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Southern Alliance for Clean Energy

Cleaner Energy for Southern Company:
Finding a Low Cost Path to Clean Power Plan Compliance

Summary of Project Findings

With the US Environmental Protection Agency poised to release its final Clean Power Plan rule, some utilities have raised alarm about the rule's cost. Although regulated by four state utility commissions, Southern Company does not provide public access to basic information about what it plans to do, what its future costs will be, and why it has chosen those plans. For example, Alabama Power Company does not provide the public with access to its integrated resource plan (IRP), and routinely makes large capital investments without regulatory review of alternatives. Other Southern Company operating utilities are subject to more oversight, but data regarding energy and cost forecasts are routinely withheld from public review – far more restrictive practices than for most other regulated utilities.

To help answer questions about whether there are more cost-effective options for Southern Company's compliance with the Clean Power Plan, SACE conducted a financial analysis of alternative scenarios and commissioned a study using a dispatch model to simulate the cost of operating the Southern Company system.[1] In addition to a "proof of concept" reference case, the dispatch study includes three scenarios of coal plant retirements and replacement with varying levels of gas and renewable energy resources.

For this summary, the focus is on two hypothetical coal retirement scenarios, as summarized in Table 1. Because the dispatch model scope did not include expansion plan optimization, La Capra Associates (LCA) ensured that each scenario met reliability criteria. In both scenarios, 5,205 MW of coal are retired. In one scenario, LCA determined that 4,150 MW of natural gas resources would provide a reliable replacement. The second scenario requires only 1,100 MW of gas resources, which are complemented by 7,200 MW (4,500 MW on peak) of solar and wind resources. These findings illustrate the choice between "Gas Only" and "Gas + Renewables" replacement scenarios.

Table 1: Coal Retirement Scenarios

Coal Units Retired	**Gas Only Replacement Scenario**	**Gas + Renewables Replacement Scenario**
Barry 4, 5 (AL) Crist 4,5,6,7 (FL) Gorgas 8,9,10 (AL) Hammond 1,2,3 (GA) Lansing Smith 1,2 (FL)[2] McIntosh 1 (GA) **5,205 MW Retired**	Gas Intermediate (1600 MW) Gas Peaking (2550 MW) **4,150 MW Peak Capacity Added**	Gas Intermediate (-400 MW) Gas Peaking (1500 MW) Solar-Fixed Mount (1800/800 MW) Solar-Tracking (2500/1330 MW) In-Region Wind (400/55 MW) HVDC Wind (2500/1215 MW) **4,500 MW Peak Capacity Added**

Note: Capacities listed for renewable energy resources are nameplate/peak ratings.

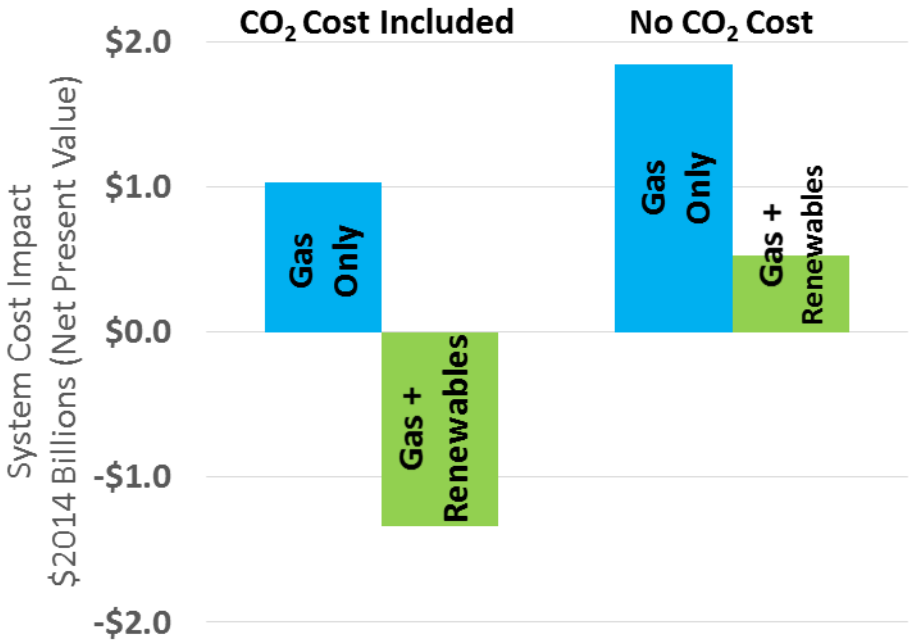
[1] The model, based on publicly available data, is described in a report by La Capra Associates (LCA), *Southern Company & Neighboring Regions Energy Dispatch Model* (February 2015).
[2] Gulf Power has announced that this plant will be retired.

Founded in 1985, the Southern Alliance for Clean Energy is a nonprofit organization that promotes responsible energy choices that create global warming solutions and ensure clean, safe, and healthy communities throughout the Southeast.

Results: The Gas + Renewables scenario appears to cost less than the Gas Only scenario. With a carbon dioxide (CO_2) emission control cost included, the cost savings associated with the Gas + Renewables scenario are $2.4 billion, saving customers about $1.3 billion compared to the baseline (coal) case. Or, for every $10 million invested in renewable energy, customers save about $1.3 million.

Southern Company's planning practices anticipate that there will be a cost or regulatory requirement to reduce CO_2) emissions. Even if such a cost or regulatory requirement (e.g., EPA's proposed Clean Power Plan) does not occur soon, the cost impact of moving to the Gas + Renewables scenario may be negligible as the cost estimate for the baseline case (with coal) may omit capital costs associated with maintaining the plants over their remaining lifetimes.

Figure 1: Total Cost of Alternative Coal Replacement Portfolios for Southern Company System (2014-2034)



These cost findings are consistent with other analyses and Southern Company's recent policy changes. In 2013, SACE and partner organizations conducted modeling of Southern Company's system that suggested the utility was overlooking cost savings opportunities from solar energy resources even without regulatory requirements. Over the past two years, Georgia Power and Alabama Power have publicly stated that solar power is a cost-effective electric resource at today's prices. However, Southern Company's utilities have not disclosed specific cost estimates, nor have they publicly discussed renewable energy scenarios of the magnitude reported in this research summary.

Regarding emissions, retirement of the 5,205 MW of coal plants reduced Southern Company CO_2 emissions by 7% in the Gas Only scenario, and by 18% in the Gas + Renewables scenario, as illustrated in Figure 2. The emission reduction effect is relatively flat beyond 2020, because all of the renewable energy added in this scenario occurred during the 2015-2020 time period. It is also notable that, as summarized in Table 2, operation of the remaining coal units is relatively unaffected by the renewable

energy modeled for this study, which mainly offsets natural gas generation when compared to the Gas Only scenario.

Figure 2: CO_2 Emissions by Scenario, Southern Company System

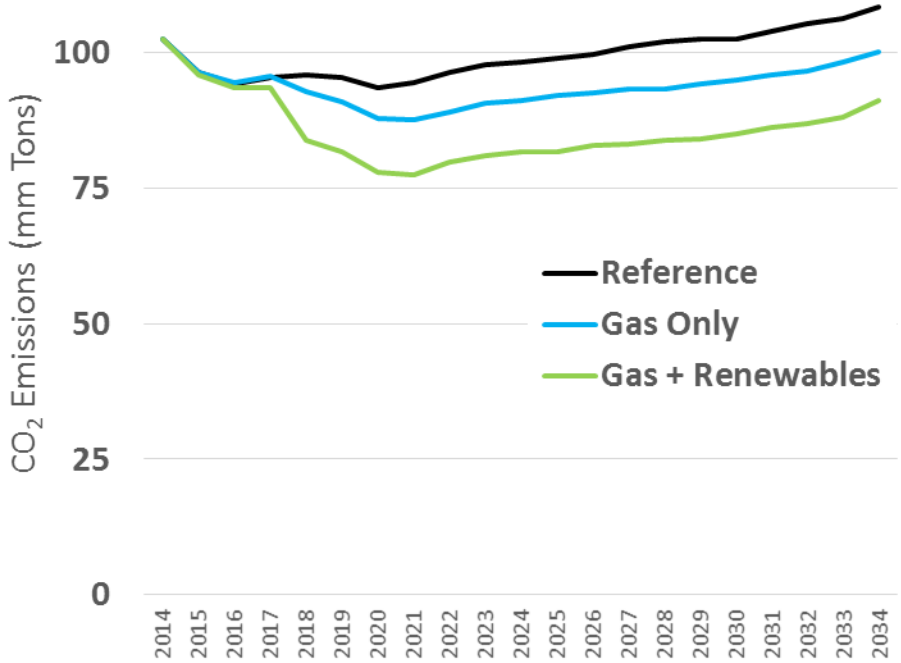


Table 2: Generation Impacts of Coal Retirement Scenarios, Southern Company in 2024 (GWh)

Resource	Reference Scenario	Gas Only Replacement Scenario	Gas + Renewables Replacement Scenario
Coal	61.2	49.2	49.5
Gas	76.0	90.2	67.5
All Other	45.8	45.8	69.3
Total	**183.0**	**185.3**	**186.2**

It should be noted that the small increase in coal generation in the Gas + Renewables scenario is not significant enough to be a finding because the capacity expansion plan was not fully optimized in a model due to project scope limitations. However, it is reasonable to conclude (consistent with findings in other regional studies) that once a substantial number of coal plants are retired, renewable energy will not affect remaining coal generation very much, but rather will mainly affect gas generation.

Next Steps: These results suggest that for purposes of compliance with forthcoming CO_2 regulations, renewable energy resources reduce emissions much more deeply, at a long-term cost that appears to be slightly lower than the natural gas resources they replace. In the future, this model could serve to:

- Explain to the public the cost and environmental implications of Southern Company's plans. Southern Company considers its forecast information confidential.
- Compare alternative scenarios for compliance with EPA's final Clean Power Plan rule.
- Provide input to other models, such as those used to study energy efficiency program design.

As a proof-of-concept model, certain specific calculations and capabilities need further refinement, but this report indicates that the general capacity to study and discuss Southern Company's future is now available.

1. Method for Calculation of Total System Costs

The La Capra Associates (LCA) dispatch model did not include the capability of calculating the total system cost. In order to "solve" for the correct dispatch of various fleets, LCA needed to use "backcast benchmarking" to calibrate the model to closely resemble actual operating decisions. As a result, the model is expected to provide a reasonable estimate of plant operations. As a result, plant operating costs, including fuel costs, are effectively estimated by the model. However, LCA did not report capital costs and did not validate fixed costs.

To estimate a total system cost, SACE calculated fixed operating and capital costs. The fixed costs were derived from the same original sources used by LCA, but as noted those were not validated. SACE performed a cursory review of fixed operating costs included in the EPIS Database used by LCA and identified an issue with vintage of costs associated with solar power resources. Based on more up-to-date market data, SACE reduced solar operating costs by 50% for solar resources only. SACE did not review the fixed operating costs associated with coal plants to determine if the costs associated with future environmental upgrades were adequately represented; accordingly, the retirement scenarios may underestimate (or overestimate) fixed operating cost savings.

Based on a review of multiple public data sources, SACE selected cost assumptions for generating units, as presented in Table 3, with the intent of representing costs likely to be experienced in the Southern Company region. However, for wind resources, three different performance profiles were used based on data provided by SACE for the project, with two of these profiles representing resources imported into the Southeast.[3] As a result, the cost assumptions varied based on the wind resource characteristics and transmission requirements associated with each project.

For in-region wind, a slightly higher per kW project cost is assumed due to the need for greater hub heights than for the wind resources delivered by the HVDC projects. For the HVDC projects, transmission costs were embedded in the capital cost. The Clean Line Plains and Eastern Project is assumed to have slightly higher transmission costs than the Pattern Energy Southern Cross Project for two reasons. First, the Clean Line project will need to be "wheeled" through the Tennessee Valley Authority system. Second, the Clean Line project is significantly longer than the Pattern Energy project. Due to the lack of public data on these transmission projects, the costs have a significant degree of uncertainty.

[3] Wind and solar resource profiles are described in: Southern Alliance for Clean Energy, *Increased Levels of Renewable Energy Will Be Compatible with Reliable Electric Service in the Southeast* (November 2014), p. A-9.

Table 3: Capital Cost Assumptions Selected by SACE

Unit Type	$/kW for 2014	Nominal Escalation Rate Thru 2020	Nominal Escalation Rate Beyond 2020
NGCC	$1,000	2%	2%
NGCT	$600	2%	2%
Solar – Fixed	$1,500	-5%	2%
Solar – Tracking	$1,750	-5%	2%
Wind	$1,600	-5%	2%
Clean Line Wind	$2,000	-5%	2%
Pattern Energy Wind	$1,920	-5%	2%

Note: Capital costs do not include the cost to fuel, maintain or operate the unit. Of those costs, variable costs (mainly fuel) are calculated in model used by La Capra. Fixed operating costs are discussed in the text.

The financial model used by SACE to approximate the present value revenue requirement (PVRR) is very simple, and does not include sophisticated treatment of corporate taxes or specific assumptions about amortization schedules. The discount rate used is 8%, and the model effectively assumes that amortization and depreciation occur at the same rate (e.g., overnight costs are equal to the PVRR of the revenue requirement).

Future development of the model should include more attention to fixed operating costs and capital costs, as well as development of a more sophisticated utility finance model. Other needs for model development include the use of sensitivities to develop risk estimates. Due to these shortcomings, the report results should only be used to draw general conclusions about the effects of different system resource plans, and should not be used to conclude that a specific portfolio is a "best" choice.

2. Method for Calculation of Emission Rates

Although the model used by La Capra Associates calculates emissions internally, the final reporting did not include CO_2 emission rates. As a result, SACE utilized simple emission rate factors to calculate total emissions. These values were selected after reviewing several government (US Energy Information Administration and US Environmental Protection Agency) reference values. As CO_2 emission rates depend on the specific fuel characteristics, the actual rates may vary slightly from plant to plant. For purposes of this report, however, the emission rates included in Table 4 were used.

Table 4: CO_2 Emission Rate Assumptions

Fuel Type	lbs / mmbtu
Coal	210
Natural Gas	117
Oil	161

Project directed by John D. Wilson, MPP, Research Director with contributions by Ulla Reeves, Angela Garrone, David Roman, Charlie Coggeshall, and Simon Mahan.

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