Are Existing Coal Plants Less Expensive Than New Gas, Wind or Solar?

The nation's mix of electricity resources is changing rapidly. One of the major changes is the retirement of a large number of coal-fired power plants across the nation (43 states, to be precise). So far, almost 40 percent of the coal fleet has retired or announced plans to retire. *But does it make sense to continue retiring even more coal-fired power plants?*

This paper illustrates the economic advantage of existing coal-fired power plants compared to new sources of electricity. This is an important consideration because most people assume that new sources of electricity (gas, wind and solar) must be cheaper; otherwise, why would utilities retire existing coal-fired power plants? However, this assumption is not necessarily correct.

Levelized Cost of Electricity There are different ways to answer the question above. One way is to consider the **dispatch cost** that determines which power plants will be dispatched at any given moment. The dispatch cost affects the revenues of a power plant. The dispatch cost ($/MWh) includes only variable costs, such as fuel, that are directly involved in generating each MWh of electricity. Other things being equal, plants with the lowest variable costs are dispatched first, and plants with increasingly higher variable costs are brought on line sequentially as electricity demand increases. However, the dispatch cost does not include other costs, such as maintenance and capital expenditures, which are an important consideration over a longer period of time.

A better way to answer the question is to consider the **levelized cost of electricity** (LCOE), which is a single value that captures all of the costs (variable, fixed, capital and financing) of an electricity resource over its lifetime.[i] Conceptually, LCOE is a measure of lifetime costs ($) divided by electricity production (MWh). Typically, levelized costs have been used to compare investments in new electricity resources. However, levelized costs are useful in comparing existing resources, such as coal-fired power plants, to new resources such as gas, wind or solar.

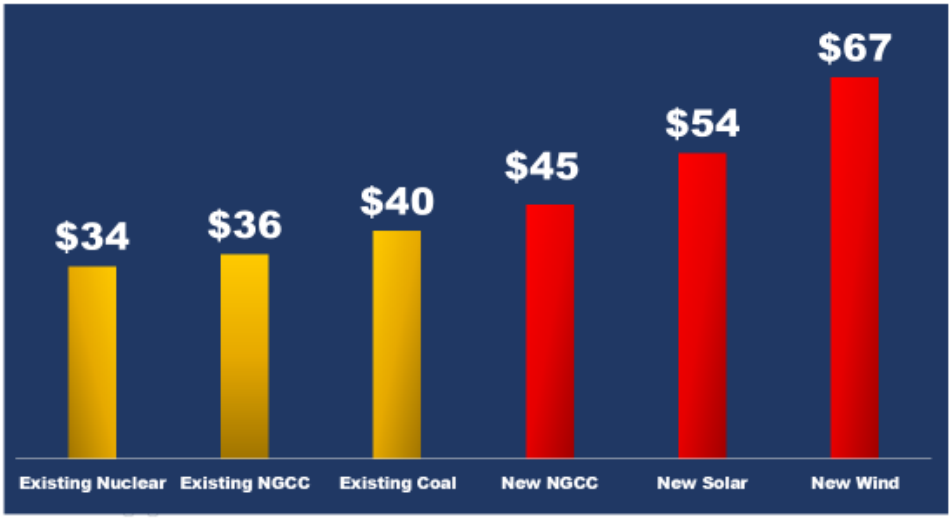
This paper summarizes the results of several studies to illustrate how the levelized cost of existing coal-fired power plants can be less than new sources of electricity. ACCCE retained Energy Ventures Analysis (EVA) to provide

levelized cost estimates for various types of electricity resources.[ii] This paper also summarizes the results of analysis by others.

We compare levelized costs on a national average basis. Actual costs will vary from region to region and plant to plant. However, national average results illustrate that levelized costs are an important consideration in evaluating retirement decisions.

Comparison of Levelized Costs On average, the levelized cost for an existing coal-fired power plant is less than new natural gas combined cycle (NGCC), wind or solar capacity. To illustrate this point, the chart below compares levelized costs in 2020. The costs are derived from the EVA model and are show in the table below.

LCOE ($/MWh) for electricity sources in 2020 per EVA model



Further, at fuel prices forecast by EVA, the average *existing* coal-fired power plant is less expensive than the average *existing* NGCC plant by 2025 (red in the table below).[iii]

Levelized Costs (2018$/MWh)[iv]

	Coal (Exist)	NGCC (Exist)	Nuclear (Exist)	NGCC (New)	Wind (New)	Solar (New)
2016	$38.44	$32.45	$33.59	$42.00	$52.26	$48.40
2018	$40.18	$34.13	$33.86	$43.40	$53.48	$48.97
2020	$40.00	$35.88	$33.83	$44.59	$67.03	$53.74
2025	$40.55	$43.80	$34.00	$50.65	$76.74	$70.16
2030	$40.79	$46.42	$34.10	$52.63	$77.50	$70.29
2035	$41.25	$49.10	$34.20	$54.61	$77.92	$70.70
2040	$41.66	$51.35	$34.23	$56.57	$77.71	$70.50

Levelized costs from the EVA model are roughly comparable to other studies (table below), except that levelized costs for new solar and wind from the Institute for Energy Research (IER) are higher than other studies (red in the table below). IER notes that wind and solar need to be paired with gas-fired generation in order to provide the same reliable output as coal, NGCC and nuclear. Therefore, IER's forecast for wind and solar includes an added cost for NGCC as backup.

Levelized Costs ($/MWh)[v]

	ACCCE/ EVA	IER[vi]	LAZARD[vii]	EIA[viii]	NREL[ix]
Existing					
Coal	$40.00	$39.90	--	--	--
NGCC	$35.88	$34.40	--	--	--
Nuclear	$33.83	$29.10	--	--	--
New					
NGCC	$44.59	$55.30	$60	$49	$50
Wind	$67.03	$107.40	$45	$59	$42
PV solar	$53.74	$140.30	$47.50	$63	$51

Our point in writing this paper is to illustrate another economic advantage of existing coal-fired generation. To be fair, these levelized costs are national averages, and there are other considerations that could affect decisions to retire existing electricity sources. For example, future environmental compliance costs could increase levelized costs. On the other hand, changes to wholesale market rules that value fuel security and other attributes provided by the coal fleet could reduce levelized costs.[x] Regardless, levelized costs are an important and underappreciated consideration in retirement decisions.

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[i] We use the term levelized cost of *electricity*, but LCOE is usually called levelized cost of *energy*. In the case of this paper, we are using the terms synonymously.

[ii] A full discussion of the EVA LCOE model, inputs and results is available in Energy Ventures Analysis, *The Competitiveness of Coal in U.S. Electricity Markets: A 20-Year Outlook, 2018 Update*, June 2018.

[iii] The economics of natural gas versus other electricity resources are highly dependent on natural gas prices. EVA's natural gas price forecasts are proprietary. However, for perspective, EVA's Henry Hub prices are lower in the early years and higher in the later years than EIA's 2018 AEO reference case. Over the period 2018-2035, EVA's forecasts are lower than EIA's by an average of

$0.12/MMBtu, which is 3% lower on average than EIA's. For the other studies in the table, we do not have the natural gas price inputs, or they are unavailable.

[iv] Strictly speaking, LCOE is the minimum price at which energy must be sold for an energy project to break even.

[v] The levelized costs in this table are not intended to be used as a precise comparison. For example, the studies use different year dollars (2013$ to 2018$), and the years in which the resources come online vary from 2015 to 2022.

[vi] Stacy, Thomas F., and G.S. Taylor. *The Levelized Cost of Electricity from Existing Generation Resources*. Institute for Energy Research, July 2016. https://www.instituteforenergyresearch.org/wp-content/uploads/2016/07/IER_LCOE_2016-2.pdf

[vii] Lazard Ltd. *Lazard's Levelized Cost of Energy Analysis Version 11.0*. November 2, 2017. https://www.lazard.com/perspective/levelized-cost-of-energy-2017/.

[viii] U.S. Energy Information Administration. *Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2018*. March 27, 2018. https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf.

[ix] National Renewable Energy Laboratory. *2017 Annual Technology Baseline*. https://atb.nrel.gov/.

[x] In addition to explicitly valuing attributes like fuel security, it seems likely at the time this paper is being written that DOE will issue an order to prevent the retirement of coal and nuclear plants that are deemed critical to national security. Steps taken by DOE could affect levelized costs.