20-YEAR CONCEPTUAL SCENARIO REPORT

For the State of Colorado

To comply with

Rule 3627
of the
Colorado Public Utilities Commission
Rules Regulating Electric Utilities

February 1, 2026

Table of Contents

ACRONYMS AND ABBREVIATIONS

Acronym or Abbreviation	Term
2026 Scenario Report	2026 20-Year Conceptual Scenario Report
Black Hills	Black Hills/ Colorado Electric, LLC, d/b/a Black Hills Energy
Commission or CPUC	Colorado Public Utilities Commission
CPWG	Conceptual Planning Working Group
FERC	Federal Energy Regulatory Commission
HVDC	High Voltage Direct Current
Public Service or PSCo	Public Service Company of Colorado
RES	Renewable Energy Standard
Roadmap	Colorado Greenhouse Gas Pollution Reduction Roadmap
SCADA	Supervisory Control and Data Acquisition
SPS	Southwestern Public Service Company
Tri-State or TSGT	Tri-State Generation and Transmission Association, Inc.
VPPs	Virtual Power Plants

I. Executive Summary

Rule 3627, which was adopted by the Colorado Public Utilities Commission ("CPUC" or "Commission") in 2011, requires the preparation and biennial submission of 10-year transmission plans and conceptual long-range scenarios that consider a 20-year transmission planning horizon. The first 10-year transmission plan was submitted jointly by Black Hills Colorado Electric, LLC, d/b/a Black Hills Energy ("Black Hills"), Public Service Company of Colorado ("Public Service" or "PSCo"), and Tri-State Generation and Transmission Association, Inc. ("Tri-State" or "TSGT") (each referred to individually as a "Company" and collectively as the "Companies") on February 1, 2012. In 2012, the Companies were not required to submit 20-year conceptual scenarios. The first 20-Year Conceptual Scenario Report was filed in 2014 with subsequent reports filed in 2016 and 2018. This 2026 20-Year Conceptual Scenario Report ("2026 Scenario Report") has been jointly prepared and is being submitted by the Companies.

Scenario-based analysis is a technique for considering uncertainties that may impact decision-making in today's world based on potential future conditions. It may be useful when evaluating long-term investments despite the inability to accurately predict future conditions. While it is impossible to predict the future with complete accuracy, scenario development can assist with the identification of strategic choices that utility planners, project developers, regulators, and advocates may reasonably need to consider over a 20-year time period.

The scenarios offered in this filing include three provided by Black Hills, three from Tri-State, and four from Public Service. The Companies' scenarios generally address what the future state of the transmission system might look like in Colorado based on the occurrence of different factors or events, including changes in generation mix, load growth, load demand, social, economic, generation technology, transmission assumptions, and changing public policy requirements.

II. Overview of the Colorado 20-Year Conceptual Scenarios Analysis

The 2026 Scenario Report identifies and assesses various credible future alternatives and provides information that can be used individually or in conjunction with utilities, coordinated planning organizations, lawmakers, and other industry stakeholders to further evaluate the ongoing transmission needs in the State of Colorado. These scenarios describe a set of economic, technological, and societal circumstances that the Companies believe could conceivably come to pass. Transmission planning study models are not developed to represent the 20-year conceptual scenarios.

Consistent with the requirements of Rule 3627(e), the Companies' conceptual scenarios discussed herein include, at a minimum:

- Reasonably foreseeable future public policy initiatives;
- Possible retirement of existing generation due to age, environmental regulations, legislation or economic considerations;
- Emerging generation, transmission, and demand limiting technologies;
- Various load growth projections;
- Studies of any scenarios requested by the Commission in the previous biennial review process; and
- Changes in market conditions.

III. Company Perspectives on Conceptual Scenarios Analysis

A. Black Hills

Black Hills recognizes the potential for 20-year conceptual planning to contribute to the development of 10-year transmission plans. While not all utilities and planning organizations will always agree about whether a particular future scenario is probable or realistic, simple consideration of the impacts of any and all given scenarios can only add

value to each Company's planning process. One distinction that sets Black Hills apart from some other entities in Colorado is that, as an electric utility under the jurisdiction of both the Federal Energy Regulatory Commission ("FERC") and the Colorado Commission, we must consider potential future federal and/or public policy initiatives that may not directly impact other entities. When considering the large number of potential future scenarios for this report, Black Hills also had the opportunity to explore and draw on the implications of various driving factors experienced by its sister electric utilities in Wyoming and South Dakota.

It is Black Hills' view that much of the planning work that previously has been performed within the various utilities and regional planning groups and reported in the preceding Rule 3627 20-Year Scenario Reports generally suggested transmission development to enhance reliability and connect planned and potential resources located along the southern and eastern part of Colorado to the Denver area load center. The increase of PV and DG interconnections will have a growing impact on future transmission scale renewables. The magnitude and timing of future transmission expansion, as well as the degree of participation from utilities and other entities, could be driven by any combination of drivers mentioned in Rule 3627(e).

For the purposes of this filing, Black Hills considered scenarios that are variations of those included in the previous filings, as well as new scenarios unique to this filing. The scenarios described below were selected by contemplating scenarios that provided dissimilar yet significant impacts to the transmission system while remaining plausible. There are no specific transmission plans associated with the scenarios described herein, but rather a general discussion of potential impacts and considerations.

B. Tri-State

Tri-State brings a unique perspective to the 20-year conceptual scenario planning process under Commission Rule 3627(e). While Black Hills and Public Service are investor-owned, vertically integrated electric utilities providing retail electric service in Colorado, Tri-State is a not-for-profit generation and transmission cooperative providing

wholesale electric power to its 40 Member Systems located in four states: Colorado, Nebraska, New Mexico, and Wyoming.

Unlike Black Hills and Public Service, Tri-State is a regional power provider and its transmission system is designed and operated without specific regard to individual state boundaries. Rather, Tri-State operates an integrated, interconnected, interstate transmission system to deliver reliable, affordable, and economic power to its Member Systems. There also are generation resource differences that influence Tri-State's long-range conceptual transmission scenario perspectives, as compared to other utilities. Tri-State's generation resources are located in Colorado, New Mexico, Wyoming, and Arizona and require an interstate transmission system that efficiently moves that power to its Member Systems in Colorado and elsewhere.

In addition to these fundamental differences in transmission system and generation resource considerations, Tri-State also faces other considerations that are similar to those that apply to Black Hills and Public Service, including compliance with Colorado's Renewable Energy Standard, dynamic market forces, a changing resource mix driven by federal and state public policy developments, and expanding deployment of distributed generation and other technologies.

Tri-State's view of the long-range conceptual future is not limited to possible developments in Colorado and must consider the load-serving, reliability, economic, social, and technological needs of all of its Member Systems and the states in which they are located.

These scenarios are conceptual and illustrative only and are provided to facilitate long-range discussion under Commission Rule 3627. They rely on extensive assumptions and hypotheticals about future policy, technology, economics, market structure, and load growth that may or may not occur, and actual system needs may differ significantly from what is discussed in the scenarios. Nothing in these scenarios should be understood as a transmission plan, commitment, proposal, or representation regarding any particular project, investment, or course of action by Tri-State.

Tri-State's 2026 Conceptual Scenarios, including rationale, drivers and assumptions behind each scenario, can be found in Appendix B.

C. Public Service

Public Service is an investor-owned utility serving approximately 1.6 million electric customers in the State of Colorado.[1] Public Service serves approximately 75 percent of the State's population. Its electric system is summer peaking with a 2025 peak customer (retail + wholesale requirements) demand of 7,010 MW. The entire Public Service transmission network is located within the State of Colorado and consists of nearly 5,300 miles of transmission lines. Colorado is on the eastern edge of the WECC transmission system, which constitutes the Western Interconnection. The Western Interconnection operates asynchronously from the Eastern Interconnection. The Public Service transmission system is interconnected with the transmission system of its affiliate, Southwestern Public Service Company ("SPS"), via a jointly owned tie line with a 210 MW High Voltage Direct Current ("HVDC") back-to-back converter station. Most of the Public Service retail service customers are located in the Denver-Boulder metro area. However, the Public Service retail service territory also includes the I-70 corridor to Grand Junction, the San Luis Valley region, and the cities and towns of Greeley, Sterling, and Brush.

One of Public Service's strategic priorities is to be a leader in transitioning its resource mix towards cleaner energy sources. Xcel Energy, Public Service's parent company, aspires to deliver 100% carbon-free electricity to customers by 2050, with an interim goal of reducing carbon emissions from electric generation 80% below 2005 levels by 2030. In addition to transitioning to cleaner energy resources, Public Service is also forecasting significant load growth driven by residential and commercial development, expanded electrification of transportation and heating, and large new customer requests

[1] Public Service is one of four utility operating companies of Xcel Energy, Inc, along with Northern States Power Company – Minnesota, Northern States Power Company – Wisconsin, and Southwestern Public Service Company

related to development of new energy-intensive facilities such as data centers or manufacturing facilities.

The Commission approved a Clean Energy Plan in Proceeding No. 21A-0141E that results in the acquisition of significant new wind, solar, and energy storage resources through 2028. Public Service's Just Transition Solicitation, a resource plan intended to continue the clean energy transition and further address the effects of the clean energy transition on Colorado communities while also accounting for additional near-term load growth, is before the Commission in Proceeding No. 24A-0442E with a Phase II resource solicitation expected to be issued in 2026. Additionally, in response to the phase-out of federal clean energy tax benefits enacted through H.R.1 in 2025, Public Service jointly proposed with Commission Staff, the Office of the Utility Consumer Advocate, and the Colorado Energy Office a "Near-Term Procurement" in Proceeding No. 21A-0141E to acquire up to 4,000 MW of tax-advantaged new renewable generation and 500 MW additional thermal and energy storage resources to support the integration of variable renewable resources. Public Service has completed a solicitation for generation bids and approval of a resource portfolio in the Near-Term Procurement is currently pending before the Commission.

Public Service participates in CCPG, WestConnect, and WECC planning forums, including the subcommittees and working groups that perform transmission scenario analyses. Scenario outlooks differ from 10-year transmission analyses because the number of unknown factors to consider increases significantly with each year into the future. While 10-year plans tend to identify specific or conceptual transmission projects, the longer-term scenario analysis generally results in narrative descriptions of what major drivers to the power supply market might look like from a transmission perspective in the future. These drivers include generation mix, load growth, load demand, transmission assumptions, and pending public policy requirements. Potential impacts to the transmission system are not described in terms of specific projects, but by conceptual descriptions of different drivers and scenarios that may impact transmission.

Scenario investigation can be informative to decision makers, especially during times of high uncertainty and risk as a result of factors such as uncertain economic conditions, changing environmental policy priorities, changes in penetration of renewable energy mix, and changes in efficiency standards. In the utilities industry, 10-year transmission planning analysis is sometimes referred to as "just-in-time planning" because the average time to analyze, site, permit, and construct transmission facilities to meet a known need is approximately seven to 10 years. Public Service's near-term planning and investment cycles are primarily driven by Colorado's public policy requirements and Public Service's goals for emissions reductions both in the electric sector as well as in other sectors of the economy. The 20-year scenarios will help inform the Company's efforts as it monitors developments that will come after the major compliance milestone of 2030 and toward a carbon-free electric system by 2050, consistent with Public Service's goals and Colorado policy.

Consistent with the Commission's directives in Decision No. C22-0319-I, Public Service provides the following supporting information concerning its 2046 load and generation forecasts. Public Service provides this data for informational purposes only and notes that this data was not used in any analysis supporting the qualitative scenarios identified in this Report. Public Service's generation data is based on Phase I of its Just Transition Solicitation, as filed with the Commission. Expected summer and winter peak coincident generation mix information is provided at a system level consistent with the values developed in Phase I of the Company's JTS in Proceeding No. 24A-0442E. The expected cost of electricity is sourced from Portfolio SCC10-USA and represents wholesale energy costs only with all delivery costs excluded. Public Service expects that the values identified in this table will change based on the selection of resource portfolios through the Near-Term Procurement in Proceeding No. 21A-0141E and Phase II of the JTS.

Table 3. 2044 Public Service Forecasted Electric Resource Planning Load and Generation Data[2]

Summer Peak – Native Load (MW)	Winter Peak – Native Load (MW)	Reduced summer peak load when BTM generation is maximized (MW)	Reduced winter peak load when BTM generation is maximized (MW)	Expected summer peak coincident generation mix	Expected winter peak coincident generation mix
12,971	13,775	10,863	9,112	10% storage 0.1% hydro 90% wind	53% natural gas 31% wind 15% storage

Public Service Long-Term View

Public Service expects that the next 20 years of change in the electric sector in Colorado will be driven by two primary factors: the potential for significant increases in customer demand, and the continued transition to cleaner energy resources. Public Service's generation and transmission are undergoing transformational change driven by the Company's 2021 ERP & CEP, as well as by future resource acquisitions anticipated in the Near-Term Procurement and Just Transition Solicitation resource procurements. At the same time, Public Service has seen significant interest from new and existing customers seeking to locate energy-intensive operations in Colorado, in addition to load growth drivers such as population growth, electric vehicle adoption, and beneficial electrification of fossil fuel uses such as heating. However, recent federal policy changes have reduced incentives available for renewable resources and electrification, creating potential headwinds for the economic adoption of further carbon reduction measures.

Nevertheless, while the approval and implementation of these near-term plans will be the primary drivers of change through the next decade, Public Service still sees longer-

[2] Enc Export – 24.0910 SCC 02 Base 2PRM PNLD FR 2046

term uncertainty driven by customer demand, policy, technology, and consumer interest. The scenarios identified by Public Service in this report help provide alternative viewpoints of a future that has the common destination of a carbon-free electric system, however, the scenarios envision significant variability in the levels of load growth and the pace and technological options available for ongoing carbon reductions from the generation system.

The Commission has raised increasing concerns about the ability of near-term planning processes to sufficiently align the development of needed transmission with the speed of clean energy deployments. Public Service is working to ensure that its transmission planning processes are oriented towards the identification and development of "no-regrets" transmission solutions and believes that the 20-Year Scenarios identified here can play an informative role in the near-term planning processes to better align system expansion plans with reasonably expected longer-term system needs.

Because potential future scenarios are numerous, and due to the uncertainties discussed within this Report, the long-term view of the build-out of the state's transmission system retains significant elements of uncertainty. However, despite this uncertainty, Public Service sees common themes across this range of scenarios that reinforces the value of transmission expansion in supporting customers' energy needs and meeting emissions reduction objectives. Transmission expansion is a significant component of the transformation of Colorado's electric sector across Public Service's scenarios. Based on these scenarios, Public Service sees four common elements of transmission development that are likely to be needed in Colorado over the next 20 years. These elements include:

1.) increased transmission to deliver energy within the growing Front Range load center;
2.) increased transmission capacity to interconnect and deliver renewable resources developed on Colorado's Eastern Plains and/or the San Luis Valley; and
3.) increased transmission links to neighboring regions to maximize the value of resource portfolios with significant levels of wind and solar generation.

While the scale and complexity of these common transmission elements are expected to vary by scenario, the common elements will continue to guide Public Service's ongoing long-term planning efforts.

Public Service Scenarios

To develop and refine the four scenarios in this Report, Public Service looked to some of the analyses conducted as part of the Just Transition Solicitation, as well as key public policy drivers that are likely to affect energy consumption by our customers and across the economy more broadly. However, these scenarios are speculative and qualitative in nature and as such the necessary detail to model the complete impact of each scenario is unavailable and the quantitative results of such analyses are not likely to provide significantly more value than a qualitative analysis because the assumptions are inherently highly uncertain. The 20-Year Report is meant to provide a directional indication of the impacts of possible futures on the transmission planning process and the general need for transmission expansion in Public Service's footprint – as such they are not meant to identify specific projects or outcomes. By evaluating multiple future scenarios – none of which are meant to be projections or predictions – Public Service, the Commission, and stakeholders are able to identify common takeaways and/or insights from a wide variety of potential futures that will qualitatively inform ongoing transmission planning efforts. Longer-term scenario analyses can help provide indicators and drivers that could prompt changes in the transmission solutions, allowing decision makers to make better-informed choices concerning investments in long-lived infrastructure.

Public Service Scenario #1: Clean Energy Growth

This scenario represents the pairing of significant growth in electric demand with the continued large-scale buildout of renewable generation as the primary resources available to meet that demand. Load growth in this scenario is driven by both traditional retail customer demand growth including population and economic growth, EV adoption, and beneficial electrification of fossil fuel end uses such as heating in homes and businesses, as well as by the development of new large loads such as manufacturing

facilities and data centers in Colorado. Under this scenario, annual energy consumption by Public Service's existing and new retail customers increases to three times current levels, though the peak system demand only approximately doubles due to load management. Notably, due to electrification of heating, Public Service's summer and winter peaks are approximately even in this scenario.

Load growth is primarily met with the continued expansion of currently-available renewable generation technologies – solar and wind. Consistent with Colorado's emissions reduction requirements, energy storage provides the primary dispatchable capacity to maintain reliable system operations, however, smaller-scale natural gas combustion turbines are also used to meet customer demand.

Public Service considered data from the Just Transition Solicitation in the development of this scenario. This data was not used to quantify the future adequacy of transmission capacity to accommodate the load and generation identified in this scenario; however, it provides a directional indication of the effects of large loads and the ongoing transition to cleaner energy. This would likely require an increase in transmission as thermal based resources are less likely to be operating and more renewables would be required. Under this scenario, electrification also significantly increases the winter load.

Public Service Scenario #2: High Penetration of Distributed Energy Resources

This scenario represents the pairing of significant growth in electric demand with the deployment of new, carbon-free dispatchable generation technologies to serve the state's growth. In this scenario, Colorado commits to sustained, cutting-edge progress in the use of new generation technologies such as advanced geothermal, nuclear, or other forms of dispatchable generation to power a high-growth advanced electric economy.

Load growth in this scenario includes traditional retail customer demand growth including population and economic growth, EV adoption, and beneficial electrification of fossil fuel end uses such as heating in homes and businesses, however, the state's leadership in deployment of large-scale advanced technologies and the abundant availability of electricity attracts significant new large loads such as manufacturing

facilities and data centers. Under this scenario, annual energy consumption by Public Service's existing and new retail customers increases to four times current levels, though the peak system demand only approximately doubles due to advanced load management and enhanced customer deployment of distributed resources that are collectively managed through programs such as virtual power plants. System utilization in this scenario is high, and notably, due to electrification of heating and effective load management practices, Public Service's winter peaks surpass summer peaks.

Customer demand in this scenario is primarily served by deploying advanced generation technologies that can be constructed close to existing load centers on the system. While renewable resources continue to play a valuable role in this scenario, the economic value of new dispatchable, centralized, and high capacity factor generating technologies such as advanced geothermal or nuclear power allow for demand to be met without further large-scale renewable developments that would require substantial enhancement and expansion of transmission backbone systems that currently exist or are under development throughout eastern or southern Colorado. Additionally, by relying on dispatchable, carbon-free resources, the assumptions in this scenario are consistent with the "HB19-1261" scenario identified in the Roadmap paired with Governor Polis' stated goal of moving Colorado to 100% clean energy by 2040.

Public Service Scenario #3: Steady Transition

This scenario addresses the continuation of previous trends for the electric system, where (1) moderate levels of load growth are steadily driven primarily by the continuation of current adoption rates of electric vehicles and beneficial electrification, but overall levels of both energy and demand growth are moderate and Colorado does not see increased customer demand driven by prospective large loads, and (2) presently available renewable and energy storage technologies, with continued use of natural gas, remain the primary resources available to serve customer demand.

In this scenario, load growth is consistent with past trends, where the effects of steady population are partially offset by increased efficiency and customer adoption of electric vehicles and beneficial electrification do not materially depart from long-term trends. As

a result, both peak demand and annual energy consumption increase by approximately 50 percent. Though beneficial electrification contributes to a slight increase in the system's winter peak demand relative to the summer peak, the system remains summer peaking.

Load growth is primarily met with the continued expansion of currently-available renewable generation technologies – solar and wind. Consistent with Colorado's emissions reduction requirements, energy storage provides the primary dispatchable capacity to maintain reliable system operations, however, smaller-scale natural gas combustion turbines are also used to meet customer demand

Public Service Scenario #4: Stalled Transition

Under this scenario, Colorado pulls back from policies and ambitions that would drive both additional growth in electric demand and the expansion of renewable generation in order to reduce capital investment in the transmission system.

Load growth levels in this scenario are significantly muted, with system peak and energy demand increasing approximately 25 percent due to general population growth. Adoption of electric vehicles and beneficial electrification are diminished due to the withdrawal of federal incentives. In order to avoid investments in the electric system, Colorado discourages the development of large energy-intensive new customers in the state and economic development is not a significant driver of electric demand.

Additionally, while Colorado continues to prioritize emissions reductions from the electric sector, cost increases driven by equipment availability and the withdrawal of federal incentives challenge the state's continued expansion of renewable generation. While new renewable generation will be developed as the most economic options available to serve load, other generation retirements may be postponed to maintain system reliability.

IV. 20-Year Base Case Scenario

In Decision No. R14-0845, the Commission directed the Companies to include "at least one scenario that utilizes an updated 20-year base case power flow model" as part of the 20-Year Conceptual Scenario Report. Through CCPG's Conceptual Planning Working Group ("CPWG"), the Companies have worked collaboratively with stakeholders to develop a 20-year base case power flow model to serve as the basis of this scenario in previous 20-Year Conceptual Scenario Reports. While detailed analysis is not performed on the 20-year planning models due to the increasing levels of uncertainly looking beyond the five and 10-year horizons, the Companies presented a 20-year base case power flow model reflecting peak and off-peak conditions developed from a 10-year WECC planning model reflect projected renewable energy development based on current Renewable Energy Standard ("RES") requirements for investor-owned utilities and cooperatives, as well as conceptual transmission projects.

The power flow models are created using Siemens PTI PSS/E software and available upon request made to Colorado Coordinated Planning Group (CCPG) Chair. These models may be used by interested stakeholders to perform conceptual analyses for long-term planning horizon. Due to WECC policy governing all derivations of WECC base cases and their classification as Critical Energy Infrastructure Information ("CEII"), a non-disclosure agreement is required between WECC and the requester.

2026 Scenario Analysis Appendices

Appendix A:	Black Hills Scenarios
Appendix B:	Tri-State Scenarios
Appendix C:	Public Service Scenarios

Appendix A

Black Hills Scenarios

Black Hills Scenario #1: Large Load Interconnection

1. ***Description***

This scenario considers potential impacts of large data center loads on the Black Hills system. Large loads with high load-factors may present new challenges for the transmission system. These high load-factor loads could be challenging to serve with 100% renewables because they need a firm, around-the-clock energy supply, while wind and solar generation are inherently variable. In 2025, NERC issued a Level 2 Alert highlighting risks associated with large loads. The NERC Alert issued recommendations for utilities to establish formal study processes and interconnection requirements for large loads.

2. ***Rule 3627 (e) Application***

Rule	Credible alternatives	Apply
(I)	Reasonable foreseeable future policy initiatives	**X**
(II)	Possible retirement of existing generation due to age, environmental regulations or economic considerations	**X**
(III)	Emerging generation, transmission and demand limiting	**X**
(IV)	Various load growth projections	**X**
(V)	Requested by Commission	

3. ***Assumptions and Drivers***

- Increasing interconnection requests for data center loads.
- Volatility of future renewable generation resources.

4. ***Indicators***

- Demand for data centers is rising due to rapid growth in cloud computing, artificial intelligence and machine learning workloads

5. ***Potential Benefits and Transmission Impacts to Colorado***

While the increasing data center demand may present significant resource and transmission planning challenges, data center load could benefit Colorado by

accelerating economic investment while reinforcing the state's energy and technology leadership. Large data centers bring substantial capital spending, expanding the local tax base and supporting high-quality construction, engineering, and operations jobs, while also attracting complementary technology and cloud-based businesses along the Front Range. Their growing electricity demand can help justify new transmission, generation, and grid-modernization investments. When paired with thoughtful rate design and infrastructure planning, data center growth can strengthen grid resilience, stimulate rural and urban economic development, and position Colorado as a competitive hub for digital infrastructure in the Mountain West.

Black Hills Scenario #2: Increase in Renewable Energy Resources and Battery Storage

1. *Description*

This scenario considers the impacts of carbon regulations that may reduce the use of higher carbon-intensive resources and increase the use of lower carbon-intensive resources. A change in Colorado's generation portfolio may require improvements to the transmission system to ensure reliability and power delivery capabilities from typically more isolated generation centers to load centers in more centralized locations. This scenario was included in the previous Rule 3627 filing, but it is worth revisiting as each electric utility further develops plans to meet renewable energy goals.

2. *Rule 3627 (e) Application*

Rule	Credible alternatives	Apply
(I)	Reasonable foreseeable future policy initiatives	X
(II)	Possible retirement of existing generation due to age, environmental regulations or economic considerations	X
(III)	Emerging generation, transmission and demand limiting	X
(IV)	Various load growth projections	X
(V)	Requested by Commission	

3. *Assumptions and Drivers*

Current Colorado policy continues to show an increased interest in carbon emission reduction and places a greater focus on renewable energy generation. With utilities adopting clean energy plans, the amount of thermal carbon-based generation on the system is being reduced.

4. *Indicators*

- Increased public and political interest in a reduction of carbon emissions.
- Development of more efficient and reliable battery storage to help dampen out potential issues during peak time power consumption.

5. ***Potential Benefits and Transmission Impacts to Colorado***

The increased implementation of generation with reduced carbon output can have both negative and positive effects on the transmission system. The existing power system typically delivers power from centralized generation facilities to customers. With changes to how power is generated, there may be upgrades and additions to the system to ensure continued reliability. The different power output capabilities of lower carbon emission generation may present issues when they are unable to output maximum power. This could indicate the need for either battery storage or generation that is able to operate should load increase above the available renewable output capabilities.

Another challenge that comes from an increase of renewable resources lies in finding a suitable location for large wind or solar farms. Such land may be scarce in locations that act as load centers. This land also may be at long distances from local load. This may require additional transmission lines to reliably serve load.

Benefits to increasing the renewable profile of Colorado exist despite the challenges in this scenario. An increase in renewable generation may require additional transmission infrastructure. Increased infrastructure may help to reduce loading on existing transmission and could negate the need for upgrades or rebuilds. Additionally, power flow from existing carbon-intensive generation facilities can cause large power flows through systems when the normal paths to load are unavailable. Adding renewables may provide an opportunity to reduce potential through flow issues that can occur during outages on existing transmission.

Appendix B

Tri-State Scenarios

TSGT Scenario #1: Interregional Backbone Expansion and Transfer Capability

1. ***Description***

This scenario envisions Tri-State (independently or in collaboration with the Southwest Power Pool ("SPP"), other utilities, or agencies) developing new long-distance, high-voltage transmission corridors to strengthen the regional "backbone" grid. Specifically, it assumes construction of one or more 345 kV or 500 kV AC lines (or major upgrades to existing interfaces) that span multiple states, significantly increasing transfer capacity into and out of Colorado. The goal would be to enhance Colorado's import/export capability by tying its system more tightly with neighboring regions, allowing large power flows between Colorado and other areas. Such a backbone expansion is relevant in light of the rapidly evolving resource mix and policy environment – as Colorado's current interstate ties are relatively limited, stronger interregional connections are increasingly seen as opportunities to improve market access and grid resilience. Under this scenario, Tri-State's broad, multi-state footprint and its participation in emerging regional markets position it to play a key role in pursuing these large-scale transmission projects.

2. ***Rule 3627(e) Application***

Rule	Credible alternatives	Apply
(I)	**Reasonably foreseeable future policy initiatives**	**X**
(II)	**Possible retirement of existing generation due to age, environmental regulations or economic considerations**	**X**
(III)	**Emerging generation, transmission and demand limiting technologies**	**X**
(IV)	**Various load growth projections**	**X**
(V)	**Scenarios Requested by Commission in 2022 biennial review process**	

3. ***Assumptions and Drivers***

- **Retirement of legacy generation:** Coal plant retirements are assumed across Tri-State's system and the broader region. This reduction of local baseload capacity drives the need for new transmission to import power and to deliver energy from replacement resources located in other areas.
- **Public policy and clean energy goals:** Aggressive clean energy targets in Colorado and neighboring states (e.g. renewable portfolio standards and greenhouse gas reduction laws) are major drivers. These policies necessitate large-scale renewable generation development, often in remote high-resource zones, and create momentum for expanding the grid to meet statewide and regional clean energy objectives. In Colorado, the legislature has explicitly recognized that participation in organized wholesale markets and expanded transmission will help ensure a resilient, clean grid.
- **Organized market participation:** Tri-State and certain other utilities are joining the Southwest Power Pool (SPP) Regional Transmission Organization in the Western Interconnection, expanding the footprint of an organized market. Tri-State's participation in SPP's Western RTO may increase its opportunities to enhance transfer capability between regions.
- **Grid reliability and resilience needs:** Recent experience with extreme weather events and an evolving resource mix heightens the focus on system reliability. A key assumption is that stronger interregional ties are pursued as a strategy to improve resilience – allowing broader emergency support and resource sharing during droughts, cold snaps, or other high-stress events. By networking Colorado more tightly with surrounding systems, the region could better withstand disturbances. Additionally, as more inverter-based resources come online, a robust backbone helps maintain stability and voltage support over a wider area.

4. Potential Transmission Impacts to Colorado

Under this scenario, the expansion of a high-voltage interregional backbone could yield operational, economic, and reliability benefits for Colorado. By linking to a broader market, Colorado may be able to access lower-cost generation from other areas when economical and export surplus power when it is not needed locally. For example, during

high renewable output periods in Colorado, excess generation could be exported rather than curtailed, while during low-output or peak demand periods, Colorado could import power from elsewhere to meet its needs. This flexibility in balancing resources over a larger footprint could translate to reduced curtailment of renewables and more optimal dispatch of generation overall. It also provides operational flexibility and may reduce the total generating capacity needed to maintain reliable reserves – sharing reserves across a wider area means planning for a lower peak reserve margin in each individual area. Additionally, a strong interregional grid could allow certain local transmission projects to be deferred or avoided by relying on regional solutions that address both local and broader needs.

In an emergency or during extreme peak conditions, a robust interregional link means Colorado can import substantial power from other regions to prevent shortages or blackouts, beyond the limited support the current ties provide. The expanded transfer capability thus could also bolster resource adequacy and resilience for Colorado, acting as a safety net during supply shortfalls or outages.

TSGT Scenario #2: Colorado's Accelerated Decarbonization and Renewable Energy Efforts

1. *Description*

Colorado continues to pass legislation focused on aggressive economy-wide greenhouse gas reduction targets (e.g., aiming for net-zero emissions by 2050 with interim milestones) and to advance ambitious clean energy policies. If these policies continue, they may increase electricity demand through widespread electrification of transportation, heating, and other sectors, while also driving the reduction of fossil-fueled generation and replacement with renewable resources. As a result, Tri-State may experience growth in peak demand and overall energy requirements due to new electric uses, even as it plans for the retirement of its coal and gas plants in alignment with decarbonization goals. At the same time, Tri-State may have opportunities to serve new load growth and integrate emerging generation resources – expanding its wholesale services and supporting economic development (for example, powering data centers, electric vehicle charging infrastructure, and other newly electrified loads).

This scenario assumes steady advancement in renewable generation and energy storage technologies, examining the potential impacts of sustained clean energy adoption on Tri-State's transmission system. It focuses on the expansion of renewable resources such as solar photovoltaic, geothermal, wind, biomass, and hydropower, alongside the increasing deployment of energy storage.

2. *Rule 3627(e) Application*

Rule	Credible alternatives	Apply
(I)	Reasonably foreseeable future policy initiatives	X
(II)	Possible retirement of existing generation due to age, environmental regulations or economic considerations	X
(III)	Emerging generation, transmission and demand limiting technologies	X
(IV)	Various load growth projections	

(V)	**Scenarios Requested by Commission in 2022 biennial review process**	

3. Assumptions and Drivers

- The price of renewable energy resources continues to fall over time. This assumption projects long-term decline in price of renewable energy, despite recent federal policy changes regarding renewable energy program subsidies and priorities.
- New storage technologies emerge that allow for greater storage capacities to serve transmission needs.
- There is continued interest and increased penetration of community-based and behind-the-meter business models that make renewables available to more consumers.
- In the long term, energy storage technologies, particularly batteries, continue to improve and prices continue to fall, leading to wider deployment both in front of and behind the meter. In addition, higher penetrations of renewables will require additional storage on the system.
- In the long term, technological advances and regulatory policies are prompting utilities to explore the various applications of energy storage such as demand response, peak shaving, integration of renewables, and ancillary services.
- Existing and potentially increased state renewable energy standards and carbon reduction policies continue to drive the need for renewable resources at both the utility and consumer levels. These policy drivers are complemented by changing market forces that result in competitive prices for renewable resource generation.
- Despite recent federal policy changes, Colorado continues to push renewable energy targets, state tax credits, and procurement commitments to keep demand for renewable energy projects on track to align with the state's greenhouse gas emissions goals.

4. Potential Benefits and Transmission Impacts to Colorado

Under this scenario, Tri-State would likely diversify its resource mix by integrating substantially more renewable generation and invest significantly in energy storage to maintain system reliability. Rising electricity demand from electrification necessitates planning for enhanced transmission capacity to serve higher peak loads. While energy storage can, in some cases, act as an alternative to certain transmission upgrades by supplying power during peak periods or providing backup during outages, additional transmission investments would still likely be required to ensure adequate transfer capability under extreme conditions (such as periods of high import or export driven by severe weather events). Coordinated expansion of the bulk transmission system – including strategic regional transmission projects – may reduce the number and size of separate local transmission upgrades needed, potentially yielding cost efficiencies. Major regional lines will remain important to manage large power flows and prevent congestion as energy is moved across the state. An increased deployment of storage on the system could also improve grid resilience, helping to maintain reliable power delivery during planned maintenance or unexpected line outages by offering flexibility and backup energy where needed.

Large-scale renewable generation in this scenario is likely to be sited in resource-rich but relatively remote areas of Colorado and neighboring states (for example, high wind regions on the eastern plains or strong solar regions in the south/west). Accordingly, additional new or upgraded transmission lines may be required to transport power from these generation hubs to the state's load centers. The need to build transmission into remote areas can significantly increase costs, due to factors such as land acquisition for new rights-of-way and the greater distances involved. On the other hand, the growth of distributed energy resources closer to load can help offset some demand for new large-scale infrastructure. For instance, customer-sited DERs (like rooftop solar coupled with battery storage or community solar projects) have the potential to defer or reduce the need for additional utility-scale generation and major transmission expansion, particularly when these resources produce power during periods of peak grid demand. By serving a portion of local load directly and providing localized backup power, DERs

can alleviate strain on the bulk transmission system and may help lower overall costs for utilities and end-users.

TSGT Scenario #3: Technology Shifts

1. Description

This scenario envisions a coordinated adoption of emerging grid technologies as a systemic response to a high-renewables future. A suite of advanced solutions – including high-voltage direct current ("HVDC") transmission, advanced transmission technology, grid-forming inverters, and other advanced technologies – are put into place as the technologies mature. Driven by policy support and market evolution, these technologies collectively address the challenges of integrating widespread renewable generation, maintaining reliability, and improving resilience.

At the national and regional level, long-distance HVDC links gain prominence for bulk power transfer. HVDC lines can efficiently move large amounts of remote wind and solar energy over hundreds of miles with much lower losses than equivalent AC lines. They also enable power exchange between regions that were previously not synchronized, improving overall grid flexibility and reliability. In parallel, grid-forming inverter technology matures and becomes standard in new renewable and storage projects. Grid-forming inverters allow inverter-based resources (solar, wind, batteries) to operate like traditional synchronous generators, providing essential stability services such as frequency control and voltage support. Industry studies indicate that such inverters will be critical to reliably operate grids with very high inverter-based resource penetration. Under this scenario, many new generators use grid-forming controls, enabling the power system to withstand disturbances and recover from blackouts without relying on spinning fossil-fueled units.

2. Rule 3627(e) Application

Rule	Credible alternatives	Apply
(I)	**Reasonably foreseeable future policy initiatives**	**X**
(II)	**Possible retirement of existing generation due to age, environmental regulations or economic considerations**	**X**

(III)	**Emerging generation, transmission and demand limiting technologies**	**X**
(IV)	**Various load growth projections**	**X**
(V)	**Scenarios Requested by Commission in 2022 biennial review process**	

3. Assumptions and Drivers

- Federal and state funding is available for research and development of energy storage, inverter technology, and HVDC technology.
- Large energy storage and inverter (grid-forming) technology continues to develop to ensure reliable resource performance under system disturbances.
- HVDC options are available in major corridors; opportunity for converter and storage integration continues to increase.
- Evolving market structures and regulations encourage regional integration and non-wires solutions.
- Grid-forming inverter capabilities continue to improve, enabling inverter-based resources to reliably operate through disturbances and contribute to grid stability. Utilities gain operational experience with these inverters in smaller systems (microgrids, island grids) and scale up their use. Control systems and standards evolve to ensure interoperability and safe dynamic performance in an inverter-dominated grid.
- Energy management and grid control technologies continue to develop in order to coordinate these diverse resources. Sophisticated forecasting, automation, and real-time controls are assumed to be in place to ensure generation and load remain balanced with predominantly variable resources. These tools help system operators optimize the charging of storage, the dispatch of renewables, and power flow on HVDC links, maintaining reliability in a complex, distributed grid
- Higher penetrations of renewables require additional storage on the system.
- Energy management technologies continue to develop to ensure appropriate balance of generation and load with solely variable energy resources.

4. ***Potential Benefits and Transmission Impacts to Colorado***

In this technology-forward scenario, the nature of transmission investment, design, and operation in Colorado undergoes a significant shift. There is less reliance on building long new AC lines; instead, the emphasis moves toward targeted high-capacity corridors and smarter use of the existing grid. For bulk power transfers, strategic HVDC lines could potentially provide backbones that link Colorado to distant generation and neighboring states.

Large-scale storage deployment in this scenario could lead to a more robust transmission system that can better handle maintenance outages and unexpected events – stored energy can be used to supply local load if a line is out of service, enhancing reliability during contingencies. Widespread use of grid-forming inverters and fast control systems could maintain stability with reduced spinning reserves available at thermal units, ensuring that voltage and frequency remain stable despite the high renewable penetrations.

In contrast to the other scenarios, which emphasize more traditional transmission expansion strategies, this scenario focuses on the potential for advanced technologies. This scenario also distinguishes itself through the integration of large-scale energy storage and widespread grid-forming inverter technologies, which could increasingly serve transmission-supporting functions. Storage systems are leveraged to mitigate peak loading, support system reliability during outages, and defer or replace select traditional upgrades. Grid-forming inverters enhance voltage and frequency stability in a system with declining synchronous generation, enabling stable operation under high renewable penetration. Together, these technologies could shift the focus of transmission investment from conventional line builds to advanced control infrastructure, system flexibility, and new operational capabilities that support a more dynamic and distributed electric grid.

TSGT Scenario #4: Grid Resilience and Climate Adaptation

1. *Description*

In this scenario, protecting the grid against wildfires and extreme weather becomes the dominant priority for transmission planning in Colorado. Federal and state policies increasingly push utilities to harden power lines, eliminate the potential for wildfire ignitions, and prepare for severe weather events. The focus is on proactively strengthening the Colorado transmission system to withstand climate extremes and mitigate wildfire risks, even if that means prioritizing safety and reliability over purely economic expansion.

2. *Rule 3627(e) Application*

Rule	Credible alternatives	Apply
(I)	Reasonably foreseeable future policy initiatives	X
(II)	Possible retirement of existing generation due to age, environmental regulations or economic considerations	X
(III)	Emerging generation, transmission and demand limiting technologies	X
(IV)	Various load growth projections	
(V)	Scenarios Requested by Commission in 2022 biennial review process	

3. *Assumptions and Drivers*

- Wildfires continue to threaten Colorado and the west.
- Extreme weather and unpredictable weather events overload and threaten Tri-State's transmission system, Colorado's electric grids, and Member Systems.
- Vulnerability of existing infrastructure to extreme conditions, resulting in power outages, disruptions, and other failures.
- Opportunity to access resilience funding, spurring investment and innovation at federal and state level to meet needs for grid hardening.

- Driven by a need for reduction in liability and exposure from wildfires and extreme weather events, and subsequent outages.
- Driven by rising operational and maintenance and capital needs.

4. Potential Benefits and Transmission Impacts to Colorado

By making resilience and wildfire mitigation the top priority, this scenario could lead to notable changes in how Colorado's transmission system is designed and operated. Key technology shifts and their impacts could include:

- High-risk transmission and sub-transmission lines are selectively moved underground to protect them from fire and weather. While undergrounding is expensive, this scenario prioritizes it in zones where overhead lines present an unacceptable safety risk.
- Microgrids become more prominent, especially for critical facilities and remote communities. Under this scenario, utilities and local authorities could deploy microgrids to ensure that hospitals, emergency response centers, water treatment plants, and other essential services can remain powered during wildfire-related outages or public safety power shutoff events.
- The scenario could also result in systematically upgrading infrastructure with fire-resistant and climate-resilient materials. Utilities could, for example, replace remaining wooden poles with steel or composite poles that are less likely to burn or collapse in a fire. Covered conductors (insulated wires) could be used to prevent sparks from contact with trees or wildlife.
- This scenario may also result in the increased use of sensors and real-time monitoring to detect problems early. Sophisticated forecasting tools could be used to model fire spread and weather impacts, enabling operators to be more aware of potential risks.

Appendix C

Public Service Scenarios

Public Service Scenario #1: Clean Energy Growth

1. Description

This scenario represents the pairing of significant growth in electric demand with the continued large-scale buildout of renewable generation as the primary resources available to meet that demand. Load growth in this scenario is driven by both traditional retail customer demand growth including population and economic growth, EV adoption, and beneficial electrification of fossil fuel end uses such as heating in homes and businesses, as well as by the development of new large loads such as manufacturing facilities and data centers in Colorado. Under this scenario, annual energy consumption by Public Service's existing and new retail customers increases to three times current levels, though the peak system demand only approximately doubles due to load management. Notably, due to electrification of heating, Public Service's summer and winter peaks are approximately even in this scenario.

Load growth is primarily met with the continued expansion of currently-available renewable generation technologies – solar and wind. Consistent with Colorado's emissions reduction requirements, energy storage provides the primary dispatchable capacity to maintain reliable system operations, however, smaller-scale natural gas combustion turbines are also used to meet customer demand.

2. Rule 3627 (e) Application

Rule	Credible alternatives	Apply
(I)	Reasonably foreseeable future policy initiatives	**X**
(II)	Possible retirement of existing generation due to age, environmental regulations or economic considerations	**X**
(III)	Emerging generation, transmission and demand limiting	**X**
(IV)	Various load growth projections	
(V)	Requested by Commission	

3. Potential Benefits and Transmission Impacts to Colorado

The transformation of the state's electric system driven by significant load growth and the continued large-scale deployment of renewable resources would lead to major additional transmission system expansions. The doubling of peak demand would be expected to require substantial expansion of transmission within the Company's primary load centers to serve that load. Furthermore, meeting this load primarily through renewable resources would require significant expansion of the transmission system throughout the state.

Within the load centers, expansion projects would first focus on maximizing the capabilities of existing transmission assets through the deployment of advanced technologies or by rebuilding aging facilities. However, the overall levels of load growth, especially considering the concentrated presence of energy-intensive customers, will require the development of new transmission paths in order to maintain system reliability and flexibility. Additionally, transmission projects in this scenario may focus on reconfiguring the existing transmission network to increase voltage classes of existing paths or to remove restrictions on transmission capacity that may arise from the interaction between lower-voltage (115 kV or 230 kV) and higher-voltage (345 kV and above) elements of the system.

In order to meet new electric demand while remaining compliant with state emissions reductions policies, this scenario dramatically increases the need to generate and deliver additional renewable energy from diverse, resource-rich regions of the state such as southeastern Colorado and the San Luis Valley, or to develop interstate transmission lines that can create further geographic diversity. Transmission projects that enhance transfer capacity from these regions to the state's load centers, potentially including the development of 500 kV or 765 kV backbones, would provide significant value by accessing large-scale and geographically diverse areas of renewable development potential. Under this scenario, the significant buildout of variable renewable generation would also enhance the value and benefits of additional regional and interregional transmission

connections, such as projects that enhance ties between Colorado and the Southwest Power Pool through additional Direct Current ties to the Eastern Interconnection, or through connections the north and/or west that access western energy markets.

Though increased peak demand drives the need for additional transmission system expansion, increased loading on the system caused by the divergence between annual energy consumption and peak demand growth, as well as the flattening of summer and winter peaks, would allow for the more efficient use of the transmission system. Increased system utilization would benefit customers by reducing the potential rate pressure that can be caused by system expansion. The deployment of energy storage within the load center may help further alleviate the need for some transmission expansion, but rising utilization of the transmission system driven by increased off-peak consumption would also reduce the available headroom to charge storage from remotely-located renewable generation, potentially muting some of the transmission-related benefits of energy storage.

Public Service Scenario #2: High Tech Economic Development

1. ***Description***

This scenario represents the pairing of significant growth in electric demand with the deployment of new, carbon-free dispatchable generation technologies to serve the state's growth. In this scenario, Colorado commits to sustained, cutting-edge progress in the use of new generation technologies such as advanced geothermal, nuclear, or other forms of dispatchable generation to power a high-growth advanced electric economy.

Load growth in this scenario includes traditional retail customer demand growth including population and economic growth, EV adoption, and beneficial electrification of fossil fuel end uses such as heating in homes and businesses, however, the state's leadership in deployment of large-scale advanced technologies and the abundant availability of electricity attracts significant new large loads such as manufacturing facilities and data centers. Under this scenario, annual energy consumption by Public Service's existing and new retail customers increases to four times current levels, though the peak system demand only approximately doubles due to advanced load management and enhanced customer deployment of distributed resources that are collectively managed through programs such as virtual power plants. System utilization in this scenario is high, and notably, due to electrification of heating and effective load management practices, Public Service's winter peaks surpass summer peaks.

Customer demand in this scenario is primarily served by deploying advanced generation technologies that can be constructed close to existing load centers on the system. While renewable resources continue to play a valuable role in this scenario, the economic value of new dispatchable, centralized, and high capacity factor generating technologies such as advanced geothermal or nuclear power allow for demand to be met without further large-scale renewable developments that would require substantial enhancement and expansion of transmission backbone systems that currently exist or are under development throughout eastern or

southern Colorado. Additionally, by relying on dispatchable, carbon-free resources, the assumptions in this scenario are consistent with the "HB19-1261" scenario identified in the Roadmap paired with Governor Polis' stated goal of moving Colorado to 100% clean energy by 2040.

2. Rule 3627 (e) Application

Rule	Credible alternatives	Apply
(I)	Reasonably foreseeable future policy initiatives	X
(II)	Possible retirement of existing generation due to age, environmental regulations or economic considerations	X
(III)	Emerging generation, transmission and demand limiting	X
(IV)	Various load growth projections	X
(V)	Requested by Commission	

3. Potential Benefits and Transmission Impacts to Colorado

Though significant load growth will inherently drive the need for additional transmission capacity, generation deployments in this scenario would be concentrated on existing transmission paths and in close proximity to Public Service's load centers. The doubling of peak demand would be expected to require substantial expansion of transmission within the Company's primary load centers to serve that load. In this scenario, expansion projects would first focus on maximizing the capabilities of existing transmission assets through the deployment of advanced technologies or by rebuilding aging facilities. However, the overall levels of load growth, especially considering the concentrated presence of energy-intensive customers, will require the development of new transmission paths in order to maintain system reliability and flexibility. Additionally, transmission projects in this scenario may focus on reconfiguring the existing transmission network to increase voltage classes of existing paths or to remove restrictions on transmission capacity that may arise from the interaction between lower-voltage (115 kV or 230 kV) and higher-voltage (345 kV and above) elements of the system.

While the overall need for transmission expansion within the load center will be high under this scenario, the location of generation within, or in close proximity to, the load centers would have a material effect on specific system needs. Development of generation resources within Just Transition communities, such as Pueblo or Hayden, would likely require additional system reinforcements to existing transmission paths used by retiring generation located in those communities. Enhanced regional and interregional ties may provide additional value in this scenario, however the reduced reliance on variable resources could limit the overall value of those links.

Though increased peak demand drives the need for additional transmission system expansion, increased loading on the system caused by the divergence between annual energy consumption and peak demand growth, as well as the flattening of summer and winter peaks, would allow for the more efficient use of the transmission system. Increased system utilization would benefit customers by reducing the potential rate pressure that can be caused by system expansion, and the high levels of demand growth would create significant benefits to both new and existing customers.

The deployment of energy storage within the load center may help further alleviate the need for some transmission expansion, but rising utilization of the transmission system driven by increased off-peak consumption would also reduce the available headroom to charge storage from remotely-located renewable generation, which could increase the system value of storage that is co-located with renewable generation inside the load center, such as customer-sited DERs, but could otherwise potentially inhibit some of the transmission-related benefits of energy storage.

Public Service Scenario #3: Steady Transition

1. ***Description***

This scenario addresses the continuation of previous trends for the electric system, where (1) moderate levels of load growth are steadily driven primarily by the continuation of current adoption rates of electric vehicles and beneficial electrification, but overall levels of both energy and demand growth are moderate and Colorado does not see increased customer demand driven by prospective large loads, and (2) presently available renewable and energy storage technologies, with continued use of natural gas, remain the primary resources available to serve customer demand.

In this scenario, load growth is consistent with past trends, where the effects of steady population are partially offset by increased efficiency and customer adoption of electric vehicles and beneficial electrification do not materially depart from long-term trends. As a result, both peak demand and annual energy consumption increase by approximately 50 percent. Though beneficial electrification contributes to a slight increase in the system's winter peak demand relative to the summer peak, the system remains summer peaking.

Load growth is primarily met with the continued expansion of currently-available renewable generation technologies – solar and wind. Consistent with Colorado's emissions reduction requirements, energy storage provides the primary dispatchable capacity to maintain reliable system operations, however, smaller-scale natural gas combustion turbines are also used to meet customer demand.

2. ***Rule 3627 (e) Application***

Rule	Credible alternatives	Apply
(I)	Reasonably foreseeable future policy initiatives	**X**
(II)	Possible retirement of existing generation due to age, environmental regulations or economic considerations	**X**
(III)	Emerging generation, transmission and demand limiting	**X**

(IV)	Various load growth projections	**X**
(V)	Requested by Commission	

3. Potential Benefits and Transmission Impacts to Colorado

The continuation of previous trends in load growth and renewable development will contribute to significant additional transmission expansion for Public Service's system as remaining headroom on the existing system continues to be utilized, customer demand remains concentrated within the existing Public Service load center, and growth is primarily served by the development of new renewable generation resources throughout eastern and southern Colorado.

Within the load center, expansion projects would first focus on maximizing the capabilities of existing transmission assets through the deployment of advanced technologies or by rebuilding aging facilities. Transmission projects in this scenario may also focus on reconfiguring the existing transmission network to increase voltage classes of existing paths or to remove restrictions on transmission capacity that may arise from the interaction between lower-voltage (115 kV or 230 kV) and higher-voltage (345 kV and above) elements of the system. However, given the continued erosion of existing headroom on the transmission system, moderate levels of load growth are also likely to require the development of new transmission paths in order to maintain system reliability and flexibility.

In order to meet the steady growth of electric demand while remaining compliant with state emissions reductions policies, this scenario moderately increases the need to generate and deliver additional renewable energy from diverse, resource-rich regions of the state such as southeastern Colorado and the San Luis Valley. Transmission projects that enhance transfer capacity from these regions to the state's load centers, such as the reinforcement of existing or planned 365 kV transmission backbones, would provide value by accessing large-scale and geographically diverse areas of renewable development potential. Under this scenario, the continued buildout of variable renewable generation may also

enhance the value and benefits of additional regional and interregional transmission connections, such as projects that enhance ties between Colorado and the Southwest Power Pool through additional Direct Current ties to the Eastern Interconnection, or through connections the north and/or west that access western energy markets, however the value of these links may not surpass their cost given lower levels of renewable deployments.

In this scenario, increased peak demand drives the need for additional transmission system expansion, and while some advanced technology deployments may enable the more efficient use of existing transmission facilities and optimization of new transmission paths. However, because the growth of peak demand and annual energy consumption remains closely coupled, overall system utilization levels do not materially increase, leading to the potential for additional rate pressure. In this scenario, the deployment of energy storage within the load center may help further alleviate the need for some transmission expansion if system utilization levels allow for headroom to charge storage from remotely located renewable generation.

Public Service Scenario #4: Stalled Transition

1. ***Description***

Under this scenario, Colorado pulls back from policies and ambitions that would drive both additional growth in electric demand and the expansion of renewable generation in order to reduce capital investment in the transmission system.

Load growth levels in this scenario are significantly muted, with system peak and energy demand increasing approximately 25 percent due to general population growth. Adoption of electric vehicles and beneficial electrification are diminished due to the withdrawal of federal incentives. In order to avoid investments in the electric system, Colorado discourages the development of large energy-intensive new customers in the state and economic development is not a significant driver of electric demand.

Additionally, while Colorado continues to prioritize emissions reductions from the electric sector, cost increases driven by equipment availability and the withdrawal of federal incentives challenge the state's continued expansion of renewable generation. While new renewable generation will be developed as the most economic options available to serve load, other generation retirements may be postponed to maintain system reliability.

2. ***Rule 3627 (e) Application***

Rule	Credible alternatives	Apply
(I)	Reasonably foreseeable future policy initiatives	**X**
(II)	Possible retirement of existing generation due to age, environmental regulations or economic considerations	**X**
(III)	Emerging generation, transmission and demand limiting	
(IV)	Various load growth projections	**X**
(V)	Requested by Commission	

3. ***Potential Benefits and Transmission Impacts to Colorado***

Despite muted load growth, transmission expansion remains necessary for the Public Service transmission system as remaining headroom on the existing system continues to be utilized and customer demand remains concentrated within the existing Public Service load center.

Within the load center, transmission projects are primarily focused on replacing aging facilities and maximizing the capabilities of existing transmission assets. Transmission projects in this scenario may also focus on reconfiguring the existing transmission network to increase voltage classes of existing paths or to remove restrictions on transmission capacity that may arise from the interaction between lower-voltage (115 kV or 230 kV) and higher-voltage (345 kV and above) elements of the system, though lower loading levels may reduce the overall need for such projects. However, given the continued erosion of existing headroom on the transmission system, even lower levels of load growth may require the development of limited new transmission paths in order to maintain system reliability and flexibility with currently-approved generation and load levels.

In this scenario, generation development is primarily concentrated on the existing transmission system, reducing the need for the development of additional new backbone transmission facilities. Instead, statewide transmission expansion would focus on rebuilding aging infrastructure with modernized facilities that provide incremental additional transmission capacity or otherwise upgrading existing transmission paths when needed.

Transmission system utilization does not improve in this scenario due to the limited levels of load growth that are not proactively managed. Though total capital expenditures on the transmission system are reduced compared to other scenarios, the need to maintain aging infrastructure and address system needs that drive new transmission development would increase cost pressure on customers as system utilization does not grow commensurate with investments in the system. Additionally, the lack of development of new backbone paths throughout eastern or

southern Colorado would sacrifice access to additional renewable generation that may have economic value for customers. It is unlikely in this scenario that the reduction in investment in the transmission system will result in customer savings.