

PUBLIC – TRADE SECRET INFORMATION REDACTED

**TESTIMONY
JAMES A HEIDELL**

**STATE OF NORTH DAKOTA
BEFORE THE
NORTH DAKOTA PUBLIC SERVICE COMMISSION**

NORTHERN STATES POWER COMPANY

CASE NO. PU-17-372

ADVANCE DETERMINATION OF PRUDENCE – DAKOTA RANGE WIND PROJECT



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1 **I. Introduction**

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

3 **A. My name is James A. Heidell. I am a Director at PA Consulting Group (PA). My**
4 **business address is 1700 Lincoln Street, Suite 1550, Denver, CO 80203.**

5
6 **Q. On whose behalf are you filing this testimony?**

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

9
10 **Q. Please summarize your qualifications and experience.**

11
12 **A. I have worked in the energy industry for the past 35 years, primarily specializing in**
13 **electricity and utilities. I have worked on issues related to resource planning, rates,**
14 **analysis of electricity markets, and analysis of the economics of financial transactions for**
15 **utilities and wholesale generation owners. My academic background includes a BSE in**
16 **civil engineering from Tufts University, a MS in engineering economics from Stanford**
17 **University, and a MBA in finance from the University of Washington. I am a Chartered**
18 **Financial Analyst. My CV is provided in Exhibit JAH-1.**

19
20 **Q. Have you testified before the North Dakota Public Service Commission previously?**

21
22 **A. Yes. I testified on behalf of Montana-Dakota Utilities in the matter of Montana-Dakota**
23 **Utilities Co., and Otter Tail Corporation; Advance Determination of Prudence, Big Stone**
24 **II Generating Station Case Nos. PU-06-481 and PU-06-482. I have submitted pre-filed**
25 **direct testimony on behalf of Advocacy Staff in the following dockets:**

- 26
 - Northern States Power Company's request for an Advanced Determination of
- 27 **Prudence (ADP) for 1,550 MW of Wind, Case Number PU-17-120;**

- 1 • Otter Tail Power Company's Request for an ADP for the Astoria CT and
- 2 Merricourt Wind Project, Case Nos. PU-17-140, PU-17-141, and PU-17-143;
- 3 • Northern States Power Company, Case Nos. PU-17-270, PU-17-271, and PU-
- 4 17-322; and
- 5 • Northern States Power Company Resource Treatment Framework, Case Nos.
- 6 PU-12-813 et al.

7

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

9

10 **A.** The purpose of my testimony is to provide the Commission with my assessment of the

11 Northern States Power Company's (NSP or the Company) request for an Advance

12 Determination of Prudence (ADP) for the proposed 302.4 MW Dakota Range I and II

13 Wind Project (Dakota Range or Project). NSP has applied for an ADP for the Project. I

14 have reviewed the Application, supporting testimony, supplemental testimony, and

15 responses to interrogatories to develop a recommendation regarding:

- 16 • Whether the proposed Project is likely to lower electricity costs for NSP's North
- 17 Dakota customers;
- 18 • Whether the Project is needed to meet the capacity and energy needs of the
- 19 utility's customers;
- 20 • Whether the Commission should approve the ADP; and
- 21 • Whether conditions should be put on an approval of the ADP.

22

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

24

25 **A.** Yes. I start with presenting my recommendations and findings, followed by a detailed

26 discussion of the analysis I conducted to support my recommendations and findings. I

27 then address additional factors I considered during my review. Finally, I address

1 proposed conditions on approval of the ADP. My testimony is separated into nine
2 sections:

- 3 • A summary of my recommendations (Section II);
- 4 • A summary of my findings (Section III);
- 5 • An overview of the Project (Section IV);
- 6 • An assessment of the need for the Project (Section V);
- 7 • An evaluation of the Company's economic analysis of the Project (Section VI);
- 8 • My independent economic analysis of the Project (Section VII);
- 9 • An assessment of the projected energy cost savings associated with the Project to
10 the Company's North Dakota customers (Section VIII); and
- 11 • Consideration of additional issues (Section IX).

12
13 **Q. Are you sponsoring any exhibits to your testimony?**

14 **A. Yes, I am sponsoring three exhibits:**

- 15 • Exhibit JAH-1: James Heidell CV
- 16 • Exhibit JAH-2: Projected Energy Cost Savings Compared to Market
- 17 • Exhibit JAH-3: Impact of Wind Additions on Coal Plants

18
19 **II. Summary of Recommendations**

20 **Q. What is your recommendation with regard to approving the Company's**
21 **Application for an ADP to add the proposed Project to the NSP integrated system?**

22
23 **A. My recommendation is that the Commission conditionally approve the Application on the**
24 **basis that the Project is projected to lower electricity costs for NSP's North Dakota**
25 **customers. However, I note that there is no immediate need for the capacity provided by**
26 **the Project. My recommendation is based solely on the projected economic benefits of**
27 **the Project, based on its projected lowering of electricity costs for the Company's North**

1 Dakota customers. I evaluated these economic benefits based upon information presented
2 by the Company, supplemented by my evaluation of its analysis and my own independent
3 analysis.

4
5 **Q. What conditions do you recommend this Commission put on the approval of the**
6 **ADP?**

7
8 **A. My recommendation for approval is based on my conclusion that the Project will lower**
9 **electricity costs for NSP's North Dakota customers compared to the alternative of not**
10 **developing the Project. For customers to realize these projected savings, at a minimum it**
11 **will be necessary for the Company to:**

- 12
- 13 • Construct and operate the Project within the proposed revised Project budget as
- 14 amended in the March 23, 2018 supplemental testimony;
- 15 • Achieve the assumed total generation production from the Project;
- 16 • Achieve the operational cost savings as amended in the March 23, 2018
- 17 supplemental testimony, and
- 18 • Qualify for effective full realization of 80% of the Production Tax Credits (PTC)
- 19 for the Project as described in the Company's application including realization of
- 20 the manufacturer's commitments to meet the required timeline for qualifying for
- 21 the PTC.
- 22

23 Therefore, I recommend a conditional approval of the ADP, subject to the following
24 conditions:

- 25 • Recovery of Project construction, interconnection, and transmission costs for the
- 26 Project should be limited to no more than **[CONFIDENTIAL DATA BEGINS**

1 [REDACTED] CONFIDENTIAL DATA ENDS] excluding AFUDC with
2 recovery of any supplemental construction cost subject to additional Commission
3 review; and

- 4 • The Company's shareholders should be responsible for any shortfall should the
5 Company fail to obtain 100% of the PTC available to the Project as described in
6 the Company's application.
7

8 **III. Summary of Findings**

9 **Q. Would you please provide a summary of the findings in your testimony that support**
10 **your recommendation regarding the Commission's treatment of the Application**
11 **and its request for an ADP?**

12
13 **A. Based upon my review and analysis of the testimony filed in the Application, the exhibits**
14 **contained within the Application, the Supplemental Filing, and the information produced**
15 **in discovery, I find the following:**

- 16 • The Project is projected to sell its generated electricity into the Midcontinent
17 Independent System Operator (MISO) energy markets. Resources in MISO are
18 dispatched based upon Short Run Marginal Costs (SRMC), subject to constraints on
19 generation units and transmission. With an SRMC of near zero, the Project is
20 projected to be fully dispatched by MISO operators for all of its available generation
21 subject to MISO curtailments;
- 22 • The Project is projected to receive revenues from the MISO energy markets which
23 exceed its Levelized Cost of Energy (LCOE), creating margins which are projected to
24 lower the Company's overall electricity costs;

¹ The capital cost has been reduced [CONFIDENTIAL DATA BEGINS [REDACTED] CONFIDENTIAL
DATA ENDS] from the original application due to savings attributed to transmission upgrade and interconnection
costs and the South Dakota sales tax rebate grant.

1 curtailment expected to be approximately four percent.

2
3 **Q. Why did the Company file Supplemental Testimony?**

4
5 **A.** The original Application was filed on October 10, 2017. Before the Commission made a
6 decision on the Application, the federal income tax rate for the Company was revised by
7 the US Congress via the Tax Cuts and Jobs Act (TCJA), which was signed into law in
8 December 2017. As a result of the revised tax rates for the Company, the Project's
9 economics changed. The Company then revised the analysis and filed Supplemental
10 Testimony for the Application on March 23, 2018.

11
12 **Q. What is the status of the Project's transmission interconnection agreement?**

13
14 **A.** The MISO system impact and facility studies have been completed for the Project and all
15 required transmission upgrades are known; these upgrades are included in the Dakota
16 Range Generator Interconnection Agreement (GIA) that was submitted to the Federal
17 Energy Regulatory Commission (FERC) in December 2017. The Supplemental
18 Testimony indicates that the cost of the upgrades and interconnection have decreased
19 based upon an updated MISO impact study completed on November 21, 2017,
20 subsequent to the filing of the original application on October 10, 2017. The reduced
21 interconnection cost is reflected in my testimony and analysis.

22
23 **Q. What is the estimated construction cost and total LOCE for Dakota Range?**

24
25 **A.** The Company estimates the total cost of the Project to be [CONFIDENTIAL DATA
26 BEGINS ██████████ CONFIDENTIAL DATA ENDS], including
27 [CONFIDENTIAL DATA BEGINS ██████████ CONFIDENTIAL DATA ENDS]
28 in transmission upgrade and interconnection costs, The Company projects the LCOE for
29 the Project to be [CONFIDENTIAL DATA BEGINS ██████████ CONFIDENTIAL

1 **DATA ENDS].**
2
3

4 **V. Needs Assessment of the Project**
5

6 **Q. Does the Company need the Project to meet its capacity requirements?**
7

8 **A.** The Company does not project an immediate capacity need, but identifies 2025² as the
9 first year it will need new capacity and that capacity need will be deferred for
10 approximately two years as a result of the Dakota Range project.
11

12 **Q. Should the Commission grant an ADP for the Project if there is not an immediate**
13 **need for capacity?**
14

15 **A.** The Company states that because the Project is projected to lower the Company's system
16 average cost, the Project should be considered "least cost". In addition, the Project is
17 projected to defer the Company's need for capacity from 2025 to approximately 2027.
18 While the project would be on line a little over two years prior to capacity being required
19 in 2025³, resource acquisitions are often not precisely timed to the date of first need.
20

21 **Q. How does the proposed Project impact the Company's energy mix from a resource**
22 **diversity perspective?**
23

² NSP Response to Data Request 5-9

³ NSP Response to Data Request 5-9

1 A. In 2017, the Company's energy mix is largely made up of nuclear generation (31%),
2 coal-fired generation (30%), approximately 24% renewable generation, 11% natural gas-
3 fired generation, and 4% hydro generation.⁴ Note that this mix will be different in 2022
4 depending on the retirement of coal plants and whether the 1,550 MW of proposed wind
5 additions are added to the system. In 2022 the Company estimates that nuclear and coal
6 generation will decrease to 27% and 26% respectively, gas fired generation will decrease
7 to 5%, and renewables will increase to 38% of the generation.⁵
8

9 **VI. Evaluation of the Company's Economic Analysis of the Project**
10

11 **Q. How did the Company evaluate the proposed Project's impact on its system costs?**
12

13 A. In addition to evaluating the Project's LCOE, the Company conducted planning studies
14 using the Strategist resource planning model to evaluate the projected impact on its
15 system costs. The Company used Strategist to simulate the operation of the NSP System
16 both including the Project and excluding it, and estimated the total system costs both with
17 and without the Project.
18

19 **Q. Would you briefly describe how the Strategist model works?**
20

21 A. Strategist simulates the operation of electric systems for a given planning period. The
22 model calculates the cost of serving a system's demand and energy requirements
23 incorporating any required capacity reserves. Key model inputs include fuel prices,
24 market electricity prices), and current and potential supply and demand side resources.
25 The model, proceeding one year at a time, simulates the dispatch of the system, though it
26 does not specifically forecast each hour, which is a critical limitation. Moving forward

⁴ NSP 2017 FERC Form 1.

⁵ Estimated generation mix calculated from NSP response to NDPSC data request 2.10 for the Preferred

Case

1 through the planning period, Strategist will determine the point at which new resources
2 are needed to satisfy capacity requirements, and will add various combinations of
3 potential new resources and account for the total system costs (capital plus operating)
4 associated with each combination, or portfolio. At the end of the model run, Strategist
5 produces the least cost portfolio.
6

7 **Q. Is Strategist limited in its ability to accurately evaluate the economics of adding**
8 **wind generation to the Company's system?**
9

10 **A. Yes.** Strategist has limitations, particularly with respect to the evaluation of wind and
11 solar resources. There are two specific limitations of Strategist related to its ability to
12 properly assess the economics of wind and solar generation. The first limitation is related
13 to Strategist's projections of system resources' operations. The model employs what is
14 known as a load duration curve methodology. Load duration curves calculate the amount
15 of time during a given year that a system requires a certain level of capacity. By
16 "stacking" available resources in order of lowest operating cost to highest operating cost
17 and overlaying the stack with the load duration curve, the model can quickly estimate the
18 projected operation of each asset until the total system needs are met, beginning with
19 lowest cost resources and incrementally utilizing higher cost resources. However, in
20 using the load duration curve methodology to determine resource requirements, the
21 model loses precision. By not explicitly projecting operations for each generator in each
22 hour of the study period, as well as generator and transmission constraints, the model
23 tends to understate the operations of higher cost peaking resources, as well as understate
24 the ramping and cycling operations of dispatchable resources. Both of those
25 understatements in turn understate the total system costs related to scenarios with
26 increased amounts of variable energy resources, such as the Project.
27

28 The second limitation is that Strategist performs a statistical averaging of the energy

1 attributed to non-dispatchable, intermittent resources such as wind generation. This
2 averaging loses the variability of the maximum and minimum generation of the facility
3 within the month, which again causes the model to understate additional system costs
4 associated with ramping other dispatchable resources to accommodate the intermittent
5 resources.

6
7 **Q. Do the limitations of Strategist prevent drawing conclusions regarding the relative**
8 **savings of the Project?**

9
10 **A.** No, even while acknowledging Strategist's shortcomings in accurately representing both
11 system load and intermittent generation facilities, the Company's analysis demonstrates
12 that the proposed Project will provide significant savings for the Company's customers.
13 The Project's LCOE is projected to be much lower than the Company's current system
14 average cost. In addition, the Company exogenously applied an assumption regarding
15 wind integration costs. I believe the Project will provide savings to the Company's
16 customers under a reasonable range of market conditions, even with the Strategist
17 limitations in evaluating them.

18
19 **Q. Did you review the Company's Strategist modeling?**

20
21 **A.** Yes. Specifically, I reviewed the following:

- 22 • The results of the planning scenarios the Company conducted via Strategist; and
- 23 • The representation of the Company's natural gas and market price projections in
24 the model.

25
26 **Q. When was the modeling conducted?**
27

1 A. My understanding is that the initial analysis was based upon fuel price projections and
2 market price forecasts associated with the Summer 2017 Resource Treatment
3 Framework⁶ Filing.⁷ The Company subsequently updated the analysis and filed
4 Supplemental Testimony in early 2018 to reflect an updated cost of capital, the revised
5 cost of a combustion turbine (CT), revised income tax rates, and a revised capacity credit
6 and the need for capacity starting in 2025.⁸ The Company did not update what I consider
7 to be critical inputs and modeling assumptions, including natural gas costs and MISO
8 energy market prices, or other inputs including wind congestion cost, wind integration
9 costs, and wind coal cycling costs.⁹

10
11 Q. Do you have any concerns regarding the Company not updating the Dakota Range
12 savings estimates based upon a more recent analysis of project savings?
13

14 A. Yes. Wholesale market prices and fuel prices frequently change from month to month as
15 do long-term forecasts. At this point the savings estimates are approximately one year
16 old. While these critical inputs to the model will continue to change, I believe it is
17 appropriate for the Commission to be informed by current forecasts and understand
18 whether the forecasts have changed or not and if they have changed, how significant is
19 the change.
20

21 Q. Given your concerns about not having an updated Strategist run, should the
22 Commission proceed to review and potentially approve the ADP based upon the
23 analysis submitted by the Company?
24

⁶ CASE NOS. PU-12-813, PU-13-706, PU-13-707, PU-13-708, PU-13-742, PU-13-743, PU-13-194, PU-13-195.

⁷ See NSP Responses to Data Requests 5-9 and 2-6 and Martin Direct lines 8-9, page 18.

⁸ NSP Response to Data Request 5-7.

⁹ NSP Response to Data Request 5-9.

1 A. Yes. I view the role of the Strategist model as identifying whether the wind project
2 lowers total resource costs compared to adding a different type of generation resource or
3 making market purchases. My analysis, described later in this testimony, demonstrates
4 that the wind project is expected to provide lower cost energy than MISO market
5 purchases. I do not expect that Strategist would identify a gas-fired resource as a lower
6 cost alternative even if the capital costs of the CT and CC were updated along with the
7 gas prices and the MISO market prices.

8
9 Q. What is the basis for your expectation that updating the Strategist inputs would not
10 change the selection of the Dakota Range project as a lower cost resource?

11
12 A. The Company provided updated calculations of the levelized cost of the CT and CC
13 which translated into an approximate 6% drop in the capacity credit for those resources,
14 which is not significant with respect to the energy savings. I also compared the change in
15 the forecast of gas costs and MISO market prices over the last year and while the gas
16 prices dropped between approximately 2-8%, that drop is not enough to make energy
17 from a CC or CT competitive with the levelized cost of Dakota Range.

18
19 Q. Would you please summarize the scenarios that the Company evaluated using
20 Strategist?

21
22 A. Yes. The Company developed scenarios that it labeled "Markets On" and "Markets Off".
23 Markets On refers to the assumption that the Company is a member of MISO and can buy
24 and sell electricity from and to the MISO market, while Markets Off assumes a closed
25 utility system. The Company also ran a scenario based upon its preferred resource
26 additions from 2016 to 2030, as well as two scenarios around high and low natural gas
27 prices and two scenarios adjusting the Project's output by plus and minus five percent.

1 **Q. Do you consider the Markets Off scenario cases to be relevant for this Commission**
2 **to consider?**

3
4 **A. No. The Markets Off scenario does not assume the Company has access to buy and sell**
5 **power in the MISO market. This does not reflect reality as the Company buys and sells**
6 **power in the MISO market every day and dispatches all its generation into the market**
7 **based upon MISO instructions. My understanding is that the Markets Off scenarios were**
8 **developed for the Minnesota Public Utilities Commission (MPUC).**

9
10 **Q. Did the Company's estimate of savings change between the initial filing and the**
11 **supplemental filing?**

12
13 **A. Yes. In the original Application, the Company projected the present value of the base**
14 **case savings attributable to the Project to be approximately \$182M. In the Supplemental**
15 **Testimony, the Company projects the base case savings will decrease by approximately**
16 **\$15M, or about 8 percent. My understanding is that this is primarily attributed to the**
17 **combined impact of the capital cost savings and the O&M savings offsetting some of the**
18 **decreased benefits related to income tax deductions associated with the Tax Cuts and**
19 **Jobs Act.**

20
21 **Q. How will the revenues of the Dakota Range Project be determined in the MISO**
22 **market?**

23
24 **A. The Project will earn revenues based upon bidding into the MISO market and receiving**
25 **the market clearing price for its generation. The market clearing price will reflect**
26 **congestion and losses allocated to the generator's interconnection node.**

27
28 **Q. Does the Strategist model create the forecasts of the market prices?**

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A. No. The market prices are an exogenous input to Strategist. The market prices prepared by the Company would have either been purchased from a third-party vendor or developed internally with a different model.

Q. Are the market electricity prices impacted by natural gas prices?

A. Yes. When natural gas-fired generation units are the marginal units setting market prices, there is a strong relationship between gas prices and power prices. The MISO May 2018 Market Monitor reports that over the last 13 months, the correlation coefficient between the Henry Hub natural gas price and the MISO RT LMP was 0.843.¹⁰ The 2018 Market Monitor Report notes that gas-fired generation sets the market marginal energy price for approximately “44% of all intervals for the year including almost all peak hours” and coal-fired generation sets the marginal price for approximately 56% of the intervals.¹¹

Q. How does the forecast of natural gas prices compare to other forecasts?

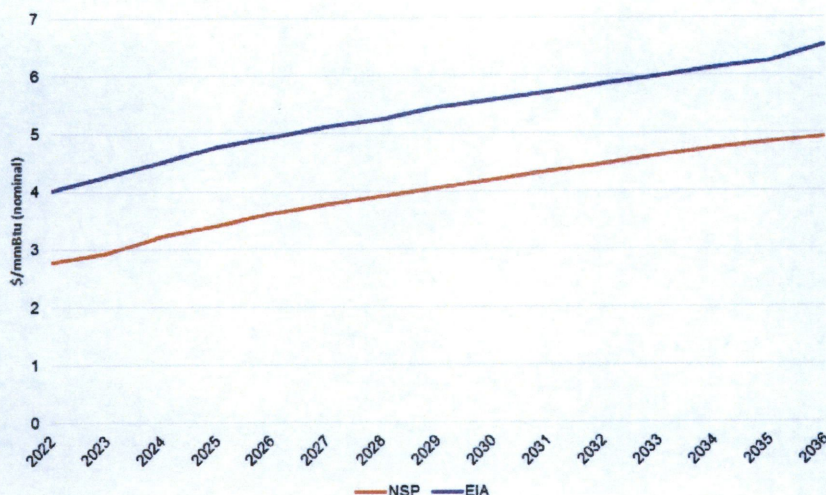
A. The Company’s natural gas price forecast appears reasonable and in fact conservative compared to an independent third party fundamental forecast. Figure 1 shows the Company’s forecast used in the analysis, as well as the Energy Information Administration’s (EIA) 2018 Annual Energy Outlook forecast for comparison¹². In general, lower gas prices will tend to reduce the value of the energy cost savings of the proposed Project, and given that the Company’s forecast is approximately \$1.50/MMBtu lower than the EIA forecast, I believe the forecast is reasonable.

¹⁰ MISO May 2018 Monthly Market Assessment Report, Market Evaluation and Design, July 12, 2018, p 16.

¹¹ 2017 State of the Market Report for the MISO Electricity Markets, Potomac Economics, p4. (Note hydro and wind each set the price 1% of the intervals.)

¹² The EIA forecast was created using EIA’s Reference Case Henry Hub forecast, to which PA Consulting’s estimate of basis differential and transport costs were added to project the Ventura Hub forecast.

1 **Figure 1. EIA Natural Gas Price Forecast vs. NSP Forecast (\$/MMBtu)**
2



3
4
5
6 **Q. Does the Company’s market power price forecast appear reasonable based upon the**
7 **calculated market heat rate?**

8
9 **A.** Yes. I calculated monthly on- and off-peak market heat rates using the monthly market
10 price and gas price forecasts used by NSP as inputs to Strategist, and did the same using
11 the forward market power price and natural gas price forecasts.

12
13 **Q. Did you review the Company’s economic analysis of the levelized cost of the Projects**
14 **and the estimated electricity cost savings to ratepayers?**

15
16 **A.** Yes, I reviewed the spreadsheet model provided by the Company as well as the ratepayer
17 savings analysis that is based upon the Strategist model runs. My conclusion is that the
18 spreadsheet models were developed correctly and that the reported levelized costs are
19 consistent with the models. Of course, these results are based upon a number of critical
20 assumptions.

1
2 **Q. Did the Company use an appropriate discount rate in calculating the present value**
3 **of savings and the levelized cost?**

4
5 **A. Yes, the discount rate is appropriate. The Company used a 6.630 percent discount rate in**
6 **the levelized cost calculations for Dakota Range. However, there is a small discrepancy**
7 **in that the Company also calculates a 6% WACC.¹³**

8
9 **Q. How is the capacity of the Project valued in the economic analysis?**

10
11 **A. The spreadsheet financial models address costs and not revenues. While the Company**
12 **has identified a need for capacity starting in 2025, the Company has indicated that they**
13 **did not include a capacity credit for the Project in their economic modeling until it**
14 **reduces the need for CT capacity starting in 2027.¹⁴ However, the value of the capacity**
15 **associated with a new CC or CT is embedded in the Strategist analysis as part of the least**
16 **cost resource selection process.**

17
18 **Q. Does the economic analysis include any assumption regarding wind integration**
19 **costs?**

20
21 **A. The summary of the levelized cost of the Project does not include wind integration costs.**
22 **However, the Company provides an estimate of \$0.53/MWh - \$0.56/MWh depending on**
23 **the Project.**

24

¹³ 17-0694 MPUC-020_Att A – Dakota Range_Final TRADE SECRET.xlsx - Tabs Inputs &

Assumptions and Levelized Cost

¹⁴ NSP Response to NDPSC Data Request 5-9 c).

1 **Q. Did you review the Company's updates to the project costs provided in the**
2 **Supplemental Filing?**

3
4 **A. Yes. The Company described two updates to the initial capital cost estimates and two**
5 **updates to the initial O&M estimates. The capital cost updates reflect lower transmission**
6 **and interconnection costs and a larger grant from the South Dakota Reinvestment**
7 **Payment Program. The O&M cost update reflects near term savings from O&M**
8 **contracts for other wind projects that were applied to the Dakota Range estimates.**
9 **The capital cost estimated savings are known with reasonable certainty as the Project has**
10 **a Generator Interconnection Agreement (GIA) with MISO effective December 15, 2017**
11 **and estimates provided in conjunction with the GIA. However, the costs could change**
12 **based upon detailed engineering, contracting, and actual construction costs. The South**
13 **Dakota Board of Economic Development grant is subject to certain restrictions. The**
14 **Company has estimated the amount of the grant based upon the cap determined by 65%**
15 **of the South Dakota sales / use tax as opposed to the maximum potential amount of the**
16 **grant.¹⁵ My assessment is that these updates to the Project's estimated capital costs are**
17 **reasonable.**

18
19 **[CONFIDENTIAL DATA BEGINS** [REDACTED]

20 [REDACTED]
21 [REDACTED]
22 [REDACTED]
23 [REDACTED] **CONFIDENTIAL**

24 **DATA ENDS] My assessment is that these updated assumptions regarding O&M are not**
25 **unreasonable, even though they are not known with any reasonable degree of certainty**
26 **and are less conservative than the assumptions in the original application.**

¹⁵ NSP Response to NDPSC 5-4.

¹⁶ NSP Non-Public Response to NDPSC Data Request No. 5-5

1
2 **Q. Did the Company account for removal costs?**

3
4 **A. Yes. The Company assumed approximately [CONFIDENTIAL DATA BEGINS]**
5 **██████████ [CONFIDENTIAL DATA ENDS]¹⁷. I also reviewed the DNV-GL analysis of**
6 **decommissioning cost prepared for Apex and filed in South Dakota APEX hearings. The**
7 **Company's assumption of decommissioning costs is higher than DNV-GL's estimate**
8 **prior to salvage value.¹⁸ The DNV-GL report assumes that salvage value will offset the**
9 **decommissioning cost. Based upon the DNV-GL analysis, it is reasonable to conclude**
10 **that the Company has adequately accounted for decommissioning costs and in fact may**
11 **have overestimated them.**

12
13 **Q. What did you conclude regarding the Company's economic analysis of the Project?**

14
15 **A. I concluded that the Company's analysis is a reasonable estimating of savings and that**
16 **Dakota Range can reasonably be expected to lower energy costs for North Dakota**
17 **customers compared to either purchasing a gas-fired resource for energy, or making**
18 **market purchases.**

19
20 **VII. Independent Economic Analysis of the Project**

21
22 **Q. Would you please summarize your independent economic analysis of the Project?**

23
24 **A. Yes. My analysis focused on three components. First, I developed an estimate of Dakota**
25 **Range's savings compared to market purchases based upon PA's long-term forecast of**
26 **Minnesota Hub prices. Second, I reviewed the natural gas price forecast used by the**

¹⁷ 17-0694 MPUC-020_Att A – Dakota RangeFinal TRADE SECRET.xlsx

¹⁸ Dakota Range Wind Project Decommissioning Cost Analysis, Apex Clean Energy Management, LLC, DNV-GL, December 8, 2017 (Exhibit A4-2) and update prepared on June 8, 2018.

1 Company, developed last year, with PA's current long-term forecast of natural gas prices.
2 Third, I reviewed the MN Hub wholesale electric price forecast used by the Company,
3 developed last year, with PA's current long-term forecast for MN Hub.
4

5 **Q. Would you please describe how you assessed the savings compared to market**
6 **purchases?**
7

8 **A.** Yes, I used a PA developed long term hourly forecast of MN Hub prices and used those
9 prices in conjunction with Dakota Range's projected hourly production profile to
10 estimate the revenues that the Company will receive as a result of dispatching the Dakota
11 Range project into the MISO market. I compared the estimated revenues with the
12 levelized cost of the project as developed by the Company. The long-term price forecast
13 was developed using the Aurora XMP hourly chorological dispatch model. Note, this
14 analysis does not demonstrate that Dakota Range is the lowest cost resource to acquire,
15 only the savings compared to market purchases.
16

17 **Q. Did you evaluate the impact of changes in production resulting from curtailment or**
18 **other deviations from expected performance?**
19

20 **A.** Yes. I evaluated the Project's projected savings compared to market purchases using
21 alternate production forecasts, including both 5 percent higher production and 5 percent
22 lower production, relative to the Project's projected annual production. I also calculated
23 the Project's estimated savings using the Company's market price forecasts using the
24 same two adjustments to the production forecast. The results are presented in results
25 summary in Section VIII below.
26

27 **Q. Did you evaluate the impact of changes in natural gas prices on the Project's**
28 **potential energy savings?**

1
2 **A.** Yes. I evaluated the Project's projected savings compared to market purchases using
3 both a high natural gas cost case and a low natural gas cost case. Using lower and higher
4 gas cost forecasts has a material impact on the resulting market prices. The alternative
5 market electricity prices in turn has a material impact on the Project's potential energy
6 savings compared to market purchases. My results are presented in results summary in
7 Section VIII below.

8
9 **Q.** Did you consider the potential for Project cost overruns into your analysis?

10
11 **A.** Yes. As I described in Section VI above, the capital costs are now known with reasonable
12 certainty, while the O&M cost updates are an estimate and are not yet secured with
13 contracts.

14
15 **Q.** Did you incorporate capacity compensation into your analysis?

16
17 **A.** No. In my independent analysis of the Project's economics, I focused on the potential
18 energy revenues available to the Project and did not ascribe any capacity compensation
19 revenues to the Project. However, the Project will receive capacity credits from MISO
20 and will contribute to meeting the Company's capacity obligation.

21
22 **Q.** Does your economic analysis consider any other costs of the Project, such as wind
23 integration, wind congestion, or wind-induced coal plant cycling costs?

24
25 **A.** Yes. The Company's wind congestion, wind integration, and coal cycling costs were
26 included in my savings projections.

27
28 **Q.** Does your economic analysis include the estimated impact of the recent federal tax
29 rate legislation?

1
2 **A.** Yes. I have reviewed the Company's revised revenue requirements model and how it
3 incorporated the change in the federal corporate tax rates, and believe it to be a
4 reasonable estimate of the impact. The resulting revenue requirements are included in my
5 projection of Project savings discussed below.

6
7 **Q.** Does the economic analysis include any valuation of environmental or economic
8 development benefits?

9
10 **A.** No, neither environmental nor economic development benefits are incorporated into the
11 estimated savings to ratepayers or levelized cost analysis.

12
13 **Q.** Have you prepared a summary of your analysis of savings compared to market
14 purchases?

15
16 **A.** Yes, the summary is provided in Exhibit JAH-2.
17
18

19 **VIII. Assessment of the Projected Energy Cost Savings of the**
20 **Project**
21

22 **Q.** Would you please compare your estimates of the projected energy cost savings to
23 the Company's estimates?
24

25 **A.** Yes. The Company's Supplemental Testimony indicated the projected savings
26 attributable to the Project as calculated by its Strategist analysis were approximately \$15
27 million lower than its original projection of \$182 million, for a revised estimate of
28 approximately \$167 million.
29

30 I calculated the Project's projected savings using both the Company's forecasted MISO

1 energy prices, as well as PA's independently forecast of MISO energy prices. Using this
2 methodology, the Company's view of energy prices project approximately
3 [CONFIDENTIAL DATA BEGINS ██████████ CONFIDENTIAL DATA ENDS]
4 in savings (and less than the estimates from Strategist), while PA's view of energy prices
5 project approximately [CONFIDENTIAL DATA BEGINS ██████████
6 CONFIDENTIAL DATA ENDS] in savings (and similar to the estimates that the
7 Company developed in Strategist).. Table 1 below provides a summary view of both my
8 and the Company's estimates of potential savings. [CONFIDENTIAL DATA BEGINS

9 **Table 1. Projected Energy Savings of the Project**

10
11
12
13
14
15 **CONFIDENTIAL DATA ENDS]**

16 **Q. What are your conclusions with regard to the Project's potential energy savings**
17 **compared to market purchases?**

18
19 **A.** First, I note that when using PA's view of MISO market prices, my estimate of the
20 Project's savings are higher than when using the Company's view of MISO market
21 prices. This is due to the Company's view of market prices being lower than PA's view
22 of market prices – as discussed previously, when market prices are higher, the Project can
23 be expected to have greater savings relative to market purchases. However, under both
24 the Company's and PA's market views, the Project is expected to lower energy costs for
25 the Company's customers.

26
27 I also conclude that should the Project's production vary from the forecasted value, the
28 Project is still expected to provide energy savings. Even should the Project's production

1 drop by 5%, both PA and the Company are projecting between [CONFIDENTIAL
2 DATA BEGINS [REDACTED] CONFIDENTIAL DATA ENDS] in present value savings
3 compared to market purchases.
4

5 Regarding the natural gas price impacts, the lowest projected savings attributable to the
6 Project are associated with the Company's view of low gas prices. These low gas prices
7 in turn lower market prices, which in turn lowers the projected energy savings. The
8 Company's low gas price forecast is much lower than PA's view of low gas prices. The
9 Company's low gas forecast projects prices of less than [CONFIDENTIAL DATA
10 BEGINS [REDACTED]
11 [REDACTED]
12 CONFIDENTIAL DATA ENDS] in 2035. In my view, the Company's low gas forecast
13 is a very conservative forecast, and yet would still be projected to result in the Project
14 providing energy savings should those low prices occur.

15 While the actual market revenues will inevitably be different than either the
16 Company's or my forecast, Dakota Range also provides a benefit with regards to a stable
17 cost to customers.
18

19 **Q. What are your conclusions with regard to the Company's estimate of approximately**
20 **\$167 million of savings from the Project based upon Strategist?**
21

22 **A.** My conclusion is that the Project will result in electricity cost savings to North Dakota
23 customers. While the Company has not provided an updated estimate of the level of
24 savings the Project compared to its Base Case, I note that my independent economic
25 analysis of the Project compared to purchasing an equivalent amount of energy from the
26 MISO energy markets results in significant savings. Furthermore, the cost of energy
27 from the Project also appear to be significantly greater than electricity from a gas-fired
28 resource.
29

1 **IX. Other Considerations**
2

3 **Q. Did you consider any other issues related to the Project in making your**
4 **recommendations?**

5
6 **A. Yes. I considered the impact of potentially high renewable generation penetration rates in**
7 **the MISO market, and how that may impact North Dakota's coal mining and generation**
8 **industries.**

9
10 **Q. Did you consider the impact of approving Dakota Range on coal plants?**

11
12 **A. No, not Dakota Range as a single project. Adding the Dakota Range project is not likely**
13 **to change coal plant dispatch significantly given the size of the project compared to**
14 **MISO Zone 1 generation, However, I considered the impact on total MISO coal plant**
15 **capacity factors by evaluating two wind expansion cases: adding 14.5 GW or 30 GW of**
16 **additional wind over the 2018 – 2031 time frame.**

17
18 **Q. What was the basis for the two scenarios of wind additions?**

19
20 **A. The wind additions are based upon the Policy Regulatory Plant Additions and the**
21 **Accelerated Alternative Technology Plant Additions scenarios developed as part of the**
22 **2017 MISO Transmission Expansion Plan (MTEP17).**

23
24 **Q. How did you evaluate the impact of the two wind cases on coal plants?**

25
26 **A. I modified a base case Aurora hourly production cost model for MISO to evaluate coal**
27 **plant dispatch with the incremental wind plant additions associated with the two MTEP17**
28 **scenarios. In these sensitivity analyses I did not change any other assumptions such as**
29 **any impact on natural gas pricing due to less demand for natural gas fired generation. I**

1 then reviewed the change in coal plant generation across the base case and the two policy
2 cases. To get a better understanding of how coal plants would be impacted I separated
3 the results into coal plants with 9,000 – 10,000 heat rates and then in 1,000 increments.
4

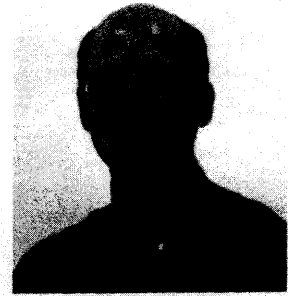
5 **Q. Would you please summarize the results of your analysis?**

6
7 **A. Yes.** Not surprisingly, the reduction in coal generation is greater under the higher wind
8 build case, and the reduction in capacity factors tends to be greater for the high heat rate
9 plants. PA projects that a number of MISO coal generating plants are currently operating
10 at marginal economics and are candidates for retirement over the next decade; adding
11 significant amounts of wind generation to MISO will likely accelerate these retirements.
12 A summary of the analysis is provided in Exhibit JAH-3.
13

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

15
16 **A. Yes.**

**JIM
HEIDELL**
DIRECTOR



Jim Heidell specializes in electric and gas utility regulation, wholesale electricity markets, 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.

- **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

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

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 of 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 of 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 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 – 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.

JAH-2

CONFIDENTIAL-FILED AS TRADE SECRET

JAH-3

CONFIDENTIAL-FILED AS TRADE SECRET

