Chapter 9
Stochastic Supply Resource Risk Analysis

I. Background

The results presented in Chapter 8 represent the expected Present Value of Revenue Requirements (PVRR) of a portfolio of resources under a specific set of input assumptions in the form of forecasts and resource availability. It is known, however, that there is a high degree of uncertainty when forecasting load, weather, commodity prices, and resource costs 20 years into the future. Therefore, it is important to test the sensitivity of the expected least cost supply resource acquisitions detailed in Chapter 8 to assumptions about prices, price basin differentials, weather, customer growth, and resource costs. This Chapter documents the risk analysis performed using stochastic Monte Carlo simulation to evaluate how resource availability[1] impacts portfolio performance over a wide range of possible futures. Also, since a recall of Mist storage capacity from interstate storage in 2019-20 is the only expected supply resource acquisition planned for the period covered by the Action Plan in this IRP (the next 2-4 years), this Chapter will make clear there is very little risk that adding Mist Recall to the Company's supply resource portfolio in flexible amounts as is called for in the Action Plan will result in a portfolio that does not represent the best combination of cost and risk for customers (i.e. resource decisions where risk analysis are more critical will be made in future IRPs). However, while this means resource decisions where stochastic risk analysis is highly valuable will not be made in this IRP, stochastic risk is new to the 2016 IRP and a review of the methodology and how NW Natural plans to apply it when resource decisions that carry a reasonable amount of risk are required is relevant and important.

II. Stochastic Simulation Overview

As is detailed in Chapter 8, after resource choices are made under each Scenario through deterministic peak planning (which includes a peak day, a week-long peak weather event, and peak heating season in each year of the planning horizon to ensure adequate resources are available) normal weather optimization is completed on the resulting portfolios to determine the expected PVRR under "base case" conditions under each Scenario. Stochastic risk analysis is completed on each of these same portfolios through two separate Monte Carlo simulations and their subsequent optimizations to estimate the PVRR for each Scenario under a wide variety of possible future environments to determine if the expected least cost resources remain the best option for customers in all (or most) possible future environments. If not, least cost and lowest risk are at odds and the best combination of least cost and risk for customers needs to be decided.

Simulation 1: Variable Costs with Prices and Weather as Stochastic Inputs

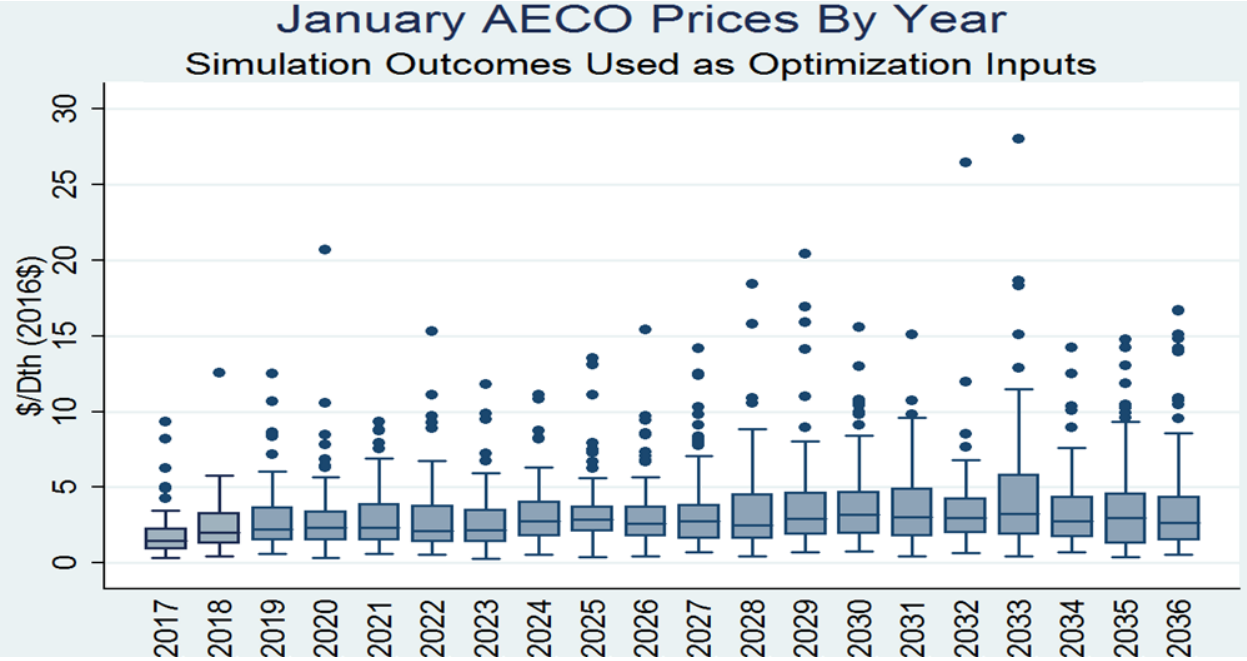
Weather and commodity price (inclusive of basin differential) uncertainty are simulated using SENDOUT®'s stochastic Monte Carlo facilities which includes a re-dispatch (optimization) of the resource portfolio for each simulation draw for each day in the planning horizon. Each of 100 simulation draws includes daily price and weather patterns for each trading hub and load center, respectively, drawn from

[1] The three resource availability possibilities being considered: (1) no new regional interstate pipeline is constructed during the planning horizon, (2) one of the three new regional interstate pipelines analyzed is constructed and available for subscription on a timeline chosen by NW Natural, and (3) one of the new regional pipelines is constructed and available for subscription starting in 2021-22 only with a decision required in the near future.

defined distributions so that each resulting draw (or "future") is different than the base case future but in a way that is consistent with the best approximation of the uncertainty of each component. A correlation matrix defined from historical data also establishes the relationship of the prices between basins, the weather between load centers, and the prices at each basin to the weather at each load center so that each draw represents a "future" that is representative of the real world. The same 100 futures are used for all 100 optimizations of each resource portfolio so that the PVRR for each portfolio can be compared for each simulated future.

Stochastic Input #1- Commodity Prices: The mean of the distribution for natural gas prices through time at each of the five relevant trading hubs[2] is defined by the consultant price forecast detailed in Chapter 2 for each month of the planning horizon. The distribution (lognormal distribution) and standard deviation for the stochastic price draws is defined by historical price variation and an assessment of the current market.[3] Each of the 100 draws has a simulated price in each day of the planning horizon at all of the relevant trading hubs. Figure 9.1 is an example used to show the results of the simulation across draws with a box and whisker plot representing the distribution of the average of daily prices in January of the 100 draws for each year in the planning horizon at the AECO trading hub in real terms (2016$).

Figure 9.1: Variable Cost Stochastic Input #1- Prices (January AECO Example)



Note, consistent with the historical reality of natural gas prices, the shape of the lognormal distribution can be seen with the outliers being on the high end of the scale but most of the price outcomes being much lower.[4] Also important to point out as it relates to storage operations and option value is that

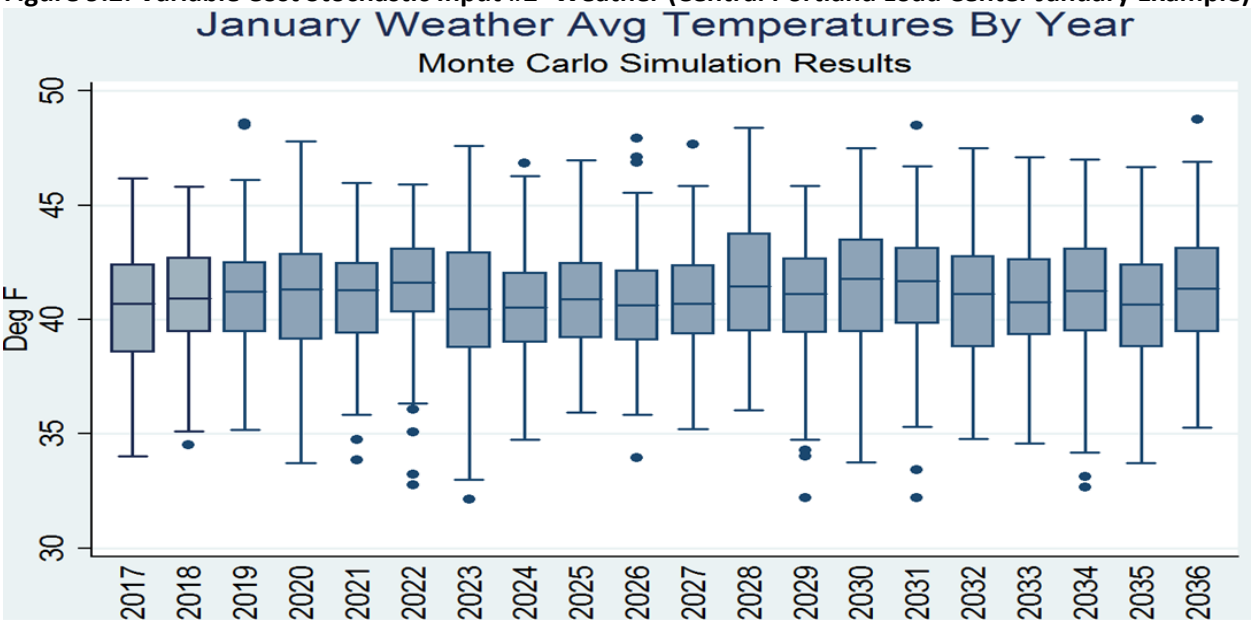
[2] AECO, Rockies (Opal), Sumas, Malin, and Station 2.
[3] Price volatility has generally been lower since the "Shale Gale" so volatility in the last 3 years is more heavily weighted than volatility before this time.
[4] In only 2033 are 75 of the 100 draws not less than $5/Dth.

while in the base case price forecast winter prices are higher than prices the previous summer for every year in the planning horizon (which is the expected situation in normal conditions), this is not true for all years in each draw, which is a more realistic representation of reality. It is also key that the draw with the highest price at some point in time at the beginning of the planning horizon is not necessarily (and is in fact unlikely to be) the draw with the highest price later on in the planning horizon, indicating how each simulated price path acts more realistically in that it might "wander" higher and lower throughout the planning horizon as actual prices have shown to do through time.

The prices between basins are highly—though not perfectly—correlated, with the correlations defined by historical relationships. Therefore, the basin differentials between trading hubs vary across draws and through time within draws. Basin differentials represent one of the largest sources of variation in relative PVRR between the portfolios across draws, as basin optimization is one of the variables within the an LDCs control to minimize costs.

Stochastic Input #2- Weather: The mean, standard deviation, and distribution (normal) for weather are defined by 30 years of daily weather history for each of the load centers modeled by NW Natural and represented by monthly heating degree days (HDDs). To exemplify the variation in weather across draws of the simulation Figure 9.2 shows boxplots of the average monthly temperature for January in the Central Portland load center by year in the planning horizon. Weather is highly, though not perfectly, correlated across load centers, with the correlation defined by the actual correlation over the last 30 years. A correlation between the weather at each load center and the price at each trading hub is also defined from historical correlations.

Figure 9.2: Variable Cost Stochastic Input #2- Weather (Central Portland Load Center January Example)



Weather and prices are not highly correlated, even in winter months, because the weather-price relationship is driven primarily by North American weather as a whole. Since weather in the Portland area is not strongly correlated with weather continent-wide, weather in NW Natural's service territory is not strongly correlated with natural gas prices at the relevant trading hubs of the Pacific Northwest.

Simulation 2: Fixed Costs with Supply Resource Option Costs as the Stochastic Input

Uncertainty in the costs[5] of the supply resource options considered is simulated with a Monte Carlo analysis separate from Simulation 1.[6] Supply resource costs are typically represented in a $ per Dth of daily capacity form[7] and can be thought of as fixed costs since they are typically reservation charge payments paid monthly regardless of the utilization of the contracted capacity. Resource costs are a large driver of the difference in PVRR across portfolios and the assumptions about prospective resource costs could impact the position of a given resource as the expected least cost option to meet customer needs. For example, if two resource options—one with an expected cost of $0.50/Dth of Daily Capacity and the other with an expected cost of $0.55/Dth of Daily Capacity, with both sourcing gas at the same trading hub so that the expected variable costs associated with either option are equal—have different levels of relative cost risk (so that it is possible with a reasonable degree of certainty that the $0.50/Dth of Daily Capacity option could turn out to be $0.75/Dth of Daily Capacity but highly unlikely the $0.55/Dth of Daily Capacity option could turn out to be above 0.65/Dth of Daily Capacity) it may make sense to choose the option that is not expected to be the least cost option to mitigate the higher risk associated with the option that is lowest cost in the expected case.

Table 9.1 summarizes the distributions used to simulate the supply resource costs for the options considered in this IRP and Figure 9.3 shows the results of the simulation of 100 cost outcomes for each supply resource option considered.

Table 9.1: Supply Resource Option Costs and Potential Deviations (2016$)

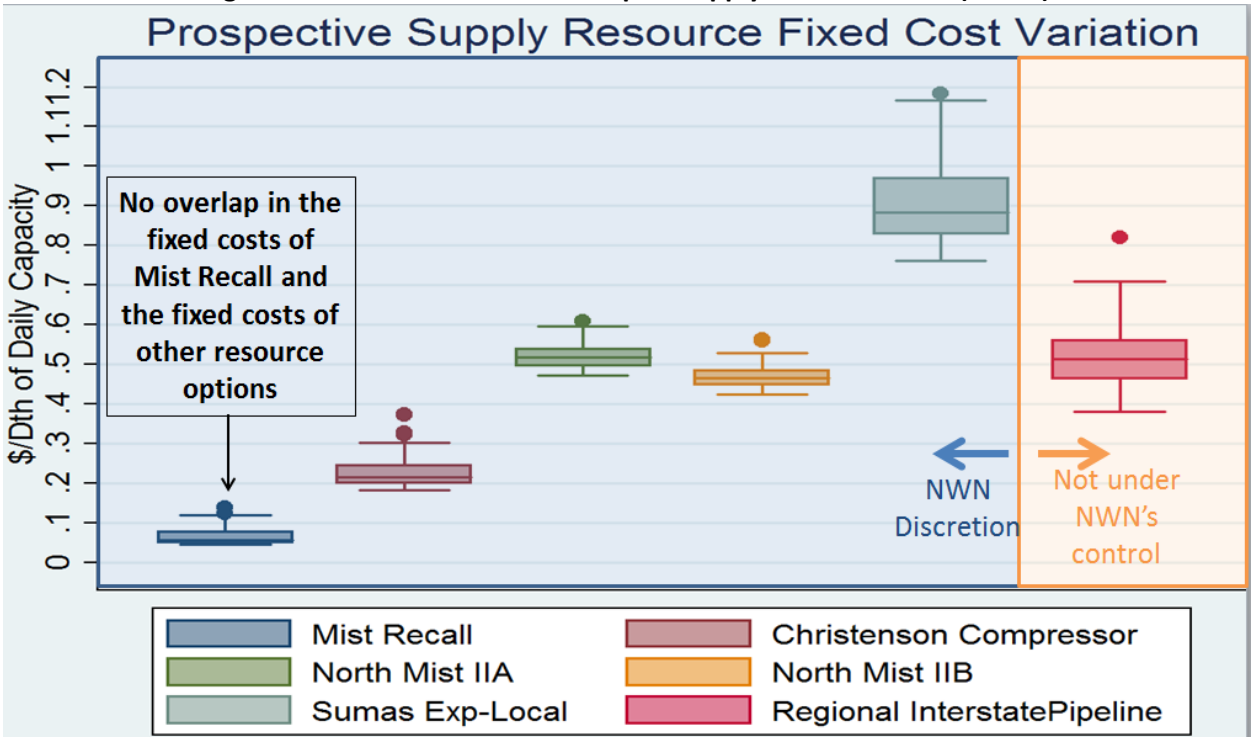
Supply Resource Capacity Rates ($/Dth of Daily Capacity)					
	Low	Mid	High	-	+
Mist Recall	$0.050	$0.055	$0.110	10%	100%
Christenson Compressor	$0.189	$0.210	$0.294	10%	40%
North Mist II-A	$0.483	$0.503	$0.584	4%	16%
North Mist II-B	$0.429	$0.446	$0.515	4%	16%
Sumas-Local	$0.774	$0.880	$1.100	12%	25%
Regional Interstate Pipeline	$0.385	$0.499	$0.660	23%	32%

The regional pipeline costs and their distribution (low and high estimates) are defined from a cost study by a third party consultant[8] and information provided by the interstate pipeline companies and combined into one resource notated as the "Regional Interstate Pipeline." Mist Recall costs and distribution characteristics are defined by current Mist accounts and the potential cost of service impact of the Mist Asset Management program. Christensen Compressor costs have been estimated by NW Natural engineers with the distribution defined by the greenfield definitions for compressor stations in the third party consultant report. North Mist IIA and North Mist IIB for core customers costs are defined by the most recent available contractor bid for the North Mist Expansion for PGE that includes

[5] In the form of revenue requirement.
[6] Note that this implies that resource cost variation is not correlated with variation in weather or prices.
[7] Meaning, for example, if a resource cost is $0.50/Dth of daily capacity and 10,000Dth/day are contracted the annual payment for the resource in a non-leap year is $0.50* 10,000 *365 = $1.825 million and is the same in all non-leap years.
[8] See Confidential Appendix 7 in NW Natural's 2014 IRP for this report from Willbros Group, Inc.

substantial customer contractual cost risk protections with the distribution defined by NW Natural expertise. As is typical with large construction projects, each resource option is more likely to experience cost overruns of a given magnitude than they are to experience a savings relative to the current projected cost of the same magnitude (i.e. upside risk is greater than downside risk/benefit for all options). Note however, that while the risk is asymmetric for all of the resource options, the asymmetry is not equivalent across resources.

Figure 9.3: Fixed Cost Stochastic Input- Supply Resource Costs (2016$)



While keeping in mind that supply resource option costs do not represent all of the difference in cost between portfolios for any given future (as the variable cost component associated with each option is evaluated in Simulation 1 and its subsequent optimizations must be considered as well to estimate total portfolio PVRR), Mist Recall is the lowest cost option available to customers and there is no overlap in the range of Mist Recall fixed with the cost ranges of the other supply resource options. Additionally, the Christensen Compressor is lower cost than each of the other options other than Mist Recall for the fixed cost component and there is no overlap in the fixed cost outcomes. There is, however, considerable overlap in the fixed cost estimate ranges of both North Mist IIA and B with that of the prospective regional interstate pipeline projects, making a choice between these options more inherently risky. Note, however, that NW Natural does not face a choice between these resource options in this IRP.

Combining Simulations 1 and 2

After both simulations are complete every possible combination of outcomes from the two simulations is paired to determine the net present value of costs of each of the nine Scenarios under the resulting 10,000 prospective future environments. However, since NW Natural cannot control which interstate pipeline will be built, the results from Scenarios 2 (Pacific Connector (PC) is available with timing chosen

by NW Natural (NWN)), 3 (Trail West (TW) is available with timing chosen by NWN), and 4 (Sumas Expansion Regional SE(R) is available with timing chosen by NWN) are combined so that the 10,000 PVRR results from each Scenario are combined into a "Regional Pipeline NWN Timeline" option that includes 30,000 PVRR outcomes. Each of these outcomes is compared (ranked) against the PVRR of the equivalent future for the "No Regional Pipeline" option (Scenario 1). This same process is completed for Scenarios 7, 8, and 9 (the "Regional Pipeline-2021" option), which are the same as Scenarios 2, 3, and 4 except regional interstate pipeline capacity is available starting in 2021-22 and must be evaluated now or the opportunity to pick up capacity will be foregone forever (which is covered in more detail in Chapter 8).[9] These 30,000 PVRR outcomes are also compared against the "No Regional Pipeline" option to evaluate the likelihood that picking up capacity in 2021-22 is preferable to not acquiring any regional pipeline capacity within the planning horizon (which is a more likely scenario than NW Natural being able to bring on capacity on its own timeline).

These results are then tested for customer growth uncertainty by completing both simulations again for the low and high load growth Scenarios (5 and 6) under the assumption that none of the three regional pipeline projects goes forward.

III. Stochastic Risk Analysis Results

Results Framing and Important Considerations

Before proceeding, note again that NW Natural does not have a preferred portfolio and it is not appropriate to compare the PVRR of the portfolios for each of the Scenarios detailed in Chapter 8 and conclude that one portfolio shows as the least cost Scenario for NW Natural's customers, as the only interstate pipeline option NW Natural has control over is the Sumas Expansion Local (SE(L)) project, which is a NW Natural specific expansion.[10] If one of the potential interstate regional pipeline projects (of Trail West, Sumas Expansion-Regional, and Pacific Connector) shows as the least cost alternative it does not mean the Company can plan on subscribing to that pipeline because it may not be built and available for subscription.

Additionally, most of the Scenarios considered under the base case assumptions (Scenarios 1, 2, 3, and 4) result in the exact same resource portfolio through 2026-27 and Scenarios 7, 8 and 9 have identical portfolios as the other base case assumption portfolios until the forced timeline interstate pipeline acquisition in 2021-22. This means that each of these Scenarios will have identical PVRRs through 2020-21 and Scenarios 1, 2, 3, and 4 have identical portfolios through 2026-27 in each of the 30,000 futures. Moreover, under the high and low growth Scenarios (5 and 6), only the timing of Mist Recall and the Christensen Compressor are different from the base case assumption portfolios in the first 10 years of the planning horizon and the earliest the Christensen Compressor is called for is 2021-22 (in the high load growth Scenario). Consequently, the only resource decision that is likely to be required before the next (2018) IRP is the level and timing of Mist Recall. As Mist Recall is by far the lowest cost resource option in terms of fixed resource costs and on system storage allows both basin and seasonal

[9] Note again that NW Natural is not currently faced with this decision and, though it is possible, does not expect it will be faced with a similar decision before the next IRP.
[10] Which is another way of saying that NW Natural does not control any of the *Regional* Interstate Pipeline projects.

optimization so that Mist Recall is also associated with low variable costs, it is hard to imagine a scenario where recalling Mist capacity would retrospectively turn out not to be the least cost resource.[11] Since the primary function of this risk analysis is to determine the risk that a resource decision will turn out not to be the lowest cost option retrospectively, this means the decision to include an Action Item related to Mist Recall carries little cost risk. Furthermore, Mist Recall is more flexible than most resources since it can be added in small increments on a flexible timeframe with a relatively short lead time (decisions for Mist Recall are made in the summer for a recall the following spring).

Also, since the Company currently holds nearly 1,000 MDT of supply resource capacity for a peak day and gradually adds resources to hold roughly 1,200 MDT of peak day capacity by the end of the planning horizon, most of the costs for each of the portfolios are tied to resources currently held to meet existing needs and therefore do not vary across Scenarios. In fact, as is show in Chapter 8, in the last year of the planning horizon (2035-2036) the difference in resources between all of the portfolios using the base case assumptions represents less than 3% of the total daily capacity expected to be held to meet peak needs.[12]

Lastly, resources in every portfolio distribute the same fuel regardless of the supply resource being considered, so the relative asymmetries in costs of resources that exist in electricity generation fleets, where different resources have drastically different cost profiles and operating/fuel costs, is not present.[13] In summary, the difference in costs across portfolios for any given future tends to be small in PVRR terms. That being said, the small differences in costs across portfolios are driven primarily by three factors: (1) the difference in fixed costs of the resource options being considered; (2) price basin differentials and the supply basins associated with the different resource options; and (3) the difference between storage and pipeline resources as they relate to seasonal price spreads and the ability to purchase gas at the cheapest available basin for storage resources where pipeline resources are typically tied to purchasing gas at a particular supply basin.

Results Part A- Regional Interstate Pipeline is Available on NW Natural's Preferred Timeline

Again, while a decision on subscription of a regional interstate pipeline is not imminent, this section shows how the Company would analyze the decision if a pipeline were to move forward and it was expected that the pipeline would not be fully subscribed upon completion so that Company could subscribe on the timeline that is the lowest cost for customers.

Figure 9.4 shows the frequency distribution of the simulation PVRR results for the 30,000 future environments for the "No Regional Pipeline" availability Scenario (Scenario 1) to provide an example of the final results from combining the fixed and variable cost simulation process results. Notice that the mean of the PVRRs of all the draws as well as the 95th and 99th percentile draws are depicted with

[11] Note that short term citygate delivery (see Chapter 3) contracts may be lower cost than Mist Recall and, if the opportunity to contract a citygate delivery is expected to provide customer benefits relative to Mist Recall, NW Natural will take advantage of this opportunity. The availability and price of citygate deliveries is uncertain.
[12] Less than 32 MDT of daily capacity is different between the portfolios
[13] Note that the expected carbon intensity of all of the portfolios is also expected be identical so even though carbon policy costs are a major risk to customers they do not impact supply resource choice since differences in the incremental carbon policy adders would impact all of the portfolios in concert rather than asymmetrically.

vertical lines. The 95th and 99th percentile confidence bands are shown to represent the upside risk of a given resource portfolio.

Figure 9.4: Stochastic Risk Analysis Final Results- No Regional Pipeline Example

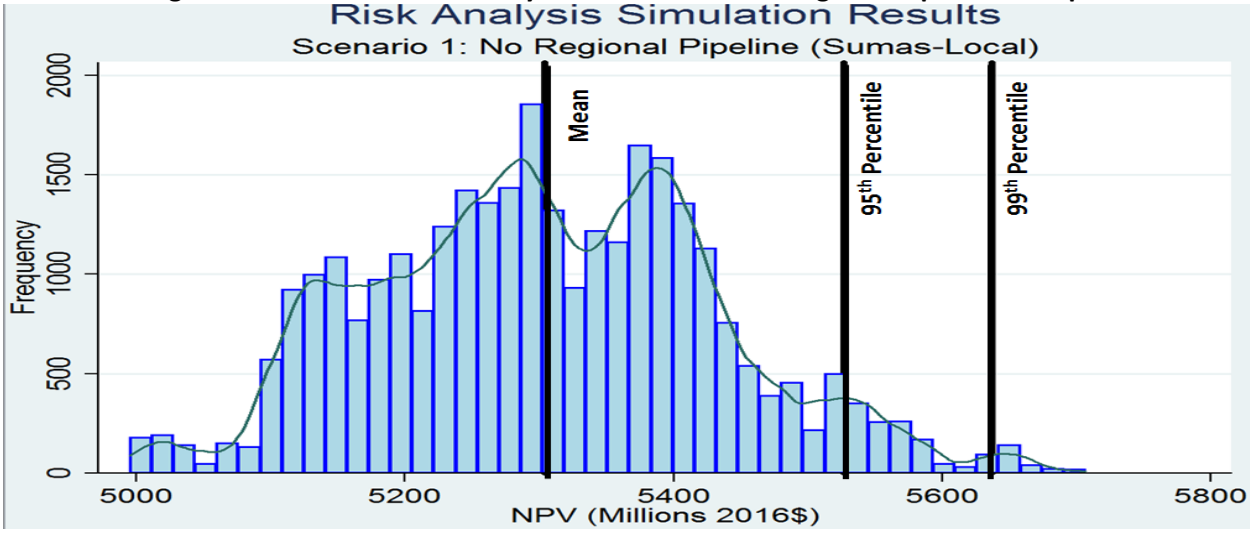
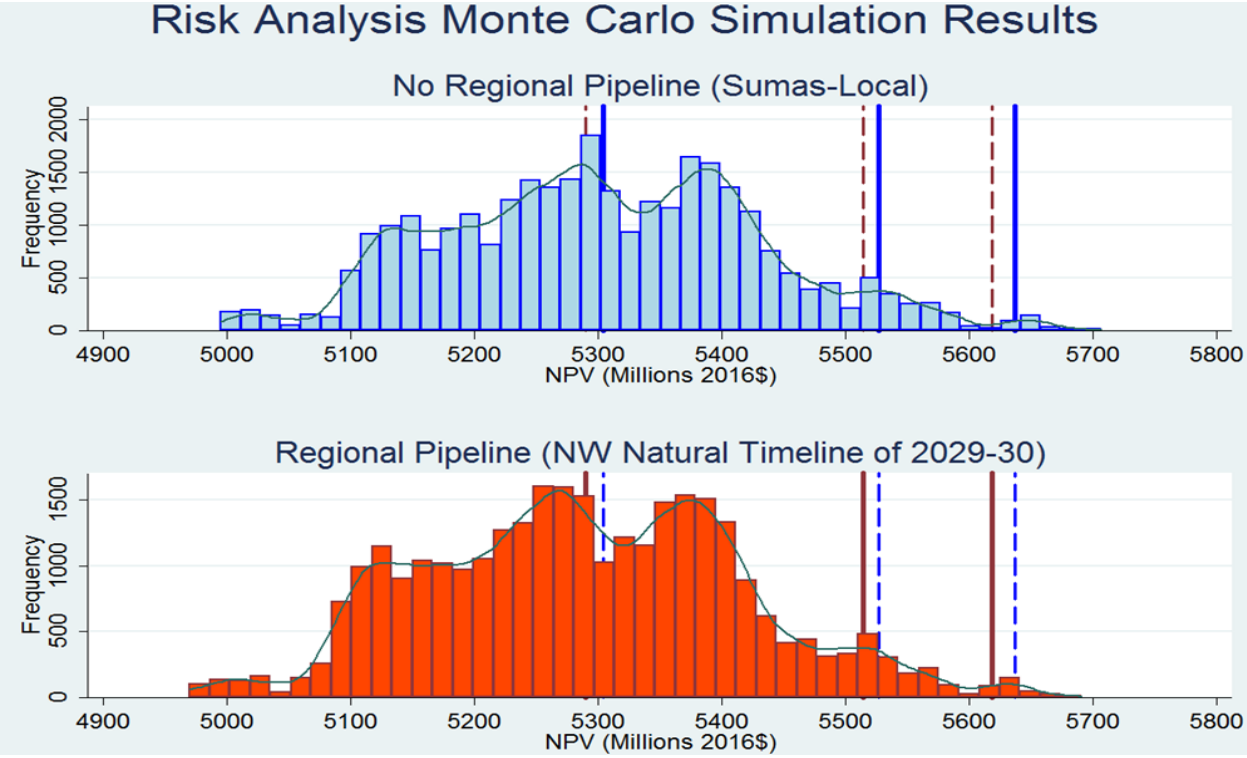


Figure 9.5 compares the frequency distributions of the "No Regional Pipeline" availability Scenario (Figure 9.4) with the "Regional Pipeline NWN Timeline" availability Scenario to compare the relative difference in PVRR distributions across simulation draws as well as compare the means, 95th, and 99th percentiles (shown with the respective colors of the different distributions on each graph segment).

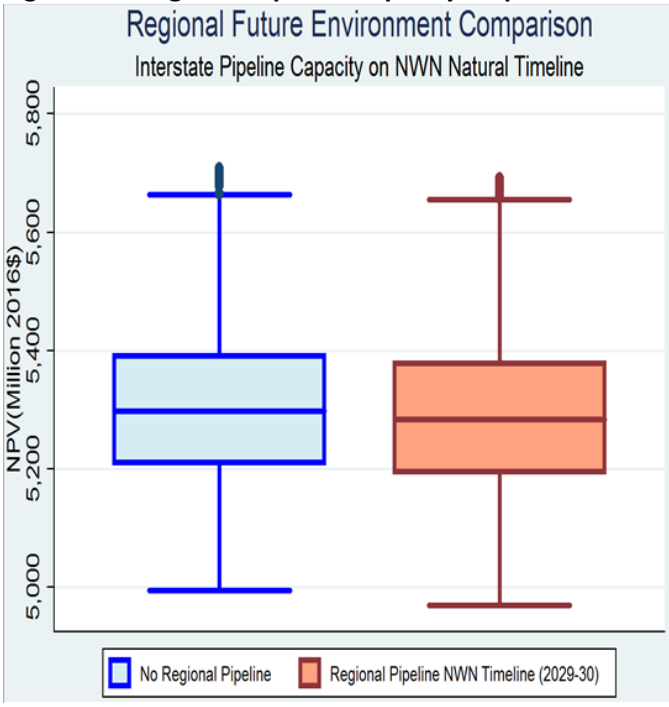
Figure 9.5: Comparing Simulation Distributions with and without a Regional Pipeline Available



Since the future where the regional pipeline is not available is the result that is expected if a regional pipeline project were constructed and NW Natural decided not to subscribe, comparing the two graphs in the figure is a helpful as tool in deciding if it is in customers' interest to subscribe to a regional interstate pipeline were one to be available. As can be seen from the graphs in Figure 9.5, if a regional pipeline is available along a timeline of NW Natural's choosing[14] the mean, 95th percentile and 99th percentile PVRRs for the regional interstate pipeline subscription future are all cheaper than if a regional pipeline is not available.

However, it is more enlightening to determine under how many of the 30,000 simulation draws analyzed it would be least cost to subscribe to the pipeline and how many simulation draws it would be least cost to *not* subscribe to the regional interstate pipeline were one available. Figure 9.6 shows the same distributions as Figure 9.5 in boxplot form and a summary of the ranking of the portfolio's for each draw analyzed (a rank of 1 means the portfolio is the lower cost for that future/draw whereas a rank of 2 means the portfolio is the higher cost of the two portfolios for that future) and the PVRRs at different points on the distribution of each portfolio.

Figure 9.6: Regional Pipeline Capacity Acquisition Decision if Timeline Could be Chosen by NWN



Ranking of Future Environment by Monte Carlo Assumption Draw (NPV in Millions of 2016$)		
Draws with:	No Regional Interstate Pipeline Built	Regional Interstate Pipeline Capacity Acquired on NWN Timeline (2029-2030)
#1 Rank	372	29628
#2 Rank	29628	372
Total	30000	30000

Scenario Monte Carlo Results (NPV in Millions of 2016$)		
	No Regional Interstate Pipeline Built	Regional Interstate Pipeline Capacity Acquired on NWN Timeline (2029-2030)
1%	$5,023	$5,010
5%	$5,110	$5,093
10%	$5,137	$5,117
25%	$5,210	$5,189
50%	$5,298	$5,285
75%	$5,392	$5,379
90%	$5,464	$5,449
95%	$5,527	$5,514
99%	$5,637	$5,619
Mean	**$5,304**	**$5,290**
Std Dev	127.59	127.74

The table in Figure 9.6 shows that in almost 99% of the futures it would be least cost for NW Natural to acquire regional interstate pipeline capacity if it were available and not fully subscribed (so that NWN could chose the timing of acquisition). Therefore, there is a high degree of confidence (low risk) this decision would turn out to be the least cost option for customers. Again, this analysis is primarily for

[14] The most obvious way this would be possible would be a pipeline is built but not fully subscribed so capacity is available for subscription at any time, much like it is possible to contract capacity on TransCanada's Gas Transmission Northwest (GTN) pipeline today as there is capacity available for subscription.

exposition purposes as a decision on pipeline subscription is not imminent and the difference between portfolios is only in the last few years of the 20 year planning horizon. As a decision about acquisition becomes closer in time in future IRPs the variation between portfolios would increase as the differences in portfolios would not be as highly discounted and more years in the PVRR calculation would have cost differences.

Results Part B- Take it or Leave Decision on Pipeline Capacity Available at One Point in Time

To show an important way the stochastic risk analysis would be applied to a resource decision that would likely carry a fair degree of risk and to analyze one of the major risks the NW Natural could face— the timing of regional interstate pipeline projects beyond its control— an example where the Company must decide to subscribe to a regional interstate pipeline under a forced timeline is used. The most likely instance of this would be a binding open season before construction begins on a pipeline where it is expected that upon completion the pipeline would be fully subscribed. In this case the Company would be presented with a "take it or leave it" opportunity to acquire interstate pipeline capacity. While NW Natural believes this situation is highly unlikely to occur within the next couple of years, it is not implausible that the Company could face this decision regarding one of the prospective regional pipeline projects before the next IRP, so the method of risk analysis is presented here to detail the risk analysis that would be completed in such a situation (this is the analysis extending Scenarios 7, 8, and 9 from Chapter 8). Figures 9.7 and 9.8 are the same graphs as Figures 9.5 and 9.6 under the constraint that NW Natural must acquire the interstate pipeline capacity in 2021-22 or not have the opportunity to subscribe indefinitely.

Figure 9.7: Comparing Subscribing to a Regional Pipeline Project in 2021-22 or not at all

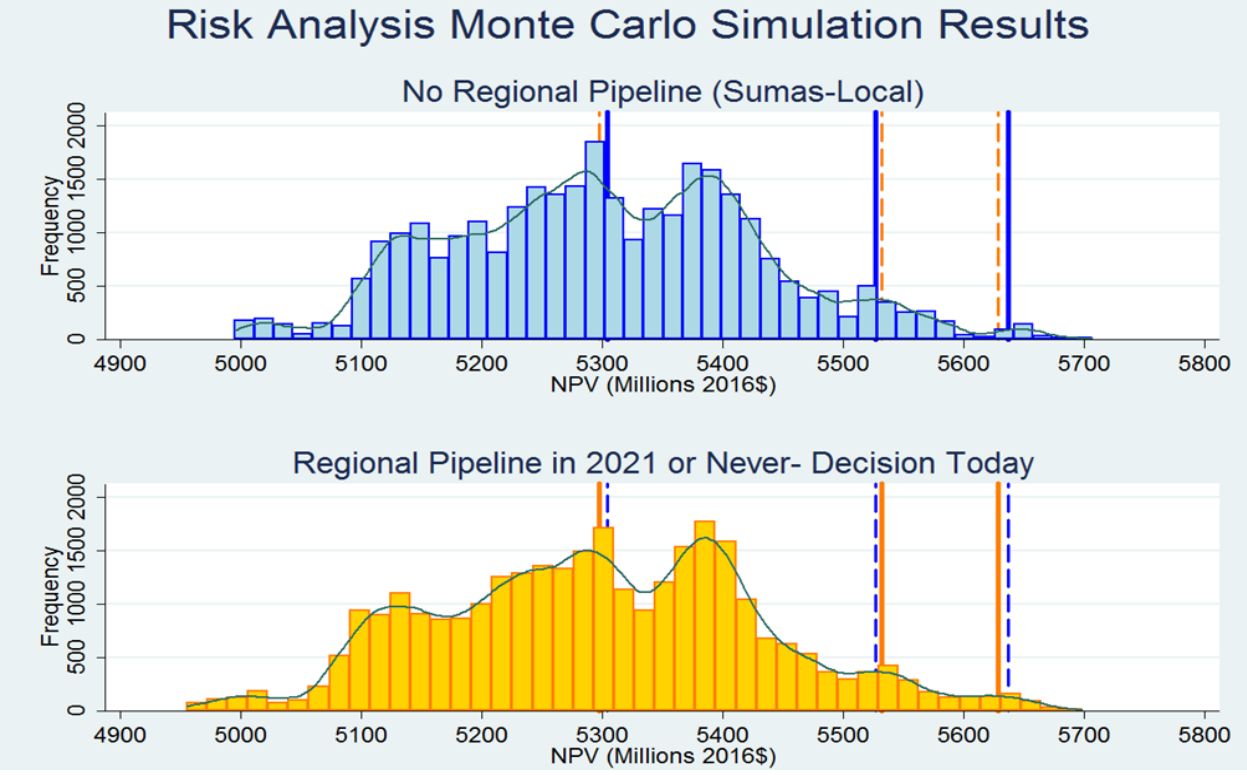
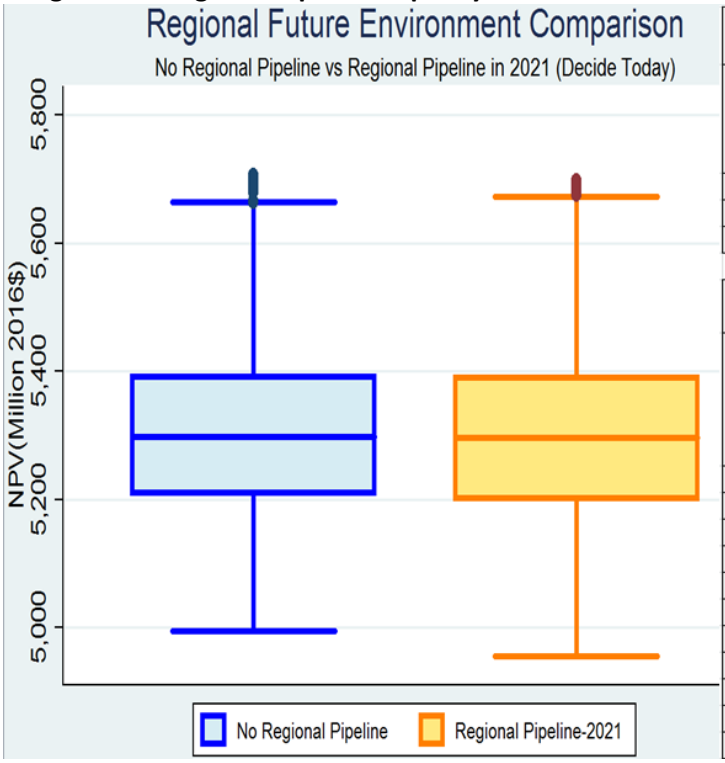


Figure 9.8: Regional Pipeline Capacity if Faced with Take-it-or-Leave-it Starting in 2021-22 Decision



Ranking by Monte Carlo Draw with Pipeline Decision in 2021 (NPV in Millions of 2016$)		
Draws with:	Choose not to Acquire Interstate Pipeline Capacity in 2021	Choose to Acquire Regional Interstate Pipeline Capacity in 2021
#1 Rank	10216	19784
#2 Rank	19784	10216
Total	30000	30000

Scenario Monte Carlo Results with Pipeline Decision in 2021 (NPV in Millions of 2016$)		
	Choose not to Acquire Interstate Pipeline Capacity in 2021	Choose to Acquire Regional Interstate Pipeline Capacity in 2021
1%	$5,023	$5,005
5%	$5,110	$5,092
10%	$5,137	$5,120
25%	$5,210	$5,201
50%	$5,298	$5,296
75%	$5,392	$5,390
90%	$5,464	$5,465
95%	$5,527	$5,532
99%	$5,637	$5,629
Mean	**$5,304**	**$5,297**
Std Dev	127.59	134.07

As Figures 9.7 and 9.8 detail, if a decision had to be made to subscribe to a regional pipeline project now for a subscription starting in 2021-22 (or never) the decision is not as clear cut as it is if the Company can choose its own timeline (where the lowest cost option is 8 years later in 2029-30). Whereas nearly 99% of the simulation draws show it would make sense to subscribe to the interstate pipeline if NW Natural could chose the timeline, it would be lowest costless expensive to subscribe to the pipeline in 2021-22 in roughly 2/3 of the simulation draws. Additionally, while it is expected that subscribing to the pipeline would be the least cost option (the mean is lower than not acquiring the capacity), at the 95th percentile the least cost option is choosing to *not* subscribe to the pipeline.[15] While this analysis is informative, should an actual pipeline project that was expected to be fully subscribed upon completion move forward, the Company could use the cost estimates of that specific project to do the deterministic and stochastic risk analysis as opposed to lumping the three potential pipelines into one grouping since it is not known which, if any, project will go forward.

IV. Key Findings

- NW Natural's stochastic supply resource risk analysis utilizes Monte Carlo simulation methodology that is new to this IRP.
- The goal of stochastic risk analysis is to test the sensitivity of expected resource decisions to assumptions about prices, weather, resource costs, and customer growth that are known to be uncertain.

[15] Interestingly at the 99th percentile it is cheaper to subscribe to the pipeline as opposed to not subscribing.

- NW Natural's current resources serve to mute the difference in PVRR across portfolios in different futures of the stochastic risk analysis as they will make up the majority of the resource stack over the planning horizon even when considering resources acquired to accommodate load growth.
- Since LDCs are in the business of distributing natural gas, variation in costs in different future environments tends to move in concert across resource portfolios as fuel switching is not possible.
    - It is only possible to take advantage of supply basin/trading hub basin differentials if pipeline capacity is held at multiple basins and seasonal price arbitrage through storage resources
- All base case load Scenarios (1-4 and 7-9) have identical resource portfolios through 2020-21 and Scenarios 1-4 have identical resources through 2026-27 and are only significantly different in the last years of the planning horizon.
    - Most variation in costs across portfolios takes place at highly discounted values
- There is little chance Mist Recall will turn out to be more expensive than the other long term resource options considered available (though as-of-now-unknown short term city-gate delivery options or recall agreements could be competitive).
- Load growth uncertainty is not a considerable risk to resource choice in the short term since Mist Recall is flexible and the amount recalled can be determined one year in advance of need.
- Resource choices that carry considerable customer risk will be decided in future IRPs.
- Feedback on the stochastic risk analysis methodology is important so the tool is ready to go in case a decision with a reasonable degree of risk needs to be made.