APPLYING POTENTIAL BECCS SOLUTIONS TO THE US COAL SECTOR: NEW COAL BOOM OR BUST?

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Key Words: CO_2 mitigation; power sector; BECCS supply chain; coal fired plants; United States;

Coal-fired plants have been the pillar of US power generation for more than a century, still contributing nearly 40 percent to U.S. electricity supply and accounting for about a third of national CO_2 emissions. Nevertheless, coal's dominance in the United States is waning, mainly because new emissions regulations are changing the economics of power generation, making coal uneconomical in some areas. At the same time, according to recent scenarios of energy transition, coal will continue to play a large and indispensable role in a carbon constrained world. Indeed, the challenge for governments and industry is to find a path that mitigates carbon emissions yet continues to utilize coal to meet urgent energy needs. Biomass coupled with post-combustion carbon capture and storage (BECCS) could play an important role in deeply cutting CO_2 emissions from existing coal-fired power plants. However, adding existing commercial sequestration systems to pulverized coal power plants might significantly increase the cost of electricity and lead to energy penalty. Thus, the feasibility of CCS retrofit should be evaluated on a site-specific basis so to account for varying unit characteristics. Under such premises, the main goal of this work is to identify candidate coal plants for which CCS options might be economically feasible considering different policy scenarios (e.g. increasing carbon prices) and given the presence of site specific constraints (e.g. plant maturity, biomass availability and proximity of a suitable CO_2 sink). The methodology implies the adoption of the spatially explicit model BeWhere, which optimizes the cost of the entire BECCS supply chain. Three CCS options are investigated according to different carbon abatement rate: Biomass co-firing up to 15% of total output from a single coal plant with no CCS, CO_2 capture and a carbon negative routes through the adoption of biomass coupled with CCS. Saline aquifers located in the US territory and currently representing over 90% of the estimated capacity, are adopted as potential storage sites. The model outputs include the number and location of feasible coal power plants, the length and diameters of CO_2 pipelines as well as the location and dimension of the injection sites. The results shows that although the storage of CO_2 is largely economically sustainable, the implementation of a full scale BECCS project would require the imposition of high carbon prices (approximately $70/ton). We conclude that to allow the transition of North American black fuel towards a green energy, and thus to defer both climate change and coal plants phase-out, bold policies of clear vision to include CCS in the country’s emissions reductions agenda, must be undertaken.