The energy sector and the CO2 boom

By **Sam A. Rushing**, gasworld magazine on Oct 28, 2015

A changing industry – another boom and bust? This answer is very mixed. Before the drop in oil prices, there was certainly a boom within the greater hydrocarbon industry. Carbon dioxide (CO2) fracs are still few and far between in some markets, such as West Texas, and a sheer lack in Canada due to greenhouse gas regulations, but on the other hand there are some regions such as the Bakken Field in North Dakota which is said to be consuming CO2.

Enhanced oil recovery (EOR) is the greater consumer and method of recycling and sequestering CO2 available in many cases – and there are numerous successful EOR projects operating in North America.

As for the long-term, oil prices are expected to increase and stabilise, with this technology continuing to represent a growing demand for CO2 product. Such product is sourced from regions as the US Mississippi Jackson Dome, and the Bravo Dome, which also supply the merchant sector. Most North American EOR projects are derived from natural sources; however, some sourcing is from gas processing facilities such as the ExxonMobil La Barge source in Wyoming, and the Dakota Gasification facility serving the Saskatchewan oil fields.

In the future, in servicing EOR needs, CO2 will come from (probably subsidised) dilute US CO2 flue gas sources derived from power plants, and (non-subsidised) concentrated large industrial sources, such as large ethylene oxide and ammonia sources to be constructed, which will only occur with long-term supplies of abundant and cheap natural gas. In Canada, due to Government subsidies and greenhouse reduction schemes, EOR flue gas sources are already underway to supply the Saskatchewan oil fields sourced by Sask Power's coal-fired plants.

The energy sector is one of the most vital and ever-changing industries around, particularly today where a great amount of volatility has entered the picture related to fossil fuels. When considering oil and gas, prices remain low and supplies very abundant, which have a negative impact on the industry and the service companies. At the time of writing, oil will fetch $44.68 per barrel, and natural gas $2.605/MM BTU.

Further, when departing from fossil fuels, the emergence of renewables is growing, albeit unevenly. Solar and wind energy are gaining a significant amount of ground, however, advanced biofuels have significantly lagged behind largely due to a lack of scaling up various technologies and platforms, as well as a basic lack of investment to further develop and finance such projects. Simply put, there is a lot of press on cellulosic technologies and feedstocks, however, there are very few cases of actual implementation and commercialisation.

There is a huge supply of natural gas production driven by shale gas production, and there is a mix of ups and downs. Domestically there is a net slowdown in production. It is felt a modest growth will be noticed within the natural gas production industry in 2016, and in the longer term there could be another boom leading to 2017 and 2018, in part due to greater efficiencies realised in best shale plays.

In the end, much of this news does not show significant boom times – currently, for fossil fuels production, due to low prices and high reserves. For advanced biofuels, investment and implementation must rise.

The role of CO2

This year, I evaluated several CO2-based EOR projects, which were to source CO2 from grain-based (first generation) ethanol plants. Some producers maintain that an oil price of at least $60/barrel is needed to make for a successful project. Of course, it was much easier to plan and consummate an EOR project with $100/barrel oil, compared to today's $44.68/barrel oil.

However, many of today's operating projects such as those in Canada, which foster greenhouse gas reduction initiatives, or in the US, which sometimes have government subsidies such as DOE grants, have gained success. Denbury's Jackson Dome CO2 sources are ever-growing for the EOR network in Mississippi, Louisiana, and Southeastern Texas, while sourcing in the upper Rockies demonstrates the pipeline infrastructure is the key to feasibility.

As for secondary and tertiary recovery with CO2, if the right combination of sourcing and destination factors, greenhouse gas reduction schemes, government grants, and oil plays are underway, it is much easier to develop a successful EOR project. However, most projects are waiting for stronger oil prices than those of today. Generally these projects call for a pilot flood before a full scale operation is developed. It is further stated by the DOE that some 400 billion barrels of oil are 'stranded' in place, up to 84 billion barrels of which are recoverable with CO2.

Depending upon the challenges, advantages and subsidies, CO2-based EOR is economically feasible with values from $50 to $100/barrel Therefore, CO2-based EOR will be a growing market, where it is more than likely that oil prices will return to a higher level, and it is further possible in the future that climate legislation may occur in the US, favouring EOR when viewed through the lens of carbon sequestration.

Due to a mix of uncertainties, it is unlikely we will go any lower with oil prices for a sustained period of time, while it is also unlikely that the demand for enhanced recovery of trapped oil will disappear. In the long-term the factors in favour of making more EOR projects work in America – such as rising oil prices and the need for sequestration and possible climate change legislation – would represent a positive future for CO2-based EOR projects.

Then we move to the subject of biofuels. There has been wavering support for the addition of ethanol to gasoline, and wavering support in favour of advanced biofuels has also been one of the reasons for little or no growth in the biofuels sector outside of biodiesel projects, where CO2 could play a role in improved photosynthesis via uptake in algae projects as a carbon sink.

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The highly publicised advanced biofuels projects by Poet/DSM in Emmetsburg, Iowa, the Abengoa plant in Hugton, Kansas, and the DuPont plant in Nevada Iowa are the three commercial US cellulosic plants in the US – however, these are located in CO2 markets which are already highly saturated with CO2 sources. We need more strategically located first and second generation biofuel plants for supply to the merchant CO2 network. There was another planned cellulosic project in Southern California which I worked with, to be sourced from sugarcane cellulosic materials. However, the financing failed for this venture and it become another casualty in the industry.

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I have predicted in the past that new cellulosic-based ethanol plants will soon yield tomorrow's product for the merchant and captive markets. I maintain this forecast will occur in the future, however, as with many projects, movement in this industry is simply taking more time due to insufficient financing and fewer projects moving toward commercialisation. There is some movement in other regions of the world, which will use other cellulosic technology, and these are located in Italy and Brazil, under Beta Renewables. When thinking of algae uptake as a carbon sink, most of these projects have been entirely too small to consider

significant from a carbon sequestration volume perspective.

What to expect...

In the short-term the CO2 boom, as it were, is more of a reflection of what will come as oil prices rise and some additional primary and advanced biofuel projects are commercialised. The boom has been taking place for some time with stronger oil prices; we are now taking a breather, waiting for oil prices to rise and stabilise, and investments to return.

All of this is slated to happen, but in some respects it is a reflection of the global financial crisis, which lingers on in various sectors. To this end, I believe a significant amount of consolidation has already occurred in the first generation grain-based ethanol industry. As investment expands and the commercialisation of second generation technologies occurs, this should enable new viable merchant and captive sources for the CO2 markets, depending upon location as the primary factor.

As discussed earlier, developments and improved prices in the oil and gas sector will precipitate more of a 'boom' impact over time. Today is an interesting chapter in the industry, where many firms in the industry are trying to capitalise on and improve upon their current operating assets and businesses. As for the gas companies and EOR projects, opportunities will arise as the commercialisation of cellulosic technologies occurs, and once oil prices have risen. The same could be said for the greater hydrocarbon industry, which should precipitate more opportunities in the merchant and EOR sectors.

About the author

Sam A. Rushing is President of Advanced Cryogenics, Ltd, a chemist, and a global consultant to all sectors of the CO_2 industry, as well as cryogenic gases. If you have a CO_2-related or cryogenic project, and need expertise, please call upon the company. Advanced Cryogenics also supplies a full menu of CO_2 and cryogenic equipment, new and used.

+001 305 825 2597, rushing@terranova.net **www.carbondioxideconsultants.com**