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Submitted by Electronic Mail to records@utc.wa.gov

RE: Comments of Absaroka Energy
Docket Nos. UG-141169 and UE-141170 – Puget Sound Energy 2015 Integrated Resource Plan

I. Introduction

Absaroka Energy is developing the Gordon Butte Pumped Storage Hydro Project (Gordon Butte), a 400 to 600 MW pumped storage hydro project with 3,200 MWh of storage capability to be interconnected to the Colstrip 500 kV transmission lines near Martinsdale, Montana. Gordon Butte will employ the latest ternary turbine technology to provide fast-ramping flexible capacity ideally suited for integrating intermittent renewable resources into the Western US transmission grid. Gordon Butte coupled with Montana's robust wind resources provides a reliable, cost-competitive, and carbon-free solution for replacing the aging coal-fired generating plants at Colstrip when those units are retired. The final license application for Gordon Butte (FERC Docket No. P-13642) was accepted with no deficiencies by FERC in November 2015 and the issuance of the FERC license is expected in 2016. Additional information on the Gordon Butte Project can be found at: http://gordonbuttepumpedstorage.com/.

Absaroka Energy participated in the meetings of the Puget Sound Energy (PSE) Integrated Resource Plan (IRP) Advisory Group (IRPAG) beginning in September 2014. Through the IRPAG process, Absaroka Energy was able to learn about PSE's energy supply situation and its planning processes. Absaroka Energy was also able to offer its comments and suggestions as the 2015 IRP was being developed. Absaroka Energy appreciates the opportunity to participate in the process and to contribute toward the exchange of ideas on how best to meet the future energy supply needs of PSE's customers.

In developing the 2015 IRP, PSE considered large amounts of information and conducted extensive analysis. In this process a number of significant issues were considered, some for the first time in a PSE IRP. PSE's efforts to assess and address these cutting edge issues certainly leads to an improved understanding of these topics. However, as will be discussed further below, PSE's analysis fell short in some instances. Many of these shortcomings can and must be improved upon in PSE's 2017 IRP. Therefore, it would be premature to base significant new supply-side resource decisions on the 2015 IRP. Fortunately, PSE does not need to begin procurement of any significant new supply-side resources until after the 2017 IRP has been completed.

II. Flexible Capacity Analysis

PSE has identified a modest need for new capacity resources beginning in 2021 that increases significantly in 2026. [IRP, Figure 1-4, page 1-14] However, PSE has not completed an adequate assessment of its flexible capacity needs and the added value provided by flexible resources. This flexible capacity analysis is critical to determining how much of the new capacity should be provided by conventional peaking units such as frame combustion turbines (CTs) and how much should be provided by more flexible sources such as aero-derivative CTs, reciprocating engines, batteries and pumped storage hydro.

The 2015 IRP includes an assessment of the value of flexible capacity, but this analysis is based on flexibility analysis that was prepared for the 2013 IRP. PSE started the 2015 IRP process with good intentions to improve upon its 2013 analysis, but due to staffing and time constraints was not able to complete this important work. The 2015 IRP includes a commitment to conduct a new flexibility analysis for the 2017 IRP. [IRP, page 1-11] Because of the importance of this work for determining the optimal mix of capacity resources, the Commission should direct PSE not to procure new supply-side capacity resources until after the 2017 IRP has been prepared with the improved flexibility analysis. And the Commission should encourage

PSE to work collaboratively with the IRPAG, or a similar group, in the preparation of the 2017 IRP flexibility analysis.

In addition, PSE should use the time between IRPs to refine its assumptions on the costs and performance characteristics of the various types of flexible resources. Two sets of assumptions in the 2015 IRP, in particular, would benefit from additional scrutiny.

First, the cost of reciprocating engines was reduced by more than 25% late in this process, significantly improving the competitiveness of this technology. [IRP pages 6-73 and 6-74] This was done with little explanation and appeared to base the cost for recips on a different standard than the costs for other resources that were prepared using a consistent methodology by Black & Veatch at the beginning of the IRP cycle. It would also be beneficial to do an assessment of air emissions issues that might make recips more difficult to successfully permit than other flexible capacity resources.

Second, PSE assumed that batteries with only 2 hours of storage should receive a 100% capacity value. [IRP, Figure 4-17, page 4-27 and page 6-72] This assumption established the same capacity value for a) batteries with 2 hours of storage, b) pumped storage hydro with 10 hours of storage, and c) flexible gas units that can operate 24 hours a day. Absaroka Energy is not familiar with the methodology used by PSE to determine the 100% capacity value for batteries with only 2 hours of storage. However, Absaroka Energy recommends that an effective load carrying capability (ELCC) study be included in the 2017 IRP to establish appropriate capacity values for all of these resources.

III. Montana Wind

PSE made a sincere effort to include Montana wind in the 2015 IRP process. This is appropriate considering the robust wind resource in Montana, capacity value and integration benefits from diversifying PSE's wind fleet, and the possibility of transmission capacity becoming available with future retirement of part (or all) of Colstrip. Unfortunately, having decided to look at Montana wind, PSE made several assumptions that undermined an objective analysis and resulted in the 2015 IRP portraying Montana wind unfavorably.

First and foremost, PSE assumed throughout the analysis that Montana wind was not eligible to meet the Washington Renewable Portfolio Standard (RPS). This was a critical assumption because in most of the scenarios studied by PSE wind was only determined to be cost effective for meeting RPS requirements. In these scenarios, Washington wind was selected without competition from Montana wind.

The Washington RPS statute does place additional requirements on Montana wind located outside the BPA service territory.[1] However, these requirements are not impossible to meet. Absaroka Energy asked PSE to include portfolios that assumed Montana wind did meet the Washington RPS, but PSE declined to do so. This analysis would have provided an indication of the value to PSE customers 1) of acquiring Montana wind that meets the current RPS requirements, or 2) of modifying the current RPS to put Montana wind on a level playing field with Washington and Oregon wind.

Second, PSE assumed a very robust 34% capacity factor for Washington wind (based on expansion of PSE's Lower Snake River project). This is at the upper end of the range for Washington wind sites. PSE assumed a 41% capacity factor for Montana wind. This is a middling site for Montana and sites in the 45+% capacity factor range are readily available.

Third, PSE began with extremely pessimistic assumptions about transmission costs for Montana wind. PSE's original assumptions were that new 500 kV transmission lines would be needed between Broadview, MT and Garrison, MT and between Garrison, MT and Ashe, OR to deliver Montana wind to Washington and Oregon utilities. This would clearly make Montana wind uneconomic.

Through discussion with the IRPAG PSE was made aware that lower cost transmission capacity could be made available, either through the retirement of Colstrip generation or by increasing series compensation levels on the Colstrip and BPA transmission systems. Absaroka Energy's comments to PSE on this subject are provided as Exhibit 1 to these comments. Although PSE modified its transmission assumptions to some extent based on this information,

[1] The stature defines an Eligible Renewable Resource as "Electricity from a generation facility powered by a renewable resource that commences operation after March 31, 1999, where: (i) the facility is located in the Pacific Northwest; or (ii) the electricity from the facility is delivered into Washington state on a real-time basis without shaping, storage, or integration services" [RCW 19.285.030 (12), emphasis added]

the IRP is not entirely clear on which transmission assumptions were used for each scenario. Without transparency on these details, it is not possible to tell if PSE applied this information correctly.

Examples of the unfavorable portrayal of Montana wind can be found throughout Section H of Chapter 6 of the IRP. This is the only place in the IRP where Montana wind and Washington wind are directly compared. This comparison takes place primarily in Figure 6-45. [IRP, page 6-78]

This figure shows four possible transmission scenarios - two using existing transmission assuming Colstrip retirements and two assuming new 500 kV transmission lines are needed with Colstrip continuing to operate. The much lower cost alternative of adding series compensation with continued Colstrip operation is not included.[2]

The text accompanying Figure 6-45 concludes that Montana wind is at least $2/MWh more expensive than Washington wind ($91/MWh vs $89/MWh)[3] using existing transmission freed up by retirement of Colstrip. No meaningful discussion is provided with this conclusion. Several points should be noted:

- This comparison is based on 34% capacity factor for Washington wind and 41% capacity factor for Montana wind. If the capacity factor for Montana wind is increased to 45%, the comparison would favor Montana wind by $6/MWh ($83/MWh vs. $89/MWh).
- This comparison assumes Montana wind would pay a transmission tariff to PSE for using PSE's existing capacity in the Colstrip lines. This is inappropriate because the costs of the Colstrip lines are already in PSE's rates and if Colstrip is retired these costs would effectively be stranded if this transmission capacity is not used for Montana wind.
- And the comparison does not take into account the higher capacity value and likely lower integration costs for Montana wind. Elsewhere in the IRP, PSE

[2] The text on page 6-77 reads "Upgrade Colstrip line to Garrison" for Scenarios C and D. However, costs for these scenarios are based on building a new 500 kV line from Broadview to Garrison.
[3] Note that these costs assume no production tax credits are available and include PSE's estimated transmission and integration costs.

determines that applying its current capacity value methodology to its Montana wind data results in a capacity value of 55% for Montana wind (compared to only 8% for Washington wind). [IRP, Figure 4-17, page 4-27] PSE expresses some skepticism about this capacity value due to the "limited data set" of Montana wind used in this evaluation. [IRP, page D-41, footnote 11] Absaroka Energy's understanding is that PSE had 7 years of data for the Montana wind site which should be sufficient to determine a reasonable capacity value. In addition, Portland General Electric in its current IRP process recently calculated a 43% winter capacity value for Montana wind based on a full ELCC analysis[4]. Assuming a cost of $100/kw-year for new capacity, the 55% capacity value for Montana wind is worth about $15/MWh (compared to $2/MWh for Washington wind with an 8% capacity value).

Accounting for these factors, shows that Montana wind on existing transmission is much lower cost than Washington wind, as summarized in the table below. This conclusion is much different than the unfavorable portrayal of Montana wind in the 2015 IRP.

	Cost ($/MWh)	
	Washington Wind	Montana Wind
Cost from IRP, Figure 6-45, Scenario A (existing transmission)	$89/MWh	$91/MWh
Increase MT capacity factor from 41% to 45%		-$8/MWh
Remove PSE Colstrip transmission tariff		-$2/MWh
Include credit for capacity value (MT-55%, WA-8%)	-$2/MWh	-$15/MWh
Adjusted Cost	$87/MWh	$66/MWh

The IRP also considered Montana wind as one alternative for replacing PSE's Colstrip generation. The analysis concluded that 300 MW of Montana wind was part of the preferred portfolio for replacing PSE's roughly 300 MW share of Colstrip 1&2. [IRP, page 6-52] PSE,

[4] 12-17-15 PGE IRP public meeting presentation, slide #88, https://www.portlandgeneral.com/-/media/public/our%20company/energy%20strategy/documents/2015-12-17-irp-public-meeting.pdf

however, expresses doubt about this conclusion because it is based on a 55% capacity value for Montana wind. [IRP, page 6-34 and page D-41, footnote 11] Again, this is an example of how the IRP casts Montana wind in an unfavorable light by focusing on one assumption that PSE believes may favor Montana wind while ignoring other assumptions that disadvantage Montana wind:

- As discussed above, based on PSE's own analysis and on Portland General Electric's recent ELCC study, Montana wind appears to have significant capacity value.
- Also as discussed above, PSE's Colstrip replacement analysis is based on a conservative 41% capacity factor for Montana wind and burdens Montana wind with already sunk transmission costs for using PSE's existing capacity in the Colstrip transmission lines.
- And, PSE does not treat the Montana wind as being RPS-eligible, thereby ignoring the potential economic benefit of replacing less-cost-effective Washington wind selected for RPS compliance.

IV. Colstrip Retirement Analysis

PSE's analysis of alternatives for replacing Colstrip allows all resources to compete on a least-cost basis for this opportunity. If all or part of Colstrip is retired early, a primary driver would be to reduce carbon emissions. Therefore, it would provide useful information for policy makers to develop portfolios that replace Colstrip with carbon-free energy that can be compared to portfolios that rely on carbon emitting replacement resources such as gas-fired units and market purchases. This would provide a clear indication of the additional cost, if any, for selecting carbon-free resources as opposed to resources that would substantially diminish the carbon reduction benefits of early retirement of Colstrip.

As discussed above, the IRP selected 300 MW of Montana wind in the preferred portfolio for replacing Colstrip 1&2. It appears that Montana wind in the preferred portfolio was limited to 300 MW based on PSE's transmission rights freed up from retirement of Colstrip 1&2. Unfortunately, because Montana wind has a lower capacity factor than Colstrip (40-45% vs. 80-90%), the Montana wind in this portfolio only replaces about half of PSE's Colstrip 1&2

production. Other carbon-emitting resources (gas-fired generation and/or market purchases) must be called upon to replace the balance of PSE's Colstrip 1&2 generation.

An alternative portfolio with 600 MW of Montana wind and 300 MW of Montana pumped storage hydro would provide a carbon-free replacement for PSE's share of Colstrip 1&2. 600 MW of Montana wind would provide energy equivalent to PSE's share of Colstrip 1&2. 300 MW of Montana pumped storage hydro would provide capacity equivalent to PSE's share of Colstrip 1&2. And the pumped storage hydro could be utilized to reshape the wind energy to provide a resource with less variability than stand-alone wind that maximizes the utilization of PSE's existing transmission rights freed up by retirement of Colstrip 1&2.

The Commission should encourage PSE to look at carbon-free Colstrip replacement portfolios before defaulting to gas-fired generation or market purchases as the preferred solution.

V. Conclusion

In the 2015 IRP PSE has made a good-faith effort to analyze flexible capacity needs, Montana wind resources, and various alternatives for the eventual replacement of Colstrip. Unfortunately, this analysis falls short in some important respects, as discussed above. PSE should improve upon this analysis in the 2017 IRP before procuring any significant new supply-side resources.

The Gordon Butte Pumped Storage Hydro Project could provide value to PSE's customers by providing 1) an extremely flexible, low-cost, carbon-free resource to meet a portion of PSE's flexible capacity needs, or 2) in combination with Montana's robust wind resources, a reliable, low-cost, carbon-free resource package to replace a portion (or all) of PSE's Colstrip generation.

Respectfully submitted by:

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Exhibit 1

Comments on MT Wind and Pumped Hydro in PSE 2015 IRP

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April 3, 2015

Wind in 2015 IRP

Wind vs. Gas

It will be difficult for wind to compete with gas in the near term with low gas prices, no price on carbon and no PTCs. However I think it would be useful to vary these critical inputs (gas prices, carbon prices and PTCs) to see what combinations of these inputs would make wind competitive with gas. This could be accomplished without too much effort using levelized cost of energy (LCOE) analysis. This will give PSE and the IRPAG some sense of whether wind might be competitive under some set of reasonable assumptions, or if the gap is too large to bridge.

Even if wind is not found to be competitive with gas, PSE will need additional renewables to meet its RPS obligations during the later years of this planning horizon (post-2020). Some wind for RPS compliance is likely to be included in the out-years of this IRP and it's worth some effort to model wind alternatives properly.

Montana vs. Washington Wind

The LCOE analysis presented at the 3/20/15 IRPAG meeting shows that MT wind can be competitive with Washington wind under a set of reasonable assumptions (34% WA CF, 41% MT CF, modest MT transmission costs). My understanding was that the LCOE analysis was performed to see if this might be the case and to assess whether the LCOE numbers were close enough to warrant additional effort to refine the input assumptions. Based on the initial results, I think this additional effort is warranted.

Capacity Factors. I'll repeat an assertion I've made before. The 34% WA CF is an aggressive assumption and is based on an exceptional WA wind site. The 41% MT CF is for a typical MT wind site and sites with CFs in the mid-40's are readily available. Some sensitivity analysis on the CFs seems to be in order.

Transmission. I'm encouraged by PSE's efforts to look at various transmission cost scenarios for MT wind. But, I think the costs for some of the scenarios as presented at the 3/20/15 IRPAG meeting do not reflect recent transmission studies performed by BPA and the Colstrip owners. Simply put, these recent studies conclude that 500-600 MW of additional transmission capacity out of Montana can be created at reasonable cost by adding series compensation to the Colstrip and BPA transmission systems. Attachment A provides specifics for what I think are a reasonable set of transmission cost scenarios. I would like to see LCOE analysis used to determine what MT CF makes MT wind and WA wind cost-equivalent for each of these transmission scenarios.

Other Attributes. Assuming MT wind is competitive with WA wind on an LCOE basis using reasonable assumptions, MT wind has other attributes that could add value for PSE including: 1) seasonal shapes better matched to PSE's load, 2) higher capacity value, and 3) diversity with PSE's existing WA wind resources.

Pumped Hydro in 2015 IRP

Capital Costs

The 3/20/15 presentation to the IRPAG showed a capital cost of $5,288/kw for pumped hydro based on information from EIA. Attachment B is a report on generation capital costs prepared by E3 Consulting for use by WECC in conducting regional transmission planning studies. Table 31 on pages 52-53 of the report shows capital cost estimates for pumped hydro from numerous sources including EIA. Inspection of this information indicates that the EIA estimate is an outlier (i.e., much higher than any other source). After stakeholder review and comment, WECC adopted E3's recommendation of $2,400/kw for pumped hydro.

However, pumped hydro costs are site-specific and a project at a site with outstanding physical attributes such as Absaroka Energy's Gordon Butte site in central Montana can be expected to have lower costs than a generic site. Three separate engineers' estimates for Gordon Butte come in at about $2,000/kw for a 400 MW project with 10 hours of storage. Increasing the project capacity to 600 MW (with 7 hours of storage) reduces the cost to about $1,800/kw.

I would also note that the 3/20/15 presentation show battery costs in the $1,500/kw to $1,700/kw range with 2 hours of storage. This seems extremely optimistic. The E3 report for WECC shows battery costs from various sources in Table 32 on page 53. WECC adopted E3's recommended value of $4,500/kw for battery storage with 8 hours of storage. I think it is also important to think about the useful life of batteries compared to more mature technologies like pumped hydro.

Pumped Hydro vs. Flexible Gas Resources

Pumped hydro's value proposition has changed over time. In the past, pumped hydro was viewed by utilities primarily as a source of peaking capacity with the ability to shift some energy from night to day. However, as increasing amounts of intermittent resources have been added to utilities' systems, the highest value use of pumped hydro is as a fast-ramping, flexible resource capable of integrating wind energy and providing ancillary services such as regulation and load following. Below is a comparison of capital costs for pumped hydro and gas aeroderivative turbines and reciprocating engines. (Note that frame units are not included in this comparison because they are not capable of continuous, fast-ramping operation.)

Flexible Capacity Resources

Resource	Technology	Capacity (MW)	Min Load (MW)	Reg. Capacity (MW)	Installed Cost ($MM)	Capacity Cost ($/kw)	Reg. Cost ($/kw)
Gordon Butte	Pumped Hydro	600	-600	1,200	$1,100	$1,833	$917
Gordon Butte	Pumped Hydro	400	-400	800	$800	$2,000	$1,000
NWC DGGS	Aero CTs	150	10	105	$183	$1,217	$1,738
PGE PW2	Recips	220	9	211	$319	$1,451	$1,513
PGE 2013 IRP	Aero CT	100	30	70	$135	$1,348	$1,925
PGE 2013 IRP	Recips	110	8	102	$181	$1,648	$1,777
PSE 2015 IRP	Aero CT	206	52	154	$259	$1,255	$1,679
PSE 2015 IRP	Recips	220	9	211	$352	$1,600	$1,668

This comparison indicates that the gas options have lower costs per kw of installed capacity. However, because pumped hydro can both generate and absorb energy its regulating range is effectively doubled and it has by far the lowest costs per kw of regulating capability.

In addition to its low costs, pumped hydro has other advantages compared to gas resources such as no fuel price risk, no carbon emissions and the ability to shift energy from night to day.

<u>Transmission for MT Pumped Hydro</u>

The basic information in Attachment A discussing transmission scenarios for MT wind is also applicable to transmission for MT pumped hydro. However, Gordon Butte pumped hydro is less than 10 miles from the Colstrip transmission lines so a long generator tie line would not be necessary.

In addition, MT pumped hydro and wind have complementary transmission needs in at least two important ways. First, the two resources could quite easily share the same dedicated transmission capacity with the pumped hydro generating at times when the wind is not producing. Second, the interconnection substation for the pumped hydro project would provide a local on-ramp for extremely high quality wind in the area (45+% CF) without the need to build long generator tie-lines back to Broadview.

The combination of MT wind and MT pumped hydro on shared transmission would provide a carbon-free alternative for replacing Colstrip capacity and energy in the Colstrip retirement scenarios in the 2015 IRP.

<u>Attachment A - Transmission for MT Wind</u>

Hypothetical 400 MW Wind Farm Located near Judith Gap

<u>Generator Tie Line</u>

<u>Cost</u>: Assume 70 miles of radial 230 kV from Judith Gap to Broadview. With 1272 MCM ACSR this line has a capacity of 470 MVA. The estimated cost is about $500,000/mile for wood H-frame construction in rolling terrain or $35 million. This is about $90/kw for a 400 MW wind farm.

This cost is less than buying transmission service from NWC and should be treated as an adder to wind farm capital costs.

<u>Losses</u>: Losses at 400 MW are 4.7%. Losses at 200 MW are 1.2%. Estimate 3% as average loss over wind farm production profile.

<u>Broadview-Townsend</u> (Colstrip Transmission System)

<u>Cost w/ Colstrip Retirements</u>: No additional investments.

<u>Cost w/o Colstrip Retirements</u>: NWC TSR study for Gaelectric (Attachment C) says 550 MW can be added between Broadview and Garrison with additional series compensation for $73 million. $47 million of this is east of Townsend. This is about $120/kw for a 400 MW wind farm. Assuming a 15% annual fixed charge rate this is equivalent to about $18/kw-year. This would be the appropriate rate since it is higher than the PSE CTS rate of $9.16/kw-year.

<u>Losses</u>: Losses for CTS are approximately 3% (PSE tariff is 2.7%), half between Colstrip and Broadview and half between Broadview and Garrison. Use 1.5% for Broadview to Garrison.

<u>Townsend-Garrison</u> (BPA Montana Intertie)

<u>Cost w/ Colstrip Retirements</u>: No additional investments.

<u>Cost w/o Colstrip Retirements</u>: NWC TSR study for Gaelectric (attachment C) says 550 MW can be added between Broadview and Garrison for $73 million. $26 million of this is west of Townsend. This is about $65/kw for a 400 MW wind farm. Assuming a 15% annual fixed charge rate this is equivalent to about $10/kw-year. This would be the appropriate rate since it is higher than the BPA MT Intertie rate of $7.36/kw-year.

Losses: Losses are included in CTS Broadview-Garrison losses discussed above.

West of Garrison (BPA Main Grid)

Cost w/ Colstrip Retirements: No additional investments.

Cost w/o Colstrip Retirements: BPA 2011 Network Open Season studies concluded that 460 MW of TSRs could be accommodated at costs that could be rolled into the existing BPA Main Grid rate of $17.75/kw-year. BPA 2013 Network Open Season studies confirmed the 2011 results and further concluded that an additional 160 MW of TSRs could be accommodated at costs that could be rolled into the existing BPA Main Grid rate of $17.75/kw-year. (Additional TSRs above 620 MW would require construction of a new 500 kV line between Garrison and Ashe.)

Losses: BPA Main Grid losses of 1.9%.

MT Wind Transmission Scenarios - Hypothetical 400 MW Wind Farm Located near Judith Gap

Scenario	A	B	C
Description	Favorable with Colstrip Retirements	Conservative with Colstrip Retirements	No Colstrip Retirements
Generator Tie Line	Cost: $35 million (add to wind CapEx) Losses: 3%	Cost: $35 million (add to wind CapEx) Losses: 3%	Cost: $35 million (add to wind CapEx) Losses: 3%
Broadview-Townsend (CTS)	Cost: None. (PSE CTS costs are sunk costs that will be recovered from PSE ratepayers whether or not the capacity is used.) Losses: 1.5%	Cost: $9.16/kw-year (PSE CTS rate) Losses: 1.5%	Cost: $18/kw-year (estimated incremental rate for series comp additions) Losses: 1.5%
Townsend-Garrison (BPA)	Cost: None. (MT Intertie rolled into BPA Main Grid or PSE MT Intertie costs are sunk costs that will be recovered from PSE ratepayers whether or not the capacity is used.) Losses: None. (included in CTS losses above)	Cost: $7.36/kw-year (BPA MT Intertie Rate) Losses: None. (included in CTS losses above)	Cost: $10/kw-year (estimated incremental rate for series comp additions) Losses: None. (included in CTS losses above)
West of Garrison (BPA)	Cost: $17.75/kw-year (BPA Main Grid rate) Losses: 1.9% (BPA Main Grid losses)	Cost: $17.75/kw-year (BPA Main Grid rate) Losses: 1.9% (BPA Main Grid losses)	Cost: $17.75/kw-year (BPA Main Grid rate. Series comp additions rolled into existing Main Grid rate as per BPA 2011 and 2013 NOS.) Losses: 1.9% (BPA Main Grid losses)