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TESTIMONY

JAMES A HEIDELL

**STATE OF NORTH DAKOTA**

**BEFORE THE**

**NORTH DAKOTA PUBLIC SERVICE COMMISSION**

OTTER TAIL POWER COMPANY CASE NO. PU-23-066

ADVANCE DETERMINATION OF PRUDENCE – ASTORIA STATION ONSITE FUEL INVENTORY SYSTEM

61 PU-23-66 Filed: 12/20/2023 Pages: 45
PSC Exhibit 1 – Testimony of James Heidell – Redacted

Public Service Commission

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# I. Introduction

**Q. Would you please state your name, affiliation, and address?**

A. My name is James A. Heidell, and I work as a Partner for PA Consulting Group, Inc. (PA). My business address is 1700 Lincoln Street, Suite 3550, Denver, CO 80203.

**Q. On whose behalf are you filing this testimony?**

A. I am filing this testimony on behalf of the Advocacy Staff of the North Dakota Public Service Commission (Commission or NDPSC).

**Q. Please summarize your qualifications and experience.**

A. I have worked in the energy industry for the past 40 years, primarily specializing in electricity and utilities. I have worked on issues related to resource planning, rates, analysis of electricity markets, and analysis of the economics of financial transactions for utilities and wholesale generation owners. My academic background includes a BSE in civil engineering from Tufts University, a MS in engineering economics from Stanford University, and an MBA in finance from the University of Washington. I am a CFA Charterholder. My CV is provided in Exhibit JAH-1.

**Q. Have you testified before the North Dakota Public Service Commission previously?**

A. Yes, I have submitted testimony on behalf of Advocacy Staff in numerous dockets including the following:

- Northern States Power Company's request for an ADP for the Sherco Solar (Case Number PU-21-152);
- Northern States Power Company's request for an ADP for the Heartland Divide II Wind Project (Case Number PU-20-433);
- Montana-Dakota Utilities' 2020 Natural Gas Rate Increase Application (Case Number PU-20-379);

- Montana-Dakota Utilities' request for an ADP and Certificate of Public Convenience and Necessity for an 88 MW Simple Cycle Combustion Turbine (CT) (Case Number PU-19-307);
- Northern States Power Company's request for an ADP for the Dakota Range III Wind Facility (Case Number PU-18-430);
- Northern States Power Company's request for an ADP for the Dakota Range Wind Project (Case Number PU-17-372);
- Northern States Power Company's request for an ADP for 1,550 MW of Wind (Case Number PU-17-120);
- Otter Tail Power Company's Request for an ADP for the Astoria CT and Merricourt Wind Project (Case Nos. PU-17-140, PU-17-141, and PU-17-143);
- Advance Prudence – Biomass Application for deferred accounting Northern States Power Company (Case Nos. PU-17-270, PU-17-271, and PU-17-322); and
- Northern States Power Company Resource Treatment Framework (Case Nos. PU-12-813 et al.).

**Q. What is the purpose of your testimony?**

A. The purpose of my testimony is to provide the Commission with my assessment of Otter Tail Power Company's (Otter Tail or Company) Application for an Advanced Determination of Prudence (the Application) for the Onsite Fuel Inventory System at the site of the Astoria 250 MW natural gas fired combustion turbine (Fuel Storage, or the Project). The Project consists of constructing LNG storage tank and vaporizers.

Otter Tail indicates that the Fuel Storage project provides needed reliability benefits as well as fuel hedging benefits. Based upon Otter Tail's analysis, the project is cost effective as a hedge against natural gas reliability. The Project is included in Otter Tail's most recent Supplement Resource Plan (IRP).

# II. Organization of the Testimony

**Q. Would you please summarize the organization of your testimony?**

A. Yes. I start with presenting my recommendations and findings followed by a detailed discussion of my supporting analysis and additional factors considered. Finally, I propose conditions for the Commission to consider imposing if it approves Otter Tail's request for the Fuel Storage project. My testimony is separated into eleven sections:

- A summary of my recommendations (Section III);
- A summary of my findings (Section IV);
- An overview of the Project (Section V);
- A discussion of the options considered (Section VI);
- An assessment of the need from a reliability perspective (Section VII);
- Quantification of the value of LNG storage at Astoria (Section VIII);
- An assessment of the fuel hedging benefits (Section IX);
- Approval of costs (Section X); and
- My conclusions and recommendations (Section XI)

**Q. Are you sponsoring any exhibits to your testimony?**

A. Yes, I am sponsoring two exhibits:

- Exhibit JAH-1: James Heidell CV; and

# III. Summary of Recommendations

**Q. Do you recommend the Commission approve Otter Tail's ADP request for the Project?**

A. No, I do not recommend approval of the ADP at this time. I recognize that having a second source of natural gas will provide incremental reliability benefits to the MISO system and it has the potential to have value as a hedge against extreme gas prices. However, I do not conclude that the potential benefits outweigh the incremental cost. From a MISO system reliability benefit it is difficult to quantify that incremental value of installing on-site LNG storage at Astoria. MISO and Otter Tail already have a 25.5%

winter planning reserve margin (PRM) requirement to address generator contingency. Furthermore, as Otter Tail identified, over 90% of its winter load in 2026 will be covered with resilient generation without onsite fuel storage at Astoria.[1] While situations of high gas price volatility tend to be unique, my review of recent history, including two major winter storms, does not suggest that there are sufficient fuel cost savings associated with the proposed Project.

**Q. If the Commission approves Otter Tail's request, are you recommending modifications?**

**A.** Yes, as conditions to any Commission approval of the ADP, I recommend that the Commission limit the ADP to the forecast of the capital cost included in the Application.

# IV. Summary of Findings

**Q. Would you please provide a summary of the findings you believe the Commission should consider as it determines whether to approve NSP's Application for an ADP?**

A. My key findings and observations include the following.

- Onsite LNG storage is a lower cost option versus construction of fuel oil capability or connection to another gas pipeline.
- While financial hedges may be a lower cost option to protect against fuel price volatility, the hedges do not provide additional operational resiliency.
- The overall increase to reliability of the MISO system is difficult to quantify as well as the incremental value of Otter Tail having 100% of its generation resilient versus 91%. (Note this is an Otter Tail definition versus a MISO or industry definition.)
- On-site LNG is not likely to have significant value as a hedge against natural gas costs outside of another major event similar to Winter Storm Uri.
- It is difficult to extrapolate benefits based upon Winter Storm Uri as major storms are likely to have unique factors impacting generation, transmission, and distribution.

[1] Prefilled Testimony of Nathan Jensen, p 7 lines 11-16.

- The upper range of benefits calculated by Otter Tail associated with on-site storage based upon the Winter Storm Uri gas and power markets is overstated based upon my review of the scenarios Otter Tail modeled.
- When evaluating the benefit of onsite storage from an insurance perspective, there is the possibility that the project could be cost effective after a few major storms. There is also the possibility that the cost of the Project will never be recovered and that customers are better-off self-insuring, i.e., not funding the project and risking the consequences.

**Q. Do you have additional specific findings?**

A. Based upon my review and analysis of the testimony filed in the Application, the exhibits contained within the Application, and the information produced in discovery, I find the following relevant in determining whether to approve the ADP for the Project:

- If the Commission determines that having a second source of fuel on-site for Astoria is appropriate for operational resiliency, I accept Otter Tail's analysis that onsite LNG is a lower cost option than either constructing a fuel-oil backup, or constructing a connection to a second pipeline.
- I caution the Commission from assuming that the next extreme weather event will result in fuel cost savings comparable to the estimates that either Otter Tail, or I calculate based upon Winter Storm Uri. Future storm events are unpredictable in the type and extent of damage that will occur. For instance, a storm that knocks out transmission and distribution infrastructure will have different consequences than a storm that affects the availability of gas supply.
- The proposed onsite fuel storage system is unlikely to have significant fuel cost hedging benefits in relationship to its cost and other options with regards to the normal day-to-day operations of Astoria.
- A second fuel source at Astoria will increase the resiliency of the Astoria project and MISO. However, whether the added resiliency is worth the price is questionable given the current resource mix in MISO and reserve margin.

- A second fuel source does not create new accredited capacity and would not be additive to the 25.5% winter reserve margin that Otter Tail currently has.

## V. Overview of the Project

**Q. Would you please provide an overview of the Otter Tail's proposal to construct LNG storage and vaporizer facilities at the Astoria CT site?**

**A.** Otter Tail proposes to construct onsite underground LNG storage tanks capable of supplying a five-day supply of natural gas to the 250 MW Astoria CT.[2] The project also includes associated LNG vaporizer equipment for the LNG. The Astoria CT is connected to the Northern Board Pipeline and that is currently the only source of fuel for the Astoria CT. The Commission in November 2017 approved the ADP for the Astoria CT in Case Nos. PU-17-140.

**Q. Did Otter Tail identify the need for additional fuel sources for Astoria at the time of the ADP for Astoria?**

A. No, Otter Tail did not. However, Otter Tail proposed developing dual fuel capability (fuel oil) in its 2021 IRP. In Otter Tail's 2023 Supplemental Resource Plan 2023-2027 Otter Tail indicated its intention to gain approval of LNG storage.

**Q. What is the cost of Otter Tail's proposed Project compared to the Astoria CT?**

A. Otter Tail estimates that the onsite LNG storage system will have a capital cost of **[Trade Secret Begins]** $xxM **[Trade Secret Ends]** along with associated O&M cost. The completed cost of the Astoria CT was $149,123,621.[3]

**Q. Will the project have non-fuel operating costs?**

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[2] Astoria's summer capacity rating is 245 MW and the winter rating is 286 MW.
[3] 2022 FERC Form 1 page 402-403.

A. Yes, Otter Tail has identified non-fuel operating costs and property taxes that start at **[Trade Secret Begins]** $x,xxx,xxx / year **[Trade Secret Ends]** with the operating cost escalating at inflation.[4]

**Q. What benefits of the Project does Otter Tail identify?**

A. Otter Tail asserts that the onsite LNG fuel storage will protect ratepayers from extreme events and mitigate natural gas price volatility. Their argument primarily centers around providing fuel during times that it is either unavailable due to upstream pipeline issues, or during times when natural gas prices are elevated to such a level that it becomes more economical to utilize onsite LNG. Otter Tail also notes that the addition of onsite LNG storage at Astoria will enhance the amount of "resilient" generation in Otter Tail's portfolio.

**Q. Would you please summarize the historical operating performance of Astoria?**

A. Yes, the historical capacity factor is shown in the following table. Note, only 2022 is a complete year. In 2022 Astoria was connected to load for 873 hours.

| | Annual | Winter | Summer |
|---|---|---|---|
| 2021[5] | 14.58% | 11.85% | 17.88% |
| 2022 | 7.02% | 5.69% | 11.23% |
| 2023[6] | 11.33% | 6.66% | 22.52% |

# VI. Options Evaluated

**Q. What options did Otter Tail evaluate for providing grid reliability and fuel hedging benefits?**

A. Otter Tail evaluated the following options[7]:

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[4] Otter Tail response to Advocacy Staff 2-16 Attachment 4.
[5] Partial year
[6] Partial year
[7] See Otter Tail response to NDPSC 2-9.

- Dual fuel capability with onsite oil storage,
- Connection to the Great Lakes Pipeline and Northern Natural Gas pipeline systems,
- Storage contacts,
- Financial instruments, and
- Battery storage.

**Q. Do you agree that those are a reasonable set of alternative options?**

A. Yes, along with considering the additional option of not making an investment in a second fuel source at this time. Not making an investment at this time does not preclude pursuing other options in the future when there may be increased concern about winter reserve margins.

**Q. Why did Otter Tail reject the fuel oil dual fuel option?**

A. Otter Tail estimated that installing dual fuel capability and storage would cost more than LNG onsite storage, increase emissions, and have lower power output.

**Q. Do you agree with Otter Tail's assessment that LNG is a better option than using oil as a supplemental fuel?**

A. While I have not reviewed the cost analysis of constructing on-site fuel oil storage, I accept Otter Tail's characterization that the oil facilities cost more and will have a higher operational cost.[8] However, as noted later in my testimony, my conclusion is that the LNG or oil will rarely be used hence I would not anticipate a significant increase in emissions nor do I anticipate that the decrease in resilient capacity would be significant.

**Q. Why did Otter Tail reject constructing a connection to a second pipeline?**

A. Otter Tail estimated that connecting to the Great Lakes Pipeline would entail constructing a 200 mile pipeline and would cost $500,000,000 and hence more than the LNG onsite

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[8] Otter Tail Response to NDPSC 2.9.

storage.[9] Alternatively, Otter Tail identified that it considered a connection to the Alliance Pipeline that is seventy miles away. This connection option would also be more expensive than onsite LNG based upon using the same estimated cost per mile for natural gas pipelines used to assess the financial viability of a Great Lakes Pipeline connection.[10]

**Q. Do you agree that a second natural gas pipeline is expected to be more costly than onsite LNG storage?**

A. Yes. Otter Tail did not appear to have a detailed cost analysis but used an estimate of $2,500,000 mile. While that estimate is generic, it is in the range of reasonableness.

**Q. What financial instruments did Otter Tail evaluate?**

A. Otter Tail evaluated forward natural gas purchases and natural gas call options, both with physical delivery of natural gas, as financial instrument alternatives.

**Q. What is your impression of Otter Tail's primary argument for reject financial hedging?**

A. A financial hedge, or forward natural gas purchase, would deliver a set quantity of natural gas to Astoria every day of the defined contract period. However, Otter Tail's position is that this would only serve as a financial hedge and not a hedge against reliability. Otter Tail contends that a financial hedge, even when combined with firm transportation service, would not guard against delivery or production limitations that could be experienced by Northern Border. Otter Tail pointed to Winter Storm Elliot as an example of an event which could curtail delivery of forward purchases even if Astoria had a firm transportation contract.

**Q. Do you agree that hedging with firm transportation rights does not hedge against operational reliability?**

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[9] See Otter Tail response to NDPSC 2.8.
[10] See Otter Tail response to NDPSC 2.9 (3) and 3.2.

A. I agree that there is the possibility of another event that would interrupt gas flow on the pipeline and result in curtailment of generation from Astoria. A similar event would have financial repercussions, but it is not clear that it would adversely impact MISO system reliability to the point that load would have to be curtailed beyond interruptible service customers or requesting voluntary load reductions.

**Q. Did Otter Tail have additional concerns with financial hedging?**

A. Yes. Otter Tail contends that the required daily delivery and receipt of a certain quantity of natural gas is problematic. Gas that is nominated but not consumed must be sold on the spot market. This could be a frequent problem for Astoria given its low-capacity factor. There are frequently days when the plant does not generate and thus does not burn any gas. Having to liquidate supplies in the spot market could result in losses on the sale. Conversely, there could be days when Astoria's gas needs exceed its forward contract volume. In that scenario the plant could be left with an open financial position.

**Q. Do you concur with Otter Tail's conclusion that financial hedging is not a viable option to protect against price volatility?**

A. No, I do not agree that financial hedging is not a viable strategy for addressing price volatility. I recognize that contracting for a fixed quantity of physical gas on a daily basis can create issues for an asset such as Astoria that has a low-capacity factor and highly variable fuel needs. I also agree with Otter Tail that a forward purchase could provide some level of protection against commodity price volatility, but that protection could be outweighed by losses realized in having to sell excess gas on the spot market if the full contracted quantity is not needed. However, my perspective is that the rationale for hedging is to provide insurance against high prices. A hedge, versus speculation, reduces uncertainty and does not have to be profitable just as there are no guarantees that investing in onsite LNG will provide financial benefits that outweigh the costs.[11]

[11] To avoid all doubt, I am referring to hedging against potential winter gas needs for Astoria and not speculating on the gas or power markets.

**Q. Are pure financial hedges a viable strategy?**

A. Yes. While I have not reviewed Otter Tail's hedging policies, I assume that the utility has risk management policies and appropriate oversight of trading operations to use financial hedging where appropriate.

Otter Tail also notes that forward purchases can only be purchased in the short term and do not guarantee commodity price stability. While contracts for forward purchases of natural gas with physical delivery beyond the upcoming winter season could be difficult given a lack of market liquidity for physical gas, the market for financially settled hedges offers more liquidity and it is not uncommon for purchasers of such hedges to buy over the long term. In addition, it likely does not make sense to hedge beyond an upcoming winter season or alternatively only to hedge for a month at a time.

**Q. Does Otter Tail make additional arguments for why financial hedging is not a viable alternative to on-site LNG?**

A. Yes, Otter Tail asserts that forward natural gas can only be purchased in the short-term and does not guarantee price stability or availability in the future. Otter Tail cites two examples of the short-term nature of forward purchases and the volatility associated with such purchases. On December 16, 2019, Otter Tail inquired about the cost of a forward contract for Winter 2020/21 and was quoted a price of **[Trade Secret Begins]** $x.xx/MMBtu **[Trade Secret Ends]**. On May 22, 2023, Otter Tail again sought quotes for a forward purchase for the Winter 2023/24 season and was quoted **[Trade Secret Begins]** $x.xx/MMBtu **[Trade Secret Ends]**.[12] Otter Tail notes this represents an increase of 60% over three years.

**Q. Are you persuaded by Otter Tail's example of price volatility?**

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[12] Response to Data Request 2.09 pg. 2.

A. No. While I agree that there has been price volatility in the natural gas market, the Otter Tail example does not come close to justifying using LNG as a hedge against recent price volatility even excluding the capital and non-fuel operating costs of the project. Furthermore, depending on the quantities and months purchased the hedge could have been profitable given the increase in gas prices. Note, this is an observation and not a recommendation or argument that Otter Tail should have purchase a hedge.

**Q. Do you have other comments about Otter Tail's example of price volatility?**

A. Yes, the pricing example relies upon one day of data, not an average price of what the strip traded at over time. Furthermore, natural gas prices across the country were well below historical levels in late 2019 and early 2020 when Otter Tail received the first quote. In December 2019, the Northern Ventura spot price averaged $2.08/MMBtu, nearly $0.50/MMBtu lower than the preceding 12 months. This makes the comparison to the May 22, 2023, quote quite stark. The May 22, 2023, quote came at a time that natural gas forwards were elevated following pronounced volatility during 2022 and into early 2023 as demand rebounded following the pandemic. These two price quotes represent what could be best described as "cherry picked" examples that show a large price delta that existed at one point in time but do not accurately represent typical forwards market pricing. More importantly despite referencing points that suggest high volatility, both price quotes are well below the assumed cost of LNG.

**Q. In summary, do you conclude that financial hedges are not a viable alternative to onsite LNG?**

**A.** My conclusion regarding onsite LNG storage versus hedges is that onsite LNG is insurance against reliability issues and does not offer value as a hedge against price volatility given realized historical prices and the ability to mitigate commodity price risk through financially settled hedges. I concur with Otter Tail that financial hedges do not offer protection against the risk of being unable to receive natural gas due to upstream issues. Hedges do not guard against extreme outlier events where gas is unable to be delivered. I disagree that financial hedges may not be a more cost-effective way to manage gas price volatility outside of extreme events.

**Q. Why did Otter Tail reject natural gas call options?**

A. Otter Tail rejected call options since options are expensive and they do not ensure operational reliability.

**Q. Do call options provide operational reliability?**

A. No, call options do not serve as a hedge against reliability since there is no guaranteed deliverability.

**Q. Why did Otter Tail conclude that options were an expensive alternative to onsite LNG storage?**

A. Otter Tail evaluated three types of natural gas call options: a fixed call option, a first of the month call option, and a customized intraday call option. Each option would entail negotiation of a contract premium and a strike price.

Otter Tail cites the cost of such call options as a limiting factor. In November 2019, Otter Tail was quoted a Winter 2020/21 fixed call option with a premium of **[Trade Secret Begins]** $x.xx/MMBtu and a strike price of $x/MMBtu **[Trade Secret Ends]**. The premium alone for this call option would cost Otter Tail **[Trade Secret Begins]** $xx million **[Trade Secret Ends]** annually to cover Astoria's full winter output **[Trade Secret Begins]** (~xx,xxx MMBtu per day) **[Trade Secret Ends]**.[13] Otter Tail additionally received a quote for a first of month call option with a **[Trade Secret Begins]** $x.xx/MMBtu premium **[Trade Secret Ends]** , which would have cost **[Trade Secret Begins]** $x.x million **[Trade Secret Ends]** annually to cover the winter season.[14] Lastly, Otter Tail also received a quote for a customized intraday call option that would minimize intraday price risk and allow them to call on 15,000 MMBtu of gas at morning

[13] Response to Data Request 2.09 pg. 4.
[14] *Id.*

quoted gas pricing until 2PM. The premium for this winter contract was quoted at **[Trade Secret Begins]** $x.x million **[Trade Secret Ends]** annually.[15]

Additionally, the terms of the call options, including physical volumes associated with them, would need to be determined well in advance of when the gas would be called upon and the option would need to be oversized to adequately carry Astoria through a winter storm event.

**Q. Do you concur with Otter Tail's conclusion that natural gas call options are not a viable option?**

A. Yes, to an extent. The call options are likely a more expensive way to guard against price volatility than onsite LNG storage. The premiums associated with the fixed and first of month call options may be more expensive over the long-term than utilizing onsite LNG storage, even before considering commodity costs. However, it should be noted that the strike price on the call options referenced by the Company is significantly below the cost of LNG. Hence, a call option at the price of LNG is likely to have cost significantly less than the premium noted by Otter Tail.

The premium associated with the intraday call option is far lower than that of the fixed and first of month call options and this could serve as a viable financial hedge against intraday volatility. But as Otter Tail notes, this would not guarantee delivery of gas should transportation be curtailed, and the intraday volume only accounts for just over one-fourth of Astoria's potential daily need.

**Q. Do you agree that battery storage is not a cost-effective alternative?**

A. Yes. On a $/kW basis 8 hour battery storage at a cost of approximately $2,085[16] /kW is clearly more expensive than the approximate **[Trade Secret Begins]** $xxx/kW **[Trade Secret Ends]** for the LNG storage. However, the analysis is more complex. The LNG storage does not increase Otter Tails' total capacity for MISO accreditation unless there

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[15] *Id.* at pg. 5.

[16] NREL 2022 ATB, Utility-Scale Battery Storage | Electricity | 2022 | ATB | NREL

are years when Astoria would not have operated but for the LNG. On the other hand, battery storage adds accredited capacity that could not only backstop the threat of gas interruptions in the winter, but also add capacity to meet Otter Tail's summer capacity obligation. In addition, using LNG will always be costly compared to the prospect of using batteries for time-based arbitrage to take advantage of hours of low-cost energy. I also note that while batteries have accredited capacity, they would not offer the long duration energy source that onsite LNG storage offers.

**Q. Do you agree that onsite LNG storage was the most reasonable option for Otter Tail to consider for operational reliability?**

A. Yes. Otter Tail appears focused on ensuring reliability of fuel supply, and to that end there are really just two options to consider – dual fuel capability with fuel oil, and onsite LNG storage. Installing dual fuel capability with fuel oil would likely prove more expensive than onsite LNG storage, so I agree that onsite LNG storage is the most reasonable option to ensure fuel reliability.

However, when it comes to strictly guarding against commodity price risk, physical and financial hedges would more than likely provide sufficient protection against commodity prices rising to or above the level of Otter Tail's assumed LNG cost. Therefore, the issue comes down to whether the cost of onsite LNG storage is worth its cost as insurance against the consequences associated with potential fuel supply disruptions.

## VII. Generation Resiliency

**Q. Would you please summarize your understanding of Otter Tail's argument about the need for generation resiliency?**

A. Otter Tail identifies resilient generation based on three characteristics: 1) dispatchability; 2) reliable fuel supply; and 3) energy price protection. Under their definition of resilient generation, only coal generation, dual fuel simply cycle, and fuel oil simple cycle units are defined as resilient generation. Natural gas simple cycle, battery storage, solar, and wind resources are not considered resilient generation resources as per Otter Tail.[17] Based on Otter Tail's definition, adding on-site LNG would then qualify Astoria as "resilient generation". Specifically, "Otter Tail projects that 10.6% of its overall load will be exposed to market energy prices assuming no variable resource generation in 2022."[18]

**Q. Do you agree with Otter Tail's characterization of resiliency?**

A. I believe all three attributes that Otter Tail describes are important but for the purpose of evaluating the ADP my recommendation is to separately address the issue of generation availability to meet loads (dispatchability and energy supply) from the cost (energy price protection / hedging value).

**Q. Does MISO have resiliency requirements?**

A. Not that I am aware of. However, the RASC has started to investigate a more formal definition of reliability attributes. These attributes are: availability, fuel assurance, ramp up capacity, voltage stability, rapid start-up, and long duration energy at high output.[19] However, I am not aware that there is a formal agreed upon definition or associated measurement criteria for these attributes. For example, it is not known whether Astoria would be classified as long duration energy output without a supplemental fuel source.

**Q. Is there a standard industry definition of resiliency?**

A. No, not that I am aware of. I do, however, note that Northern States Power, a large utility operating in North Dakota, South Dakota, Michigan, Minnesota, and Wisconsin essentially defines resiliency as a firm dispatchable resource. To this end, Northern States Power considers natural gas combustion turbines as firm dispatchable, and thus resilient, even without onsite fuel storage.[20]

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[17] ADP Table 3-8
[18] ADP, Figure 3-9, p. 17
[19] System Attributes Stakeholder Workshop, September 21, 2022
[20] Xcel Energy, Upper Midwest Integrated Resource Plan 2020-2034, p. 45, 106.

**Q. How much of Otter Tail's generation is resilient based upon Otter Tail's definition?**

A. Otter Tail noes that based upon its 2023 forecast 88% of its load can be met with its resilient generation and if onsite storage is constructed at Astoria Otter Tail can meet 99% of its load with resilient generation.[21] However, it is important recognize that Otter Tail as a member of MISO is part of a large system so it does not necessarily rely on its own generation even at the hour of peak demand. Furthermore, Otter Tail maintains a winter reserve margin of 25.5%.

**Q. Do you agree that achieving close to 100% generation resiliency by Otter Tail's criteria is the appropriate planning criteria?**

A. Given the winter reserve margin and that MISO Zone 1 is currently summer peaking, I am not convinced that it is an appropriate absolute target.

**Q. What are your concerns with adopting virtually 100% resilient generation as thee planning criteria?**

A. While I agree that generation resiliency is important, I want to acknowledge there are tradeoffs between striving for 100% resiliency and the cost to customers. I note that the Otter Tail appears to be making an argument that virtually all of its generation capacity should be resilient. The rationale appears for onsite LNG is to protect against an outlier event, such as an extreme storm, for both the full 10% of load to be exposed to market prices and for those prices to be very high. Potentially, mitigating against this outlier event creates an additional cost to customers in that the Otter Tail is already required to have a reserve margin which in theory protects against an already-established level of risk. There is a trade-off between the level of risk one is willing to accept and the associated cost to reduce the probability of an outage. At some point, customers will be unwilling to pay for additional risk mitigation because the cost outweighs the benefits.

**Q. What is Otter Tail's winter capacity load and obligation?**

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[21] Figures 4-1 and 4-2, Supplement Resource Plan.

A. According to the Supplement IRP, Otter Tail has winter peaking resources of 1,170.9 MW and meets the 25.5% winter reserve margin (1,117 MW) required by MISO.[22] While Otter Tail only characterizes 720 MW of its current winter generation as resilient, it has 227 MW of generation reserved for contingencies in the winter.[23]

**Q. Is it possible to quantify how much customers should be willing to pay for additional generation resiliency?**

A. While it is a crude metric, MISO does define a cost to residential and small commercial customers associated with the loss of load.

**Q. What value does MISO assign to the cost of loss-of -load?**

**A.** MISO defines a target Value of Lost Load (VOLL) of $3,500 /MWH. Clearly, if the there is a loss of load the assumed economic impact is consequential. However, I do not have an approach for estimating what is the decreased probability of a loss of load event associated with having a second fuel source at Astoria. I would note that as per MISO procedures, energy and ancillary combined market prices default to the VOLL only during very specific conditions: MISO must be unable to balance energy during a NERC Energy Emergency Level 3 event which affects either the entire MISO Balancing Area or an entire sub-area (Local Balancing Areas or LBAs).[24]

**Q. If Astoria were the lynchpin in causing a loss-of-load event, would that make onsite LNG storage a cost-effective investment?**

**A.** Yes, under the hypothetical that having onsite LNG storage would avoid a loss-of-load event for over **[Trade Secret Begins]** xx hours **[Trade Secret Ends],** it would make the capital investment cost effective.

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[22] Winter Capacity Resources identified in Table 1-1, Appendix C: Existing Resources, Supplement Resource Plan, Reserve margin defined in Table 4-2 of the Supplement Resource Plan.
[23] Otter Tail characterization of its resilient generation capacity in ADP Table 3-9 of its Application, p. 5.
[24] MISO Open Access Transmission, Energy and Operating Reserves Tariff Module A and Module C

**Q. If Astoria were needed for system reliability but was not bid into the market due to expectations regarding gas and electric prices, would Otter Tail be compensated for the gas costs?**

A. Yes, if gas were available and MISO directed Astoria to run, then Otter Tail would be compensated under MISO's Price Volatility Make-Whole Payments.

**Q. If Astoria were needed for system reliability but could not secure gas at any price would there be a financial implication?**

A. Yes, if Astoria was not available to run during a system peak hour it would impact its capacity accreditation.

**Q. Has natural gas service been curtailed to Astoria?**

A. Yes, Otter Tail notes that gas was curtailed during Winter Storm Elliot over the period of December 23 – December 26, 2022.[25] While gas was flowing on the Northern Border Pipeline, upstream capacity was reduced by nearly 50% and delivery was mostly only available for firm shippers nominating on a primary firm transportation path. Tenaska Marketing Ventures, the asset manager for Astoria, holds firm transportation rights on Northern Border, but delivery to Astoria is secondary firm, not primary.[26] Therefore, Astoria was unable to receive gas during this time. However, even if Astoria had firm primary firm transportation, the unit might not have been able to receive its fully contracted quantity due to reduced upstream capacity.

**Q. Would natural gas service have been curtailed to Astoria if the plant were online during Winter Storm Uri?**

A. Otter Tail indicates that natural gas would have been available. However, Otter Tail notes that an additional fuel source would have value to associated with managing intra-day price risk.

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[25] Application p 25.
[26] Fuel Supply and Fuel Management Services Agreement, NDPSC 2.6 Attachment 2 p 5.

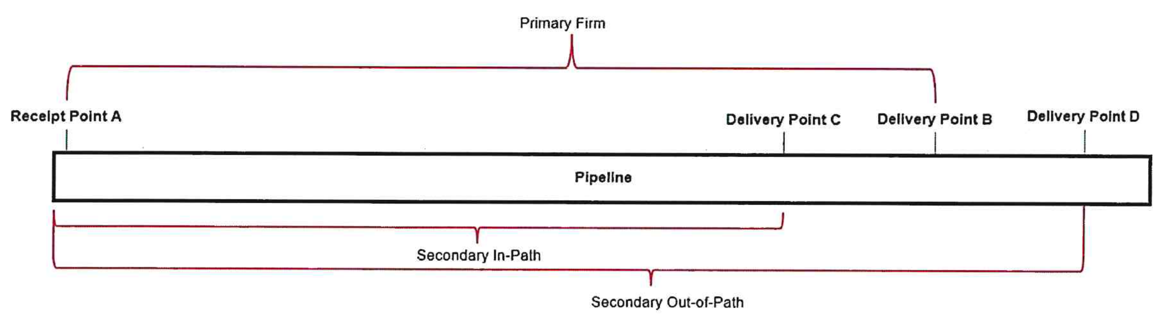
"In fact, even during Winter Storm Uri in February 2021, natural gas would have been available for Astoria Station if it would have needed to operate." [Application p 19]

**Q. Are there different levels of firm service from the pipeline?**

A. Yes, the Northern Border Pipeline tariff defines three types of firm transportation that are outlined: 1) primary firm; 2) secondary in-path; and 3) secondary out-of-path.

**Q. What is primary firm service?**

A. Primary firm transportation is when a shipper nominates a receipt and delivery point that are explicitly defined in their firm transportation contract. Using the example in the image below, consider a hypothetical situation in which a shipper has contracted for firm transportation with a pipeline and the defined receipt point in the contract is Receipt Point A, and the defined delivery point in the contract is Delivery Point B – this is the contract path. A primary firm shipment of gas would be when the shipper nominates receipt of gas at Receipt Point A, and delivery of gas at Delivery Point B.




**Q. What is secondary firm service?**

A. Secondary in-path would be when the shipper nominates for receipt of gas at Receipt Point A, but delivery of gas at Delivery Point C. Delivery Point C is in the firm transportation path of the contract (Receipt Point A and Delivery Point B) but is not the actual defined delivery point as per the terms of the contract. Secondary out-of-path would be when the shipper nominates for receipt of gas at Receipt Point A, and delivery of gas at Delivery Point D.

**Q. How would the different types of firm service impact deliverability of natural gas to Astoria?**

A. In the event that the aggregate quantity of all validated nominations on a given day exceed Northern Border's ability to receive or deliver gas at a specific location, capacity will be allocated first to primary firm, then to secondary in-path, and finally to secondary out-of-path. While Tenaska Marketing Ventures holds firm transportation rights on Northern Border via a number of contracts with varying receipt and delivery points, Astoria is not a defined delivery point under any of the contracts. Thus, delivery to Astoria is either secondary in-path or secondary out-of-path, depending on the contract under which Tenaska Marketing Ventures is using to nominate and deliver gas to Astoria. Per the Fuel Supply and Fuel Management Agreement

**[Trade Secret Begins**

**[Trade Secret Ends]**

**Q. What happened to gas supply during Winter Storm Elliot?**

A. During Winter Storm Elliot Northern Border reduced pipeline capacity due to limited supply coming on to the system as a result of production shut-ins and compression issues. As a result, Northern Border allocated capacity first to primary firm shippers on a pro-rata basis. Astoria was unable to receive during Winter Storm Elliot due to nominations to the plant were secondary in-path, and after primary firm nominations were honored, there was no capacity left to serve Astoria's fuel needs.

It is likely that Astoria would have been able to receive at least a pro-rata share of gas during Winter Storm Elliot if Tenaska Marketing Ventures held primary firm transportation to Astoria. However, Astoria is not a defined delivery point for any of

Tenaska's contracts, the plant was unable to receive gas during the storm, and deliveries to the plant were curtailed. Barring a situation in which Northern Border is unable to deliver or receive any quantity of natural gas, holding primary firm transportation would guarantee at least some level of delivery even during curtailments subject to the force majeure provisions in the contract.

**Q. Did MISO have to curtail load during the time that Astoria was curtailed?**

**A.** No, not that I am aware of.

**Q. Was there a loss of load in MISO as a result of curtailment of gas at Astoria?**

**A.** No, not that I am aware of.

**Q. Has MISO had load shedding events subject to its tariff?**

A. Yes, MISO identified seven load curtailment events in a 2021 presentation.[27] These events were all localized and not system wide. MISO also notes the associated drivers of the events. It is noteworthy that loss of transmission is one of the drivers in all the events with the exception of the curtailment in the MISO South Sub-Region during Winter Storm Uri. While a second fuel source would make the Astoria generation station more resilient, it does not necessarily make the total MISO system more resilient as a result of other contributing factors including transmission outages and the possibility of storm damage to the generators.

**Q. Is it reasonable to identify the reliability value of installing LNG storage at Astoria?**

A Yes, despite the challenge and inherent inaccuracy of such a value, the value of avoiding a MISO outage is an important consideration. I view the LNG storage in the context of an insurance policy; paying an annual premium to avoid a potentially large cost.

[27] 20210708 MSC Item 07 Application xof VOLL during Force Majeure Events (MSC-2021-3)566591.pdf (misoenergy.org)

However, it should be noted that the probability that LNG storage at Astoria would avoid a MISO outage is equally challenging to evaluate.

**Q. What do you conclude about Otter Tail's need for additional resilient generation and whether adding onsite LNG to Astoria assists this need?**

A. Otter Tail's resilient generation fleet covers 90% of their load needs, without considering any generation from intermittent resources or "non-resilient" resources. Additionally, Otter Tail is required to meet MISO Planning Reserve Margins (PRM) which provide mitigation against a predetermined loss of load expectation (LOLE) target.[28] Currently, the MISO winter reserve margin is set at 25.5% (UCAP). MISO Zone 1, where Otter Tail is located, had an excess of 3900 MWs in the Winter 2023/24 Planning Resource Auction (PRA), translating to an actual reserve margin of 52%.[29] This means that MISO Zone 1 is oversupplied for winter capacity and Otter Tail could turn to the market for replacement winter capacity if needed.

MISO indicates that reserve margins may become tighter in the future with generation retirements and the transition to a greater percentage of renewable generation.[30] However, if Otter Tail did not pursue adding onsite LNG now, it is not precluded to adding LNG in the future when there is more of a demonstration of need.

Based upon my review I conclude that Otter Tail has not adequately demonstrated the need for additional resilient generation at this time for the purposes of operational resiliency.

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[28] For Winter 23/24, MISO-wide LOLE target is 0.01.
[29] Winter 2023/24 PRA Results by Zone: 2023 Planning Resource Auction (PRA) Results628925.pdf (misoenergy.org)
[30] 2023 Planning Resource Auction (PRA) Results628925.pdf (misoenergy.org)

# VIII. Valuing Generation Resiliency

**Q. What are some considerations in valuing generation resiliency?**

A. When I evaluate generation resiliency, I consider both the cost savings that resilient generation can bring as well as the value of generation availability. I will first discuss potential fuel cost savings of adding on-site LNG to Astoria, and then discuss the value of having Astoria available when needed.

**Q. How are you defining fuel cost savings for the purpose of your analysis?**

A. I define fuel cost savings as the times when gas is available to Astoria and when the LNG fuel cost (excluding capital and non-fuel maintenance) is less than the price of delivered natural gas.

**Q. How many hours did the plant operate when the day-ahead gas price was over Otter Tail's assumed price for LNG delivered to the Astoria facility?**

A. Based upon the target price of **[Trade Secret Begins]** $xx.xx / MMBTU **[Trade Secret Ends]** the plant operated **[Trade Secret Begins]** x **[Trade Secret Ends]** hours, though Otter Tail has noted that natural gas transport was curtailed at this time. These hours occurred during Winter Storm Elliott in late-December 2022. The shut-in across Appalachia and the Midcontinent created a ripple effect across much of the East Coast and Midwest, and prices climbed above the assumed LNG price.

**Q. Had Astoria been operating were their other times when the day-ahead gas price was over Otter Tail's assumed price for LNG delivered to the Astoria facility.**

A. A polar vortex in late February through early March 2014 with sustained low temperatures created pipeline constraints and well shut-ins in the Midwest, which drove natural gas prices at Ventura above the target LNG price. In late December 2017, a cold air outbreak east of the Rockies briefly drove prices above this level. In February 2021 Winter Storm Uri 2021 caused shut wells throughout Texas and the Midcontinent, and Ventura saw prices above the assumed LNG price. The incidences when natural gas prices were over the LNG price is shown in the following graphic. In the following graphic I did not assume a fixed price for delivered LNG. The LNG price is the sum of the assumed LNG adder identified by Otter Tail to the average summer Ventura price of natural gas.

**[Trade Secret Begins]**

**[Trade Secret Ends]**

In total, since 2014 there have been 24 days during which the day-ahead gas price exceeded the assumed LNG price. During the 2014 polar vortex, the day-ahead gas price remained above the assumed LNG price for a stretch of 11 days, with three individual days wherein the day-ahead gas price was higher than the LNG price in the two weeks before the 11-day stretch. In late 2017, gas prices exceeded LNG prices for only a single day. During Winter Storm Uri in February 2021, gas prices exceeded LNG prices for a stretch of seven days and during Winter Storm Elliott, gas prices exceeded LNG prices for a stretch of two days.

**Q. Did Otter Tail calculate a cost savings value associated with adding a secondary energy supply at Astoria?**

A. Yes, Otter Tail developed a hypothetical estimate of what savings would have been realized had Astoria been operating during Winter Storm Uri both with and without onsite LNG storage. Otter Tail also noted the risk of lost accredited capacity if Astoria was not able to generate during the MISO peak. However, Otter Tail did not assign a dollar value of replacement accredited capacity if hypothetically Astoria was not available but would have been available with onsite LNG storage.

**Q. What value did Otter Tail associate with on-site LNG storage as a solution to financially protect customers from extreme events?**

A Otter Tail developed an analysis of the savings under different natural gas purchase options had the Astoria CT been online during Winter Storm Uri in February 2021. Otter Tail presented a range of value from \$4.7M to \$23.7M depending on the amount of gas that would have been purchased day-ahead versus intra-day. Otter Tail also developed scenarios with higher electric costs that what was experienced during Winter Storm Uri and in the most extreme case identified \$117.8M of savings.[31]

**Q. Do you agree with Otter Tail's range of estimates of what the cost savings would have been?**

A. No, my conclusion is that the estimation of the benefits in the scenario that Astoria had reached commercial operation and had onsite LNG storage were over-stated. I recognize that it is a hypothetical analysis and that the analysis is based upon assumptions. However, my assessment is that in the high financial loss scenarios the assumptions are not reasonable regarding varying amounts of day ahead purchase that would have been purchased.

**Q. Why are the assumptions not reasonable?**

A. The model incorporates the gas supplier's estimate of what timely nominations will settle at. This is the "Timely Quote" for next day gas. While the settlement price is likely to differ from the Timely Quote, the Timely Quote should be the indicator for expected gas cost and consequentially any DAM bid into MISO. All but the 0% Timely Purchase scenarios assume that various amounts of gas are bought day ahead on February 11, 2021 thru February 20, 2021. However, given the actual Day Ahead prices Otter Tail's bids

[31] ADP Table 3-12, p 23.

into MISO would not have been picked up based upon the expectation of gas prices. If the bids were not selected, then Otter Tail would not have purchased day ahead gas and then liquidated the gas intraday at a loss. The following table shows for each day the number of hours that the DAM price was below the expected cost of gas and the gross margins that would have been realized in the MISO market. As a result, I conclude that it would not have been reasonable to have made day-ahead bids that would have been picked up by MISO and consequentially the losses assumed in the "gas only" scenario are not reasonable.

| Date | Expected Day Ahead Margin | # of Hours with Negative Expected Margin |
|---|---|---|
| 2/10/2021 | (2,796) | 14 |
| 2/11/2021 | (372,418) | 24 |
| 2/12/2021 | (279,916) | 24 |
| 2/13/2021 | (2,945,276) | 24 |
| 2/14/2021 | (2,520,323) | 24 |
| 2/15/2021 | (1,905,581) | 24 |
| 2/16/2021 | (1,392,293) | 21 |
| 2/17/2021 | (7,117,490) | 24 |
| 2/18/2021 | (3,601,545) | 24 |
| 2/19/2021 | (503,271) | 21 |
| 2/20/2021 | (133,081) | 24 |

**Q. What estimate of savings associated with Uri do you think is reasonable?**

A. My recommendation is to use the use the Net Benefit Average Gas case ($4.7M) for Winter Storm Elliot. In this scenario my assumption is that Otter Tail made no day-ahead gas purchases as its bids would not have been accepted in virtually all the hours in Otter Tail's analysis.

**Q. If there was onsite LNG during Winter Storm Elliot, would Astoria have been dispatched?**

**A.** Yes, based upon real-time energy prices and intraday gas prices, it would only have been three additional hours during Storm Elliot.

**Q. If there was onsite LNG during Winter Storm Elliot, would Astoria have created cost savings?**

**A.** Yes, based upon my analysis, customers would have saved approximately $170,000 over the period of December 20 through December 26. A summary of my results follows.

| | No LNG | With LNG | Delta |
|---|---|---|---|
| **Revenues** | 2,592,728 | 2,771,896 | 179,168 |
| **Gas Cost** | 853,962 | 863,496 | 9,534 |
| **Margin** | 1,738,765 | 1,908,400 | 169,634 |

**Q. Would you briefly describe your analysis?**

**A.** Yes, I looked at settled gas prices and day ahead and real-time LMPs for the Astoria node. I recognize that this is a simplified analysis since I did not use expectations of day ahead gas prices as Otter Tail did in their analysis of Winter Storm Uri.

**Q. Does your analysis of the savings during Winter Storm Elliot demonstrate that there will never be situations where on-site LNG storage at Astoria is a cost-effective investment?**

**A.** No, the point of my analysis is that not every major storm will have the same natural gas cost savings as the Winter Storm Uri and gas service to Astoria is not curtailed in every winter storm.

**Q. Do you have any qualifiers you want to add to your savings estimate?**

A Yes. I would note that "extreme" events, regardless of their frequency, should be considered unique. While there inevitably will be future "extreme" events, they may not be like Winter Storm Uri. There are inevitably a range of operational issues associated with different extreme events that impact the deliverability of fuel, operation of on-site generation and associated systems, and well as delivery of energy, and customer demand.

**Q. Does Otter Tail identify other economic benefits besides gas price risk?**

A Yes, Otter Tail notes that under the MISO capacity construct Astoria accredited capacity is based upon historical seasonal performance and that the lack of a secondary fuel source creates a risk related to the accredited capacity.

**Q. Did Otter Tail quantify that risk?**

A No.

**Q. Do you anticipate that to be a significant risk?**

A No. While there are scenarios where the economic impacts are large and could negate a large portion of the cost of constructing the onsite LNG storage, I do not consider those scenarios to be likely.

**Q. What would the financial implications be of replacing the accredited capacity of Astoria if the plant were not available due to a lack of natural gas supply?**

A First I note that there are a number of factors / assumptions that need to be considered in assessing the financial implications and there are a broad range of outcomes. However, as a proxy to provide some context to the financial risk I came up with the estimate of $2.2M / year in the event that a major storm occurs every three years and that natural gas prices reach the same level they did during Winter Storm Elliot. This cost is significantly less than the cost to build the LNG storage facility.

**Q. Do you consider the $2.2M cost a precise estimate?**

A. No, I would describe it as indicative; it is a proxy and an order of magnitude comparison that I used to provide some context to how I evaluated the risk in conjunction with the cost of the projects. I treat is as a component of my evaluation as to whether to recommend approval of the ADP.

**Q. Have you quantified the potential benefits of onsite fuel storage?**

A. Yes, I developed a matrix around three different components of benefits: 1) having onsite fuel during a major winter storm, 2) avoiding the cost of replacement capacity if Astoria is not available during MISO's winter peak demand hours, 3) natural gas hedging value outside of major storms. I used my previously discussed calculations of the savings during Winter Storm Uri ($4.2M) and replacement capacity based upon MISO CONE ($2.2M). I adjusted the savings for the first two parameters based upon different frequency of major storms (every two, three, or four years.) I also adjust the baseline cost for each of the three parameters with multipliers of 0.5, 1.5, and 2 to reflect uncertainty in the cost estimates. As shown in the following table, I developed a range of annual savings from less than one million dollars to $6.5M. These savings would presumably escalate over time. These savings would offset the potential annual cost to customers of approximately **[Trade Secret Begins]** $xxm and $x.xM **[Trade Secret Ends]** for the first and second ten years respectively.

| | Major Storm Frequency | | |
|---|---|---|---|
| **Price Impact** | **Two Years** | **Three Years** | **Four Years** |
| .5X Scenario | $1.6MM | $1.1MM | $0.8MM |
| 1X Scenario | $3.2MM | $2.2MM | $1.6MM |
| 1.5X Scenario | $4.9MM | $3.3MM | $2.5MM |
| 2X Scenario | $6.5MM | $4.4MM | $3.3MM |

**Q. What assumptions did you use to develop the range of annual estimates of onsite fuel storage ?**

A. I considered the following assumptions.

- MISO's seasonal capacity construct means that the loss of accredited capacity will only apply on a seasonal basis.

- I assume that the situation where gas is not available to the plant is limited to the winter season.
- The MISO accreditation is based upon historical performance over the RA hours for the prior three years.
- I assume a major storm occurring every second, third, and fourth year, but I also assume that pipeline gas is not available for only 1/3 of the RA hours (i.e., approximately 22 hours). This translates into one third of the winter capacity of 285 MW is not accredited.
- For major storms, I assumed multiples of the cost I calculated for Winter Storm Uri.
- I assume that Otter Tail can go out and purchase replacement capacity on a bilateral basis or through the PRA. While Otter Tail could be exposed to a penalty situation, I assumed multiples of the CONE price.
- I assume a CONE price of $257.53 MW-day as the proxy cost for replacement capacity.

# IX. Fuel Hedging Benefits

**Q. Would you please summarize what you are characterizing as fuel hedging benefits?**

A. Yes, my reference to fuel hedging benefits is my assessment of what are the potential cost savings of having the option to use on-site LNG versus purchasing pipeline natural gas. In short, assuming that natural gas is available, what is the expectation of occurrences where it is both cost effective to dispatch the Astoria CT and there would be fuel cost savings from using LNG from on-site storage. At a high level, given Otter Tail's expectation of the cost of LNG and the Astoria heat rate, when would MISO prices be over **[Trade Secret Begins]** $xxx/MWH **[Trade Secret Ends]**

**Q. Would you please summarize how Otter Tail calculated the benefits?**

A. Otter Tail did not develop a specific estimate of the fuel hedging benefits outside of extreme events.

**Q. What did Otter Tail conclude about the fuel hedging economic benefits from the Project?**

A. Otter Tail notes that energy and gas market price volatility is more of a concern and notes that its projections of natural gas and energy prices is currently higher than recent years.[32] Otter Tail also provides an illustration of Ventura Hub natural gas prices since 2009. However, outside of extreme weather events it does not provide a quantification of the hedging value of the Project.[33]

**Q. Did you develop your own assessment of the fuel hedging benefits?**

A. Yes, I looked at daily historical fuel prices back to 2005 and associated hours when the MISO LMP indicated that Astoria would have been in the money excluding non-fuel operating costs and any start costs.[34]

**Q. Historically, how many days as the Ventura Hub price been over Otter Tail's estimated LNG cost?**

A. Based upon Otter Tail's target LNG price there have been **[Trade Secret Begins]** xx days **[Trade Secret Ends]** in the last 14 years.[35]

**Q. How frequently are MISO Day-Ahead or Real-Time prices high enough for LNG dispatch to be economical?**

A. Based on the price level at which LNG can be dispatched economically, Day-Ahead LMP at the Astoria location was over that level for a total of 97 hours during the time-period for which LMP data is available for Astoria (9/1/2020 to present). Real-Time LMP at the same location was over the same threshold level for a total of 261 hours during the same time-period. The vast majority of these instances were during Winter Storms Elliott and

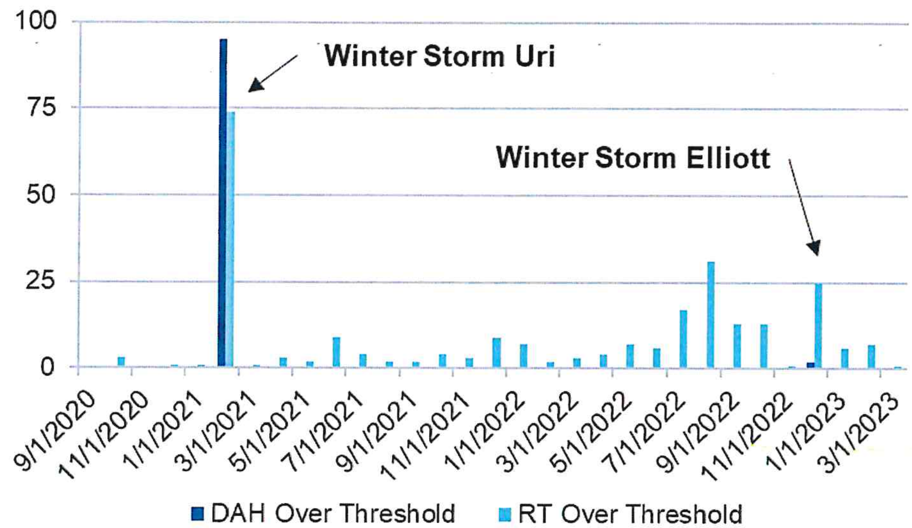
[32] Direct Testimony of Mr. Retzlaff, p2

[33] I review the value of hedging natural gas prices during extreme weather events in the prior section of my testimony.

[34] I used the NSP node for Yankee Ridge Wind farm as the proxy LMP prior to the creation of the Astoria generation node.

[35] Attachment a to Attachment 2 in response to NDPSC 2-16.

Uri, though Real-Time LMP sometimes breached that threshold in other seasons – with a notable excursion in the summer of 2022. Outside of Winter Storms Uri and Elliott, the LMP is never over the threshold for the Day-Ahead prices and is over the threshold in 162 hours for the Real-Time prices. I illustrate this graphically below.




**Q. What would the gas cost savings have been if there was onsite LNG storage?**

A. A simplified calculation of the hourly savings if the facility dispatched whenever LMP were economic for LNG prices yielded cost savings of $4.161 million when dispatched against Day-Ahead prices and $3.242 million when dispatching against Real Time prices. When Winter Storms Uri and Elliott are not considered, the cost savings drop considerably to $652,836 when dispatched against Day-Ahead prices and to $5,144 when dispatched against Real-Time prices. When conducting this analysis, a proxy node for a nearby generation facility was used as a stand in for the time-period before LMP data was available for the Astoria facility (Astoria LMP data is only available from 9/1/2020 onward). The proxy node data goes back to 3/1/2009 which allowed me to analyze a hypothetical scenario in which the facility existed and was able to dispatch with LNG before its start date.

**Q. How does the potential hedge value of onsite LNG storage compare to the estimated cost of the project?**

A. Over the fourteen years of my historical analysis the average hedge value of onsite LNG would have been $50,000 / year, excluding the value during the Uri and Elliot storms that I have previously discussed. The average annual revenue requirement of the proposed storage facility to be recovered from customers is approximately **[Trade Secret Begins]** $xx,xxx,xxx **[Trade Secret Ends]** for the first ten years.[36] I note that my analysis does not include the impacts of differences between expected day-ahead gas costs and actual gas costs as well as any liquidation of gas during intra-day operations. However, given the large difference between my simplified analysis and the expected annual cost of the on-site LNG facilities, I conclude that the facility has minimal natural gas hedging value outside of major storms.

## X. Other Considerations

**Q. Is the cost of the Project known with certainty?**

A. No, Mr. Phinney notes that the cost presented in the application is not final and that Otter Tail will update the Commission as the project develops.[37]

**Q. If the Commission approves the ADP should it be contingent on the total capital cost?**

A. Yes, the ADP should be limited to the capital cost estimate provided in Otter Tail's Application. Should the actual cost exceed the estimate, the additional costs should be evaluated for prudence.

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[36] Attachment A to Attachment 4 to Advocacy Staff 2-16.
[37] Direct Testimony of Mr. Phinney p 8, l. 11 – 19.

# XI. Conclusions and Recommendations

**Q. Would you please summarize your conclusions?**

A. Yes. The Commission should not approve the ADP for the Onsite Fuel Inventory System based upon the following findings.

- While onsite fuel storage provides additional MISO system reliability, the benefits of that additional reliability are hard to quantify given the existing winter reserve margin requirement of over 25% and Otter Tail's classification that over 90% of its generation is already resilient.
- While onsite fuel storage for Astoria will provide insurance against gas price spikes during major winter storms, I have concluded that the cost of that insurance appears high compared to the anticipated savings for customers.
- While onsite fuel storage for Astoria provides hedging costs against natural gas prices outside of major winter storms, the anticipated benefits are relatively small compared to the anticipated cost of onsite storage facility.

**Q. Does this conclude your testimony?**

**A.** Yes.

# JIM HEIDELL

MEMBER PA MANAGEMENT

Jim Heidell specializes in electric and gas utility regulation, distributed energy, evaluation of renewable energy technologies and financial analysis of complex investments. Mr. Heidell assists clients with due diligence associated with acquisition of natural gas and electric utilities and wholesale energy market transactions. He has extensive financial and energy market modeling experience coupled with a deep understanding of regulated and competitive markets that he applies to the valuation of energy assets. Mr. Heidell has prepared and submitted testimony in both regulatory proceedings and civil contract damages cases. His regulatory experience and testimony includes rate design, cost of service, resource planning, and merger conditions. Mr. Heidell also specializes in strategic analysis and evaluation of opportunities associated with renewable / alternative energy technologies. Prior to working at PA Consulting he held positions as the Director of Finance and Director of Federal and State Regulation at Puget Sound Energy. Mr. Heidell is a CFA and has an MBA in finance from the University of Washington, a MS in Engineering Economics from Stanford University, and a BSE in civil engineering from Tufts University.

## PRIMARY EXPERTISE

- Electric and natural gas utility regulation and finance
- Analysis of wholesale electric markets
- Renewable Energy Technologies
- Asset valuation / M&A Advisor
- Damages estimation for civil litigation
- Strategic planning
- Financial modelling of complex investments
- Financial planning

## CLIENTS

- Riverstone Holdings
- Puget Sound Energy
- Solarcity
- Comision Federal de Electricidad
- North Dakota Public Service Commission

## QUALIFICATIONS

- 30-years' experience with electric & gas utilities and electricity markets
- MBA University of Washington
- MSE Engineering Economics, Stanford University
- BSE, Civil Engineering, Tufts University
- CFA

## EXPERIENCE SUMMARY

- **Utility Regulatory Support** – Prepare expert testimony in regulatory hearings related to resource acquisition, QF issues, rate impacts, marginal and embedded cost of service, and rate design. Developing marginal and embedded cost studies for regulated utilities.
- **Financial Analysis** – Long-term modelling of utility finance. Analysis of major capital investments using a variety of tools to incorporate uncertainty and risk.
- **Analysis of Energy Markets** – Develop energy and capacity forecasts for U.S. power markets to support: strategic investments by utilities and major energy companies, development of utility risk management strategies, and corporate strategies for generation asset acquisition and disposition.

- **Evaluation of Distributed Energy and Behind the Meter Generation** – Forecast of margins of community solar projects, portfolios of customer sited PV projects, and analysis of regulatory policies and rules associated with community solar projects and behind the meter PV projects.
- **Renewable Energy Technologies** – Develop business plans, market positioning strategies, and financial analysis of renewable technologies including PV cell manufacturing, flywheels, and fuel cells along with renewable generation technologies including solar thermal, geothermal, wind, battery storage, and IGCC projects.
- **Asset Valuation / M&A Advisor** – Provide valuation advice for acquisition of electric generation portfolios, single power plants, transmission projects, electric utilities, and gas distribution companies. Work also included review of wholesale and retail regulatory pricing mechanisms and analysis of associated risk.
- **Damages Estimation for Civil Litigation Testimony** – Prepare expert witness testimony to support power contract litigation, property tax cases, power plant development agreements, and quantification of economic damages.

## EXPERIENCE

### CIVIL LITIGATION TESTIMONY & SUPPORT

Rebuttal of claims of economic damage associated with the cancellation of a water desalination project in Monterey California.

Prepared an analysis of claims of economic damage associated with the performance of an anaerobic digester designed to provide gas for an electric generation project. Analysis included evaluation of performance, revenues and costs, and cost of capital used to discount projected future earnings. Prepared expert report and testified in jury trial in federal district court.

Developed an analysis of material and labor cost increases on EPC costs for a natural gas fired power plant located in New Mexico. The analysis was used to refute a claim that cost overruns were not reasonable in a cost plus EPC contract. The analysis demonstrated how much of the total project cost increases was associated with labor and material costs beyond the control of the general contractor.

Prepared an analysis of loss of margins at two coal plants during periods when there were alleged violations of EPA opacity emission limits. The analysis demonstrated that client did not receive any economic benefit associated with the periods of alleged violations.

Prepared an analysis of the commercial distributed solar sector in the 2010 – 2011 time frame and demonstration of the unreasonableness of the plaintiff's claims for economic damages associated with the defendant's decision not to pursue participation in an equity fund.

Prepared an analysis of the U.S. wholesale electric power markets in the 2008 – 2010 time frame to demonstrate why the plaintiff's decision to terminate construction of a coal fired power plant was due to cost increases in the EPC contract and not due to the changing natural gas prices and emission laws.

Prepared an estimate of lost margins associated with the extended outage of a Canadian nuclear reactor. The analysis included an estimate of what Ontario wholesale power prices would have been but-for the outage and estimates of the total damages including repair and inspection costs.

Prepared an Expert Report regarding rate making and financial policies of the Southern Minnesota Municipal Power Agency in conjunction with a contract dispute regarding a power contract and investments in new generation resources to serve full requirements customers.

Assisted expert witness by the preparation of a report on how a third party would value the Trans-Alaska Pipeline as part of a property tax dispute with the municipality of Anchorage.

Prepared an analysis of damages associated with claims for losses associated with the interruption of business of a Texas gas-fired power plant as a result of the rupture of a natural gas pipeline use to supply the power plant.

Prepared of an analysis of the economic benefits that accrued to the defendant associated with the purported delay of implementation of measures to correct water pollution discharge violations associated with a power plant.

### ANALYSIS OF RENEWABLE ENERGY INVESTMENTS

Preparation of multiple Independent Market Expert Reports to support financing of community solar projects in Illinois, Maine, Massachusetts, New York, New Jersey, and Maryland.

Prepared an Independent Market Expert Report to support the debt financing of BrightSource Energy's Ivanpah solar thermal projects with purchased power agreements with California investor owned utilities.

Prepared an Independent Market Expert Report to support the debt financing of Solona, a large solar thermal project with molten salt storage, with a purchased power agreement with an Arizona Public Service.

Prepared an Independent Market Expert Report to support the expansion of a CdTe PV manufacturing facility in Colorado including the analysis of the business plan and projection of long-term prices for the PV modules.

Prepared an Independent Market Expert Report to support the expansion of a c-Si PV manufacturing facility including the analysis of the business plan and projection of long-term prices for the PV modules.

Prepared an Independent Market Expert Report to support the expansion of a polysilicon manufacturing facility including the analysis of the business plan and projection of long-term prices for polysilicon and the associated raw materials.

Prepared an evaluation of the global market for concentrating solar power plants as of 2012 as part of a client analysis of a potential purchase of a solar mirror manufacturing company.

Prepared an evaluation of the U.S. solar PV market to support evaluation of a Japanese firm's potential expansion in the U.S. markets.

Assisted client with a bid into a utility's renewable energy procurement program. The analysis included an assessment of competitors and analysis of pricing to support the bid of a renewable energy resource into 2011 Entergy RFP for renewable resources.

Prepared long range forecasts of multiple wind portfolios with an emphasis on the valuation of post PPA revenues and the value or renewable energy credits.

Prepared an analysis of the market for future expansion of the wind business of a major U.S. wind developer based upon an assessment of the competitiveness of wind generation with gas fired generation.

Prepared a fair market value analysis of associated with the purchase of a minority position in a wind project located in Ontario, Canada.

Prepared an Independent Market Expert Report to support the debt financing of a geothermal power project located in the Pacific Northwest.

Prepared an Independent Market Expert Report to support the debt financing of the Beacon flywheel energy storage project in New York.

Prepared an Independent Market Expert Report to support the debt financing of the AES battery energy storage project in New York. Development of an Independent Market Expert Report to support the financing of the Kemper IGCC plant including an analysis of the regulatory structures being relied upon to support cost recovery as well as wholesale electric prices to support wholesale power sales.

## UTILITY REGULATORY SUPPORT

Analysis and testimony on behalf of Constellation Energy Group related to typical merger and acquisition conditions required by regulators in utility and non-utility transactions. Testimony related to the EDF / Constellation joint venture.

Testimony related the use and design of ratchet rates on behalf of Northern Indiana Public Service Company. Testimony related to the application of ratchets to the client's unique position and appropriate recovery of costs.

Analysis of the economics of an electric utility's interruptible rates including the value of interruptions versus the payments received by customers. Developed recommendations for pricing interruptible rate programs that were consistent with the utility's avoided costs and ISO markets.

Developed electric cost-of-service studies, rate design, and testimony to support Puget Sound Energy in multiple general rate cases in Washington. The engagements included addressing issues such as special rates for strategic customers with competitive options, line extension policies, and rates to address revenue attrition.

Developed natural gas cost-of-service studies, rate design, and testimony to support Puget Sound Energy in a general rate case in Washington.

Prepared marginal cost of service studies and testimony to support Montana-Dakota utilities in multiple Montana rate cases.

Assist Montana-Dakota Utilities in development of its integrated resource plan through analysis of options using the Strategist planning model.

Supported Montana-Dakota Utilities in answering a complaint in front of the South Dakota Public Utilities Commission regarding a wind generator requesting a contract under the provisions of PURPA.

Provided expert testimony related to Montana Dakota's proposed participation in the Big Stone II power plant. Prepared and delivered testimony provided in multiple hearings in North Dakota and Minnesota.

Prepared testimony on behalf of Hydro One Networks regarding rate shock and how to address necessary rate changes associated with the restructuring of the electric utility business in Ontario.

Developed an analysis or weather risk associated with the retail power sales of IPALCO. Effort was conducted as part of a comprehensive risk assessment conducted by AES. Models of the weather / load relationship were developed and then integrated with the rate structures and cost adjustment mechanisms to assess the utility's overall exposure to weather risk.

Advised Old Dominion Electric Cooperative on options for acquiring new generation in a depressed power market and incorporation of the analysis in their long-term resource planning.

**M&A and BANKRUPTCY ADVISOR**

Prepared an analysis of New Mexico Gas Company to support a prospective buyer. We assisted multiple clients with due diligence related to the acquisition of gas LDCs. Assisted the client with a review of the deal model including: assumptions about rate cases, assumptions regarding ROE, sales growth by rate class, and revenue by rate class. The engagement also included an assessment of the regulatory climate and potential conditions and costs associated with obtaining regulatory approval of the transaction.

Prepared a valuation of the Mountaineer Gas Company including the analysis of regulatory issues to support the debt financing associated with the purchase of the energy company.

Assisted an infrastructure fund in valuing power contracts and reviewed the regulatory model used in conjunction with establishing the price to bid for the acquisition of Northwestern Utility.

Prepared an analysis of Duquense Light to support an infrastructure fund's bid for the utility. The analysis included projections of growth opportunities through distribution & transmission investment, analysis of the POLR load obligation, and a review of key regulatory issues.

Developed a valuation model of Mirant including analysis of debt carrying capacity to assist a strategic player in the U.S. Power Industry determine whether to make an unsolicited offer to purchase Mirant.

Assisted an international oil company in development of modelling processes and assumptions to support a corporate effort to acquire a fleet of U.S. merchant generating assets.

Support a strategic player in valuing the Lake Road Generation Plant as part of their bid to acquire the asset in a competitive auction. Effort involved projection of future gross margins of the plant, analysis of the ISO-NE Forward Capacity Market, and analysis of transmission constraints.

Directed the valuation of the entire NRG portfolio on behalf of the bank creditors in the NRG bankruptcy hearings. The valuation work included advising on a range of types of generation assets in the U.S. as well as in Europe, South America, and the Asia-Pacific region. Mr Advised on the fairness of offers for assets being disposed of by NRG. Assisted creditors in the valuation of assets in the NEG bankruptcy including the options for completing unfinished gas-fired generation assets. Served as the interim finance manager for the Lake Road Generation facility.

Member of team that advised Calpine as part of the company's restructuring and plan of reorganization. Assignment included analysis of the Canadian portfolio, advising on the sale of generation assets, modelling of long-term turbine maintenance costs, and the valuation of complex power contract.

Assisted the lenders on valuation and strategy related to AES' turn-back of the Granite Ridge Power Plant to the lender group.

Advised the bank and lender group on valuation and strategy related to the bankruptcy of the Kendall Power Plant.

**ASSET APPRAISALS**

Prepared a valuation of a large eastern coal plant as a third party appraiser required in a transaction where the lessee wanted to exercise a buy-back provision in a sale lease-back agreement.

Prepared a valuation of a California cogeneration plant for the purposes of identifying the tax loss.

Completed an appraisal to support the transfer of the Trans Bay Cable from the development arm to a separate fund managed by the infrastructure fund. The appraisal addressed the California power markets, operations of the CA ISO high voltage transmission and a forecast of revenues given the FERC and CA-ISO regulatory schemes as part of the income approach. The appraisal also incorporated a comparable sales and replacement cost analysis.

Developed an appraisal of a nuclear power plant based upon discounted cash flow, replacement costs, and comparable sales as part of an effort to determine the fair market value under a lease agreement that contained a buy-back provision.

Completed multiple appraisals of the KeySpan generation assets on Long Island that were subject to a generation repurchase agreement with LIPA. The appraisals were part of the ongoing process for KeySpan to develop a strategy to address the LIPA repurchase option.

Development of an Independent Market Expert Report to support the financing of the Kemper IGCC plant including an analysis of the regulatory structures being relied upon to support cost recovery as well as wholesale electric prices to support wholesale power sales.

**ELECTRIC GENERATION FINANCE SUPPORT**

Market expert report for the Landfill Energy Systems, a national 66 MW portfolio of fourteen landfill gas power plants. The market expert report included a discussion of the key attributes of each of the power markets that the portfolio encompasses, long-term forecasts of wholesale electricity prices, and forecasts of gross margins.

Independent Market Expert Report to support the financing of the repowering and development of a fleet of combined cycle and simple cycle power plants in the ERCOT market. The independent market expert report was used to support the syndication of loans and obtaining debt ratings associated with investing over $1 billion in the Barney Davis, Nueces Bay, and Laredo Energy Center facilities.

Independent Market Expert Report to support the financing of Sequent Power's purchase of the Wolf Hollow 730 MW combined cycle power plant located in ERCOT. The report was used to support the syndication and rating of over $400M of primary and mezzanine debt. The report incorporated forecast of gross margins for both the contracted and non-contracted portions of the facility as well as providing a detailed description of the ERCOT market conditions and key assumptions to the financial analysis.

Independent Market Expert Report to support the financing of Invenergy's purchase of the partially completed Grays Harbor 620 MW combined cycle power plant located in the Pacific Northwest. The report was used to support the syndication and rating of over $100M of debt. The analysis included valuing both hedged and unhedged positions for the facility and conducting extensive due diligence regarding how NW power markets are likely to evolve and the role of independent power in a market dominated by vertically integrated public and investor-owned utilities.

Independent Market Report to support the refinancing of the Dynegy corporate revolver. The effort included analysis of multiple U.S. power markets, valuation of the fleet of generation assets and associated contracts, and review of regulatory conditions impacting the Company's ability to realize earnings in markets with competitive auctions to serve load.

Multiple forecasts of California power market prices including support of a bid for a cogeneration facility located in the San Francisco Bay area and sale of La Rosita.

Forecast of the New England power markets to support a bid for the First Light Generation Assets.

Forecast of the California and SPP power markets to support a bid for assets from the EIF portfolio.

Analysis of the ERCOT, PJM and MISO markets for multiple bids for merchant gas fired generation plants.

Development of multiple Confidential Information Memorandums to support the sale of power plants. CIMs included description of the wholesale power markets and summaries of the key attributes of the assets to be sold in auction.

Preparation of sale offering of the Audrain power plant in response to Ameren solicitation to acquire new resources. Effort included evaluation of likely competitors and the development of the bid strategy.

Advise on pricing for offering power contracts as well as the sale of gas-fired combined cycle power plant in the South-East. Pricing and sale price based upon projections of the value of the power plant as a merchant unit, assessment of potential competitors, and the analysis of transmission constraints.

**ELECTRIC MARKETS RISK MODELING**

Provided support to a bond insurance company to prepare an assessment of the distribution of income from a fleet of peaking power plants in the South-East. Analysis used to review the provision for loss reserves.

Supported a bond insurance agency in determining the probability that a fleet of Mid-West generation assets would generate insufficient cash to meet debt payments and reserve requirements.

Developed an Excel based model for a mid-west public utility to assist in developing annual targets for the amount of surplus generation capacity to be sold as merchant and in contracts of varying tenor. The model was integrated into the corporate financial model to assist in identifying the appropriate risk profile to support building the reserve fund and to delay future rate increases.

**DSM ADVISORY SERVICES**

Advised Con Edison on the status of electric decoupling and incentive mechanisms in the United States as part of the New York state initiative to reintroduce decoupling.

Advised a private equity fund on the status of demand side management in New England, likely projections of growth, and probability of successful implementation as part of an evaluation of long-term supply and demand conditions in the New England electric markets.

Worked with Montana-Dakota utilities regarding the incorporation of projections of demand side management potential into the utility's long-term resource plan.

## ADDITIONAL EXPERIENCE – EXPERT TESTIMONY

Before the Louisiana Public Commission, Direct Testimony and Schedules of James A. Heidell in Re: Application of 1803 Electric Cooperative, Inc. For Approval of Power Purchase Agreements and For Cost Recovery, Docket No. U-35927.

Before the North Dakota Public Service Commission, Direct Testimony and Schedules of James A. Heidell, In the Matter of Northern States Power Company Advance Prudence – Heartland Divide II Wind Project, Case No. PU-20-433.

California-American Water Company, a California Corporation; Monterey County Water Resources Agency, Plaintiffs, vs. Marina Cos Water District; RMC Water and Environment, a California Corporation; and DOES 1 through 10, inclusive, Defendants, Case No. CGC-15-546632. Report and Deposition on behalf of RMC Water and Environment addressing alleged economic damages as a result of a cancelled desalination project.

Before the Hawaii Public Service Commission, Direct Testimony Of James A. Heidell, Docket No. 2017-0105 In The Matter Of The Application of Hawaii Gas Company Application for a General Rate Increase. Testimony on behalf of Hawaii Gas addressing rate spread and rate design.

Before the North Dakota Public Service Commission, Direct Testimony and Schedules of James A. Heidell, In the Matter Of Otter Tail Power Company Advance Determination of Prudence Astoria Natural Gas Project, Merricourt Wind Project and Certificate of Public Convenience and Necessity Merricourt Wind Project, Case Nos. PU-17-140, PU-17-141, & PU-17-143,

Before the North Dakota Public Service Commission, Direct Testimony and Schedules of James A. Heidell, In the Matter Of Northern States Power Company Advance Prudence – Dakato Range Wind Project, Case No. PU-17-372.

Before the North Dakota Public Service Commission, Direct Testimony and Schedules of James A. Heidell, In the Matter Of Northern States Power Company Advance Prudence – 1,550 MW Wind Portfolio, Case No. PU-17-120.

Before the North Dakota Public Service Commission, Direct Testimony and Schedules of James A. Heidell, In the Matter Of Northern States Power Company Advance Prudence – BIOMASS APPLICATION FOR DEFERRED ACCOUNTING, Case Nos. PU-17-270, PU-17-271, & PU-17-322.

Before the North Dakota Public Service Commission, Direct Testimony and Schedules of James A. Heidell, In the Matter Of Northern States Power Company A Minnesota Corporation D/B/A XCEL Energy Jurisdictional Cost Allocation Matters, Case Nos. PU-12-813 et. al.

Before the Arizona Corporation Commission, Direct and Settlement Testimony Of James A. Heidell, Docket No. E-01345A-16-0036 and Docket No. E-01345A-16-0123 In The Matter Of The Application of Arizona Public Service Company for a Hearing to Determine the Fair Value of the Utility Property of the Company for Ratemaking Purposes, To Fix a Just and Reasonable Rate of Return Thereon, To Approve Rate Schedules Designed to Develop Such Return.

Before the Public Utilities Commission of Nevada, Direct and Rebuttal Testimony Of James A. Heidell, Docket No. 16-06006, In The Matter of the Application of Sierra Pacific Power Company, d/b/a NV Energy, Filed pursuant to NRS 704.110(3), addressing its annual revenue requirement for general rates charged to all classes of Electric customers.

Amana Society, Inc. and Amana Farms, Inc. v. GHD, Inc. and Excel Engineering, Inc. Testimony on behalf of GHD, INC regarding the economic performance of a manure digester and evaluation of claims of damages by Amana. Expert Report 2012, Jury Trial September 2012.

Affidavit of James A. Heidell & Mark Repsher, Appropriate Approach to Calculating the Weighted Cost of Capital, Docket No. ER14-2940-0000, U.S. Federal Energy Regulatory Commission, October 15, 2014.

Affidavit of James A. Heidell & Mark Repsher, on behalf of Peabody Energy Corporation to stay the final Clean Power Plan rule, September 9, 2015.

Declaration and report of James A. Heidell & Mark Repsher, Utility and Allied Petitioners' motion to stay the final Clean Power Plan rule, October 16, 2015.

City of Rochester, Minnesota v. Southern Minnesota, State of Minnesota, County of Olmsted File No: 55-C3-05-002712. Testimony on behalf of the City of Rochester regarding the interpretation of a power contract. Testimony and deposition 2008.

Before the Public Service Commission of Maryland, Rebuttal Testimony Of James A. Heidell, Case No. 9173, Phase II In The Matter Of The Current And Future Financial Condition Of Baltimore Gas And Electric Company.

Before the Indiana Utility Regulatory Commission, Rebuttal Testimony in Northern Indiana Public Service Company's request to raise rates in Cause No. 43526. Testimony on behalf of the utility related to ratchets and other mechanisms appropriate to recover costs allocated to large energy using customer classes.

Before Public Service Commission of the State of North Dakota, Direct and Rebuttal Testimony in Montana Dakota Utilities Co., and Otter Tail Corporation; Advance Determination of Prudence, Big Stone II Generating Station Case Nos. PU-06-481 and PU-06-482. On behalf of Montana-Dakota Utilities. 2007 & 2008. On behalf of Montana-Dakota Utilities.

Before the Public Service Commission of the State of Montana, Direct and Rebuttal Testimony in Montana-Dakota's General Rate Case – Marginal Cost of Service Study, Docket No. D2010.8.82. On behalf of Montana-Dakota Utilities.

Before the Public Service Commission of the State of Montana, Direct and Rebuttal Testimony in Montana-Dakota's General Rate Case – Marginal Cost of Service Study, Docket No. D2007.7.79. On behalf of Montana-Dakota Utilities.

Before the Minnesota Public Utilities Commission, Direct and Rebuttal testimony on behalf of Montana-Dakota Utilities regarding a Certificate of Need for the Big Stone II Power Plant, Docket No. CN-05-619. On behalf of Montana-Dakota Utilities.

Before the Ontario Electric Board, Expert Report regarding the 2006 Electric Rate Distribution Handbook and Rate Mitigation, on behalf of Hydro One Networks, Inc. January 2005.

Before the Washington Utilities and Transportation Commission, Direct Testimony in 2004 General Rate Case Regarding Electric Cost of Service & Rate Design and Gas Rate Design, April 2004. On behalf of Puget Sound Energy.

Before the Washington Utilities and Transportation Commission, Direct Testimony in 2001 General Rate Case Regarding Electric Cost of Service & Rate Design, November 2001. On behalf of Puget Sound Energy.

Before the Washington Utilities and Transportation Commission, Testimony Regarding the Need for a Special Competitive Rate for Intel. Docket No. UE-960299, 1996. On behalf of Puget Power.

Before the Washington Utilities and Transportation Commission, Rebuttal Testimony in the Merger of Puget Power and Washington Natural Gas Regarding Electric Rates, Docket Nos. UE-95-1270 & UE-960185, 1995. On behalf of Puget Power.

STATE OF NORTH DAKOTA

PUBLIC SERVICE COMMISSION

| | | |
|---|---|---|
| Otter Tail Power Company<br>Advanced Prudence – Application | Astoria Station Onsite Fuel Inventory System | Case No. PU-23-066 |

## VERIFICATION

STATE OF WASHINGTON )<br>
) ss.<br>
COUNTY OF SAN JUAN )

James A. Heidell, being first duly sworn on oath, deposes and states that he has read the testimony and exhibits submitted in the above captioned matters under his name, that they were prepared by him or under his direction, that he knows the contents thereof, and that the same are true and correct to the best of his knowledge and belief.

J. A. Heidell

James A. Heidell

Subscribed and sworn to before me this 6th day of September, 2023.

KARIMAH SALAAM
Notary Public
State of Washington
Commission # 23009933
My Comm. Expires Apr 7, 2027

K. Salaam

Notary Public

My Commission Expires: 4/07/2023