NATURAL RESOURCES

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OIL AND GAS

OIL AND GAS VIEWPOINT

The IEA says no to hydrocarbons development

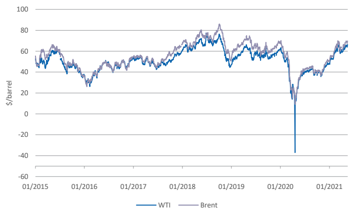
The IEA (International Energy Agency), the Paris-based intergovernmental energy watchdog, announced in a recent report that new oil and gas project development should cease this year, if the UN net-zero greenhouse gas (GHG) emission target is to be achieved by 2050. The same conclusion was reached concerning coal-fired power stations without carbon capture and storage. Arguably, the IEA's conclusion concerning fossil fuel development is not that radical assuming compliance with the UN's objective is considered sacrosanct. Compliance with the objective inevitably implies a sharp cutback in demand and therefore production over a short time frame. The fact that an organisation as influential as the IEA has made the pronouncement is nevertheless highly significant in advance of the Glasgow COP26 (26th UN Climate Conference of the Parties) assembly in November 2021. In the hysterical atmosphere being whipped up the outcome of COP26 could be some ill-advised energy policy positions and impractical objectives.

- **UN 1.5°C objective**: The aim of the UN net-zero GHG (the key ones by volume are carbon dioxide, water vapour and methane) emission target is to prevent near surface temperatures globally from rising 1.5°C above pre-industrial levels. The consensus scientific view is that an increase in temperature much in excess of 1.5°C could trigger dangerous changes in climatic conditions. Presently, the increase is estimated by relevant scientific bodies to be just over 1°C with the trend steepening. Global warming theory suggests that the increasing concentration of GHG emissions in the atmosphere is absorbing more of the heat radiated from the earth's surface. While some escapes into space the remainder is radiated back to earth. The scientific community estimates that the concentration of carbon dioxide in the atmosphere has increased from 280 ppm (parts per million) at the beginning of the industrial age to 416 ppm currently. On current trends 550 ppm is likely by mid-century according to scientific opinion.

- **Global warming guaranteed regardless:** Even if the net zero GHG emission target can be achieved it is far from being the end of the global warming story. The problem is that global warming is a function of the accumulation of emissions in the atmosphere not the annual total generated. Furthermore, CHGs and particularly carbon dioxide lingers in the atmosphere for decades or even centuries before being radiated into space or absorbed into carbon sinks and by plants and trees. Interestingly, the IEA points out that even if net zero GHGs can be achieved by 2050 there would still be a temperature rise of around 2.1°C from pre-industrial levels by 2100. This, however, compares with possibly 4°C assuming unconstrained emissions.

- **How feasible is the IEA's proposal**? The IEA's proposal to abruptly cease fossil fuel development is infeasible unless politicians wish to drastically reduce energy supplies over the next 20-30 years. Currently hydrocarbons plus coal account for 84% of primary energy sources, based on BP's Statistical Review. According to the IEA's proposal, the weighting would reduce to slightly over 20% by 2050 with the residual applications for oil and gas being mainly in petrochemicals. Until recently, at least, mainstream oil industry opinion would probably recognise a weighting closer to 70%. The void would be filled by nuclear and renewables mainly in the form of wind and solar power and 'green' hydrogen. Wind and solar power might have emerged as viable competitors to conventional energy in power generation in some parts of the world but there are many difficult to abate sectors where there are no readily available technological solutions to replacing fossil fuels. In this category falls much of metallurgical processing where carbon is both a heat source and reduction agent, building materials, aviation, long-haul trucking, marine and earth moving and agricultural equipment. It also needs to be remembered that the lead times involved in transitioning to new energy technology are considerable, as are the costs. The IEA has suggested spending $5tr/year or over 5% of world GDP for the purpose.

BRENT VS WTI RECENT TRENDS



Source: EIA

Analyst: Peter J Dupont

Phone: 0203-002-2078

Email: p.dupont@allenbycapital.com

www.allenbycapital.com

EQUITY RESEARCH

MATERIALS ARE A MAJOR ISSUE

Critical materials availability overlooked: The new energy advocates often overlook the availability of raw materials required for the radical extension of electrification technology to areas where fossil fuel usage is currently dominant. Admittedly, the IEA has mentioned the need for more investment in mining. There is, however, a tendency to understate the difficulties involved, partly reflecting the lack of readily available reserves of key minerals and metals such as copper and nickel, and partly the very long lead times for the development of mines, smelters and downstream processing facilities.

Material availability looks like being a particular issue in the context of rechargeable batteries for electric vehicles plus a whole range of equipment currently powered by ICEs (internal combustion engines). Post mid-decade, if not before, it is by no means clear where the vast quantities of copper, lithium, nickel, manganese and rare earths are going to be sourced for automotive battery applications.

Copper requirement for auto rechargeable potentially needs another 7 Escondida mines: As an indication of the demands that a changeover from ICE to BEV (battery electric vehicle) technology would entail for metals consumption, it is worth looking at copper. Currently the average light vehicle uses about 35 lbs of copper while a BEV needs around 183 lbs. Based on annual production of 100m units, the incremental copper requirement is 6.7m tonnes/year of copper. This is equivalent to 7x the annual production of the world’s largest copper mine, Escondida in Chile. Mines, such as Escondida, take years to develop. More fundamentally perhaps, large-scale copper resources are becoming more difficult to find while grades at existing mines are tending to fall. Electrification will also require substantial quantities of copper and other metals to increase power generation, transmission and distribution capacity.

IEA needs to make a reality check: Particularly regarding critical material availability, a reality check is required by the IEA and others concerning the viability of switching from ICEs to electric power in the auto and other transport equipment sectors in the timeframe envisaged.

SECULAR DECLINE IN EXPLORATION PROBABLY UNDERWAY:

We believe that we are already in the early stages of a secular decline in oil and gas exploration. Major producers such as BP and Shell have indicated that they are scaling back exploration activity and certainly not moving into new frontiers. Both companies are looking for a sizeable drop in oil production by 2040 reflecting to a large extent field depletion rather than merely disposals. President Biden’s policies of embargoing drilling on federal land and offshore combined with restrictions on pipeline development are also aimed at restricting supply.

The likely widespread adoption of carbon taxes and carbon trading will impact supply but by firstly depressing demand. In principle, the most efficient way of eliciting a transition from fossil fuels to renewables and electrification with the minimum of disruption would be by imposing a carbon tax with uplifts on an annual basis to achieve emissions objectives. This approach is being adopted in Canada. Significantly, the US has neither a federal cap and trade system or carbon taxation. The state of California does however have a cap and trade system as does the EU and UK.

Once carbon taxation or a cap and trading system are in place the speed of the transition to adopting new energy technology will then depend on four factors as follows:

- **The price elasticity of fossil fuels.** Demand tends to be inelastic in relation to price reflecting the practical advantages of fossil fuels which largely relate to their superior energy density than alternative battery technology.

- **The speed at which new technology can be introduced.** Although there are some mature renewable technologies such as wind power, there are other new energy age technologies which are still at an embryonic stage. Even in the case of well understood technologies, such as hydrogen fuel cells, considerable product development and testing is still required for application in long distance heavy trucks, for example. Interestingly, Daimler Truck's new fuel cell powered GenH2 heavy truck, not surprisingly, is undergoing extended testing. High volume series production is not scheduled to commence until 2026/7. Volvo Truck will probably be much the same timing as they share a common fuel cell facility. Widespread application of fuel cell technology in trucks will probably be post 2030. Hydrogen also is unlikely to be used as a substitute reductant in the near term for coking coal in metallurgical processing. The phasing out of blast-furnace based iron and steelmaking is, in our view, unlikely to occur on a large scale until the second half of the 2030s.

- **The technical performance of new technology.** There are pluses and minuses on this front. Battery technology has a theoretical advantage vis-à-vis ICE technology in automotive applications in terms of acceleration but this is short-lived due to the lower energy density of batteries than diesel and gasoline. Intensive use of the performance will rapidly drain the battery so the advantage in acceleration is more apparent than real. Lower energy density also leads to the well-known drawbacks of BEVs in terms of range and recharging times.

- **The cost relationship between new and legacy technology.** The economics of renewables in power generation has improved dramatically in recent years. In many parts of the world wind and solar power generation economics is now comparable with conventional energy. The issue of intermittent supply has also been partially overcome with the application of rechargeable battery storage technology. BEV and FCEV (fuel cell electric vehicle) technology however remains significantly more expensive than that of ICEs. Conceptually BEVs do have significant economic advantages over ICEs in terms of maintenance and particularly fuel or energy costs. The former advantage relates to fewer components and moving parts while the latter reflects to a considerable extent the use of untaxed energy. Operating costs for FCEV's currently stand at a premium to both ICE's and BEVs due to the high cost of hydrogen fuel.

  The consensus view is that with BEVs and particularly FCEVs capital costs should decline with high-volume series production. In the case of BEV's, we are sceptical that battery costs can decline significantly near to medium term given what we believe may well be upward pressure on raw materials prices. The issue with hydrogen fuel costs is partly a question of an energy intensive production process and partly high distribution costs associated with low volume. If the issue of economics can be solved, we believe hydrogen fuel cells offer a very promising powertrain technology for heavier vehicles (vans, pickups, SUVs, medium and heavy trucks). They offer superior on-road performance with similar payload, range and refuelling times to diesel trucks. We believe the performance advantage is particularly significant in mountainous regions reflecting the extra boost provided by auxiliary battery power.

IEA's proposal would be too disruptive: We believe that a combination of technological, public and corporate policy developments will be tending to dampen the growth in both oil and gas demand and supply over the balance of the decade. A sudden embargo on oil and gas development, as suggested by the IEA, would however seem unlikely given the potential for severe disruption in energy markets in the transition before new age energy technology is fully available. There would also be highly negative economic ramifications of a sudden shut-off in energy supply. The inference is that the net zero objective is probably not achievable by 2050 in the absence of a major technological innovation.

WHAT ABOUT STRANDED ASSETS?

Risk of stranded assets increased by IEA announcement: Stranded assets are those which have unexpectedly lost value or possibly all value as a result of factors such as technological change, a deterioration in production economics and an adverse change in the legal/public policy backdrop. The public policy preoccupation with global warming and climate change has certainly raised the subject of stranded assets in oil and gas circles in recent years. The IEA's latest report on the need to cease oil and gas exploration and development arguably raises the risk level concerning the potential for stranded assets.

Long-life assets particularly at risk: Clearly, the assets mainly at risk are of the long-life variety which are undeveloped and large relative to current production rates. We believe the most exposed are the major OPEC producers notably Saudi Arabia and particularly Venezuela. The latter has proved reserves of over 300m barrels, the world's largest but for about 20 years Venezuela has experienced an horrendous decline in production from around 3.5mm b/d to 0.5mm b/d. This reflects a combination of bad management, politicisation of decision making within the state oil company PDVSA, an exodus of skilled personnel and most significantly the imposition in recent years of US sanctions. Doubtless in the event of the removal of sanctions and the emergence of a more favourable operating environment, production could probably be boosted quickly to comfortably over 1mm b/d. However, to return to previous peak levels will take time and a considerable sum of money. Venezuela does not have the luxury of time in the current circumstances and may find capital for the restoration of its petroleum industry difficult to obtain.

Alberta oil sands risk being stranded: Outside OPEC, we think that oil and gas E&P companies generally are not highly exposed to potentially stranded assets. Proved reserves are typically less than 15 years at current production rates. Exposure is perhaps greatest for Russian companies with undeveloped reserves in Eastern Siberia and Canadian concerns with large positions in the Alberta oil sands. Until recently, the long life and near ultra-low depletion characteristics of the oil sands was a major competitive advantage.

Development and production likely to stepped-up: We believe a key consequence of the desire of the IEA and others to drastically cutback oil and gas exploration and development and the risk of stranded assets will be to encourage stepped up production wherever possible. In our view, it will be very difficult to dissuade OPEC producers from raising production. We also believe that Brazil will be eager to continue a rapid rate of development in the Santos Basin while Russia will want to press ahead with development projects in the Arctic latitudes and Eastern Siberia. Should a new nuclear proliferation treaty be agreed with the US we think Iran will be aiming to increase production by as much as 2mm b/d. A near to medium-term influx of supply could constrain the boom in petroleum prices that some observers are expecting over the next year or so. According to the bulls, WTI could hit $90/barrel which is arguably fanciful given the overhang of supply.

CARBON ENGINEERING LTD MAY HAVE AN ANSWER TO GLOBAL WARMING

The accumulation of GHGs----The underlying problem facing the world concerning global warming is the approximate 50% increase in the accumulation of GHGs in the atmosphere from 280 ppm to 420 ppm since the Industrial Revolution more than 200 years ago. Significantly, global warming has a lagged relationship to the accumulation of GHGs. The lag is lengthy reflecting the tendency of GHGs to linger in the atmosphere over decades if not centuries. Even if all fossil fuel production and usage were to cease tomorrow the climate would still be warming for years to come and quite possibly into the next century.

------necessitates direct extraction from the atmosphere: The magnitude of the problem is such that CHGs need to be extracted from the atmosphere to sharply reduce the accumulation. The process is known as carbon dioxide removal (CDR). In its simplest form CDR can be executed by planting trees and creating carbon sinks such as wetlands. The drawback to all these natural processes is that they take too long to become effective and have little impact at the margin.

Carbon Engineering has powerful investors and is the leading exponent of DAC technology: There are however engineering solutions which enable carbon dioxide to be removed from the air through a procedure known as direct air capture (DAC). The leading exponent of the technology is Carbon Engineering Ltd (CE), a Canadian company based in Squamish, British Columbia about 60 km north of Vancouver. The company is funded by three oil/resource companies BHP, Chevron and Occidental Petroleum plus government bodies and a group of private investors, including Bill Gates and Murray Edwards, the founder of Canadian Natural Resources, one of the leading Alberta oil sands producers.

Pilot DAC plant since 2015: CE has had a pilot DAC plant operating at Squamish since 2015. When operating, the plant captures about 1 tonne/day of carbon dioxide. Commercial facilities are planned at up to 1m tpy of CO2. CE's proprietary technology works by using giant fans to pull in air to a structure containing a thin plastic honeycomb over which potassium hydroxide flows. A chemical reaction results with the CO2 binding to the solution to form a carbonate salt. The CO2 is subject to further chemical processes for the purposes of concentration, purification and compression. Salt pellets are then formed and heated which drives off the CO2 gas in pure form. This can then be stored geologically or used for industrial processes, including oilfield enhanced recovery. The key inputs required for CE's DAC technology are power, water and chemicals. In common with other capital-intensive industries maintenance costs will presumably be a significant item of cost.

Development of ultra-low carbon synthetic fuels: Interestingly, CE has also devised a proprietary Air-Liquids synthetic gasoline and fuels technology. This combines hydrogen produced by the electrolysis of water with the CO2 captured during the DAC process. The synthetic fuels are ultra-low carbon products and compliant for use in existing ICEs.

CE's DAC technology is highly innovative in our view and has several interesting features as follows:

- The equipment and processes used are well established in other large-scale industries such as power generation and water treatment. Installation costs are therefore transparent. CE's genius has been system integration at scale.

- The footprint of a large-scale DAC plant at around 100 acres is decidedly modest compared with carbon sinks and forests. A 1m tpy CE DAC plant will have the same impact on CO2 extraction as 40m trees. Furthermore, plants can be situated on low grade land.

- Compared with the alternatives, the cost of CO2 capture appears competitive at about $100/tonne based on the CE website. This should be seen in the context of carbon prices and taxes that are trending upwards and in some parts of the world are already approaching $100/tonne. For oil companies, economics may be further enhanced using CE's low-carbon synthetic fuel technology. In the past, DAC costs of $600/tonne have been mentioned in the technical press.

- The CE DAC process is carbon free providing power needs are met from renewables.

Occidental Petroleum DAC plant

Plant possibly in operation by end 2023: In May 2019 CE announced its first large-scale, commercial DAC project. A licensing agreement was made with Occidental Petroleum to establish a 0.5m tpy plant to capture CO2 in the Permian Basin, Texas. This was later expanded to 1m tpy. The FEED (front end engineering, design) for the project was announced in early 2021 with construction scheduled for 2022. Start-up, we believe, is possible by end 2023. The Occidental DAC plant will easily be the world's largest to date. Earlier plants had capacities of no more than a few thousand tonnes. It should also help validate the technology.

CE's business model is to license its technology extensively around the world to achieve deployment as quickly as possible to meet the climate challenge. By 2050 CE has indicated that it believes that 'DAC facilities will be playing a mainstream and significant role in the global effort to achieve net zero emissions and restore safe levels of CO2 in the atmosphere.' Based on current carbon emissions of around 50 bn tpy the world currently would need 50,000 DAC facilities similar to CE's 1m tpy plant to achieve a comparable offset. This, however, is unduly conservative given that on-site carbon capture and storage (CCS) facilities can probably be established where large quantities of CO2 are being generated. DAC facilities should largely be used for capturing CO2 from the atmosphere.

Disclaimer

Research Disclosure

Peter J Dupont is the author of this research recommendation. Peter is employed by Allenby Capital Limited as an Equity Analyst. Unless otherwise stated the share prices used in this publication are taken at the close of business for the day prior to the date of publication. Information on research methodologies, definitions of research recommendations, and disclosure in relation to interests or conflicts of interests can be found at www.allenbycapital.com.

Allenby Capital, 5 St Helen's Place London EC3A 6AB, +44 (0)20 3328 5656, www.allenbycapital.com