Paris Energy Club

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A summary of remarks

Session 1: The Future of Shale Gas and Light Tight Oil (LTO)

The main activities both for tight oil and shale gas are in the United States. The production has been a major success story. US oil production seems to have been started in 2009 for crude oil production and much earlier for the gas. We have seen a phenomenal growth in production over a relatively short time, which helped cause the problems of 2014.

The light oil that was produced replaced the previously imported light oil from North and West Africa. That oil then in turn had to find new places to market it. It was marketed in Asia and that in turn created difficulties for the Middle Eastern producers of medium-grade oil. This was the beginning of a competition for market share in Asia. When OPEC and Saudi Arabia decided (27 November 2014) NOT to reduce production in order to rebalance the market, oil prices collapsed.

If OPEC had decided to reduce production, Canada, the US or North America would have continued to take the bulk of the increase in the global demand. The approach taken by OPEC and the Saudis was the only one, that's to say, to let the market absorb the surpluses, as the Saudis did in 1986. Sheikh Zaki Yamani, the oil minister of Saudi Arabia in 1986, who decided to open the taps of the Saudi production in order to make the price fall and regain market share,has said many times in the last 30 years that the Saudis would never allow their production to be reduced again, and we see that they kept their word.

Despite the huge decline in the price of oil and the subsequent significant decline in drilling activity, production of shale oil held up pretty well until fairly recently. Production peaked in March last year at about five and a half million barrels per day and started declining slowly until December when the decline sped up.

The situation is very different basin by basin, and the Bakken peaked in December '14. On the other hand, the Permian and Utica only peaked in April of this year. One of the reasons that the production has held up so well is the significant improvement in the performance of the wells. From 2011, production per well dramatically increased and doubled or more. Productivity has made it possible to maintain production with one-third of the rigs.

Regarding oil and gas production added per rig, there was an enormous growth of more than 550% in the Niobrara, and up to 231% in the Bakken. In 2011, it took more than 22 days to drill a well.Now it is a little over 7 days. The wells per year per rig moved from 16 to 47 over those years. The 30-day

average initial production (IP) rate almost doubled. There was a dramatic improvement in productivity gains.

The net result has been that despite the lower prices, return on investment has still been pretty good. When the price of oil was USD 90 in the autumn of 2014, the returns from the Bakken were 39%. Eagle Ford and the Permian were at 40%. At USD 90 a barrel, they were making a lot of money from tight oil production.

Then the price fell to USD 50 a barrel in the spring of 2015. Based on the same characteristics as in 2014, this would have caused a dramatic fall in productivity. However, technological improvementsonce again changed the picture. Now, with reduced cost, at USD 45 per barrel, many of the areas are still giving a very decent return.

There are significant regional differences, as a result of geology and also of transportation. The cost of transportation from the Bakken to the refineries in Houston was over USD 15 per barrel at one point. Now it is lower, because of the new pipelines that have been built. It is now probably about USD 10, but there is still a USD 10 difference between that and oil that is produced from the Eagle Ford which are to the refineries in the Houston area.

The EIA and the industry agree that we are in a decline. They may differ on the size of the decline and on whether it will continue at less than USD 50 a barrel into 2017. Citibank say that they now believe 2017 could very well be flat. In other words, there will be no further decline. The reason behind this is that they believe there are 4,000 wells that are not complete. If we remain at USD 45/50 a barrel or so by the end of the year, many of these could be brought back into production. This could flatten the curve.

What is the break-even price for tight oil? There is no break-even price for tight oil. There are ranges within each of the areas. A study by Kent Moors shows that these ranges were quite significant. Again, these ranges depend on the quality of the reserves, and how many sweet spots exist. Mark Papa, who is the former Chairman of EOG and is currently with Riverstone says he agrees with the consensus that we will see a significant decline this year and a small decline next year. According to Papa we need a price of about USD 50-55 a barrel just for stagnant production. If we have less than 50, we will continue to decline. And we need about USD 75 a barrel over several years, to get an increase of the production of LTO by about 0.5 Mbd.

The current Chairman of EOG believes that once it starts turning around, it will take about 18 months to get back to growth of about half a million barrels per day per year.It would need at least USD 65 a barrel to make that possible. At a higher price, we would get a little bit more.

If you have a very small company and you want to keep people employed, you will accept a return of less than 10% just to keep them employed.

The cost and price assumptions, on a worldwide basis, put the US in the middle – regarding production costs - , between the high-cost producers and the low-cost producers (Middle East and especially Saudi Arabia).

Can other countries produce at a much lower price than the US? Yes, but they are dependent on oil as the main source of income for the country, as opposed to for the companies. Most countries, even

in the Middle East, with the exception of perhaps the smaller Gulf States, need significantly higher prices than 50 USD/bl today just to balance their budgets.

The latest figures from EIG show that at less than USD 40, there are many bankruptcies and production continues to fall. At USD 40-50, hedging activity picks up, especially in the higher 40s, but firms are still under financial pressure. There is slowing output, which declines as the companies continue to work on the DUCs and inventories and some rigs restart. The DUCs are uncompleted wells. At USD 50-60, output stabilises and begins rising. There is new drilling in sweet spots and more DUC inventory worked off. At more than USD 60, there is strong production growth.

What is the future of shale gas? Shale gas production isincreasingin the US, andhas never stopped increasing. It started when we had extremely high gas prices. Now with lower prices will it stop? The US Department of Energy is not forecasting a stop in growth. There will be slower growth, but there will continue to be growth in shale gas production in 2016 and 2017.

Why did this happen? The idea was hedging. In a world where gas pricesweremore than USD 10 per million BTU, companies were making hedges, so if prices were going down, companies continued to grow production. The other story was that with gas you get oil. With oil at USD 100 per barrel, as long as you get your profitability in oil, you continue with gas. Interestingly enough, this is not working any longer. These days, we have low oil and gas prices. Hedging is not possible, or very little hedging is possible, not at extremely high prices. However,production is continuing to grow because itmay still be profitable to produce shale gas in the US even at those low prices.

What the US is doing with this gas? Cheap gas prices in the US killed the nuclear Renaissance many years ago. In parallel, electricity production shifted from coal to gas.

Interestingly enough, the US Department of Energy is saying that coal and gas will be negatively affected in the years to come with more hydro and more renewables. Even in the US, things are getting a little bit greener.

The demand for gas in the US will not increase very much. So a fraction of the gas will have to be exported. LNG will have to go to Asia or to Europe. Asia was the favourite destination a few months ago because the price of gas in Asia reached more than 15 USD/MMBTU. This was due to the high demand for gas in Japan after Fukushima. But the abundance of gas and a limited increase in the demand pushed price down to 5 USD/MMBTU.

So Europe may become a “mandatory” destination. In fact the demand for gas has decreased by nearly 10% in 10 years (demand has stabilised in 2015). But at the same time there is a strong decrease of the local production, made worse with the limitation of production in Groningen, because of earthquakes.

The price of gas was high in Europe from 2008 to 2014 and favoured imports especially from Russia and Norway.

The US is in the process of building five LNG plants. Australia is also building large LNG plants. We must be cautious because those projects are very difficult and most projects are experiencing delays and CAPEX increases. But those LNG volumes will come online.

There is a growth in supply, which on a worldwide level will come mostly from the US and Australia. The supply from the US will mostly come into Europe, and will be competing against our historical suppliers, Norway and Russia. The costs of LNG imports from the US are high but now can or have to be considered as sunk costs. The industry does not like sunk costs, but that is how it works. Once you have built something, it is there, so you either produce it or you do not.

For specialists, the minimum price to make LNG profitable today is around the Henry Hub plus five. It was closer to the Henry Hub plus six in the past. Nowadays, the first cargo arriving in Portugal may not be very profitable, because the figure is way below target. However, it will continue to come as long as we cover variable costs.

The industry will face some challenges in Europe. The issue is Russia and Norway. Will they have prices in Europe that will stay above the target, meaning US LNG will come into Europe? Or will they push prices further down and allow us to maintain the market share and keep US LNG out of Europe. In the last three months, we have seen a record level of Norwegian and Russian exports into Europe. The idea is that we may continue to see lower prices in the US and in Europe.

Session 2: OPEC: Strategies and Future Challenges

Recently, oil price forecasts were based on fundamentals like supply and demand. Among the fundamentals, monitoring OPEC policy has always beenimportant.

For a long time,OPEC used to have a government official price, with a large range of prices depending upon the moment.Later even if GOSP were abandoned there was an objective.Up to recently (two years ago) most specialists thought that OPEC would defend a price in the range of 100 US/bl.

The concern is about the mid- and long-term prices which will have an impact on the investment cycles. The drastic change in attitude of Saudi Arabia in a number of very important fields - military, economics, finances, and oil came as a surprise.

Saudi Arabia always used oil as an instrument for its strategy, including global geopolitical strategy. But why did Saudi Arabia adopt such a position to let the market work?

There are two possibilities. The first is that it is a tactical position and the second is that it is a genuine strategic position. In the present context, knowing the financial need of Saudi Arabia, the tactical position is the most likely one. That means that Saudi Arabia could revise its position relatively soon provided that it reaches some of the goals. This means slowing down the US shale oil production, stopping the mega projects, the very big projects like offshore ones. This is also sending the message to some big allies that Saudi Arabia is still important and they should nurture its stability.

In this case we can assume that they will resume negotiations with OPEC. As a result, they will reach a compromise, and the compromise is possible. A compromise of around USD 50 is possible. USD 50 is an unofficial price to defend. In that situation, prices will increase progressively, with the resumption of the surplus.

Why USD 50? From what we read, all US shale costs are between USD 30 and 60, which corresponds to a break-even price of 40-70. So prices will fluctuate between USD 50 and 70. USD 50 as a minimum is feasible and is defended by OPEC and others. USD 70 is a cap and above that, we have massive expansion of oil coming from US, Canada, here and there.

The second possibility is a strategic option. In this case Saudi Arabia will let the market work. This means the end of the OPEC regulation policy. On the high side,the reference cost will be the cost of US shale oil, on the low side the cost will be the lowest cost of production possible in the market, which is the Saudi one, as everyone knows, or the MENA (Middle East/North Africa) countries' cost, which is USD 20.

Another strategy would be to encourage the volatility and uncertainty on prices. Firstly by preventing OPEC from sending a message of "objective price". Secondly by encouraging volatility. Why until now have the big NOCs (National Oil Companies) of OPEC countries and Saudi Arabia not been present on the oil financial market?

If the price is volatile, it is much more difficult to plan costly projects. It is clear that despite the massive expansion of production outside OPEC, OPEC is still producing 32Mbd. By 1973 OPEC was producing 30 million barrels per day. Today, 43 years later, OPEC is still producing 32 millions barrels per day.

Following market logic,production starts in the less costly zone. That was the case before ’73. In ’73, the rules of the game changed because of the OPEC Government Official Selling Price which guaranteed that some areas would be developed. It was a win-win, an informal agreement between OPEC and importing countries that they could develop the North Sea, the Gulf of Guinea and so on, at much higher costs than OPEC. In the future, if uncertainty is the rule we will go back to the possibility of expansion of OPEC production. This is certainly not at the rate before ’73, during the Seven Sisters era, when it was a less costly zone. However, there were higher returns than in the last 40 years.

The discussion shifted to the resilience of the oil producing countries in this low oil price environment. The revenues of OPEC were USD 1,100 billion in 2012 and they were USD 320 billion in 2016. OPEC’s revenues for oil were divided in four in four years. We can all imagine the huge impact on these economies, which are completely dependent on oil prices and oil exports. There was a failure in diversification policies in the last few years, which makes them completely dependent on the oil prices.

The prices of oil needed by these economies to balance their budget are well known. There were already fiscal deficits in most of the countries in 2015 and this will probably be the case in 2016.

However, we all know that this is not new in the oil industry and that the oil industry has been living like this, in these boom and bust cycles, for the last three decades. During hard times, there is a reduction of expenditures and adaptation. During good times, there is an increase in these expenditures and in public expenditure programmes. To a certain extent, this is business as usual. However, there is something today that is different from the previous declines in oil price in 1998 for instance. The decline in oil prices has arrived after 10 years of very high oil prices.

During these 10 years, we have seen a lot of countries, such as Saudi Arabia and Algeria, who have used their oil revenues to decrease their debt and have very low debt. This was not the case in 1998. In 2001, Saudi Arabia’s debt was around 97% of GDP. They have also used their oil revenues to constitute huge financial reserves. There are the sovereign wealth funds for the Middle Eastern countries, for instance Kuwait, Qatar and the United Arab Emirates.

There were huge financial reserves during the last 10 years. The returns from the sovereign wealth funds for countries such as the United Arab Emirates, Abu Dhabi, Qatar or Kuwait are fair. It is difficult to have visibility on these sovereign funds, but the return from the sovereign wealth funds represents between 20 and 40% of the expenditures of these countries.

These huge savings did not exist a few years ago. Now several countries have more solid financial indicators than before. Financially, they are more resilient than in previous years. In Venezuela, Nigeria and Angola, the situation is different.

Another indicator to look at is social indicators.The UN’s human development indicators are published every year. It is interesting that we see that countries such as Saudi Arabia and Russia have

really progressed in this human development indicator(comprised of education, GDP per capita and life expectancy at birth).

Here we see some progress, even though the biggest threat is unemployment in a lot of these countries. According to the IMF, unemployment in Saudi Arabia is estimated at around 11-12%. However, youth unemployment, which is a huge challenge for these countries, is estimated at more than 40%. Unemployment among women is another key issue. Social resilience is there, but there are huge challenges, more than before because of the demographic growth. In Saudi Arabia, more than 70% of the population is composed of young people aged less than 25 years.

So there is a need for austerity policies, and we see this in every country today. We see it in Algeria, which has recently announced a 9% decrease in its expenditure and a tax increase. We have seen all the announcements from Saudi Arabia in terms of the decrease of expenditure and the implementation of new taxes. Value added taxes will be implemented at the Gulf level and will notably be implemented in Saudi Arabia. We have some austerity measures, even though some of them are new, such as the implementation of taxes, which did not exist in previous years.

We also have some countries such as Angola which are decreasing their expenditure considerably, and this is the new picture. We have countries such as Saudi Arabia, which has announced a lot of privatisation. In Saudi Arabia, we have the possible Saudi Aramco' partial privatisation. There is also the announcement of a public investment fund of USD 2 trillion, with the objective of diversifying the economy within 20 years.

A key policy is the reform (reduction) of fossil fuel subsidies. It has not been decided yet in Kuwait and it is only for the foreign residents. The United Arab Emirates, Algeria etc. have all announced a decrease in their subsidies and a progressive increase in the final price for the consumers.

However, there are many uncertainties that we must keepin mind. These are not easy reforms and we all know that subsidies are a way to redistribute the rent to the population in these countries. We know that, for instance, in Indonesia and Nigeria, they had a lot of protests each time they tried to cut these subsidies. They have often stepped back because it was too difficult to implement these reforms. This is also something to watch. We also have uncertainty regarding the impact of these kinds of subsidies on the oil market and demand. We also have some uncertainty here, but this is another question.

There is another thing to watch: in this new low-price environment, can tax conditions be renegotiated? This is also something we observe in the previous episodes with declining oil prices. There were contract renegotiations, and even the implementation of a new tax regime such as in Algeria during the 10-year period when the oil prices were increasing. This is also something new that could happen. Renegotiating tax conditions for the oil and gas companies is possible but, the bargaining power of the oil producing countries is less important than before.

In Russia, it is expected that the share taken by the Government will be increased. Venezuela is in the most critical situation today among all these heavily-indebted countries. It is a country with huge national debt and external financial needs are estimated at around USD 25-35 billion. PDVSA, the national oil company, has a lot of debts. We know that several of them will have to be paid in October or November, at the end of the year, so this is a very important deadline for the country.

The interesting thing is the role of China in this picture. We know that there are discussions between China and Venezuela in order to define a financing agreement. Venezuela borrows money and repays it in shipments of oil and fuel. There are also the same discussions between China and Angola, which is heavily indebted.

At the beginning of this week, there was a strike in Kuwait and production declined by 1.6 million barrels. The workers were protesting against a decrease in their wages. Bloomberg stated at the beginning of this week that what Doha could not do for the oil market, Kuwait did by accident

Another point to mention is the resilience of the Iranian economy in this context. It is interesting to note that Iran is more diversified and has a larger industrial base. The sanctions in place since 2012 forced Iran to implement some reforms, such as the removal of the subsidies, which started in 2012. It is also very interesting to note the role of China on the geopolitical scene in this context, as well as the relations with the producing countries.

Looking at Russia, despite the rumours and expectations, Russia managed to produce as much oil as was possible. Last year, there was record oil production of more than 10 million barrels per day. This was the highest since the collapse of the Soviet Union. All in all, last year, Russia managed to get the biggest market share of the oil market in terms of production, at 14%.

Having gained this share, Russia is not eager to lose it. All these talks about discussions with OPEC are, more than anything, to give the market a feeling that something is going on. However, Russia will not cut production and it will freeze it to the January level, which was the highest level of production. The major point is keeping the market share.

Generally, the complex energy industry is doing quite well and Russia is number one in oil production and number two in gas production. Coal is number six, but that is still good, and power generation is good as well. However last year was the first year ever when the revenues to the state budgets from the energy activities was not number one. Number one is now agricultural business and military exports, and not energy anymore, which is good for diversification of the economy.

The level of production last year was 534 million tonnes, and it is expected to be a bit higher this year. Capital investment also went up. It is in roubles, not in dollars, but many companies are investing domestically in roubles, so it is fine. Oil exports went up and oil reserves grew. The industry feels quite good and that is mainly due to the very cheap production costs in Vankor,a new and very productive oilfield in East Siberia. Also, the break-even point in the Russian strategy for investments is USD 25 per barrel. There have been no job cuts.

There is no slowing down on the major shelf projects, which are very expensive. It is not the biggest part of oil production in Russia and it is only 3%. However, even on the Okhotsk Sea and Pechora Sea in the Arctic, it is still going on. It is not frozen and it is going on and it will be developed strategically. Capital expenditure projects from major Russian oil companies are not modified very much. The companies declared quite a substantial number of investments this year. Maybe the reality will not be that great, but the companies will still invest. They are cutting OPEX and slowing down CAPEX, but this is limited.

Russia and OPEC countries were not present in the financial oil markets. Now there is a relatively new entity in Russia: the St Petersburg Commodity Oil and Gas Exchange. They are very active in

trying to introduce a new financial instrument, which involves trading euros with dollars in St Petersburg's stock exchange. This will bring additional margin to the oil producers.

Even though it looks a bit premature and risky at this time, it is a very new attempt to get financial liquidity through the Russian market, and it is the right time. Russian markets have managed to get support from the major oil producers, but there is a risk of not enough spare capacity and very low financial liquidity currently. However, that is the right step forward in developing a financial market for oil trading in Russia. These are some new things which we will follow and it was important to mention them.

Session 3: COP 21: the Impact on the Oil and Gas Industry

Even though the Paris agreement is not perfect and is not an end in itself, it provided key elements for potential changes, and we have to keep it in mind. For the first time, 195 countries have committed to work together to curb greenhouse gas emissions and they have adopted a common long-term objective. The aim is to limit global warming by the end of the century at less than 2°C and to pursue further efforts, to limit the temperature increase to 1.5°C. Whether the target is credible or not, it has been set.

The third point is that each individual country has set an Intended Nationally Determined Contribution (INDC).The INDCs are a quantified objective for greenhouse gas emission reduction up to 2025 or 2030. They are not binding, but they do provide references for all governments accountable against current or future policies. These commitments should be reviewed every five years. Each review should be more ambitious and restrictive regarding greenhouse gas emissions than the previous ones. The INDCs are a means for governments to communicate at a worldwide level what steps they will take to reduce their greenhouse gas emissions.

Let us look more closely at what the 2°C target means, more specifically for the energy sector. According to the Inter Governmental Panel on Climate Change (IPCC), it means that current global greenhouse gas emissions should decrease by at least 40% at by 2050. Or even more, by 70%, if the target is 1.5°C. This also takes into account the uncertainty about those results. The other consequence is that greenhouse gas emissions should drop to near zero at the end of the century.

If we analyse several exercises performed during the last few decades, several 2°C scenarios have been explored by different organisations or teams of researchers. They agreed that such an objective implies, in the field of energy, a decrease in coal consumption from now on. Second, there will be a levelling off or decline of oil consumption between 2020 and 2025, but it depends on the scenario. Third, there will be a levelling off and a decline of natural gas demand between 2020 and 2030, but this also depends on the scenario.

By 2050, the decarbonisation of the worldwide energy mix, consistent with the 2°C target, implies a wide range of measures. These include improving energy efficiency, decarbonising the electricity sector and other energy carriers. These measures must also be taken in the industry, in building and transport activities. All of them must be done at the same time. It is also worth noting that this also implies an evolution of lifestyles, behaviours and regional development. The target is highly challenging.

Let us move now to the next point. Will the sum of the INDCs deliver the 2°C ambition? There are different types of INDC, because countries are at different phases in their growth cycles. There are countries that have set an absolute CO_2 reduction target. In this category, you will find most of the OECD countries, for example in Europe. Their commitment is to reduce greenhouse gas emissions by 40% by 2030. Large emerging countries, such as India and China, have defined an intensity target i.e. a percentage reduction of greenhouse gas emission per unit of GDP.

What is the result of the sum of those commitments? If we consider the period up to 2030, the current INDC will not curb global emissions before 2030 and in fact, emissions will probably continue to grow. The increase in the temperature, if we rely on the INDC, remains far above the 2°C target. The projections show that the gap between the INDC trajectory and the 2°C target will probably increase up to the end of the century.

Nevertheless, things are changing, compared to the data based on previous policies. To illustrate the changes, let us have a look at economic tools implemented during the lastfew years and decades and let's focus on the CO_2 markets all around the world. Today, there are 17 carbon emission trading schemes in the world. This is in countries and areas that produce 40% of the global wealth. At the present time, 12 governments are exploring the possibility of implementing an emission trading system. China for example announced the launch of their national emission trading scheme for 2017. There are already different markets in China, but for 2017, it must be a very large one.

We are far from the 2°C target and trajectory, but the current pledges and INDCs of countries seem to be preventing the catastrophic rise of temperatures that was previously announced. We are no longer expecting an increase of 4-5°C at the end of the century. The worldwide real decline of oil and natural gas consumption will probably not be effective before 2030. This is because the INDCs are not sufficient to curb oil and gas consumption.

Nevertheless, things are changing and very fast, maybe more quickly than we anticipated and players in the sector should keep an eye on this. Let's underline that the dynamics of change are coming increasingly from local players and not only from governments. Cities, regions, industry, consumers and civil society are taking more and more initiatives. This is one of the conclusions of the 21st Conference of the Parties (COP21).

We looked then at the effect of COP21 in the current investment climate on investments in oil and gas. There are two kinds of investors in energy projects, and in oil and gas in particular and the first one is industrial investors, which are either national or international oil companies.The second kind is financial investors. One has seen that the level of investment has been pulled back last year and this year by 25-26%each year. It is 30% for investing in new projects for exploration and production, except for Russian companies. Many companies have curtailed their investment in oil and gas in general.

The financial world is somewhat different and it was investing in oil companies of various sizes. It was investing in different projects, service companies and renewable companies and so on. It has had a couple of years of bonanza. After the 2008-09, the investors, the large pension and investment funds, invested in the oil and gas industry because of the recovery of oil prices. They have sent back distributions of money which have been phenomenal. Today, they have a huge amount of liquidity,

because of the dividends and capital gains they have made out of the investments that they put together after the last crisis in 2008-09.

Today, there is a lot of liquidity in the financial world. Where does this liquidity go and what does it cause, as far as investment profilegoes? First of all, some of the larger, very well-known funds, such as Carlyle, Kohlberg Kravis Roberts (KKR), CalPERS and so on have raised tens of billions of dollars. This is to invest in whichever section of the industry they would like to. These funds are completely funded up and ready to invest anywhere.

There is the sheer size of these funds, in the tens of millions of dollars range and clients, who are the institutions. These clients have to generate money to be able to pay pensions and other things, and they are concentrating the funds in which they put money.They do not go to 70 different people to invest their money but only to 10-12. They give them huge cheques rather than sprinkling them around, so you have a concentration. Despite the huge liquidity in the investment community, you have somewhat of a concentration on a few players only. There are still hundreds of those, but there are a few players which are trendsetters and which are directing the way the investments go.

Where do investments go today? What are the investment strategies? You have strategies like geographical strategies. One was during the US boom, but now it is overpriced. Then people invested in Europe, but Europe is a little bit difficult, and now it is also becoming a little bit overpriced. Then China has been a big hope in the emerging markets. China was disappointing and the emerging markets are threatening. Brazil and Russia are not what they used to be, but perhaps India is.

There are some geographies which are still favoured, but more importantly, the sectors have moved a little bit away from energy. There is a lot of investment today in the digital economy, in healthcare and even in infrastructure. Despite the low interest rates, there are investments made in those sectors. However, energy has been suffering to some extent, and less money has been flowing into energy.

Part of the money from these mammoth investors, especially in the US, has been used to invest in the US shale industry. It used to be called energy at large and a part of it is also going to renewables, which has been growing. However, regarding oil and gas, most of it is directed towards the US shale industry. Now people are suffering somewhat from this. They just bought acreage, regardless of the potential of that acreage to hold hydrocarbons. However, they realised further down the road that the shale industry has never returned USD 1 to investors.

The investors who invested in the shale industry have been able to sell the asset, whether at a profit or not. However, they never had any dividend from that. Now the asset price has been collapsing and therefore, there have been huge losses in the energy investment from those big investors in the US. Some of them have suffered a lot, including the banks, which have financed that a little bit irrationally.

In 2015-16, the house of cards collapsed, with these big funds hit by this plunge in the asset price. Now, however, one sees some of these investors coming back to the energy scene and once more, that covers renewables as well as oil and gas. This takes advantage of the price signals that one has today. Even if we may see the oil recovery as a little bit fragile and not too long-lasting, the financial community bets on it and makes big commitments.

Big commitments have led toCarlyle buying a share of Baker Hughes and Halliburton, which are service companies for USD 14 billion. This is apart from the merger of the two companies. These are big cheques, written to reset the way the industry is reorganising for that. After the crisis, when the prices go up, a few healthier companies will be able to emerge.

That is the context of massive investment in energy, including and starting with oil and gas. When one looks at the consequences of COP21 on this, there has been a draw towards renewables. It is interesting to see that some of the renewables projects are now being refinanced. This means that the original sponsors, the ones who put in the equity in the first place, were able to refinance it with new investors and banks. This was even before the project is producing any cash. There is a clear signal there that there is an attraction towards this.

As far as oil and gas is concerned, there are the consequences of COP21 regarding all the environmental constraints whichhave been put on the industry. The first thing is that some groups like 350.org or Nicolas Hulot in France put pressure on investors. This means they do not invest anymore in fossil energies. They drive a car to get there and they need oil and cook with gas, but they still do not want that.

There are pressure groups that have an influence on where these big asset managers, the people who invest the money, can put the money. Remember CalPERS, the pension fund for the employees of California State. They succeeded in forcing some listed companies to adopt more commendable behaviour by saying, 'I am not investing in certain segments of the economy anymore'.

There is another pressure on investors called the ESG responsibility: environmental and social responsibility, applied to the investors. Everybody has to write a policy saying, 'I will not do this', or 'I will do that', and show to the investors that they behave very well. There are so many rules on professional investors like those funds and the alternative investment fund management directive and the ILPA reporting. We have been completely overwhelmed by these rules.

Our clients are the people who needed to invest their money for the long term and at the end of the day, they do not care. They say to investments funds, 'You seem to be reasonable and have a good performance, so I will give you the money anyway'. The disaffection for energy investments as a whole has transformed into an attraction to renewables, especially for companies that can spin their projects faster than in the oil and gas value chain. There has been a slight return during only the past few weeks, with major investment funds coming back to the energy scene.

Everybody is betting that the pricing for the second half of the year will be positive. If it is negative, you will see the money run away again. Remember, low oil prices give a strong dollar. The dollar is going down a little bit and the oil price is going up, but the interest rate is still very low. The arbitrage between the various asset classes is still there. Whichever money is going back to the energy scene today may retrench again very rapidly if the signals are not there.

We moved to discuss the technology of carbon capture, utilisation and storage, because things have changed. There is a bridge between the fossil empire and the green empire. There is a divide between them but this divide is in no-one's interest. People have formed the carbon management coalition which is promoted under the World Economic Forum.

There have been many changesand revolutions in the energy industry and now we are coming to the final stage of the decarbonisationrevolution, since the turn of the century. Energy is influenced by many things, but today, the largest factors affecting energy and everything is climate change, as we have discussed. There are many efforts to develop decarbonisetechnologies.

There is a white paper writtenby the World Economic Forum. There is a long list of wonderful trend technologies already in implementation and that have started, or are about to start. These are not enough, because there are so many needs for energy. The green empire is strongly envisaged by everybody and it is very fashionable to talk about that. However, green energy will only cater for one-fifth of the entire energy demand by 2040, so what can we do? There is a big issue of energy production in the middle and 1.2 billion people are unable to access to commercial technology and electricity today.

The only answer is to decarbonise fossil fuels. Fossil fuels will still account for 75% of total demand in 2040. Without dealing with this 75% in decarbonising, the world will face very serious problems. The answer is carbon capture, utilisation and storage (CCUS). The conventional wisdom is that this is a technology we tried many times and it does not come anywhere near to the reality. That was the story until yesterday, but the Paris agreement brought new horizons. We have several promising technologies and one is membranes to separate CO_2. This is just one-hundredth of the cost of conventional technology. It is at an advanced developmental stage at Kyoto University.

The second one is chemistry to separate CO_2 at USD 35 per tonne and by 2018, it will be US 15 per tonne. With current technology, it costs USD 80-120 per tonne for separation, so again, it is a revolution. Already, the commercial phase has been implemented in Norway and is under construction in the Netherlands. The last one is very attractive and it is a company called Blue Planet, where DiCaprio is advising. They capture and utilise CO_2 to produce building and rooftop materials. They use a natural process of catching CO_2 and combining it. They have made a tile which can capture sunshine at up to 96%. As you can imagine, a building covered with this will be far cooler than otherwise. Those are just three examples out of many on the horizon.

There should be a link between the green empire and the fossil empire. There is no point in fighting each other or denying each other. The most important thing is to align with each other in the same category of decarbonising. This will make the world a better place.