

# 2024 Transmission Capacity Expansion Study

Summary Presentation to the Joint Energy Committee

January 16, 2025

Prepared on behalf of the:



# Study Background and Purpose

- **In 2023, the State of Colorado directed CETA (SB23-016) to study the need for expanded transmission capacity in the State. The study offers critical insights into the transmission infrastructure needed to meet Colorado's long-term energy demand and policy goals.**

Study **objective** was to forecast transmission additions that:

- ✓ Help meet forecasted demand for electricity
- ✓ Achieve the State's emission reduction goals
- ✓ Improve power flows on the system
- ✓ Enhance grid reliability

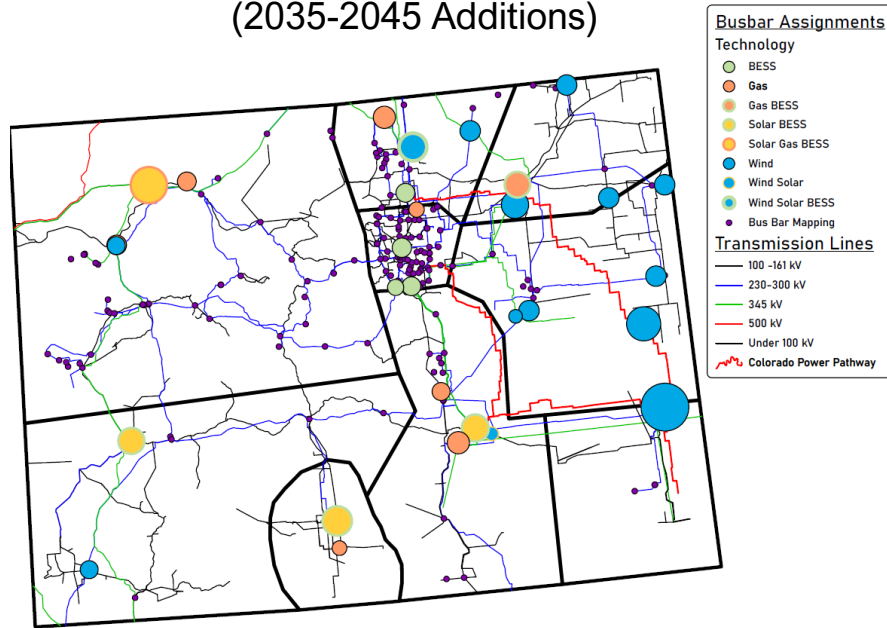
A **stakeholder process** resulted in study participation from utilities, state agencies, trade associations, developers, and environmental organizations

The **approach** was a long-run, holistic study that identified Colorado's transmission needs over the approaching 20-years, considering:

- ✓ Construction of new lines
- ✓ Upgrades to existing lines
- ✓ Enhanced connections to adjacent states and markets
- ✓ Use of advanced transmission technologies and storage, and
- ✓ Options to limit land impacts & maximize use of existing rights of way

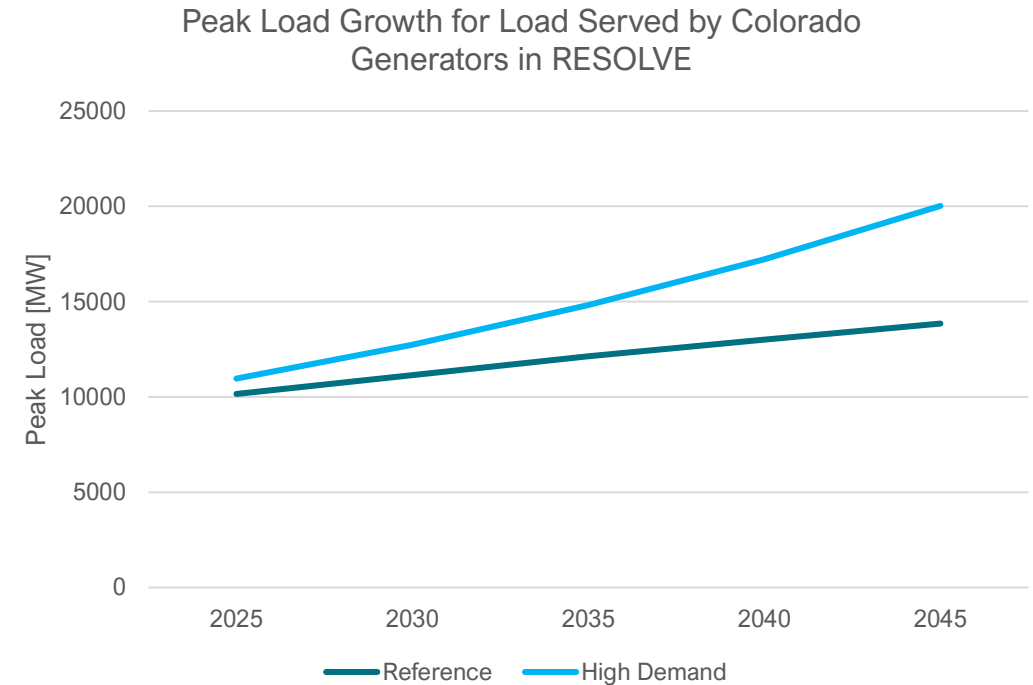
# Critical Assumptions Impacting Transmission Outcomes of Study

## 2045 Reference Case Generator Additions and Busbar Mapping (2035-2045 Additions)



- Study required assumptions regarding the siting of ~15 GW of new generation – a major driver of transmission outcomes
- Detailed geospatial siting considered commercial interest, hosting capacity, land constraints, resource quality, engineering preference, stakeholder feedback

## 20-Year Colorado Demand Forecast



- Transmission need was highly sensitive to magnitude of load growth assumed in Study

# Key Finding: Colorado's Urgent Need for Additional Transmission Capacity

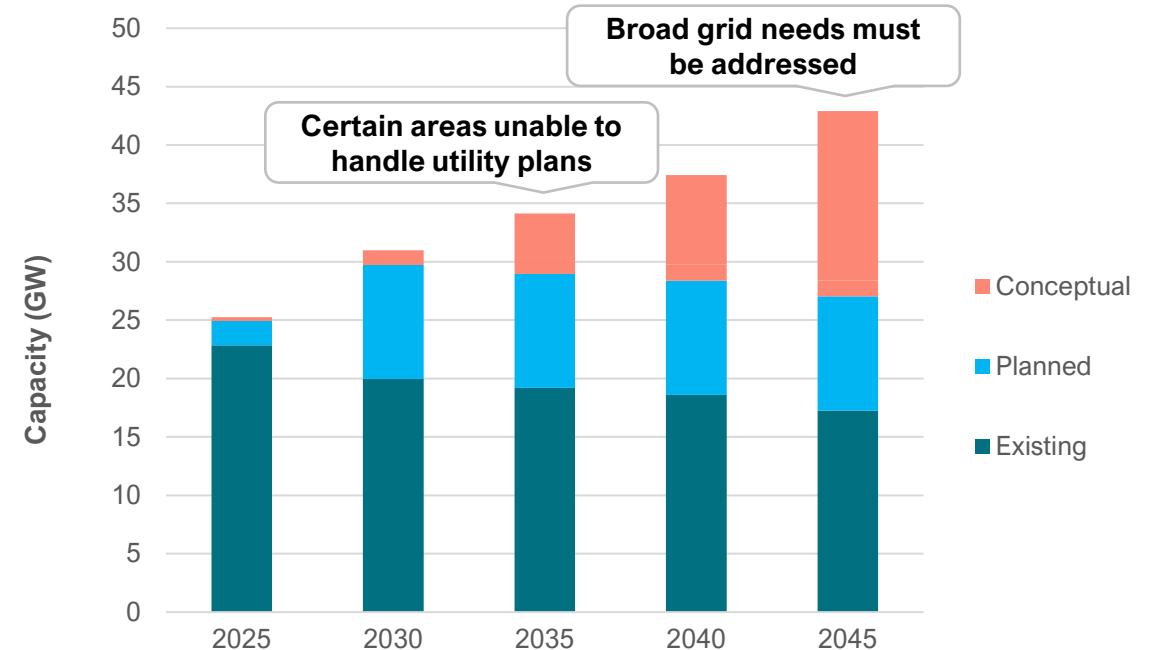
## Study Takeaways

Identified **insufficient transmission capacity** to accommodate Colorado's growing load & generation forecasts sourced from utility plans

Additional **transmission infrastructure is needed** to achieve the state's clean energy goals and service reliability

**Near term transmission gaps** include the San Luis Valley, Northeast Colorado, and Southeast/South Central Colorado

### Forecasted Colorado Generation Capacity



*Generation buildouts to meet policy and energy requirements require increasing amounts of transmission expansion*



# Key Finding: \$4.5 Billion of Additional Transmission Investment Forecasted for Colorado Over 20-years

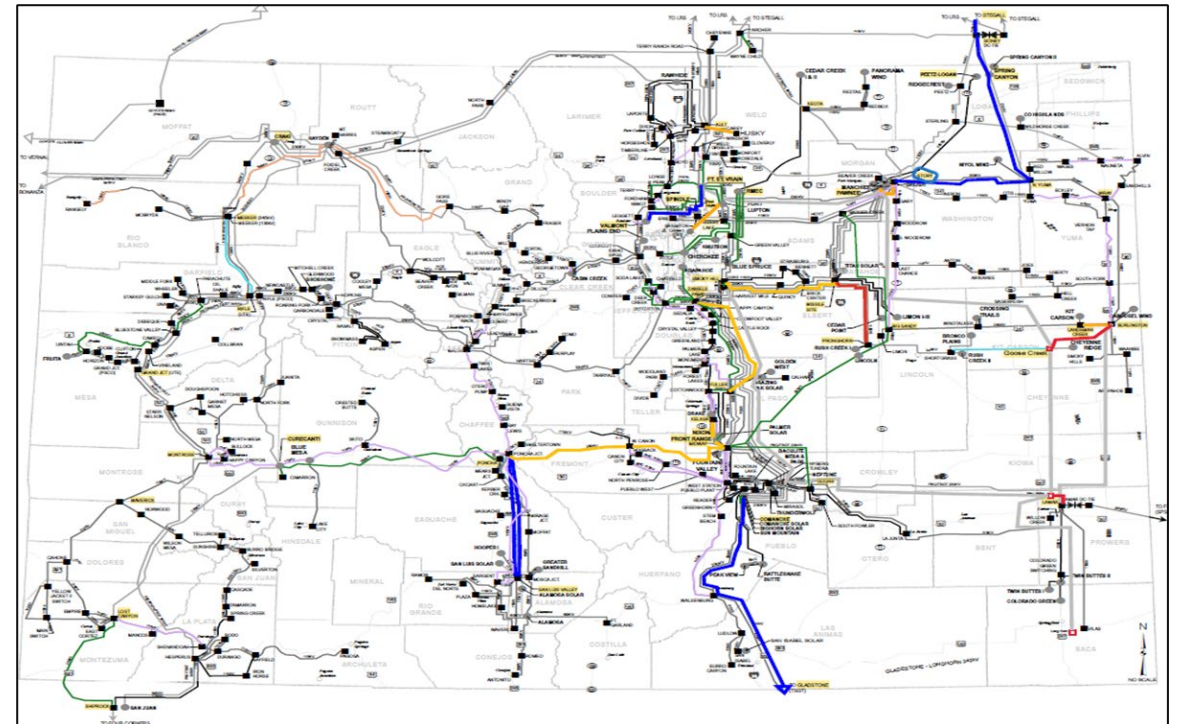
## Study Takeaways

**Planned transmission is insufficient** in 20-year horizon, requiring more than \$4.5B in new grid investments

Approximately **80% of the transmission needs** identified in the study can be addressed by upgrading existing infrastructure and leveraging existing rights-of-way




**Greenfield transmission development will also be needed**, with the study identifying 550 miles of critical new lines

## 20-Year Reference Case Transmission Portfolio



Capital Investment (\$M)

\$4,503

-  New 230kV Lines
-  New 345kV Lines
-  Conceptual Projects
-  Rebuild to Double Circuit

# Key Finding: Higher Load Levels Drives Total Grid Investment to \$8.7 Billion

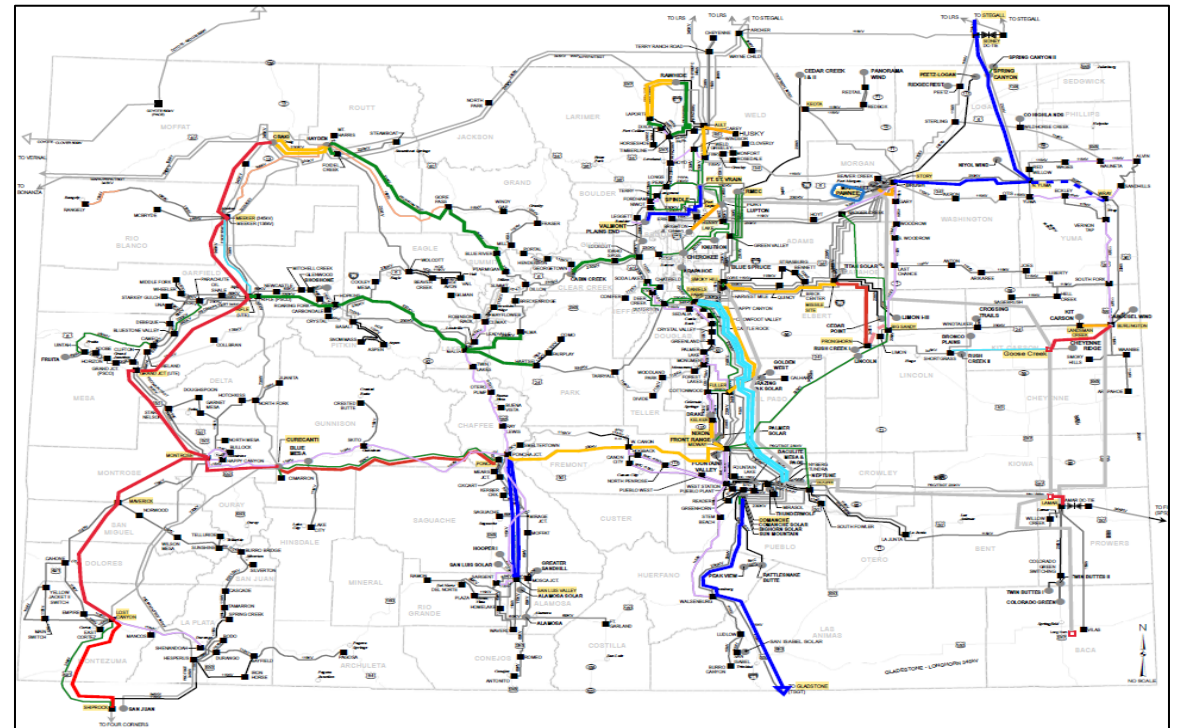
## Study Takeaways

Increased demand due to electrification, data centers, or other new point loads like hydrogen production **further increase grid strain**

Increasing forecasted loads by ~45% (to 20 GW) required additional resources (+7 GW), both of which contributed to **higher grid usage**

**Additional reconductoring and upgrade projects are needed under this future, emphasizing the value of existing corridors**

## 20-Year Reference Case Transmission Portfolio



### Capital Investment (\$M)

\$3,800 + Ref. Case

- |                           |                   |
|---------------------------|-------------------|
| New 230kV Lines           | Reconductor 345kV |
| New 345kV Lines           | Reconductor 230kV |
| Conceptual Projects       | Reconductor 138kV |
| Rebuild to Double Circuit | Reconductor 115kV |

# Key Finding: CETA is Uniquely Positioned to Help Address Colorado Transmission Needs

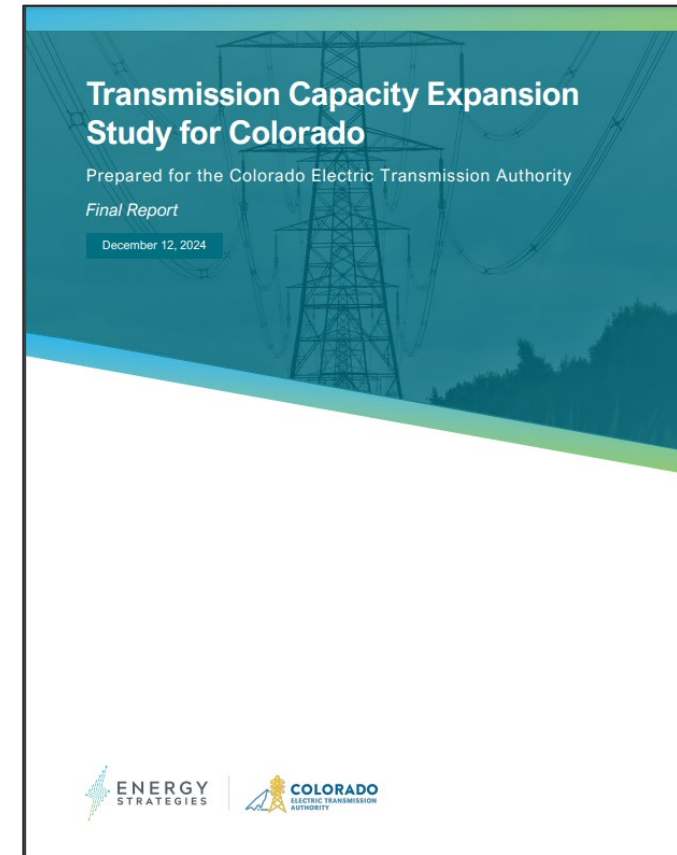
## Study Takeaways

CETA can take a **long-term, holistic view** of transmission needs that doesn't fit with utility planning practices

CETA's revenue bonding authority could be used to help **lower financing costs** of certain critical transmission projects

Focusing on difficult-to-build projects, those that require coordination, or upgrades that need "right-sizing" are among many **viable strategies for CETA** identified in the study

Final Report with complete findings, assumptions, and methods available on [CETA's website](#)





# Thank You

[www.energystrat.com](http://www.energystrat.com)

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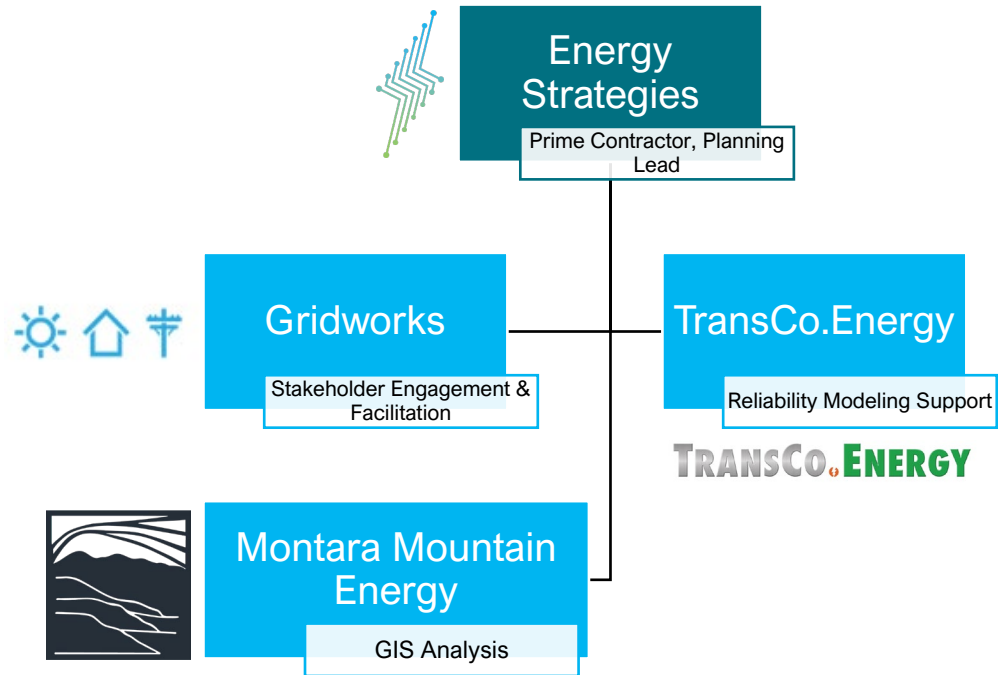


# Appendices

# Introductions: CETA and the Project Team

## Project Team

CETA awarded transmission study to a project team, led by Energy Strategies, with necessary tools, data, modeling capabilities and experience with the Colorado transmission system to execute the study scope.



## CETA Background

An independent entity created in 2021 to develop electric transmission facilities that help deliver clean energy in Colorado. Powers include transmission planning, establishing corridors, partnering with public and private entities, and issuing bonds. CETA aims to improve grid reliability, support clean energy goals, and foster economic development.



# Clarifying the intent of this work

## What it is...

- ✓ Focused on identifying Colorado transmission needs, featuring a gap analysis that will target identification of some (but not all) needs that are not already met by planned projects
- ✓ An effort to identify viable transmission solutions that could meet the identified needs
- ✓ An independent assessment that seeks to benefit from broad stakeholder and utility input on models, data, and approaches
- ✓ A consideration of transmission projects that are “in-flight” and are likely to be built
- ✓ Concerned with identifying potential grid challenges and solutions in a holistic manner

## What it is not...

- ✗ An ERP for Colorado utilities, a state-sponsored resource plan, or an endorsement of the same
- ✗ A “state-wide” transmission plan – the goal is not to complicate the planning landscape & roles in Colorado
- ✗ Designed to result in the “approval” of any individual transmission line
- ✗ A detailed permitting, siting, or cost allocation exercise
- ✗ Focused on supporting specific utility or developer transmission projects
- ✗ A “selection” or formal endorsement of any particular transmission solution for a given need or corridor
- ✗ An effort to “re-do” or undermine utility transmission planning



**Study features 10- and 20-year horizons, with a focus on identifying long-run transmission gaps that may impact Colorado’s ability to service loads, integrate new resources, and benefit from inter-state power exchanges**

# Stakeholder Engagement was High Throughout Study Process

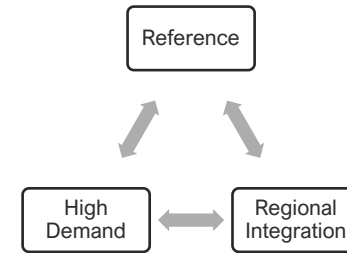
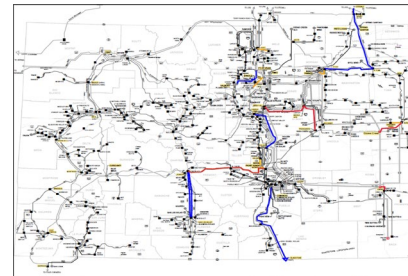
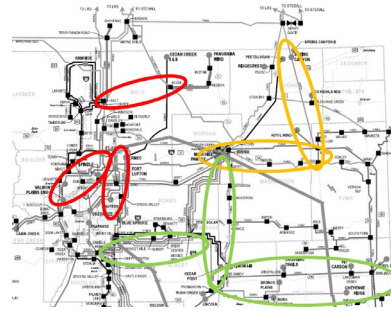
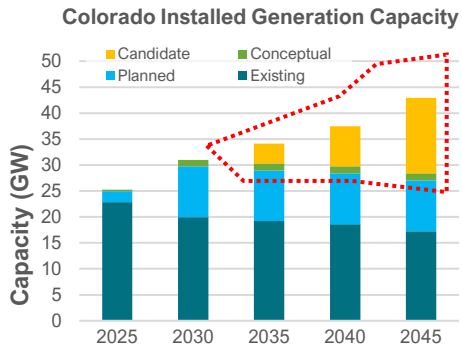
***"Active stakeholder engagement is a very important principle for this project."***

<b>Meeting #1</b> <b>Feb. 9, 2024</b>	<b>Meeting #2</b> <b>Mar. 22, 2024</b>	<b>Busbar Mapping Proposal</b> <b>April 12, 2024</b>	<b>Meeting #3</b> <b>May 24, 2024</b>	<b>Meeting #4</b> <b>July 26, 2024</b>
<ul style="list-style-type: none"> <li>Methodology and reference case assumptions, introduced busbar mapping</li> <li>46 stakeholders from ~30 orgs</li> <li>6 written comments</li> </ul>	<ul style="list-style-type: none"> <li>Reviewed methodology and study progress, proposed study scenarios</li> <li>54 stakeholders from ~40 orgs</li> <li>7 written comments</li> </ul>	<ul style="list-style-type: none"> <li>Proposed zonal resource allocations and busbar mapping details</li> <li>Circulated to ~100 contacts on distro list</li> <li>Informal exchange to strengthen inputs</li> </ul>	<ul style="list-style-type: none"> <li>Reviewed reliability results and discussed potential solutions</li> <li>40 stakeholders from ~30 orgs</li> <li>11 written comments</li> </ul>	<ul style="list-style-type: none"> <li>Reviewed production cost modeling results, discussed top expansion opportunities</li> <li>51 stakeholders from ~48 orgs</li> <li>written comments laid over to initial report issuance</li> </ul>

**All materials available on the [CETA website](#)**



# Study Process Builds Toward Assessment of 20-Year Transmission Gap for Colorado



- Captured Colorado ERPs call for **~10 GW of new capacity by 2035**
- Forecasted a need for **+15 GW of additional resources** to meet load and policy goals in 2045
- Assessment accounted for **all Colorado planned transmission upgrades (~\$2B)**
- Performed independent **reliability and congestion analysis** to explore 20-year transmission need
- Developed **\$4.5B transmission portfolio** with 550 miles of new lines and 3,150 miles of rebuild/reconducting
- Considered **advanced transmission technologies** (via transmission alternative analysis) & detailed routing
- Scenarios used to explore how transmission portfolios **change under different futures**
- **Identified portfolio of interstate upgrades (\$750M)** that increase connectivity to WY, CO, and NM
- Significant 20-year transmission **development gaps exist in Colorado**
- Positions CETA to **take action and prioritize** future transmission development opportunities



# Transmission Portfolios: Reference Case

- Reference Case portfolio meets the 20-year reliability, deliverability and economic needs of high-voltage system in Colorado

## Capital Investment (\$M)

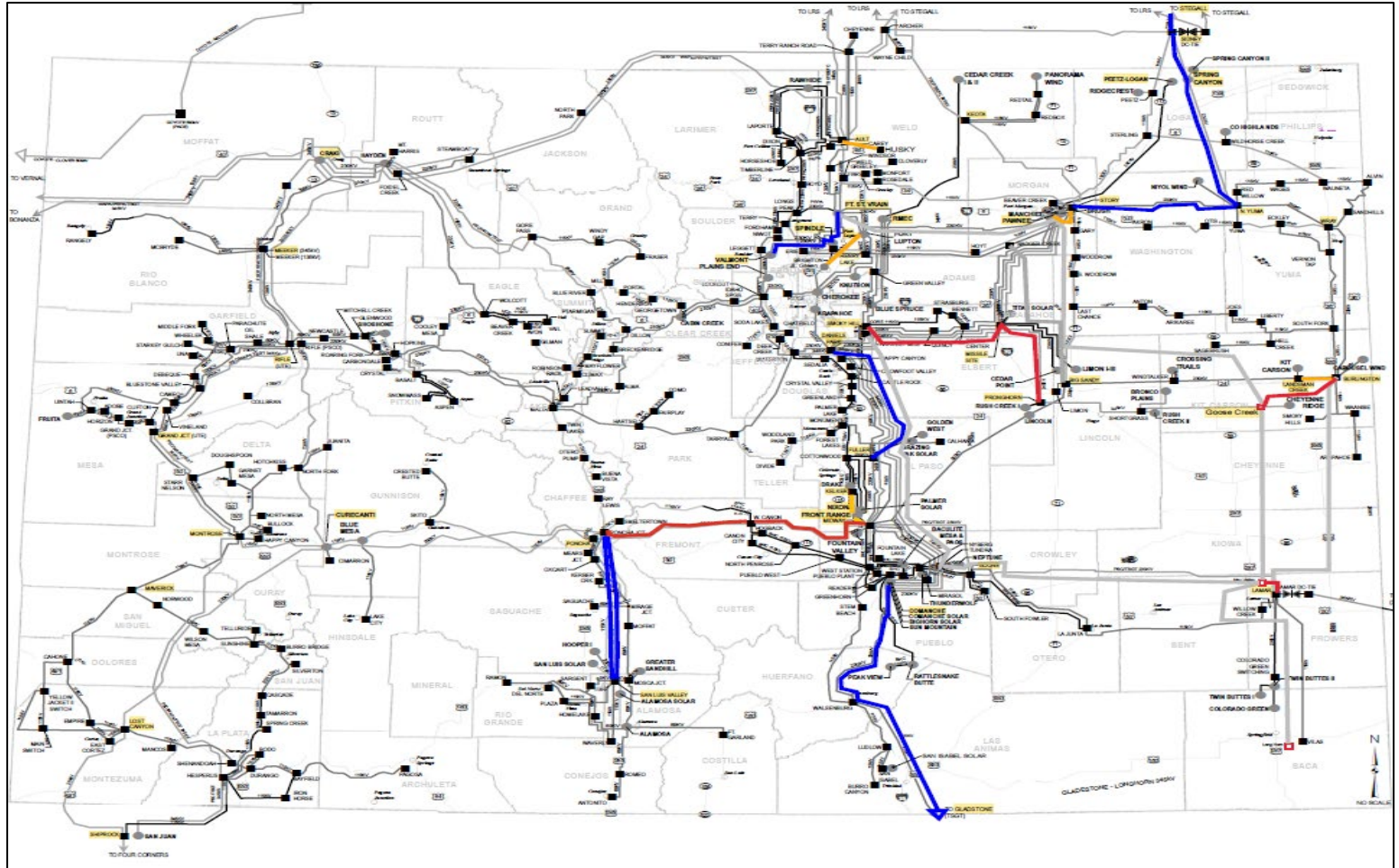
\$4,503

## Portfolio Line Miles

Greenfield	548
Rebuild	269
Reconductor	2883

## Build Categories

- █ New 230kV Lines
- █ New 345kV Lines
- █ █ █ Conceptual Projects
- █ Rebuild to Double Circuit



# Transmission Portfolios: Reference Case (+ Reconductoring)

- Reference Case portfolio meets the 20-year reliability, deliverability and economic needs of high-voltage system in Colorado

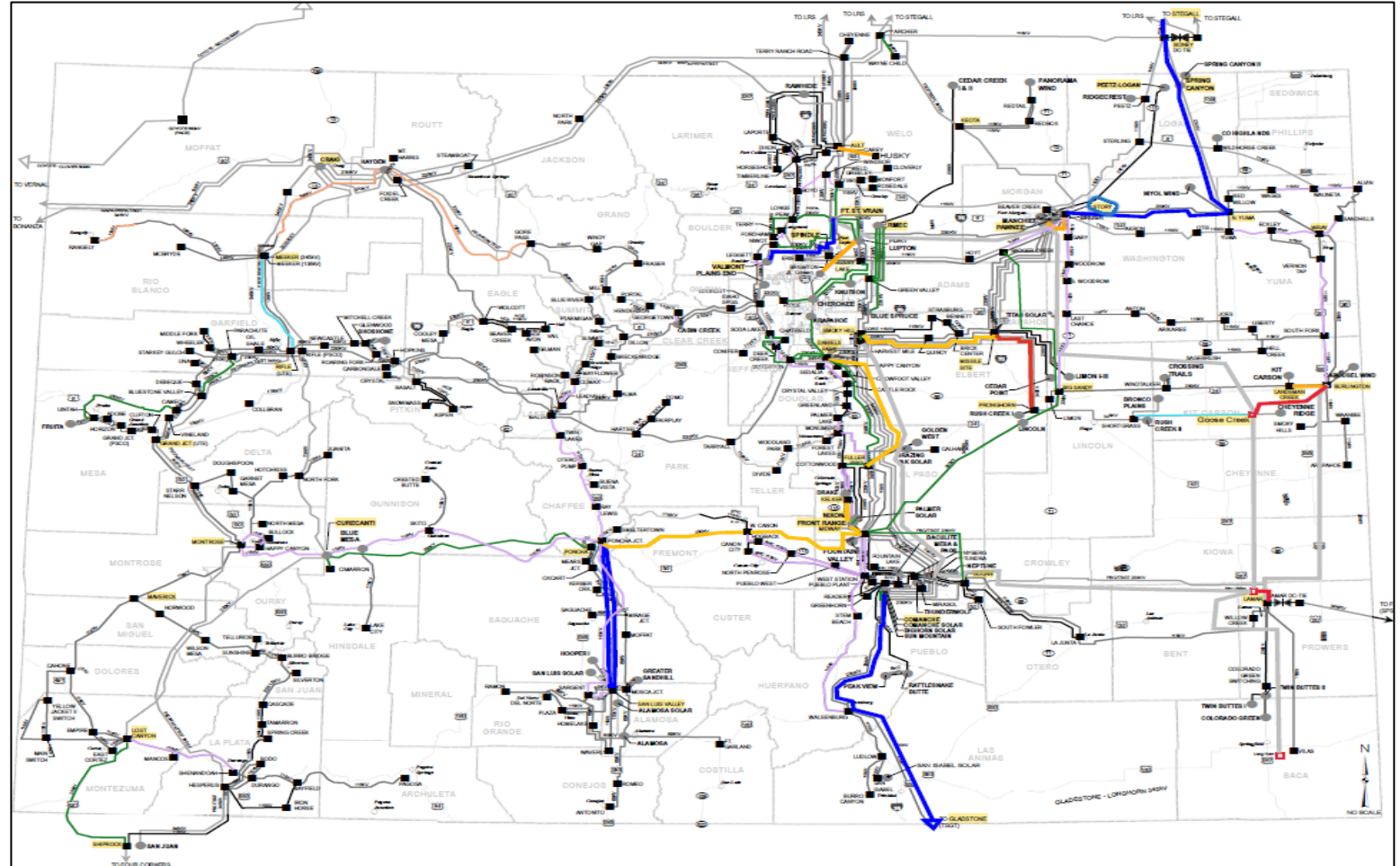
## Capital Investment (\$M)

\$4,503

## Portfolio Line Miles

Greenfield	548
Rebuild	269
Reconductor	2883

Build Categories	
	New 230kV Lines
	New 345kV Lines
	Conceptual Projects
	Rebuild to Double Circuit
	Reconductor 345kV
	Reconductor 230kV
	Reconductor 138kV
	Reconductor 115kV



# Transmission Portfolios: Reference Case List

	Project	Miles	Cost (\$M)
<b>New</b>	New Lamar – May Valley 345kV Line	5	\$37.49
<b>New</b>	New Missile Site – Pronghorn 345 kV	45	\$151.24
<b>New</b>	New Comanche/Huckleberry-Gladstone 230kV Line	163	\$619.89
<b>New</b>	New San Luis Valley – Poncha 230kV Line double-circuit	64	\$306.95
<b>New</b>	New Burlington - Goose Creek 345kV Line	36	\$169.44
<b>New</b>	New N. Yuma - Spring Canyon – Sidney – Stegal 230kV line	189	\$564.57
<b>New</b>	New N. Yuma - Story 230kV Line	46	\$106.98
	<b>SUB-TOTAL</b>	<b>548</b>	<b>\$1,956.56</b>

	Project	Miles	Cost (\$M)
<b>Rbld</b>	Rbld Kelker–RD Nix/Frnt Range–Midway 230kV to dbl-ckt	20	\$48.94
<b>Rbld</b>	Rebuild Burlington – Landsman Crk 230kV line to dbl circuit	5	\$23.01
<b>Rbld</b>	Rebuild Husky - Ault 230kV line to double circuit	6	\$21.11
<b>Rbld</b>	Rebuild Ft. Lupton – JL Green 230kV line to double circuit	20	\$66.07
<b>Rbld</b>	Rebuild Story to Pawnee 230kV line to double circuit	11	\$29.35
<b>Rbld</b>	Rebuild Ft. St. Vrain - Spindle - Valmont Line to double circuit	38	\$119.24
<b>Rbld</b>	Rebuild Poncha – Midway 345kV Line to double circuit	80	\$504.69
<b>Rbld</b>	New Daniels Park – Fuller 230kV Line to double circuit	46	\$207.32
<b>Rbld</b>	New Smoky Hill – Missile Site 345kV Line to double circuit	43	\$261.34
	<b>SUB-TOTAL</b>	<b>269</b>	<b>\$1,281.07</b>

- Includes \$60M of economic upgrades to address in-state congestion – the remaining upgrades are reliability & deliverability driven
- Costs sourced from MISO & Montara Optimal Routing:
  - Estimation incorporated specific terrain multipliers, including mountains, forests, wetlands, bodies of water, and fire risk,
- There may be alternative options for the newbuild and rebuild upgrades that provide similar performance and efficiency at lower cost

	Project	Miles	Cost (\$M)
<b>Rec</b>	345kV Transmission Lines	94	\$55.46
<b>Rec</b>	230kV Transmission Lines	1079.1	\$394.7
<b>Rec</b>	138kV Transmission Lines	111.4	\$41.21
<b>Rec</b>	115kV Transmission Lines	1145.8	\$425.17
<b>Tx</b>	Transformer Additions	N/A	\$163.21
	Metro Reconductors and TX	453.1	\$185.47
	<b>SUB-TOTAL</b>	<b>2883.4</b>	<b>\$1,265.22</b>
	<b>GRAND TOTAL</b>		<b>\$4,502.85</b>



# Transmission Portfolios: Conceptual Upgrades

- List of conceptual projects (not a portfolio) which are alternatives to Reference Case upgrades and/or may be needed for different resource deployment or interstate

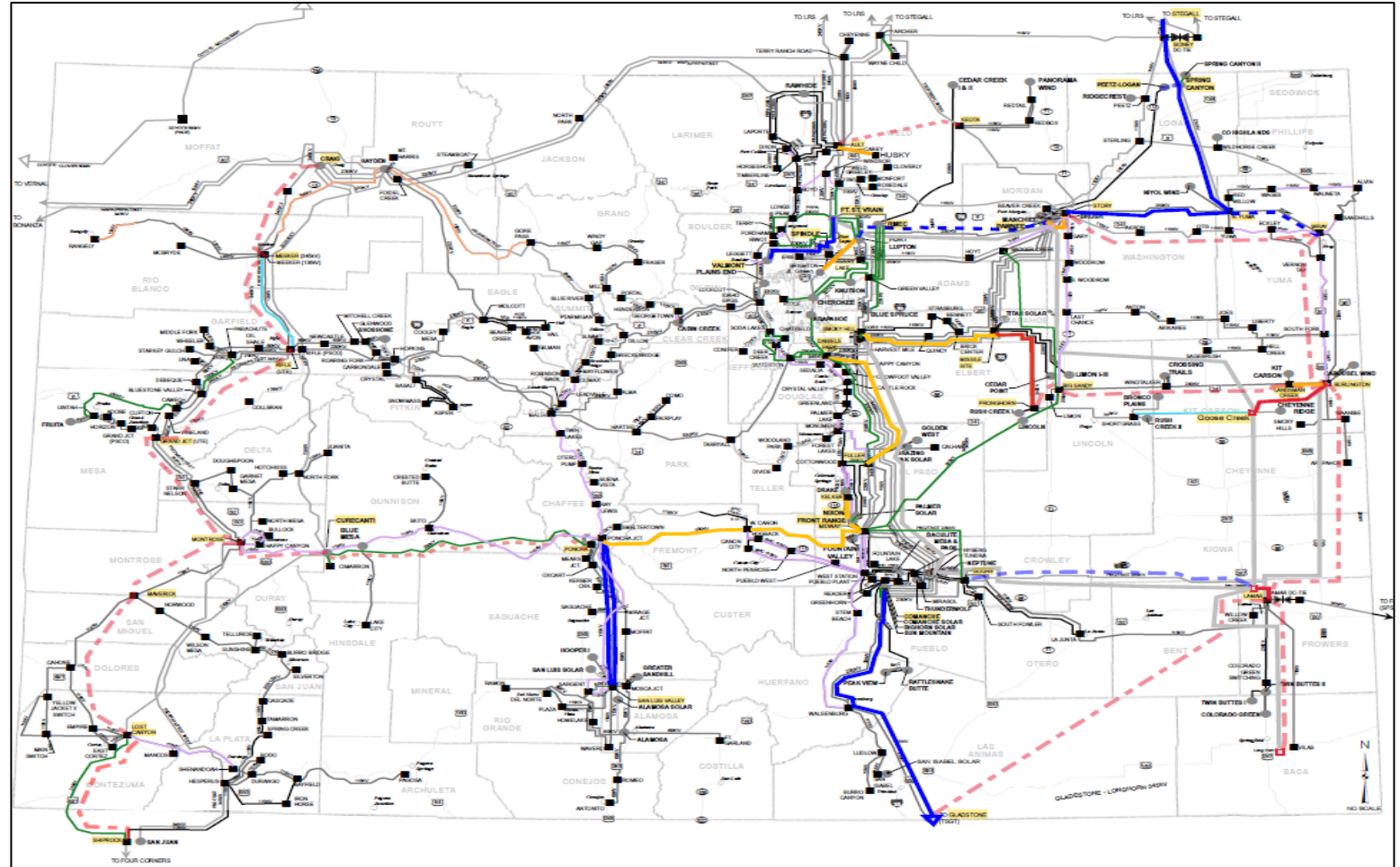
## Capital Investment (\$M)

\$4,757<sup>1</sup>

## Line Miles of Conceptual List

Greenfield

1155



**Build Categories**

	New 230kV Lines		Reconductor 345kV
	New 345kV Lines		Reconductor 230kV
	Conceptual Projects		Reconductor 138kV
	Rebuild to Double Circuit		Reconductor 115kV

(1) Total cost of conceptual upgrades represents sum of costs of these alternative projects and would not be implemented as a portfolio

# Transmission Portfolios: *Additional* Upgrades to Enhance Interstate Transfers

- Representative portfolio of solutions that increases interstate transfer capability
- Other comparable solutions exist
- Reference Case portfolio needed to enable these additions

## Capital Investment (\$M)

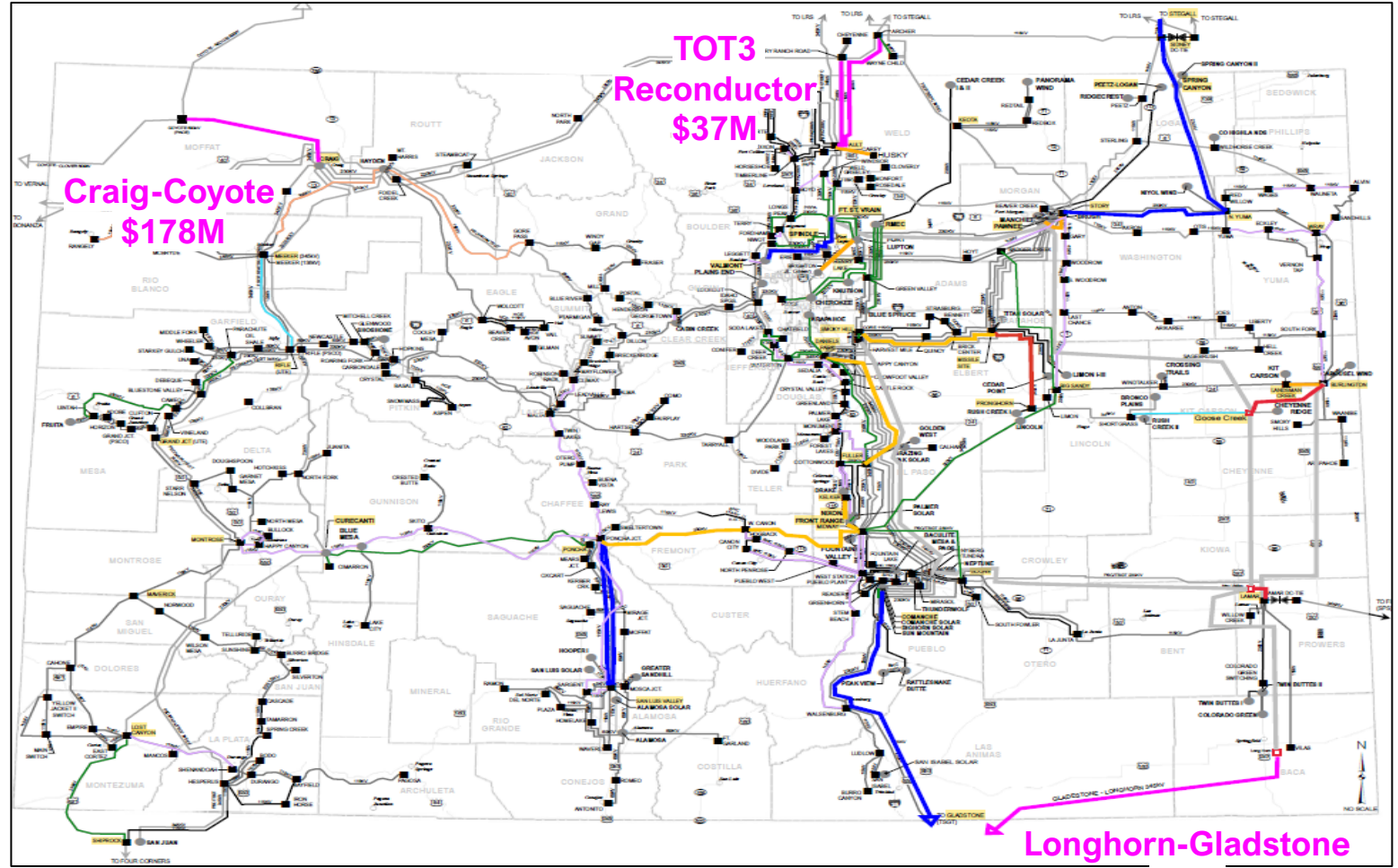
\$753 + Ref. Case

## Portfolio Line Miles

Greenfield	177
Rebuild	0
Reconductor	75

## Build Categories

- █ New 230kV Lines
- █ New 345kV Lines
- █ Conceptual Projects
- █ Rebuild to Double Circuit
- █ Interstate Projects
- █ Reconductor 345kV
- █ Reconductor 230kV
- █ Reconductor 138kV
- █ Reconductor 115kV



Longhorn-Gladstone \$538



# Transmission Portfolios: *Additional* Upgrades to Accommodate Regional Integration Scenario

- Portfolio captures additional 20-year upgrades needed to accommodate ~2 GW of wind from SPP near DC ties









## Capital Investment (\$M)

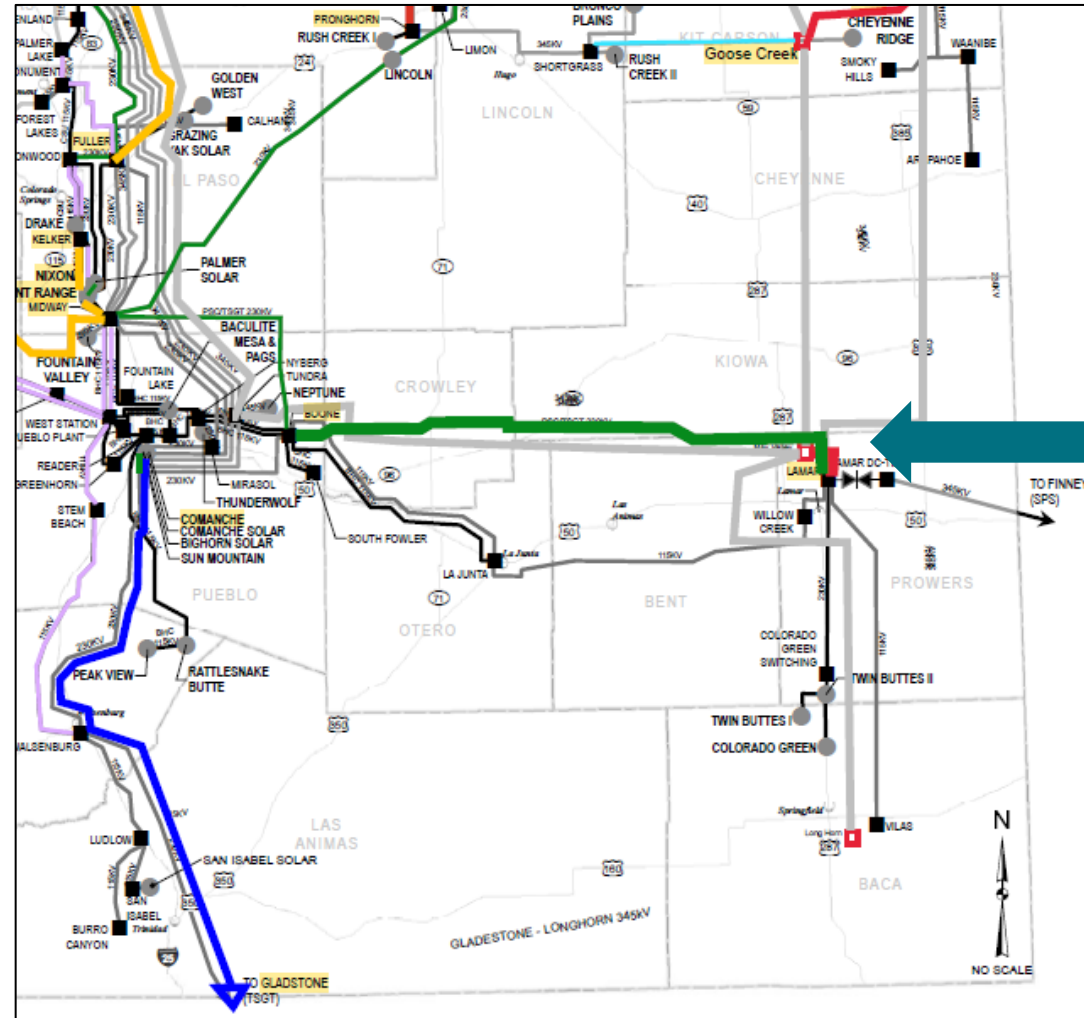
>\$951 + Ref. Case

## Portfolio Line Miles

Greenfield	5
Rebuild	0
Reconductor	98.9

## Build Categories

 New 230kV Lines	 Reconductor 345kV
 New 345kV Lines	 Reconductor 230kV
 Conceptual Projects	 Reconductor 138kV
 Rebuild to Double Circuit	 Reconductor 115kV



(1) Cost does not include DC station upgrade costs. Also, map does not show alternative transmission portfolio addition for accommodating wind at different DC ties, which were higher cost.