Jupiter Oxygen Corporation : For Distribution (3)

The Challenges and Opportunities for the Energy Sector

The U.S. is an extraordinary position to demonstrate innovation, creativity, and leadership in the sector of clean energy. The climate technology that is ready to be deployed can accomplish a wide array of economic, social, and environmental goals. Our leadership can provide a global roadmap to the mitigation of climate change encouraging innovation as a prime driver.

In the power utilities and the broader energy sector, growth will be characterized by investments in innovative technologies in response to the challenge to decarbonize. Serving a growing clean power demand from stakeholders; the public, government, and shareholders, the pace of adoption of climate technologies could far exceed any previous rate of technology improvement and performance enhancement. Traditionally privileging reliability and low cost, both manufacturing and utilities are breaking with tradition. The broader energy sector is responding to both customer and regulator pressures to provide more than reliable products and power with climate change mitigation technologies.

For the foreseeable future, transformation in the energy and utilities sector will revolve around clean energy technology. The sheer volume of new technologies in the pipeline is indicative of comprehensive change across the entire value stream. The sector is investing not just in wind and solar technologies but in fusion, bio- and agrofuels, energy storage, grid to vehicle applications, and comprehensive digital upgrades. Energy companies and, utilities are establishing strategies to provide resilience, equity, cost control and local control while prioritizing clean energy technology. Historically slow at the adoption of transformative technologies (specifically generation controls and gas turbines) it is anticipated that energy and utilities will be first movers in application of innovation and transformation through advanced technologies that will shape the global energy future.

Another challenge facing the energy sector is not the new technologies but disinformation. wyofile.com wrote *You know that American energy is going through a topsy-turvy time when the Washington Post decides to quote the Sierra Club on economics while looking to… (electric utilities) …for expertise about environmentalism.* A corresponding opportunity is to transcend the current binary of fossil fuels and renewables. We are in a transition. The industry must continue to increase the pace of mitigation technology transformation with increased focus on sustainable and renewable while developing effective messaging on mitigation efforts with transparency on fossil fuel and renewable investing.

At some point in the future, renewables will be the dominant source for energy. Until that time, fossil fuels and renewable technology are interdependent. For example, wind turbines use electricity from the grid to power the lighting and communication mechanisms as well as the sensors, ironically, sourcing fossil fuels. Battery dependent operations from renewable power plants to electric cars re-power from the grid, again – requiring fossil fuels. All renewable technologies are dependent – to some degree - on the grid, specifically fossil fuels, in their siting, manufacturing and operations. Renewable energy is essential to the mitigation of the ravages of climate change. During this transition, every economy in the world continues to be dependent on fossil fuels.

Fossil Fuels, Specifically Domestic Coal Use, is the Safety Net During the Global Energy Transition

The use of fossil fuels; both coal and natural gas to produce electrical power is commonly viewed as being at odds with global and domestic environmental goals. There is no fundamental reason why electric power generation should continue to contribute to climate change. Advanced fossil fuel technologies for climate change mitigation, with their accompanying federal and legislative support and energy infrastructure initiatives have demonstrated both viability and maturity.

Progressive reductions in carbon intensity can co-exist with fossil fuels, specifically coal's critical place in the supply chain to meet the energy demand that fluctuates through extreme weather events and the current pandemic. While renewable technologies are experiencing decreasing costs and increasing operational facilities, there are noteworthy requirements for more renewable deployment include re-engineering the grid, being able to provide large-scale consistent generation especially during extreme weather events, providing low reactive power to re-charge from blackouts to name a few. Despite aggressive development of renewable energy alternatives, the continued use of fossil fuels will remain essential to sustaining the domestic and global energy supply.

The International Energy Agency has outlined interdependent relationships for every energy strategy, globally. These policy objectives are energy security/reliability, containment of costs, and environmental/ climate concerns. Within the recent past multiple states have experienced the perils of replacing baseload coal generation with renewables. Most notable are Texas and California during the 2019 and 2020 heat waves that were measured at the worst in a decade. Power reserves fell below a critical threshold causing load interruptions resulting in blackouts affecting over 4 million people.

The popular press is replete with sources highlighting the reducing costs, access, and efficiency of renewable energy. The percentage of total energy provided by renewables *is* increasing. And global adoption of renewable energy technologies is continuing to gain strength. However, consider the four principal areas the energy sector supports: electricity generation, air and water heating/cooling, transportation and off-grid (rural or developing region services). And, globally, the energy sector is a US$60 billion market projected to grow to US$1 trillion and provide 15 million more jobs inclusive of low carbon technologies in development. There is no scenario where renewable technologies can support the global energy sector. Global energy demand – in every scenario considered - will continue to rise driven by Asia and Africa. In consideration of these factors together with the early-stage development of renewables, fossil fuels will continue to be the safety net for innovative renewable energy technology.

Making Carbon Capture Utilization and Storage/Sequestration Profitable

CCUS is a series of industrial processes that made an economically viable product while reducing CO_2 emissions through the entire value stream to near zero. These processes are the only technologies that decrease CO_2 emission from fossil fuels sources to atmosphere. The purposes of these technologies are to capture, store, reuse, sequester, or utilize CO_2 emissions so these same emissions will not enter the atmosphere.

Commercialized within the next [STEVE?] years….

CCUS is a category inclusive of all projects where CO_2 is permanently stored, wither geologically or by enhanced oil recovery. The CCUS value chain, while case sensitive, most broadly involves mining, transport & delivery, power plant, carbon capture; conditioning & compression, storage, transport or pipelines or sequestration/mineralization or utilization (oilfield pipelines, injection, and oil recovery).

'Carbon Capture' is the process of capturing/concentrating the CO_2 from other major elements in the flue gas. 'Storage' is deep geological isolation of CO_2 into the geosphere where it naturally exists. In most cases this is a deep saline formation or in a depleted oil or gas field. The CO_2 goes underground as a liquid with a similar viscosity and density of oil. Any geological formation that can hold a similar buoyant fluid – based on its permeability and porosity – can hold CO_2. Conservative estimates for storage capacity in the U.S. alone is estimated to be <12 trillion tons of CO_2.

'Utilization' is a range of market-driven strategies for carbon capture in coal and natural gas power and industrial facilities. It is in this area where the business case is made for carbon capture technologies. Projections of a CCUS market at US$90 billion by 2030 as the industry continues to mature and projects move into commercial phase. The lions share of market opportunities are in the U.S. supported by government initiatives, policy, and funding. Further, both private industry and government initiatives have identified hubs whose access to an existing CO_2 pipeline infrastructure and/or access to appropriate geological storage sites make utilization opportunities and profitability straightforward.

Driven by economics, technical progression, policy, employment and public opinion, current trends in the energy market are focused on developing and optimizing carbon capture technologies that can be retrofitted in existing plants. Further, and in consideration of the size of the U.S. coal fleet, retrofitting presents a major opportunity for carbon capture projects. A retrofit with oxy-fuel combustion carbon capture can use approximately the same footprint as the existing plant.

The opportunities for carbon capture technologies added to new power plants is best summed up in the previous comments regarding the aging of power plants across the U.S. Simply, many of the power plants are old units and have low potential for rebuilds. It is important to note that oxy-fuel combustion carbon capture has a measurable economic advantage in new build power plants. If the sale of CO_2 is constant, oxy-fuel carbon capture offers a higher rate of return to owners and investors of new build power plants.

Enhanced Oil Recovery (EOR) as a Strategy for Return on Equity

EOR is a CO_2 utilization technology that involves injecting CO_2 into existing oil reservoirs. This injection creates pressure and pushes oil to the surface. First applied in 1972, it is a commercially viable technique for increasing oil production in fields that are considered depleted by conventional means transforming a liability into a producing asset. The Western Governors Association has identified EOR as a national, economic, and environmental solution for energy security, climate change mitigation, industry, and employment. The National Energy Technology Laboratory estimates that there are >80 billion barrels of oil that are recoverable using advanced EOR technologies. For a benchmark, <8 billion barrels of oil are used in the U.S. every year. Further, for every 2.5 barrels of oil that is recovered using EOR techniques, 1 metric ton of CO_2 is sequestered.

EOR operations begin with CO_2 that has been captured, compressed to a liquid state then transported via a pipeline to an oil field where it is injected into an oilfield where it lowers the viscosity of the oil that is remaining in the oil field. When the CO_2 encounters the stranded oil there are two primary chemical reactions; the oil expands and the strong intermolecular cohesive forces that are holding the oil to the underground rock formations are weakened. Next the oil that was previously adhered to the rocks can move more freely and gathered by conventional oil production processes.

Most of the CO_2 that was injected into the well remains in the well and is sequestered. The CO_2 that returns to the surface is separated, compressed then reinjected into the oil field. Any CO_2 that escapes the process of initial is considered *de minimis*; miniscule.

An ownership interest in an EOR development gives an advantage as the industry moves through critical development phases in the next three to five years. The global market opportunity for carbon capture together with the accompanying applications of both utilization and storage is estimated to be US$5.6bn in 2026 *(Bloomberg & Fortune Business Insights)*

Government Incentives & Policy Initiatives Play an Important Role in CCUS Deployment

As with any large-scale energy deployment, policy measures that align market opportunities with end results is critical. Strong political commitment is necessary. Recognition has been growing since 2000 that CCUS is the lowest-cost global solution during the transition from fossil fuels to renewables. Policy support has been sporadic and occasionally the victim of political theatre in global climate change negotiations and broader global conditions.

The normal fluctuations of political cycles, politicians with their policy and accompanying financial support have created more complexities in the development and deployment of CCUS and their long timeframe for project development through commercialization together with the high capital and operating costs. Market adoption requires large government incentives and serious legislation on emissions.

Developing large scale CCUS projects will require a strong bi-partisan climate policy with achievable climate targets and a planned transition; economic, technological, and political. A conglomeration of technologies executing multiple scenarios requiring broad coalitions with varying adaptabilities must be central. The policies must transcend the binary of renewables or fossil fuels.

One final comment on productivity is to recognize measures of cost effectiveness and productivity. For the past hundred and forty years, technological improvements in the energy sector have led to productivity improvements. The measure of “productivity” will need to be expanded to include downstream measures of mitigation

The U.S. Department of Energy’s Commitment and Support of CCUS and the Environment

Carbon capture has been receiving increasing policy and legislative attention for its transformative value creation, market opportunities as well as its climate mitigation features. The DOE’s support of CCUS extends into exploration and testing of sequestration sites across the country. A key question regarding the long-term viability of CCS and CCUS is if its upstream and downstream operations function with a respect for the protection of the local environment and human health. While CO_2 has been stored in geological formations on earth for millions of years, evidence was required that injection of CO_2 into geological formations can be safe and secure.

CO_2 storage has been monitored in projects since 1996. With almost 25 years of research and geological assessment, the DoE has been developing technologies that safely and permanently store CO_2 without adversely impacting natural resources or hindering economic growth. Over this period, the DOE has invested over $1 billion in carbon capture technologies and the accompanying capabilities insuring environmental and human safety. In 2003, the DoE launched the Regional Carbon Sequestration Partnerships (RCSP) established a framework for broad evaluation of CCUS including the identification of existing CO_2 sinks and future CO_2 sequestration sites. The RCSP's focused on technology evaluation, resource assessment, regulations, and the infrastructure needs. Building on the regional foundation, the DOE established the Carbon Storage Assurance Facility Enterprise (CarbonSAFE). CarbonSAFE was established to further advance the development of CO_2 storage sites. Focusing on screening, site selection, monitoring, accounting and assessment procedures as well as design and permitting oversite, CarbonSAFE looks to identify storage sites for 50 million metric tons of CCUS, a fraction of the storage capacity in the U.S.

The DoE's National Energy Technology Laboratory in partnership with the EPA conducted research and testing to establish guidelines for CO_2 technologies and the resulting storage. In 2010, the EPA presented a final set of requirements for geologic storage of CO_2. These requirements included the establishment of a new class of wells; Class VI. The Class VI rule protects underground sources of drinking water. Relevant to CCUS, Class VI also ensures safe, permanent CO_2 storage. Regarding CO_2 injection for long term storage, the Class VI rule address CO_2 injection for long-term storage to ensure that wells used for geologic storage of CO_2 are appropriately sited, constructed, tested, monitored, funded, and closed. Comprehensive, detailed to the extent of exhaustive in its requirements, the six-year permitting process necessitates a Pre-Feasibility, Feasibility, Site Characterization & Assessment before the two and a half year Permitting and Construction phase begins.

Since 2010, individual states with interest in CCS and CCUS began to establish local regulations within the DOE and EPA framework. Primary enforcement ability or 'Primacy' is a qualification given by the EPA recognizing a state's ability to protect the environment and the public health safely and responsibly through the effective management of drinking water. Class VI injection well regulatory primacy give individual states the autonomy to enforce regulations over Class VI wells and allowing for local decisions regarding permitting fo future CCS and CCUS projects. Two states have qualified for the EPA designation of "Primacy": Wyoming and North Dakota.

45Q Tax Credit is Foundational to Profitable CCUS Deployment

The primary method of government support for R&D of CCS and CCUS has been to provide funding through the annual appropriations process. In pursuit of clean energy deployment, a generous federal tax credit – the Carbon Oxide Sequestration Credit or 45Q – was established that gave companies the opportunity for a tax credit if CCS or CCUS technologies were installed at gives companies. 45Q is widely considered to be the most progressive CCS and CCUS incentive program globally. The most compelling argument for subsidization of sequestration is the perspective that climate change mitigation is a public service like water treatment or waste disposal.

Enacted with the Energy Policy Act of 2007, 45Q initially provided a credit of $20 per metric ton of qualified CO_2 that is captured and transitioned to secure geological storage. And, $10 per metric ton of qualified CO_2 that is captured and used as an injectant in a qualified EOR or natural gas recovery project. As part of the Bipartisan Budget Act in 2018, the tax credits allowed on a per ton basis were increased.to $35 for every metric ton of CO_2 that is used commercially (Utilization) and $50 for every ton of CO_2 that is permanently stored (Sequestration).

Carbon Removal technologies are provided a credit of $180 per metric ton of qualified CO_2 that is captured. Electric generating plants must capture at least 500,000 metric tons of CO_2 per year to qualify for the tax credit. Industrial facilities like cement or steel plants must capture at least 100,000 metric tons of CO_2 to qualify for the tax credit.   45Q can be combined with state and local climate mitigation incentives. Individual states, such as Wyoming are adopting policies that incentivize the use of carbon capture technology and are reducing regulatory barriers to CCUS projects.

Finally, 45Q allows for a variety of partnership structures. While the tax credit is intended for the taxpayer who owns and operates the CCS and CCUS equipment, 45Q is available as an alternative financing mechanism through partnerships and investors. An investor can be an owner, partner and/or developer.

Jupiter Oxygen Corporation – Technological Innovation for the CCUS Necessary for Net Zero

Jupiter Oxygen Corporation is a privately held company in Chicago that has patented an innovative carbon capture technology to capture CO_2 emissions at the source. With *near zero* emissions, our technology offers a viable solution to address emissions control from fossil fueled power generation sources. We are leading the application of oxy-fuel carbon capture technology worldwide.

Oxy-fuel combustion burns near pure oxygen in the combustion process (instead of ambient air) with recycled flue gas. While additional energy is used in the Air Separation Unit in the production of near pure oxygen, the result of the combustion process is a significantly increased concentration of CO_2 in the flue gas allowing for more efficacious capture.

In the 1990's, Jupiter Oxygen conducted experiments with the use of oxygen in industrial melting furnaces. Knowledge from these experiments let to a new technology for combustion and burner systems for the oxy-fuel combustion process that had been used in industrial plants for decades. The results are dramatic; a 78% reduction of natural gas fuel and a waste oil fuel usage reduction as high as 68%.

A complete coal combustion and flue gas treatment process was designed, constructed and operated at bench scale as a product of cooperative research between the U.S. Department of Energy's Albany Research Center and Jupiter Oxygen Corporation.

The unique oxy-fuel technology was then transferred from industrial melting furnaces to fossil fuel steam generates and power plants, focusing on efficiency and emissions benefits in cooperation with the U.S. Department of Energy and its National Energy Technology Laboratory.

Our technology features significantly in every low carbon scenario resulting in an economically efficient and carbon neutral energy supply. By all metrics for comparing carbon capture technologies; Technology Readiness Level, Economic Analyses, etc. Jupiter Oxygen's oxy-fuel carbon capture technology ranks premiere. Our pragmatic and practical approach will augment the environmental benefits at Near Zero emission power plants. Positioned to be first-of-a-kind carbon capture in Wyoming, Jupiter Oxygen has a valuable role in unlocking the profitability of carbon capture.

While post-combustion is the most developed and mature technology, Jupiter Oxygen's high flame temperature oxy-fuel technology is superior in all measures of efficacy and economics.
Jupiter Oxygen plans to retrofit PacifiCorp's Dave Johnston power plant in Glenrock, Wyoming. As one of six planned retrofit projects, Jupiter Oxygen technology at Dave Johnston will secure the current jobs as well as increase employment affiliated with this by as many as [STEVE FILL IN].

Our Advantages

- The technology provides capabilities to generate energy from fossil fuels with near zero emissions providing 97+% decarbonized electrical generation. Virtually emission free power production.

- The increased heat in our combustion process with near pure Oxygen allows for the capture of not only CO_2 but Nitrous Oxides, Sulfur Oxides, Mercury, and Particulate Matter.

- The technology creates more efficient heat transfer for industrial furnaces with moderate process temperatures. Improved efficiency is due to elimination of airborne nitrogen, more radiant heat transfer, and longer gas residence time.

- The high flame temperature oxy-combustion technology offers fuel efficiency gains in the boiler and latent heat recovery for additional efficiency, as well as process water reuse.

- Parametric studies performed to determine the optimal performance conditions and to generate the necessary technical data required to demonstrate our technology substantiate the technology is viable technically and economically at levels not yet achieved by other carbon capture technologies.

- Jupiter Oxygen Corporation's technology is, in general, at a higher level of maturity and is a simpler concept compared to other more novel technologies suggesting a buffer against the growing divestment from fossil fuel investing.

- We are targeting smaller scale fossil fueled units to retrofit with our technology. This will significantly lower the overall capital cost expenditures, reducing financial hurdles that would be found in new build fossil fueled power plants.

- Jupiter Oxygen's timeline represents one of the fastest to market of the low-carbon advanced coal technology allowing it to capitalize on the existing 45Q CO_2 tax credits.
- The cost of capture and EOR application offers price efficacies far superior to membrane, solvent, or direct air carbon capture technologies.

- Given the nascent state of development of many renewable energy technologies, our speed to market provides an immediate solution for climate change mitigation and offers a competitive advantage in the growing low-carbon economy.

- Jupiter Oxygen is partnering with some of the most progressive engineering and energy companies with a combined focus of meeting the rising energy demand with our innovative technologies.

- This innovation and the scaling up of our decarbonization technology has led to major reductions in the cost of our technology, the primary challenge in any carbon capture demonstration project.

Milestones

- Jupiter Oxygen is the project owner, director, and technologist for the High Flame Temperature Oxy-Fuel Combustion carbon capture project at PacifiCorp's Dave Johnston Power Plant in Glenrock, Wyoming.

- Our patented technology has undergone rigorous testing at our Hammond, Indiana Pilot Plant while working with the U.S. Department of Energy over a ten-year period. Our technology is ready for full scale demonstration at an operating coal-fired plant (TRL 6).

- Our nimble operations have fast-tracked our carbon capture technology through Feasibility Study to FEED Study of Retrofit of a Coal-Fired Electric Power Generating Unit with a vital CO_2 off-take market.

- A Feasibility Study was completed in 2018. A Front-End Engineering and Design study began in February 2020 and is scheduled to be completed in June 2021. This FEED study will ultimately lead to a complete plan to build the largest oxy-combustion CO_2 capture facility in the world and to demonstrate a viable cost-effective strategy for retrofitting existing coal-fired power plants with low-carbon, poly-generational technology.

- The proposed demonstration project involves the engineering and construction of a carbon capture utilization and storage (CCUS) facility involving the retrofit of PacifiCorp's Dave

Johnston Unit 2 to oxy-fuel combustion with carbon capture for delivery of CO_2 to a nearby oil field for CO_2-EOR long term operations.

- Our demonstration project will capture the power plant emissions, purify, and deliver the CO_2 to an oil field approximately 10 miles away. The CO_2 will then be injected in the oil field for enhanced oil recovery, a proven means of producing residual oil from older and depleted oil fields that would otherwise be stranded when using convention oil production techniques

- Following successful deployment of demonstration, Jupiter Oxygen's plan is to further deploy its oxy-combustion carbon capture technology as a retrofit to existing fossil-fueled units throughout Wyoming, the U.S. and abroad.