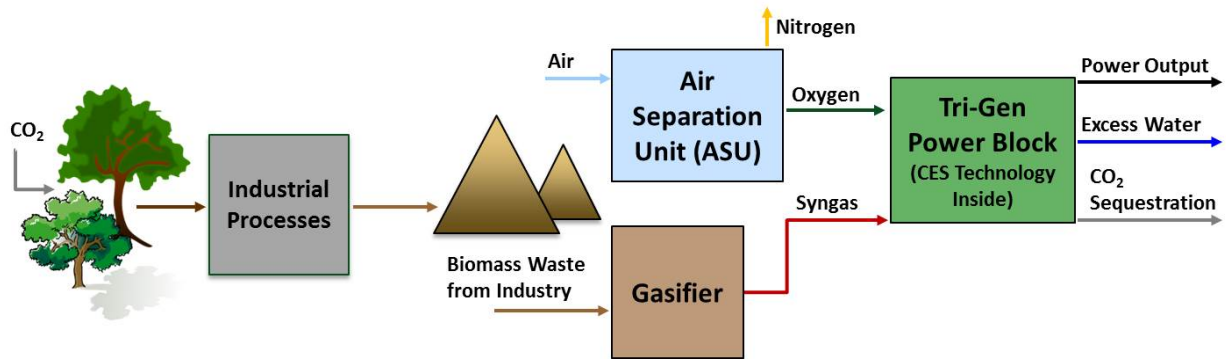
Purpose

The purpose of this document is to request regulatory inclusion of CES' BioCCS and similar cycles as ARB incorporates CCS into the LCFS program in order to provide a policy more conducive to advancing new technologies which offer negative-carbon cycles. The suggestions provided herein will create the appropriate economic environment required to deploy advanced negative-carbon power cycle and ultimately surpass the goals set forth in current GHG reduction mandates.

Background

Clean Energy Systems has developed a negative-carbon power cycle, called BioCCS, capable of producing electricity, renewable natural gas (RNG), and/or hydrogen, all of which may be used as alternative transportation fuels. The feedstock to the BioCCS system is woody biomass waste which has absorbed CO_2 over its lifetime. When this waste is disposed using traditional methods, such as natural decomposition or burning in a conventional biomass power plant, the carbon is released back into the air in the form of CO_2 or methane. Using this feedstock as a fuel, the BioCCS cycle captures and sequesters the absorbed CO_2 while producing clean electricity (see schematic below); notice there is no exhaust stack required.



CES' BioCCS Cycle

Requested Regulatory Updates

While the BioCCS cycle offers a truly effective method for removing CO_2 from the atmosphere with the added benefit of producing a useful product (electricity), deployment has thus far been constrained. This is partially due to regulations focused too narrowly on particular requirements rather than promoting any system which provides a solution to the challenge of producing energy with a lower (in this case, a negative) carbon footprint. CES requests that an amendment be made to the LCFS regulations to allow for indirect allocation of power in generating credits for energy produced with a carbon intensity value of less than zero or for those which employ CCS technologies when using renewable fuels. A cap may be placed on this indirect allocation, possibly calculated by the amount of EV charging required in the state (based on the number of EVs) minus the power accounted for by direct charging stations.

Rationale

Current wording in the regulation requires direct coupling of a generation source with the charging facility, inherently preventing the utility-scale deployment of these negative-carbon power plants required for California to reach our de-carbonization goals in the transportation sector. In reference to the aforementioned indirect allocation cap, over 60,000 new EVs were sold in California in 2014 alone, translating to *over 283 GWh* of power for charging per year. This is a significant amount of power that can be generated using negative-carbon cycles if that electricity is eligible for generating LCFS credits. Additionally, EV vehicles require at least 20-30 minutes to draw a useful charge using latest technology. Utility-scale facilities cannot and should not be located at sites where the general public must wait for their vehicles to charge due to safety and security concerns; this is why charging stations are located at malls and other entertainment areas. The challenge under the existing system, then, is to allow for negative carbon cycle plants to functionally or virtually deliver electricity to multiple sites for end-use.

While any carbon-capture cycle is inherently more capital intensive than a system without CCS, power market pricing and LCFS credit trading prices make BioCCS cycles competitive with conventional fossil fuel-based power plants; such a modification to the LCFS regulations will allow for the required economics to garner the private investment needed to deploy a series of negative-carbon power plants throughout California and remove over 1.25 metric tons of CO_2 per MWh generated. With each 1% market penetration, BioCCS technology will *remove* over 3.5 million metric tons of CO_2 from the atmosphere every year while also displacing fossil fuel-based power, *preventing an additional* 2 million metric tons per year from being released, as well as a reduction in all other criteria pollutants.

Additional Arguments

Net-negative carbon cycles and those employing CCS provide an energy product while removing and preventing the release of carbon into the atmosphere. These cycles offer lower carbon intensities than the existing and planned LCFS pathways, yet currently are not eligible. For example, RNG produced from biomass resources fit in the LCFS program even though all of the carbon will ultimately be released to the atmosphere when burned in a CNG IC engine. Electricity produced via the BioCCS cycle and sent to the grid also displaces power which would have been generated using fossil fuels and has environmental attributes better than wind and solar technologies. With the goal of reaching 1.5 million ZEVs on California's roads by 2025 (http://www.energy.ca.gov/renewables/tracking_progress/documents/electric_vehicle.pdf), there will be the cumulative demand to allow for multiple large-scale (~25-50 MWe) power production facilities, displacing power generated from traditional fossil fuel facilities.

As an example, if the average EV uses 35 kWh/100 miles, and the average distance traveled per year per driver in California is 13,500 miles, and assuming 50% of the ZEVs on the road by 2025 are traditional EVs, this translates to over 3,540 GWh/year of negative-carbon power, *removing* 4.44 million metric tons of CO_2 while avoiding an additional 2.49 million metric tons from being released. With this assumption, a fleet of 500 MW to 1,000 MW of BioCCS plants will offer the most impactful carbon reduction plan to meet the state's objectives.

Conclusion

Clean Energy Systems' intent for this letter was to provide the argument for adopting new language in the LCFS regulation to provide considerations for cycles which exceed the spirit of the mandate, regardless of the direct use of the energy. The negative-carbon BioCCS cycle is a solution to the challenge of actually removing existing GHGs, not simply reducing emissions, and provides a pathway for California to meet the current and future GHG emission reduction targets.

Questions/Contact Information

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