# The future of the oil industry. 15th Sep 2021

**SPEAKER: Professor Jonathan Craig,** Head of Exploration Strategies and Professional Areas for Eni Natural Resources based in Milan, Italy, where he has responsibility for Eni's global exploration strategy and its geoscience staff worldwide. He also holds Honorary Professorships at University College and Royal Holloway London, University of Durham and the University of Jammu in India. He is also the Earth Resources theme Council member of the Scientific Board of the UNESCO/IUGS International Geoscience Programme.

Jonathan's slides had been circulated previously. The challenge for both humanity and the oil industry is how do to reduce greenhouse gas emissions to mitigate climate change. Most assumptions are that we need to go from 100m/bbls oil/day down to 60-65m/bbls/day by 2040; that is, 2L of oil for every person on the planet, every day. What would a world running on less than 70m/bbls/day look like? As a measure, during the pandemic when there were scarcely any cars or planes in use, we were still using about 80m/bbls/day, which gives a good idea of what the challenge looks like to reach a maximum increase of 2°C by the end of the century. On the other side, the global population is likely to get to 10bn by 2040, from 7.5bn today and 13bn by 2100. Therefore, global energy demand will increase with a similar trend, i.e. an increased energy demand of 25% by 2040 can be expected.

Today, about 2.5bn people (a third of the world's population) use only wood for cooking on and about 20% of the world's population have no access to electricity – energy poverty in other words. So, the world has a huge future energy demand and an energy transition will be critical, but how do we make that a just transition, to address both energy poverty and reduction in our carbon footprint. For the vast majority of the world's population, there is no opportunity to change from coal, oil and gas to more sustainable sources of energy, and so it is inevitable that these sources will continue to supply the bulk of energy to at least the end of the century.

In this circumstance, how quickly can we make this energy transition and what is the future of the oil & gas industry in this environment? It will be very different; most of the big energy companies today are transitioning to be integrated energy companies, with big renewables divisions, particularly those based in Europe. In ENI for example, the current split is about 50:50 between oil and gas. By 2040 it expects to be about 80% gas and 20% oil, because gas is a much cleaner fuel and the ability to use gas for electricity generation to replace coal. And there is much more focus these days on value rather than volume. It used to be about finding big reserves and keeping production levels up, but today it is much more about what is the value of the assets we hold, and which have the lowest carbon footprint. Big changes, but few people like change and there is a lot of negativity within exploration departments; comments like "it is a dying industry, there is no more room for geoscientists, the oil and gas industry is finished" are common.

However, Jonathan takes a different view, and wishes he were coming into the energy business today, because it is an exciting time in terms of geoscience being applied to energy, and to the carbon climate change issue being the big challenge for the future. For example, 5 years ago there were around 500 geoscientists in ENI, all of whom were working in oil and gas. Today he has a lot of geoscientists working on carbon sequestration, low and high temperature geothermal, using produced water from the hydrocarbon fields to generate electricity or heating greenhouses, natural hydrogen exploration and storage, and work on helium. So, a huge range of work is taking place in what used to be wholly oil and gas companies, which is hugely exciting.

One of the great problems, however, is that the reputation of the industry is now so damaged that it is very difficult to recruit bright young scientists to come into the industry; yet geoscientists will be key workers to both manage the carbon problem, largely by sequestering a lot of carbon underground, and to supply energy for the world's population.

Discussion

Q: Gold hydrogen – what is the current status?
A: We are probably at the beginning of understanding how such accumulations occur, so difficult to know if it will develop into a major industry.

Q: Are university courses keeping up with the varied aspects of transition within the industry?
A: This is a really big challenge because courses need to have people from industry to teach aspects and to advise departments on the curriculum. Very often the lecturers do not have the necessary skill sets. There has to be enhanced collaboration therefore between industry and academia, particularly as in the speaker's experience students are very keen to have industry figures come in and teach 'this is what I am working on this week" material, because this really inspires them, rather than restating what the story was 20 yrs ago.

Q: As far as the use of oil and releasing $CO_2$ into the atmosphere is concerned, how does this differ between the developed and underdeveloped world - is there a geographical bias?
A: The Western view tends to ignore the status of oil producing countries. Angola for example, relies on oil and gas exports for 95% of its income. If we were to go for a very rapid energy transition and say ban exports of oil and gas by 2040, there would be major economic collapse in many countries around the world. Would that be fair? The average annual energy consumption per capita in Ethiopia is the same as the annual energy consumption of the speaker's fridge! Therefore, we have to be careful during this energy transition that we do not alienate large parts of the world.

The burning of oil in the West is declining rapidly while in Indonesia by 2050, it will be burning 50% more oil than today. But there may, before then, be a means of burning oil in more efficient ways and perhaps of burying more $CO_2$. And it must not be forgotten that a vast amount of what we use hydrocarbons for is not for burning, but for plastics, medicine, fabrics and a huge range of other products. It is often said that electric vehicles (EV) are the answer, but in India, China, Vietnam etc, electricity comes from coal, so in reality the EVs in those countries are coal powered. There is no such thing as clean energy! All energy has a

consequence. The ideal would be an internal combustion engine burning only hydrogen of course, or burn oil without having a negative impact on the climate because it is the most energy efficient source we have. The only other option would continue to burn fossil fuels but we sequestrate $CO_2$ somewhere. Can we ramp up carbon sequestration to the level that it would be required to store all the carbon that we produce? Some years ago, a calculation was done by a group of senior executives in the oil and gas companies, which concluded that you would need an industry that is twice the size of today's oil and gas industry.

Q: Is there enough pore space in the world to do this and how would the economics for this work?
A: We probably do have enough pore space, if one includes reservoirs plus aquifers, so what one then needs is a realistic carbon price; but this would probably only occur if governments impose it.

Q: Do you think that carbon prices could be as simple as taxation or would there be prolific exemptions?
A: That would be the imperfection and also it would not take place at the speed needed. We already have varying world prices for both oil and compressed natural gas, so this creates a market to ship it around the world. Could one imagine $CO_2$ being shipped around the world like this?

Q: With a prediction of 25% increased energy demand by 2040 and a similar level of population increase (based on almost straight-line predictions), humans are presumably heading for some sort of major crisis. Will this affect existing predictions therefore?
A: Predictions can be awful and the oil price is a good example where major swings have occurred of course; and another major pandemic would potentially have a major impact on human population and therefore energy demand. On the other hand, if fusion energy proved workable, the electricity supply would change hydrocarbon use radically. There are many unknowns. Even if population growth slowed, it is possible that as countries become richer, they would also expect vastly more energy as they move towards a Western lifestyle.

Q: Given the huge amount of energy consumed in exploration by the drilling industry, would it ever be possible to reduce the energy wasted on dry holes?
A: But if one does not find HCs, one will generally find water, so on land at least, this could be used either for heating greenhouses or other buildings, or if hot enough, for electricity generation. In that vision, all wells drilled would have an economic value. Most big oilfields decline about 5-7% p.a. so exploration has always been a vital part of the industry. But it is changing greatly and it is not now all about big concepts in ultra-deep water; it is much more about incremental additions to existing portfolios and carbon footprints are always being examined these days. It is much more about managing the portfolio now than finding big reserves. There is a lot less exploration than in the past, and more focus on recovery from existing fields.

Q: what is the role of the national oil corporations (NOC)?
A: The role of the NOC is becoming much stronger than it was. In fact the big international oil companies (IOC) only produce 10% of the oil in the world, 90% is from the NOCs, which have a completely different set of drivers, e.g. protecting the national interest.

As far as the future of the industry is concerned, clearly the NOCs are not subject to the same stakeholder or litigation pressures (to put it mildly) and not likely to come under the same pressure to reduce their carbon footprint compared to the independents. With renewed pressures and expectations on the IOCs, and also distressed assets (high carbon output) will probably revert to an NOC and not receive as high a price on the market, or go to small companies who will maintain that asset for as long as possible, thereby adding to the carbon problem.

It follows that public pressure on an IOC (with only 10% of the carbon 'target') is not really relevant to the carbon debate. But as far as a national debate is concerned, sadly it is true that the industry has not helped itself with a very poor record at revealing the truth about activities in the past, and so the industry does not have the confidence of the public. The IOCs represent bad news while the NOCs don't exist in the minds of both politicians and the public, who are equally ill informed on energy issues.

Q: Has the industry lost the confidence of the public?
A: Yes, and it may not be possible to recover this. It will take time for the carbon issue to be central to investment but already investors are making enquiries about the carbon intensity per bbl produced for a given field. It may take time to distinguish between perception and true value, but capital will ultimately exploit the difference.

Q: Will Western energy suppliers ultimately be heading for a price crisis or a supply crisis in the short term (next few years).
A: We are already there and this winter could be difficult. The Grid has already had to bring a coal station on stream in a recent calm, high pressure zone, particularly as the UK is becoming more dependent on imports from places that are not as secure as we would like. Energy security is a really big issue. In addition, we have a very small gas storage volume, as does Italy.

Q: Can you envisage a scenario whereby energy companies are paid to pump $CO_2$ underground at the end of a HC well's life?
A: My vision for the future is that large basins, like the N Sea, will become super energy and storage hubs producing HCs, sequestering $CO_2$ - for enhanced recovery of existing fields as well as importing liquid $CO_2$ from big industrial complexes - stripping the heat out of the produced water from existing HC fields, using renewable energy from big offshore wind farms to split methane and produce hydrogen. This is already happening in Liverpool Bay and geoscientists will have a central role in this vision.

John Bennett