

Rush Creek Task Force (CCPG)

May 25, 2017

1. Introduction

- ❖ See Attendance list

2. Anti-trust Reminder

- ❖ Patrick reviewed the anti-trust guidelines with the group. The guidelines are attached to the meeting agenda.

3. Approve Meeting Notes

a. April 27, 2017 Meeting

- ❖ Patrick sent the draft notes on May 9, 2017
- ❖ One comment was made by Chris Neil and Patrick sent out updated draft notes on May 24, 2017.
- ❖ No further corrections were provided at this meeting.
- ❖ Motion was made and seconded to approve the notes.
 - Discussion: None
 - None
- ❖ Vote: no objections
 - April 27, 2017 meeting notes were approved.

4. Action Item Review

- ❖ Reviewed the action items from the April 27, 2017 meeting:

Item	Action	Status
1	Draft Benefits Language	Ongoing; noted that report will indicate that the primary benefits are the injection levels studied. Costs will be the capital costs of alternatives.
2	Update power flow results with new alternatives	Discuss Today
3	Transient stability analysis	Started. Working on model development.
4	Cost estimates	Started. PSCo Project Management has begun preparing estimates. Some costs may be available at the next meeting
5	Summarize results with narrative	Ongoing.

5. Review Updated Power Flow Study Results

a. Alt 5a

- ❖ Alternative 5 includes new transmission from RCI to Burlington and RCI to Big Sandy.
- ❖ Alt 5a expands Alt 5 by adding a Big Sandy – Story 345 kV line.
 - If N. Yuma – Red Willow 115 kV, Leetsdale – Monroe, and Leetsdale – Monaco 230 kV underground line limitations are resolved, the injection capability increases from 1150 to 2000 MW.
 - The limiting condition becomes the new RCI to Big Sandy 345 kV line rating.

b. Alt 5b

- ❖ Alt 5b is the same as 5a, except for a RCI to Daniels Park 345 kV line.
 - If N. Yuma – Red Willow 115 kV, Leetsdale – Monroe, and Leetsdale – Monaco 230 kV underground line limitations are resolved, the injection capability for Alt 5b increases from 1150 to 1550 MW.
 - The limiting element becomes the Daniels Park – Santa Fe 230 kV line.
 - Chris Neil asked about how the power flowed from Story in Alternatives 5a and 5b, believing the power from Rush Creek was sent all the way to Laramie River Station and back to Ault Substation. PSCO and Tri-State indicated some power may flow on the 230 kV line from Story to Henry Lake as well as the 230 kV line from Pawnee to Fort Lupton. PSCO will confirm the power flow.

c. Pawnee – Story 345 kV Sensitivity

- ❖ The benchmark with the Pawnee – Story 230 kV as the limiting condition was used for the study. The intent was to determine if the addition of a Pawnee – Story 345 kV line would result in adverse impacts to the Tri-State system east of Story.
- ❖ Results indicated that there were no adverse impacts to the Tri-State system.
- ❖ Updated power flow results are shown in Attachment A

6. Transient Stability Studies

- ❖ Patrick has started developing the models.
- ❖ Studies will focus on the benchmark case and some select alternatives to verify that the system is transiently stable.
- ❖ Results should be available by the next meeting.

7. Stakeholder Comments

- ❖ Chris Neil insisted the RCTF perform a study of new transmission between the Green Valley Substation and the Pawnee – Missile Site 345 kV lines. The purpose would be to try to improve injection capability at Rush Creek, Missile Site and Pawnee.
 - PSCO indicated that this was not an alternative to integrate the Rush Creek Gen-tie and was outside the scope of the RCTF. No other stakeholder indicated support for Chris Neil's suggestion, so that study will not be performed by RCTF.
- ❖ Chris Neil indicated that the RCTF should be evaluating improvements to the Denver-Metro Area system because of Denver-Metro Area limitations seen in many alternatives. Chris Neil said that these Denver-Metro Area upgrades should be considered if they can increase injection capability at low cost.
 - Chris Neil pointed to the Cherokee-Arvada-Russel-Ridge line that was recently converted from 115 kV to 230 kV cost of \$4.7 million. PSCO said that was not a valid comparison since the Cherokee – Ridge project was pre-built double-circuit, 230 kV capable. Many of the Denver-metro issues could not be resolved without more expensive mitigation, such as underground lines and rebuilding of overhead lines.
 - PSCO pointed out that the limitations in the Denver-Metro area are due in part to the heavy Rush Creek dispatch, and that the focus should be on higher level transmission issues, rather than local issues that result from high generation injection.
 - Mark Detsky indicated that the RCTF may not need cost estimates for all of the alternatives. Also felt that cost estimate methodology should be consistent with that used for the Rush Creek Gen-tie.
 - PSCO will begin compiling the cost information and RCTF can discuss what estimates to include at the next meeting.

8. Action Items

Item	Action	Resp
1	Draft Benefits Language	PSCo
2	Transient stability analysis	PSCo
3	Cost estimates	PSCo
4	Summarize results with narrative	PSCo
5	Review power flow in Alts 5a and 5b	PSCo

9. Next Meeting

❖ June 22, 2017; 1:00 PM

10. Attendees List

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11. Attachment A – Updated power flow results

Rush Creek Task Force

Alternative Analysis 5/25/2017

Power Flow Results - Heavy Summer 2026

Alternative	Alternative Description	Incremental Injection Capability (MW)	Total Injection Capability (MW)	Limiting Element	Owner	Limiting Rating	Limiting Contingency
Alt 0	Benchmark	550	1150	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
		850	1450	Pawnee-Story 230 kV	PSCo	576 MVA	Missile Site-Smoky Hill 345 kV
Alt 1	RCII - Burlington	100	700	Burlington-Bonny Creek 115 kV	TSGT	145 MVA	Missile Site-RCI 345 kV
		200	800	Burlington-Big Sandy 230 kV	TSGT	274 MVA	
		250	850	Wray-N Yuma 230 kV	TSGT	287 MVA	
Alt 2	RCI - Big Sandy	100	700	Big Sandy-Last Chance 115 kV	WAPA	109 MVA	Missile Site-RCI 345 kV
		250	850	Last Chance-Beaver Creek 115 kV	WAPA	109 MVA	
		250	850	Burlington-Big Sandy 230 kV	TSGT	274 MVA	
Alt 3	RCII - Limon gen	-250	350	Missile Site-Limon I 345 kV	Other	810 MVA	Missile Site-RCI 345 kV
Alt 4	Missile - RCI - RCII #2	550	1150	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
		850	1450	Pawnee-Story 230 kV	PSCo	576 MVA	Missile Site-Smoky Hill 345 kV
Alt 5	RCII - Burlington, RCI-Big	350	950	Big Sandy-Last Chance 115 kV	WAPA	109 MVA	Missile Site-RCI

	Sandy	500	1100	Burlington-Bonny Creek 115 kV	TSGT	145 MVA	345 kV
		550	1150	Lincoln-Midway 230 kV	TSGT	637 MVA	
Alt 5a	RCII - Burlington, RCI-Big Sandy-Story	600	1200	N Yuma-Red Willow 115 kV	TSGT	79 MVA	Wray-Sandhill 115 kV
		900	1500	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
		1400	2000	RCI-Big Sandy 345 kV	PSCo	1637 MVA	Missile Site-RCI 345 kV
Alt 5b	RCII - Burlington, RCI-Big Sandy-Story, RCI-Daniels Park	650	1250	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
		800	1400	N Yuma-Red Willow 115 kV	TSGT	79 MVA	Wray-Sandhill 115 kV
		950	1550	Daniels Park-Santa Fe 230 kV	PSCo	319 MVA	Greenwood-Monaco 230 kV
Alt 6	RCII - Burlington, RCI-Limon gen	-100	500	Missile Site-Limon I 345 kV	Other	810 MVA	Missile Site-RCI 345 kV
Alt 7	RCII - Burlington, RCII-Limon gen	-100	500	Missile Site-Limon I 345 kV	Other	810 MVA	Missile Site-RCI 345 kV
Alt 8	RCI - Daniels Park, RCII-Burlington	550	1150	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
		750	1350	N Yuma-Red Willow 115 kV	TSGT	79 MVA	Wray-Sandhill 115 kV
		800	1400	Daniels Park-Santa Fe 230 kV	PSCo	319 MVA	Greenwood-Monaco 230 kV
Alt 9	RCI - Daniels Park, RCI-RCII	550	1150	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
		750	1350	Daniels Park-Santa Fe 230 kV	PSCo	319 MVA	Greenwood-Monaco 230 kV
Alt 9a	RCI - Daniels Park, RCI-RCII, Waterton Loop	600	1200	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
		850	1450	Daniels Park-Santa Fe 230 kV	PSCo	319 MVA	Greenwood-Monaco 230 kV

Power Flow Results - Light Spring 2026

Alternative	Alternative Description	Incremental Injection Capability (MW)	Total Injection Capability (MW)	Limiting Element	Owner	Limiting Rating	Limiting Contingency
Alt 0	Benchmark	250	850	Pawnee-Story 230 kV	PSCo	576 MVA	Missile Site-Smoky Hill 345 kV
		750	1350	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
		750	1350	Pawnee-Story 230 kV	PSCo	576 MVA	Pawnee-Story 345 kV
Alt 1	RCII - Burlington	150	750	Burlington-Bonny Creek 115 kV	TSGT	145 MVA	Missile Site-RCI 345 kV
		200	800	Burlington-Big Sandy 230 kV	TSGT	274 MVA	
		200	800	Bonny Creek-South Fork 115 kV	TSGT	147 MVA	
Alt 2	RCI - Big Sandy	100	700	Big Sandy-Last Chance 115 kV	WAPA	109 MVA	Missile Site-RCI 345 kV
		150	750	Last Chance-Beaver Creek 115 kV	WAPA	109 MVA	
		300	900	Burlington-Big Sandy 230 kV	TSGT	274 MVA	
Alt 3	RCII - Limon gen	-250	350	Missile Site-Limon I 345 kV	Other	810 MVA	Missile Site-RCI 345 kV
Alt 4	Missile - RCI - RCII #2	250	850	Pawnee-Story	PSCo	576 MVA	Missile Site-Smoky Hill 345 kV
		750	1350	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
Alt 5	RCII - Burlington, RCI-Big Sandy	250	850	Last Chance-Beaver Creek 115 kV	WAPA	109 MVA	Missile Site-RCI 345 kV
		300	900	Big Sandy-Last Chance 115 kV	WAPA	109 MVA	
		550	1150	Lincoln-Midway 230 kV	TSGT	637 MVA	
Alt 5a	RCII - Burlington, RCI-Big Sandy-Story	1050	1650	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
		1400	2000	Elati-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
Alt 5b	RCII - Burlington, RCI-Big	850	1450	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-

	Sandy-Story, RCI-Daniels Park						Arapahoe 230 kV
		1000	1600	Elati-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
Alt 6	RCII - Burlington, RCI-Limon gen	-100	500	Missile Site-Limon I 345 kV	Other	810 MVA	Missile Site-RCI 345 kV
Alt 7	RCII - Burlington, RCII-Limon gen	-100	500	Missile Site-Limon I 345 kV	Other	810 MVA	Missile Site-RCI 345 kV
Alt 8	RCI - Daniels Park, RCII-Burlington	650	1250	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
		850	1450	Pawnee-Story 230 kV	PSCo	576 MVA	Missile Site-Smoky Hill 345 kV
Alt 9	RCI - Daniels Park, RCI-RCII	600	1200	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV
		600	1200	Pawnee-Story 230 kV	PSCo	576 MVA	Missile Site-Smoky Hill 345 kV
Alt 9a	RCI - Daniels Park, RCI-RCII, Waterton Loop	650	1250	Pawnee-Story 230 kV	PSCo	576 MVA	Missile Site-Smoky Hill 345 kV
		700	1300	Leetsdale-Monroe 230 kV UG	PSCo	398 MVA	Daniels Park-Arapahoe 230 kV