Docket E-100 Sub 190
Brad Rouse comments on modeling process and biases in Duke's 2024 CPIRP approach.
June 27, 2024

After watching the initial technical conference for the Carbon Plan IRP (CPIRP) Docket e-100 SUB 190, and reading some of the full testimony, I conclude that intervenors have not been strong enough in their criticisms of a fundamental flaw in Duke's modeling process. This flaw is short period optimization, which was the core of my final brief to the NCUC in the previous carbon plan and was the subject of my previous public comments and spoken testimony at the Asheville hearing in April. Here I would like to speak about the problem in the context of the current proceedings thus far.

Short period optimization is a technique used in the EnCompass modeling system to reduce the computational complexity of finding the least cost plan over the time period to 2050 when carbon emissions must get to zero. It divides a 28-year problem – 2023 to 2050 – into four 7-year problems. The model solves for 2023-2029, sets the plan thus determined into stone, and then solves for 2030-2036, and so on. The first period solution puts a gas plant into service in 2029. In thinking that is the best option, it knows nothing about what is to come, including the fact that that gas plant is not going to be usable for burning gas 21 years after it starts up, that its usage will likely get less and less over time in a gradual tightening up to 2050, and that a major new resource making solar and wind more attractive – the Bad Creek pumped hydro upgrades – is coming in 2034.

The use of short-period optimization forces EnCompass to ignore that the energy that the gas plant produces is going to have to be replaced with carbon free resources well into the useful life of the gas plant. Short period optimization forces EnCompass to not consider that it might be better to go ahead and build those resources now that will be needed to replace the gas plant anyway and not build the gas plant at all, or not build as many. EnCompass needs to be able to consider these important factors, or the results that it produces will be invalid and biased towards gas as a resource.

The Commission understood this problem both in its findings and orders in the 2022 CPIRP and asked Duke to take steps to correct it. Duke's testimony reported that the runtimes were so extreme that going to a 15-year optimization period (through 2036) was not feasible. Public Staff witness Jeff Thomas reported on Staff's investigation of this issue, concluding (1) using a 15-year optimization period was indeed computationally burdensome to the extent that it would not be practical and (2) they were able to get some 15-year optimizations to solve and that using a 15-year optimization did not seem to produce significantly different results (a few more batteries were selected but no difference in the choice of gas CCs or CTs). [1] As such Thomas states that: "the Public Staff agrees with Duke's rationale for using a seven-year optimization period and has likewise used a seven-year optimization period in its own modeling."

Staff made a good decision to evaluate the optimization period, but I don't agree with their conclusions. Their evaluation did not go far enough and did not consider all of the important issues at hand, for several interrelated reasons.

First, the 15-year optimization period includes the years 2023 through 2037. That period of time is simply not long enough to capture the decrease in gas utilization required through 2050. The cuts in allowed emissions are gradual, so the majority of the cuts happen in the period 2038-2050. How

[1] Testimony of Jeff Thomas, Docket E-100 Sub190, May 29, 2024, p19.

much decrease in emissions does occur greatly depends on the emissions compliance year, 2035 (or 2037 if you count Duke's plan for a gas unit in SC) in Duke's P3 and 2034 in Staff's preferred plan. The later the compliance date, the more gas use is allowed in the early period optimization. An optimization period that ends in 2037 does not show much of the required decline in emissions.

Second, Bad Creek is scheduled to come online in 2034, so the 15-year period thinks that it is available only about a quarter of the total time. The presence of greater long-term storage available through Bad Creek improves the relative attractiveness of solar and wind and could lead to greater selection of solar and wind in the optimization if it is considered.

Third, there are multiple other reasons that the modeling is biased toward natural gas. This leads to the conclusion that the modeling forces gas into the mix whether short term optimization is used or not. In other words, short term optimization and the other constraints favoring gas means that Duke has doubled the factors supporting gas. Eliminate just one such bias, and not much happens.

Staff and others have indeed found that the modeling was severely constrained - "the period between approximately 2028 and 2032 is extremely constrained, with significant load growth and limited options for adding new resources".[2] And, "The solar and solar plus storage constraint is binding from 2028 through 2036, with" the exception of 2030." [3] SACE et al witness Maria Roumpani found: "The Companies' modeling, although extensive, is overly restricted in the set of solutions it can select. Consequently, it can only provide results that are almost pre-determined. This reduces its informational value. "[4]

The presence of these constraints means that even with the short optimization period, the model finds it more economical to add more solar and wind, and less gas, but Duke's inputs prevent it from doing so. Even with full optimization this would be the case. Take away these (and other) constraints, and full period optimization would likely add far more renewable energy and less gas.

The true solution to a lower cost and lower emissions future is to look at the entire time range AND figure out how to resolve the interconnection and other limits slowing the speed of the transition. Dividing the process up into four or even two sequential optimizations to save on computer runtime is not appropriate.

What should the NCUC do? In hindsight, the Commission's 2022 order to move to a 15-year optimization, which was not obeyed, was not adequate. In 2024, the Commission should order full 26-year optimization. To achieve this, a technical committee, consisting of Duke, Public Staff, intervenors, the software provider, and other experts should be convened to work out a new process. This new process will likely consist of a simplified system representation that allows a full 26-year optimization as an early step in the analysis. Resource constraints should be loosened so we can observe the truly least cost optimization. Additional process steps should then be defined to add back in the realistic constraints determined by the committee. Near term actions should focus intense efforts to resolve those constraints so that North Carolina can achieve a truly least cost and environmentally responsible future.

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[2] Ibid, p61
[3] Ibid, p 62
[4] Direct Testimony of Maria Roumpani, Docket E-100 Sub 190, May 28, 2024, p13