Attachment IV

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

New York Independent System Operator, Inc. **Docket No. ER25-___-000**

AFFIDAVIT OF CHAD W. SWOPE, KIERAN MCINERNEY, AND MATTHEW LIND

I. Qualifications

A. Chad Swope

1. My name is Chad W. Swope. I am the Project Delivery Director for the Generation Asset Advisory Business Line in 1898 & Co., part of Burns & McDonnell Engineering Company, Inc. (1898 & Co.). Burns & McDonnell has been in business since 1898, serving multiple industries, including the electric power industry. Burns & McDonnell is a family of companies made up of more than 14,000 engineers, architects, construction professionals, scientists, consultants and entrepreneurs with more than 75 offices across the world and headquartered in Kansas City, Missouri. My business address is 9400 Ward Parkway, Kansas City, Missouri 64114.

2. I have been with Burns & McDonnell since 2008. As Director of the Generation Asset Advisory Business, I oversee the related business development, marketing, staff training and project execution for the business unit. This business unit specializes in the early project development, operations and maintenance (O&M) optimization, technical due diligence, and decommissioning planning for non-renewable power generating assets. The business unit serves municipal, cooperative, and investor-owned utilities; independent generation and transmission developers; investment banks and private capital groups; and regional transmission organizations. Projects range from technology evaluations, asset management, condition assessments, decommissioning studies, sell- and buy-side transaction due diligence reviews, and other unique projects. I have led or supported client engagements in markets across the United States and some international markets working directly with plant staff, market operators, market participants, and developers of power infrastructure.

3. I hold a B.S. in Mechanical Engineering from the University of Missouri-Science & Technology. I am a registered Professional Engineer in the state of Missouri. My curriculum vitae is attached as Exhibit A.

B. Kieran McInerney

4. My name is Kieran McInerney. I am a Senior Consultant and Project Manager at 1898 & Co., located at 9400 Ward Parkway Kansas City, Missouri 64114.

5. I have been with Burns & McDonnell since September 2013. During that period, I have worked on a wide range of planning studies and development projects related to electrical energy production and energy storage in various areas, including New York State. Prior to working for Burns & McDonnell, I worked for URS Corporation (acquired by AECOM in 2014), Johnson Controls, and York International (acquired by Johnson Controls in 2005).

6. I hold a B.S. in Mechanical Engineering from Marquette University. I am a registered Professional Engineer in the state of Colorado. My curriculum vitae is attached as Exhibit B.

C. Matthew Lind

7. My name is Matthew E. Lind. I am a Director leading the Resource Planning & Market Assessments Business at 1898 & Co. My business address is 9400 Ward Parkway, Kansas City, Missouri 64114

8. I have been with Burns & McDonnell since 2004. As Director of the Resource Planning & Market Assessments Business, I oversee the related business development, marketing, staff training and project execution for the business unit. This business unit specializes in development of economic models and analyses associated with generation and transmission planning serving municipal, cooperative, investor-owned utilities, independent generation and transmission developers, and regional transmission organizations. Projects range from integrated resource planning, new resource procurement evaluation, economic transmission planning, demand-side management, asset retirement, transmission congestion impacts, and other economic planning decisions. I have led or supported client engagements in markets across the United States and some international markets working directly with market operators, market participants, and developers of power infrastructure. I have supported development of work product and submitted testimony to multiple state regulatory commissions on matters related to both generation and transmission assets.

9. I hold a M.B.A. in Finance from the University of Missouri-Kansas City and a B.S. in Industrial Engineering from Iowa State University. I am a registered Professional Engineer in the state of Kansas. My curriculum vitae is attached as Exhibit C.

II. Purpose and Summary of Affidavit

10. Section 5.14.1.2.2 of the New York Independent System Operator, Inc. (NYISO) Market Administration and Control Area Services Tariff (Services Tariff) requires the NYISO to conduct a comprehensive review of the ICAP Demand Curves every four

years.[1] An independent consultant assists with conducting the periodic reviews. In order to develop recommended ICAP Demand Curve parameters, the independent consultant develops the initial assumptions and analysis, and reviews these with the NYISO and stakeholders through a stakeholder process. This process culminates in the filing with the Federal Energy Regulatory Commission (FERC or Commission) of the ICAP Demand Curves approved by the NYISO Board of Directors. This process is commonly referred to as the ICAP Demand Curve reset (DCR).

11. Analysis Group, Inc. (AG) was hired as the independent consultant for review of the ICAP Demand Curves to be used starting in the 2025-2026 Capability Year (2025-2029 DCR). AG worked with 1898 & Co. to complete the tariff-required periodic review process (together, AG and 1898 & Co. are referred to in this Affidavit as the "Independent Consultant").

12. This affidavit addresses four topics. First, we provide an overview of 1898 & Co.'s role in the 2025-2029 DCR, which is described more fully in the accompanying *Affidavit of Paul J. Hibbard, Dr. Todd Schatzki, Joseph Cavicchi, Charles Wu, and Dr. Daniel Stuart* that is set forth in Attachment III of the filing letter to which this Affidavit is attached (AG Affidavit). Second, we provide an overview of the technology screening criteria and technology advancements related to power generating technology considered as part of the screening process. Third, we describe the methodology used for estimating costs for technologies meeting the screening criteria. Finally, we address certain key issues which impacted our basis for conceptual plant designs and the resulting cost estimates, all of which are described more fully in Section II and Appendix A of the final report completed by AG and 1898 & Co. for the 2025-2029 DCR dated October 2, 2024 (Final Report). The Final Report is attached as Exhibit F to the accompanying AG Affidavit.

III. Overview of Role and Methodology

13. As more fully described in Section II of the Final Report and the AG Affidavit, 1898 & Co.'s role was to select peaking plant technology options to be evaluated for each ICAP Demand Curve and to develop the representative design assumptions (including site requirements, location considerations and emission controls), cost estimates, and performance information for each option in Load Zones C, F, G (Dutchess County), G (Rockland County), J, and K.

14. Consistent with past DCRs, 1898 & Co. utilized the following screening criteria to assess the viability of technology options for consideration as a peaking plant to anchor the ICAP Demand Curves:

- Standard generating facility technology – available to most market participants;
- Mature market technology – operating experience as a commercial power plant;

[1] Capitalized terms that are not specifically defined in this Affidavit shall have the meaning set forth in the filing letter to which this Affidavit is attached or, if not defined therein, the meaning set forth in the Services Tariff.

- Unit characteristics that can be economically dispatched;
- Ability to cycle and provide energy and/or ancillary services;
- Whether the technology can be practically constructed in a particular location; and
- Ability to meet applicable environmental and other operating requirements and regulations.

15. The 2021-2025 DCR evaluated utility-scale lithium-ion energy storage and found the technology to be a viable option because it satisfied each of the above-described screening criteria. Since the 2021-2025 DCR, the energy storage industry has advanced rapidly. Battery energy storage system implementation has dramatically increased nationwide, growing from approximately 1.0 GW at the start of 2020 to 15.5 GW through the end of 2023, according to U.S. Energy Information Administration data.[2] Lithium-ion technology is the dominant option for new facility installations in the utility-scale stationary energy storage space in the U.S. and worldwide. Lithium-ion technology has benefitted greatly from the research and development efforts in the electric vehicle industry, which enabled technology and commercial maturity timelines that have outpaced alternative battery technologies.

16. The rated discharge duration for stationary storage applications with lithium-ion technology typically ranges from approximately 1 to 8 hours depending on the intended use case of the system. As energy storage implementation has increased and capital costs have become more competitive when compared to traditional fossil generation options, battery energy storage system (BESS) technology is increasingly considered as an alternative to traditional peaking technologies both in wholesale market environments and regulated utility environments. The 2021-2025 DCR study included BESS with 4-hour, 6-hour, and 8-hour discharge durations. BESS with 2-hour and 4-hour discharge durations are currently the most common in the utility industry, and they commonly use the same enclosure products. Certain stakeholders disagree that a 2-hour BESS would be suitable for peaking use due to discharge duration limitations. However, based on the satisfaction of all screening criteria, the 2-hour BESS is an economically viable technology option for the 2025-2029 DCR.

17. There are several other energy storage technologies that are increasing in technological and/or commercial maturity, but non-lithium technologies were not considered for further evaluation as there is insufficient demonstrated online capacity at utility scale to demonstrate that such non-lithium alternatives represent proven technologies at this time. As a result, such alternatives were not found to be viable technology options for the 2025-2029 DCR.

[2] "Preliminary Monthly Electric Generator Inventory (based on Form EIA-860M as a supplement to Form EIA-860),", available at: https://www.eia.gov/electricity/data/eia860m/

18. 1898 & Co. identified the following representative energy storage options for continued evaluation in the 2025-2029 DCR, based on lithium-ion battery technology, for comparison to traditional simple cycle gas-fired turbine (SCGT) technologies:

    - 200 MW, 2-hour (400 MWh stored energy) lithium-ion
    - 200 MW, 4-hour (800 MWh stored energy) lithium-ion
    - 200 MW, 6-hour (1,200 MWh stored energy) lithium-ion
    - 200 MW, 8-hour (1,600 MWh stored energy) lithium-ion

19. 1898 & Co. determined that the following SCGT technologies satisfy the screening criteria:

    - Aeroderivative Combustion Turbines
        - General Electric (GE) LM6000PF+
        - GE LMS100PB
        - Siemens SGT-A35
        - Mitsubishi Power Americas (MPA) FT8 SWIFTPAC 60
        - Mitsubishi Power Americas (MPA) FT400 SWIFTPAC 70
    - Frame Combustion Turbines
        - GE 7F.05
        - Siemens SGT6-5000F
        - GE 7HA.03
        - Siemens SGT6-9000HL
        - MPA M501JAC
        - GE 7HA.02
        - GE 7HA.01
        - Siemens SGT6-8000H
        - MPA M501GAC
    - Reciprocating Internal Combustion Engines (RICE)
        - Wartsila 18V50SG

20. The State of New York passed the Climate Leadership and Community Protection Act (CLCPA) in 2019 which establishes a requirement that 100% of New York load be served by zero-emissions resources by January 1, 2040. Notably, however, the term "zero-emissions" is not defined in the CLCPA and New York has not yet finalized rules to establish eligibility requirements for CLCPA-compliant zero-emission fuels, technologies, or other options. Therefore, 1898 & Co. assumed for purposes of this study that a potential zero-emission operating design would consist of a generation resource that produces zero direct carbon dioxide (CO_2) emissions during operation. 1898 & Co. determined that zero-emission peaking plant technologies are not viable for the 2025-2029 DCR due to their prohibitive costs, the

absence of demonstrated commercial viability, and the absence of final rules to establish eligibility to qualify as a CLCPA-compliant zero-emissions resource. In reaching this determination, 1898 & Co. identified the following considerations:

a. Current carbon capture technology is limited to a 90%-95% CO_2 capture rate. This does not appear to meet the CLCPA's zero emissions requirement. Additionally, current carbon capture technology would not be capable of fast startup times and flexible ramp rates undermining the ability for the technology to satisfy the criteria for cycling capability and capability to provide peaking service. Due to these reasons, post combustion carbon capture was not evaluated.

b. There are several potential carbon-free fuels that might satisfy the CLCPA's zero-emissions requirement, such as hydrogen, ammonia, biodiesel, and renewable natural gas. All of these are considered emerging technologies and have no commercial operating experience at this time. Notably, all three major gas turbine original equipment manufacturers (OEMs) are performing research and development on dry low emissions combustor technology capable of firing 100% hydrogen. However, this combustor technology is not expected to be commercially available until the 2030 timeframe.

21. Although not viable, 1898 & Co. did conduct a preliminary evaluation of a potential retrofit of a fossil-fired frame turbine to a potential zero-emission operating design for informational purposes. For purposes of this informational assessment, 1898 & Co. assessed the conversion of a fossil-fired frame turbine to burning 100% hydrogen as a "proxy" for a potential zero-emissions operating design. Considering the costs related to onsite storage and compression of hydrogen at the plant site to support operations, 1898 & Co. identified that the cost for such a retrofit option could exceed $2 billion. Additionally, to accommodate such onsite hydrogen storage and compression, 1898 & Co. determined that sites in excess of 60 acres may be required. These site requirements present challenges to the feasibility of identifying an appropriately sized parcel, especially in downstate population centers such as Load Zones J and K.

22. For the BESS options, 1898 & Co. updated the assumed design specifications for lithium-ion energy storage systems. The design modifications used for the 2025-2029 DCR are based on market trends observed from 1898 & Co.'s experience. The following BESS design considerations were identified for this reset:

a. A key technological advancement since the 2021-2025 DCR is the development and common adoption of product modularization. In efforts to reduce construction costs and drive product consistency and safety, lithium-ion BESS equipment suppliers typically offer a purpose built, integrated, modular enclosure product with factory installed battery modules for stationary storage applications. During the 2021-2025 DCR study, this trend was relatively early in commercialization, and project owners were likely to

compare costs of modular enclosures against building-based or enclosure-based options that would have field-installed battery modules. In today's market, field-installed modules or building-based designs may be considered for niche applications, but the utility scale market is dominated by supplier competition with modular enclosure products. These modular enclosures are commonly designed to meet applicable Underwriters Laboratories (UL) safety standards and integrated with unit level controls, safety, and thermal management systems. Suppliers may provide their own battery cells and/or modules in the integrated enclosures, or they may procure them from a third-party provider. To address this market shift, the 2025-2029 DCR assumes the use of the modular enclosure form factor, but because of the numerous participants and competitive nature of the BESS market, the costs are not intended to represent a specific product or provider. Instead, the costs are intended to be representative of the current market costs for BESS as of the second calendar quarter of 2024.

b. The BESS design concept basis accounts for applicable requirements in New York State, including but not limited to the New York City Fire Department (FDNY) requirements for energy storage systems in Load Zone J. The 2025-2029 DCR assumes the energy storage technology for Load Zone J has received the FDNY Bureau of Fire Prevention TM-2 Certificate of Approval. The design concept basis for Load Zone J also accounts for other applicable FDNY requirements for BESS, including external flame detection, external water suppression, and addressable fire panel.

c. The interconnection voltage assumptions are also updated for BESS technologies for all locations except Load Zone K. For the 2025-2029 DCR, the assumed interconnection voltage for Load Zones C, F, and G (Dutchess County) is 115 kV, and the assumed interconnection voltage for Load Zone G (Rockland County) and Load Zone J is 138 kV. Consistent with the 2021-2025 DCR, the interconnection voltage for Load Zone K remains at 138 kV. These interconnection assumptions were updated during the study process with support from evaluations by the NYISO that indicated that the 200 MW BESS facilities evaluated for this study would be deliverable at the lower voltage interconnections for each location.

23. With respect to the assumed lower voltage interconnection for BESS, certain stakeholders have raised concerns that the estimated costs of a 138 kV interconnection in Load Zone J may be excessive. Specifically, these stakeholders noted that the cost of the interconnecting electric transmission line between the switchyard and the BESS facility (commonly referred to as the "generator lead") for the 138 kV interconnection in Load Zone J exceeded the cost of the generator lead developed as part of an alternative, preliminary estimate assuming a 345 kV interconnection in Load Zone J. For the electric interconnection cost for the BESS options, there are two relevant line items within the owner's cost category: the interconnecting switchyard and the generator lead. For Load Zone J, the combined

estimate for these two items is approximately $4.6 million less for the 138 kV interconnection than the same combination at the 345 kV level. However, the individual line items changed in different directions. The lower voltage interconnecting switchyard component requires less expensive equipment and materials resulting in a reduction of 26% from the cost of the same system for a 345 kV interconnection. This reduction, however, was partially offset by an increase to the generator lead costs for the lower voltage interconnection in Load Zone J. For Load Zone J, the generator lead is assumed to be a one-mile underground line regardless of the interconnecting voltage. For overhead lines, lower voltage means reduced spacing requirements between conductor phases, which then reduces the costs of the structural elements of the line. There are no elevated structural elements for an underground line, but there is significantly more conductor material for a lower voltage transmission line that carries the same power requirement as a higher voltage interconnection. While both overhead and underground lines would require more conductor material in this scenario, the conductor material and related installation costs in an underground line represent a larger percentage of the total cost than they do for an overhead line. Therefore, lowering the interconnecting voltage from 345 kV to 138 kV in Load Zone J resulted in an approximate 33% increase in the cost estimate for the generator lead component.

24. For SCGT technology options, 1898 & Co. identified representative technologies for each of the following technology types: (1) aeroderivative turbines; (2) F-class frame turbines; (3) G-class frame turbines; (4) H-class frame turbines; and (5) J-class frame turbines. Options were selected for the 35-100 MW size range for the aeroderivative turbines, 225-250 MW for the F-class frame units, 275-350 MW for the G/H-class frame units, and over 400 MW for the J-class frame units. Based on preliminary cost screenings, the representative technologies selected for further evaluation and development of detailed cost estimates are as follows:

    - H-class frame turbine peaking plant:
        - One GE 7HA.02 unit with selective catalytic reduction (SCR) emissions controls
        - One GE 7HA.02 unit without SCR emissions controls

    - J-class frame turbine peaking plant:
        - One GE 7HA.03 unit with SCR emissions controls

25. Each fossil plant technology option includes the necessary equipment and operating costs in order to meet the federal and New York State environmental requirements and regulations within each of the locations evaluated. This includes New Source Performance Standards (NSPS) Subpart KKKK and Subpart TTTTa along with the New York Codes, Rules and Regulations (NYCRR). Additionally, fossil plant technology options located in areas that are in non-attainment would require compliance with Lowest Achievable Emission Reduction (LAER). LAER would include SCR emissions controls. 1898 & Co. identified the following considerations with respect to SCR emissions controls for the various SCGT options evaluated:

- The base model GE 7HA.02 emits 25ppm nitrogen oxides (NOx), which would require SCR emissions controls to comply with Subpart KKKK. However, GE also offers a version of the 7HA.02 unit tuned to emit 15 ppm NOx, which would not require SCR emissions controls to satisfy Subpart KKKK. The GE 7HA.02 turbine is controlled for a lower combustion temperature to reduce NOx production. Because firing temperature impacts the turbine's output and efficiency, there is also a performance impact for the alternative design tuned to emit 15 ppm NOx.

- The base model GE 7HA.03 emits 25ppm NOx, which would require SCR emissions controls to comply with Subpart KKKK. GE does not currently offer an alternative version of the 7HA.03 that is tuned to emit 15 ppm NOx.

- The 7HA.02 and 7HA.03 units are expected to be able to comply with the intermediate load CO_2 emission limit, defined by Subpart TTTTa, without any controls. This limits each of the fossil peaking plant technology options to 3,504 hours of operation based on a 12-month rolling average.

26. The capital investment costs include the installed cost of the plant, owner's costs, and financing costs during construction. The installed cost estimate is based on a developer entering into an engineer, procure, construct (EPC) contract for project execution. Owner's cost estimates include the electric and, if applicable, gas interconnection facilities, owner development and management activities, fuel inventory (applicable for fossil plant options with dual fuel capability), builder's risk insurance, and an additional contingency.

27. The capital cost estimates are based on our experience as an EPC contractor, engineering design firm, and consulting firm in the power generation and energy storage industries. Gas turbine costs are based on budgetary estimates from the respective OEM. Other equipment and material quantities and costs are based on 1898 & Co. experience, which includes projects in New York. Estimates for BESS options are intended to be indicative of the current state of the BESS market as of the second calendar quarter of 2024 and are not intended to represent a specific product or provider. 1898 & Co. considered BESS equipment pricing observations from multiple providers, including those that would be suitable for inclusion in Load Zone J. Because of the confidential and competitive nature of the equipment estimates, BESS equipment cost breakouts were not disclosed in the DCR study.

28. Labor costs are based on man-hour durations within each craft multiplied by the respective labor rates. Costs are based on the EPC contractor self-executing the steel, piping, and equipment scopes. BESS options include the EPC self-executing the electrical scope. All other craft scopes are assumed to be subcontracted. Construction craft base wages and supplemental (fringe) benefits were obtained from the RSMeans Labor Rates for the Construction Industry (RSMeans) for the nearest municipality to each location evaluated as part of the 2025-2029 DCR. Burdened

labor rates were developed by adding Federal Insurance Contributions Act (FICA) tax, state and federal unemployment taxes, general liability insurance, and workmen's compensation insurance. All-in wage rates were developed by adding allowances for small tools, supervision, construction equipment, and subcontractor overhead and profit. Work is assumed to be performed on a 50-hour work week by qualified union craft labor available in the respective area. Direct installation labor man-hours for the base cost estimates are for an ideal location and must be adjusted for locations where productivity is reduced due to a variety of factors, including, but not limited to, weather, union rules, construction parking and laydown space limitations. Based on 1898 & Co. experience, man-hours were multiplied by a labor productivity factor for each location evaluated.

29. Owner's costs include allowances for items such as development activities, project management oversight, Owner's Engineer, legal fees, financing fees, emission reduction credits (ERCs) and fuel inventories (applicable for the SCGT options), start-up and commissioning support, temporary utilities during construction, public outreach and area development, site security, builder's risk insurance, and additional contingency for the project. Owner development, oversight, permitting, and management related activities are duration-based, with assumptions for personnel cost for the owner and/or consultants, plus expenses. As applicable, electrical interconnection, gas interconnection, and water supply costs are included, and those are intended to be standalone costs that also include respective development and permitting estimates. Allowances are included for spare parts, legal fees, and area development concessions that often arise as part of project permitting/siting. For the SCGT options, applicable ERC price assumptions for NO_x and volatile organic compounds (VOCs) in each location are based on discussions with emissions brokers familiar with the current ERC market in New York.

30. As part of the electrical interconnection costs for each peaking plant technology option, the potential need for System Deliverability Upgrade (SDU) costs were considered. The NYISO conducted deliverability assessments of the peaking plant technology options evaluated for the 2025-2029 DCR. The NYISO's deliverability assessment determined that all technology options were fully deliverable in all locations, except for the GE 7HA.03 frame turbine option for Load Zone K. Load Zone K SDU costs for the GE 7HA.03 frame turbine option were estimated to be at least $300 million, while Load Zone K SDU costs were zero for the GE 7HA.02 frame turbine and all BESS options (*i.e.*, these options were all fully deliverable without incurring any need for SDUs). Given the high SDU costs for the GE 7HA.03 turbine option, 1898 & Co. selected a GE 7HA.02 with SCR emissions controls to comply with LAER, and dual fuel capability to serve as the representative SCGT option for Load Zone K.

31. Construction financing costs were developed from indicative project schedules.

32. Fixed operations and maintenance (O&M) costs were developed using 1898 & Co.'s proprietary tools and related market intelligence. 1898 & Co. accounted for the following technology-specific O&M considerations:

    - Estimated fixed O&M costs for the lithium-ion energy storage technologies include allowances for routine O&M for the BESS equipment and balance-of-plant equipment, extended warranties/performance guarantees for BESS equipment, and allowances for asset management, energy management, standby auxiliary power cost, and a sinking fund for unplanned maintenance / inverter replacement. For the purposes of accommodating differing cycling scenarios, the O&M costs related to BESS augmentation were algebraically broken into fixed and variable components based on annual energy throughput. Labor based portions of the O&M estimate were adjusted based on differences in wages and productivity factors for the locations evaluated. Load Zone J O&M also includes additional scope for fire protection equipment to comply with applicable FDNY requirements. Additional details regarding staffing assumptions in the fixed O&M costs for the BESS options are provided in Section IV.D of this Affidavit.

    - Estimated fixed O&M costs for the SCGT options include salaries for plant staff labor and training, laboratory expenses, safety equipment, building and grounds maintenance, and administrative and general costs. Labor costs were adjusted for the respective location and based off RSMeans Labor Rates for the Construction Industry.

33. The site leasing costs for each peaking plant technology option were determined based on an annual lease rate ($/acre-year) multiplied by the land requirement in acres. 1898 & Co. escalated the land values approved for the 2021-2025 DCR to 2024$ using the cumulative change in the Gross Domestic Product (GDP) implicit price deflator (Q1 2019-Q1 2024). This methodology was consistent with prior DCRs. Additionally, 1898 & Co. reviewed publicly available property listings to compare against the escalated values. Except for values in New York City, the escalated values were in the range of the observed publicly available listings. New York City property values had a wide range of observed values that indicated recent property values had increased beyond the GDP deflator. Further details regarding the evaluation of the Load Zone J annual lease rate are provided in Section IV.C of this Affidavit.

IV. Key Issues

34. 1898 & Co. addresses certain key issues raised by stakeholders during the DCR below. Specifically, 1898 & Co. provides additional information regarding the following matters: (1) the assumptions and rationale regarding investment tax credit (ITC) basis for energy storage projects; (2) the sales tax assumptions for energy storage projects; (3) the assumed land lease cost for Load Zone J; (4) the staffing

assumptions for energy storage fixed O&M; and (5) the determination of cost component weighting factors for annual updates to gross cost of new entry (CONE) values.

A. ITC Assumptions and Rationale for Energy Storage

35. 1898 & Co. developed assumptions regarding the net value of the federal investment tax credit (ITC) for the BESS options. These ITC assumptions and allowances are based on 1898 & Co.'s research of publicly available information, correspondence with tax consultants and developers, and related knowledge from confidential project experience. The 30% ITC eligibility is based on requirements for prevailing wage and craft apprenticeship requirements, so the wage rates and apprenticeship ratios used for the BESS capital cost estimates were developed to support this assumption. The credit applies to ITC-eligible costs only, including equipment required for supplying electricity, plus related direct and indirect costs. Costs related to the interconnecting switchyard, portions of site prep/civil scope, fencing, external fire protection, noise mitigation, and site security systems are assumed to be excluded from the ITC-eligible costs. The assumed point of change of ownership is the interconnecting switchyard. Because the generation lead sits between the BESS facility and the interconnecting switchyard, the ITC eligible cost buildup assumes that the generation lead line is ITC eligible in the Final Report.

36. Certain stakeholders contested the inclusion of the generator lead line as an ITC eligible cost. In the DCR, the inclusion of the generator lead line is an assumption that is based on our interpretation of verbal correspondence with experienced tax consultants and our interpretations of ITC eligible cost estimates performed by others and observed by 1898 & Co. on confidential prior project experience.

37. We recognize that project-specific factors and other factors determined by tax professionals or regulatory entities may determine which items may ultimately be included in any project's ITC eligible cost buildup. Exclusion of the generator lead, as we understand has been directed by the NYISO Board of Directors, is a reasonable alternative assumption for determining the eligible cost basis for the ITC for the DCR.

B. Sales Tax Assumptions for Energy Storage

38. State and local sales tax is included for major equipment on the BESS projects and electrical interconnection (*i.e.*, the generator lead line and interconnecting switchyard) related to those projects, as bulk energy storage is not currently eligible for an as-of-right state sales tax exemption in New York. The sales tax for major equipment is shown as a line item within the "owner's cost" section. The sales tax for the interconnecting switchyard and generator lead line are included within those respective line-item costs in the owner's cost section. Sales tax for construction supplies and consumables are also assumed to be taxable and those taxes are included in the unit costs within the estimate buildups for all projects.

39. For O&M costs on BESS options, 1898 & Co. assumes that sales taxes will be required for materials and labor related to BESS augmentation as well materials and labor related to any third-party O&M agreements.

40. 1898 & Co. assumes that the BESS projects and related electric interconnection (*i.e.*, the generator lead line and interconnecting switchyard items) could potentially qualify as capital improvement projects, and therefore did not include sales tax for labor/installation related activities or indirect costs in those estimates in the Final Report. Certain stakeholders challenged this assumption because the BESS is assumed to be on leased land and New York applies a rebuttable presumption that leasehold improvements do not qualify as capital improvements. These stakeholders argued that a BESS installed on leased land would not meet the permanence requirements to qualify a capital improvement project for sales tax purposes in New York.

41. We recognize the uncertainty regarding whether a BESS project on leased land may meet the permanence requirements to be considered a capital improvement project, and that project-specific factors and other factors determined by tax professionals or regulatory entities may determine which items may ultimately be taxable. A reasonable alternative assumption, as we understand has been directed by the NYISO Board of Directors, would be to treat BESS projects as not qualifying as capital improvement projects and, as such, subject to sales tax on labor and indirect project costs.

C. Land Lease Costs for Load Zone J

42. As part of determining the annual land lease cost assumption for Load Zone J, 1898 & Co. reviewed publicly available data of listed property values and determined that escalating the land lease value approved for the 2021-2025 DCR did not appropriately account for land lease price increases in Load Zone J since the last reset. Historical data for transactions of industrial zoned property near transmission substations in Load Zone J over the last five years was provided in a report by JLL that was submitted for consideration by a stakeholder during the DCR.[3] 1898 & Co. based its assumed land lease cost for Load Zone J on this data. Assessment values were used to calculate an estimated property tax pursuant to the process outlined by the New York City Department of Finance.[4] Combined with a market assessed 5.9% capitalization rate, the estimated property tax, assessed values, and land area were used to calculate a lease rate for the property on a per-acre basis. The per-acre lease rate was then averaged across the identified properties from the JLL report to determine the appropriate land lease rate for Load Zone J for the 2025-2029 DCR. This average was used as the assumed land lease cost in Load Zone J in lieu of

[3] JLL, *New York City's M Zoned Land Value Analysis* (May 2024), available at: https://www.nyiso.com/documents/20142/44660396/TigerGenCo-New-York-City%20M-Zoned-Land-Value-Analysis.pdf.
[4] https://www.nyc.gov/site/finance/property/calculating-your-property-taxes.page

escalating the land lease cost values from the 2021-2025 DCR. The range of values calculated based on the JLL report is summarized in the table below:

Description	Property Value ($/Acre)	Annual Lease ($/Acre-year)
Low end observed property value range	$2,636,000	$187,000
First quartile of observed property value range	$7,210,000	$466,000
Average observed property value range	$10,569,000	$717,000
Median observed property value range	$11,010,000	$728,000
Third quartile of observed property value range	$14,824,000	$947,000
High end observed property value range	$16,568,000	$1,178,000

D. Staffing Assumptions for Energy Storage Fixed O&M

43. Staffing assumptions vary based on technology. The fixed O&M estimate for the SCGT options accounts for 7 full-time equivalents (FTE) to perform regularly scheduled activities such as inspections, review testing results, replace parts, and address emergencies.

44. BESS O&M estimates are based on market indicative cost information rather than specific FTE buildups. A large portion of the 1898 & Co. confidential O&M cost source information is based on observations from contracts and/or proposals from OEMs/integrators/other third-party providers, as these execution methodologies are common in the industry. Certain stakeholders claim that the BESS O&M cost estimates do not meet applicable fire safety requirements for the Load Zone J or qualify for certain economic development benefits because they do not explicitly reference some quantity of owner personnel usage. However, the intent of the O&M information provided for the BESS options for this reset is to indicate reasonable cost estimates for the applicable O&M scope, not to specify whether, in practice, the project owner relies on third party staff or owner employed staff for any of the tasks within the O&M scope. Indeed, some owners prefer to self-perform maintenance, asset management, and energy management activities because they believe they can achieve lower costs that way. Some owners may also rely on internal, local personnel to meet certain local requirements. While we did not provide specific assumptions for FTE quantities, it is reasonable that these O&M scopes may be performed by Owner personnel within the O&M cost estimates developed for the BESS options.

E. Determination of Cost Component Weighting Factors for Annual Updates to Gross CONE

45. As discussed in the AG Affidavit, the ICAP Demand Curves are updated annually based on an updating of (1) gross CONE, (2) net Energy and Ancillary Services revenues, (3) seasonal capacity availability, and (4) the relative seasonal reliability risks. An element of annual updates is the update of gross CONE values. Each year, the gross CONE of each peaking plant will be updated based on a statewide,

technology-specific escalation factor representing the cost-weighted average of inflation indices for the following four major plant cost components (as prescribed by Section 5.14.1.2.2.1 of the Services Tariff): labor/wages, turbines/storage batteries, materials, and other costs. Consistent with the previous two DCRs, the cost-component weighting factors are calculated for each peaking plant technology reflecting each component's relative share of total peaking plant installed EPC capital costs. The same weighting factors and indices will be used over the reset period, but the values resulting from the indices will be updated annually.

46. 1898 & Co. supported the identification of the cost component weighting factors for the peaking plant technology options evaluated for this reset. The weighting factors are representative percentages of each of the four cost components based on the entire EPC project cost. The estimates for each technology were organized into the four cost categories for each location and then those resultant percentages were averaged among the locations to provide the representative technology class weighting factors. The types of costs included within each of the components are as follows:

    - The labor/wages category accounts for the labor costs and related construction tools from the EPC contractor and subcontractors.

    - The materials category accounts for construction commodity materials (*i.e.*, cable, conduit, piping, concrete, steel, piles, etc.), controls related equipment, fire protection equipment, chemical feed equipment, and all other project equipment besides the major equipment in the turbine/storage batteries category.

    - The turbines/storage batteries category is the major equipment purchases. For the SCGT options, this includes the combustion turbine package and SCR emissions control equipment, as applicable. For the BESS options, this includes modular battery enclosures, inverters, and medium voltage transformers.

    - The other costs category is intended to capture the remaining EPC cost items such as construction management, engineering, startup, escalation, and EPC warranties.

47. Certain stakeholders suggest that, for the BESS options, the turbines/storage batteries category accounts for too large a percentage of the costs of BESS projects. While there may be a logical desire to break this category down to represent only the battery module/cell subassemblies, this is challenging in practice. The confidential source information 1898 & Co. used for the BESS equipment cost estimates is representative of products provided by suppliers in the stationary storage industry, which do not include breakout pricing for the component parts or subassemblies of the battery enclosure product. The BESS capital costs consider multiple suppliers of modular, integrated enclosure products. Most suppliers provide an enclosure with a direct current (DC) connection that requires an external power conversion system (PCS),

which is commonly an inverter and a medium voltage transformer on a common skid. There are also a growing number of suppliers who offer a BESS enclosure with string inverters installed inside the integrated enclosure for an alternating current (AC) system connection. The suppliers of "DC enclosures" and "AC enclosures" are competing for the same projects in the market, and the scope of the PCS changes with respect to the selection of the BESS product. As described in Section III of this Affidavit and Section II of the Final Report, the capital cost estimates for BESS are intended to represent the market indicative costs, not those of a particular product or supplier. This necessarily led to bundling the cost of the BESS enclosure and PCS equipment in the turbine/storage batteries category for purposes of determining the component weightings. To break the cost down further to a battery module or battery cell price, this would likely require estimates for subassemblies directly from a supplier. This would be an atypical (and unlikely granted) request to a supplier for confidential/competitive supply chain information. It also would not represent how developers estimate the cost of BESS projects in practice.

V. Conclusion

48. 1898 & Co.'s role in this DCR was to assist AG with: (1) the selection of peaking plant technology options to be evaluated for each ICAP Demand Curve; and (2) developing the necessary design concept basis information (including site requirements, location considerations, and emission controls), cost estimates, and performance information for each option in Load Zones C, F, G (Dutchess County), G (Rockland County), J, and K.

49. In this role, we identified and evaluated the viability of various options and selected potential peaking plant technology options for each ICAP Demand Curve. For each selected option, we developed capital costs, operating costs, operating parameters, and considered applicable siting and environmental permitting requirements. We also considered how the peaking plant could be practically constructed within each location, and how a potential developer may evaluate various design capabilities and environmental control technologies when making investment decisions in consideration of project development and operational risk, and opportunities for revenues over the economic life of the project.

50. Section II of the Final Report contains additional information regarding 1898 & Co.'s scope of work and results. Appendix A of the Final Report provides additional detail on the total capital investments, fixed and variable O&M costs, and performance data. Exhibit A of the *Affidavit of Zachary T. Smith* which is set forth in Attachment V of the filing letter to which this Affidavit is attached includes a revised version of Appendix A that reflects incorporation of three changes for the BESS options directed by the NYISO Board of Directors for inclusion within the NYISO's proposal in this proceeding.

51. This concludes our affidavit.

ATTESTATION

I am the witness identified in the foregoing affidavit. I have read the affidavit and am familiar with its contents. The facts set forth therein are true to the best of my knowledge, information, and belief.

Chad W. Swope
November 25, 2024

Subscribed and sworn to before me
this 25 day of November, 2024

Sydney Elayne Miller
Notary Public

My commission expires: 09-16-2027

SYDNEY ELAYNE MILLER
Notary Public, Notary Seal
State of Missouri
Jackson County
Commission # 19628064
My Commission Expires 09-16-2027

ATTESTATION

I am the witness identified in the foregoing affidavit. I have read the affidavit and am familiar with its contents. The facts set forth therein are true to the best of my knowledge, information, and belief.

Kieran McInerney
November 25, 2024

Subscribed and sworn to before me
this 25th day of November, 2024

Sydney Elayne Miller
Notary Public

My commission expires: 09-16-2027

SYDNEY ELAYNE MILLER
Notary Public, Notary Seal
State of Missouri
Jackson County
Commission # 19628064
My Commission Expires 09-16-2027

ATTESTATION

I am the witness identified in the foregoing affidavit. I have read the affidavit and am familiar with its contents. The facts set forth therein are true to the best of my knowledge, information, and belief.

Matthew E. Lind
November 25, 2024

Subscribed and sworn to before me
this 25th day of November, 2024

Sydney Elayne Miller
Notary Public

My commission expires: 09-16-2027

SYDNEY ELAYNE MILLER
Notary Public, Notary Seal
State of Missouri
Jackson County
Commission # 19628064
My Commission Expires 09-16-2027

Exhibit A

Education
Bachelors, Mechanical Engineering, 2007

Registrations
- **Professional Engineer (MO)**

Experience
- **16 years** with 1898 & Co.
- **16 years** of experience

Visit my **LinkedIn** profile.

Chad Swope

Project Delivery Director

Chad is a Director at 1898 & Co., part of Burns & McDonnell. He has experience in the technical development, optimization, and implementation of generation projects. His primary role consists of business strategy and optimization for power generation assets. This includes site selection, technology evaluation, early project planning, technical due diligence, and feasibility evaluations.

PROJECT EXPERIENCE

Natural Gas Project Development / Confidential Client

Tennessee / May 2024 - Oct 2024

Project Manager. 1898 & Co. supported a Confidential Client with early project development activities associated with building a new natural gas generation facility. 1898 & Co. completed a technology assessment, including level 1 schedule to evaluate duration to delivery, and a site selection study, including a permitting matrix. The technology assessment provided capital cost, O&M cost, and performance information for multiple technology options to support evaluating value of capacity. The schedule provided a roadmap for development and execution of the project. The site selection study identified and evaluated potential candidate sites for the facility and the permitting matrix outlined required permits for the new facility.

Natural Gas Project Development / Confidential Client

Iowa / June 2024 - Oct 2024

Project Manager. A Confidential Client hired 1898 & Co. to support with early project development activities. This included a technology assessment for simple cycle gas turbines, reciprocating internal combustion engines, and combined cycle. Additionally, 1898 & Co. performed a site evaluation of sites provided by the client. The technology assessment provided capital cost, O&M cost, and performance information to support technology selection. The site evaluation used a quantitative scoring matrix to rank potential candidate sites and select a preferred site to continue further development.

Natural Gas Project Development / UAMPS

Utah / April 2024 - August 2024

Project Manager. UAMPS hired 1898 & Co. to support with early project development activities. This included a technology assessment for simple cycle gas turbines, reciprocating internal combustion engines, and combined cycle. Additionally, 1898 & Co. identified and evaluated potential candidate site for new generation. The technology assessment provided capital cost, O&M cost, and performance information to support technology selection. The site evaluation used a quantitative scoring matrix to rank potential candidate sites and select a preferred site to continue further development.

Technology Assessment / Montana-Dakota Utilities

North Dakota / December 2023

Project Manager. 1898 & Co. supported Montana-Dakota Utilities with evaluating generation technology options for their Integrated Resource Plan (IRP). The technology assessment provided capital cost, O&M cost, and performance information for multiple technology options as inputs to their IRP. The technology options included simple cycle gas turbines, reciprocating internal combustion engines, combined cycle solar, wind, and battery energy storage systems (BESS).

Generation Replacement Assessment / Confidential Client

North Dakota / December 2023

Project Manager. 1898 & Co. supported a Confidential Client in North Dakota with evaluating generation technology options to replace an existing coal unit that is to be retired. The assessment provided capital cost, O&M cost, and performance information for multiple technology options, including simple cycle gas turbines, reciprocating engines, combined cycle, solar, wind, battery energy storage system (BESS). 1898 & Co. also evaluated the existing site to determine capability of the site to support the generation options.

Technology Assessment / Northeast Texas Electric Cooperative

Texas / December 2023

Project Manager. 1898 & Co. supported Northeast Texas Electric Cooperative with expanding generation at their Harrison County Power Plant in Longview, Texas. 1898 & Co. supported evaluating transmission injection capabilities and generation technology options. The Transmission injection study looked at injecting up an additional 600 MW at the existing substation as well as looked at five potential new points of interconnect in ERCOT. The technology assessment provided capital cost, O&M cost, and performance information for multiple gas-fired technology options. The assessment also evaluated the ability to supply additional natural gas to the site.

Technology Assessment / Confidential Client

Sweeney, Texas / December 2023

Project Manager. 1898 & Co. supported a Confidential Client with evaluating new generation technology options in ERCOT. The technology assessment provided capital cost, O&M cost, and performance information for multiple technology options. The technology options included simple cycle gas turbines, reciprocating internal combustion engine, and mainspring linear generators.

Technology Assessment / Confidential Client

Nebraska / May 2023

Project Manager. 1898 & Co. supported a Confidential Client in Nebraska with evaluating transmission injection capabilities and generation technology options to meet future capacity needs. The Transmission injection study looked at injecting up to 650 MW across the entire service territory to identify the “right size” for new generation. The technology assessment provided capital cost, O&M cost, and performance information for multiple technology options to mee the “right size” with the intent of meeting the client’s future capacity needs. The technology options included combined cycle, simple cycle, solar, reciprocating internal combustion engine, wind, battery energy storage system (BESS), and nuclear.

Technology Assessment / Florida Municipal Power Agency

Florida / May 2023

Project Manager. 1898 & Co. supported Florida Municipal Power Agency with evaluating generation technology options for their Integrated Resource Plan (IRP). The technology assessment provided capital cost, O&M cost, and performance information for multiple technology options to support evaluating in levelized cost of energy analysis. The technology options included combined cycle, simple cycle, solar, reciprocating internal combustion engine, wind, battery energy storage system (BESS), and nuclear.

Technology Assessment / Confidential Client

Colorado / June 2023

Project Manager. 1898 & Co. supported a Confidential Client in Colorado with evaluating generation technology options to replace an existing coal-fired facility. The technology

assessment focused on technologies that could provide 500 MW of generation with a significantly reduced carbon footprint. The assessment included providing capital cost, O&M cost, and performance information for multiple technology options. The technology options included combined cycle with carbon capture, simple cycle with hydrogen fuel, various energy storage technologies, and nuclear.

Technology Assessment / Confidential Client

Texas / April 2023

Project Manager. 1898 & Co. supported a confidential utility client with evaluating peaking generation technology options in ERCOT. The technology assessment provided capital cost, O&M cost, and performance information for gas peaking generation technology options to support new generation development activities. The technology options included aeroderivative simple cycle gas turbines, frame simple cycle gas turbines, and reciprocating internal combustion engines.

Technology Assessment / Confidential Client

Arizona / April 2023

Project Manager. 1898 & Co. supported a confidential utility client with evaluating peaking generation technology options in Arizona. The technology assessment provided capital cost, O&M cost, and performance information for gas peaking generation technology options to support new generation development activities. The technology options included aeroderivative simple cycle gas turbines and reciprocating internal combustion engines. Additionally, we provided a permitting matrix to summarize the various federal, state, and local permits required for the facility.

Natural Gas Project Development / WVPA

Indiana / Aug 2022 - Oct 2022

Project Manager. 1898 & Co. supported Wabash Valley Power Alliance (WVPA) with early project development activities associated with building a new natural gas generation facility to increase dispatchable capacity. We supported WVPA with developing a level 1 schedule, technology assessment, permitting matrix and site selection study. The schedule provides roadmap for development and execution of the project. The technology assessment provided capital cost, O&M cost, and performance information for multiple technology options to support evaluating in dispatch modeling. The permitting matrix outlined required permits for the new facility. The site selection study helped evaluate potential candidate sites for the facility.

NG Project Development / Alliant Energy

Iowa / Aug 2022 - Sept 2022

Project Manager. 1898 & Co. supported Alliant Energy Interstate Power & Light (IPL) with early project development activities associated with building a new natural gas generation facility to increase dispatchable capacity. We supported IPL with developing a technology assessment, site layouts, transmission injection studies, and site selection study. The technology assessment provided capital cost, O&M cost, and performance information for multiple technology options to support evaluating in dispatch modeling. The layouts showed how multiple technologies would fit on several existing brownfield sites. The transmission injection studies investigated the likely transmission system upgrades required if additional generation was added at various points of interconnect. The site selection study helped evaluate potential candidate sites for the facility.

Natural Gas Project Development / AECI

Missouri / Jan 2022 - May 2022

Project Manager. 1898 & Co. supported Associated Electric Cooperative Inc. (AECI) with early project development activities associated with building a new natural gas generation facility to increase dispatchable capacity. We supported AECI with developing a technology assessment, site selection study, generation interconnect application data, and developing gas turbine specifications. The technology assessment provided capital cost, O&M cost, and performance information for multiple technology options to support evaluating in dispatch modeling. The site selection study helped evaluate potential candidate sites for the facility. Generation interconnect application data was compiled to support AECI submitting the application for additional generation. The gas turbine specifications were used to solicit firm bids for new gas turbines to support the project.

SMR Site Selection Study / NPPD

Nebraska / December 2022 - Current

Project Manager. 1898 & Co. supported Nebraska Public Power District (NPPD) with identification and evaluation of potential sites for a small modular reactor (SMR) project. The site selection study included using NRC and EPRI guidelines to evaluation exclusionary zones and evaluation criteria for potential candidate sites. GIS data was used to identify up to thirty candidate sites that were evaluated using a quantitative scoring matrix. The preferred candidate sites will be further evaluated for future development of an SMR project.

Natural Gas Project Development / WVPA

Indiana / Aug 2022 - Oct 2022

Project Manager. 1898 & Co. supported Wabash Valley Power Alliance (WVPA) with early project development activities associated with building a new natural gas generation facility to increase dispatchable capacity. We supported WVPA with developing a level 1 schedule, technology assessment, permitting matrix and site selection study. The schedule provides roadmap for development and execution of the project. The technology assessment provided capital cost, O&M cost, and performance information for multiple technology options to support evaluating in dispatch modeling. The permitting matrix outlined required permits for the new facility. The site selection study helped evaluate potential candidate sites for the facility.

Technology Assessment / CenterPoint Energy

Indiana / Aug 2022 - Oct 2022

Project Manager. 1898 & Co. supported CenterPoint Energy with evaluating generation technology options for their Integrated Resource Plan (IRP). The technology assessment provided capital cost, O&M cost, and performance information for multiple technology options to support evaluating in dispatch modeling. The technology options included combined cycle, simple cycle, solar, reciprocating internal combustion engine, wind, battery energy storage system (BESS), nuclear, and coal.

NG Project Development / Alliant Energy

Iowa / Aug 2022 - Sept 2022

Project Manager. 1898 & Co. supported Alliant Energy Interstate Power & Light (IPL) with early project development activities associated with building a new natural gas generation facility to increase dispatchable capacity. We supported IPL with developing a technology assessment, site layouts, transmission injection studies, and site selection study. The technology assessment provided capital cost, O&M cost, and performance information for multiple technology options to support evaluating in dispatch modeling. The layouts showed how multiple technologies would fit on several existing brownfield sites. The transmission injection studies investigated the likely transmission system upgrades required if additional generation was added at various points of interconnect. The site selection study helped evaluate potential candidate sites for the facility.

Natural Gas Project Development / AECI

Missouri / Jan 2022 - May 2022

Project Manager. 1898 & Co. supported Associated Electric Cooperative Inc. (AECI) with early project development activities associated with building a new natural gas generation facility to increase dispatchable capacity. We supported AECI with developing a technology assessment, site selection study, generation interconnect application data, and developing gas turbine specifications. The technology assessment provided capital cost, O&M cost, and performance information for multiple technology options to support evaluating in dispatch modeling. The site selection study helped evaluate potential candidate sites for the facility. Generation interconnect application data was compiled to support AECI submitting the application for additional generation. The gas turbine specifications were used to solicit firm bids for new gas turbines to support the project.

Hydrogen Usage Feasibility / Confidential Client

International / 2021

Senior Consultant for a confidential client who retained our team to evaluate multiple options for producing and using hydrogen. As part of the evaluation, we developed a 20-year proforma to compare capital costs, operating & maintenance costs, and performances for each option along with technical readiness, risks, and future potential. The evaluated options included producing green hydrogen using electrolysis, utilizing hydrogen directly and producing the ammonia. These options included compression and storage of the hydrogen and ammonia. For ammonia, our team looked at burning the ammonia directly in a boiler and cracking the ammonia back to hydrogen and producing power in both fuel cells and combustion turbines. Responsibilities included conceptual design, performance estimating, and developing capital cost estimates.

Asset Management Roadmap / Cleco

Louisiana / Aug 2020 – Feb 2021

Senior Consultant 1898 & Co. worked with Cleco to develop a roadmap to transform its asset management organization, The goal was to assist Cleco in transitioning from an ad hoc and reactive approach to a structured approach that allows for efficient use of resources while being proactive. By leveraging a framework from the Institute of Asset Management and performing a maturity assessment to benchmark against industry best practices, 1898 & Co. developed a roadmap for Cleco to be more proactive and realize the benefits of asset management. The roadmap provided actionable recommendations for Cleco to focus on to provide value and assisted Cleco in laying out an action plan for the next several years to improve their asset management program.

Integrated Resource Plan/ Lafayette Utilities System

Lafayette, Louisiana / Aug 2019 - Dec 2020

Senior Consultant Condition assessment for Lafayette Utilities System (LUS) in support of Integrated Resource

Planning (IRP). The condition assessment evaluated four simple cycle combustion turbine units at two different sites and a 500 MW coal-fired generation unit. The assessment determined the existing condition of the facility and the maintenance activities necessary to operate the unit reliably for three different retirement horizons. The O&M cost projections were used to evaluate the economic viability of the asset using production cost modeling software.

Nemadji Trail Center/ NTEC.

Superior, Wisconsin / March 2014 - Dec 2018

Development Engineer Nemadji Trail Energy Center is a 1x1 "H-class" combined cycle power generation facility. We were the Owner's Engineer and started by assisting NTEC evaluate multiple gas turbine technologies and further refined the project scope with a project definition report. We then assisted NTEC with developing gas turbine technical specifications and is assisting NTEC with evaluation of the bids. Responsibilities included thermal cycle performance optimization and technical evaluation of bids, including LTSA.

Unit Parameters Analysis / Public Service Company of New Mexico

La Mesa, New Mexico / July 2019 - Oct 2020

Senior Consultant Unit parameters analysis consisting of determining startup times, startup costs, online ramp rates, minimum continuous operating load, temperature decay times after shutdown, heat rate versus output curves, and fixed and variable O&M costs. These unit parameters were calculated for a natural gas fired steam unit, a 2x1 combined cycle, and a 1x1 combined cycle in PNM's fleet. PNM is using this information to support dispatch parameters for the Energy Imbalance Market (EIM) in CAISO.

Unit Parameters Analysis / Tucson Electric Power

Tucson, Arizona / Jan 2020 - Oct 2020

Project Manager CAISO Energy Imbalance Market (EIM) integration support with unit parameters analysis and performance testing consisting of determining startup times, startup costs, online ramp rates, minimum continuous operating load, temperature decay times after shutdown, heat rate versus output curves, and O&M costs. These unit parameters were calculated for all of TEP's fleet and consisted of natural gas fired steam units, combined cycle units, simple cycle combustion turbine units, reciprocating internal combustion engines, coal-fired steam units and renewables. We used the technical information developed to support filling out generation resource data templates and consult on strategy for dispatch parameters to use when joining CAISO EIM.

Warren County Power Station / Warren County Energy Partners

Front Royal, Virginia / June 2011 - Oct 2017

Lead performance engineer and mechanical startup field engineer Warren County Power Station is a 3x1 M501GAC combined cycle power generation facility which produces over 1400MW. As part of a joint venture EPC contractor, Our team was responsible for design, procurement, field engineering support, and startup of the facilities. Responsibilities included Performance optimization; establishing performance guarantees; developing heat balances; assisting with equipment evaluation and selection; directing steam blows, demonstration tests, and performance tests; coordinating various vendors on site; supporting plant operations; and coordinating startup schedule. Accomplishments: Successfully achieved Provisional Acceptance on December 10, 2014 and met all Performance Guarantees.

Exhibit B

KIERAN MCINERNEY, PE

Project Manager / Senior Consultant – Energy Storage and Renewables Development

Kieran is a Senior Energy Storage Consultant for 1898 & Co. He has 21 years of professional experience in energy and related industries, including the last 7 years focusing on energy storage (>25,000 MWh of project experience). Kieran specializes in techno-economic evaluations and project development efforts for both lithium-ion and non-lithium technologies. His experience includes use case analyses, performance modeling, capital cost estimates, O&M cost estimates, life cycle cost estimates, conceptual design, strategic planning, and project management related to energy storage, renewable energy, and gas generation projects.

EDUCATION

- BS, Mechanical Engineering, Marquette University

REGISTRATION

- Professional Engineer (Colorado)

AWARDS/PUBLICATIONS

- Federal Energy and Water Management Award, U.S. Department of Energy, 2013
- Publications (See Section Below)

SPECIALTIES

- Energy Storage Consultation
- Project Development Support
- GridBEAST Energy Storage System Modeling
- Project Management
- Feasibility and Technology Studies
- Economic Evaluation
- Capital and O&M Cost Estimating
- Strategic Planning

11 YEARS WITH BURNS & MCDONNELL

21 YEARS OF EXPERIENCE

Generation and Storage Assessment for Demand Curve Reset | NYISO

August 2023 – Present

Energy Storage Lead Consultant for peaking generation and energy storage gross CONE inputs to the 2025-2029 NYISO Demand Curve Reset (DCR). The DCR study involves evaluating assumptions, performance, capital cost, and O&M cost information for multiple lithium-ion energy storage and simple cycle gas turbine peaking options for the NYISO. Responsibilities include stakeholder engagement, report development, capital cost estimate, O&M cost estimate, and performance estimate activities.

Project Procurement and Greenfield Development Support | Confidential Cooperative Utility

September 2024 – Present

Energy Storage Lead for project development efforts for solar, storage, and wind projects for a cooperative utility. 1898 & Co. is providing transaction advisory and greenfield development support for the utility as it considers greenfield development options and development transfer or build transfer options.

Project Procurement Support | Confidential Utility

September 2024 – Present

Energy Storage Lead for Project Procurement support for a US utility looking for build transfer and power purchase agreement options for solar and solar + storage projects on their distribution system. 1898 & Co. provided RFP and specification package support, and will provide advisory services on project submittals.

KIERAN MCINERNEY, PE
(continued)

Transaction Advisory Support for Energy Storage Equipment Procurement | Confidential Utility
October 2024 – November 2024

Energy Storage Consultant for transaction advisory services for a utility procuring energy storage equipment. Scope includes client consultation with respect to diligence reviews on equipment pricing, warranty, use case, and consultation for the successful buyer of the projects.

Independent Engineer Report | Confidential IPP
June 2024 – September 2024

Energy Storage Lead Consultant for Independent Engineering Report for 300 MW BESS project. Provided consultation, analysis, and management of client provided project information for battery energy storage system. Led technical reviews and commentary on equipment contracts, EPC contract, LTSA contract, financial model inputs, and other documents.

Non-Lithium Long Duration Storage Development | Confidential Utility
August 2023 –February 2024

Project Manager for technology evaluation, LCOS analysis, and conceptual design support for replacing utility's fossil generating units with a non-lithium, long duration energy storage (LDES) system. Support includes project management, technology assessments and analyses for performance, capital cost estimates, O&M cost estimates, levelized cost of storage, and conceptual design activities.

BESS O&M and Auxiliary Load Evaluation | Confidential Developer
January 2024 – February 2024

Project Manager for O&M market consultation, O&M cost estimate, and auxiliary load analyses for confidential client developing multiple utility-scale energy storage projects in North America.

Transaction Advisory Support for Energy Storage Portfolio | Confidential Developer
November 2023 – January 2024

Project Manager for transaction advisory services for two energy storage projects in Texas. Scope included project management, report development, due diligence document reviews, and consultation for the successful buyer of the projects.

Energy Storage Market and Technology Assessment | Confidential RTO/ISO
November 2023 – December 2023

Energy Storage Lead Consultant for market assessment and technology assessment for confidential RTO/ISO in North America. Responsibilities included report development, research, capital cost, O&M cost, and performance evaluations for multiple energy storage technologies.

Green Hydrogen Infrastructure Study | Confidential Utility
September 2023 – February 2024

Energy Storage Lead Consultant for green hydrogen infrastructure evaluation. The purpose of the study was to evaluate life cycle costs for multiple green hydrogen scenarios to support transportation needs in parts of California. Mr. McInerney and team used proprietary GridBEAST modeling tools to identify potential renewable energy and energy storage pairings to support electrolyzer loads.

Energy Storage Market and Technology Assessment | Confidential Utility

August 2023 – October 2023

Project Manager for energy storage market assessment and technology assessment for a confidential utility in the Midwest. Responsibilities included report development, research, client engagement, and project management.

Transaction Advisory Support for Energy Storage Portfolio | Confidential Developer-UK

April 2023 – June 2023

Energy Storage Lead for transaction advisory services for the potential buyer of a multi-site, utility scale storage portfolio. Scope includes review/commentary on contract and technical and commercial documents.

BESS O&M and Auxiliary Load Evaluation | Confidential Developer

April 2023 – June 2023

Lead Consultant for O&M and auxiliary load study for long duration lithium-ion project. Evaluated the potential impacts of auxiliary load estimates on O&M costs and PPA contract risks for multiple scenarios.

Energy Storage Development for Solar Plus Storage Portfolio | Confidential Cooperative Utility

March 2023 – December 2023

Energy Storage Lead for development support for a portfolio of utility scale and distribution scale solar plus storage projects for a confidential cooperative utility client in the southeastern US. Scope includes battery storage sizing, conceptual design, capital cost estimates, O&M estimates, and project filing support. Battery systems were sized to optimize the economic returns with respect to PV generation profiles, production cost model results, and circuit loading information. Systems were modeled for solar shifting (and load following, as applicable) using Burns & McDonnell proprietary GridBEAST modeling tools. The study results are being used to support the confidential client's project filings for grant funding from the Rural Utility Service.

Owner's Engineer for Solar Plus Storage Development Project | Confidential IPP

November 2021 – January 2023

Technical Lead for Owner's Engineering support for a utility scale solar plus storage development in the western US. Using Burns & McDonnell proprietary GridBEAST modeling tools, BMcD modeled the hourly performance and revenue estimates of the solar plus storage project with respect to the PV output, BESS technical specifications, and PPA structure. The study results and report are being used to support the confidential client's financial position on the development.

Energy Storage Development and RFP Support | Confidential Cooperative Utility

January 2023 – May 2023

Energy Storage Lead for development support for a portfolio of utility scale storage projects for a confidential cooperative utility client in the southeastern US. Scope includes development consultation, technology assessment, support for developer RFP process, and support for interconnection applications.

KIERAN MCINERNEY, PE
(continued)

Owner's Engineer for Non-Lithium Storage Project | Confidential IPP
January 2023 – May 2023

Senior Consultant for Owner's Engineering support for confidential client's development of options for a non-lithium battery storage project. Support includes technology assessments and analyses for performance, capital cost estimates, O&M cost estimates, life cycle cost, and correspondence with OEMs.

Flow Battery Product Consultation | Confidential OEM
October 2022 – December 2023

Project Manager for commercial and technical consultation for a confidential flow battery OEM as they establish and/or update products for commercial and utility scale market sectors. The primary focus of Burns & McDonnell's support was consultation on market trends, cost expectations, strategic design elements, and performance expectations. Mr. McInerney' s responsibilities included project management, consultation on commercial viability and market trends, and technical support for product and BOP elements.

Energy Storage Development Consultation | Confidential Utility
February 2023 – April 2023

Energy Storage Lead for a generation replacement study at coal generation facility slotted for retirement in the southwestern US. Scope included battery storage sizing, conceptual design, capital cost estimates, and O&M estimates. Battery systems were sized with respect to arbitrage opportunities and expected PV generation, as applicable. Systems were modeled for arbitrage and solar shifting using Burns & McDonnell proprietary GridBEAST modeling tools. The study results are being used to support retirement and replacement planning for the existing facility.

Energy Storage Development for BTM Solar Plus Storage | Confidential IPP
November 2022 – January 2023

Senior Consultant for development of a utility scale, behind-the-meter (BTM) solar plus storage facility at a large manufacturing facility in West Virginia. Scope included long duration battery storage technology reviews, system sizing, conceptual design, capital cost estimates, O&M estimates, and project filing support. Battery systems were sized with respect to expected loads for the facility, net metering ability, and expected PV generation. Systems were modeled for load following and solar shifting using Burns & McDonnell proprietary GridBEAST modeling tools.

Energy Storage Development for Solar Plus Storage Portfolio (Phase 2) | Confidential Utility
August 2022 – September 2023

Project Manager for development support for a portfolio of distribution scale solar plus storage projects for a confidential utility client in northeastern US. Scope included battery storage sizing, conceptual design, capital cost estimates, O&M estimates, and project filing support. Battery systems were sized with respect to critical loads on the circuits and expected PV generation. Systems were modeled for solar shifting using Burns & McDonnell proprietary GridBEAST modeling tools. The study results are being used to support the confidential client's project filings to the utility commission.

KIERAN MCINERNEY, PE
(continued)

Owner's Engineer for Non-Lithium Storage Project | Confidential Utility
August 2022 – January 2023

Project Manager for Owner's Engineering support for confidential client's development of a non-lithium, long-duration energy storage (LDES) project in Florida. Burns & McDonnell engineering support includes OEM proposal and product technical reviews, capital cost estimates, O&M cost estimates, life cycle cost analyses, and correspondence with OEMs.

Independent Engineer Report | Confidential IPP
August 2022 – December 2022

Development Lead for Independent Engineering Report. Provided consultation, analysis, and management of client provided project information for battery energy storage system in New York City. Led technical reviews and commentary on equipment contracts, EPC contract, and IFC drawings.

Energy Storage Development Consultation | Confidential IPP
June 2022 – December 2022

Project Manager for development of a utility scale lithium-ion energy storage facility in Texas. Provided consultation and technical support for equipment selection, preliminary design, capital cost, O&M cost, and vendor correspondence.

Energy Storage Market Study – Canada | Confidential Utility
April 2022 – August 2022

Project Manager for an energy storage market study for a Canadian utility. Led the research and report development for a study regarding energy storage technologies, use cases, capital costs, O&M costs, and applications in North America, with specific focus on the Canadian market.

Energy Storage Development for Wind Plus Storage Project | Confidential Utility
April 2022 – August 2022

Development Lead for an energy storage project at an existing wind generation facility for a confidential utility client. Scope included wind generation profile analysis, battery storage sizing, conceptual design, capital cost estimates, and O&M estimates. Battery systems were sized with respect to historical wind generation and interconnection limitations. Systems were modeled for solar shifting using Burns & McDonnell proprietary GridBEAST services.

Owner's Engineer for Non-Lithium Storage Project | Confidential Utility
January 2022 – February 2023

Development Lead for Owner's Engineering support for confidential client's development of three non-lithium storage projects. Burns & McDonnell engineering support includes OEM proposal and product technical reviews, conceptual design, correspondence with OEMs, BESS sizing, project scoping, EPC RFP specifications, EPC contractor proposal reviews, and anticipated Owner's Engineering support for the duration of the project.

Energy Storage Development for Solar Plus Storage Portfolio (Phase 1) | Confidential Utility
March 2022 – May 2022

Project Manager for development support for a portfolio of distribution scale solar plus storage projects for a confidential utility client in northeastern US. Scope included battery storage sizing, conceptual design, capital cost estimates, O&M

estimates, and project filing support. Battery systems were sized with respect to critical loads on the circuits and expected PV generation. Systems were modeled for solar shifting using Burns & McDonnell proprietary GridBEAST modeling tools. The study results are being used to support the confidential client's project filings to the utility commission.

Energy Storage Development Consultation | Confidential IPP

February 2022 – March 2022

Project Manager for Owner's Engineering support for a utility scale energy storage development in Virginia. Provided consultation and technical support for the confidential clients project proposal. Scope include project design concept reviews, correspondence with OEMs/integrators, capital cost estimates, BESS equipment proposal reviews, BESS O&M proposal reviews, and technical inputs for the client's proposal.

Owner's Engineer for Energy Storage Development Portfolio | Confidential IPP

September 2021 – August 2023

Project Manager for Owner's Engineering support for a portfolio of utility scale energy storage developments in ERCOT and PJM territories. Projects include solar plus storage and standalone storage developments. Burns & McDonnell engineering support includes BESS sizing, conceptual design, interconnection support, permitting support, civil design, and electrical design activities.

Microgrid Feasibility Assessment | Confidential Utility

July 2021 – December 2021

Development Lead for a microgrid feasibility assessment and use case development study for targeted distribution circuits for a Midwestern utility client. The microgrids are being studied to improve distribution system reliability and renewable energy integration. Responsibilities include use case evaluation, system modeling using proprietary GridBEAST modeling tools, storage technology evaluation, and economic analyses.

Owner's Engineer for Energy Storage Development Project | Confidential IPP

September 2021 – October 2021

Project Manager for Owner's Engineering support for a utility scale energy storage development in New York City. Burns & McDonnell is providing technical support for technical development including BESS sizing, conceptual design, capital cost, and O&M cost. The scope supports the client's interconnection applications, environmental permit applications, technology selections, and commercial offtake proposals.

Owner's Engineer for Energy Storage Development Project | Confidential IPP

March 2021 – August 2021

Project Manager for Owner's Engineering support for a utility scale energy storage development in Mexico. Burns & McDonnell is providing technical support for environmental permit applications and commercial offtake proposals. Continued support will include the development of specifications and evaluation support for equipment procurement and construction contracts.

Specification Development for 50 MW Energy Storage Project | Confidential Utility

June 2021 – August 2021

Project Manager for EPC specification development and preliminary design of a 50 MW / 200 MWh battery storage project for a utility client in the Southwest.

Energy Storage Technical and Economic Assessment | Confidential Manufacturer

March 2021 – April 2021

Technical Lead for a technical and economic feasibility assessment for an onsite energy storage at an existing manufacturing facility in Michigan. The purpose of the study was to size an appropriate battery energy storage system to reduce demand charges from the utility and provide an acceptable internal rate of return (IRR) for the client. Using Burns & McDonnell proprietary GridBEAST modeling tools, the study modeled the performance of energy storage systems in a behind-the-meter (BTM) arrangement with respect to the facility load profile. The economic analyses calculated the Owner's IRR with respect to the system capital costs, O&M costs, and the net savings in utility charges.

Lithium-ion Battery Product Consultation | Confidential OEM

March 2021 – May 2021

Consultant on a team supporting a lithium-ion battery OEM as they establish new products for commercial and utility scale market sectors. The primary focus of Burns & McDonnell's support was consultation on market trends, codes and standards, strategic design elements, and performance expectations. Mr. McInerney' s responsibilities included consultation on use case analyses, system sizing, capital cost expectations, and O&M cost expectations.

Synchronous Condenser Technology and Market Assessment | Electric Power Research Institute (EPRI)

September 2020 – February 2021

Project Manager for a synchronous condenser market study for select members of the Electric Power Research Institute. The study included market research for use cases and project examples, performance characteristics of commercially available utility scale equipment, and capital and O&M cost estimates for example projects. The study considered three new build project examples and two conversion project examples.

Renewable Generation and Energy Storage Economic Assessment | Confidential Manufacturer

September 2020 – February 2021

Project Manager for a technical and economic feasibility assessment for onsite generation and energy storage at a proposed manufacturing facility in the Midwest. The Owner seeks onsite renewable energy production to reduce carbon intensity of the manufactured product and to reduce reliance on utility purchased power. Using Burns & McDonnell proprietary GridBEAST modeling tools, the study modeled the performance of multiple generation and storage combinations in a behind-the-meter (BTM) arrangement with respect to the anticipated facility load profile. The economic analyses calculated the Owner's internal rate of return (IRR) with respect to the system capital costs, O&M costs, utility energy reduction, net metering benefits, and higher revenues from the lower carbon intensity of the manufactured product in the target market.

Generation and Storage Technology Assessment | Duke Energy

October 2020 – December 2020

Technical Lead for a generic unit assessment study evaluating multiple energy storage technologies, distributed generation technologies, and utility scale generation technologies including simple cycle, reciprocating engine, combined cycle, landfill

gas, wind, solar. Responsibilities included project definition, capital cost estimation, O&M cost estimation, and performance estimation.

Renewable Generation and Energy Storage Economic Assessment | Confidential Oil Production Company

September 2020 – October 2020

Technical Lead for a technical and economic feasibility assessment for onsite generation and energy storage at existing oil extraction and pumping facilities in Texas. Because of the remote location of the oil wells and pumping stations, the Owner sought to compare the life cycle cost and value of onsite renewable energy production and storage with respect to electric transmission and onsite fossil generation options. The study identified the sizing requirements for solar plus storage arrangements using proprietary GridBEAST modeling tools developed by Burns & McDonnell. The study modeled the performance of multiple generation and storage combinations in a behind-the-meter (BTM) arrangement with respect to the anticipated facility load profile. Provided the system capital costs and O&M costs for the economic analysis.

Owner's Engineer for Battery Procurement | Confidential IPP

August 2020 – September 2020

Technical Lead for evaluation of battery energy storage equipment proposals. Burns & McDonnell served as the Owner's Engineer for a utility scale solar plus storage project. Mr. McInerney's responsibilities included proposal reviews, vendor correspondence, analysis of performance and scope with respect to Owner requirements and competitive proposals, and recommendations to the Owner.

Microgrid Feasibility Assessment | Confidential Utility

June 2020 – September 2020

Project Manager for a microgrid feasibility assessment for a geographically isolated distribution system in California using solar and storage technologies. The microgrid was intended to increase renewable energy on the system, reduce reliance on purchased power, and support the utility's customers during a potential Public Safety Power Shutoff (PSPS) event. Responsibilities included system modeling using proprietary GridBEAST modeling tools, storage technology evaluation, conceptual engineering, capital cost estimates, and O&M cost estimates.

Energy Storage Use Case Analysis | Confidential Utility

May 2020 – July 2020

Technical Lead for an energy storage use case economic analysis. The study identified and analyzed multiple use cases for energy storage at an existing generating facility in Kentucky, including behind-the-meter (BTM) and front-of-meter (FOM) options. Developed an economic model to determine net present value of the battery facility based on capital cost, O&M costs, demand charge savings for BTM applications, revenue potential for FOM applications, charging costs, and unique site constraints.

Solar Plus Storage Project Development | Confidential IPP

May 2020 – June 2020

Technical Lead for engineering support of two solar plus storage developments in Georgia. Responsibilities included system modeling with proprietary GridBEAST modeling tools and conceptual design for a solar smoothing application. The model shapes the system to maintain desired ramp rates at the point of interconnection based on the PV output, battery size, state of charge, and cycling constraints, and system losses.

KIERAN MCINERNEY, PE
(continued)

Renewable Energy and Storage Technology Assessment | PacifiCorp
June 2020 – July 2020

Energy Storage Lead for a storage and renewable energy technology assessment to support resource planning for a Western USA utility. Responsibilities included capital cost estimation, O&M cost estimation, and performance estimation for multiple storage technology options including lithium ion and flow battery technologies of varying capacities and locations.

Solar Plus Storage Project Development | Confidential Utility
May 2020 – June 2020

Technical Lead for engineering support of three solar plus storage sites in Texas. Responsibilities included system modeling to shape the system output based on locational marginal pricing, PV output, POI interconnection limits, state of charge, system losses, and cycling constraints. Modeling was performed using proprietary GridBEAST modeling suite developed by Burns & McDonnell.

Generation and Storage Assessment for Demand Curve Reset | NYISO
December 2019 – November 2020

Technical Lead for peaking generation and energy storage inputs to the 2021-2025 NYISO Demand Curve Reset (DCR). The DCR study involved evaluating performance, capital cost, and O&M cost information for lithium-ion storage, simple cycle gas turbine, and combined cycle technologies in New York. Responsibilities included stakeholder engagement, report development, capital cost estimate, O&M cost estimate, and performance estimate activities.

Energy Storage Feasibility Study | Confidential Cooperative Utility
November 2019 – March 2020

Project Manager for an energy storage feasibility study in South Carolina. The study identifies use cases, system sizing, costs, and risks for a non-wires alternative to transmission system upgrades. Responsibilities include project management, use case development, system sizing, storage technology evaluation, conceptual engineering, capital cost estimates, and O&M cost estimates.

Lithium-ion Battery Product Consultation | Confidential OEM
December 2019 – January 2020

Consultant on a team supporting a lithium-ion battery OEM as they establish and/or update design guidelines, installation manuals, and O&M manuals. The primary focus of Burns & McDonnell's support was consultation on fire safety in product and system designs. Mr. McInerney' s responsibilities included research and consultation on fire safety designs in building-based and containerized applications.

Generation and Storage Technology Assessment | Duke Energy
October 2019 – February 2020

Project Manager for a generic unit assessment study evaluating multiple energy storage technologies, distributed generation technologies, and utility scale generation technologies including simple cycle, reciprocating engine, combined cycle, landfill gas, wind, solar. Responsibilities included project definition, capital cost estimation, O&M cost estimation, and performance estimation.

Exhibit C

Matthew Lind, PE MBA

Director – Resource Planning & Market Assessments Business

Matthew is the Director of the Resource Planning & Market Assessments Business at 1898 & Co., part of Burns & McDonnell. In this role, Matthew is responsible for overseeing the related business development, marketing, staff training and project execution for the Business Unit. This Business Unit provides market evaluations and strategic system planning studies requiring regulatory, engineering, and/or financial analyses consulting. Matthew has a diverse background of experience using sophisticated economic and production cost models to provide decision-making analysis to investor-owned utility, regional transmission organization, cooperative, and municipal utility clients as well as independent developers of transmission and generation projects. Matthew's Business Unit helps clients navigate future uncertainty and target investment decisions informed by robust analytics. Over the course of his career, Matthew's planning studies have evaluated and recommended multiple billion dollars in generation and transmission infrastructure investment and supported these recommendations through multiple regulatory bodies and jurisdictions. Matthew has managed studies in multiple North American and international organized markets including:

- CAISO
- WestConnect
- Southwest Power Pool
- ERCOT
- MISO
- PJM Interconnection
- Ontario IESO
- NYISO
- SERC
- FRCC
- Puerto Rico
- Australia

Matthew's study experience includes evaluations and expert witness testimony working directly with market operators, market participants, and developers of power infrastructure related to:

- Integrated resource planning
- Decarbonization policy planning
- Resource/energy adequacy
- Energy storage applications
- Stakeholder process engagement
- Competitive transmission planning (Order 1000)
- Regional security constrained economic dispatch (SCED) and transmission congestion evaluations
- RFP/power supply procurement support
- Strategic asset optimization/evaluation

The following is a selection of recent projects that Matthew has managed or provided advisory input.

Education

B.S. / Industrial Engineering
MBA / Finance

Registrations

Professional Engineer
(KS)

20 years with 1898 & Co.
20 years of experience

Visit my LinkedIn profile.

Select Publications

- Achieving 100% renewable energy
- Making the case for energy storage
- Green Hydrogen and clean energy resiliency

TESTIMONY/REGULATORY FILING EXPERIENCE

Utility Company	Regulatory Agency	Docket No.	Subject
Arizona Electric Power Coop.	Arizona Corporation Commission	E-01773A-12-0305	Env. Compliance and Regulatory Consulting
Basin Electric Power Cooperative	Federal Energy Regulatory Commission	EL20-68-002 Rebuttal:BE-0304 Sur-surrebuttal:BE-0346	Review of Member Rates for 2020 and 2021
New York Independent System Operator, Inc.	Federal Energy Regulatory Commission	ER21-502-000	ICAP Demand Curve Parameter Review
GridLiance Heartland, LLC	Illinois Commerce Commission	23-0061 Direct Testimony Rebuttal Testimony Surrebuttal Testimony	CPCN for substation and transmission facilities
Indianapolis Power & Light Company	Indiana Utility Regulatory Commission	45493 Direct Testimony	CPCN for acquisition of new solar facility
Indianapolis Power & Light Company	Indiana Utility Regulatory Commission	45591 Direct Testimony	CPCN for acquisition of new solar + storage facility
Southern Indiana Gas and Electric Company, Inc.	Indiana Utility Regulatory Commission	44446 Rebuttal Testimony	CPCN for Federally Mandated Requirements (Mercury and Air Toxics Standards)
Southern Indiana Gas and Electric Company, Inc.	Indiana Utility Regulatory Commission	44927 Direct Testimony Rebuttal Testimony	Proposed Demand Side Management Program and spending approval
Southern Indiana Gas and Electric Company, Inc.	Indiana Utility Regulatory Commission	45052 Direct Testimony P1 Direct Testimony P2 Rebuttal Testimony	Certificate of Public Convenience and Necessity for new CCGT plant
Southern Indiana Gas and Electric Company, Inc.	Indiana Utility Regulatory Commission	46100 Direct Testimony	Proposed Demand Side Management Program and spending approval
Minnesota Power	Minnesota Public Utility Commission	E015/M/AI-17-568	Petition for new wind, solar, and natural gas resources
Minnesota Power	Minnesota Public Utility Commission	E015/RP-15-690	Integrated Resource Plan
Minnesota Power	Minnesota Public Utility Commission	E015/CN-12-1163	Certificate of Need for new 500kV t-line
Minnesota Power	Minnesota Public Utility Commission	E015/RP 13-53	Integrated Resource Plan
Minnesota Power	Minnesota Public Utility Commission	E015/RP 09-1088	Supplemental Integrated Resource Plan
Minnesota Power	Wisconsin Public Service Commission	9698-CE-100	Certificate of Public Convenience and Necessity for new CCGT plant
Otter Tail Power Company	Minnesota Public Utility Commission	E017/RP-10-623	Supplemental Integrated Resource Plan

PROJECT EXPERIENCE

Expert Witness Support – DSM Program Spending and Approval Cause No. 46100 / CenterPoint Energy

MISO Market / 2024

Matthew served as an expert witness providing testimony in support of CenterPoint Energy's proposed DSM program and associated spending filed with the state regulatory commission. His analysis and testimony was provided to support CenterPoint Energy's decision to implement energy efficiency programs on a three year forward basis based on analysis and decisions determined through their 2022/2023 IRP.

2024 IRP Technical & Stakeholder Engagement / Duke Energy Corp.

Indiana / 2024

Duke Energy Indiana must file an integrated resource plan every 3 years with the Indiana Utility Regulatory Commission. Matthew supported a diverse project team focused on supporting content related to public stakeholder meeting interactions in the development of a preferred IRP portfolio supporting customer demand forecasted over a 20-year period from 2025-2044.

Transmission Benefits Evaluation & Expert Witness Testimony / NextEra Energy Transmission, LLC

MISO Market / 2024

Matthew oversaw an analysis to evaluate the transmission benefits associated with certain facilities. The benefits were measured under a variety of scenarios using PROMOD. Benefit calculations were provided using typical MISO formulas. Matthew also provided expert witness testimony related to the analysis and the overall characterization of benefits associated with the transmission facilities.

Demand Curve Reset / New York ISO

NYISO / 2023-2024

Matthew supported a project team consisting of technical and environmental engineers that studied and developed the determination of Gross CONE values less revenues obtained through energy and ancillary services for representative simple cycle and battery energy storage systems. These values were used as the basis to set the NYISO's ICAP Demand Curves for the four Capability Years beginning with the summer 2025 period. The development of the demand curves included monthly presentations to a public stakeholder working group and a report to be filed with the FERC in 2024.

Expanded Power Pool Benefits Study / Confidential Clients

Confidential Location / 2023-2024

Matthew helped lead a study contemplating the potential benefits of expanding joint dispatch across multiple utility partners. The study considered near term scenarios from stand alone to coordinated operations stepping through potential benefits including production cost and shared reserves.

Expert Witness Testimony – Docket No. EL20-68-002 / Basin Electric Power Cooperative

SPP Market / 2023

Matthew provided expert witness testimony related to prudency review of investments related to existing power generation facilities as compared to replacement alternatives. Matthew's testimony was in support of submitted member rates before the FERC.

Power Supply Strategy Stakeholder Facilitation / Arizona Public Service Co.

Arizona / 2021-2024

Driven by regulatory mandates, APS created a diverse membership of stakeholders through its Resource Planning Advisory Council (RPAC). The RPAC's charge was to review key issues and provide input on matters related to short and long term resource management, including load forecast elements, resource procurement mechanisms, and resource adequacy/reliability challenges driven by the renewable energy transition. Matthew coordinated and facilitated monthly meetings bringing together the external RPAC members in discussion with APS and other external consultants to drive transparency and understanding around these and other key issues facing APS resource strategy. **Read a Case Study on this project**.

Independent Review and Stakeholder Support / CPS Energy

ERCOT Market / 2022-2023

As part of a broader team of resources provided by 1898 & Co., Matthew reviewed and advised on the reasonableness of resource plans and the analytical approach of CPS Energy's consultant-led resource planning process. The review was done in support of the Rate Advisory Committee (RAC), a stakeholder group made up of CPS Energy and City Council-appointed members.

ASRFP Administration & Evaluation / Evergy

SPP Market / 2022-2023

Evergy sought proposals to meet energy and capacity needs identified in its IRP update and capture pricing momentum from the Inflation Reduction Act. The RFP was developed in collaboration with Evergy staff based on benchmarking of industry practices that enable a transparent and fair process resulting in competitive offers for utility ownership and PPA. The RFP document and supporting documents were hosted under an 1898 website built to streamline communications with bidders. Bids were evaluated for conformance with RFP requirements, composite scoring based on screening factors and further diligence of shortlisted projects through congestion and technical evaluations.

Integrated Resource Plan / CenterPoint Energy

MISO Market / 2022-2023

CenterPoint Energy must file an integrated resource plan every 3 years with the Indiana Utility Regulatory Commission. Matthew supported a diverse project team providing long term capacity expansion, stochastic risk analysis and public stakeholder meeting interactions in the development of a preferred portfolio supporting customer demand forecasted over a 20-year period from 2023-2042. The resource plan required novel approaches to emerging industry challenges including seasonal resource adequacy and capacity accreditation for intermittent technologies under effective load carrying capability (ELCC) methods.

Combined License Application (COLA) Evaluation Support / Carbon Free Power Project (CFPP)

Utah / 2022

The CFPP is a nuclear plant to be located at the Idaho National Laboratory. The CFPP uses NuScale's small modular reactor (SMR) technology to provide emission free energy to members of the Utah Associated Municipal Power Systems (UAMPS) among other project owners. Matthew supported evaluation of market alternatives and other related analysis required to support a combined license application (COLA) to the Nuclear Regulatory Commission for the project.

All Sources RFP Administration & Evaluation / Arizona Public Service Co.

Arizona / 2022

In support of its clean energy commitments, APS developed an All-Sources RFP to pursue reliable capacity and clean energy resources. Nearly 1.5 GW of clean energy and capacity were sought through the solicitation. The RFP was developed in conjunction with APS as well as its independent monitor (IM) to be compatible with APS's sourcing platform - PowerAdvocate. The RFP and its evaluation requirements were also reviewed through a stakeholder process facilitated by Matthew. More than 100 projects were evaluated and screened for conforming characteristics and then scored according to criteria prescribed in the public RFP document.

Efficient Fuel Switch Evaluation Framework / Minnesota Power

MISO Market / 2022

The state of Minnesota passed the Energy Conservation and Optimization Act (ECO Act) in 2021. This legislation provided updated incentives to utilities under the state's Conservation Improvement Program to allow utilities to receive cost recovery for beneficial fuel switching. Matthew led a team supporting Minnesota Power in the investigation and development of an evaluation framework to allow Minnesota Power to propose programs as part of its triennial conservation program filed with the state commission. The evaluation protocols were developed in conjunction with Minnesota Power's resource planning team and aligned with IRP planning models.

All Sources RFP Administration & Evaluation / CenterPoint Energy

MISO Market / 2022

CenterPoint Energy required an All-Sources RFP to support potential procurement of capacity and energy products in support of its ongoing clean energy transition and provide inputs to new technologies within its IRP. All bids were evaluated for both quantitative and qualitative factors and scored relative to similar technology types. The pricing and evaluation was presented through a public stakeholder process for review and input.

All Sources RFP Bid Evaluation and Support / UNS Energy/Tucson Electric Power

Arizona / 2021-2022

Matthew coordinated overall development of RFP soliciting all technology sources for purchase and/or acquisition. Focus on evaluation of resources from cost, reliability and sustainability factors with potential projects ranging from PPA, BTA, and EPC partnering at utility-owned sites. The RFP and evaluation was developed in order to provide a transparent and thorough evaluation that would support utility decision before the state regulatory commission.

Cold Weather Tabletop Exercise Facilitation / Confidential Client

Southeast / 2021

In February of 2021, Winter Storm Uri created significant reliability challenges to many utilities in Texas and beyond. Matthew supported the strategy and scenario development around a cold weather tabletop exercise designed to challenge a utility's readiness to respond to a severe and prolonged cold weather event similar to Winter Storm Uri. Planning, fuel inventory, reserve margin, energy delivery, financial, operational and logistics issues were all stressed during the tabletop exercise. Following the exercise, a brief summary of the exercise and observations and recommendations were shared in a report format providing near term and long term actions.

Offshore Wind Interconnection Policy & Market Assessments / Confidential Client

ISO-NE/NYISO/PJM/CAISO Markets / 2021-22

Matthew coordinated white paper development associated with the current, proposed and potential future policy framework driving transmission interconnection development in emerging offshore wind markets across the US. In addition to these policy papers, Matthew's team supported the evaluation of market scenarios interconnecting specific offshore wind projects into markets and identifying congestion and curtailment concerns. This analysis was performed using security constrained economic dispatch (SCED) market models.

All Sources RFP Bid Evaluation and Expert Witness Support – Cause No. 45591 / Indianapolis Power & Light

MISO Market / 2021

Matthew coordinated evaluation of RFP bids for reliability and congestion impacts on a comparable basis. Evaluation included the independent verification of MISO-reported network upgrades associated with generator interconnection. Where MISO reports were unavailable, the project team performed proxy analysis of NRIS, ERIS, and affected facilities studies. In addition to reliability impacts, locational congestion impacts were considered via security constrained economic dispatch (SCED) analysis for each short-listed bid. Subsequent to this analysis, Matthew provided testimony in support of the analysis.

Strategic Planning Workshop & Facilitation / Florida Municipal Power Pool

Florida / 2021

Matthew facilitated a strategic workshop with leaders from three (3) municipal utility members in Florida that presently pool/jointly dispatch energy production resources. Over two half day sessions, the workshop focused on challenges associated with changing grid conditions related to decarbonization policies. The workshop facilitated the identification of issues, goal-setting and tactical steps to be taken to begin to address identified issues.

All Sources RFP Bid Evaluation / Evergy

SPP Market / 2021

Matthew provided advisory support to Evergy in the issuance of an all sources RFP for power products. Matthew and the 1898 & Co. team supported Evergy through development and issuance of the RFP solicitation, website hosting, bidder email correspondence and Q&A, and bid evaluation and short list recommendations. Nearly 30 different developers provided bids for multiple projects including wind, solar, storage and hybrid resources. A range of offers for power purchase or build-transfer agreements were evaluated in order to recommend short list projects.

All Sources RFP Bid Evaluation and Expert Witness Support – Cause No. 45493 / Indianapolis Power & Light

MISO Market / 2020-2021

Matthew coordinated evaluation of RFP bids for reliability and congestion impacts on a comparable basis. Evaluation included the independent verification of MISO-reported network upgrades associated with generator interconnection. Where MISO reports were unavailable, the project team performed proxy analysis of NRIS, ERIS, and affected facilities studies. In addition to reliability impacts, locational congestion impacts were considered via security constrained economic dispatch (SCED) analysis for each short-listed bid. Subsequent to this analysis, Matthew provided testimony in support of the analysis.

Energy Storage Commercial Strategy Evaluation / Confidential Client

MISO Market / 2020

Project manager supporting client review of current business models associated with energy storage and alignment with client's current and future business models. An evaluation framework including consideration of regulatory, economic, social, and technology factors was followed in informing the client.

Integrated Resource Plan / Central Electric Power Cooperative, Inc.

South Carolina / 2020

Matthew supported a project team in the development of an integrated resource plan for Central Electric Power Cooperative, Inc. who provides service to 20 different member cooperative throughout the state of South Carolina. The IRP was developed as a result of the passage of South Carolina's Energy Freedom Act (Act 62) compelling utilities to develop an IRP and consider alternative futures with higher levels of renewable energy and energy efficiency. 1898 & Co. collaborated with Central's planning staff in the development of its first ever IRP through the use of Capacity Expansion portfolio optimization software.

Energy Storage Interconnection Evaluation / Confidential Client

Ontario IESO Market / 2020

Project manager coordinating a team of planning and technical engineers providing a third party assessment of the technical and commercial viability of a proposed merchant energy storage project. The third party review included technical scope of preferred interconnection as well as an evaluation of alternative interconnection locations. High voltage AC and DC technologies were considered as well as submarine and overland routes in order to avoid environmental sensitivities. A memorandum and presentation summary was provided recapping the review.

All Sources RFP Administration & Evaluation / Vectren Energy Delivery

MISO Market / 2019-2020

Project manager supporting the design and development of an All-Sources RFP seeking to procure capacity and energy products capable of delivering 10 MW up to 700 MW of capacity and energy to Vectren. All bids were evaluated for both quantitative and qualitative factors and scored relative to similar technology types for purposes of evaluating within the portfolio development of Vectren's 2019/2020 integrated resource plan. Bids were independently evaluated for both reliability and congestion/deliverability concerns prior to making short list recommendations.

Demand Curve Reset / New York ISO

NYISO / 2019-2020

Matthew managed a project team consisting of technical and environmental engineers supporting the development of a study used as the basis to set the NYISO's ICAP Demand Curves for the four Capability Years beginning with the summer 2021 period. This included the determination of Gross CONE values less revenues obtained through energy and ancillary services for representative simple cycle, combined cycle, and battery energy storage systems. The development of the demand curves included monthly presentations to a public stakeholder working group and a report to be filed with the FERC in 2020.

Portfolio Optimization & Bid Evaluation Support / Confidential Client

Southeast / 2019-2020

Matthew provided strategic oversight and advisory support on our project team supporting a cooperative utility that was considering potential purchase transactions which considered comprehensive decisions and consideration for long term power supply and associated transmission impacts. The study first provided pre-bid analysis to understand what decisions may yield operational or other savings and then validated bid details in the middle of a pre-defined commercial bid window. This study utilized Strategist for portfolio optimization, PROMOD security constrained economic dispatch to inform financial and rate impact modeling and steady state power flow modeling to inform transmission reliability impacts.

Southeast Market Study / Confidential Client

Southeast / 2019

Project manager on the study of customer cost, unit viability and reliability impacts associated with various market scenarios within the southeast. This study utilized PROMOD security constrained economic dispatch and steady state power flow modeling to inform the analysis. Generator utilization, unit profitability, and adjusted production cost were key elements compared across market scenarios that considered an expanded day ahead market footprint. Key sensitivities such as fuel price, load growth, and renewable energy source penetration were analyzed compared to a reference set of assumptions. Results were presented to clients' corporate officers and documented in a final report.

Energy Storage Deployment Economic Study / ITC Holdings Corp.

MISO Market / 2019

Project manager for a project developing benefit scenarios in which energy storage solutions could be compared on a large and small scale. Benefits defined within select scenarios included resource adequacy, market efficiency, and reliability. Energy storage project configurations were varied based on the targeted benefit looking at large and small-scale lithium-ion applications and large scale advanced compressed air

energy storage applications. Comparative costs and policy discussions around each technology were included in a final report to be shared with state regulators and policymakers.

LMP Impacts Study / Confidential Client

MISO Market / 2019

Matthew provided support developing regional locational marginal price (LMP) forecasts looking out 15 years, considering changing future regional conditions including plant retirements, new renewable builds, and altered transmission facilities including both AC and HVDC facilities. The impacts to load and generator LMPs were reported based on the changing future conditions. LMPs were forecasted through the use of PROMOD and security constrained economic dispatch modeling.

SPP 2019 ITP Transmission Project Development Support / Confidential Client

Southwest Power Pool Market / 2019

Project manager for a utility client in support of developing proposed transmission projects to be submitted in SPP's 2019 ITP regional transmission expansion plan and Order 1000 process. Proposed transmission and non-wires alternative projects were analyzed and developed to address reliability, public policy, or economic needs as identified as part of SPP's ITP assessment. The study considered projects across multiple futures and included analysis developed through multiple software platforms including PSS/E and PROMOD Nodal software. Project types considered included both AC and HVDC transmission and battery energy storage systems.

Puerto Rico Economic & Disaster Recovery Plan: Power Infrastructure Assessment / Rand Corporation

Puerto Rico / 2018-2019

Matthew was one of 4 principle authors developing a comprehensive report prepared for the Homeland Security Operational Analysis Center (HSOAC), FEMA, and the Rand Corporation focused on all facets of the power system infrastructure in Puerto Rico. This report discussed the impacts associated with the hurricanes Irma and Maria that struck the island in 2017. Scenarios contemplating rebuilding the generation, transmission, distribution, and customer interfacing infrastructure were discussed and an estimated cost was provided. These served as a road map to inform future spending of disaster recovery funds.

PJM 2018/19 RTEP Long Term Proposal Window Support / Confidential Client

PJM Interconnection Market / 2018-2019

Project manager for a team of system planners and engineers to support a transmission company in the collaborative development of proposed transmission projects to be submitted in PJM's 2018/19 RTEP Long Term proposal window. Matthew coordinated all activities in collaboration with the client throughout the window including the development of transmission and battery storage solutions and evaluation of solutions for competitiveness. Project development within this window focused on market efficiency needs and were evaluated for both economic and reliability benefits using licensed software including PROMOD, PSS/E and TARA.

SPP 2019 ITP Resource Plan Phase 2 Support / Southwest Power Pool

Southwest Power Pool Market / 2018

Project manager for a project team developing the resource expansion plan to be used in reliability and economic models associated with Southwest Power Pool's 2019 Integrated Transmission Plan. Resource plans were developed for the entire SPP footprint based on stakeholder feedback associated with future load growth and generator retirements for three different future scenarios. Each scenario had differing policy goals associated with renewable integration. Resource plans were developed using Strategist and results were communicated through SPP's stakeholder working group for final approval.

Expert Witness Support – Certificate of Public Convenience and Necessity Cause No. 45052 / Vectren Corporation

MISO Market / 2017-2018

Matthew served as one of 14 expert witnesses providing testimony in support of Vectren's Certificate of Public Convenience and Necessity (CPCN) filed with the state regulatory commission to build an approximately $850M generating facility. His analysis and testimony was provided to support Vectren's decision to self-build new generation capacity in replacement of existing unit retirements including the evaluation of competitive project bids received through an RFP process.

Energy Storage Feasibility Assessment / Confidential Client

Southeast / 2018

Project manager for a team evaluating the business case of an energy storage solution mitigating a substation transformer overload. The energy storage solution was developed such that it could be evaluated and compared against deferred or avoided transmission and/or distribution upgrades. An economic comparison was performed looking at the energy storage solution compared to transmission and distribution upgrades on a net present value basis.

CAISO 2017/18 TPP Submission Window Support / Confidential Client

CAISO Market / 2017-2018

Project manager for a team that supported the evaluation and development of transmission projects which were submitted to CAISO during the Phase 2 Request Window as part of its Transmission Planning Process for the 2017/18 planning cycle. Transmission solutions were developed to address reliability needs as identified by CAISO and were analyzed for steady state reliability performance using PSLF.

Transmission solutions were additionally analyzed for economic and policy-related production cost benefits using GridView. Benefit-cost ratios following CAISO calculation methodology and various other metrics were reported to communicate the multiple benefits provided by the transmission solutions as submitted.

Expert Witness Support – DSM Program Spending and Approval Cause No. 44927 / Vectren Corporation

MISO Market / 2017

Matthew served as an expert witness providing testimony in support of Vectren's proposed DSM program and associated spending filed with the state regulatory commission. His analysis and testimony was provided to support Vectren's decision to implement energy efficiency programs on a three year forward basis for up to 1 percent of eligible customer sales. Testimony was provided to support IRP analysis and energy efficiency program decisions.

PJM 2016/17 RTEP Long Term Proposal Window Support / Confidential Client

PJM Interconnection Market / 2016-2017

Project manager for a team of system planners and engineers to support a transmission company in the collaborative development of proposed transmission projects to be submitted in PJM's 2016/17 RTEP Long Term proposal window. Matthew coordinated all activities in collaboration with the client throughout the window including the development of transmission and battery storage solutions, evaluation of solutions for competitiveness and development of formal project proposals which include engineering, routing and permitting detail which were submitted to PJM for independent evaluation. Project development within this window focused on market efficiency needs and were evaluated for both economic and reliability benefits using licensed software including PROMOD, PSS/E and TARA. Multiple bids were submitted.

Pacific Gas & Electric 2016 Energy Storage Request for Offers Window Support / Confidential Client

CAISO Market / 2016-2017

Pursuant to California Assembly Bill 2514, PG&E is required to solicit bids for transmission, distribution, and behind the meter connected energy storage projects. Matthew provided support for a third-party developer in the feasibility evaluation associated with energy storage projects to be submitted into PG&E's bid window. The feasibility evaluations were responsible for targeting viable locations with beneficial applications for reliability and resource adequacy benefits for PG&E and/or the third-party battery operator.

CAISO 2016/17 TPP Submission Window Support / Confidential Client

CAISO Market / 2016

Project manager in the development and evaluation of transmission projects which were submitted to CAISO during the Phase 2 Request Window as part of its Transmission Planning Process for the 2016/17 planning cycle. Transmission solutions including transmission and battery storage were developed to address reliability needs as identified by CAISO and were analyzed for steady state reliability performance using PSLF. Multiple projects were submitted for evaluation by CAISO and included a summary of planning performance and estimated costs related to the project.

PJM 2016 RTEP Proposal Window #3 Support / Confidential Client

PJM Interconnection Market / 2016

Project manager in PJM's 2016 RTEP proposal window related to short term reliability issues. Matthew provided management and direction on planning, project evaluation, and proposal development of transmission solutions within PJM's Order 1000 process. Transmission solutions were developed to address reliability needs as identified by PJM and were analyzed for steady state reliability performance using PSS/E and TARA. He also supported the strategic decision-making associated with identifying evaluated transmission solutions to be submitted to PJM within the proposal window.

SPP 2017 ITP10 Staff Augmentation / Southwest Power Pool

Southwest Power Pool Market / 2016-2017

Project manager for an independent study supporting the Southwest Power Pool's Economic Planning team. The project support was provided as staff augmentation and supported updates associated with the regional Integrated Transmission Plan Year 10 (ITP10) modeling. Model updates were incorporated, and reliability and economic transmission needs were identified and compared against a prior version. This supported SPP staff in transmission project portfolio recommendations as part of their 2017 ITP10.

PJM 2016 RTEP Proposal Window #2 Support / Confidential Client

PJM Interconnection Market / 2016

Project manager for PJM's 2016 RTEP proposal window related to short term reliability issues. Matthew provided management and direction on planning, project evaluation, and proposal development of transmission solutions within PJM's Order 1000 process. Transmission solutions were developed to address reliability needs as identified by PJM and were analyzed for steady state reliability performance using PSS/E and TARA. He also supported the strategic decision-making associated with identifying evaluated transmission solutions to be submitted to PJM within the proposal window.

Alternative Technology Solution Planning / Smart Wires

South Australia / 2016

Project manager for supporting the evaluation of a market efficiency solution utilizing Smart Wires technology to support the integration of

renewable generation and facilitate cost effective energy imports. The evaluation considered steady state comparison of solutions utilizing PSS/E comparing multiple dispatch and transfer scenarios. Results were presented to the transmission owner for consideration and submission to the regional market studies.

Alternative Technology Solution Planning / Smart Wires

MISO Market / 2016

Project manager for a project which considered the development of an alternative transmission reliability solution utilizing Smart Wires technology. This included a steady state evaluation and comparison of solutions using PSS/E. The Smart Wires solution was ultimately selected in lieu of the previously approved transmission solution.

Unregulated Generation and Transmission Development Support / Confidential Clients

Puerto Rico / 2016-2017

Provided expert witness testimony and strategic consulting related to the development of a comprehensive generation and transmission solution by a third-party utility consortium. He advised both generation and transmission strategy throughout the course of the project.

Integrated Resource Plan Regulatory Filing Support / Vectren Corporation

Indiana / 2016

Project manager who worked collaboratively with client's staff to develop long range resource plans in the framework of a public utility commission-filed Integrated Resource Plan. Matthew provided strategic and planning support in a variety of analysis applications and public meeting presentations. The analysis included consideration of both supply and demand-side options using the Strategist and PROMOD IV production cost modeling software. The IRP process included several public meetings and development of a regulatory filing report.

SPP 2017 ITP10 Transmission Project Development Support / Confidential Client

Southwest Power Pool Market / 2016

Project manager for a utility client in support of developing proposed transmission projects to be submitted in SPP's 2017 ITP10 regional transmission expansion plan and Order 1000 process. Proposed transmission projects were analyzed and developed to address reliability, public policy, or economic needs as identified as part of SPP's 2017 ITP10 assessment. The study considered projects across multiple futures and included analysis developed through multiple software platforms including PSS/E and PROMOD Nodal software.

PJM 2016 RTEP Proposal Window #1 Support / Confidential Client

PJM Interconnection Market / 2016

Project manager for PJM's 2016 RTEP proposal window related to short term reliability issues. Matthew provided management and direction on planning, project evaluation, and proposal development of transmission solutions within PJM's Order 1000 process. Transmission solutions were developed to address reliability needs as identified by PJM and were analyzed for steady state reliability performance using PSS/E and TARA. He also supported the strategic decision-making associated with identifying evaluated transmission solutions to be submitted to PJM within the proposal window.

Western New York Public Policy Transmission Need Project Solicitation Support / Confidential Client

NYISO Market / 2015

Project manager for a team supporting the development and evaluation of proposed transmission projects that address the public policy transmission needs identified by the New York ISO (NYSO). The study included analysis of combined generation and transmission solutions. Both AC and DC transmission solutions were evaluated and compared to sufficiency criteria as defined by the NYISO. The study provided analysis through multiple software platforms including PSS/E and TARA.

Michigan Peninsula Transmission Connection Study / Confidential Client

MISO Market / 2015

Project manager supporting the development and evaluation of proposed transmission projects that connect transmission facilities in the Lower and Upper Peninsulas of Michigan. The study was needed to support recommendations to a state approved Board responsible for reviewing potential transmission project options and associated project costs and benefits. The study included analysis of both AC and DC transmission solutions evaluating solution performance related to thermal and voltage violations, transfer capability, generation deliverability, resource adequacy, adverse impacts, and economic benefits. The study provided analysis through multiple software platforms including PSS/E, TARA, and PROMOD Nodal software.

Strategic Corporate Planning / Confidential Client

MISO Market / 2015

Project manager supporting strategic corporate planning initiatives related to future power supply investment decisions. This support included analysis that considered both aggressive customer-side initiatives as well as new conventional power supply as compared to costs associated with operation of the existing generation fleet while meeting future regulations including coal combustion residuals (CCR), effluent limitation guidelines (ELG), and the Clean Power Plan (CPP). A comparison of various power supply portfolios was studied using

PROMOD and evaluated for multiple benefits including customer cost, shareholder return, and regulatory compliance.

RFP Design and Development Support / Minnesota Power

MISO Market / 2015

Project manager for strategic consulting through participation and leading a client steering committee dedicated to the development of an RFP for a combined cycle facility to be available in the early 2020 timeframe. The RFP and bid evaluation factors stipulated within the RFP were developed with design parameters related to reliability and plant availability in mind. The RFP process was designed to create a fair and open process in which to compare Minnesota Power's self-build generation alternative to other similar market offerings and garner approval from the public utility commission.

Integrated Resource Plan Regulatory Filing Support / Minnesota Power

MISO Market / 2015

Project manager working collaboratively with Minnesota Power's planning staff to develop a long range resource plan. The study provided strategic and planning support in a variety of analysis applications considering long term operation and shut down alternatives for existing power supply as well as new supply and demand side alternatives. The analysis considered various scenarios related to future regulatory and other uncertainties using the Strategist production cost modeling software. The IRP was filed with and approved by the Minnesota Public Utility Commission (Docket No. E015/RP-15-690).

SPP 2016 ITPNT (Near Term) Transmission Project Development Support / Confidential Client

Southwest Power Pool Market / 2015

Project manager supporting a utility in developing proposed transmission projects to be submitted in SPP's 2016 ITPNT regional transmission expansion plan. Proposed transmission projects were analyzed and developed to address reliability needs as identified by SPP. The study considered projects across multiple futures and included analysis developed through PSS/E and TARA power flow modeling software.

PJM 2015 RTEP Proposal Window #1 Support / Confidential Client

PJM Interconnection Market / 2015

Project manager for a team of system planners and engineers to support a utility in developing proposed transmission projects to be submitted in PJM's 2015 RTEP proposal window related to short term reliability issues. Transmission solutions were developed to address reliability needs as identified by PJM and were analyzed for steady state reliability performance using PSS/E and TARA. Matthew also supported the strategic decision-making associated with identifying evaluated transmission solutions to be submitted to PJM within the proposal window.

Great Northern Transmission Line Certificate of Need Filing Support / Minnesota Power

MISO Market / 2015

Project manager working collaboratively with Minnesota Power's planning staff to evaluate and quantify the customer benefits associated with ownership of a proposed 500kV transmission line. The analysis included consideration of generation alternatives versus the new transmission and associated access to Canadian markets and energy. The environmental attributes associated with the generation mix procured as a result of the new transmission line were also considered. The Certificate of Need was filed with and approved by the Minnesota Public Utility Commission (Docket No. E015/CN-12-1163).

Ongoing Resource Planning and Software Consulting / Minnesota Power

MISO Market / 2011-2015

Matthew has provided ongoing consulting support to Minnesota Power's Resource Planning Department on a variety of analyses topics. The primary focus of Matthew's support includes economic evaluation of detailed production cost modeling, resource expansion, environmental compliance, and strategic long-range planning. Most of his support is related to regulatory filings. Analyses are typically developed comparing PVRR and annual cash flow comparisons.

PJM 2014/15 RTEP Proposal Window Support / Confidential Client

PJM Interconnection Market / 2014-2015

Project manager for a team of system planners to support a transmission company in developing proposed transmission projects to be submitted in PJM's 2014/15 RTEP project proposal windows. This support included two 30-day proposal windows focused on short term reliability issues and a third long term (120 day) proposal window focused on reliability and market efficiency issues. Transmission solutions were developed to address reliability or market efficiency needs as identified by PJM. Reliability projects were analyzed for steady state reliability performance using PSS/E and TARA. Market efficiency projects where studied using PROMOD Nodal software and evaluated on a benefit to cost ratio basis with benefits calculated according to PJM protocol. Matthew also supported the strategic decision-making associated with identifying evaluated transmission solutions to be submitted to PJM within the proposal window.

ERCOT Regional Planning Group Studies / Confidential Client

ERCOT Market / 2014-2015

Project manager for a study looking at potential transmission expansion options in West Texas to be submitted as part of ERCOT's Regional

Planning Group (RPG). The study considered the development of transmission projects to address reliability issues associated with increased load from oil and gas production and increased generation from renewable energy projects. Various software programs were used for the analysis and evaluation of transmission solutions including PSS MUST and PSS\E.

Integrated Resource Plan / Pedernales Electric Cooperative

ERCOT Market / 2014-2015

Project manager for a long-range integrated resource plan for Pedernales Electric Cooperative, the largest electric distribution cooperative in the United States. The analysis considered various power supply and customer demand side options supplementing a partial requirements energy contract under varying scenarios. The analysis helped the utility's short-term and long-term energy purchase strategy, distributed energy resource deployment, and market coincident peak demand management. The study deliverables included a final report and multiple Board presentations.

Value of Solar Tariff Analysis / Minnesota Power

MISO Market / 2014

Provided consulting support to Minnesota Power's Resource Planning Department in regard to an approved methodology for calculating a uniform value of solar (VOS) tariff. Consulting support included developing or consolidating all components necessary to calculate the VOS as prescribed. The study also provided information to support Minnesota Power in recommendations for change regarding the appropriate methodology and assumptions basis for a VOS tariff applied to Minnesota Power's customers. The study ultimately helped Minnesota Power calculate their VOS and provided a detailed overview of the inputs required to calculate all of the components that make up the tariff rate as prescribed.

SPP 2015 ITP10 Transmission Project Development Support / Confidential Client

Southwest Power Pool Market / 2014

Project manager supporting a utility client in developing proposed transmission projects to be submitted in SPP's 2015 ITP10 regional transmission expansion plan. Proposed transmission projects were analyzed and developed to address reliability, public policy, or economic needs as identified as part of SPP's 2015 ITP10 assessment. The study considered projects across multiple futures and included analysis developed through multiple software platforms including PSS/E and PROMOD Nodal software.

Integrated Resource Plan Regulatory Filing Support / Vectren Corporation

MISO Market / 2014

Project manager who worked collaboratively with client's staff to develop long range resource plans in the framework of a public utility commission-filed Integrated Resource Plan. Matthew provided strategic and planning support in a variety of analysis applications and public meeting presentations. The analysis included consideration of both supply and demand-side options using the Strategist and PROMOD IV production cost modeling software. The IRP process included several public meetings and development of a regulatory filing report.

MATS Compliance Regulatory Filing Expert Witness Testimony Support / Vectren Corporation

MISO Market / 2014

Provided expert witness testimony support on behalf of Vectren Corporation to the Indiana Utility Regulatory Commission related to filing Cause No. 44446. His testimony supported the client's capital investment decision regarding compliance for the Mercury and Air Toxics Standards (MATS). The utility's investment decision was ultimately supported and approved by the IURC.

High Priority Incremental Load Study / Southwest Power Pool

Southwest Power Pool Market / 2013-2014

Project manager in support of a special study commissioned by Southwest Power Pool and its Members. The purpose of the study was to evaluate reliability and economic transmission expansion projects to support incremental load growth related to oil and natural gas drilling and exploration. The study considered a range of load scenarios over multiple years and included analysis developed through multiple software platforms including PSS/E and PROMOD Nodal software.

Environmental Compliance Resource Planning and Regulatory Consulting / Arizona Electric Power Cooperative

Arizona / 2013-2014

Project manager that supported a generation and transmission cooperative client in the southwest. The analysis supported regulatory filings and provided the foundational basis for long range capital planning decisions at existing assets. The analysis involved long range investment decisions of multiple operating configurations and included multiple project stakeholders. The study was filed with the Arizona Corporation Commission (Docket No. E-01773A-12-0305).

Integrated Resource Plan Regulatory Filing Support / Minnesota Power

MISO Market / 2013

Project manager supporting the development and documentation of an integrated resource plan regulatory filing. This project included strong collaboration with client's staff throughout all aspects of the study including base and sensitivity assumption development, scenario development for risk analysis, modeling and summarizing benefits and costs associated with various resource plans. Matthew provided strategic and planning support in a variety of analysis applications including consideration of both supply and demand-side options using Strategist, an industry standard production cost modeling software program. The IRP was filed with and approved by the Minnesota Public Utility Commission (Docket No. E015/RP-13-53).

Wind Farm Congestion and LMP Forecasting / Nordex-USA, Inc.

Southwest Power Pool Market / 2013

Project manager for a project that predicted medium and long-term LMP projections and generation curtailment for a potential wind farm and several potential off takers in the Southwest Power Pool. The analysis was based on long range models using PROMOD Nodal that included future transmission projects and generation as included in regional transmission organization transmission expansion plans. Study assumptions were primarily based on SPP planning assumptions and models. Upon completion of the Study, our team prepared a formal report with conclusions that was used in support of marketing the potential wind farm project.

Due Diligence Economic Evaluation Support / Perennial Power Holdings, Inc.

Multiple Locations / 2013

Provided economic analysis for a developer / investment client in support of generation asset purchase / acquisition due diligence activities. The analysis consisted of review and development of long-range project pro formas representing predicted cash flows. Project markets included PJM and ERCOT. Detailed spreadsheet summaries for evaluation purpose were developed representing an income statement and statement of cash flows. NPV and IRR were key metrics used for project comparison.

Generation Expansion and Long-Range Transmission Study / Southwest Power Pool

Southwest Power Pool Market / 2012-2013

Provided software expertise and analysis support to Southwest Power Pool's Economic Planning group to determine long range generation expansion plans throughout the eastern interconnect with a focus on the SPP footprint. The expansion plans were used in the ITP20 transmission assessment to analyze the benefits of future transmission projects using security constrained unit commitment and economic dispatch with PROMOD Nodal software.

Generation Fleet LMP Forecasting / Alliant Energy

MISO Market / 2012

Project manager for a project that developed medium and long-term LMP forecasts at specific nodes for an investor-owned utility that operates within the MISO transmission system. The analysis used security constrained economic dispatch to provide information assisting in the determination of estimated economic benefit for various existing and potential generation assets. The long range LMP forecasts included future transmission projects and generation as outlined in regional transmission organization transmission expansion plans and was based on MISO transmission models. The analysis was performed using PROMOD Nodal software.

Baseload Diversification Study Regulatory Filing / Ottertail Power Company

MSIO Market / 2012

Worked collaboratively with client's staff to develop long range resource plans in the framework of a public utility commission-ordered Baseload Diversification Study. Matthew provided strategic and planning support in a variety of analysis applications. The primary focus of the study was to consider the benefit to utility ratepayers of fuel diversification over a long-range study period. The analysis considered new build alternatives as well as several environmental retrofit configurations at existing generation assets under defined future environmental regulatory scenarios using Strategist. The Baseload Diversification Study was filed with and approved by the Minnesota Public Utilities Commission (Docket No. E017/RP-10-623).

Generation Asset Valuation Study / CPS Energy

ERCOT Market / 2012

Aided with near-term resource planning regarding capital project spending for a municipal utility in Texas. The focus of the study was to develop economic analysis and unit valuation for justification of long-range plant expenditures related to improved reliability and unit availability. Matthew helped analyze various long-range scenarios through use of the Strategist production cost modeling software.

Baseload Diversification Study Regulatory Filing / Minnesota Power

MISO Market / 2011-2012

Project manager who worked collaboratively with client's staff to develop long range resource plans in the framework of a public utility commission-ordered Baseload Diversification Study. Matthew provided strategic and planning support in a variety of analysis applications. The primary focus of the study was to consider the benefit to utility ratepayers of fuel diversification over a long-range study period. The analysis considered new build alternatives as well as the potential

retirement of existing generation assets under a variety of environmental regulatory scenarios using Strategist. The Baseload Diversification Study was filed with the Minnesota Public Utilities Commission (Docket No. E015/RP-09-1088).

Long Range Transmission Study Staff Augmentation / Southwest Power Pool

Southwest Power Pool Market / 2011

Matthew served as supplemental staffing to Southwest Power Pool's Economic Planning group to provide support in the evaluation of long-range high voltage transmission projects for their ITP10 transmission expansion plan. The analysis considered the benefits of reduced congestion, reduced losses, and increased reliability against the potential project costs using security constrained unit commitment and economic dispatch with PROMOD Nodal software.

Joint Planning & Operations Study / Sunflower Electric Power Corp. & Golden Spread Electric Cooperative

Kansas & Texas / 2011

Project manager for a long-term resource planning study with two cooperatives in the lower Midwest. Matthew provided planning support to both utilities to quantify potential benefits of a virtual integration. The analysis considered new build alternatives as well as transmission consideration for integrated operations using the Strategist and PROMOD IV production cost modeling software.

Generation Asset Retirement and New Technology Evaluation Update / Austin Utilities

MISO Market / 2011

Project manager for a long-term economic feasibility study for a municipal utility in the upper Midwest. The analysis included development of long-range pro formas that considered the integration of simple cycle generation against wind production at an existing node. The analysis helped the utility's short-term resource planning and decision making regarding the existing generation facility and consideration of power development alternatives.

Integrated Resource Planning / Lafayette Utilities System

MISO Market / 2011

Supported integrated resource planning and analysis with a large municipal utility in the Southeast. The analysis included various unit retirements options as well as new build and re-power of existing resources under various environmental compliance scenarios. The analysis helped the utility's short-term and long-term resource planning and decision making around the impact to the existing generation fleet from potential future environmental regulations.

Resource Purchase Evaluation Study / Kansas Power Pool

Southwest Power Pool Market / 2011

Project manager for a planning study for multiple municipalities in the Midwest. Matthew helped analyze the economic impact of pursuing joint ownership of a generation resource versus smaller individual based projects for various generation technologies using the Strategist production cost modeling software. Economic and feasibility screening analysis was provided over a study period of 20 years.

Integrated Resource Plan and Regulatory Filing Support / Wyoming Municipal Power Agency

Wyoming / 2011

Project manager for an integrated resource planning study for a municipal power agency in the Mountain west. The IRP was prepared pursuant to the requirements of Federal Register Notice 10 CFR Part 905 in support of submittal to the Western Area Power Administration as a purchaser of federal power. The analysis included consideration of both supply and demand-side options using the Strategist and PROMOD IV production cost modeling software. The IRP process included several public webinars and public involvement. The IRP was submitted to and approved by the Western Area Power Administration.

Integrated Resource Planning / Minnesota Power

MISO Market / 2010-2011

Supported integrated resource planning and analysis with an investor-owned utility in the upper Midwest. His assistance included benchmarking production cost modeling output based on previous analysis and support of long-range integrated resource planning analysis. The analysis included various unit retirements options as well as new build and power purchase alternatives. The analysis helped the utility's short-term and long-term resource planning and decision making around the least cost plan compared to alternatives reducing the utilities coal-based generation.

Generation Asset Retirement Review / Westar Energy

Southwest Power Pool Market / 2010

Performed a 10-year economic analysis for an investor-owned utility in the Midwest considering various levels of capital investments required under different environmental regulatory scenarios. The study analyzed potential retirement dates of older resources within the utility's fleet as well as fuel switching to natural gas or installing pollution controls equipment to comply with expected environmental regulations. The study provided mid-range planning direction while balancing retirement considerations as well as the potential new capital investment required in future environmental regulations. Use of Strategist and PROMOD IV software was used in the study.

Generation Asset Retirement and New Technology Evaluation / Otter Tail Power Co.

Minnesota / 2010

Performed a long-term economic analysis for an investor-owned utility in the upper Midwest for various generation alternatives at an existing power station using PROMOD IV. The analysis included various repower scenarios including fuel switching to natural gas or installing pollution controls equipment to comply with expected environmental regulations. The analysis helped the utility's short-term and long-term resource planning and decision making around the existing generation facility.

Demand Side Management Study / Sunflower Electric Power Corp.

Kansas / 2010

Project manager for the study of demand side management options to reduce a client's native peak load through demand response or direct load control programs. The options considered included residential A/C and electric hot water heater, irrigation, and oil well load control. The load control programs were evaluated over a 20-year study period and various future scenarios were evaluated to determine the robustness of the study results.

Demand Side Management and Long-Term Power Supply Planning / Manitowoc Public Utilities

Wisconsin / 2010

Provided long term integrated resource planning assistance for a municipal utility in the Upper Midwest. He helped analyze the benefit/cost ratios for multiple conservation and peak reduction demand side management programs in the residential sector. The benefit/cost ratio screening analysis was provided over the life of the programs. A review of the client's modeled supply side analysis was also performed, along with assistance integrating the supply and demand side analysis.

Preliminary Joint Resource Planning Study / Kansas Municipal Utilities

Kansas / 2010

Provided long term planning assistance for multiple municipalities in the Midwest. He helped analyze the economic cost impact of pursuing larger joint ownership generation resources or smaller individual based projects for various generation technologies ranging from gas-fired peaking to baseload options through PROMOD IV and Strategist production cost modeling software. Economic and feasibility screening analysis was provided over a study period of 20 years.

Renewable Energy Resources Alternatives Study / Great Lakes Utilities

Wisconsin / 2010

Provided long term resource planning assistance regarding state and federal regulatory requirements for a client in the Upper Midwest. He helped analyze the feasibility and economic cost impact of building various renewable energy generation projects including biomass, wind, solar, and low impact hydro options. Economic and feasibility screening analysis was provided over the life of the projects.

Generation Asset Retirement and New Technology Evaluation / Austin Utilities

Minnesota / 2010

Provided a long-term economic feasibility study for a municipal utility in the upper Midwest for various generation alternatives at an existing power station. The analysis included a comparison of resource production costs compared to forecasted long-term fuel and wholesale market energy prices over a 20-year period. The analysis helped the utility's short-term resource planning and decision making regarding the existing generation facility.

Asset Valuation Study / Corn Belt Power Cooperative

Iowa / 2010

Project manager for a project that provided the estimated fair market value of multiple generation and transmission distribution assets for a power cooperative in the Midwest. The present and future worth of the assets was forecasted using the income and reproduction cost approaches over a 20-year period. The assets' fair market value was used to assist in negotiations for fair compensation after the termination of power pooling contracts.

Generation Resource Planning / Sunflower Electric Power Corp.

Kansas / 2008-2010

Provided long term planning assistance for a generation and transmission cooperative in the Midwest. He helped analyze the economic cost impact of building various generation technologies ranging from gas-fired peaking to baseload options through Strategist, a resource optimization and production cost modeling program. Economic and feasibility screening analysis was provided over a study period of 20 years.

Gas Generation Technology Assessment / Fayetteville Public Works Commission

North Carolina / 2009

Provided a long-term economic feasibility study for various generation alternatives for a municipal utility in the Mid-Atlantic region. The analysis included forecasting long-term fuel and wholesale market energy prices over a 20-year period and comparing the economic

benefits of generation alternatives to market-based energy. The analysis helped the utility's short-term resource planning and decision making.

Rate Impact Analysis / Corn Belt Power Cooperative

Iowa / 2009

Assisted a Midwest client with analyzing economic impact to its members under several different potential future conditions through the use of PROMOD IV hourly dispatch model. Rate analysis included scenarios where the client became a Class A ratepayer of another cooperative or continued standalone operations and remained independent. Analyses included operational and regulatory risks.

Generation Asset Retirement Study / CPS Energy

Texas / 2008

Aided with near-term resource retirement planning for a municipal utility in Texas. He helped analyze various long-range scenarios through use of the Strategist production cost modeling software. Scenarios were modeled to mirror expected conditions as well as bias the advantages of existing resources studied for retirement consideration. Along with long-range integrated production cost-planning, Matthew helped develop a spreadsheet tool that the client could use to monitor future conditions and make high level resource retirement decisions.

Fair Market Valuation Assessment / Prairie Power, Inc.

Illinois / 2008

Provided an estimate of the fair market value of several units in the client's generating fleet by forecasting the present worth of future cash flows based on expected and forecast maintenance, production costs, and other fixed and regulatory costs over a nine-year period. The assets' fair market value was used to aid in negotiations with member cooperatives considering cancellation of their wholesale power supply contracts.

Generation Resource Planning / Dairyland Power Cooperative

Wisconsin / 2008

Provided long term planning assistance for a client in the upper Midwest. He helped analyze the economic cost impact of building various generation technologies ranging from gas-fired peaking to baseload options using Strategist software. Economic and feasibility screening analysis was provided over a study period of 20 years and sensitivity analyses related to load growth, carbon regulation scenarios, and commodity prices were performed.

Demand Side Management Program Training and Analysis / Dominion Resources Services, Inc.

Virginia / 2008

Aided with long term power supply planning for a municipal utility in the Midwest. He helped analyze various scenarios ranging from contract purchase power pricing to the addition of self-built generating options including wind and repowering existing gas-fired peaking resource options through spreadsheet production cost modeling analysis. Economic and feasibility screening analysis was provided over a study period of 20 years.

Production Cost Modeling / South Mississippi Electric Power Association

Mississippi / 2007-2009

Provided resource planning assistance for client by modeling multiple supply and demand management alternatives including baseload, intermediate, peaking, and renewable resources. He provided economic screening analysis of the best alternatives identified through production cost modeling using Strategist and PROMOD IV software. Also reviewed sensitivity to cost estimates, fuel and other assumptions to evaluate both near term and long-term issues.

Power Supply Planning / Rochester Public Utilities

Minnesota / 2007-2008

Aided with long term planning for a client in the upper Midwest. He helped analyze various scenarios ranging from contract purchase power pricing to the addition of self-built generating options including wind to meet state mandated renewable portfolio standards and gas-fired peaking resource options through hourly production cost modeling using PROMOD IV software. Economic and feasibility screening analysis was provided over a study period of 25 years.

Siting Studies / Southwest Public Power Resources Group

Southwest / 2007

Provided assistance with comprehensive strategic siting services that involved identifying suitable locations throughout the Southwest for a large coal-fired facility as well as natural gas-fired resources including combined and a simple cycle combustion turbine facility. Services provided include site identification and selection, management of environmental review, economic and technical screening analyses, and site recommendations.

Integrated Resource Planning / City of Columbia

Columbia, Missouri / 2007

Provided comprehensive resource planning assistance with supply and demand-side alternatives for a municipal utility in the Midwest. He developed a production cost model of existing resources and tested the economic feasibility of adding demand management programs, baseload, intermediate, peaking, and renewable resources to meet client's projected energy demand growth using Strategist and PROMOD IV software. Also reviewed sensitivity to cost estimates, fuel and other assumptions of the optimal alternatives having both near term and long-term generation implications.

Power Supply Study / Midwest Energy, Inc.

Kansas / 2007

Aided with ongoing future supply options for client by modeling various generation and contract capacity alternatives. Feasibility of alternatives was analyzed based on the hourly production costs determined through use of PROMOD IV software. Analysis provided over near term, five-year study period.

Avoided Cost Study / Corn Belt Power Cooperative

Iowa / 2006-2008

Assisted client with contract planning for a wind generation resource by establishing the utility's hourly avoided cost over a one-year period. He determined the avoided cost by modeling the hourly production cost of the client's generation portfolio using PROMOD IV planning software. The resulting avoided cost was used to determine an appropriate energy price for a wind generation contract.

Power Supply Study / Corn Belt Power Cooperative

Iowa / 2006

Aided with updating a previous resource expansion plan for Corn Belt Power Cooperative. He helped analyze the addition of wind, gas, and coal-based resource options through hourly production cost modeling using PROMOD IV. Reviewed sensitivities to cost estimates, fuel and other assumptions and analyzed both near term and long-term issues.

Peaking Review Study / Fayetteville Public Works Commission

North Carolina / 2006

Provided assistance with the review of best generation alternatives to meet load demand above the utility's contract rate of delivery from the market. The review was done by modeling the client's system using PROMOD IV software to analyze a variety of simple cycle and combined cycle generation alternatives and identifying trade-offs between start costs and operating efficiencies.

Coal-Fired Power Plant Siting Study / Arkansas Electric Cooperative Corp.

Arkansas / 2006

Assisted with the strategic evaluation of locating a coal-fired power plant site in Arkansas. He aided with site identification, mapping, environmental review, technology assessment, and economic analysis of options.

Solid Fuel-Fired Power Plant Feasibility Study / Old Dominion Electric Cooperative

Mid-Atlantic Region / 2006

Assisted a client with strategic site evaluation for locating a coal-fired power plant in the mid-Atlantic region of the east coast. He aided with site identification and evaluation, mapping, environmental review, economic analysis, and technology assessment.

Coal-Fired Cost Estimate / Progress Energy

North Carolina/Florida / 2006

Project manager tasked with providing performance and cost estimates for a baseload and intermediate power projects located in North Carolina and Florida. The project provided estimates for plant performance and costs including capital investment, fixed and variable operation and maintenance expenses.

Siting Study and Technology Assessment / Arizona Public Service

Arizona/New Mexico / 2005-2006

Assisted APS with a strategic siting evaluation study that involved locating a large, multi-unit coal-fired facility in the Southwest. Services provided include site identification and selection, transmission analysis management, environmental review, and technology assessment.

Siting Studies / Westar Energy, Inc.

Kansas / 2005-2006

Assisted Westar with strategic siting services that involved locating both a large, multi-unit coal-fired facility and a simple cycle combustion turbine peaking facility in Eastern Kansas. Services provided include site identification and selection, and management of environmental review and technology assessment.

Baseload Feasibility Study / Wisconsin Public Power, Inc. and Madison Gas & Electric Co.

Wisconsin / 2005

Assisted with a feasibility study for locating a multi-unit, solid fuel-fired generation facility in Wisconsin. The study included site identification and selection, environmental review, and technology assessment.

Due Diligence Evaluation / Old Dominion Electric Cooperative

Virginia / 2004

Assisted the client with an asset due diligence study of a simple cycle peaking power plant on the east coast. He reviewed much of the material agreements as well as operational data to assist the client in the bidding process. A summary report of this due diligence was also prepared.

Joint Baseload Feasibility Study / Wisconsin Public Service and Wisconsin Power & Light

Wisconsin / 2004

Assisted with a siting study of a coal-fired generation station located in Wisconsin. The siting study involved mapping assessment,

infrastructure assessment, environmental analysis, and field verification of the mapping and infrastructure results.

Coal-Fired Power Plant Siting Study / Ameren UE

Missouri / 2004

Assisted in a strategic siting evaluation for a potential coal-fired generation station located in Missouri. The siting study consisted of detailed analysis of land availability, fuel delivery and transmission infrastructure, water resources and availability, and environmental impacts of the potential coal-fired power plant.