

Cascade Natural Gas Integrated Resource Planning Feedback Report

Item #	Date	TAG Meeting	Name/Company	Comment/Question	Cascade Response
1	4/4/2022	TAG 1	WUTC	Will Cascade consider more frequent breaks throughout the TAG meetings?	Cascade would be open to ideas on how often the Company should break during TAG meetings. Cascade suggests we shouldn't break more often than once per hour, with a 5-minute maximum for each break, unless we need a longer lunch break.
2	4/4/2022	TAG 1	WUTC	Will Cascade consider adding in at least 15-minutes of unscheduled time during meetings, perhaps at the end, for the sole purpose of encouraging questions?	Cascade intended for the penultimate TAG 1 slide to be that unscheduled time as you indicated. Key Cascade members will remain in the meeting as long as needed to respond to questions.
3	4/4/2022	TAG 1	WUTC	During the virtual presentation, is hand raising encouraged or unmuting? Any guidance in future meetings on how to participate would be beneficial for stakeholders. Perhaps laying this groundwork at the beginning of TAG meetings would be useful.	Cascade's meetings are very informal so either unmuting or raising your hand, or even typing questions into chat is fine with Cascade. Cascade will clarify this in future TAG meetings as well as include this information in the Stakeholder Engagement Design Document.
4	4/4/2022	TAG 1	WUTC	Does Cascade plan on sending out minutes/summaries of each meeting? Staff's hope is that such summaries would include any comments or questions from TAG members and Cascade's initial response to those items, in addition to including such as an appendix in the final IRP.	Yes, Cascade will provide minutes that include questions, stakeholder comments, and Cascade's responses.
5	4/4/2022	TAG 1	WUTC	On slide 17, Cascade staff noted natural gas volatility of 179.1%. Staff is not familiar with volatility as a metric. It would be helpful to have a bit more explanation of what it is, how it is measured, and what it signifies. Could this volatility result in supply risk/interruption, rather than simply pricing risks? What do volatility projections look like for the future? Does this spike in volatility have greater meaning to Cascade beyond hedging and prices?	<p>Volatility is a statistical measure of the magnitude of changes for a particular value, regardless of direction. Volatility is often measured with terms such as variance or standard deviation. A low variance/standard deviation would mean low volatility.</p> <p>The EIA defines their measure of volatility as the magnitude of daily changes in the closing price for natural gas in a 30-day window, based on rolling front-month contracts. For example, the EIA would measure what future contracts are for February 2022 each day in January 2022. A high volatility might show low February priced contracts earlier in January, but as time goes on, the market begins showing very high February contracts, resulting in a high volatility measure. This could be due to a number of market conditions, supply issues, production issues, unexpected weather; even related to pricing hubs in Europe and Asia where Henry Hub price volatility has historically corresponded.</p> <p>Volatility is key metric in Cascade's Value at Risk analysis. A high volatility environment presents high risk to the both the hedged and unhedged portion of the Company's portfolio. Short term, the Company is projecting that high volatility will continue into the upcoming heating season, as there is still great uncertainty surrounding the variables discussed above. Long-term, however, Cascade does expect the market to stabilize, leading to lower volatility in the outer years of Cascade's hedging horizon and beyond. Cascade does not see any significant relationship between volatility and supply/interruption risk.</p>
6	4/4/2022	TAG 1	WUTC	Since the UTC has new staff assigned to this IRP, it would be helpful to staff to schedule a walkthrough of the load forecast, avoided cost methodology, upstream emissions methodology, stochastic analysis, and resource integration. Additionally, if Cascade does indeed intend to use Plexos rather than SENDOUT as its resource integration software for this IRP, it will be helpful to schedule a demonstration of the software and how Cascade uses it.	Cascade's next four TAG meetings are intended to dig into these models and much of the TAG meetings will be a walkthrough of these models. Cascade's recommendation would be that after each TAG meeting, if there is still a request for a walkthrough, Cascade would gladly set up a meeting to further dive into a model/methodology.
7	4/4/2022	TAG 1	WUTC	UTC staff commend Cascade for starting a conversation around stakeholder engagement and their demonstrated openness to amendments to the IRP stakeholder engagement document.	We appreciate this comment. Cascade is committed to implementing best practices for stakeholder engagement while recognizing stakeholders have a full workload.

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8	4/4/2022	TAG 1	WUTC	During the meeting Cascade Staff noted previous engagement strategies (e.g. Facebook posts regarding the Bend TAG and consideration of a mailer), for the sake of clarity, would it be possible to have anticipated outreach strategies outlined in the IRP stakeholder engagement document during a future update? Clearly outlining Cascades outreach plans/efforts may make it easier to have future discussions about improving outreach strategies. For example, "Cascade staff plans to publish TAG meeting notices on their Twitter account 2 weeks prior to each meeting" – this example would clearly communicate one step Cascade plans to take.	Cascade appreciates this comment and perspective. The Company understands the importance of stakeholder engagement and wants to ensure customers and interested parties know how and when to participate in Cascade's IRP efforts. Cascade will include on the TAG 2 meeting agenda a discussion of Cascade's engagement strategies. The Company looks forward to this discussion.
9	4/6/2022	TAG 1	OPUC	OPUC checked in on the plan to not hold separate DSM-related workshops noted in Order 21-127 and in Slide 14 of Cascade's TAG presentation and just addressing through the TAG meetings. OPUC is fine with that plan as long as the Company will be addressing all the issues that were raised in the Order on that topic.	Cascade agrees with this and is amenable to any follow up workshops if those topics are not discussed in detail to OPUCs satisfaction during Cascade's TAG meetings.
10	5/26/2022	TAG 2	WUTC	Has Cascade considered using the RCP8.5 emissions pathway for its climate modeling? This is the modeling pathway used by the Northwest Power and Conservation Council in their 2021 Northwest Power Plan. Avista has chosen to follow suit and also uses the RCP8.5 pathway.	Yes, Cascade considered RCP2.6, RCP4.5, RCP6.0, and RCP8.5. RCP 8.5 is the most extreme scenario and described as "to be very unlikely, but still possible as feedbacks are not well understood." Cascade also believes taking a more conservative approach to ensure the Company doesn't underplan other decarbonization strategies is the best approach. In the two- to four-year action plan, Cascade will continue to research and gain a better understanding on the potential impacts of climate change.
11	5/26/2022	TAG 2	WUTC	Staff recommends that Cascade update their Consumer Forecast in light of the recent changes by the State Building Code Council.	Due to recent changes to the State Building Code, Cascade will be making changes to the load forecast models. However, given the timing of the changes, Cascade will not be able to make this change for this IRP. Revamping the load forecast model to account for end use changes will be a 6 month to year long project, which falls outside of the IRP Planning timeline. Cascade will include this in the two- to four-year action plan.
12	5/26/2022	TAG 2	WUTC	Staff would like to commend Cascade for their responsiveness to previous comments. Cascade outlining their strategies for outreach provided more clarity regarding their outreach process. Cascade made it clear how participants could interact during the TAG; this improved the accessibility of the meeting.	Cascade appreciates this comment and perspective. The Company understands the importance of stakeholder engagement and wants to ensure those attending our meetings have the ability to interject and ask questions or make comments.
13	5/26/2022	TAG 2	WUTC	Why doesn't the pricing forecast include cap and trade, renewable natural gas, green hydrogen, the social cost of carbon or other environmental risks?	The price forecast presented in TAG 2 is intended to be the Company's projected forecast for the price of geologic natural gas. Cascade does believe that exogenous factors as listed by Staff are incorporated into the various basin forecasts that the Company references as appropriate regarding their potential impact to regional traditional natural gas processes. This forecast is ultimately one input, of many, to the Company's processes that utilize the price forecast. In Cascade's resource optimization process, the Company models the costs and availability of geologic natural gas, renewable natural gas, green hydrogen, and offset credits (typically priced as a function of the Social Cost of Carbon). The resulting projected cost of gas is an optimized blend of all of these factors. Cascade will present the price of RNG, green hydrogen, and offset credits in future TAG meetings.
14	5/26/2022	TAG 2	WUTC	On slide 4, of the TAG 2 presentation, it states "The Company believes that customers and interested parties were made aware of Cascade's IRP meetings" – what is this belief based on?	Cascade has a designated web page that informs customers and interested parties of the IRP process and how to participate. Cascade also reached out via email to dockets where the Company felt those intervenors would be interested in Cascade's IRP. With that said, Cascade does have a plan to continue and better bolster our communication for future IRP processes.

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15	7/13/2022	TAG 3	WUTC	1. On slide 19, the Winter Supply Stack graph features two datasets in the same color. Would it be possible to get new draft of that graph with each element in a different color?	Cascade has updated this slide, along with an updated slide 9 due to coloring issues, in the TAG 3 presentation that is on Cascade's Washington IRP website.
16	7/13/2022	TAG 3	WUTC	On slides 82-101, Cascade discusses new methodology for determining Avoided Costs. This analysis, in part, focuses on Distribution System Costs. a. For slides 87-95, what is the net outcome of these changes on avoided costs? b. As shown in slides 87-95, does this result in a kind of double counting of what is already considered in avoided costs? Does the "time value of money" apply to most components of Cascade's avoided cost calculation such as Commodity Costs, Variable Storage Costs, or even Fixed Transportation Costs?? c. For slides 93 and 94, what are Cascade's assumptions of the "time value of money"? How does it plan to value the delay shown in the charts? d. Slides 93 and 94 suggest that it is a sort of timed cost savings between present real costs and lower presumed future real costs for upgrades as opposed to traditional "time value of money" that relies upon a default ROI assumption. Is this a correct interpretation?	a. In appendix A at the bottom of the feedback report Figure 1 and 2 show distribution costs for the 2023 IRP as well as the avoided distribution system costs in the filed 2020 WA IRP. b. It is important here to recognize that distribution system costs are a unique element of the avoided cost mix because they represent a variable that is not avoidable, but rather deferrable. For an element such as commodity cost, for instance, for every therm that is not consumed by an end use customer but instead is conserved, that is one therm that Cascade will never need to purchase. Regarding distribution system costs, however, assuming that the Company is continuing to grow, reducing demand peak load does not remove the need for a distribution system enhancement, but rather delays when the forecasted point of deficit will occur (see slide 91 for a visual example.) One exception to this could be fixed transportation costs, where energy efficiency may not be able to remove the need for incremental upstream capacity but rather defer it to a later year, but Cascade has not identified a need for any incremental upstream capacity and thus has no avoidable fixed transportation costs in the 2023 IRP. c. It is important to note that slides 93 and 94 are illustrative examples and not representative of actual numbers. The assumption of the time value of money is the standard valuation formula, where $PV = FV / (1+i)^t$ where i = Cascade's weighted average cost of capital (WACC) and t = number of years. In slide 93, the assumption is that costs rise by inflation over time. In slide 94, ceteris paribus, Cascade's WACC exceeds inflation, leading to lower future valuations over time. d. Slides 93 and 94 suggest that it is a sort of timed cost savings between present real costs and lower presumed future real costs for upgrades as opposed to traditional "time value of money" that relies upon a default ROI assumption. Is this a correct interpretation? – As discussed in Cascade's answer to 2c. the cost savings shown between slides 93 and 94 are a function of default ROI assumptions. Any money that does not need to be immediately spent on distribution system projects should generate an ROI for the Company equal to its WACC. That fundamental principle supports the calculation of the Present Value of Deferral illustrated on slide 95.
17	7/13/2022	TAG 3	WUTC	For slides 85 and 86, what is the difference between the previous "carbon compliance costs" from the 2020 IRP and the new "Environmental Compliance Costs"?	This value is, for the most part, relatively unchanged. The name has been updated to reflect the fact that these compliance costs do not just reflect carbon but all emissions under the banner of CO2e. The SCC was also updated to be expressed in Real \$2021. A comparison of the values can be found with Figure 3 and 4 in appendix A.
18	8/17/2022	TAG 4	WUTC	On slide 8, does this graph include Cascade's methane emissions discussed in slide 10?	No. The emissions on this graph are emissions from natural gas combustion from customer use.
19	8/17/2022	TAG 4	WUTC	The bar graph on slide 8 is very useful. It does a good job communicating the scope of baseline emissions growth. Staff would like to request a similar graphic showing Cascade's combined portfolio of fuels and CCA compliance options over time to meet that demand while complying with its various legal and regulatory requirements?	Cascade will be providing graphics with this information at TAG 5.

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20	8/17/2022	TAG 4	WUTC	On slide 27, Cascade notes that their gas is 93.4% methane. What is the other 6.6%?	<p>Natural gas is composed mostly of methane and small amounts of other constituents. Literature¹ provides a typical composition in the table displayed below.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="3" style="text-align: center;">Typical Composition of Natural Gas</th> </tr> <tr> <th style="text-align: left;">Name</th> <th style="text-align: left;">Formula</th> <th style="text-align: left;">Volume (%)</th> </tr> </thead> <tbody> <tr> <td>Methane</td> <td>CH₄</td> <td>>85</td> </tr> <tr> <td>Ethane</td> <td>C₂H₆</td> <td>3-8</td> </tr> <tr> <td>Propane</td> <td>C₃H₈</td> <td>1-2</td> </tr> <tr> <td>Butane</td> <td>C₄H₁₀</td> <td><1</td> </tr> <tr> <td>Pentane</td> <td>C₅H₁₂</td> <td><1</td> </tr> <tr> <td>Carbon dioxide</td> <td>CO₂</td> <td>1-2</td> </tr> <tr> <td>Hydrogen sulfide</td> <td>H₂S</td> <td><1</td> </tr> <tr> <td>Nitrogen</td> <td>N₂</td> <td>1-5</td> </tr> <tr> <td>Helium</td> <td>He</td> <td><0.5</td> </tr> </tbody> </table> <p>The US Energy Information Administration (EIA) notes on their webpage on Natural gas explained², "The largest component of natural gas is methane, a compound with one carbon atom and four hydrogen atoms (CH₄). Natural gas also contains smaller amounts of natural gas liquids (NGLs, which are also hydrocarbon gas liquids), and nonhydrocarbon gases, such as carbon dioxide and water vapor." Cascade notes there is some variability in gas quality on pipelines and between pipelines, but gas quality typically falls in the ranges indicated above.</p>	Typical Composition of Natural Gas			Name	Formula	Volume (%)	Methane	CH ₄	>85	Ethane	C ₂ H ₆	3-8	Propane	C ₃ H ₈	1-2	Butane	C ₄ H ₁₀	<1	Pentane	C ₅ H ₁₂	<1	Carbon dioxide	CO ₂	1-2	Hydrogen sulfide	H ₂ S	<1	Nitrogen	N ₂	1-5	Helium	He	<0.5
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Nitrogen	N ₂	1-5																																				
Helium	He	<0.5																																				
21	8/17/2022	TAG 4	WUTC	On slide 27, Cascade notes that their gas is 93.4% methane. Does the End of Use Emission rate include the combustion of these non-methane gasses in Cascade's natural gas?	The End of Use Emission rate used is published in EPA rulemaking. Cascade is confirming with EPA that this emission rate includes combustion of the non-methane gasses and will provide an update when we receive EPA's feedback.																																	
22	8/17/2022	TAG 4	WUTC	On slide 28, Cascade notes "The 93.4% methane in natural gas is in line with EPA estimates of 95-98% and therefore, can be maintained." What percent would be out of line with EPA estimates? What is the basis for this in vs out of line assessment?	Cascade determined to maintain the previous IRP's assumption of 93.4% methane in natural gas for this IRP. This value represents an average percentage of methane in natural gas from past EPA GHG inventory data. In comparison, there are several sources listing the methane composition of commercial natural gas: Yale Climate Communication lists the range as 70-90%, Britannica lists it at 85-90%, and the EPA Pipeline Quality Estimate lists 95-98%. Cascade believes the 93.4% is in line with the EPA estimates of 95-98%. Cascade also recently reviewed methane content data available from GTN/Williams at citygates representing natural gas delivered from the US Rockies and confirmed natural gas received is about 93.7% methane.																																	
23	8/17/2022	TAG 4	WUTC	On slide 10, staff would appreciate data presented on "other operational emissions". Have the number of these other operational emissions changed over time?	<p>Emissions estimated from distribution mains and services, meter/regulating station equipment, and larger combustion equipment, such as compressor engines, total approximately 24,000 to 25,000 metric tons of CO₂e per year. These emissions have been quantified since 2010 and have remained about the same over time as default emissions factors are required to quantify most of the emissions.</p> <p>Emissions which include excavation damage, natural force damage and other outside force damage, corrosion, and equipment/weld issues were approximately 6,154 metric tons of CO₂e in 2021 and were similar in 2020. These emissions could have a greater potential for annual variability due to the types of causes. Cascade has been collecting and reporting this data to the UTC for a couple years and the Company will use this data for evaluating emissions trends ongoing.</p> <p>Other operational emissions (blowdowns, pressure relief/venting and routine maintenance, meters, and smaller combustion equipment) are being added to Cascade's inventory this year and are preliminarily estimated to be about 10,000 to 15,000 metric tons of CO₂e. Cascade is exploring the use of company specific data to more accurately estimate these emissions. The Company's approach to quantifying these emissions may also change in future with EPA's proposed emission factor changes in the agency's 40 CFR Part 98 Subpart W rule amendments.</p> <p>Cascade is committed to reducing operational emissions. As a comparison, when considering customer emissions of approximately 2 million metric tons CO₂e, Cascade's total operational emissions are a very small percentage. Total operational emissions are currently projected to be in the range of 1-2% of total Cascade emissions regulated under the WA Climate Commitment Act.</p>																																	

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24	8/17/2022	TAG 4	WUTC	On slide 11, Cascade discussed their active efforts to track and decrease operational emissions. Does Cascade have data reporting these efforts?	Data demonstrating reductions is limited at this time. However, UTC does receive leak mitigation data reports from Cascade annually in March. Also, internal data tracked by the Company's operations shows few open leaks on the system and those are scheduled for repair according to Cascade's expedited leak management program. Expediting leak mitigation on the system shows that the Company's efforts have reduced leak emissions since implementing the program. Also, a more robust emissions inventory will be available in 2023 for 2022 emissions. Cascade plans to use this comprehensive emissions inventory to evaluate emissions and trends, identify additional emissions reduction opportunities, and better quantify emissions reductions.
25	8/17/2022	TAG 4	WUTC	On slide 21, Cascade assessed "The result was approximately 50 customers per year. Cascade decremented customer counts by 50, cumulatively, each year for the forecast." Does this mean that total customers from this city is anticipated to decrease by 50 customers per year or that, relative to the anticipated trend in customers, future values are 50 customers per year smaller? Are these losses entirely residential customers or are they randomly distributed among commercial, residential, and industrial customers?	This means that relative to the anticipated forecast in customers, future values are smaller. Cascade applied this cumulatively, so a 50 customer decrement to the forecast in the first year, 100 customers the second year, and so on and so forth through the 28-year planning horizon. Cascade believes this gas ban will have a bigger impact to the commercial customers than the residential and industrial customers so the decrement was applied to the commercial customers. Cascade will be monitoring the actual effects of this ban and will reassess this analysis in future IRPs.
26	8/17/2022	TAG 4	WUTC	On slides 21 through 24, Cascade discusses the impacts of various local natural gas policies. However, the April 2022 revision of the Washington State Building Code was not discussed. What impacts will that revision have?	Cascade discussed the Washington State Building Code changes during TAG 2. Cascade indicated at that meeting that due to the timing of the building code votes, and the fact that Cascade does not do end use forecasting, implementing these changes would require Cascade to delay the IRP six months to a year to change the load demand forecast methodology. Cascade will be monitoring the effects of these building code changes as well as adjusting the load forecast methodology to account for these building code changes with end use forecasting in future IRPs.
27	10/26/2022	TAG 5	WUTC	On slide 27, the slide notes the amount of incremental RNG. Are these levels consistent with anticipated requirements of RCW 80.28.390?	The RNG amounts on slide 27 include the amounts needed for Washington and Oregon. RCW 80.28.390 only requires gas utilities to offer RNG as an offset to traditional gas. There are no statutory amount Cascade needs to require or supply under the voluntary program. Once the voluntary RNG program, Cascade will be able to monitor the amount of interest and enabling the Company to update the models with accurate voluntary RNG information.
28	10/26/2022	TAG 5	WUTC	On slide 28, the graph shows that emissions costs will result in total costs more than quadrupling. How much is this expected to impact ratepayer bills? How will these bill impacts shift demand?	Cascade is currently analyzing the ratepayer bill impacts and will provide that information in the draft filing of the IRP narrative.
29	10/26/2022	TAG 5	WUTC	On slide 79, Cascade describes the attributes of scenario 5. What impact does limiting Hydrogen to 20% have on the portfolio?	If Cascade were to constrict the model to only hydrogen to comprise 20% of supply by volume, the Company would need to acquire additional allowances through the auction mechanism. The Company still projects that it would be able to comply with emissions reduction requirements through this, but costs would increase, particularly in later years as the cost of hydrogen is forecasted to decline over time while the cost of allowances will rise. Cascade has modeled this, and in Figure 5 shows that total system costs rise when only allowing a 20% hydrogen blend.
30	10/26/2022	TAG 5	WUTC	On slide 65, there is a chart with a row labeled "Natural gas bans" with some columns filled "current bans." However, later slides, such as 70, refer to this scenario assumption as "Consideration of all expected bans in load forecast." Are these the same assumption?	Yes, those are the same assumption. Cascade will clarify that language in the IRP Narrative.

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31	10/26/2022	TAG 5	WUTC	On slide 65, there is a chart with a row labeled "Natural gas bans" with the electrification column filled "Additional Bans." However, the electrification scenario on slide 75 refers to this assumption as "Consideration of all expected and proposed bans in load forecast." Are these the same assumption?	Yes, those are the same assumption. Cascade will clarify that language in the IRP Narrative.
32	11/3/2022	Additional Q's	WUTC	On slide 101 of TAG 4, Cascade lists "Enhancement Selection Guidelines", the 3rd line notes "Segment of pipe that minimizes environmental concerns and impacts to the community" Could Cascade please expand on this?	Every system deficit will have a unique enhancement to address the deficit.
33	11/3/2022	Additional Q's	WUTC	What environmental concerns are analyzed?	Environmental concerns will depend on the enhancement considered. An example of environmental concerns would be minimizing water crossing. Pipeline routes could be modified to avoid stream, river crossing or wetlands.
34	11/3/2022	Additional Q's	WUTC	What types of community impacts does Cascade assess?	Community impacts will depend on the enhancement considered. An example of a community impact would be modifying pipeline routes to avoid road moratoriums (roads that have recently been improved) or high consequence areas.
35	11/3/2022	Additional Q's	WUTC	Does this include an equity assessment of the impacts?	Equity assessments are not currently directly involved in enhancement selection but could be a future consideration.
36	11/3/2022	Additional Q's	WUTC	What type(s) of methodology and data does Cascade use here?	Not currently being considered.
37	11/3/2022	Additional Q's	WUTC	How are these criteria weighted against the other listed points?	Not currently being considered.

Figure 1: Draft 2023 Avoided Distribution System Costs

\$/dth	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2023	0.91321002	3.12080498	2.05795516	2.01678461	2.01678461	1.81227098	1.91356241
2024	0.00000000	2.71203016	1.87062160	6.17641314	6.17641314	2.69564406	4.41959799
2025	0.93970316	2.08661663	1.12964956	1.40916221	1.40916221	1.27706815	1.34249164
2026	1.22866014	2.98390713	1.68604792	1.96593125	1.96593125	1.81934573	1.89194655
2027	1.01349731	1.86768539	0.93345949	1.36296144	1.36296144	1.14668822	1.25380393
2028	0.90999050	1.39810979	0.72419499	0.98422414	0.98422414	0.91079405	0.94716247
2029	0.62831183	1.33064563	0.61367536	0.8813022	0.8813022	0.75568008	0.81789815
2030	0.00000000	1.39641684	0.52416385	1.00885332	1.00885332	0.89291870	0.95033876
2031	1.04367617	1.89042661	0.91988573	1.26611812	1.26611812	1.14754440	1.20627155
2032	0.87249321	1.85008927	0.98867865	1.15504381	1.15504381	1.13856069	1.14672444
2033	0.51298999	1.26099274	0.56181444	0.73441624	0.73441624	0.67646187	0.70516549
2034	0.51232936	0.88941043	0.37767526	0.5199821	0.5199821	0.50248425	0.51115058
2035	0.42294758	0.75986421	0.36707085	0.46771964	0.46771964	0.46015886	0.46390356
2036	0.00000000	0.88996281	0.32556048	0.54462577	0.54462577	0.55768123	0.55121512
2037	0.40591469	1.04080725	0.55803519	0.71059515	0.71059515	0.60827385	0.65895150
2038	0.40627074	0.68822626	0.33395934	0.43826705	0.43826705	0.42313867	0.43063145
2039	0.39775740	0.65586520	0.30556349	0.39816944	0.39816944	0.39587271	0.39701023
2040	0.35987509	0.45787451	0.22382584	0.27444211	0.27444211	0.29829774	0.28648253
2041	0.00000000	0.00000000	0.15058588	0.3252165	0.3252165	0.32781245	0.32652673
2042	0.47435308	0.70444011	0.32166149	0.44283477	0.44283477	0.42851170	0.43560563

Figure 2: Filed 2020 WA IRP Avoided Distribution System Costs

\$/dth	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2021	0.17435758	0.17140622	0.17201064	0.18054241	0.18054241	0.17276028	0.17499891
2022	0.184021695	0.180921018	0.181531687	0.19079733	0.19079733	0.18232985	0.184778914
2023	0.188933316	0.185818523	0.186390201	0.19614467	0.19614467	0.187204523	0.189804404
2024	0.171094367	0.168304602	0.168936266	0.17794185	0.17794185	0.169605082	0.172060762
2025	0.20503093	0.201738289	0.202504462	0.21348958	0.21348958	0.2032673	0.206288953
2026	0.184611244	0.181679137	0.182180908	0.19234188	0.19234188	0.182957391	0.18572383
2027	0.184601138	0.18173303	0.182148696	0.19255561	0.19255561	0.182951579	0.185801045
2028	0.184269064	0.181431862	0.18181788	0.19240622	0.19240622	0.182631676	0.185539723
2029	0.184255467	0.181457928	0.181837777	0.19259725	0.19259725	0.182646487	0.185626518
2030	0.185133729	0.182381187	0.182880775	0.1938037	0.1938037	0.183591233	0.186686648
2031	0.18246011	0.179785675	0.180309637	0.19119067	0.19119067	0.180965571	0.184071226
2032	0.182086652	0.179438936	0.179699186	0.19085196	0.19085196	0.180501383	0.18364219
2033	0.184826789	0.182161249	0.182413949	0.19390931	0.19390931	0.183233204	0.186486497
2034	0.185716139	0.183100254	0.183313172	0.19501154	0.19501154	0.184136506	0.187464527
2035	0.185858798	0.183253198	0.183453781	0.1953277	0.1953277	0.184287017	0.187679667
2036	0.185496781	0.182960943	0.183378919	0.19520604	0.19520604	0.184046863	0.187506907
2037	0.182587532	0.180091432	0.180271681	0.19217151	0.19217151	0.181064002	0.18449511
2038	0.186232782	0.183747613	0.183901224	0.196162	0.196162	0.18470451	0.188262644
2039	0.186358129	0.183884086	0.184047586	0.19644579	0.19644579	0.184840619	0.188453087
2040	0.186004908	0.183568945	0.183639798	0.19620377	0.19620377	0.184482658	0.188156182

Figure 3: Draft 2023 Environmental Compliance Costs

\$/dth	System
2023	4.48879
2024	4.557849
2025	4.695965
2026	4.765024
2027	4.834082
2028	4.90314
2029	4.972199
2030	5.041257
2031	5.110315
2032	5.179374
2033	5.248432
2034	5.31749
2035	5.386549
2036	5.455607
2037	5.524665
2038	5.593723
2039	5.662782
2040	5.73184
2041	5.800898
2042	5.869957
	5.939015

Figure 4: Filed 2020 WA IRP Environmental Compliance Costs

\$/dth	System
2021	4.02043
2022	4.084246
2023	4.148063
2024	4.211879
2025	4.339512
2026	4.403328
2027	4.467145
2028	4.530961
2029	4.594777
2030	4.658594
2031	4.72241
2032	4.786226
2033	4.850043
2034	4.913859
2035	4.977675
2036	5.041492
2037	5.169124
2038	5.232941
2039	5.296757
2040	5.360573

Figure 5: Hydrogen Blending impact to Scenario 5

