Coal Cost Crossover — An Unreliable Story

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The nation's coal fleet promotes electric reliability and resilience; provides fuel security; offers optionality when other electricity sources are unable to generate electricity (e.g., wind and solar) or fuel prices are too high (e.g., natural gas); produces affordable electricity; contributes to fuel diversity; and promotes domestic energy security. Because of these attributes, coal is an essential part of an all-the-above energy strategy.

Despite these attributes, a recent report (Coal Cost Crossover 3.0[i]) by San Francisco-based Energy Innovation Policy & Technology concludes that coal plants should be replaced by renewables because building and operating new wind farms and solar installations would be less expensive than continuing to operate existing coal plants.[ii] The report compares the marginal cost of energy (MCOE) for existing coal plants with the levelized costs of energy (LCOE) for new solar and wind facilities — after taking into account new tax credits established by the Inflation Reduction Act — and concludes that the levelized costs of new wind and solar are less than the marginal cost for 209 out of 210 coal power plants in the U.S. However, the report fails to seriously address many of the practical obstacles to replacing the U.S. coal fleet with massive wind farms and solar installations.[iii] The following is not a comprehensive critique of the Crossover report but briefly highlights three of these obstacles.

Reliability

- Crossover downplays the potential reliability impacts of replacing coal with wind and solar but acknowledges that the "U.S. will continue relying on coal plants for reliability until we add enough new clean resources (including demand-side resources and transmission) to replace their reliability and energy services."[iv] The report also acknowledges that some regions of the country could experience reliability problems if coal is replaced with wind and solar.[v]
- Crossover does not provide any analysis showing the grid would be reliable or resilient if coal were replaced entirely with wind and solar. Crossover says that "recent studies, such as the 2030 Report [by California Berkeley analysts] ... confirm that we can maintain a dependable electricity system without coal." However, the 2030 Report states clearly that "[I]ssues such as loss of load probability, system inertia, and alternating-current transmission flows need further assessment ... [T]his analysis does not attempt a full power-system reliability assessment ..."[vi] In short, more analysis is necessary to determine whether replacing coal with wind and solar would exacerbate the already-existing risks to reliability. Also, even Crossover admits that the "reliability implications of coal plant retirement should be evaluated for each specific plant."[vii]
- Crossover downplays or ignores the value of reliability attributes such as fuel diversity, fuel security, inertia, and the high capacity value of coal. For example, coal provides a high degree of fuel security (an average of 76 days of fuel onsite), which is essential for reliability and resilience, while wind and solar provide no fuel security.[viii]

- Accredited capacity (or capacity value) is the amount of generating capacity that can be counted on to produce electricity when demand peaks, such as during extreme weather. The capacity value (or accredited capacity) of coal (90 percent) is 5.4 times greater than wind (16.7 percent) and 4.5 times greater than solar (50 percent but declining to 20 percent).[ix] Therefore, coal's high capacity value makes it considerably more dependable than wind or solar when electricity demand is highest.

Cost

- The capital cost of adding new wind and solar facilities to replace approximately 200,000 megawatts (MW) of coal-fired generation would be enormous.
- Presenting levelized costs masks the huge capital investment that would be necessary to build new wind and solar facilities, even with tax credits. Hypothetically, the capital cost of replacing the entire coal fleet on a MW-to-MW basis (one MW of new wind or solar for each MW of retiring coal) would be $344 billion for wind, $265 billion for solar, or $350 billion for solar with four-hour storage.[x] These costs are illustrative because wind and solar would be added in some combination.
- However, grid operators must ensure that enough *accredited capacity* will be available during periods of peak demand. Providing the same amount of *accredited capacity* as the coal fleet could cost hypothetically more than $1.8 trillion for new wind farms or more than $1.2 trillion for new solar installations.[xi]
- In addition, the cost of adding transmission for new wind and solar installations is not included in the LCOE for wind and solar. Costs for adding new transmission to access new wind and solar are uncertain but typically range from $200 billion to more than $600 billion, which would be in addition to the capital costs of new wind and solar installations. Besides cost, there are numerous obstacles (e.g., permits and approvals, opposition by landowners) which would impede the addition of new wind and solar. Also, the Crossover report correctly points out the problem with already-long wait times for renewable projects to connect to the grid.

Stranded Assets

- The cost of stranded coal assets is not factored into the LCOE or MCOE comparison of coal and renewables. However, utility commissions and ratepayers cannot ignore stranded assets. Replacing coal with wind and solar means that ratepayers would face at least three new costs: paying for stranded investments in coal plants, paying for new wind and solar, and paying for new transmission.
- According to Crossover, "One of the biggest hurdles … is the rate impacts of adding large capital investments to utility rates when billions are still owed to debtors and investors on uneconomic coal assets."[xii] The report mentions $176 billion in "unpaid fossil plant balances," which we interpret to mean stranded power plant assets. This figure does not appear to include stranded costs associated with the coal supply chain (e.g., coal mining and transportation) or other assets associated with coal-reliant communities.

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Caveat: The cost of adding large amounts of wind and solar is influenced by the new tax credits that were included in the IRA. For example, the production tax credit for wind and solar would lower their levelized costs. However, the extent to which other tax

credits (e.g., community tax credits) would lower costs or other barriers to adding wind and solar is speculative.

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[i] "The Coal Cost Crossover: Economic Viability of Existing Coal Compared to New Local Wind and Solar Resources," Energy Innovation: Policy and Technology, January 25, 2023, https://energyinnovation.org/publication/the-coal-cost-crossover/.

[ii] Energy Innovation published its first Crossover report in 2019 and Crossover 2.0 in 2021.

[iii] As with any analysis, the results are dependent on key assumptions. For the sake of argument, we assume the data used in the report are valid. However, different assumptions or more comprehensive analysis that takes into consideration other costs and challenges, such as the ones highlighted in this short paper, could lead to a different conclusion about new wind and solar replacing existing coal.

[iv] Crossover 3.0, page 7.

[v] "… [I]n some regions one-to-one replacement with a combination of wind and solar resources may not adversely affect reliability. In others, it may [adversely affect reliability] depending on what other resources are serving the power grid." Crossover 3.0, pages 7 and 8.

[vi] Abhyankar, et. al., "2030 Report – Powering America's Clean Economy," page 35, Goldman School of Public Policy, University of California, Berkeley, April 2021.

[vii] Crossover 3.0, page 25.

[viii] Crossover 3.0 assumes four-hour battery storage for "local" solar installations, but this is unlikely to have a major effect on grid reliability. For example, many utilities are forecasting the need for "seasonal" battery storage as they consider adding more wind and solar, rather than just a few hours of storage.

[ix] See, for example, page 6 of PowerPoint presentation "MISO System Attributes Workshop," September 21, 2022. Wind's capacity credit is 16.7 percent, solar declines from 50 percent to 20 percent over time, hybrid declines from 60 percent to 30 percent, and battery declines from 100 percent to 75 percent. Coal, gas and nuclear are credited between 90 percent and 100 percent.

[x] These cost calculations are based on overnight capital costs from EIA's "Cost and Performance Characteristics of New Generating Technologies, AEO 2022," March 2022. Overnight capital costs do not include interest charges, which would add to the cost of building new wind and solar facilities.

[xi] These costs are calculated by multiplying by 5.4 (90 percent divided by 16.7 percent) the cost of replacement wind and multiplying by 4.5 (90 percent divided by 20 percent) the cost of replacement solar.

[xii] Crossover 3.0, page 11.