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How green can black be? Assessing the potential for equipping USA's existing coal fleet with carbon capture and storage

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The mitigation of adverse environmental impacts due to climate change requires the reduction of carbon dioxide emissions – also from the U.S. energy sector, a dominant source of greenhouse-gas emissions. This is especially true for the existing fleet of coal-fired power plants, accounting for roughly two-thirds of the U.S. energy sectors' total CO_2 emissions. With this aim, different carbon mitigation options have been proposed in literature, such as increasing the energy efficiency, co-firing of biomass and/or the adoption of carbon capturing technologies (BECCS). However, the extent to which these solutions can be adopted depends on a suite of site specific factors and therefore needs to be evaluated on a site-specific basis. We propose a spatially explicit approach to identify candidate coal plants for which carbon capture technologies are economically feasible, according to different economic and policy frameworks. The methodology implies the adoption of IIASA's techno economic model BeWhere, which optimizes the cost of the entire BECCS supply chain, from the biomass resources to the storage of the CO_2 in the nearest geological sink. The results shows that biomass co-firing appears to be the most appealing economic solution for a larger part of the existing U.S. coal fleet, while the adoption of CCS technologies is highly dependent on the level of CO_2 prices as well as on local factors such as the type of coal firing technology and proximity of storage sites.