BEFORE THE PUBLIC UTILITY COMMISSION
OF OREGON

LC 66

In the Matter of PGE 2016 Integrated Resource Plan	Comments of Renewable Northwest

I. INTRODUCTION

Renewable Northwest is grateful to the Oregon Public Utility Commission (the "Commission" or "OPUC") for the opportunity to comment on Portland General Electric's ("PGE's") 2016 Integrated Resource Plan ("IRP"). We also appreciate the breadth and depth of opportunity for stakeholder participation and engagement in the 2016 IRP. PGE held nine public roundtables from April 2015 to November 2016, as well as numerous technical meetings with stakeholders.[1] Throughout the process, PGE IRP staff were open to constructive input and went to great lengths to explain their assumptions and methods. Furthermore, Renewable Northwest commends PGE staff for using some of the most up-to-date renewable resource cost assumptions, experience curves and capacity value methodologies in the region. Renewable Northwest's comments focus on PGE's plans to acquire renewable resources, PGE's durability risk metric, and issues related to any potential requests for proposals ("RFPs") that would follow acknowledgment of the 2016 IRP.

First, Renewable Northwest supports PGE's plans to acquire 175 average megawatts ("MWa") of renewable resources by 2018.[2] As discussed in Section II, such an acquisition would simultaneously enable PGE to meet future energy needs and comply with renewable energy requirements in a low cost and low risk manner. Section III outlines PGE's portfolio scores and portfolio compositions, which reveal that by a narrow margin, the company's preferred portfolio (*Efficient Capacity 2021*) includes a potential build of a 389 MW gas plant in 2021.[3] Section IV then discusses the risk metrics—severity, variability, and durability—used to score the portfolios. Renewable Northwest is concerned that the durability metric has not been justified adequately. Of particular concern, the weighting of the metrics results in the actionable portfolio with the most cost variability, *Efficient Capacity 2021,* emerging as the preferred portfolio. Without the durability metric, *Wind 2018 Long*, the portfolio with the least cost variability, would be PGE's clear preferred portfolio (see Table 4).

As Sections V-VI discuss, the durability metric should be removed. At the suggestion of PGE, Renewable Northwest reviewed the company's 2009 IRP to understand the justification for

[1] PGE 2016 IRP, Appendix C, pp 371–373
[2] PGE 2016 IRP, p 343
[3] PGE 2016 IRP, Appendix O, p 802

and weighting of the durability risk metric in the 2016 IRP; however, the 2009 IRP did not provide sufficient explanation or justification for the equivalent risk metric's inclusion or its weighing. The durability metric is not justified, and Renewable Northwest recommends that the Commission require PGE to remove durability from the weighted portfolio score.

Finally, Renewable Northwest makes two observations with regards to any potential RFP that may follow acknowledgment of the 2016 IRP. In Section VII, Renewable Northwest recommends that any potential excess transmission rights by PGE, possibly for purposes of expansion of the Carty Generating Station, be made available to bidders offering competing projects. In addition to the renewable energy procurement for COD 2018, Renewable Northwest also recommends that any RFP addressing procurement in 2021 be able to fairly accommodate project bids reflecting either *Efficient Capacity 2021* (a 389 MW gas plant in 2021)[4] or *Wind 2018 Long* (an additional 1,084 MW of renewable resource).[5]

II. TIMING OF RPS PROCUREMENT

This section discusses the support for acquisition of renewable resources in 2018. The 2016 IRP shows that a renewable acquisition coming online in 2018 has the lowest cost. Indeed, PGE has demonstrated that procurement of renewable resources that come online in 2018 in order to capture the full value of the Production Tax Credit ("PTC") results in a lower net present value revenue requirement ("NPVRR") "relative to deferring procurement to 2020, 2021, or 2025".[6] Specifically, regarding Oregon's Renewable Portfolio Standard ("RPS") timing, PGE has demonstrated that procuring 175 MWa of wind (for both system and RPS needs) with a commercial operation date ("COD") of 2018 results in a lower cost portfolio than complying with increasing RPS requirements in a "just-in-time" fashion (although Renewable Northwest anticipates that solar resources would also respond strongly to any procurement requests).[7] Accordingly, Renewable Northwest welcomes the inclusion of 175 MWa of renewable resources in the supply-side section of PGE's 2016 IRP Action Plan.[8]

PGE also investigated RPS timing across futures, beyond reference case assumptions, finding that, "While the benefits of early action vary across the futures, the finding […] is robust across all futures."[9] PGE explained the justification for the 2018 procurement of 175 MWa of renewable resources in detail during the May 16, 2016 IRP Roundtable #16–2.[10] PGE explored the reduction in NPVRR of 70 MWa, 175 MWa, and 253 MWa of renewable resources across CODs of 2018, 2019, and 2020 (respectively receiving 100%, 80%, and

[4] PGE 2016 IRP, Appendix O, p 802
[5] PGE 2016 IRP, Appendix O, p 812
[6] PGE 2016 IRP, Appendix L, p 756
[7] PGE 2016 IRP, p 308
[8] PGE 2016 IRP, p 343
[9] PGE 2016 IRP, Appendix L, 756–866
[10] PGE Roundtable #16-2, May 16, 2016
www.portlandgeneral.com/our-company/energy-strategy/resource-planning/integrated-resource-planning

60% of the PTC)[11] in comparison to a 253 MWa addition in 2025.[12] All of PGE's top four performing portfolios, which scored within six points of each other,[13] contain a 515 MW capacity (reflective of 175 MWa of renewable energy) addition of Pacific Northwest wind in 2018.[14] Such a strategy balances out the early action benefits of more tax credits and a larger Renewable Energy Credit ("REC") bank against lower capital costs and greater discounting that would come from later procurement.

In short, PGE's analysis supports the procurement of renewable resources in 2018, and we agree that such procurement is warranted. Renewable Northwest looks forward to working with the Commission, PGE, and other stakeholders on the design and execution of any RFP to meet potential 2018 renewable resource procurement.

III. PORTFOLIO SCORING

This section describes the top two portfolios and discusses their performance. The 2016 IRP top two scoring portfolios receive almost the same weighted total score (with the durability metric included), but have very different cost variability scores. Table 1 below shows PGE's portfolio scoring summary for the top 10 portfolios. It is worth emphasizing that "all of PGE's Action Plan candidate portfolios have sufficient resource capacity to meet its reliability thresholds."[15] Table 1 shows that the portfolios *Efficient Capacity 2021* and *Wind 2018 Long* have similar total portfolio scores, even though they perform quite differently with respect to cost and risk (durability is included in the risk metric). *Efficient Capacity 2021* has a weighted score of 83, scoring two more than *Wind 2018 Long*, which has a weighted score of 81.

[11] PGE acknowledges, "These assumptions do not reflect the possibility of a facility satisfying the safe harbor for a given level of tax credit with an EPC ["Engineering, Procurement, & Construction"] duration greater than the IRP assumption (and thus, a later COD for the same level of tax credit)." PGE 2016 IRP, p 309.
[12] PGE Roundtable #16-2, May 16, 2016 Slides 1–7.
[13] PGE 2016 IRP, Table 12-16
[14] PGE 2016 IRP, Appendix O, Portfolios 2–5, pp 808–814.
[15] PGE 2016 IRP, p 311

Rank	Portfolio Name	Metric Weighting 50% Cost Score	16.7% Severity Score	16.7% Variability Score	16.7% Durability Score	Weighted Score
1	Efficient Capacity 2021	100	100	0	100	83
2	Wind 2018 Long	77	94	100	63	81
3	RPS Wind 2018	92	93	7	100	80
4	Wind 2018	86	89	24	87	77
5	Wind 2018 + Solar PV 2021	84	85	15	50	67
6	Geothermal 2021	82	83	24	50	67
7	Wind 2018 + Solar PV 2018	80	81	15	50	65
8	Boardman Biomass 2021	24	21	54	0	25
9	Efficient Capacity 2021 + High EE	12	10	70	0	19
10	Wind 2018 + High EE	0	0	89	0	15

Table 1—PGE 2016 IRP Portfolio Scoring Summary[16]

Efficient Capacity 2021 (Portfolio)

Efficient Capacity 2021 is the PGE 2016 IRP current preferred portfolio.[17] As Table 1 shows, *Efficient Capacity 2021* also has the lowest (worst) variability score of the actionable portfolios, but the highest cost, severity, and durability scores. Table 4 shows the cumulative resource additions for this portfolio. As with most actionable portfolios, there is a 515 MW addition of Pacific Northwest wind in 2018 (although an RFP could potentially see this approximately 175 MWa of renewable energy being met by a suite of renewables). *Efficient Capacity 2021* also includes 389 MW of "efficient capacity" in 2021, which for modeling purposes was represented by a "combined-cycle combustion turbine (CCCT) fueled with natural gas".[18] There are also some "Generic Capacity" additions included to achieve resource adequacy, which were modeled using "the cost and heat rate characteristics of a natural gas-fired frame combustion turbine"[19] but could be met by, e.g. "seasonal contracts, mid-term/short-term contracts, energy storage, [or] combustion turbines."[20]

[16] PGE 2016 IRP, Table 12-16
[17] PGE 2016 IRP, Table 12-16
[18] PGE 2016 IRP, Appendix O, p 802
[19] PGE 2016 IRP, p 278
[20] PGE 2016 IRP, Appendix O, p 802.

Resource	2017	2018	2019	2020	2021	...	2025	...	2030	...	2035	...	2040
Energy Efficiency	16	61	104	144	180		297		404		490		571
DSG	4	9	13	17	22		30		39		48		57
DR	26	29	31	69	77		162		187		198		198
CVR	-	0.4	0.9	1.3	1.8		3.7		6.3		9.3		12.5
Wind Gorge	-	515	515	515	515		628		755		2,511		3,074
Wind Montana	-	-	-	-	-		-		-		-		-
Solar	-	-	-	-	-		-		-		-		-
Geothermal	-	-	-	-	-		-		-		-		-
Biomass	-	-	-	-	-		-		-		-		-
Efficient Capacity	-	-	-	-	389		389		389		389		389
Generic Capacity	-	290	318	318	397		707		888		1,322		1,574

Table 2—*Efficient Capacity 2021* Cumulative Resource Additions, Capacity (MW)[21]

Wind 2018 Long (Portfolio)

PGE's second best scoring portfolio, *Wind 2018 Long*, received a weighted score of 81—just two points less than the preferred portfolio.[22] Table 1 shows that *Wind 2018 Long* scored the highest (best) score for variability, 77 for cost, 94 for severity, and 63 for durability. Table 3 shows the cumulative capacity additions for this portfolio. As with *Efficient Capacity 2021*, there is the same renewables procurement in 2018. The key difference between the two portfolios comes in 2021, where instead of the 389 MW "efficient capacity" (modeled as a gas CCCT), the *Wind 2018 Long* portfolio includes 1,084 MW of additional Pacific Northwest wind. As with *Efficient Capacity 2021,* this portfolio includes some "generic capacity" in order to meet resource adequacy requirements.

[21] PGE 2016 IRP, Appendix O, p 810
[22] PGE 2016 IRP, Table 12-16

Resource	2017	2018	2019	2020	2021	...	2025	...	2030	...	2035	...	2040
Energy Efficiency	16	61	104	144	180		297		404		490		571
DSG	4	9	13	17	22		30		39		48		57
DR	26	29	31	69	77		162		187		198		198
CVR	-	0.4	0.9	1.3	1.8		3.7		6.3		9.3		12.5
Wind Gorge	-	515	515	515	1,599		1,599		1,599		1,599		3,074
Wind Montana	-	-	-	-	-		-		-		-		-
Solar	-	-	-	-	-		-		-		-		-
Geothermal	-	-	-	-	-		-		-		-		-
Biomass	-	-	-	-	-		-		-		-		-
Efficient Capacity	-	-	-	-	-		-		-		-		-
Generic Capacity	-	290	318	318	692		1,012		1,203		1,732		1,940

Table 3—*Wind 2018 Long* Cumulative Resource Additions, Capacity (MW)[23]

IV. PORTFOLIO RISK METRICS

This section discusses the risk metrics used to score the portfolios and highlights the flaws associated with the inclusion and weighting of the durability metric. The use of the durability metric is important because the top two portfolios, *Efficient Capacity 2021* and *Wind 2018 Long*, are distinguished mainly by how they score according to durability and variability metrics (see Table 1 and associated discussion). Moreover, while the latter metric is a requirement of the OPUC IRP guidelines, durability is not. Durability ultimately adds additional weight to cost.

The OPUC IRP Guidelines (effective 2007) state that, "To address risk, the plan should include, at a minimum: 1. Two measures of PVRR risk: one that measures the variability of costs and one that measures the severity of bad outcomes."[24] In the 2016 IRP, PGE uses three risk metrics which it calls "variability"[25], "severity"[26] and "durability"[27]; each of these metrics are equally weighted at 16.7%.[28] Unlike the variability and severity metrics, the durability metric does not provide a useful measure of risk. When Renewable Northwest pressed the company to justify the metric, we were directed to PGE's 2009 IRP, where the equivalent metric is treated and weighted differently.

PGE's 2009 IRP outlines its compliance with the above-referenced IRP Guidelines in Appendix A.[29] With regard to meeting the OPUC guidelines on PVRR risk, PGE's 2009 IRP states:

[23] PGE 2016 IRP, Appendix O, p 812
[24] UM 1056 (2007), Investigation Into Integrated Resource Planning, Order No. 07-002, Guideline 1: Substantive Requirements C)
[25] PGE 2016 IRP, p 297
[26] PGE 2016 IRP, p 298
[27] PGE 2016 IRP, p 302
[28] PGE 2016 IRP, p 301
[29] PGE 2009 IRP, Appendix A, pp331–349

> We use three measures of NPVRR risk for both the deterministic scenario analysis (portfolio robustness measure and worst four outcomes less the mean) and the stochastic analysis (standard deviation, and TailVar 90).[30]

This statement implies that in the 2009 IRP, the stochastic and deterministic risk metrics (the latter of which seem to include the equivalent of the 2016 IRP's "durability" metric) are PGE's method of complying with the Order No. 07-002 requirements[31] for measuring variability and severity. In contrast, the 2016 IRP treats "durability" as a separate and additional metric that is "helpful" when two portfolios may have "similar total portfolio scores"[32] but "perform quite differently respect to cost and risk".[33] PGE's 2016 IRP Appendix A, which again lays out the utility's compliance with the OPUC IRP Guidelines found in Order No. 07-002, states that to comply with the risk variability and severity requirements of Guideline 1)c)[34]:

> PGE measures the *variability* of costs by applying the semi-variance metric to portfolios' NPVRR results across futures. By averaging the three worst-case outcomes for each portfolio, PGE was able to assess the *severity* of outcomes." [Emphasis added].

PGE then added, "PGE also considers relative likelihood of high or low expected cost.[35] This seems to imply that the durability metric in the 2016 IRP (as "relative likelihood of high or low expected cost"[36]) is not directly associated with the OPUC IRP Guidelines and is additional. Below we describe each of the 2016 IRP risk metrics (variability, severity, and durability), discuss how they compare to each other, and explore the justification and utility of the durability metric.

Variability

Variability is primarily a measure of the uncertainty of future outcomes. PGE defines the variability metric as the "semivariance of the NPVRR across the futures for which the NPVRR exceeded the Reference Case NPVRR" [37] described by the equation:

[30] PGE 2009 IRP, Appendix A, p 334
[31] UM 1056 (2007), Investigation Into Integrated Resource Planning, Order No. 07-002, Guideline 1: Substantive Requirements C)
[32] PGE 2016 IRP, p 302
[33] PGE 2016 IRP, p 302
[34] M 1056 (2007), Investigation Into Integrated Resource Planning, Order No. 07-002, Guideline 1: Substantive Requirements C)
[35] PGE 2016 IRP, Appendix A, p 351
[36] PGE 2016 IRP, Appendix A, p 351
[37] PGE 2016 IRP, p 297

$$\text{Variability} = \sqrt{\sum_{i=1}^{n} \frac{(NPVRR_i - NPVRR_{ref})^2}{n}}$$

Where "$NPVRR_i$ is the cost associated with future *i*, $NPVRR_{ref}$ is the cost in the Reference Case, and n is the number of cost outcomes that are higher than the cost in the Reference Case."[38] Semivariance means that only the variation across high cost outcomes was considered, rather than across both high and low cost outcomes. Variability in this context can be thought of as standard deviation with an emphasis on the high cost outcomes. In narrative terms, the 2016 IRP states that this metric gives the company "an indication of how much the cost of a given portfolio may vary above the Reference Case cost—or how sensitive a given future is to uncertain conditions. This is primarily a measure of uncertainty".[39]

Severity

Severity is a metric that is indicative of the highest cost outcomes across futures. PGE defines the severity metric as focusing "on the absolute magnitude of bad outcomes" calculated as the "absolute average NPVRR across the futures that approximately fall in the top 10th percentile with respect to cost", selecting the three most expensive futures and averaging them.[40] In the company's words, while the variability metric "differentiates portfolios that are sensitive to uncertain future conditions", the severity metric "differentiates portfolios that introduce a risk of especially bad outcomes".[41]

Durability

The durability metric is a measure of how the portfolios rank with respect to each other with respect to their performance across futures. Regarding the durability metric, PGE's 2016 IRP states:

> Unlike the cost, severity and variability metrics, which look at one portfolio and compare its different cost outcomes across all futures, the durability across futures metric is a comparison between the costs of all portfolios for one future at a time. PGE interprets the durability across futures of a portfolio as the likelihood that it would perform well under the different probable futures versus the likelihood it would perform badly. The durability metric is helpful when considering two portfolios that may perform quite differently with respect to cost and risk but could have similar total portfolio scores due to the weights applied to cost and risk metrics.[42]

[38] PGE 2016 IRP, p 297
[39] PGE 2016 IRP, p 298
[40] PGE 2016 IRP, p 298
[41] PGE 2016 IRP, p 298
[42] PGE 2016 IRP, p 302

This description of durability is ambiguous with regard to whether the metric should be applied during portfolio scoring and then given special consideration, or after portfolio scoring as an additional screen to parse out portfolios with similar weighted scores. If the metric is used to determine the weighted score and two portfolios then have similar scores, is PGE suggesting that durability is then considered in isolation to distinguish the portfolios? Or is the implication that the portfolios should be scored without durability and then, if the portfolios have a similar score, the durability metric be considered. This distinction is important in the context of the 2016 IRP because, as Table 4 shows, the two top scoring portfolios only have similar scores when the durability metric is used to determine the weighted score.

PGE explains that the "calculation of durability is performed by examining the frequency with which each portfolio ranked among the top third (lowest cost) or bottom third (highest cost) of all portfolios for a given future".[43]

PGE's 2016 IRP uses the following formula for calculating durability:

$$P[\text{good performance}] = \frac{[\text{number of futures in which portfolio is among the top third of portfolios}]}{[\text{total number of futures}]} \times 100$$

$$P[\text{bad performance}] = \frac{[\text{number of futures in which portfolio is among the bottom third of portfolios}]}{[\text{total number of futures}]} \times 100$$

$$\text{Durability across futures} = P[\text{good performance}] - P[\text{bad performance}]$$

Figure 1—PGE 2016 IRP Formula for Calculating Durability across Futures[44]

The company then goes on to give an example meant to illustrate the utility of this metric, using the graphic shown in Figure 2.

[43] PGE 2016 IRP, p 299
[44] PGE 2016 IRP, p 299

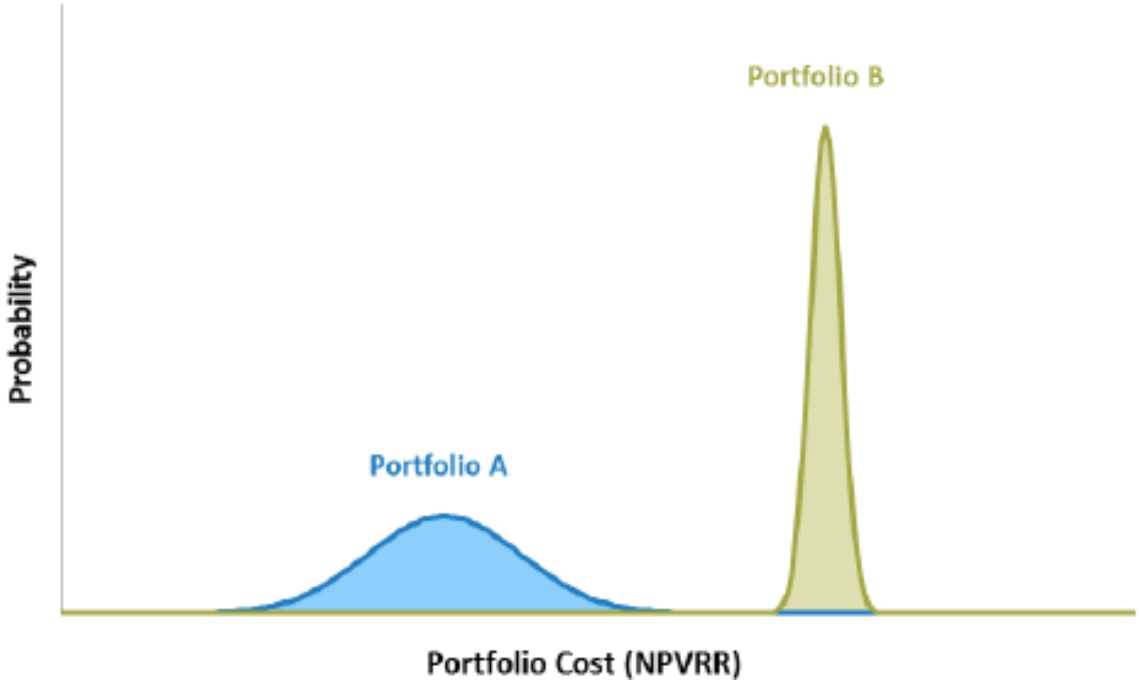

Figure 2—PGE's illustrative example of cost distributions for two competing portfolios[45]

In this example, Portfolio A "has a low cost but high risk due to high variability" and Portfolio B "has a high cost but low risk".[46] In this illustrative example, "Portfolio A is lower cost than Portfolio B in every possible future" and therefore "customers would always prefer portfolio B in hindsight".[47] The Company adds that, "Consideration of this type of ordinal information within futures is critical to effective application of scenario analysis in decision making and this is achieved in the IRP through the durability metric."[48]

PGE's example helps illustrate some of the concerns with the use of durability. First, while durability may capture ordinal information (1st, 2nd, 3rd etc), it loses any cardinal information associated with cost (for example an NPVRR of $31,319 million versus an NPVRR of $31,875 million). Second, durability acts as a proxy for cost. If PGE's example was meant to illustrate the usefulness of the application of durability in the 2016 IRP, such an example does not characterize how *Efficient Thermal 2021* and *Wind 2018_Long* compare to one another. While the difference in cost score between 2018 and 2021 is small, the difference in variability score is significant. This point is illustrated by the 77 cost score for Wind Long 2021, as compared to 100 points for Efficient Thermal 2021. In contrast, Efficient 2021 receives 0 points for variability while Wind long receives 100. The fact that durability brings Efficient Thermal 2021 to the top overall weighted score underscores the degree to which the metric acts as a proxy for cost. If the goal of an IRP were simply to identify the portfolio with the lowest NPVRR, this issue would not be problematic. However, the goal of an IRP is to identify the portfolio with the lowest cost and risk.

[45] PGE 2016 IRP, Figure 11-1
[46] PGE 2016 IRP, p 300
[47] PGE 2016 IRP, p 300
[48] PGE 2016 IRP p 300

It appears that this example is meant to simulate the comparison between the portfolios *Wind 2018 Long* and *Efficient Capacity 2021*, the former of which has a higher NPVRR, with the latter scoring worse on variability (see Table 1).

Utility of the Durability Metric

Renewable Northwest questions the usefulness of the durability metric. PGE states that the durability metric is "helpful" when two portfolios may have "similar total portfolio scores"[49] but "perform quite differently respect to cost and risk"[50], suggesting in such a case that there is a need for additional analysis. This reasoning is problematic for two reasons:

> 1) in the case that two portfolios have the same score based on cost and risk, the implication should be that they achieve the same rank, without further need for parsing them out; furthermore,
>
> 2) durability already *is* one of the risk metrics, having equal weight with severity and variability, so it is unclear how the durability metric helps distinguish portfolios with the similar portfolio scores when the durability metric itself contributes to that score.

Renewable Northwest prepared Table 4 to show the same portfolios and portfolio scoring as in Table 1, except that the weighted score is based on 50% cost (as in Table 1), 25% severity and 25% variability (so still 50% risk as in Table 1), with durability set to zero %. In this way, it can be seen whether there are portfolios that have similar total portfolio scores without the durability metric. Table 4 shows Wind 2018 Long to rank first with a weighted portfolio score of 87, while Efficient Capacity 2021 comes in second with a weighted portfolio score of 75—a difference of 12 points. In this analysis, given the significant margin between the top performing portfolio and the second best performing portfolio, the need for the durability metric—according to PGE—is not met, as the portfolios do not have a "similar portfolio score".[51] In fact, the top two performing portfolios only have a similar portfolio score when the durability metric is used.

[49] PGE 2016 IRP, p 302
[50] PGE 2016 IRP, p 302
[51] PGE 2016 IRP, p 302

Portfolio Name	Cost	Severity	Varability	Durability	Weighted Score	RANK
Efficient Capacity 2021	100	100	0	100	75	2
Wind 2018 Long	77	94	100	63	87	1
RPS Wind 2018	92	93	7	100	71	4
Wind 2018	86	89	24	87	71	3
Wind 2018 + Solar PV 2021	84	85	15	50	67	6
Geothermal 2021	82	83	24	50	68	5
Wind 2018 + Solar PV 2018	80	81	15	50	64	7
Boardman Biomass 2021	24	21	54	0	31	8
Efficient Thermal 2021 + High EE	12	10	70	0	26	9
Wind 2018 + High EE	0	0	89	0	22	10

Table 4—PGE 2016 IRP Portfolio Scoring Summary with Severity weighted at 25%, Variability at 25% (Total Risk 50%) and Durability at 0%

Comparison of Risk Metrics

As PGE indicates, the durability metric captures the ordinal information relating to how portfolios perform relative to one another,[52] but the methodology loses the cardinal information contained in the portfolios' NPVRRs. Whereas the variability metric is a measure of the "semivariance of the NPVRR across […] futures"[53], and the severity metric is "the absolute average NPVRR across the futures that approximately fall in the top 10th percentile with respect to cost"[54], the durability metric calculation is "performed by examining the frequency with which each portfolio ranked among the top third (lowest cost) or bottom third (highest cost) of all portfolios for a given future".[55] In conclusion, while the severity and durability metrics are a measure of portfolio risk with respect to different futures, the durability metric is a measure of how the portfolios rank with respect to each other across many futures, and is therefore an artefact of the composition of the other portfolios.

V. STAKEHOLDER INPUT ON RISK METRICS

Renewable Northwest sought to determine the extent of stakeholder involvement in the design of the durability metric and information explaining how the metric's weight was determined. PGE's 2016 IRP includes the following statement relating to public process and portfolio scoring:

> The goal of the scenario analysis was to identify the portfolios that consistently perform well across these futures, or in the case that relative portfolio performance is sensitive to uncertain future conditions, identify the relative risks of each portfolio with respect to variability and severity through a risk scoring process. PGE went through a lengthy public process in the current and prior IRPs to identify

[52] PGE 2016 IRP p 300
[53] PGE 2016 IRP, p 297
[54] PGE 2016 IRP, p 298
[55] PGE 2016 IRP, p 299

> metrics that incorporate these risk conditions.[56]

With regard to this statement, Renewable Northwest requested that the company provide further information on written and verbal stakeholder input on the risk metrics (severity, variability and durability). [57] In response to RNW DR 002, PGE stated:

> PGE did not remove the durability metric or alter the balanced weighting of the severity, variability, and durability metric. The durability metric was included in the acknowledged 2009 IRP scoring and continues to provide valuable information to the scoring process. The balanced weighting of the risk metrics is again, similar to the 2009 IRP scoring.[58]

Stakeholders first learned about the design and weight of durability, variability, and severity relatively late in the 2016 IRP process. In response to a data request by Sierra Club, PGE states that "scoring metrics and weighting were discussed during Round Table #16-1 [March 9, 2016] and Round Table #16-3 [August 17, 2016]."[59] However, Round Table #16-1 included only an overview of the OPUC IRP guidelines on scoring metrics and of PGE's guiding philosophy.[60] Stakeholders first learned in detail about the design and weight of variability, durability, and severity about three months before PGE filed its 2016 IRP in November 2016, and at the same meeting where PGE presented its draft preferred portfolio.[61] In other words, stakeholders were simultaneously presented with PGE's methodology and PGE's conclusion.

Although scoring metrics are key to justifying the selection of the 2016 IRP Preferred Portfolio, PGE did not meaningfully involve 2016 IRP stakeholders in decisions about the design and weighting of the metrics. In its response to data requests, PGE could not identify any such engagement efforts in the context of this IRP prior to August 17, 2016. [62] In fact, in response to our request that it identify any efforts to engage stakeholders prior to August 16, 2017 on decisions about design and weight of durability, severity, and variability, PGE referred to stakeholder and OPUC engagement in the context of its 2009 IRP.[63] Even when referencing its consideration of OPUC Staff and stakeholder input in the 2009 IRP, PGE only mentions being responsive with respect to the construction of the severity metric.[64] In the end, although in the context of the 2016 IRP PGE received written

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[56] PGE 2016 IRP, p 265
[57] PGE Response to RNW Data Request No. 002 Dated December 23, 2016
[58] PGE Response to RNW Data Request No. 002 Dated December 23, 2016 d)
[59] PGE Response to Sierra Club DR. No. 004, p. 2 (Dec. 7 2016).
[60] *See* Attachment 10, PGE's Presentation for 2016 IRP Roundtable #16-1, Slides 45-48, (Mar. 9 2016).
[61] *See* Attachment 11, PGE's Presentation for 2016 IRP Roundtable #16-3, Slides 20-31, (Aug. 17, 2016).
[62] PGE Response to Renewable Northwest DR. No. 001 (Jan. 6, 2017).
[63] *Id*.
[64] *Id*. ("With respect to the construction of the severity metric, PGE considered OPUC staff and stakeholder comments in the 2009 IRP, which emphasized the importance of severity metrics that consider the absolute cost of high cost outcomes, rather than the cost relative to the reference or expected case.")

and verbal criticism about the design and equal weighing of the three metrics,[65] neither has changed since PGE presented the three metrics in August 17, 2016.

PGE's 2009 IRP and the 2016 IRP Durability Metric

Renewable Northwest took PGE's direction from the company's response to our DRs 1–3 and looked to the 2009 IRP for more information on the durability metric, but was unable to find information that justified the metric's use in the 2016 IRP. During this investigation, it became clear that there wasn't an exact equivalent to durability in the 2009 IRP, and even within the 2009 IRP, the supposed equivalent risk metric was inconsistently referred to by many different terms including "robustness"[66], "risk durability"[67], and "Probability of High Expected Costs and Low Expected Costs".[68] Under the section titled "Description of Risk Metrics Used in Portfolio Scoring" of the 2009 IRP, eight risk metrics are listed in addition to the portfolio cost as measured by NPVRR.[69] Risk metrics 1–3 are deterministic, 4–6 are stochastic, and 7–8 deal with reliability and diversity.

1. Deterministic Portfolio Robustness
2. Deterministic Portfolio Risk Variability vs. Reference Case
3. Deterministic Portfolio Risk Magnitude
4. Stochastic Portfolio TailVar90 less the Mean
5. Stochastic Portfolio TailVar90
6. Stochastic Portfolio Year-to-Year Risk
7. Portfolio Reliability
8. Technology and Fuel Diversity

In describing the "Deterministic Portfolio Risk Variability vs. Reference Case" metric, PGE's 2009 IRP states that, "While the durability metric measures portfolio robustness in terms of frequency, it does not address magnitude of potential adverse outcomes. "[70] This implies that the previously discussed metric—Deterministic Portfolio Robustness—is a candidate for "durability metric [that] was included in the acknowledged 2009 IRP scoring."[71]

"Deterministic Portfolio Robustness" is described in the following paragraph from the 2009 IRP:

> In this risk metric, we look at the joint probability that a given portfolio does not rank among the four worst outcomes but does rank among the four best cost outcomes when measured against all 15 of our futures. This metric is measured as a

[65] *See* Attachment B to PGE Response to Renewable Northwest DR. No. 002 (Jan. 6, 2017); Additionally Renewable Northwest, other stakeholders, and OPUC Staff verbally raised their concerns with the design and weight of durability, variability, and severity in meetings with on September 21, 2016, and October 11, 2016.
[66] PGE 2009 IRP, p 248–250
[67] PGE 2009 IRP, Tabl2 11-2, p 285
[68] PGE 2009 IRP, p 261
[69] PGE 2009 IRP, p 248–250
[70] PGE 2009 IRP, p 249
[71] PGE Response to RNW Data Request No. 002 Dated December 23, 2016 d)

percentage. We do not assign weights to our futures, as we have no reliable basis to do so. Hence, they are in effect all equally likely. Our desire is to avoid portfolios that can have a high incidence of bad cost outcomes against all futures, while also identifying portfolios that have a high incidence of performing well against all of the futures. The intersection of these two views helps identify portfolios that are more robust and durable in the context of the possible futures they could operate within. For two portfolios with equal expected costs, we expect that the portfolio with a higher score in this metric will be less risky.[72]

Table 11-2 of the 2009 IRP (reproduced below in Table 5) provides the raw scores for cost and risk metrics, categorizing the metrics into deterministic, stochastic, and reliability[73], analogous to the list of eight metrics under in the 2009 IRP section "Description for Risk Metrics Used in Portfolio Scoring" discussed above.[74] There are three risk metrics under the deterministic section in Table 5 with one described as "Risk Durability", which by a process of elimination, must comport to "Deterministic Portfolio Robustness".

	1. Portfolio Evaluation Scoring: Raw Performance Metrics	Screening		Deterministic						Stochastic			Reliability & Diversity		
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)
	Scoring Consideration	Within Efficient Zone?	Meets Operating Reserve Req?	Cost: Expected Cost Reference Case	Prob. of Poor Perf.	Prob. of Good Perf.	Risk Durability: Good minus Bad	Risk Magnitude: Avg. Worst 4	Risk Magnitude: Avg. Worst 4 vs. Reference Case	Risk: TailVar	Risk: TailVar less Mean	Risk: Year-to-Year Variance	Reliability: TailVar Unserved Energy 2012-2020 & 2025	Diversity: Technology HHI	Diversity: Fuel HHI
	Units	Y or N	Y or N	$ NPV Million	%	%	%	$ NPV Million	$ NPV Million	$ NPV Million	$ NPV Million	Trillion	MWa	Points	Points
1	Market	Y	N	$ 27,211	5%	90%	86%	$ 36,155	$ 8,943	$ 29,598	$ 7,563	30.6	831.2	2240	2151
2	Natural Gas	Y	Y	$ 29,027	10%	5%	-5%	$ 35,436	$ 6,410	$ 31,050	$ 7,571	21.8	482.2	3506	1972
3	Wind	Y	Y	$ 29,288	5%	14%	10%	$ 34,238	$ 4,949	$ 27,679	$ 7,466	31.5	546.6	3168	1592
4	Diversified Green	Y	Y	$ 28,987	0%	14%	14%	$ 34,091	$ 5,104	$ 28,285	$ 6,986	21.2	517.3	2670	1635
5	Diversified Thermal with Wind	Y	Y	$ 28,891	5%	0%	-5%	$ 34,949	$ 6,057	$ 30,191	$ 7,479	19.5	495.3	2896	1920
6	Bridge to IGCC in WY	N	Y	$ 32,735	100%	0%	-100%	$ 38,635	$ 5,900	$ 32,609	$ 5,903	25.5	497.3	2693	2073
7	Bridge to Nuclear	Y	Y	$ 29,853	81%	0%	-81%	$ 34,610	$ 4,757	$ 30,373	$ 5,684	16.4	501.0	2195	1903
8	Green w/ On-peak Energy Target	Y	Y	$ 28,971	0%	19%	19%	$ 33,993	$ 5,023	$ 28,136	$ 6,937	21.7	474.0	2670	1582
9	Diversified Thermal with Green	Y	Y	$ 28,674	5%	71%	67%	$ 34,910	$ 6,236	$ 30,631	$ 7,280	21.1	492.3	2923	1942
10	Boardman through 2014	Y	Y	$ 28,593	5%	81%	76%	$ 35,126	$ 6,533	$ 31,727	$ 8,406	25.7	522.7	3718	2031
11	Oregon CO2 Compliance	N	Y	$ 30,375	81%	14%	-67%	$ 34,332	$ 3,958	$ 29,475	$ 6,801	27.2	521.7	2733	1556
12	Boardman through 2011	Y	Y	$ 28,777	10%	10%	0%	$ 35,247	$ 6,470	$ 31,827	$ 8,315	24.4	498.4	3718	2112
13	Diverse Green with wind in WY	N	Y	$ 30,828	86%	0%	-86%	$ 35,962	$ 5,134	$ 31,131	$ 5,638	15.5	426.0	2617	1662
14	Diversified Thermal w/ Green w/o Lease	Y	Y	$ 28,668	0%	71%	71%	$ 34,891	$ 6,223	$ 30,603	$ 7,453	23.6	505.2	3044	1956
15	Boardman through 2017	Y	Y	$ 28,780	10%	10%	0%	$ 35,257	$ 6,477	$ 31,670	$ 8,200	24.5	505.7	3718	1970
	Performance Range for Scoring Normalization:														
	Best Performing Portfolio(s)			$ 27,211			86%	$ 33,993	$ 3,958	$ 27,679	$ 5,638	16	426.0	2,195	1,556
	Best Basis			Min			Max	Min	Min	Min	Min	Min	Min	Min	Min
	Worst Performing Portfolio(s)			$ 32,735			-100%	$ 38,635	$ 8,943	$ 32,609	$ 8,406	31	831.2	3,718	2,151
	Spread Best to Worst			$ 5,524			186%	$ 4,641	$ 4,985	$ 4,930	$ 2,768	16	405.3	1,523	595
	% Difference			20.3%				13.7%	126.0%	17.8%	49.1%	103.0%	95.1%	69.4%	38.2%

Table 5—PGE 2009 IRP Portfolio Scoring Grid: Raw Scores for Cost and Risk Metrics[75]

In discussions of the portfolio scoring weightings, the 2009 IRP refers to "durability" (as it is called in the 2016 IRP) or "deterministic portfolio robustness"[76] / "risk durability"[77] as the "Probability of High Expected Costs and Low Expected Costs".[78] PGE described the methodology for this deterministic metric as:

> "the probability of poor performance equals the number of times that a given portfolio ranked among the worst four out of the 15 portfolios we tested against all

[72] PGE 2009 IRP, p 267
[73] PGE 2009 IRP, Table 11–2, p 285
[74] PGE 2009 IRP, p 248–250
[75] PGE 2009 IRP, Tabl2 11-2, p 285
[76] PGE 2009 IRP, p 267
[77] PGE 2009 IRP, Table 11-2, p 285
[78] PGE 2009 IRP, p 261

> 21 futures. Any portfolio that exhibits a high number of high-cost outcomes may be viewed as more likely to perform poorly under conditions that vary from the reference case." [...] "the joint probability of both avoiding poor performance and achieving good performance. This deterministic risk scoring metric receives 10% of the total score."[79]

This description seems to comport with the 2016 IRP's description of "durability across futures" as the difference between the probability of a good performance and the probability of a bad performance.[80]

In summary, the ""durability metric [that] was included in the acknowledged 2009 IRP scoring "[81] would seem to be referred to as "Deterministic Portfolio Robustness" in the 2009 IRP and described as a measure of "portfolio robustness in terms of frequency. "[82] However, the 2009 IRP does not provide sufficient information for the design and weighting of the durability metric in the 2016 IRP.

VI. RISK METRIC WEIGHTING IN THE 2016 IRP

PGE has not adequately justified the 2016 IRP's weighting of its risk metrics. In the 2016 IRP, PGE's three risk metrics—"variability", "severity", "durability"—are each equally weighted at 16.7%[83]. In our third data request, we sought information on how PGE had determined that these three risk metrics should have equal weight.[84] The Company once again referred to Sierra Club Data Request No. 004,[85] which merely states that the final scoring metrics were "informed by the OPUC Guidelines, the acknowledged 2009 IRP, and stakeholder discussions" without giving further detail as to how it was determined they should have equal weight.[86]

Renewable Northwest, at the direction of the company, again turned to PGE's 2009 IRP to find justification for how the risk metrics were weighted in the 2016 IRP. PGE's 2009 IRP had a far more complicated risk scoring structure in comparison to the 2016 IRP. PGE's 2009 IRP weighting system was as follows:

- "Portfolio expected cost under reference case assumptions" received 50% of the total score in the 2009 IRP.[87]
- "Variations from expected costs using several deterministic and stochastic risk metrics" received 30% of the total score.[88]

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[79] PGE 2009 IRP, p 261
[80] PGE 2016 IRP, p 299
[81] PGE Response to RNW Data Request No. 002 Dated December 23, 2016 d)
[82] PGE 2009 IRP, p 249
[83] PGE 2016 IRP, p 301
[84] PGE Response to RNW Data Request No. 003 Dated December 23, 2016
[85] PGE Response to RNW Data Request No. 003 Dated December 23, 2016
[86] PGE Response to Sierra Club DR. No. 004 Dated December 7, 2016
[87] PGE 2009 IRP, p 257
[88] PGE 2009 IRP, p 268

- Stochastic risk assessment received 10% of PGE's total score[89] (Tailvar 90 3.33%[90], tailvar90 without subtracting mean 3.33%[91], and year-to-year variability 3.33%[92]).
- Deterministic risk metrics received 20% of the total score:
  - "Average of Worst Four Futures" received 5% of the total score.
  - Average of worst four futures without subtracting these results from the reference case expected cost received 5% of the overall portfolio score.[93]
  - "Probability of High Expected Costs and Low Expected Costs" received 10% of the total score.[94]

- "Portfolio reliability performance" received 15% of the PGE's total score.[95]
- "Intrinsic diversity" received the remains 5% of the portfolio score.[96]

As with the 2016 IRP, cost received 50% of the total score in the 2009 IRP, and the remaining 50% was assigned to a variety of risk metrics. Deterministic risk metrics (which included the "Probability of High Expected Costs and Low Expected costs" potentially equivalent to the 2016 IRP) received 20% of the total score, stochastic risk received 10%, and then other metrics (reliability and diversity) received the remaining 20%. The "Probability of High Expected Costs and Low Expected Costs" received 10% of the total score in the 2009 IRP, or one fifth of the available risk score. It is not clear how this 2009 scoring breakdown provides justification in the 2016 IRP for the durability metric receiving equal weight (16.7%) with the severity and variability metrics.

VII. TRANSMISSION

A question has arisen with respect to the treatment of transmission rights in a future RFP that could potentially be issued if the 2016 IRP is acknowledged. In response to a data request from OPUC staff exploring the potential impact of transmission rights on portfolio scoring, PGE stated that, "Any new resources which PGE might acquire through the RFP process would be expected to bid into the RFP with sufficient transmission to deliver energy to load".[97] Renewable Northwest acknowledges that LC 66 is about PGE's IRP, not any potential subsequent RFP; however, the company's response to OPUC staff deserves comment.

To the extent that PGE may be holding transmission rights in excess of its current needs,

[89] PGE 2009 IRP, p 265
[90] PGE 2009 IRP, p 266
[91] PGE 2009 IRP, p 266
[92] PGE 2009 IRP, p 267
[93] PGE 2009 IRP, p 261
[94] PGE 2009 IRP, p 261
[95] PGE 2009 IRP, p 268
[96] PGE 2009 IRP, p 268
[97] PGE Response to OPUC Data Request No. 082, Dated January 3, 2017

possibly in anticipation of making the Carty Generating Station site available to potential bidders in any RFPs that could potentially be issued if the 2016 IRP is acknowledged[98], those transmission rights should be made available to any bidders—whether or not they propose to use the potential amended Carty site. Requiring bidders to "bid into the RFP with sufficient transmission to deliver energy to load" [99] while potentially simultaneously holding onto transmission rights for a potential rival project would place the latter at an unnecessary disadvantage and bias the RFP in favor of the former.

Renewable Northwest looks forward to further exploring and discussing this issue in the appropriate forum.

VIII. ACTION PLAN FLEXIBILITY AND THE RFP

Given the flaws with PGE's durability metric, PGE's current top portfolio should not be the preferred portfolio; rather, adjusting for the metric issues, *Wind 2018 Long* should be selected as the 2016 IRP preferred portfolio. In any case, for any 2021 procurement, renewable resources should have the opportunity to meet PGE's capacity and energy needs.

PGE's 2016 IRP Action Plan calls for the following "Capacity Resources" among its supply-side actions:

> PGE's capacity need in 2021, after actions for EE ["energy efficiency"], DR ["demand response"], CVR ["conservation voltage reduction"], DSG ["dispatchable stand-by generation"], and executed but not yet online Qualifying Facility (QF) contracts, is approximately 819 MW.
>
> PGE will issue one or more RFPs to acquire up to 850 MW of capacity. PGE will consider a mix of annual and seasonal resources. PGE may also enter into short and/or mid-term contracts (e.g. 2.5 years) to maintain resource adequacy between the time the capacity is needed and the time in which resources can be acquired through an RFP. Of the up to 850 MW, and in alignment with the Preferred Portfolio, PGE proposes pursuing acquisition of 375 to 550 MW of long-term annual dispatchable resources and up to 400 MW of annual (or seasonal equivalent) capacity resources.[100]

As can be seen from Table 1, PGE's top two actionable portfolios were only separated by a small margin. Furthermore, based on our concerns regarding the durability metric, Renewable Northwest concludes that *Wind 2018 Long* is the portfolio that offers the best balance of cost and risk considerations. We therefore recommend that *Wind 2018 Long* be selected as the 2016 IRP preferred portfolio. In either case, any RFP that results from the Action Plan needs to be able to objectively consider bids that reflect either of the main

[98] As potentially indicated in the Amendment Request to the Carty Generation Station site certificate, initially filed in August 2016 www.oregon.gov/energy/Siting/Pages/CGS.aspx
[99] PGE Response to OPUC Data Request No. 082, Dated January 3, 2017
[100] PGE 2016 IRP pp 343–344

procurement additions in 2021 as reflected in the top two portfolios: 1,084 MW of PNW wind capacity (or renewable energy equivalent) from *Wind 2018 Long*, or 389 MW of "efficient capacity" from *Efficient Capacity 2021*. To this end, we note that renewable resources are beneficial not only for RPS compliance purposes, but also to contribute to a utility's energy and capacity needs.

We also note that if PGE pursues a single RFP to meet the 2018 and 2021 resource additions, the potential complexity associated with such a single, all-source RFP should not delay the timely procurement of renewable resources that maximises realization of federal tax credits and other benefits. Renewable Northwest looks forward to further exploring and discussing these issues in the appropriate forum.

IX. CONCLUSIONS

Renewable Northwest would once again like to acknowledge its gratitude for the opportunity to comment on PGE's 2016 IRP, and recognize the hard work of the company's IRP team.

Renewable Northwest supports PGE's plans to acquire 175 MWa of renewable resources by 2018.[101] Such an acquisition will simultaneously enable PGE to meet future energy needs, as well as comply with renewable energy requirements in a low cost manner (see Section II).

We have concerns about PGE's risk metrics in the 2016 IRP, specifically durability. There is insufficient justification for this metric in the 2016 IRP (or the 2009 IRP, which the company directed Renewable Northwest towards). Renewable Northwest recommends that the Commission require PGE to remove durability from the weighted portfolio score.

Finally, Renewable Northwest makes two observations with regards to any potential RFP that may follow acknowledgment of the 2016 IRP. Renewable Northwest recommends that any available transmission rights held by PGE, possibly for purposes of expansion of the Carty Generating Station, be made available to bidders offering competing projects. Renewable Northwest also recommends that any RFP addressing procurement for 2021 be able to fairly accommodate project bids reflecting either of the top performing portfolios.

Respectfully submitted this 24th day of January, 2017.
Sincerely,

s/ M H O'Brien
Michael H O'Brien (michael@renewablenw.org)
Renewable Northwest
421 SW 6th Avenue, Suite 1125, Portland, OR 97204
503-223-4544

[101] PGE 2016 IRP, p 343

December 21, 2016

TO: Gloria Smith
Alexa Zimbalist
Sierra Club Law Program

FROM: Patrick Hager
Manager, Regulatory Affairs

PORTLAND GENERAL ELECTRIC
LC 66
PGE Response to Sierra Club DR No. 004
Dated December 7, 2016

Request:

Please refer to Chapter 11:

a. Please provide all combinations and weights of scoring metrics reviewed by the Company.
b. Please provide documents and analyses supporting the final scoring metrics used.
c. Please provide documents and analyses supporting the weighting of these scoring metrics.

Response:

PGE objects to this request on the basis that it is overly broad and unduly burdensome. Without waiving its objection PGE replies as follows:

a) Attachment 004-A, worksheet "DraftIRP" contains the scoring metrics and weights from PGE's Draft 2016 IRP. Worksheet "SeverityVariance" contains a range of weightings for severity and variance that were examined as part of stakeholder meetings after the Draft IRP was posted. Worksheet "FinalIRP" contains the scoring metrics and weights from PGE's 2016 IRP.

b) The final scoring metrics and weights were informed by the OPUC Guidelines, the acknowledged 2009 IRP, and stakeholder discussions.

OPUC IRP guidelines govern PGE's approach in evaluating portfolio costs and associated risks:

Guideline 1C

- "The primary goal must be the selection of a portfolio with the best combination of expected costs and associated risks."
- […] "Utilities should use present value of revenue requirement (PVRR) as the key cost metric"
- […] "To address risk, the plan should include, at a minimum: 1. Two measures of PVRR risk: one that measures the variability of costs and one that measures the severity of bad outcomes."

As with the 2009 IRP, cost and risk are balanced with 50/50 weighting in the 2016 IRP. Similar to the 2009 IRP, risk metrics capture variability, severity, and durability risks. With respect to the construction of the severity metric, PGE referred to discussion in OPUC staff and stakeholder comments in the 2009 IRP, which emphasized the importance of severity metrics that consider the absolute cost of high cost outcomes, rather than the cost relative to the reference or expected case.

Scoring metrics and weighting were discussed during Round Table #16-1 and Round Table #16-3 as well as stakeholder meetings held prior to filing the final IRP. Based on feedback from stakeholders received after publishing the draft IRP, PGE modified the scoring metrics to remove the Curtailment Potential metric from the final evaluation.

In the 2016 IRP, resource adequacy is treated as a screen, with all portfolios (excluding Portfolio 1) constructed to achieve resource adequacy.

c) See part b.

	Cost Metric	Risk Metric			
	Reference Cost	Severity	Variance	Risk Durability	RPS Curtailment
Weight	50%	15%	15%	15%	5%

Severity and Variability
2016 IRP Stakeholder Discussion

Variability \ Severity	0.0%	2.5%	5.0%	7.5%	10.0%	12.5%	15.0%	17.5%	20.0%	22.5%	25.0%	27.5%	30.0%	32.5%	35.0%	37.5%	40.0%	42.5%	45.0%
45.0%	0%																		
42.5%	3%	0%																	
40.0%	5%	3%	0%																
37.5%	8%	5%	3%	0%															
35.0%	10%	8%	5%	3%	0%														
32.5%	13%	10%	8%	5%	3%	0%													
30.0%	15%	13%	10%	8%	5%	3%	0%												
27.5%	18%	15%	13%	10%	8%	5%	3%	0%											
25.0%	20%	18%	15%	13%	10%	8%	5%	3%	0%										
22.5%	23%	20%	18%	15%	13%	10%	8%	5%	3%	0%									
20.0%	25%	23%	20%	18%	15%	13%	10%	8%	5%	3%	0%								
17.5%	28%	25%	23%	20%	18%	15%	13%	10%	8%	5%	3%	0%							
15.0%	30%	28%	25%	23%	20%	18%	15%	13%	10%	8%	5%	3%	0%						
12.5%	33%	30%	28%	25%	23%	20%	18%	15%	13%	10%	8%	5%	3%	0%					
10.0%	35%	33%	30%	28%	25%	23%	20%	18%	15%	13%	10%	8%	5%	3%	0%				
7.5%	38%	35%	33%	30%	28%	25%	23%	20%	18%	15%	13%	10%	8%	5%	3%	0%			
5.0%	40%	38%	35%	33%	30%	28%	25%	23%	20%	18%	15%	13%	10%	8%	5%	3%	0%		
2.5%	43%	40%	38%	35%	33%	30%	28%	25%	23%	20%	18%	15%	13%	10%	8%	5%	3%	0%	
0.0%	45%	43%	40%	38%	35%	33%	30%	28%	25%	23%	20%	18%	15%	13%	10%	8%	5%	3%	0%

2016 IRP

LC 66 – Renewable Northwest's Comments
Attachment No. 2
Page 3

	Cost Metric	Risk Metric		
	Reference Cost	Variability	Severity	Durability across futures
Weight	50%	16.7%	16.7%	16.7%

LC 66 - Renewable
Northwest's Comments
Attachment No. 3

January 6, 2017

TO: Silvia Tanner
Renewable Northwest

FROM: Patrick Hager
Manager, Regulatory Affairs

PORTLAND GENERAL ELECTRIC
LC 66
PGE Response to RNW Data Request No. 001
Dated December 23, 2016

Request:

Please list efforts to engage stakeholders, prior to August 17, 2016, first roundtable that included a presentation on the metrics, on decisions regarding the design and weighing of the risk scoring metrics severity, variability, and durability.

Response:

The scoring metrics and weightings for the 2016 IRP are similar to the 2009 IRP, which also used a balanced 50/50 weighting of cost and risk and included risk metrics for variability, severity, and durability. With respect to the construction of the severity metric, PGE considered OPUC staff and stakeholder comments in the 2009 IRP, which emphasized the importance of severity metrics that consider the absolute cost of high cost outcomes, rather than the cost relative to the reference or expected case. Please refer to PGE's Response and First Supplemental Response to Sierra Club DR No. 004, part b for additional information on meetings where metrics were discussed.

Throughout the public process for the 2016 IRP (i.e., beginning with Public Meeting #1 on April 2, 2015), PGE has encouraged participants to submit questions and comments via email or the online feedback form provided on the Company's website. PGE has tracked and responded to feedback and comments received, sharing the information during the Public Meetings and Round Tables. The tracked feedback and comments are provided in PGE's Response to Renewable Northwest DR No. 002, Attachment 002-A.

January 6, 2017

TO: Silvia Tanner
Renewable Northwest

FROM: Patrick Hager
Manager, Regulatory Affairs

PORTLAND GENERAL ELECTRIC
LC 66
PGE Response to RNW Data Request No. 002
Dated December 23, 2016

Request:

Page 295 of the filed 2016 IRP includes the following statement: "The goal of the scenario analysis was to identify the portfolios that consistently perform well across these futures, or in the case that relative portfolio performance is sensitive to uncertain future conditions, identify the relative risks of each portfolio with respect to variability and severity through a risk scoring process. PGE went through a lengthy public process in the current and prior IRPs to identify metrics that incorporate these risk considerations." Please respond to the requests below with regards to variability, severity, and durability:

a) Please list PGE's efforts in the current IRP to seek stakeholder input regarding the metrics design and weighing, including dates and the stakeholders involved.
b) Please list any written or verbal input provided by stakeholders about the metrics design and weighing in the 2016 IRP.
c) Please describe how PGE was responsive to the stakeholder input listed in subsection (b) above.
d) If PGE was not responsive to a particular stakeholder's input listed in subsection (b) above, please explain PGE's rationale.

Response:

PGE objects to the request on the grounds that it is overly broad and unduly burdensome. Without waiving these objections, PGE responds as follows:

a) Please see PGE's Response and First Supplemental Response to Sierra Club DR No. 004 and PGE's Response to Renewable Northwest DR No. 001. Additionally, PGE encouraged stakeholders to submit comments on the Draft IRP (posted September 26,

2016) and held subsequent meetings, where Renewable Northwest was a meeting attendee, which included discussions of scoring metrics and weightings. Section 2.3, *2016 IRP Public Process,* summarizes stakeholder participation in this IRP.

b) PGE did not receive any written input from stakeholders regarding scoring metrics or weightings prior to posting portfolio results. Attachment 002-A provides the tracking of feedback and comments from Public Meetings, Round Tables, and the IRP's online feedback form. Attachment 002-B provides the only set of comments received in response to the Draft IRP that included a discussion of scoring metrics and weightings.

   After reviewing the draft IRP, some stakeholders provided verbal feedback, including requests to see variance calculations, examine the impact of different weightings of risk metrics, remove the durability metric, and remove the severity metric. Several stakeholders requested that PGE remove the curtailment metric.

c) PGE added Section L.3.2, *Variability Insights*, in Appendix L in response to the request to examine variance calculations. PGE also presented an analysis showing the impact of changing risk weightings (see PGE's Response and First Supplemental Response to Sierra Club DR No. 004, Attachment 004-B). Additionally, PGE removed the curtailment metric from the risk scoring based on verbal input from several stakeholders.

d) PGE did not remove the durability metric or alter the balanced weighting of the severity, variability, and durability risk metrics. The durability metric was included in the acknowledged 2009 IRP scoring and continues to provide valuable information to the scoring process. The balanced weighting of the risk metrics is again, similar to the 2009 IRP scoring

October 26, 2016

Submitted via online stakeholder feedback form and via email to IRP@pgn.com

Re: Docket LC 66: Portland General Electric's 2016 IRP

Sierra Club submits the following preliminary comments on Portland General Electric's Draft 2016 IRP. These comments were prepared with technical assistance from Tyler Comings and Ariel Horowitz of Synapse Energy Economics, Inc. As with other Oregon IRP processes Sierra Club has participated in, we focus on the overarching goal of achieving transparent resource planning that strikes a balance between low costs and risk mitigation.

I. Summary of PGE's IRP analyses

In its Draft 2016 IRP, PGE developed a variety of resource portfolios and evaluated each under different "futures." These futures vary factors for consideration such as natural gas prices (Reference and High), carbon prices (Reference, High, and no price), and load growth (Reference, High, and Low)—among others. PGE tested the portfolios under combinations of futures (e.g. High CO_2/High Gas/High Load) and then chose a select subset of portfolios for further analysis. This subset contained those portfolios designated as "action plan candidates," meaning PGE considered them to be viable plans. PGE did not disclose its criteria for designating a portfolio as an "action plan candidate;" And, notably, several low-cost portfolios did not qualify.

Sierra Club evaluated the modeling results of the action plan candidate portfolios under various futures based on cost in the reference case and on four additional risk metrics created by PGE. These risk metrics—which collectively represent half of each portfolio's score—include severity, variability, durability, and curtailment. PGE weighted the metrics, and then used the total combined cost and risk score to rank portfolios against one another. As a result of this process, PGE concluded that its "preferred portfolio" was "Efficient Thermal 2021"—which includes the procurement of new natural gas combined-cycle (NGCC) capacity starting in 2021.

II. The IRP's methodology lacks standard industry rigor

PGE's methodology in developing its preferred portfolio lacked rigor and does not provide sufficient support to justify its portfolio selection. Instead of evaluating a diverse set of real resource options, the IRP focuses on portfolios that are composed of generic resources. It

also lacks analytical sophistication in evaluating these portfolios under future uncertainty as the risk metrics and weighting of those metrics are severely flawed.

A) PGE did not conduct capacity optimization modeling

PGE developed portfolios of pre-determined resource mixes which generally meet energy and capacity obligations while also complying with the Oregon Renewable Portfolio Standard (RPS). PGE then tested these portfolios under "futures" to determine the net present value of revenue requirements (NPVRR) under different conditions—focusing on variations of carbon, natural gas, and load forecasts. However, while the mix of specific resources changes between portfolios, the bulk of the Company's new capacity is comprised of proxy resources. While the Company asserted that it can procure a mix of resource types to fill these positions (for example, a mix of thermal and hydropower as well as seasonal or long-term contracts), PGE instead chose to model these proxies as natural gas-fired resources only. These come in the form of natural gas combined-cycle (labeled "efficient capacity") or combustion turbine (labeled "generic capacity") units.

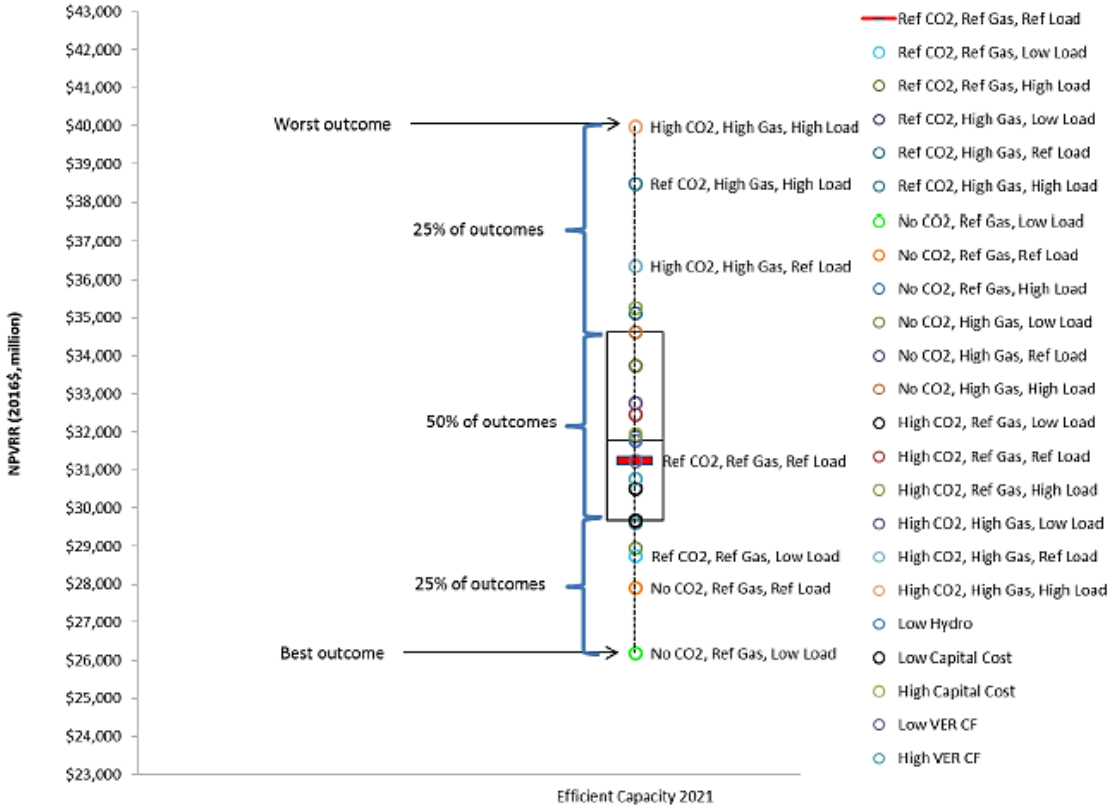
PGE did not conduct full "capacity expansion" modeling to form its candidate resource portfolios. These types of models are important because they review customer peak and energy demand, as well as current and projected resources, and build resources as required to meet those demands at lowest possible cost. Key conditions—such as natural gas and carbon prices—will affect not only how often existing resources are operated but also what capacity is added or retired. In turn, those changes affect the market prices of energy that PGE would buy or sell. For instance, if a utility knew that natural gas prices were going to skyrocket, it might think twice about planning to build a new natural gas generator. Typically, capacity expansion models are populated with a large number of supply-side (and sometimes demand-side) resources, and allowed to choose the least-cost mix of resources. Had the Company conducted this type of modeling, it could have rigorously tested the portfolio mix selected by the optimization model against different market conditions. Instead, the Company's portfolios are pre-determined, and much of the capacity added is little more than filler—modeled as natural gas combustion turbines (CT) or natural gas combined-cycle units (CC).

The Company's methodology is flawed because it does not take into account the full range of resources available to the Company, nor does it provide an indication which of the resources that might fall into the category of "generic" or "efficient" capacity are actually cost-effective. The Company assumes that retiring existing capacity (e.g. Boardman) would necessitate new natural gas construction, mostly ignoring the alternative of procuring existing resources, either outright or through power purchase agreements (PPAs). When capacity resources are not needed in the immediate future, the possibility of procuring other types of new resources should be incorporated into the scenario modeling. PGE's approach also does not allow for capacity to change with market conditions. As it stands, PGE is falsely limiting its

options. **We recommend that the PGE conduct capacity expansion modeling to provide the Company with a more meaningful example of what it should be pursuing.**

B) PGE did not perform a probabilistic analysis

PGE's "futures" analysis tests bounds of potential market outcomes. The Company then estimates the cost of a subset of portfolios under combinations of these futures (e.g. High CO_2/High Gas/High Load). Under this methodology, there is a range of possible cost outcomes for each portfolio. The results for the Company's preferred portfolio under all futures are shown below:[1]



PGE's reference case (shown as a red bar above) includes its assumptions for most likely carbon price, natural gas price, and load forecast. The other cost results are based on variations around that reference case. Notably, they skew above the reference case. This is due to the Company not testing under a low natural gas price future—only a "reference" and a high natural gas price future. Despite the reference case being the most likely outcome—according to PGE—the Company did not assign probabilities of different cases occurring. This method is misleading even though the reference case was given more credence as the key cost metric for the portfolio.

[1] Draft IRP, p.303.

PGE treated every other scenario as if it had an equal likelihood of occurring, which is not the case.

It is common utility practice to conduct probabilistic analysis to account for uncertainty. In that type of analysis, the probabilities are assigned for each event. For instance, one could assume that the reference gas price has a 75 percent chance of happening while the high price only has a 25 percent chance of happening. One could also assume that the reference carbon price has a 50 percent chance of occurring while the low and high each have a 25 percent chance. For combinations of these futures, the probabilities would look like the following:

Probability	Reference Gas (75%)	High Gas (25%)
No Carbon (25%)	19%	6%
Reference Carbon (50%)	38%	13%
High Carbon (25%)	19%	6%

The example above is a basic one using only two variables with illustrative probabilities assigned. In practice, probabilities could be applied to each "future." An even more sophisticated and meaningful approach would be to conduct stochastic (or Monte Carlo) analysis whereby each variable is given a probability distribution and the model randomly selects combinations of these variables—given the likelihood of each variable occurring. This generally accepted method allows for a robust analysis of the myriad risks at play. It has been used in other IRPs filed recently in Oregon and will be used in future IRP's.[2] In contrast, the Company has conducted a simplistic analysis that does not account for the likelihood of different futures occurring. This treatment, along with flaws in the scoring metrics, led PGE to give too much credence to unlikely scenarios. **We recommend that PGE more robustly account for risks by conducting a probabilistic analysis of portfolios.**

III. The IRP's scoring metrics are misleading and the Company's weighting methodology is arbitrary

In order to identify a single, preferred portfolio, the Company developed a set of scoring metrics. These metrics are meant to enable comparison of modeling results across futures and portfolios. Costs from different futures are often not comparable to one another; for example, a

[2] Idaho Power. 2015 Integrated Resource Plan. June 2015. Available at: https://www.idahopower.com/pdfs/AboutUs/PlanningForFuture/irp/2015/2015IRP.pdf.
Pacificorp. 2017 Integrated Resource Plan. Public Input Meeting 4. September 22-23, 2016. Available at: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Integrated_Resource_Plan/2017_IRP/PacifiCorp_2017_IRP_PIM04_9-22-2016_to_9-23-2016.pdf

future with a high gas price assumption will generally yield higher costs across all resource portfolios than a future with lower gas prices. Arriving at this result would not be surprising, nor informative in and of itself. The risks themselves are also not equally likely to occur. The highest- and lowest-cost scenarios tend to be the least likely to occur and should therefore be given lower weights. Utilities perform stochastic or probabilistic analyses such as those described above in order to be able to weigh futures according to their likelihood, thereby allowing more useful comparisons.

Because PGE did not perform probabilistic analysis, it could not directly compare risk-weighted costs from different futures. Instead, it relied on a set of scoring metrics to arrive at a portfolio "score" out of 100 possible points. Out of 100 possible points, 50 are allocated to cost in the reference case, with the cheapest portfolio getting the most points. The remaining 50 are split between: "severity" (a measure of the cost of the three most expensive scenarios for each portfolio); "variability" (a measure of the range of costs that fall above cost in the reference case, with more expensive cases weighted more heavily); "durability" (a measure of how often a given portfolio is among the cheapest, in the middle, or most expensive across the tested futures); and "potential curtailment" of renewable energy (a modeling result from the Company's flexible resource study). Severity, variability, and durability are allocated 15 points each, with the remaining 5 points represented by the curtailment score. The particular combination of metrics used by the Company and the weighting of various metrics relative to one another are unique to PGE's 2016 Draft IRP. PGE's proposed scoring methodology has not been justified or employed previously by the Company or, in Sierra Club's knowledge, other utilities.

PGE's crude scoring methodology is weak in a number of important ways. First, the scoring methodology fails to clearly identify a single top-performing portfolio. As the Company and stakeholders have noted, the scores of the top-four performing portfolios are separated from one another by less than five "points" (in other words, by less than the total weighted value of any individual metric). This narrow distribution indicates that the Company's scoring method is not yielding the most useful information to identify *one* preferred portfolio. Indeed, in an October 19, 2016, stakeholder meeting, PGE demonstrated that its choice of preferred portfolio could shift depending on relatively small changes in the weighting of the different risk metrics, showing that the Company's approach is not robust or reliable.

This demonstration is of particular concern because PGE's weighting of metrics relative to one another in its scoring method is arbitrary. The Oregon Public Utility Commission guidelines state only that utilities should rely on present value revenue requirements (PVRR) as the key metric of cost, and that utilities should seek to measure portfolio risk by using at least two separate measures which address the variability of costs and the severity of high-cost outcomes.[3] Nowhere do the guidelines direct the Company to "balance" cost and risk by

[3] Draft IRP, p.292.

assigning the two equal weight in portfolio evaluation. The Company did not, and cannot, support its choice of a half-and-half split as the appropriate approach to seeking the portfolio with the "best combination" of cost and risk. Likewise, the Company has not justified its arbitrary designation of relative weight of the risk metrics to one another.

Next, the metrics themselves are flawed and vulnerable to distortionary results. The Company cannot support its inclusion of curtailment as a metric at all, as it has not evaluated how curtailment of renewables would affects its costs or to what extent it could be a "risk" to ratepayers. Rather, PGE conducted a flexibility study to determine an upper bound for curtailment under various circumstances, under the unrealistic assumption that it must act as an isolated electrical "island." PGE appears not to have considered that allowing some curtailment may actually lower system costs in the aggregate under certain circumstances. In some cases, procurement of additional renewable energy rather than a thermal resource may be an optimal solution despite the potential need to curtail in select hours. However, the Company's analysis would not allow it to identify such circumstances, as it failed to perform capacity expansion modeling (which would select an optimal combination of resources, as described above), to determine realistic levels of curtailment given its ability to transact for energy outside of its service territory, or even to value curtailed energy.

The remaining three metrics do a poor job of conveying the risks of different portfolios. As discussed above, PGE's selection of futures has already biased its portfolio results towards higher-than-reference costs. Compounding this, the Company's scoring metrics and weighting overemphasize these costs. The severity metric examines *only* the three highest-cost results for any given portfolio, which are also the highest-weighted costs in the variability metric and also influence the durability metric. A single high-cost result, no matter how unlikely, can therefore have an extreme influence on a portfolio's ultimate score. Severity does not need to be used in ranking portfolios against one another—as PGE is now. Alternatively, the severity metric could be used as a way of screening out portfolios. For instance, one could eliminate portfolios with extremely high 95th percentile costs results.

Correspondingly, PGE's method underrepresents low-cost results, and therefore fails to truly capture variability across portfolios and futures. Only the durability metric takes any lower-than-reference costs into account and it does so only if a portfolio scores in the cheapest third of all portfolios in a given future. This creates an arbitrary threshold effect whereby a portfolio in the 33rd percentile of costs (i.e. the bottom third) in all futures it would receive a "100"—the highest score—but one in the 34th percentile would get a score of "0". This system assigns the same score to a portfolio that always ended up "in the middle" to a portfolio that scored in the cheapest third in half of all futures and the costliest third in the other half. This is a poor measure of the balance of "good" and "bad" outcomes: "reliably good" is an important characterization of a portfolio's risks, and is distinct from "sometimes excellent and sometimes terrible." The Company's method obscures the differences between the two. Indeed, taken as an aggregate, the metrics used by PGE systematically undervalue centrality of costs. The Company's decision to

focus on the absolute highest-cost portfolio results, regardless of their likelihood and to the lack of emphasis on central and "middle" outcomes, is a shallow and unhelpful representation of the concept of risk.

The Company should have employed a standard measure of variance that took both high- and low-cost results into account. This type of risk metric would be more robust and transparent. Instead, the Company chose to not follow standard practice, and went beyond Commission directives in selecting its metrics and scoring methods. The Company's approach introduces a skewed view of risk that does not give the Company, the Commission, or stakeholders useful information with which to evaluate various portfolio options. **We recommend that PGE remove the "curtailment" and "durability" metrics, use a standard measure of variance for "variability," and screen out extremely high-cost portfolios for "severity."**

The Company did not provide stakeholders with workbooks or even PVRR results by portfolio and futures, making it impossible for anyone to evaluate how different portfolios would perform under alternative scoring regimes. While we appreciate PGE's efforts to engage with stakeholders, transparency and access to data are key to productive stakeholder involvement. The lack of available data has made such involvement overly challenging at this stage of the Company's IRP process. **We recommend that PGE—at a bare minimum—be required to provide scenario results to stakeholders in the future.**

IV. The IRP is biased towards building new natural gas generation

As shown above, many of PGE's novel methodologies cause bias towards PGE acquiring new natural gas generation. In each portfolio, the Company's resource gap is filled primarily with proxy resources, which provide either capacity only ("generic capacity," modeled as a natural gas combustion turbine or "CT") or capacity and dispatchable energy ("efficient capacity," modeled as a natural gas combined-cycled or "CC"). While PGE has stated that any mix of resources may respond to the anticipated RFP, its modeling is predicated on assumed additions of CTs and CCs. As such, one of the IRP's primary modeling conclusions is that building an NGCC is preferable to building a CT, largely due to conditions outside the PGE territory.

According to PGE, a new CC would fare well on the energy market. However, by definition, this result depends on the Company's assumptions about the set of units that is likely to be built and operated in the rest of the west (*i.e.*, the local energy market). A new CC looks attractive under high carbon and high gas prices because it is more efficient and has a lower emissions rate than the market under PGE's assumptions. But the Company modeled the regional market as having a much higher carbon-intensity outside its territory, partially as a result of its assumption that western coal capacity will not change with different carbon tax levels.[4] This is

[4] Draft IRP, p.771.

unrealistic and likely misleading, especially under a high carbon tax regime. The assumption that the Company will be able to arbitrage the carbon intensity of its fleet compared to the region as a whole is based on the notion that other utilities are unlikely to respond to the same price or regulatory signals as PGE.

While the Company has claimed that it would consider procurement of other resource types following an RFP process, the portfolio costs and scores are predicated on the Company's choice to model new capacity of an "unknown resource type" a CC. This makes the benefits of the plan uncertain if another resource were to be selected instead. For instance, the portfolios assume that PGE precisely complies with the RPS over the analysis period—over-compliance was not considered. The Company also screened out several low-cost portfolios from consideration because they did not fully examine the costs involved. For example, the "Diverse Wind 2018 Long"—which includes wind built in Montana—has a lower cost than the preferred plan yet was dismissed because PGE did not fully account for transmission costs.[5] New transmission projects could facilitate low-cost renewable energy to the PGE system. Yet the Company ignored this prospect, claiming that modeling new transmission would be "too speculative to assume."[6] This unreasonably precludes the Company from choosing portfolios that would require new transmission. This is an oversight that, again, biases the IRP analysis towards the building of an NGCC in its territory.

Finally, the Company claims that it is not selecting a specific resource as a result of this IRP, but rather that it will do so after issuing a request for proposals (RFP) at a later date. Instead, the Company should have evaluated its resource needs, issued an RFP to meet those needs, and evaluated those bids in an IRP with stakeholder engagement. This is a utility common practice that accommodates stakeholder concerns over which specific resources a utility will acquire or build. In contrast, PGE's current process is problematic in that stakeholders do not have input into that RFP process. **We recommend that PGE be required to involve stakeholders in future procurement decisions.**

V. Conclusion and Summary of Sierra Club's recommendations

As shown above, PGE's portfolio formation and selection processes employed to develop its Draft 2016 IRP lacked rigor, leading to an unreliable conclusion. In light of these shortcomings, Sierra Club offers the following recommendations:

1. **We recommend that PGE conduct capacity expansion modeling to arrive at a reasonable range of optimized resource portfolios.** PGE did not rigorously test its pre-constructed portfolios against different market conditions. Instead, the Company's portfolios are pre-determined, and much of the capacity added is little more than filler—

[5] Draft IRP, p.296.
[6] Draft IRP, p.768.

modeled as natural gas combustion turbines (CT) or natural gas combined-cycle units (CC).

2. **We recommend that PGE more robustly account for risks by conducting a probabilistic analysis of portfolios.** The IRP relied on a simplistic analysis of portfolios that does not account for the likelihood of different futures occurring. This treatment produces misleading results.

3. **We recommend that PGE remove the "curtailment" and "durability" metrics, use a standard measure of variance for "variability," and screen out extremely high-cost portfolios for "severity."** PGE's attempt to evaluate portfolio risk is misleading and ill-defined, and the weighting of its risk metrics appears arbitrary. The particular combination of metrics and their weighting relative to one another are unique to this IRP and have not been justified.

4. **We recommend that PGE—at a bare minimum—be required to provide scenario results to stakeholders.** The Company did not provide workbooks or even scenario results, making it impossible for stakeholders to fully engage. For instance, stakeholders were not able to test results under different scoring metrics or weighting.

5. **We recommend that PGE be required to involve stakeholders in future procurement decisions.** The Company claims that the IRP is not intended to choose a specific technology, despite the fact that the IRP process is meant precisely to include, as PGE states, "analysis of the various *resource options* available to meet the Company's resource needs."[7] Moreover, the result emerging from the Company's modeling favors the acquisition of a new NGCC despite the claim that it will defer that decision until later. If the Company wishes to defer its analysis of the cost-effectiveness of specific resource options to a future RFP process, stakeholders must be involved in that process to a comparable extent as if it had occurred during the Company's Integrated Resource Planning.

Respectfully submitted,

/s/ Amy Hojnowski

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Beyond Coal Campaign, Sierra Club
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[7] Draft IRP, p. 35; emphasis added.

LC 66 – Renewable Northwest's Comments
Attachment No. 6

January 6, 2017

TO: Silvia Tanner
Renewable Northwest

FROM: Patrick Hager
Manager, Regulatory Affairs

PORTLAND GENERAL ELECTRIC
LC 66
PGE Response to RNW Data Request No. 003
Dated December 23, 2016

Request:

Please explain how PGE determined that the risk metrics severity, variability, and durability should have equal weights. To the extent PGE made that determination informed by OPUC Guidelines, prior acknowledged IRPs, and/or stakeholder input, please identify specifically how those impacted PGE's determination.

Response:

Please refer to PGE's Response and First Supplemental Response to Sierra Club DR No. 004.

January 6, 2017

TO: Silvia Tanner
Renewable Northwest

FROM: Patrick Hager
Manager, Regulatory Affairs

PORTLAND GENERAL ELECTRIC
LC 66
PGE Response to RNW Data Request No. 004
Dated December 23, 2016

Request:

Please describe how the severity, variability, and durability scores for the portfolio Efficient Capacity 2021 would be impacted by the addition of actionable portfolios being considered in the scenario analysis portfolio scoring.

Response:

PGE objects to this request on the basis that it requests speculation and requires new analysis. Without waiving these objections, PGE replies as follows:

Attachment A includes a modified version of PGE's portfolio scoring analysis that includes additional portfolios investigated in the IRP. In addition to the Actionable Portfolios in the IRP, this analysis also includes the following portfolios, which were designed to answer specific questions regarding RPS timing and Colstrip replacement scenarios in the IRP:

- *RPS Wind 2020*
- *RPS Wind 2025*
- *RPS Wind 2021*
- *Colstrip Efficient Capacity 2030*
- *Colstrip Efficient Capacity 2035*
- *Efficient Capacity 2021 – Minimum REC Bank*

Excluded from this analysis are the following portfolios, for which the cost and risk metrics do not capture all costs and risks associated with the portfolio:

- *RPS Wind 2018 + No Capacity Action*: This portfolio is excluded because it does not meet resource adequacy requirements.
- *Diverse Wind 2021*: This portfolio is excluded because the NPVRR does not include the full cost of transmission to the modeled Montana wind resource.
- *Colstrip Wind 2030*: This portfolio is excluded because the NPVRR does not include the full cost of transmission to the modeled Montana wind resource.
- *Colstrip Wind 2035*: This portfolio is excluded because the NPVRR does not include the full cost of transmission to the modeled Montana wind resource.
- *Efficient Capacity 2021 – 20% Unbundled*: This portfolio is excluded because the NPVRR does not include the cost of unbundled REC purchases.

In the modified analysis, the *Efficient Capacity 2021* portfolio receives the following risk scores, shown relative to the scores within the IRP:

Risk Metric	IRP portfolio score (*Efficient Capacity 2021*)	Modified portfolio score (*Efficient Capacity 2021*)
Severity	100	100
Variability	0	14
Durability	100	100

Attachment A is protected information subject to Protective Order No. 16-408.

LC 66 - Renewable Northwest's Comments
Attachment No. 8

January 6, 2017

TO: Silvia Tanner
Renewable Northwest

FROM: Patrick Hager
Manager, Regulatory Affairs

PORTLAND GENERAL ELECTRIC
LC 66
PGE Response to RNW Data Request No. 005
Dated December 23, 2016

Request:

Page 302 of the filed 2016 IRP includes the following statement regarding durability: "Unlike the cost, severity, and variability metrics, which look at one portfolio and compare its different cost outcomes across all futures, the durability across futures metric is a comparison between the costs of all portfolios for one future at a time. PGE interprets the durability across futures of a portfolio as the likelihood that it would perform well under the different probable futures versus the likelihood it would perform badly. The durability metric is helpful when considering two portfolios that may perform quite differently with respect to cost and risk but could have similar total portfolio scores due to the weights applied to cost and risk metrics." Please describe how this metric accounts for a portfolio's durability in terms of severity and volatility over different futures, as opposed to its different cost outcomes across futures.

Response:

The durability across futures metric is, by definition, a function of how multiple portfolios perform relative to each other within specific futures. It therefore relies on metrics of portfolio performance that are specific to a given future – in the case of the IRP, this metric is the NPVRR associated with the future.

In contrast, the severity metric and the volatility over different futures are both measures of how a single portfolio performs across many futures. These measures, by definition, require evaluation encompassing multiple futures and have no meaning if considered within a single future. Because a severity metric or the volatility over different futures cannot be evaluated within a specific future, these metrics cannot be incorporated into the durability metric.

January 17, 2017

TO: Kay Barnes
Oregon Public Utility Commission

FROM: Patrick Hager
Manager, Regulatory Affairs

PORTLAND GENERAL ELECTRIC
LC 66
PGE Response to OPUC Data Request No. 082
Dated January 3, 2017

Request:

While presenting Figure 12-2 at the 12/20/16 public meeting (52:00) PGE mentions the difficulty in determining the cost of transmission for wind. Is PGE in negotiations to secure existing transmission rights associated with any retiring coal plants listed on page 13 to lower the costs associated with new renewable capacity? If so, please detail the status of these negotiations. How might the securing of existing transmission rights, rather than building new transmission, impact the portfolio rankings (especially "Wind 2018" and "Diverse Wind 2021")?

Response:

PGE objects to the portions of this request that call for speculation. Notwithstanding the objection, PGE responds as follows:

PGE is not in negotiations to secure existing transmission rights associated with any retiring coal plants listed on page 13 as PGE currently has no plans to construct any resources which could take advantage of the transmission rights associated with the retiring coal plants. Any new resources which PGE might acquire through the RFP process would be expected to bid into the RFP with sufficient transmission to deliver energy to PGE load.

As described in section 12.3.4 of the 2016 IRP, PGE's treatment of incremental transmission costs for remote wind resources focuses on the present value cost difference between two portfolios that are identical, but for the wind resources. The difference in cost between portfolios can serve as a reasonable proxy for the budget that could be

allocated to securing the transmission capability needed in order to deliver the energy from a remote wind site. This approach was preferred to performing a speculative analysis comparing potential use of existing transmission rights to using rights from building new transmission of uncertain cost.

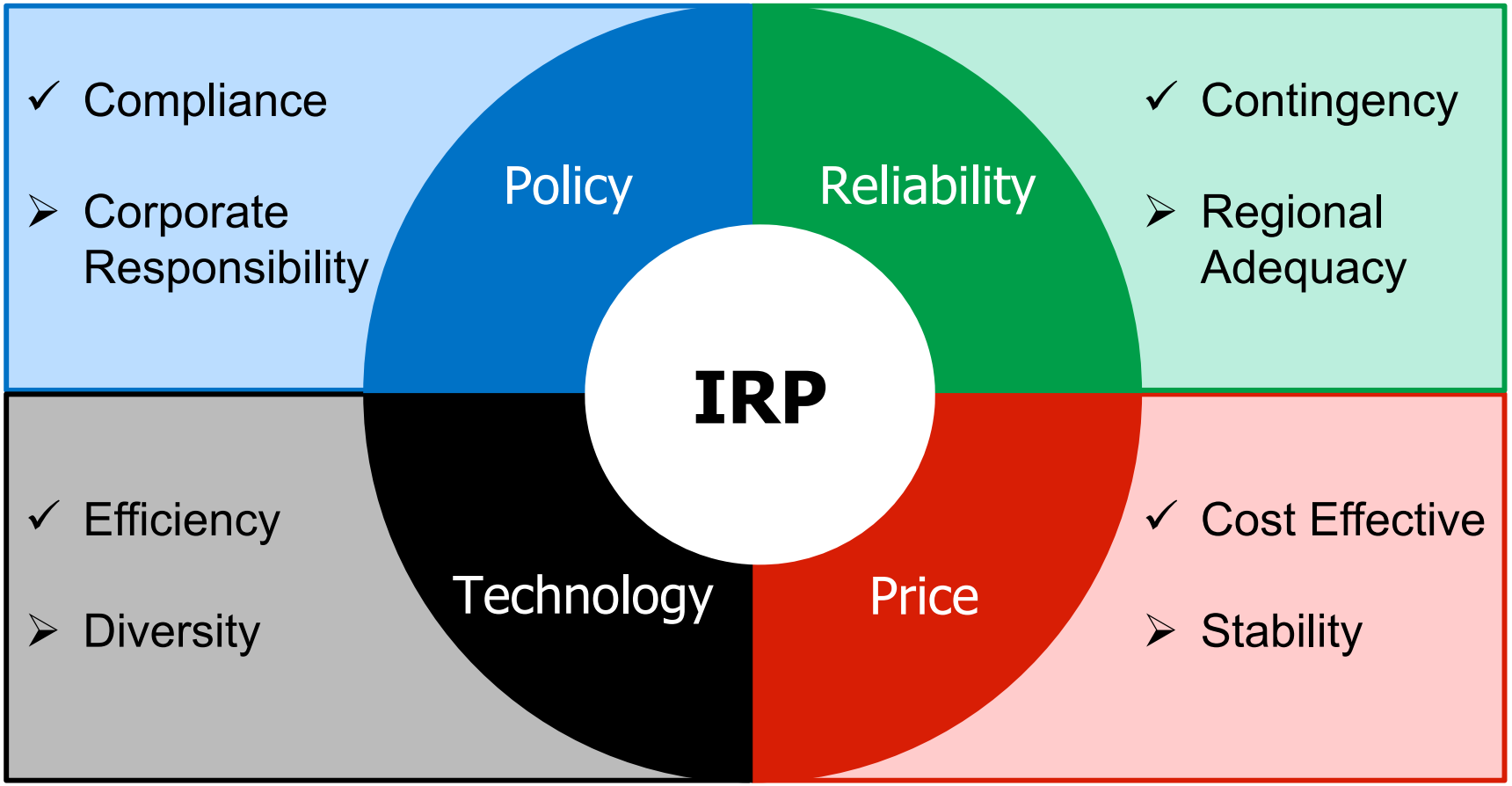
Portland General Electric

Scoring Metrics

Portfolio evaluation guidelines

Guideline (07-047)	Status
1 (c)	The primary goal must be the selection of a portfolio of resources with the best combination of expected costs and associated risks and uncertainties for the utility and its customers.
	Utilities should use present value of revenue requirement (PVRR) as the key cost metric.
	To address risk, the plan should include, at a minimum:
	1. Two measures of PVRR risk: one that measures the variability of costs and one that measures the severity of bad outcomes.
	2. Discussion of the proposed use and impact on costs and risks of physical and financial hedging.

IRP Guiding Philosophy



Metric based-decisions

- ✓ Constraints which will be met
- ➢ Values that inform decisions

Portland General Electric

Guiding Philosophy → Portfolio Scoring

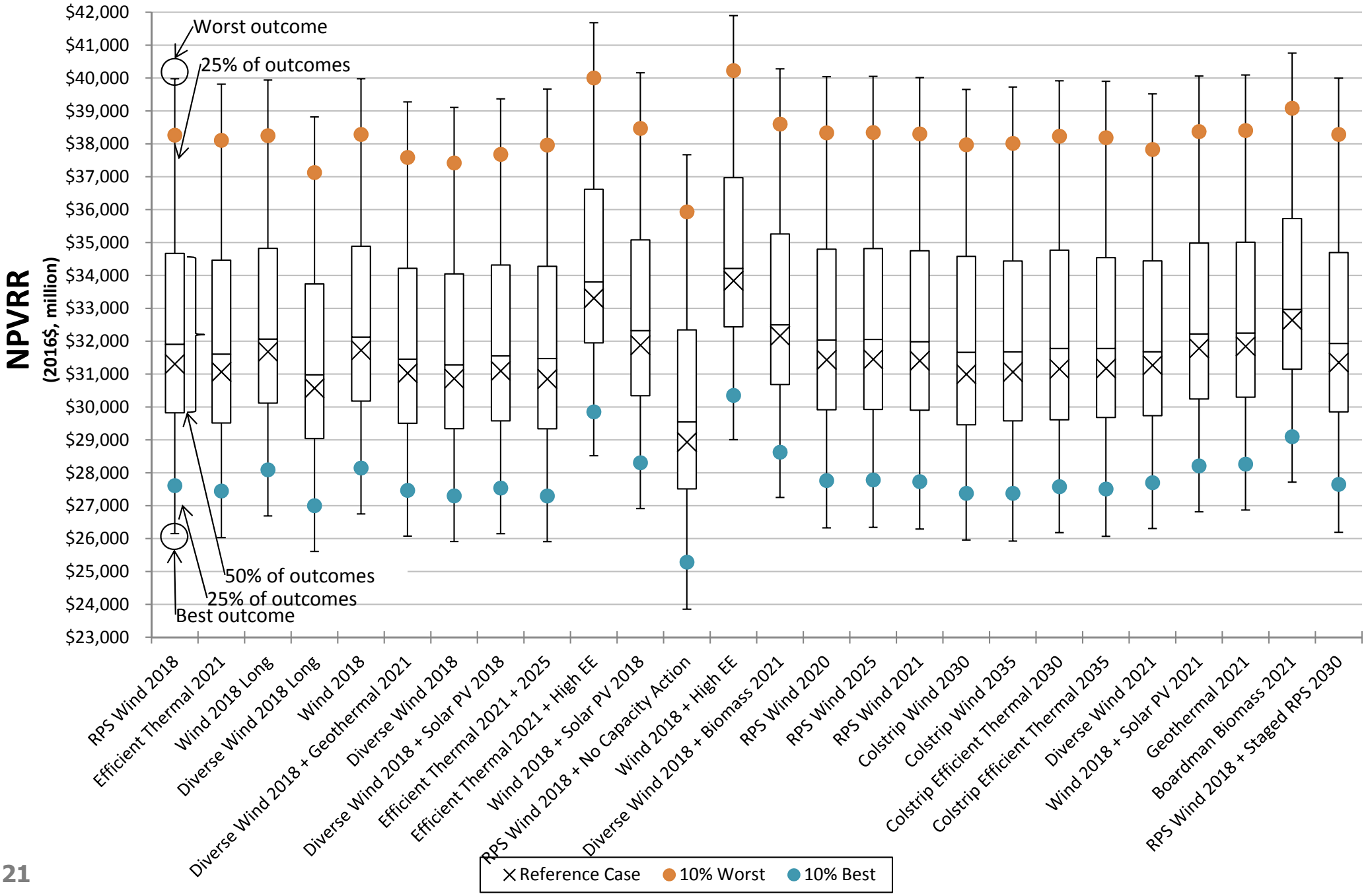
Policy	• Environmental Impact
Reliability	• Resource Adequacy
Price	• Balance Financial Cost and Risk
Technology	• Diversification

Portland General Electric

Portland General Electric

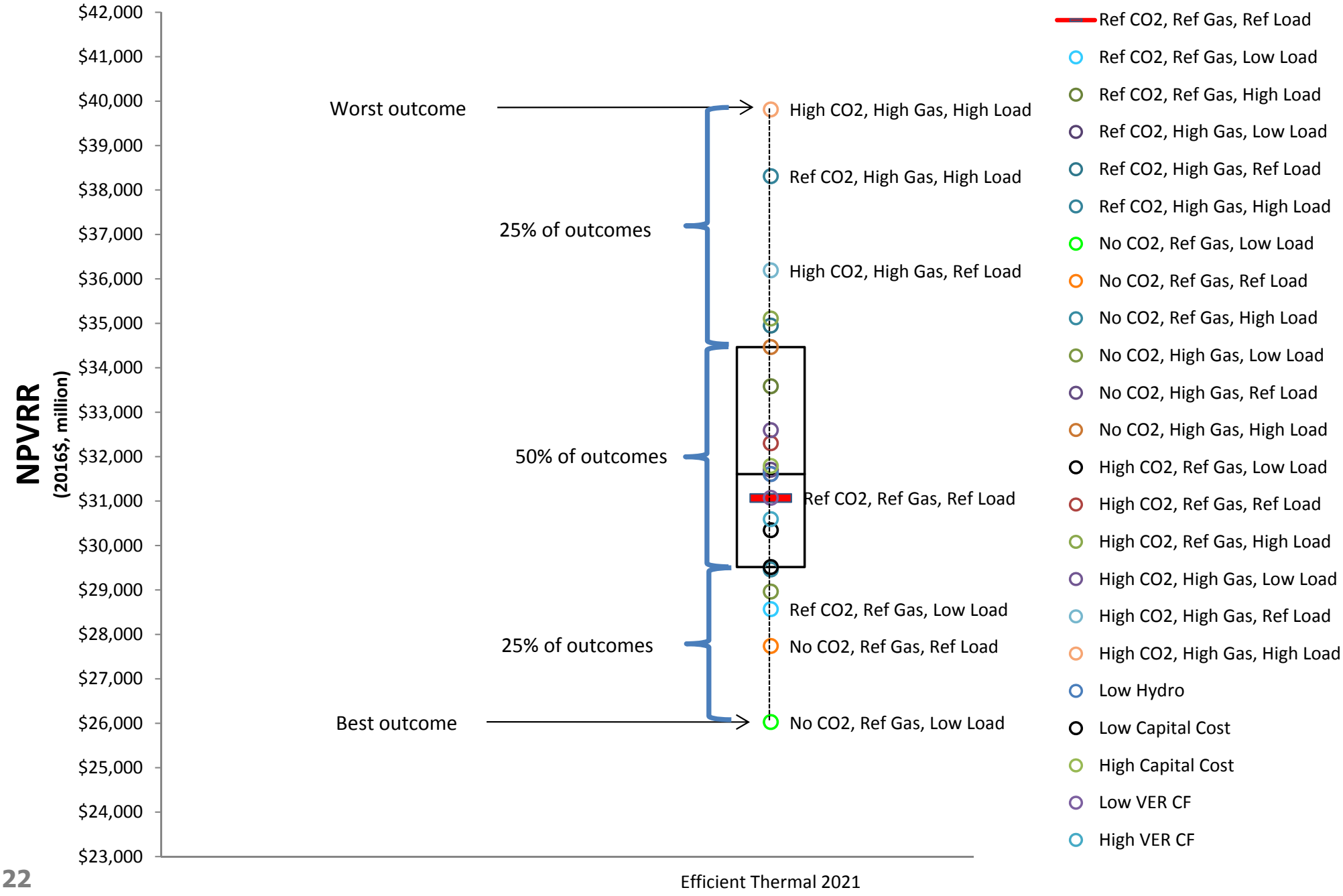
Scoring Metrics/Scoring Results

Draft 2016 IRP Portfolio Analysis Output



Example Distribution of Results

Portland General Electric



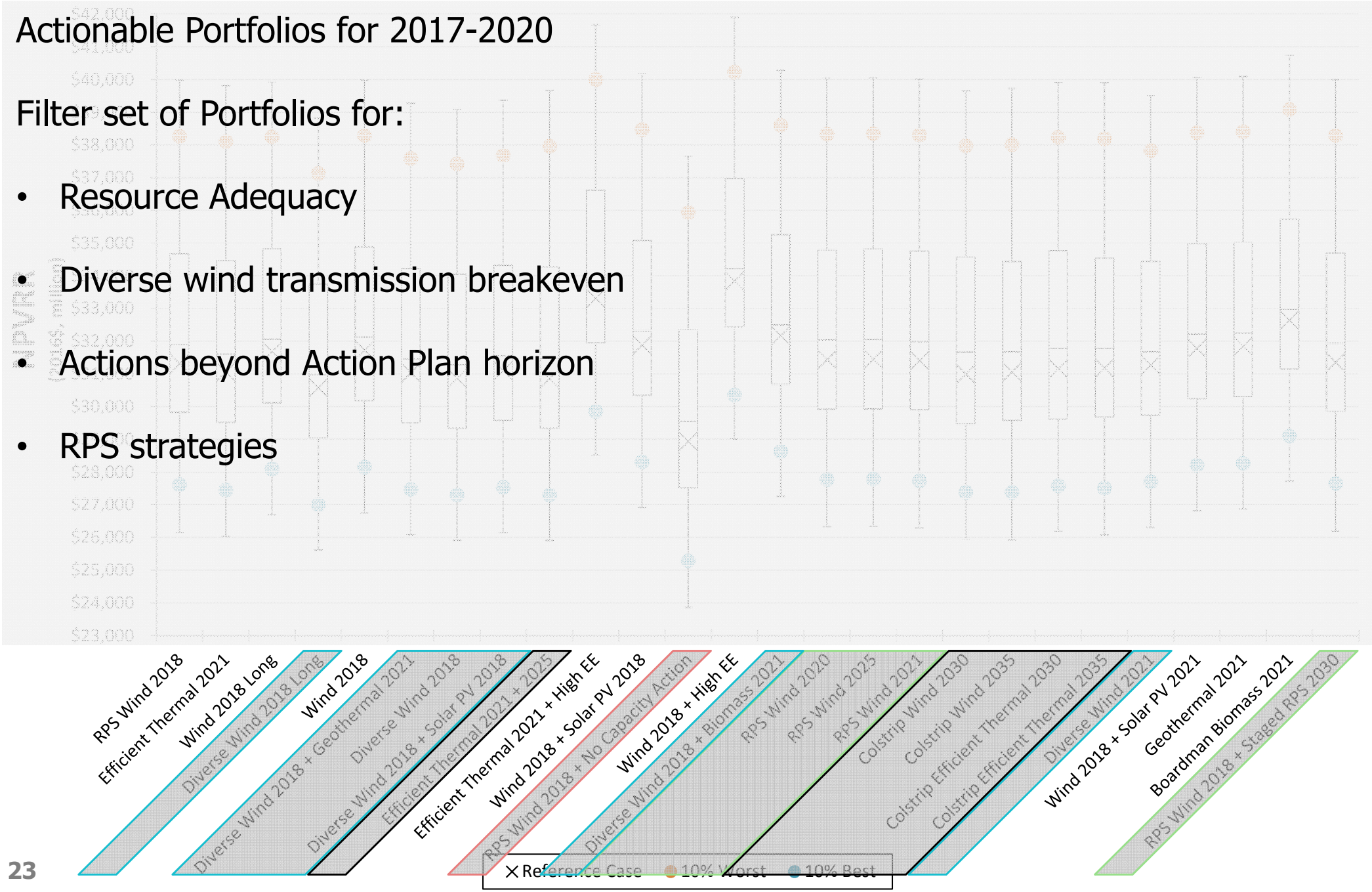
...Filter to Actionable Portfolios (Draft)

Portland General Electric

Actionable Portfolios for 2017-2020

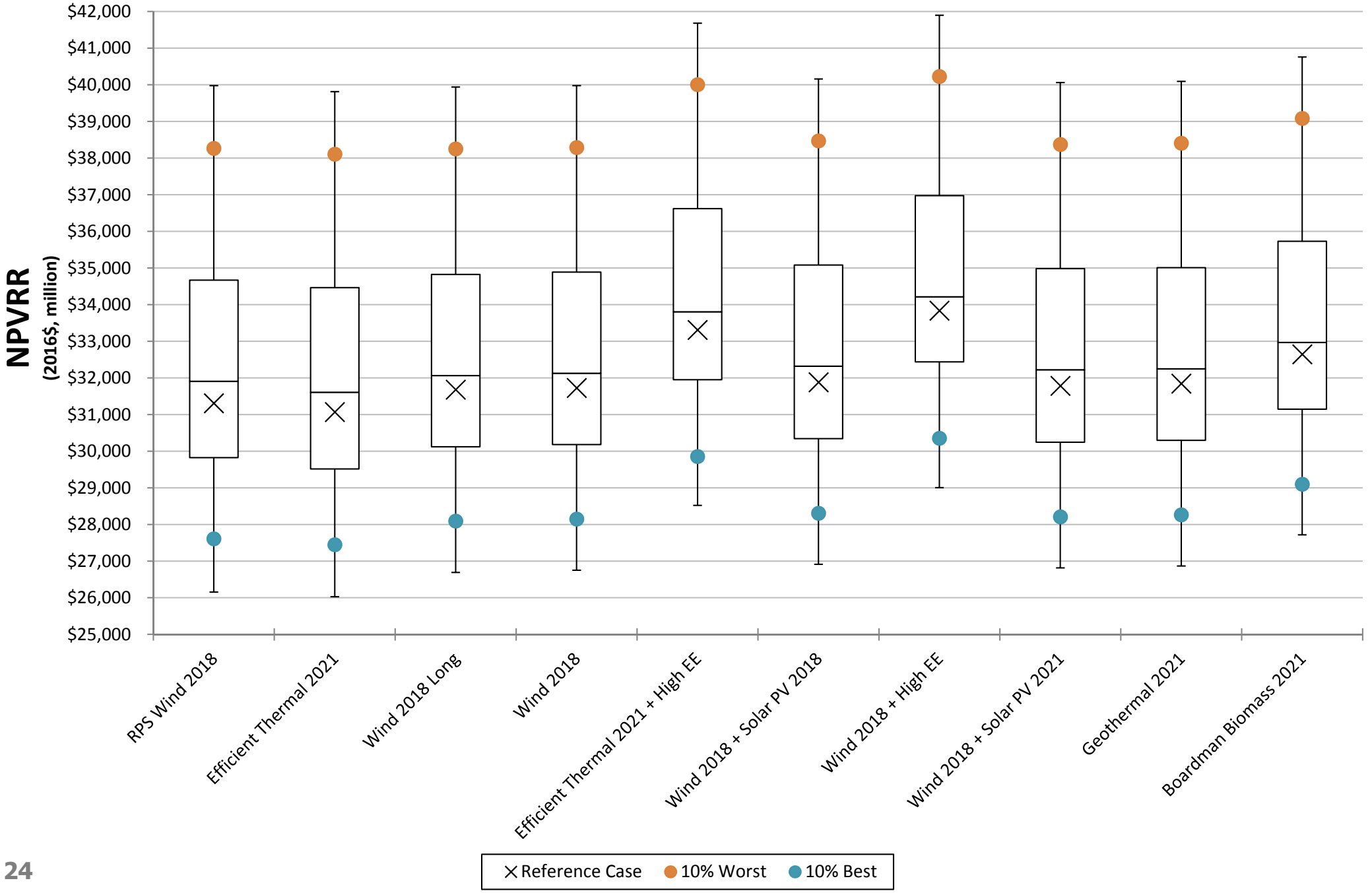
Filter set of Portfolios for:

- Resource Adequacy
- Diverse wind transmission breakeven
- Actions beyond Action Plan horizon
- RPS strategies



Action Plan Portfolios (Draft)

Portland General Electric



Scoring Metrics

Portland General Electric

- Cost, Severity, Variability, Future Durability, Curtailment metrics calculated for each Portfolio
- Normalized score 0–100 (worst to best) is determined for each Portfolio under each metric based on Portfolio's performance relative to best result
  - Portfolio Scoring results are relative; the specific Portfolios included may change the results
- Metrics are weighted:
  - 50% to Cost
  - 5% Curtailment
  - 15% to each of Severity, Variability, Future Durability
- Weighted average score leads to final Portfolio ranking

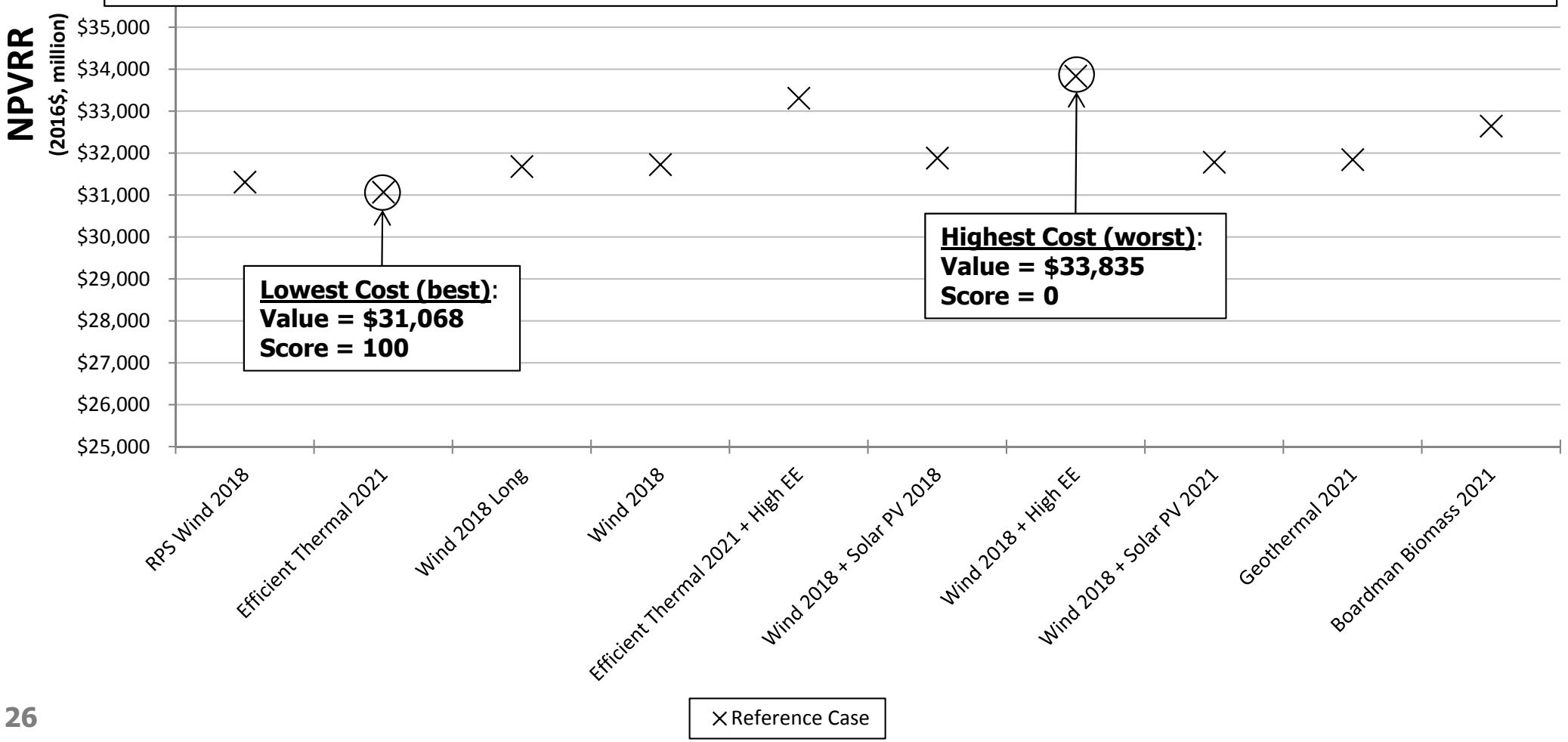
Scoring Metrics: Cost

Portland General Electric

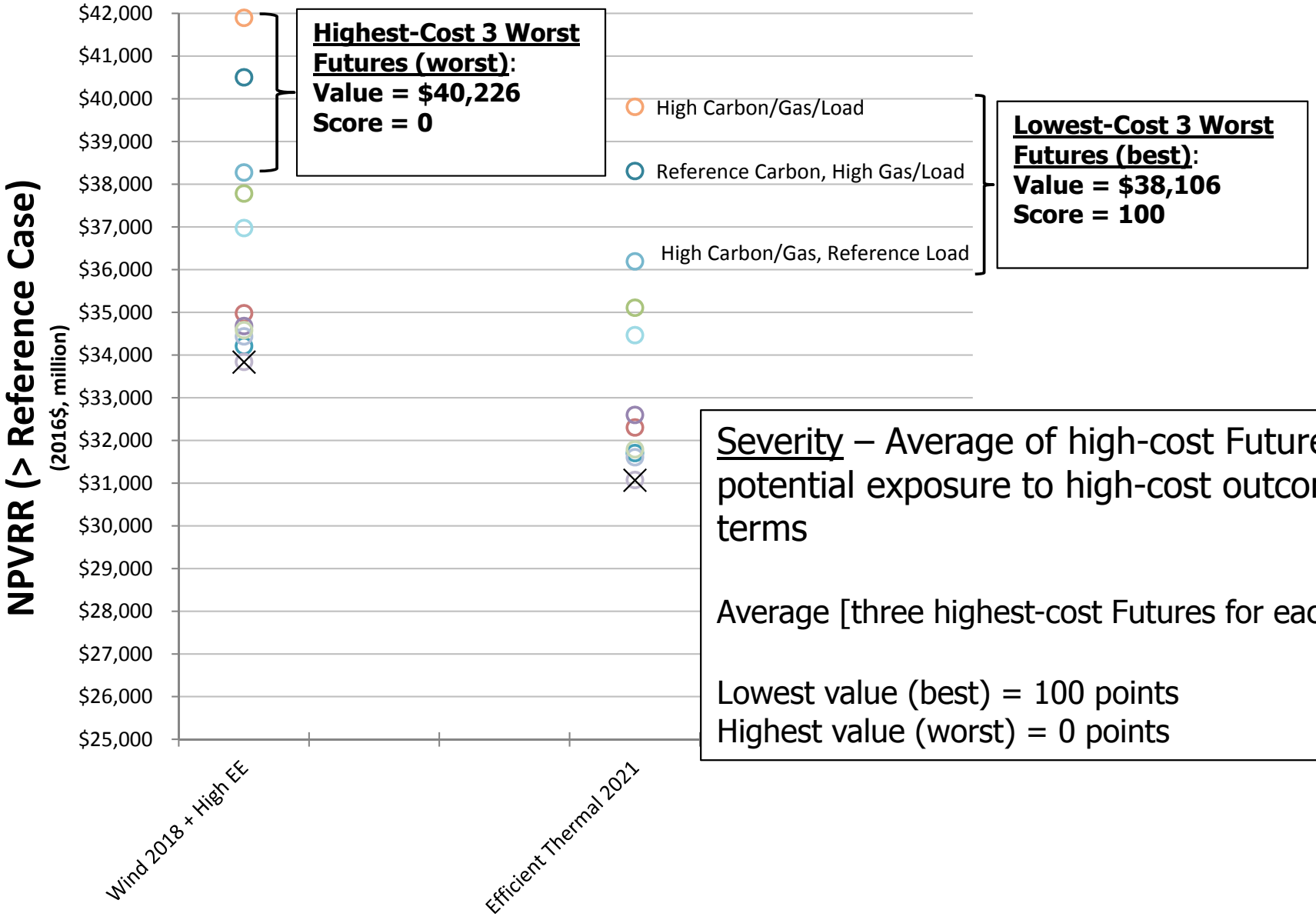
<u>Cost</u> – Net Present Value of Revenue Requirements (NPVRR)

Annually, 2017-2050: [Resource Fixed Cost + Resource Variable Costs + (Purchases – Sales)]
Present Value at PGE cost of capital

Lowest value (best) = 100 points
Highest value (worst) = 0 points



Scoring Metrics: Severity



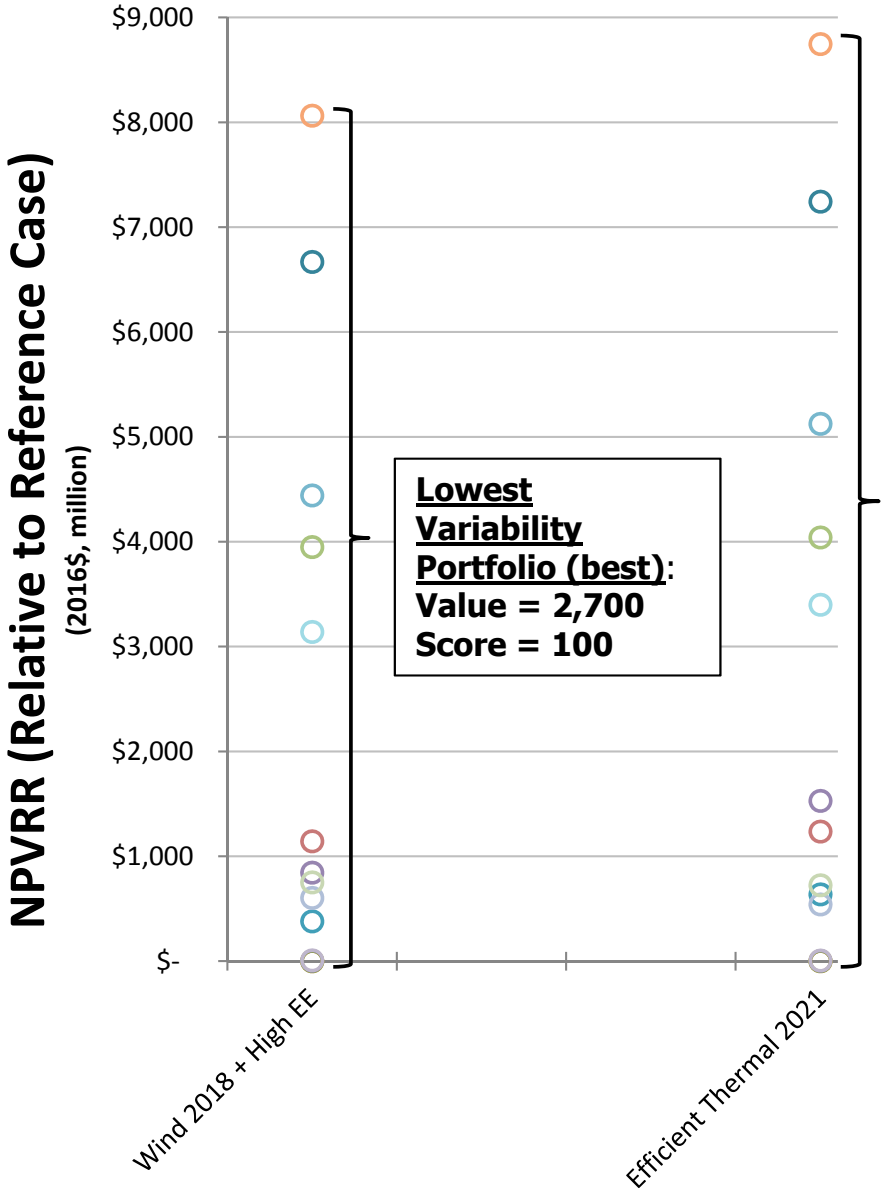
Severity – Average of high-cost Futures (NPVRR); potential exposure to high-cost outcomes in absolute terms

Average [three highest-cost Futures for each Portfolio]

Lowest value (best) = 100 points
Highest value (worst) = 0 points

Scoring Metrics: Variability

Portland General Electric



Lowest Variability Portfolio (best):
Value = 2,700
Score = 100

Highest Variability Portfolio (worst):
Value = 2,957
Score = 0

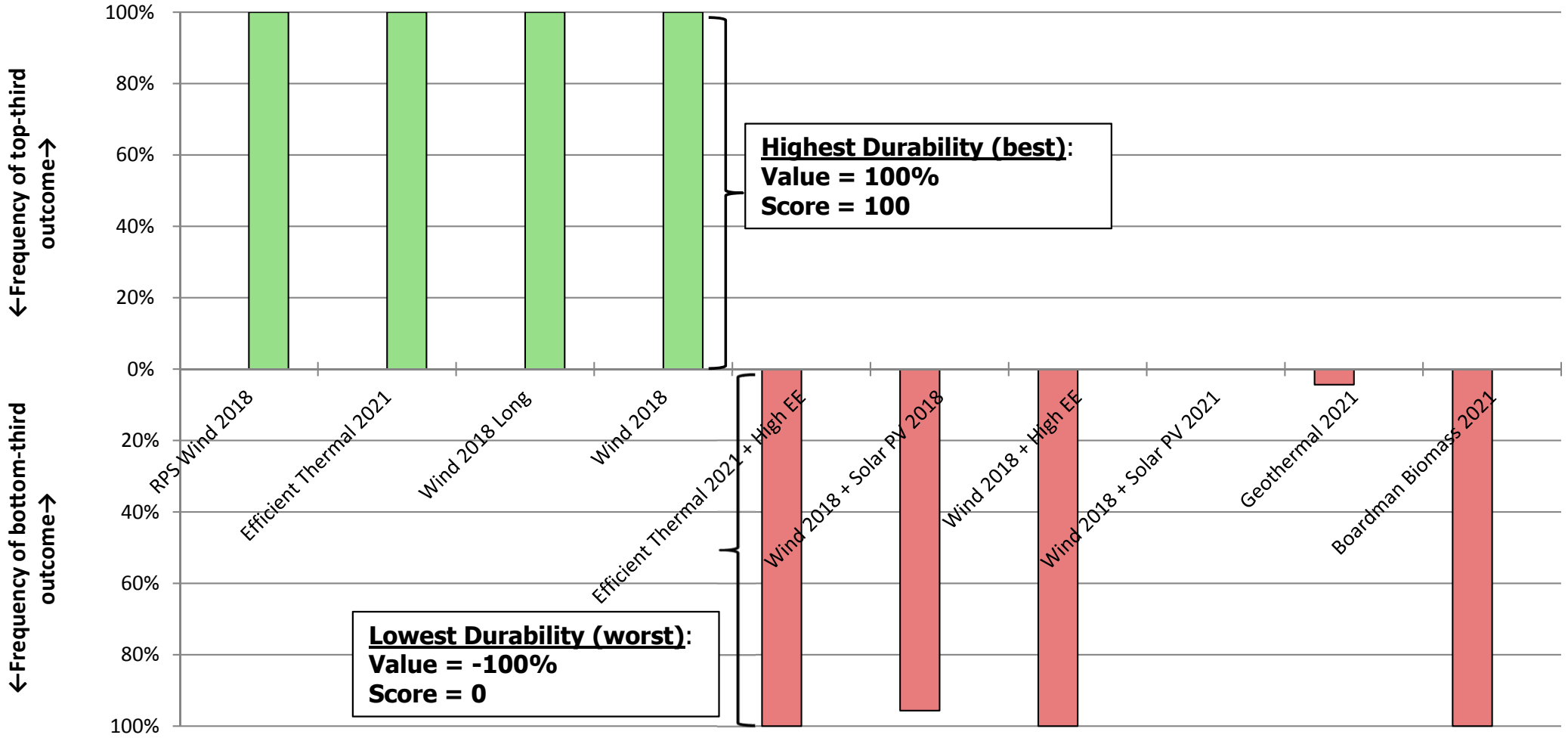
Variability – Dispersion of Futures, NPVRR > Reference Case

Square root [average sum of squared diffs. from Reference Case, where diff. > zero]

Lowest value (best) = 100 points
Highest value (worst) = 0 points

Scoring Metrics: Future Durability

Portland General Electric



Durability – frequency of top- or bottom-third ranking of each Portfolio across Futures

Rank Portfolios in each Future; Count [# of times Portfolio is in top- or bottom-third], Divide by # Futures, [Frequency top less frequency bottom]

Highest value (best) = 100 points
Lowest value (worst) = 0 points

Scoring Metrics: Potential Curtailment

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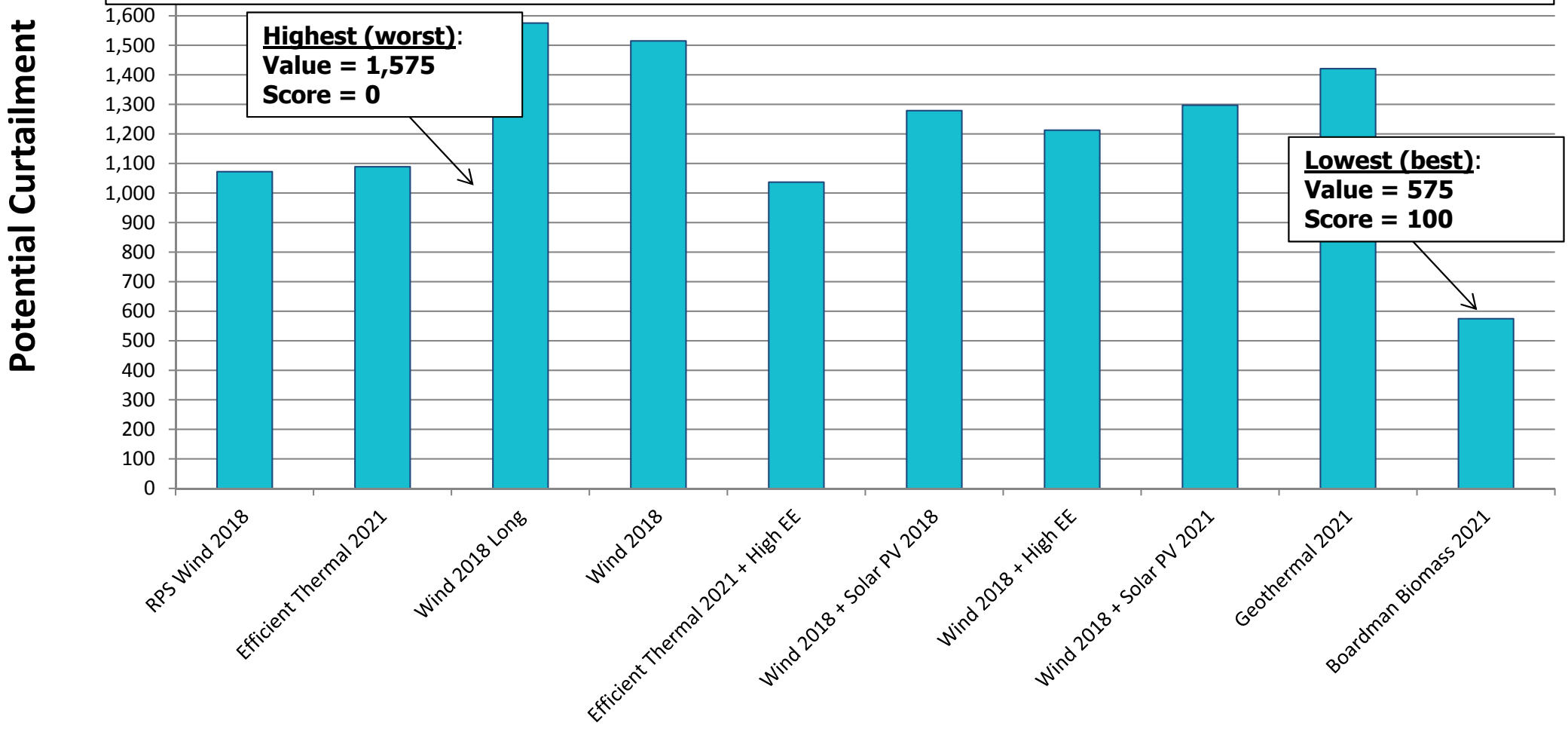
Potential Curtailment – Discounted future potential curtailment of resource mix

REFLEX study-based approximation of potential renewable curtailment

Lowest value (best) = 100 points
Highest value (worst) = 0 points



...Apply Scoring Metrics

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Weights	50%	15%	15%	15%	5%	Score					Rank					Score	Rank
Portfolio Name	Cost	Severity	Variability	Future Durability	Curtailment	Cost	Severity	Variability	Future Durability	Curtailment	Cost	Severity	Variability	Future Durability	Curtailment	Total Wtd	Total Wtd
RPS Wind 2018	31,307	38,263	2,929	100%	1,073	91	93	11	100	50	2	3	9	1	3	79	3
Efficient Thermal 2021	31,068	38,106	2,957	100%	1,089	100	100	0	100	49	1	1	10	1	4	82	1
Wind 2018 Long	31,680	38,249	2,770	100%	1,575	78	93	73	100	0	3	2	5	1	10	79	2
Wind 2018	31,726	38,287	2,768	100%	1,515	76	91	74	100	6	4	4	3	1	9	78	4
Efficient Thermal 2021 + High EE	33,308	40,002	2,817	(100%)	1,037	19	11	54	0	54	9	9	8	8	2	22	9
Wind 2018 + Solar PV 2018	31,880	38,469	2,779	(96%)	1,279	71	83	69	2	30	7	7	6	7	6	60	7
Wind 2018 + High EE	33,835	40,226	2,700	(100%)	1,213	0	0	100	0	36	10	10	1	8	5	17	10
Wind 2018 + Solar PV 2021	31,782	38,371	2,780	0%	1,298	74	87	69	50	28	5	5	7	5	7	69	5
Geothermal 2021	31,842	38,404	2,769	(4%)	1,421	72	86	73	48	15	6	6	4	6	8	68	6
Boardman Biomass 2021	32,644	39,080	2,713	(100%)	575	43	54	95	0	100	8	8	2	8	1	49	8

- Calculate values for each metric
- Normalize scores 0–100 (worst to best) for each metric
- Weight scores:
  - 50% to Cost
  - 5% Curtailment
  - 15% to each of Severity, Variability, Future Durability
- Weighted average score leads to final Portfolio ranking
  - Top-ranked Portfolio = Preferred Portfolio