October 24, 2022

VIA ELECTRONIC FILING

Ms. Shonta A. Dunston
Chief Clerk
North Carolina Utilities Commission
4325 Mail Service Center
Raleigh, North Carolina 27699-4300

RE: Duke Energy Carolinas, LLC and Duke Energy Progress, LLC's Carbon Plan, Docket No. E-100, Sub 179

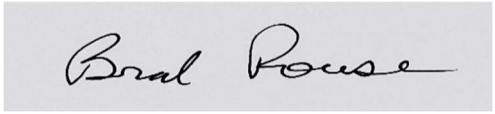
Dear Ms. Dunston:

Pursuant to the ruling of Chair Charlotte Mitchell in open hearing on September 29, 2022, I (intervenor pro se Brad Rouse) respectfully submit the following final brief and partial proposed order in Duke Energy Carolinas, LLC's (DEC) and Duke Energy Progress, LLC's (DEP) (collectively, Duke) proposed Carbon Plan.

It has been my privilege and pleasure to participate as a pro se intervenor and as an expert witness in this proceeding. I especially want to express my thanks to the Commissioners and staff for their welcoming me into this process and for their assistance along the way. I do hope that my participation, along with these final comments, is helpful in reaching a positive outcome.

By copy of this letter, I am forwarding a copy to all parties of record by electronic delivery

Sincerely,



Brad Rouse

Attachment

Cc: Parties of Record

STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. E-100, SUB 179

North Carolina Utilities Commission

In the Matter of:	)	
Duke Energy Progress, LLC, and	)	Brad Rouse Post
Duke Energy Carolinas, LLC, 2022	)	Hearing Brief and
Duke Carbon Plan	)	Partial Proposed Order

I Introduction

As presented earlier in Brad Rouse's witness summary of pre-filed testimony, the key near term issue in this case is whether the Commission should select a plan which includes building new gas fired capacity with a 2029 in-service year.[1] The below comments argue that Duke has not made the case for selecting Combined Cycle (CC) units as part of this plan. Each of Duke's portfolios 1-4 and public staff recommended portfolios 5-6 include 2,400 MW of CC capacity. Duke's proposed near-term actions include 1,200 MW of new CC capacity in 2029. [2]

The justification for this new capacity is based solely on simulations of the EnCompass software using an optimization period of 2022-2029 and does not consider the

[1] Transcript Volume 22, page 113, Witness Summary of Brad Rouse at 1, 5-12
[2] Transcript Volume 27, page 41, Rebuttal Table 1, REBUTTAL TESTIMONY OF SNIDER, McMURRY, QUINTO, AND KALEMBA , Page 8

implications of the required reductions in carbon emissions to zero by 2050. This myopia with respect to known factors limiting the use of gas imposes additional costs that are not accounted for, lead to a result that is not least cost, and likely violates rules regarding least cost integrated resource planning. None of the four Duke and two Public Staff portfolios includes an alternative to these new CC units, so we are unable to compare these units to an alternative which does not include, or which delays, their construction. In addition, the passage of the Inflation Reduction Act and increases in gas prices provide further indication that the selection of gas CC units is not least cost.

Duke's witnesses have stated that they plan to file for a CPCN for construction of gas fired capacity late in 2023[3]. This CPCN should contain modeling exercises which will remedy the above flaws in modeling methods and assumptions. A Commission decision on any CPCN application for new gas fired capacity should rely on a more complete future analysis and not in any way on "selection" of new gas capacity as part of a Commission-approved Carbon Plan or as an approved near-term action. Thus, the Commission should decline to approve Duke's request to include 1,200 MWs of CCs as an approved component of the near-term action plan.

II Duke's Plans for New Gas CCs Based Only on Conditions Expected in 2022-2029

Duke's justification for including 2,400 MW of gas CCs in the Carbon Plan, including 1,200 MW of CCs in the near-term action plan, is that they were selected by EnCompass for installation by 2030 in all four modeling portfolios and in the two Public Staff supplemental portfolios. Duke has also stated that to reduce run-time of EnCompass,

[3] Transcript Volume 27, page 268 at 5-11

given other modeling detail that Duke wished to preserve, the EnCompass runs were separated into segments, with 2022-2029 representing the first segment[4]. All Duke portfolios (1-4) and Public Staff portfolios (P5-P6) and related sensitivities used this segmented approach. Once the resources were identified for 2022-2029 in EnCompass, they were fixed in the system and the process moved on to the next segment (2030-2037) to determine the resources for the next segment.

II-A Optimization for 2022-2029 is Blind to What Comes After That

The defining goal of the Carbon Plan process is to reduce emissions 70% by 2030 (with provisions for delay) and 100% by 2050 compared to the base year. Selecting gas CC units for construction in 2029 takes the 70% reduction into account but it ignores the fact that over the following 20 years to 2050 these gas units will operate in a completely different environment. Their ability to use natural gas as a fuel will be sharply constrained by the decline toward zero for allowed carbon emissions.

The deficiency of an 8-year optimization is noted in the record by Duke, Public Staff and several intervenors. In Duke's direct testimony they indicate that they first attempted to use a full 28-year optimization, noting that "full period optimization considers the costs of all resources and constraints through the entire study period".[5] They then found that the

> "large number of resources and incorporating the additional constraint of achieving a declining CO2 ton target made the problem size too large to solve within one full period in capacity expansion"[6]

[4] Transcript Volume 7, page 281, also REBUTTAL TESTIMONY OF SNIDER, McMURRY, QUINTO, AND KALEMBA at 89, 2-11
[5] Transcript Volume 7, page 281, also DIRECT TESTIMONY OF SNIDER, McMURRY, QUINTO AND KALEMBA, page 89 at 1-2
[6] Ibid, at 3-5

They then chose to reduce the problem to smaller segments so as to not sacrifice other details of the simulation available such as model precision (MIP basis) or zero commitment. Duke then claims, but does not demonstrate, that:

> "The Companies approach to capacity expansion optimization convergence tolerance (MIP basis) and optimization segmentation appropriately balances precision and modeling complexity".[7]

In its initial comments, Public Staff criticized the selection of gas CC units in the eight-year optimization period because of the uncertainty around hydrogen conversion costs but did not critique it for the reason focused on here – the gradual reduction in usefulness of the CC due to the required carbon emissions reduction.[8] In direct testimony Public Staff witness Thomas noted that:

> "An eight-year optimization period indicates the model can only "see" costs and system conditions over an eight-year period (with a one-year extension) and is blind to any model inputs beyond the optimization period."[9]

Thomas goes on to say that he agrees with other intervenors that the short period optimization is "problematical", for reasons including the uncertainty around hydrogen costs. He also recommends that the Commission mandate a 15-year optimization period in future Carbon Plan proceedings. Witness Thomas summarizes this portion of his testimony by stating that:

> "Duke's use of an eight-year optimization period caused its models to select natural gas in 2028 and 2029, without considering the stringent carbon reduction targets and higher gas prices in later years."[10]

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[7] Transcript Volume 27, page 39, Rebuttal Table 1, REBUTTAL TESTIMONY OF SNIDER, McMURRY, QUINTO, AND KALEMBA , Page 7

[8] Comments of the Public Staff, July 15, 2022, page 85.

[9] Transcript Volume 21, page 53, TESTIMONY OF JEFF THOMAS, PUBLIC STAFF – NORTH CAROLINA UTILITIES COMMISSION, page 25 at 6-9

[10] Ibid page 70 at 12-15

Tech Customers witness Maria Roumpani also critiqued the use of the eight-year optimization period, stating that "we have concerns that the Companies' choice to segment the horizon to eight-year steps might bias the results, especially in the near term."[11] Roumpani's main focus is the bias that may be introduced by comparing capital intensive resources such as wind and solar with their higher up front costs with more fuel intensive resources like gas CCs with their costs more weighted to the longer term. This concern is echoed in the "Review of the Duke Carbon Plan and Presentation of a Preferred Portfolio for Report on Proposed Carbon Plan" prepared for Tech Customers by Gabel Associates, Inc. (Gabel Report).[12] In report pages 48-50 they analyze the modeling horizon, saying:

> "For an analysis out to 2050, performing runs on a shorter timeline is highly problematic because it will not allow the model to anticipate and plan for costs or emissions impacts in future years outside of the shortened horizon."

Gabel chose a full 28-year optimization for their modeling runs, which did not select any gas CCs[13] and which showed lower net present value of revenue requirements than the comparable Duke Portfolio 1.[14]

CLEAN intervenors expert witness Tyler Fitch of Synapse Economics, Inc., also discussed the problem of Duke's limited modeling horizon in the "Carbon Free by 2050" report prepared by Synapse, his pre-filed expert witness testimony, and in response to questions from intervenors. In "Carbon Free by 2050", Synapse discusses the planning horizon:

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[11] Transcript Volume 25, page 99 at 13-14, DIRECT TESTIMONY OF MARIA ROUMPANI, Ph.D. TECH CUSTOMERS, page 16
[12] Transcript Official Exhibits, Volume 25, Gabel Report, pages 19-60
[13] Ibid, Gabel Report, page 50
[14] Ibid, Gabel Report, page 55

> "In the context of the current energy transition, where technology costs are changing rapidly and emissions are expected to decline over a multi-decadal time scale, longer planning horizons are important for integrating long-run industry transitions. Planning horizons that are too short may prevent resource planning tools like EnCompass from adequately taking long-term trends into account."

and

> "While 8-year planning segments are within the reasonable range of planning horizons used in detailed capacity expansion modeling, they also introduce risks that resources selected in the earliest segments may not be economical resource choices when viewed over the long term."[15]

Synapse then used a 15-year optimization period. Their resulting optimal portfolios did not include gas CC units and had substantially lower costs when compared side by side with Duke's Portfolio 1, although modeling horizon was not the only factor in this result.

In Fitch's direct testimony he reiterates the need for a longer time horizon and then comments specifically on Public Staff's request for Duke to "validate selection of gas plants through a full-period capacity expansion optimization". [16] It bears re-reading Fitch's full response:

> "I do not agree with Duke's statement that its treatment of hydrogen fuel renders full-period optimization capacity expansion unnecessary. Even without hydrogen conversion, carbon requirements are expected to put pressure on gas resources to lower emissions rates, which will drive down capacity factors over time. Resources with lower utilization and higher costs are less attractive in an economic optimization and will be less likely to be selected by the EnCompass model. With a short optimization period, the model may not see the falling utilization and rising costs as it makes its near-term resource planning decisions. I therefore recommend

[15] Transcript Official Exhibits, Volume 25, "Carbon Free by 2050", Appendix B, pages B-15-B-16, pages 206-207 of pdf.

[16] Transcript Volume 24, page 167 at 3-5 TESTIMONY OF TYLER FITCH, CLEAN INTERVENORS, page 40

that the Commission direct the Company to include a full-period capacity expansion optimization."[17]

Note that Fitch has gone from supporting a 15-year capacity optimization period to supporting a full 28-year optimization, at least as a validation step, which he reiterates on the next page in his recommendations to the commission: "3. Include a full-period capacity expansion optimization."[18]

He also addresses this issue of Duke's use of a short optimization period in his answers to intervenor questions, providing an overview and then discussing how using a short optimization period might have been a good modeling compromise when industry trends were more static but is not good modeling when studying a dynamic change in the industry:

> "but the issue with that -- in the past, when the electricity industry, in general, was sort of -- had several static trends, eight-year optimization periods made a lot of sense because you could look at something like electricity -- or total load that seemed to be, you know, relatively predictable at least, or gas prices that were relatively predictable, but that didn't include things like a decline in carbon cap, which is essentially, in our modeling, producing an incredible transition in resources. So for that reason, in this case, the planning period and the optimization period is important, because using, for example, an eight-year planning period, EnCompass is choosing what is optimal from 2022 to 2030. And it might choose a carbon emitting unit like a gas CT or a gas CC, and it would see, okay, this unit might be okay to meet the percent reduction target in 2030. But, essentially, EnCompass isn't testing how it's going to do over the entire period."[19]

And answering a final question on this issue, Fitch responds:

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[17] Ibid, page 167 at 6-16
[18] Ibid, page 169 / 41 at 4
[19] Transcript Volume 24, page 207 at 16 to page 208

"So with an eight-year period, you're modeling and choosing resources for '22 to 2030 without looking in the future, and then '31 to '38 without looking in the future, '39 to '46 without looking in the future, on and on."[20]

II-B Myopic Planning Leads to Added Costs

In summary, several expert witnesses identify this limited horizon modeling as a significant flaw in Duke's modeling approach, which needs to be remedied. As both an expert witness and a pro se intervenor, I came to this conclusion only slowly as I read through the evidence and listened to the testimony. Brad Rouse's witness testimony overlooked this aspect of the modeling, due to his (my) initial assumption that EnCompass must have had some sort of "look ahead" feature that would at least approximate conditions after the short period optimization. Based on the above testimony, no such "look ahead" feature exists. As a result, expert witness Brad Rouse(me) now sees that the short-term (8-year) optimization is a severe fundamental flaw in Duke's modeling, particularly with respect to the selection of an asset (gas CC) whose ability to benefit the system will decline over 2030-2050 because of the required decline in carbon emissions to zero.

In thinking about how best to explain this flaw, it might be helpful for the Commission to consider a hypothetical example, as follows: Consider that a gas CC is being compared to a configuration of assets that does not include a gas CC. This alternative configuration would consist of a blend of additional wind, solar, batteries, energy efficiency, and gas CTs in a combination. (Note - this combination could be supplemented with short term purchases if it is not feasible to construct every component in the year the CC is first needed.) This configuration will provide the same contribution to capacity, energy, and

[20] Ibid, Page 209 at 22 to Page 210 at 2

reliability as the gas CC. In the optimization only considering the period leading up to 2030, the gas CC appears to be lower cost and is selected, as is the case in Duke's portfolios.

Post 2030, several things will happen. First, the cost of running the CC will increase with inflation (gas prices) whereas the cost of running the alternative will increase much more slowly, if at all, as a good portion of the alternative is not subject to inflation (wind and sun are free). Second, at some point in the future, the CC (and the CT) will potentially need to be converted to hydrogen which will bring an additional cost.

Finally, the CC will be more and more constrained in terms of the energy it can produce due to the carbon cap, until 2050 when it will not be available to run natural gas at all. This means that some sort of replacement energy will need to be procured to make it equivalent to the alternative combination over the planning horizon. Additional carbon free resources will need to be added to compensate for the decline in ability to use gas due to its carbon emissions. The alternative to building the CC is to build more of these replacement resources in the first place, knowing that the CC option includes the need for them later. These additional replacement resources obviously have a price tag, and that price tag is not considered in the short period optimization.

These three additional costs of the CC option– for escalating fuel, for hydrogen conversion, and for replacement energy, are not considered in the economic choice made by Duke's EnCompass runs. Ignoring these costs is a fundamental flaw of the modeling.

II-C One of Duke's Sensitivity Analyses Suggests a Gas CC Replacement Portfolio

II-B above postulates a combination of resources that would provide equivalent capacity, reliability, and energy benefits to a CC at lower cost. Duke demonstrates this in a

sensitivity presented in Carbon Plan Appendix E – Quantitative Analysis, pages 84-92. This sensitivity tests the resource selection through EnCompass in the case of a more limited and higher cost supply of natural gas by making:

> "an alternate assumption in which the Companies do not secure interstate FT service to the Companies' existing CC units (which do not already have firm supply from the Gulf Coast Region) until later in the planning horizon.'[21]

To reflect the restrictions in gas supply, EnCompass is limited to being able to add only 800 MW of CC capacity, which it chooses. Instead of the CC capacity, the model adds 1,800 MW of batteries and 1,000 MW of CTs in the near-term. This portfolio does not reach the 30% reduction in 2030 due to Duke's modeling constraints on carbon free resources. By 2035, however, the constraints on carbon free resources are relaxed enough to reach a 79.2% carbon reduction.[22] The blend of resources used to offset the reduction of 1,600 MW in CC capacity by 2035 (for the long-term) is 200 MW of solar, 300 MW of onshore wind, 400 MW of batteries, and 1,000 MW of CTs.

This scenario shows the impact of reduction in gas availability, and is thus analogous to the reduction in gas availability that will occur due to the gradually declining carbon cap. It shows that if declining gas availability is reflected in the modeling, then a blend other resources - wind/solar/batteries/CTs - will replace the CCs selected by the model.

[21] Carolinas Carbon Plan, Appendix E, Page 84

[22] Ibid Table E-6, line 1, Page 88.

II-D Selecting Assets in Near-Term Action Plan While Ignoring Entire Planning Period Violates Least Cost Planning Rules

HB951 requires that the carbon plan be developed using "least cost planning principles":

> "Comply with current law and practice with respect to the least cost planning for generation, pursuant to G.S. 62-2(a)(3a), in achieving the authorized carbon reduction goals and determining generation and resource mix for the future" [23]

Least cost planning requires that assets be selected that are cost effective over their entire lifespan, not over the first two years. The principle of evaluating asset selections over the planning period is established under North Carolina's administrative rules governing the Integrated Resource Planning process:

> "3-(2) a comprehensive analysis of all resource options (supply-and demand-side) considered by the utility for satisfaction of native load requirements and other system obligations over the planning period, including those resources chosen by the utility to provide reliable electric utility service at least cost over the planning period.",[24]

Note the ending of the rule: "least cost over the planning period". Optimization over only 8 years out of a 28-year planning period, without additional confirming analysis, violates these rules.

[23] H951, Part I, Section I, (2

[24] 04 N.C. Admin. Code 11 R08-60 - INTEGRATED RESOURCE PLANNING AND FILINGS https://www.law.cornell.edu/regulations/north-carolina/04-N-C-Admin-Code-11-R08-60

II-E Gas CCs or CTs Might Still Be Chosen in 2029-2030 Given Other Tight Modeling Restrictions

It should be noted that gas might still be chosen by the modeling due to other constraints (interconnection constraints on solar, limited ability to build wind by 2030, etc.) in the optimization as 2030 approaches, even if a full optimization period were to be used. Tech Customers Witness Roumpani notes this in her direct testimony:

> "However, in the case of Duke's Carbon Plan modeling, these constraints are so restrictive that they overly narrow the portfolio selection to a single choice: the addition of new gas resources. For example, in year 2028 the Roxboro Units 3 and 4 retire with a combined capacity of 1,409 MW. The same year, wind, either onshore or offshore, is not yet available, and solar is restricted to an annual limit of 1,050 MW. Imports are not included in the model. No matter how advanced the model, the optimization follows the simplistic logic of meeting the energy and capacity need following those constraints without any flexibility. This results in the selection of new gas capacity even if a different resource portfolio (absent annual resource limits) could be more economic. The value of using an advanced modeling tool and engaging in a complicated analysis is significantly diminished when the outcome is almost pre-determined."[25]

The restriction on available alternatives to natural gas units and the myopic 2022 - 2029 optimization period together limit what the model can choose to an extreme degree. If the solar, wind, battery and import restrictions were kept but the optimization period was extended, it is entirely possible that the model would still choose gas. However, the model might very well choose more gas CTs instead of the 2,400 MW gas CCs that were selected, as did the sensitivities on fuel availability discussed in II-C above. As mentioned earlier,

[25] Transcript Volume 25, page 98 at 7 through Page 99 at 3, DIRECT TESTIMONY OF MARIA ROUMPANI, Ph.D. TECH CUSTOMERS, page 15-16

short term purchases should be considered if they would allow a lower cost option that is otherwise precluded due to these tight constraints.

With a full-period optimization, the model would correctly balance the benefit of CCs versus CTs (CCs have lower operating cost and higher capital costs than CTs), understanding that the advantage of CCs over CTs would be reduced and then reversed as the carbon cap is tightened over time. For this reason, as stated in the introduction above, the argument here is that Duke has not made a convincing case that CCs are needed. If the model were able to use full optimization AND the limits on wind, solar, efficiency, batteries, or temporary imports were relaxed, the model might very well have chosen little of no gas CCs or CTs.

II-F Alternative Modeling Approaches are Available

While the use of a short optimization period is not appropriate for modeling in the Carbon Plan, it was adopted as an approach to solve a very real problem. Something needed to be done to reduce EnCompass runtimes to something manageable. In future carbon plans there are at least two approaches available which can be adopted individually or in combination. The first would be to continue to use segments, but make them longer, as suggested by Synapse in its use of 15-year segments, and more strategic to reduce short optimization period bias. One strategy would be to have a short segment for the first few years and then have a longer segment which would have any fossil fuel investments at the beginning, not the end, of a segment. For example, the segments for the 2022 Carbon Plan could have been a short seven-year segment of 2022-2028, a 15-year segment of 2029-2043, and a final seven-year segment of 2044-2050. While not perfect, this arrangement would

have been able to assess the gas CC more fully for the first 15 years during the decline in carbon emissions.

If segments are used at all then they should be verified with subsequent modeling analysis. This could easily have been done had Duke simply adopted more Portfolios that focused on quantifying the impact that using segments had on the outcome. Remember, segments are a problem when fundamental change is expected, as is the case with a declining carbon cap. The declining carbon cap specifically affects the value of carbon emitting resources, so any decision to invest in carbon emitting resources could have received additional scrutiny and verification. This verification was requested by Public Staff,[26] but Duke declined for insufficient reason (the hydrogen conversion costs are not the only reason such a verification step is warranted).[27]

Such a verification would be simple – it would just involve constraining EnCompass to limit availability of CCs (cases of 0, 800, and 1,600 for maximum CC availability for example) and then running the resultant portfolios through the full production cost analysis and comparing the net present value over the full planning period. We already have cases of Duke adjusting the output of EnCompass based on subsequent analysis (battery-CT optimization, for example). This would be one more such exercise.

[26] Recommendation 13: "Utilize an optimization period spanning the entire planning horizon for at least one model run. This should validate whether natural gas CCs are still selected if future hydrogen conversion costs are known.", Comments of the Public Staff in Dockete No. E-100, Sub 179, July 15,2022.

[27] Letter from Jack Jirak to NCUC, " Attachment I, Duke Energy Planned Supplemental Portfolios in Response to Public Staff and other Parties' Recommendations on Duke's Proposed Carbon Plan E-100, Sub 179", July 28, 2022, response to Public Staff request 13: "Validate selection of natural gas plants through at least one full-period optimization capacity expansion model" of "Given the removal of H2 from SP5, this step is not necessary"

The other approach is to take other steps to reduce the EnCompass modeling time or to increase the computer capacity available, or both, to achieve a full 28-year optimization. One suggestion made by intervenors was to reduce modeling precision (MIP basis). Another approach would be to define a "blend" of renewable resources which would be shown as a single option and then have the model use the blend instead of having to come up with the blend on its own. A "blend" might be made up of a single resource consisting of, for instance, 400 MW solar, 200 MW wind, and 400 MW of batteries. Analysis of the contribution to peak (ELCC) would need to be computed for each specific resource combination. Anchor Power Solutions Inc., the vendor of EnCompass, would likely have other suggestions or may even be able to identify software changes that could allow a more complete use of EnCompass while reducing or eliminating short segment myopia.

In rebuttal testimony, Duke witnesses express a willingness to improve the planning process:

> "The Companies look forward to continuing to work with the Public Staff and other stakeholders to further improve and refine the process in advance of the 2024 Carbon Plan update. However, the Companies strongly encourage the Commission not to prescribe specific settings for highly technical planning models in the regulatory process."[28]

While it may not be reasonable for the Commission to prescribe specific settings for model inputs, the Commission should express its strong desire for Duke and other stakeholders to solve the partial period / short segment optimization problem. This solution should be

[28] Transcript Volume 27, page 39, , REBUTTAL TESTIMONY OF SNIDER, McMURRY, QUINTO, AND KALEMBA , Page 7, at 24-29

achieved not only in the 2024 Carbon Plan but also in the 2023 IRP / Carbon Plan update and any CPCN for gas CC units based on partial period optimization.

III - Changes in Economic Conditions and Laws Also Weigh Against Choice of Gas CC

Changes in global economic conditions and in legislation have changed in a way that significantly favor non carbon resources versus natural gas resources. These changes are discussed extensively in the record so they will be listed here'

- Natural gas prices are much higher today than is reflected in the data.
- Liquified natural gas demand to support European independence from Russian gas in wake of Ukraine invasion will likely continue to exert upward pressure on gas demand and prices.
- The new methane fee under the Inflation Reduction Act (IRA)will add upward cost pressure on gas suppliers.
- The IRA provides extensive new incentives for wind, batteries, and utility scale solar as alternatives to gas.
- The IRA provides extensive new incentives for customer energy efficiency and distributed energy investments that make it likely that Duke programs and natural energy efficiency investments will receive much higher participation. This is countered by likely additional beneficial electrification among Duke customers. The net effect of these countervailing trends needs to be studied.

IV – Summary

Selection of resources using short optimization periods is not to be relied upon and does not correctly evaluate the benefit / cost of fossil resources in a planning future characterized by a declining ability to use those resources. Furthermore, changes in the gas markets and the passage of the Inflation Reduction Act have dramatically changed the planning situation. For these reasons, Duke has not made the case that new gas CC capacity should be "selected" as the official carbon plan or as an approved near-term action. None of the Duke or Public Staff scenarios should be selected as the official plan since they all include gas units selected during the myopic short optimization period and none account for the new economic environment.

Nevertheless, to meet the requirements of H951, the Commission is obligated to come up with a plan. That plan does not necessarily have to include a selection of specific resources for 2023-2050. Instead, the plan can be a set of near-term actions that are approved and multiple portfolios of those longer-term resource selections which represent different future pathways for future investigation and decisions. This point was addressed in Brad Rouse's direct witness testimony:

> "But developing the Carbon Plan is much more than a simple engineering problem, and even if it were, there are too many possible strategies and too many unknowns and uncertainties to just simply rely on any one software tool. Instead, tools like EnCompass are designed to develop one or more plausible futures and present that information to the decision makers, who must use their strategic vision to decide what to do, i.e., what near-term actions to take. And if there is a downside to using a tool like EnCompass, it is that using it can lead to complacency on the part of planners who would rather have the comfort of an analysis tool that simply gave them the answer. And the Synapse exercise, where a few assumptions were changed and you get $25 Billion in savings with a somewhat different plan, is the perfect

exercise to illustrate what overreliance on one tool and a single set of input assumptions could lead to." [29]

That testimony goes on the suggest a strategy of "scenario planning" which incorporates not just the Duke Carbon Plan but also the Synapse "Carbon Free by 2050" report and potentially others. Framing the plan as a grouping of future scenarios plus a series of near-term actions approved by the commission allows the decision of actions beyond the near-term actions to be postponed till future CPCNs and / or carbon plans.

V Partial Proposed Order

Based on the evidence and analysis above, the following partial proposed order is requested of the Commission.

V-Selected Commission Carbon Plan Consists of a Range of Resource Addition Options.

Based on analysis of the record in Docket No. E-100, Sub 179, the Commission Carbon Plan is comprised of four main components, as follows: (1) A set of approved near-term actions to be pursued before the following (2024) biennial Carbon Plan iteration, (2) Multiple scenarios which present a long term vision of a range of possible future pathways for meeting the carbon goals and which will inform future actions , (3) Adoption of a "check and adjust strategy" whereby the succeeding biennial iterations of the plan each include a review of progress since the last plan, a new set of near-term actions, and a new range of potential long-term plans, and (4) A review of process and methodological improvements to be pursued for the next planning cycle.

[29] Transcript Volume 23 DIRECT TESTIMONY OF BRAD ROUSE, page 74 at 3-14, page 19 of testimony.

The scenarios chosen in this 2022 Carbon Plan shall consist of complete plans produced by Duke and by intervenors that are included in the record, including Duke's alternative scenarios 1-4, Public Staff supplemental portfolio 5-6, the Synapse "optimized" and "regional resources" scenarios, and the Gabel Associates "Preferred Portfolio".

V-B Duke Must Engage in a Modeling Review and Stakeholder Process to Find Alternatives to Relying on Segmented / Partial Period Optimization.

Duke is hereby ordered to pursue a review and implementation of process and methodological improvements as mentioned in V-A – (4) above to resolve modeling issues including runtime, restrictive constraints, and partial period optimization issues. Said improvements shall be based on a collaborative effort with Public Staff and stakeholders. This process should begin as soon as practicable and precede the 2023 IRP / Carbon Plan update and any CPCN for a new gas CC. The resulting process improvements should include increasing optimization period segment length up to and including a full period optimization and / or a short segment for the first few years followed by a longer segment(s) including the first in service year of a proposed CC. The modeling should also include incorporation of alternatives to CCs that meet the goals of the Carbon Plan and an explicit comparison outside of the optimization of cases which include various levels of CC MWs (including a level of zero) versus cases that include the alternatives for those various levels of CCs.

V-C Gas CCs not approved in Near-Term Actions.

Based on evidence presented in the record, the Commission finds that Duke has not demonstrated that 1,200 MW of CCs should be included in the near-term action plan, and

Duke's request for inclusion is not approved. Duke should present an IRP / Carbon Plan update in 2023 which incorporates the process improvements from V-B above and may then submit a CPCN for gas CCs or other resource options based on the best option shown by the improved modeling process.