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Advanced Hybrid Energy System to integrate oil shale gasification technology with coal fired electric power generation to reduce carbon footprint and minimize emissions

Joseph D. Smith[1], Richard D. Boardman[1], L. Douglas Smoot[2], Khalid Omar[3], Ralph L. Coats[2], Kent E. Hatfield[2]

[1]Idaho National Laboratory, Idaho Falls, ID, United States, [2]Combustion Resources, Inc., Provo, UT, United States, [3]Western Research Institute, Laramie, WY, United States

Hybrid energy systems represent the next generation in electric power generation to reduce carbon intensity of fossil fired power plants. Using an advanced oil shale processing technology to produce spent oil shale which is supplied to a coal fired power plant has been shown to effectively capture sulfur oxide and mercury emissions. The resulting particulate generated in this process can then be used to produce high-quality cement that further reduces emissions from conventional cement production. The advanced oil shale conversion process has previously been shown capable of producing nitrogen-rich oil that can be used as an effective NO_x reburning oil. The process has also produced spent shale sorbent with very low CO_2 emissions and water consumption. This paper presents a Hybrid Energy System that combines an oil-shale processing step to produce reburning oil and spent shale sorbent with an electrolysis unit to generate hydrogen to support the oil-shale gasification step and oxygen to support oxy-fuel combustion. The paper also presents results from a plant-scale implementation of spent shale oil sorbent injection to reduce SOx and Hg emissions. The paper summarizes the relative impact of implementing this Hybrid Energy System on CO_2 foot print for a typical coal fired power plant. This work aims to advance the Hybrid Energy Systems concept and demonstrate a novel oil shale processing technology to reduce the carbon footprint and SO_x and Hg emissions from a typical coal-fired power plant.