA. The railways follow the rivers and there is a big risk of oil spills in the event of an accident.

The issue of gas prices was reviewed. Japan suffers from very high gas prices while large quantities are burnt in the USA (gas produced in combination with shale oil and for which there is no infrastructure for collection/processing/transportation).

A last point was underlined: the quality of crude oil is deteriorating in Europe. Less middle distillates are being produced, while the market is growing for diesel and jet fuel.

## **Session 2: Oil and Gas production in the USA**

Rapid growth in unconventional gas has led to 4 years of oversupply and delinking of the US market from the global gas markets. Unconventional gas development has been a technical success for producers but a combination of technology improvements, poor producer discipline, increasing amounts of associated gas, and a lack of growth in demand has led to a structural oversupply.

The estimated size of natural gas resources in the US continues to increase and full costs have stabilized at between \$4-5/Mbtu while there are probably enough reserves for more than 30 years of production. The industry structure is highly fragmented and there are few drivers likely to lead to significant industry consolidation.

Increasing the production of Light Tight Oil or Shale oil - LTO - is also bringing online significant amounts of cheap/no-cost gas, aggravating the situation. Demand for natural gas is expected to grow, especially in power generation and transportation, but – for now – at a slower pace than potential new supply. This will result – for the next decade in the USA - in a probable continued pricing of gas against coal due to additional supply from associated gas, in the range of \$2-4/Mbtu which could be followed by a rebound to full-cycle producer economics of around \$4-5/Mbtu. It is very likely that the US gas price will remain well below prices on other markets.

Unconventional gas production is robust, with more than 10 producing regions with very substantial resources. A significant amount of North American dry gas resources are economically viable at \$5/MMBTU. Shale gas in the USA continues to grow and has disconnected North American gas price from global prices

The forward curve shows gas prices climbing to \$5 – in line with many people’s estimate of full-cycle economics. The price will also depend upon producer behavior for shale gas: Will producers be disciplined in their behavior or over-produce in response to higher gas prices? But other questions are also raised. How much associated gas will come online as a result of increased LTO production? Will shale technology plateau or see substantial advances in the coming few years? How much will evolving regulations and litigation pertaining to shale development affect the industry? Will we see high demand for gas driven by higher economic growth and fuel switching in the transport sector?

At present drilling efficiency improvements are offsetting the increasing complexity of horizontal wells and deeper wells.

Fifteen terminals for LNG exports, with a combined capacity of more than 130 mt/y, have been announced but only two have approval to export to non-Free-Trade-Agreement countries. The cost of LNG exports from the USA will be low enough to ensure profitability of the projects until 2020, enabling long-term contracting to support the required infrastructure.

The forward curve suggests that North American gas will remain in oversupply, with depressed prices up until 2020. Operators must be prepared for long-term low gas prices and prioritize operations as a value lever. Growth in Marcellus production could lead to Northeast pricing at a discount to Henry Hub, increasing the relevance of an integrated marketing strategy. Low gas prices will give a strong cost advantage to the US petrochemical industry. Continued downward pressure on wholesale electric market prices may result from the use of cheap gas in power plants.

**LTO:** Light tight oil production has grown to nearly 2 million bpd in North America over the course of just a few years – a pace faster than that achieved by shale gas. There are a number of parallels between the shale oil boom today and the shale gas boom of the late 2000s in terms of producer behavior and the opportunities for midstream and downstream players. The continued development of shale oil could push total US production to 11-14 million bpd by 2020 – or even higher with technological breakthroughs, according to some participants. This is higher than about the figure being talked about within the industry. A critical lesson from the shale gas revolution is that it did not benefit buy-and-hold producers in the short term. Instead, value migrated from upstream players towards the midstream and downstream.

Current estimates suggest that Light Tight Oil (LTO) plays in North America may be able to provide between 5 to 24 billion barrels of recoverable resources. The outlook for LTO in the future depends on several factors. How much more can companies learn about directional drilling and increase production at reduced costs?

If the technology learning curve in shale gas were to be replicated, production on current basins could still see significant increases. How many LTO plays exist in the USA and how many can be produced economically? Most production is from two basins. If there is a replication of the success of shale gas this would result in a significant production increase in 12-24 months and several LTO plays are ready for development, even before the existing plays have reached full maturity. Will sufficient pipeline capacity, oilfield services, and workforces be available in LTO plays so that growth can be sustained? Will the economic returns be sufficient to ensure that there is enough capital available to develop the different basins? Will the hydraulic fracturing and waste management required for the development of LTO be restricted?

Monitoring LTO growth is important as it has significant implications across the value chain. Since – up to now – exports of crude oil from the USA are forbidden, it will be necessary to adapt Gulf Coast refineries to absorb lighter LTO oil. It would be useful to look at the potential revival of mothballed simpler refineries in the Midwest and on the East Coast and/or the creation of simple refineries to process LTO into exportable products.

There is a shortage of collection and transportation capacity until the pipeline infrastructure catches up to serve growing production in LTO basins. This will mean the continuation of prices differentials between the various regions in the USA. There is also the threat of a potential global oil glut that may challenge the discipline of OPEC countries, possibly lowering oil and product prices and thus hampering the growth of electric and alternative fuel vehicles.

The development of shale hydrocarbons obviously leads to a significant increase in US jobs and GDP growth, and a rapid reduction in the US trade imbalance.

Investments of between \$1.2 and \$1.4 trillion are required to develop North American unconventional resources. The annual impact on the US GDP will be \$420-750 billion up to 2020. Up to 1.0 to 1.8 million jobs will be created between now and 2020. This will have a broad impact on US energy-intensive industries. This will clearly make for large-scale shifts in the trade balance and the current account and will result in enhanced security of the energy supply of North America.

In conclusion, while the development of shale gas and shale oil is having very positive impacts in the USA, it is very difficult to extrapolate the US situation to other countries. For instance, the Eagle Ford “field” stretches over Mexico but there is limited interest in developing shale hydrocarbons in Mexico. Logistics play a key role. Today we transport with trucks and rail. Pipelines are required. Water is probably the most important issue - not because of the cost but because of availability and disposal.

### **Session 3: Geopolitics**

The session started with a general review of the world situation. Russia is on the decline. What can Putin do? What is the situation in Venezuela after Chavez? What is the state of the economy? Where is the oil industry? There are tensions between China and Japan and neither are in the mood to compromise. In the Middle East, Turkey is more open to discussions with Kurdistan. What will happen next in Syria? In the USA, since his re-election, Obama has been under less pressure; many problems have been solved (Afghanistan, Iraq, Medicare). Regarding environmental issues and climate change, things are changing. However local issues remain the most important. In North Korea the new leader is in trouble because of the economic situation. In Kazakhstan, new oil fields are opening up new economic opportunities but political reforms are still limited. Elections are coming in Iran: what about the Islamic revolution, theocracy, conflicts between Sunnis (abroad) and Shias. In Saudi Arabia, the demographic pressure is high. To meet the constraints, oil production of more than 10 Mbd and a \$100/bl oil price are necessary. The situation is still unstable in Iraq. In Mexico, a major challenge concerns technology and oil and gas production.

In Russia, Rosneft has become the third largest oil and gas company with production of 4 Mbd. There will be competition between Gazprom, whose exports are aimed at Europe, and Rosneft, whose exports are aimed at Asia.

The situation in the Middle East was discussed, with a focus on Iran and Saudi Arabia. Iran came

first. EU countries have stopped oil imports from Iran since July 2012, and the USA has pressed other countries to reduce the amount they buy. Sanctions more than halved Iran's crude exports in 2012. Iran's crude production capacity is down almost 20% according to the IEA. The maximum sustainable crude production capacity has fallen by 700,000 barrels per day since December 2011, to a current 3 million barrels a day. Inflation is up by more than 30% and the domestic currency (Iranian Rial) has depreciated by more than 70%. Iran projects a 40% fall in oil revenue in the coming Iranian year (21 March 2013 to 20 March 2014). The 595 billion dollar budget is based on an oil price of \$95 per barrel. Three rounds of unsuccessful talks have taken place between the IAEA and Iran since November 2012. The IAEA (International Agency for Atomic Energy) cannot conclude that all nuclear material in Iran is in peaceful activities. Iran has recently begun installing more advanced centrifuges at the Fuel Enrichment Plant at Natanz. Construction of the IR-40 Reactor continues (expected to begin operating in the first quarter of 2014).

Talks between the so called P5 +1 group and Iran resumed in Almaty, Kazakhstan on 26-27 February 2013. P5+1 (Permanent members of the UN Security Council – USA, Russia, China, United Kingdom, France plus Germany) is willing to put more substantive sanctions relief on the table in return for Iranian concessions. However the group of BRICS countries recently expressed concern about threats of military action as well as unilateral sanctions. BRICS called to resolve the West's "disagreements" with Tehran by "political and diplomatic means."

Israel leaves room for further negotiations (Iranian bomb not within a year, said Netanyahu). The next round of talks was due to take place in Almaty, Kazakhstan on 5-6 April 2013.

In the Gulf, Iran backed Bahraini opposition. Iran recently criticized Qatar for enabling an opposition bloc to open its first embassy in Doha. Conversely, Saudi Arabia arrested members of a cell on suspicion of spying this month. These had direct links to the intelligence services of Iran.

In Saudi Arabia one of the main concerns is a rapidly increasing gas demand (petrochemicals, power generation). What is the situation of the Gas Initiative, designed long ago to develop the production of non-associated gas in Saudi Arabia? Royal Dutch Shell is set to pull out soon. Total abandoned the project in 2008, ENI and Repsol abandoned their search in 2012. Gas findings are disappointing. The terms of the agreement between Saudi Arabia and the companies are poor for the companies. They were based on a high probability of non associated gas discoveries while, in fact, the exploration results have been very limited.

Saudi Arabia is trying to push ahead this year with exploratory drilling for unconventional gas reserves (600 Tcf ~170 years KSA current consumption) and the development of renewable energy (\$109 G over 20 years). A production capacity of 23 GW of electricity from renewable sources is expected to be developed by 2020 (54 GW by 2032, of which 41 GW from solar energy). The development of nuclear energy (\$109 G over 20 years) is also on the agenda: a capacity of 15 GW to be built by 2032 (16 power plants, with the first plant expected to be operational by 2019).

The main challenge in Saudi Arabia is probably the booming population. More than 2/3 of Saudi citizens are under 30 years old. 400,000 young Saudis enter the labor market each year. Public-sector wages and benefits account for 40% of Saudi government spending (official estimates). The private sector accounts for less than 10% of total employment. Access to the labor market for women is extremely limited. Out of a total population of 30 million inhabitants, there are 20 million Saudi citizens, 8 million legal foreign workers and 2 to 3 million illegal ones. Saudi Arabia is the world's second-largest source of remittances abroad, after the USA (source: IMF).

One very important challenge in the Middle East is the challenge of gas. Although gas reserves are

huge in Qatar and Iran and very reasonable in some countries, such as Saudi Arabia, there is a lack of gas in several countries. Saudi Arabia needs gas for electricity generation (the very quick increase in electricity demand – air cooling – means that large quantities of fuel oil and even crude oil are required, which should be replaced with natural gas) and also for the petrochemical industry or for water desalination. Abu Dhabi has reasonable gas reserves but unfortunately a large proportion of these gases are sour and processing costs to remove acidity are very high. That is why Abu Dhabi is importing gas from Qatar (Dolphin project) to meet local requirements and to feed the LNG plant, which has been exporting gas to Japan since 1977 (first exports of LNG from the Gulf). Nevertheless, Kuwait is importing LNG.

The opportunity cost of gas in Saudi Arabia is about 7 – 8 \$/Mbtu. This is the cost of importing gas from Qatar.

A game changer in the Near East is the discovery of gas in Israel. The Leviathan fields will allow Israel to be independent in terms of gas supplies. At the same time, Egypt is no longer in a position to export large quantities of gas to Israel both for technical and political reasons. It is likely that Israel will export gas to Turkey and perhaps Egypt. There are also potential gas discoveries in the Lebanon and Cyprus. Some conflicts may arise with respect to the delineation of the fields.

The discussion then moved on to Europe, where people rely more on Non-Governmental organizations than they do on International Organizations or States. Europe is led by two countries but can be seen as a “beheaded monster”. The Lisbon Treaty is very complicated and very difficult to operate. In the Middle East, the initiative for discussions between Israel and Iran will come from Obama, not from Europe.

The situation in Mali and in Africa more generally, as well as some countries in the Middle East (Arab Spring) is of concern. In Iran, an agreement is possible because Iran can get concessions from the West. The US policy is not containment but prevention.

In Asia, there have been several important changes in leadership in recent months. Changes took place in :

December 2011	North Korea
December 2012	Japan
February 2013	South Korea
March 2013	China

Still in China, a number of disputes remain unresolved: in the South China Sea (control of gas and oil reserves); in the East China Sea (control of gas reserves). And, of course, there are still potential conflicts over the Senkaku Islands, Tekeshima Island and the Northern Territories.

These tensions are reflected in Chinese Naval Expansion, in the Aircraft Carrier “Liaoning”, in the N. Korean Missile Test and Nuclear Test. There have been protests against Japan in China, against Japan in Korea, and against China in South East Asia. Of course, tensions between North and South Korea are very strong.

The economic situation is sluggish and deteriorating slightly, as shown in the figures below (GDP growth):

	2010	2012
China	10.5	7.8

Japan	4.5	2.2
S. Korea	6.3	2.0
Taiwan	10.7	1.3

The discussions then moved on to Fukushima. For some participants the Japanese government was brave when it recognized failure. But Tepco never recognized any mistakes up until recently. A referendum has been organized in Japan.

Contamination is present. Although the new government elected in February has adopted a different position with respect to nuclear power, it will be difficult to restart the plants. The question of safety came into the discussion. It is difficult – because it is costly – to raise safety standards too much. How will the situation evolve in Japan? Which standards will be set up in China? in Saudi Arabia?