

**BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF  
COLORADO**

PROCEEDING NO. 21A-0141E

---

**IN THE MATTER OF THE APPLICATION OF PUBLIC SERVICE COMPANY OF  
COLORADO FOR APPROVAL OF ITS 2021 ELECTRIC RESOURCE PLAN AND  
CLEAN ENERGY PLAN.**

---

**ANSWER TESTIMONY OF DIVITA BHANDARI  
ON BEHALF OF  
THE COLORADO ENERGY OFFICE  
HEARING EXHIBIT 1201**

**OCTOBER 11, 2021**

## TABLE OF CONTENTS

I. INTRODUCTION AND PURPOSE OF TESTIMONY	3
II. SYNAPSE MODELING STUDY	6

## LIST OF ATTACHMENTS

<b>DB-1</b>	Operation of Comanche 3 and Pawnee (“Synapse Modeling Study”)
<b>DB-2</b>	Curriculum Vitae of Divita Bhandari

## LIST OF FIGURES

<b>DB-1</b>	Comparison of Baseline Scenario Assumptions and Parameters
<b>DB-2</b>	Comparison of CEO Scenario Assumptions

1 I. INTRODUCTION AND PURPOSE OF TESTIMONY

2 **Q. PLEASE STATE YOUR NAME, TITLE AND BUSINESS ADDRESS.**

3 A. My name is Divita Bhandari, and I am a Senior Associate with Synapse Energy  
4 Economics, Incorporated (“Synapse”). My business address is 485 Massachusetts Avenue,  
5 Suite 3, Cambridge, Massachusetts, 02139.

6 **Q. ON WHOSE BEHALF ARE YOU TESTIFYING IN THIS PROCEEDING**

7 A. I am testifying on behalf of the Colorado Energy Office (“CEO”).

8 **Q. WHAT IS THE PURPOSE OF YOUR ANSWER TESTIMONY?**

9 A. The purpose of my Answer Testimony is to introduce and summarize the attached  
10 report entitled *Operation of Comanche 3 and Pawnee* (the “Synapse Modeling Study”) that  
11 Synapse conducted on behalf of CEO.<sup>1</sup>

12 **Q. WHAT IS SYNAPSE AND WHAT WORK DO THEY DO IN THE ENERGY**  
13 **INDUSTRY?**

14 A. Synapse is a research and consulting firm specializing in energy and environmental  
15 issues, including electric generation, transmission and distribution system reliability,  
16 ratemaking and rate design, electric industry restructuring and market power, electricity  
17 market prices, stranded costs, efficiency, renewable energy, environmental quality, and  
18 nuclear power.

19 Synapse’s clients include state consumer advocates, public utilities commission staff,  
20 attorneys general, environmental organizations, federal government agencies, and utilities.

---

<sup>1</sup> See Attachment DB-1, *Operation of Comanche 3 and Pawnee* (the “Synapse Modeling Study”).

1 **Q. WHAT IS YOUR EDUCATIONAL BACKGROUND AND WORK**  
2 **EXPERIENCE?**

3 A. I have been employed at Synapse since 2018, and prior to that was a Senior Energy  
4 Analyst at DNV GL. My early career was spent working as an electrical engineer on gas  
5 turbine, wind turbine, and solar product development. I hold a Master of Environmental  
6 Management from the Yale School of Forestry and Environmental Studies, a Master of  
7 Science in Electrical Engineering, specializing in Electric Power systems, from the Georgia  
8 Institute of Technology, and a Bachelor of Science in Electrical Engineering, also from the  
9 Georgia Institute of Technology.<sup>2</sup>

10 **Q. WHAT ARE YOUR JOB DUTIES AND RESPONSIBILITIES AT SYNAPSE?**

11 A. I provide research and consulting services on a wide range of energy and electricity  
12 issues, focusing on grid infrastructure issues, resource planning, policies around distributed  
13 energy resources, energy efficiency, and electricity markets. I also have many years of  
14 experience with electric system modeling, performing optimization and dispatch modeling  
15 as a part of utility electric resource planning.

16 **Q. WHAT WORK WAS SYNAPSE ASKED TO PERFORM REGARDING PUBLIC**  
17 **SERVICE'S 2021 ELECTRIC RESOURCE PLAN & CLEAN ENERGY PLAN?**

18 A. CEO commissioned Synapse to perform capacity optimization and production cost  
19 modeling on its behalf. These modeling efforts were focused on understanding the current  
20 operation of Public Service Company of Colorado's ("Public Service or the "Company") coal  
21 fleet and developing alternatives to the Company's Preferred Plan to maximize emissions  
22 reductions and increase clean energy generation, while considering the effects on  
23 customers, workers, and communities.

---

<sup>2</sup> See Curriculum Vitae of Divita Bhandari, Attachment DB-2.

1 **Q. HAVE YOU PERFORMED SIMILAR WORK FOR OTHER PUBLIC**  
2 **UTILITIES COMMISSION PROCEEDINGS?**

3 A. I was recently involved in the Northern States Power Company (dba Xcel Energy)  
4 Integrated Resource Plan proceeding in Minnesota (Docket No E002/RP-19-368),  
5 performing alternative resource modeling in that docket on behalf of Sierra Club. I also  
6 assisted in conducting a financial audit of Exelon Generations nuclear plants, performing  
7 modeling on behalf of the Illinois Environmental Protection Agency. I have assisted in  
8 preparing comments and testimony and participated in settlement negotiations in  
9 proceedings related to rate cases and infrastructure investment programs in New Jersey,  
10 evaluating distribution system investments on behalf of the New Jersey Division of Rate  
11 Counsel (including Board of Public Utilities Docket Nos.: EO18060629, ER18080925,  
12 ER19040499 and ER20120746). I am currently involved in Puerto Rico's Integrated  
13 Resource Plan proceeding, Case No. CEPR-AP-2018-0001 performing modeling on behalf of  
14 the Puerto Rico Energy Bureau.

15 **Q. HAVE YOU TESTIFIED PREVIOUSLY IN OTHER PUBLIC UTILITIES**  
16 **COMMISSION PROCEEDINGS?**

17 A. No.

18 **Q. ARE YOU SPONSORING ANY ATTACHMENTS AS PART OF YOUR**  
19 **ANSWER TESTIMONY?**

20 A. Yes. I am sponsoring the following two attachments:

- 21 • Attachment DB-1 is the Synapse Modeling Study.
- 22 • Attachment DB-2 is a copy of my curriculum vitae.

1 II. SYNAPSE MODELING STUDY

2 **Q. PLEASE SUMMARIZE THE PURPOSE OF THE SYNAPSE MODELING**  
3 **STUDY.**

4 A. The Synapse Modeling Study in Attachment DB-1 contains a description of the  
5 EnCompass modeling work performed for CEO, including a summary of the optimization  
6 parameters that were changed, what inputs were assumed for each scenario, and the  
7 results of each scenario.<sup>3</sup>

8 **Q. HOW DID SYNAPSE DEVELOP ITS ENCOMPASS DATABASE?**

9 A. Synapse holds a license to the EnCompass capacity optimization and dispatch  
10 model, developed by Anchor Power Solutions. We began with the EnCompass database  
11 developed by Public Service, provided in response to intervenor discovery, and updated it to  
12 include changes to specific input variables as requested by CEO.<sup>4</sup>

13 **Q. DID SYNAPSE CHANGE ANY OPTIMIZATION PARAMETERS FROM**  
14 **PUBLIC SERVICE'S ENCOMPASS MODEL OUTPUT FILES?**

15 A. Yes.

16 **Q. PLEASE DESCRIBE HOW SYNAPSE CHANGED THE OPTIMIZATION**  
17 **PARAMETERS FROM PUBLIC SERVICE'S MODEL OUTPUTS.**

18 A. Synapse had to adjust Public Service's parameters to allow for faster model run  
19 times to meet regulatory deadlines. First, in the capacity optimization model runs, we  
20 adjusted the optimization to periods of six years with three-year extension periods, meaning  
21 that the model solved the capacity optimization in nine-year blocks, rather than over the  
22 entire analysis period. Second, in the production cost model runs, we modeled 30-day

---

<sup>3</sup> Synapse Modeling Study, at 2-3 (Attachment DB-1).

<sup>4</sup> *Id.* at 2; Appendix.

1 segments with 14-day extension periods rather than modeling all 365 days in the calendar  
2 year. Third, we updated the unit commitment settings in the capacity optimization runs to  
3 reflect “No Commitment” while maintaining Public Service’s “Partial Commitment”  
4 settings in the production cost runs. These changes are described fully in Attachment DB-  
5 1.

6 **Q. HOW DID SYNAPSE’S CHANGES TO OPTIMIZATION PARAMETERS**  
7 **AFFECT CEO’S MODELING?**

8 A. First, as already noted, changing the optimization parameters reduced the model  
9 run times, so that CEO’s modeling could be completed in time for Answer Testimony  
10 submission. Second, by shortening the capacity expansion optimization period, the model  
11 was able to consider nine years of information at a time instead of the full planning period,  
12 which the Company used. This may affect the optimality of the capacity expansion plan  
13 selected, since the model has less awareness of future trends that could affect decisions  
14 during the solution window. However, as I will describe later, this doesn’t affect the  
15 integrity of the modeling, but dictates what CEO’s modeling should be compared to for an  
16 “apples to apples” comparison. Third, by shortening the optimization period in the  
17 production cost runs, annual constraints, such as generation limits, could not be enforced.  
18 This change affected the annual constraints the Company had placed on Comanche 3.  
19 Namely, the 10 percent minimum dispatch was lifted, as was the 33 percent annual energy  
20 cap the Company used to represent reduced operations starting in 2030.

21 **Q. DID THE OPTIMIZATION PARAMETER CHANGES CAUSE SYNAPSE TO**  
22 **DEVELOP ITS OWN BASELINE TO TEST CEO’S ASSUMPTIONS AGAINST?**

23 A. Yes. Because of the deviations from Public Service’s baseline that I mentioned above  
24 (referred to as “PSCo Baseline”), Synapse created a new baseline that contained the new

1 optimization parameters and the modifications to Comanche 3 that I previously described.  
2 This scenario is called “CEO Baseline.” CEO Baseline also includes the SCC applied in the  
3 capacity expansion and production cost modeling steps, unlike the PSCo Baseline which  
4 includes SCC only in the capacity expansion step. Figure DB-1 provides a summary of the  
5 PSCo Baseline and CEO Baseline scenarios and for context, provides a description of the  
6 Company’s Preferred Plan (“SCC 7”) in its Direct Filing.



1  
2

**FIGURE DB-1: Comparison of Baseline Scenario Key Assumptions and Parameters<sup>5</sup>**

	<b>Preferred Plan (SCC 7)</b>	<b>PSCo Baseline</b>	<b>CEO Baseline</b>
<b>Comanche 3 Retirement</b>	EOY 2039	EOY 2039	EOY 2039
<b>Comanche 3 Dispatch</b>	Must-run, reduced operations at 33% starting in 2030	Must-run, reduced operations at 33% starting in 2030	Must-run to 2030, economic dispatch starting in 2030
<b>Comanche 3 O&amp;M Costs</b>	As described in the Direct Case	Updated to reflect the Staff Report in Proceeding 20I-0437E	Updated to reflect the Staff Report in Proceeding 20I-0437E
<b>Comanche 3 Availability Factor</b>	As described in the Direct Case	Updated to reflect the Staff Report in Proceeding No. 20I-0437E	Updated to reflect the Staff Report in Proceeding No. 20I-0437E
<b>Comanche 3 Minimum Operation</b>	10%	10%	None
<b>EnCompass Optimization Parameters</b>	Optimization Period: CE - 2024-2050 PCM - 365 days  Unit Commitment: CE - Partial Commitment PCM - Partial Commitment	Optimization Period: CE - 2024-2050 PCM - 365 days  Unit Commitment: CE - Partial Commitment PCM - Partial Commitment	Optimization Period: CE - 6 years, with 3 year extension period PCM - 30 days, with 14 day extension period  Unit Commitment: CE - No Commitment PCM - Partial Commitment
<b>SCC Discount Rate</b>	3%	3%	3%
<b>SCC Application</b>	Capacity expansion	Capacity expansion	Capacity expansion and production cost modeling

1 **Q. DOES THE USE OF A DIFFERENT BASELINE AND DIFFERENT**  
2 **OPTIMIZATION PARAMETERS COMPROMISE THE MODELING APPROACH**  
3 **SYNAPSE USED?**

4 **A.** No. The changes Synapse made to the optimization parameters and dispatch  
5 settings to create CEO's scenarios deviate from what the Company used in its modeling, but  
6 do not sacrifice the integrity of the modeling since the original modeling requirements set  
7 by the Company were all still met in Synapse's modeling. Additionally, the purpose of  
8 Synapse's modeling was to allow CEO to understand the impact of its recommendations. By  
9 creating CEO Baseline, which admittedly differed from the Company's original modeling,  
10 Synapse provided a foundation for each CEO scenario to build from. From this foundation,  
11 each input assumption change CEO requested could be evaluated in isolation and compared  
12 to CEO Baseline to understand what effect the change had on emissions, costs, capacity  
13 expansion plans, and more.

14 **Q. HOW MANY DIFFERENT MODEL RUNS--MEANING USING DIFFERENT**  
15 **INPUT PARAMETERS--DID SYNAPSE DO?**

16 **A.** The Synapse Modeling Study presents the results of 12 different scenarios.

17 **Q. HOW DID SYNAPSE DETERMINE WHAT INPUT PARAMETERS TO**  
18 **CHANGE FOR EACH DIFFERENT MODEL RUN?**

19 **A.** CEO provided us with changes for specific variables that it wanted to model, as well  
20 as the combinations of those updated input assumptions.

21 **Q. BRIEFLY DESCRIBE EACH DIFFERENT MODEL RUN?**

22 **A.** Figure DB-2 provides a summary of the key modeling assumptions for each scenario  
23 where the social cost of carbon ("SCC") is applied in the capacity expansion and production

---

<sup>5</sup> Synapse Modeling Study, at 2-6 (Attachment DB-1).

1 cost modeling steps. CEO also requested that Synapse run three additional scenarios based  
 2 on CEO Baseline, CEO 2, and CEO 5, where the SCC was applied only in the capacity  
 3 expansion step. These additional scenarios were used to understand the emissions and  
 4 societal costs for excluding the SCC from dispatch decision making.

5 **FIGURE DB-2: Comparison of CEO Scenario Assumptions<sup>6</sup>**

	<b>Comanche 3 Retirement</b>	<b>Comanche 3 Dispatch</b>	<b>Pawnee Retirement</b>	<b>Pawnee Gas Conversion</b>	<b>SCC Discount Rate</b>	
<b>CEO Baseline</b>	EOY 2039	Must run to 2030, remove must run designation starting in 2030	EOY 2041	EOY 2027	3%	
<b>CEO 1</b>	EOY 2039	Remove must run designation starting in 2025			EOY 2028	3%
<b>CEO 2</b>	EOY 2029					3%
<b>CEO 3</b>	EOY 2035					3%
<b>CEO 4</b>	EOY 2039					2.5%
<b>CEO 5</b>	EOY 2029					2.5%
<b>CEO 6</b>	EOY 2035					2.5%
<b>CEO 7</b>	EOY 2039		N/A	2.5%		
<b>CEO 8</b>	EOY 2029			2.5%		

6 **Q. GENERALLY WHAT INFORMATION DID SYNAPSE’S MODEL OUTPUT**  
 7 **PROVIDE?**

8 A. We provide information on GHG emissions, unit capacity factors, and revenue  
 9 requirements both with and without SCC.

---

<sup>6</sup> Synapse Modeling Study, Table 1 at 6 (Attachment DB-1).

1 **Q. WHAT ARE THE RESULTS OF SYNAPSE'S MODEL RUNS?**

2 A. Attachment DB-1 provides the model outputs, explanatory text, and graphics.

3 **Q. DO YOU HAVE ANY RECOMMENDATIONS FOR THIS PROCEEDING**  
4 **BASED ON SYNAPSE'S MODELING?**

5 A. No, I do not. Mr. Hay uses Synapse's model results to make recommendations on  
6 behalf of CEO.

7 **Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

8 A. Yes.

I, Divita Bhandari, state that the within Answer Testimony of Divita Bhandari on behalf of the Colorado Energy Office, Hearing Exhibit 1201, in the above-captioned matter, was prepared by me or under my supervision and control and that it is true and correct to the best of my knowledge and belief, and would be the same if given orally under oath.

/s/ Divita Bhandari  
Divita Bhandari