



3366 93rd Avenue SE
Spiritwood, North Dakota 58481
701-253-7900
greatriverenergy.com

January 31, 2022

Karlene Fine, Executive Director
North Dakota Industrial Commission
State Capitol – 14th Floor
600 East Boulevard Ave Dept 405
Bismarck, ND 58505-0840

Dear Karlene,

Thank you for the opportunity to present this application to the Renewable Energy Council. Great River Energy is evaluating an alternative low carbon intensity fuel source at its Spiritwood Station located at Spiritwood, North Dakota. The grant funds would be utilized for the front-end engineering design (FEED) for the project.

The objective of this grant request is to evaluate alternative fuel availability, fuel costs, and the capital costs of converting the boiler, fuel handling system, and ash handling system to replace coal with the biomass, creosote treated railroad crossties (CTRT's). The study will evaluate the processed creosote treated railroad tie availability, delivered costs, and development of the FEED level capital project cost estimate associated with the design, permitting, earthwork, equipment, construction, and commissioning of the Spiritwood Station Biomass Fuel Conversion project. The results will be used to determine overall project feasibility, budget, and timeline.

The total FEED study project is estimated to cost \$133,000 which includes a Renewable Energy Council grant request of \$66,500.

We believe this project aligns well with the mission of the Renewable Energy Council to promote the growth of North Dakota's renewable energy industries through research, development, marketing, and education. Spiritwood Station has a significant impact on the local economy through 34 operating jobs plus many indirect jobs. Spiritwood Station has a positive impact on the agricultural industry by providing steam to operate the Dakota Spirit ethanol biorefinery which also provides stable, good-paying jobs and a steady market for locally grown corn. Spiritwood Station is also working to supply steam to a new soybean crushing facility that plans to locate adjacent to the plant.

Again, thank you for your consideration of this request.

Sincerely,

A handwritten signature in black ink, appearing to read 'Glenn Hauck'.

Glenn Hauck
Manager, Spiritwood Station
Great River Energy



**GREAT
RIVER
ENERGY™**

**Application for a
North Dakota
Industrial Council
Grant for:**

\$66,500

**Principal Investigator:
Glenn Hauck, Manager
Spiritwood Station**

**Spiritwood Station
3366 93rd Ave SE
Spiritwood, ND 58481**

GREATRIVERENERGY.COM

**Front End Engineering and
Design (FEED) Study for
Creosote Treated Railroad Tie
Fuel Conversion at Spiritwood
Station**

Contents

| | |
|---|----|
| Abstract..... | 2 |
| Objective:..... | 2 |
| Expected Results:..... | 2 |
| Duration:..... | 3 |
| Total Project Cost:..... | 3 |
| Participants:..... | 3 |
| Project Description..... | 3 |
| Objectives:..... | 3 |
| Methodology:..... | 4 |
| Task 1: Project management..... | 4 |
| Task 2: FEED kick-off meeting and site visit..... | 4 |
| Task 3: Conceptual design and budgetary costs..... | 5 |
| Task 4: Determine CTRT (creosote treated railroad ties) regional availability..... | 5 |
| Task 5: Economic feasibility evaluation..... | 5 |
| Anticipated Results:..... | 5 |
| Facilities, resources, techniques to be used, their availability and capability:..... | 6 |
| Environmental and economic Impacts while project is underway:..... | 6 |
| Ultimate technological and economic Impacts:..... | 6 |
| Why the project is needed:..... | 7 |
| Background/Qualifications..... | 7 |
| Background:..... | 7 |
| Management..... | 8 |
| Timetable..... | 8 |
| Budget..... | 9 |
| Patents/Rights to Technical Data..... | 10 |
| State programs and incentives..... | 10 |
| Appendix A: Spiritwood Station – Biomass Fuel Conversion FEED Scope..... | i |
| Appendix B: Resumes..... | v |
| Appendix C: Tax Liability Affidavit..... | xi |

Appendix D: FEED Proposal Document.....xiii

Abstract

Objective:

Great River Energy is evaluating an alternative low carbon intensity fuel source at its Spiritwood Station located at Spiritwood, North Dakota. The 99MW gross capacity combined heat and power plant produces steam and electricity. Currently, Spiritwood Station's primary fuel source is beneficiated lignite sourced from Great River Energy's Coal Creek Station and co-fired with natural gas fuel. Steam from Spiritwood Station powers an adjacent agriculture processing plant – the Dakota Spirit ethanol biorefinery. The plant also has the capacity to generate up to 99 megawatts of electricity for homes, farms and businesses in the regional energy market. Spiritwood Station is currently working with a new soybean crushing facility about the opportunity to serve the facility steam. Spiritwood Station has a significant impact on the local economy through 34 operating jobs plus many indirect jobs. Spiritwood Station has a positive impact on the agricultural industry by providing steam to operate the Dakota Spirit ethanol biorefinery, which uses corn from and markets distillers' grains to area farmers. Dakota Spirit also provides stable, good-paying jobs and a steady market for locally grown corn.

Due to the upcoming sale of Coal Creek Station, Great River Energy desires to evaluate alternative fuel availability, fuel costs, and the capital costs of converting the boiler, fuel handling system, and ash handling system to replace coal with biomass, specifically creosote treated railroad crossties (CTRT's).

Expected Results:

Great River Energy expects the evaluation of processed creosote treated railroad tie annual fuel availability and delivered cost to Spiritwood Station and development of a Front-End Engineering Design (FEED) level capital project cost estimate (+ 20%) associated with the design, permitting, earthwork, equipment, construction, and commissioning of the Spiritwood Station Biomass Fuel Conversion project.

Results of this evaluation will be used to determine overall project feasibility, budget, and timeline.

Duration:

The duration of this FEED study will be 5 months from contracts being executed relative to grant approval.

Total Project Cost:

Total project costs are \$133,000 with a grant request for \$66,500.

Participants:

Great River Energy and Black and Veatch.

Project Description

Objectives:

Spiritwood Station is a combined heat and power (CHP) dried lignite circulating fluidized bed (CFB) facility capable of generating up to ~800,000 lbs./hr. of high-pressure steam to a 99 MWe gross steam turbine and can supply up to 520 kpph of LP extraction steam for customer use. Maximum heat input with coal is approximately 1,100 MMBtu/hr. (HHV) but is estimated to be limited to 891 MMBtu/hr. (HHV) (81% MCR) on biomass to limit gas velocities at the inlet of the U-beams.

Due to the upcoming sale of Coal Creek Station where the coal supply comes from, Great River Energy desires to evaluate alternative fuel availability, fuel costs, and the capital costs of converting the boiler, fuel handling system, and ash handling system to replace coal with biomass, specifically creosote treated railroad crossties (CRTLs).

Great River Energy will utilize a third-party engineering firm to validate its internal estimation of project costs to convert Spiritwood Station to utilize creosote treated railroad ties as its primary fuel source. This will follow the generally accepted front end engineering design approach to the project. The results of this study will be compared to our internal estimates and used to calculate the overall project rate of return.

Great River Energy used a conservative +50% CAPEX to evaluate initial project feasibility which proved viable. Great River Energy would like to refine its internal evaluation to +20%. This will help with IRR evaluation. The second aspect of the IRR is the quantity and pricing of available CRTs. This is being compared to coal price for the benefit.

The final deliverable is a proposed project design/procurement/construction timeline. For a complete list of deliverables, see Appendix A.

Methodology:

Project methodology breaks the project into logical tasks to collect the information to support the objectives listed in the scope document in appendix A. These tasks will be used to execute the project and ensure that all required information is gathered and complete. These tasks are considered milestones in this project.

Task 1: Project management

This Task includes all work elements required to contract, maintain, manage, and report on 4 activities in accordance with the project schedule. It also includes the necessary activities to ensure planning and execution of the Project with all project participants.

Task 2: FEED kick-off meeting and site visit

Upon awarding the contract, Great River Energy will provide all internally developed layouts, specifications, and drawings for review. These documents as well as the project scope will be discussed during a project kickoff meeting. This will ensure the design team understands the scope and intricacies of the project.

- Appendix A: Fuel Supply Evaluation Scope
- Appendix A: Capital Cost Estimate (FEED) Scope

A site visit will follow once initial documents are reviewed. This will focus on equipment layout verification, space availability, and demolition requirements.

Task 3: Conceptual design and budgetary costs

This task will take Great River Energy's initial investigation further by starting to evaluate specific equipment locations and implications to the overall design. This will include but is not limited to external fuel handling, storage facilities, internal fuel handling. Please refer to the FEED scope in Appendix A for a complete list of design items.

Based on the conceptual design, an overall project cost will be estimated using preliminary quotes, material takeoffs, and regional labor rates. This will be submitted to GRE with other deliverables listed in Appendix A.

Task 4: Determine CTRT (creosote treated railroad ties) regional availability

This task will determine overall availability of CTRTs from local class 1 railroads and other short line railroads. It will include number of ties, viable means of transportation, and processing options. It will also include the pricing structure of ties. From internal investigation, Great River Energy anticipates there will be a tiered structure to the pricing. As the distance of the sourced ties increases, the pricing will also escalate.

Task 5: Economic feasibility evaluation

Great River Energy will complete this final task utilizing the findings of task 3 & 4. The price and quantity of CTRTs will be evaluated against alternative natural gas fuel. This will consider direct fuel saving costs, customer steam pricing and any renewable energy credits received. This will be the final stage of this project and will serve as an exit ramp if the economics are not feasible.

Anticipated Results:

Great River Energy anticipates that the results of this project will be a report and supporting documents that detail the following (referred to as the "FEED Study"). The FEED Study will provide a clear path towards the next stages of this project to convert Spiritwood Station from beneficiated lignite to CTRT biomass as a fuel source.

- Report summarizing national CTRT availability as a fuel source and the predicted costs (shipped, processed, & delivered) to Spiritwood Station based on annual quantities
- Detailed line-item FEED capital estimate - Excel spreadsheet
- Overall conceptual site layout & general arrangement drawings (plan & elevation views) in .DWG format
- Preliminary Process flow diagrams (PFD's) in .DWG format
- Preliminary Piping & Instrument Diagrams (P&ID's) in .DWG format
- Electrical load list in Excel spreadsheet

Facilities, resources, techniques to be used, their availability and capability:

The main facilities related to this study are Great River Energy's Spiritwood Station, Spiritwood ND and a processing facility to be located adjacent to Spiritwood Station. The tasks above address the other points.

Environmental and economic Impacts while project is underway:

Completion of this project, as defined in the scope, will have minimal environmental and economic impacts.

Ultimate technological and economic Impacts:

Completion of this FEED Study will provide the basis for a larger project which is required to convert the Spiritwood Station to a biomass fuel source. This larger project will add up to 150 jobs during construction, 20 jobs in the area after construction and during operation, and millions to the economy during and after construction.

Spiritwood Station is the source of low carbon steam for its steam customers. This project will drop the carbon intensity of the steam keeping this steam ahead of other low carbon sources. The benefits will be shared by all parties of the Spiritwood Energy Park. This will ensure prolonged operation of an important local and state resource.

Spiritwood Station has a significant impact on the local economy through 34 operating jobs plus many indirect jobs. It also has a positive impact on the agricultural industry by providing steam to operate the Dakota Spirit ethanol biorefinery, which uses corn from and markets distillers' grains to area farmers. Dakota Spirit employs 38 plus many indirect jobs. The addition of the soybean crushing facility will further enhance the economic impact for the local communities and state.

Why the project is needed:

There is increasing global pressure for a less carbon intensive energy future. Efficient baseload power plants, such as Spiritwood Station, are critically important for the stability and reliability of the bulk electric system and the economic health and vitality of the upper Midwest. Converting the state-of-the-art and efficient Spiritwood Station's fuel source to biomass benefits the environment, Great River Energy's steam customers and its members.

With increasing pressure of renewable fuel standards and other environmental factors, Spiritwood Station needs to evaluate less carbon intensive fuels, specifically CTRTs. Low carbon solid fuels are of emphasis due to their stable pricing and guaranteed availability.

Background/Qualifications

See Appendix B for applicants Resumes.

Background:

Great River Energy began evaluating the potential fuel source of CTRTs in February of 2021. This included an information gathering phase, fuel handling phase, and a boiler performance phase.

The informational phase of the project focused on CTRT fuel data, boiler operational concerns, fuel handling. GRE sent various CTRT samples to Missouri Valley Testing Laboratory Inc. for fuel property analysis. Informational reports from three vendors were commissioned to understand the potential impacts of burning

this type of fuel in the current boiler. The team also toured other biomass handling facilities to understand available equipment technologies.

In July of 2021, Jansen Combustion and Boiler Technologies, Inc. was commissioned to perform an engineering evaluation of the Circulating Fluidized Bed Boiler to Fire Railroad Crossties (RRCTs). The summary of this effort suggests that the existing CFB boiler system can combust RRCT's efficiently and within emissions specifications. See appendix D for study details.

Smith Monroe Gray Engineers, Inc. was commissioned to evaluate the feasibility of using our existing coal fuel handling equipment. They issued a report detailing the proposed changes to our system as well as a +50% contingency budget. This was coupled with a Great River Energy estimate for the internal fuel handling system requirements and asset retirements.

Great River Energy is working with EERC to perform a test burn of the proposed biomass in their CFB boiler. The test burn is expected to be completed in 2022. The goal is to understand the ash characteristics of this material under similar combustion conditions.

Management

Project management best practices will be utilized to ensure deliverables defined in the scope document are completed satisfactorily. The project team will be utilizing the tasks listed above to develop project milestones, track progress, evaluate results, and ensure deliverables are met. Regular project meetings will be used to ensure information is distributed to the appropriate group and any questions are answered in a timely manner.

Timetable

Refer to appendix D.

Budget

| Project Associated Expense | NDIC's Share | Applicant's Share (Cash) | Applicant's Share (In-Kind) | Other Project Sponsor's Share |
|-----------------------------------|---------------------|---------------------------------|------------------------------------|--------------------------------------|
| FEED Study | \$66,500 | \$66,500 | | |
| Total | \$66,500 | \$66,500 | | |

Patents/Rights to Technical Data

Great River Energy retains the rights to all technical information derived from the FEED Study.

State programs and incentives

Great River Energy was awarded a grant for the carbon capture project “pre-FEED” at Coal Creek Station. The grant was from NDIC for \$4,239,000 via NDIC contract FY20-XCI-224. Later, this contract was assigned to EERC to complete the project.

Appendix A: Spiritwood Station – Biomass Fuel Conversion FEED Scope

Scope: Evaluate processed creosote treated railroad tie annual fuel availability and delivered cost to Spiritwood Station and develop a FEED level capital project cost estimate ($\pm 15\%$) associated with the design, permitting, earthwork, equipment, construction, and commissioning of the Spiritwood Station Biomass Fuel Conversion project.

Purpose: Due to the upcoming sale of Coal Creek Station, Great River Energy is evaluating alternative lower carbon fuel availability, fuel costs, and the capital costs of converting the boiler, fuel handling system, and ash handling system to replace coal with biomass, specifically creosote treated railroad cross-ties (CTRT's).

Background: Spiritwood Station is a currently combined heat and power (CHP) dried lignite circulating fluidized bed (CFB) facility capable of generating up to $\sim 800,000$ lbs/hr of high pressure steam to a 99 MWe_{gross} steam turbine and can supply up to 520 kpph of LP extraction steam for customer use. Maximum heat input with coal is approximately 1,100 MMBtu/hr (HHV) but is estimated to be limited to 891 MMBtu/hr (HHV) (81% MCR) on biomass to limit gas velocities at the inlet of the U-beams.

Ambient Design Conditions:

1. Location and Elevation
 - a. Latitude: 46.925640°N
 - b. Longitude: 98.499512°W
2. Site Elevation (ASL): 1,480 ft
3. Site Atmospheric Pressure: 13.92 psia
4. Climate
 - a. Mean Temperature: 40.6°F
 - b. Mean Relative Humidity 40%
 - c. Recorded Lowest Temperature: -40°F (ASHRAE)
 - d. Recorded Highest Temperature: 107°F (ASHRAE)
 - e. Heating Design Temperature (Dry Bulb): -21°F (99.6% ASHRAE)
 - f. Cooling Design Temperature (Dry Bulb): 92°F (0.4% ASHRAE)
 - g. Cooling Design Temperature (Mean Coincident Wet Bulb): 70°F (0.4% ASHRAE)
 - h. Average Windspeed: 5.5 mph
 - i. Predominant Wind Direction: Northwest
 - j. Rainfall Event (5 year/24 hour): 2.9 inches
 - k. Rainfall Event (110 year/24 hour): 5.0 inches
 - l. Average Annual Precipitation (Rainfall): 19 inches
 - m. Average Annual Snowfall: 38 inches
 - n. Average Frost Depth: 4.5 ft
 - o. Extreme Frost Depth: 6.0 ft.
5. The area surrounding Spiritwood Station is primarily agricultural.

Design Criteria:

1. Biomass fuel analysis
 - a. Average moisture (mass %, wet) = 30%
 - b. Average density = 15 lb/ft³ (volume calcs); 25 lb/ft³ (weight calcs)
 - c. Average HHV (wet) = 7,178 Btu/lb
 - d. Average size = 2" minus (shred/grind)

2. Biomass fuel delivery system capacity
 - a. Minimum = 4 tons/hr (when co-firing with 80% NG)
 - b. Maximum = 80 tons/hr
 - c. Onsite covered storage capacity = 4,000 tons (minimum)
 - d. Maximum annual quantity = 7 million ties per year (500,000 tons)
3. Available Power
 - a. 480V from Coal Unloading Bldg. for external fuel handling
 - b. 480V from 7th floor boiler bldg. for internal fuel handling
4. Local Railroad
 - a. GRE owns a spur off the BNSF main rail

Fuel Supply Evaluation Scope Includes:

- Locate and assess availability of viable sources of creosote railroad ties; up to a maximum of 7 million ties per year (500,000 tons/year)
- Predict delivered and processed (2" minus) tiered fuel pricing structure based on annual quantities & availability; for example, first 100,000 tons/year at \$XX/ton, next 100,000 tons/year at \$YY/ton, etc. – assuming costs increase as shipping distance increases

Capital Cost Estimate (FEED) Scope Includes:

- Soils analysis
- Engineering, including all travel costs
- Project Schedule
- Equipment specifications
- Environmental permitting
- Construction permitting
- Construction Stormwater pollution prevention (Stormwater pollution prevention plan (SWPPP)) – during and post construction
- Site preparation including soil Stabilization
- Excavation
- Compaction
- Foundations
- Equipment grounding system
- Cathodic protection system (as required)
- Underground utilities including but not limited to:
 - Fire suppression water supply pipe (Design Pressure =175 psig; Design Temperature =100°F):
 - Wastewater return pipe from fuel storage building to coal unloading sump (Design Flow = 100 gpm; Design Pressure = 128 psig; Design Temperature = 100 °F)
 - Control / Instrument / Communications Cable Tray/Conduit or Concrete Duct Bank for all underground instrument cabling
 - Power Cable Tray/Conduit/Concrete Duct Bank for all underground power cabling
- Fuel handling equipment consisting of:
 - Fuel receiving hopper at fuel custody transfer interface (see Diagram 1)
 - Covered fuel transfer conveyor with access platform from fuel receiving hopper to fuel storage
 - Covered fuel storage bypass conveyor
 - Covered fuel storage building; 4,000 tons minimum capacity; include provisions for preventing contact water or leachate collection system

- Shuttle distribution conveyor with access platform inside storage building
 - 2 x 100% under pile traveling screw reclaimers
 - Covered fuel transfer conveyor from fuel storage to rail unloading building
 - Evaluation of existing conveyor from rail unloading to coal silo (1003 conveyor) for conversion from coal to biomass
 - Coal silo bypass conveyors from 1003 conveyor to existing coal bunkers
 - All necessary coal bunker modifications from coal to biomass
 - Live bottom metering bins
 - Fuel chutes to front side of CFB
 - Covered conveyors & fuel chutes to rear side of CFB (break out this pricing option separately)
 - All associated structural steel & access platforms for major equipment
- Circulating Fluidized Bed (CFB) boiler modifications
 - Boiler/tube modifications for enlarged (3 ft x 4 ft) fuel openings on front side of CFB
 - Boiler/tube modification for enlarged (3 ft x 4 ft) fuel opening on rear side of CFB (break out this pricing option separately)
- All structural steel required to accommodate fuel handling and CFB modifications
 - Fire detection system for fuel storage building
 - Fire suppression system consisting of hydrant near fuel storage & hydrant near fuel processing facility
 - Continuous emissions monitoring system for Commercial Industrial Solid Waste Incinerator (CISWI) designation
 - Drawing management services during design, construction, and commissioning
 - Released for Construction drawings in pdf or native format
 - As-Built drawings in native format with attributed GRE title block (DWG, Excel, Word, etc.)
 - Construction labor, materials, consumables, & equipment
 - Construction management
 - Construction engineering support
 - Commissioning labor including OEM field support
 - General painting
 - Class V restoration from construction
 - G&A Expenses
 - 5.5% IDC
 - 15% Contingency

Deliverables:

- Report summarizing national CTRT availability as a fuel source and the predicted costs (shipped, processed, & delivered) to Spiritwood Station based on annual quantities
- Detailed line item FEED capital estimate - Excel spreadsheet
- Overall conceptual site layout & general arrangement drawings (plan & elevation views) in .DWG format
- Preliminary Process flow diagrams (PFD's) in .DWG format
- Preliminary Piping & Instrument Diagrams (P&ID's) in .DWG format
- Electrical load list in Excel spreadsheet
- Overall project schedule including permitting, design, procurement, construction, commissioning, and an anticipated in-service date

Information to be included with proposal submittal:

- Cost and schedule for developing CTRT availability and anticipated cost report
- Cost and schedule for performing FEED cost estimate and submittals as listed above



Appendix B: Resumes

Glenn Hauck, PMP

Andover, MN 55304 | 612-308-9555 | glennh1222@gmail.com | www.linkedin.com/in/glennhauck

High-achieving, disciplined Management Professional with an impressive record of optimizing processes and systems, identifying, and implementing cost savings while improving efficiency, quality, and profitability in an industrial environment. Strategic thinker who easily assimilates to new processes and technologies to quickly identify capital improvement project opportunities, develop project plans, and implement efficient installation solutions. Inspirational, agile, and results-driven leader adept at cultivating collaborative environments, inspiring potential and leading operational teams who minimize costs while maximizing output and quality.

AREAS OF EXCELLENCE

5S+ Lean Profit and Loss (P&L) Team Leader

Workforce Optimization Cost Control/Reduction Plant Operations

Organization Leadership Project Management Quality Management

Culture Development Design Engineering Capital Improvement

Professional Experience

Great River Energy, Maple Grove MN 2000-PRESENT

PLANT MANAGER (MAY 2021 – PRESENT)

- Managed and lead overall plant operations, including facilities management and security, ensuring the achievement of plant targets for safety, efficiency, service, and cost.
- Led the plant workforce to maximize productivity and teamwork. Recommends and coordinates the daily and long-term plant operating schedules considering the power production needs, maintenance priorities, and fuel storage capacity and availability.
- Delivered on established budget of \$56M.
- Effective, cost-efficient planning and utilization of manpower, materials and equipment resulting in reduced planned outage duration and optimization/coordination of resources.
- Reduced incident rate by creating an atmosphere that embraced safe work practices by implementing scheduled “tail-gate” safety talks, reporting of near-misses and regular job safety analysis.
- Developed and implemented training resources for plant personnel development of electrical and instrumentation training manual allowing apprentices to become fully qualified journeyman workers.
- Oversaw the plant’s environmental compliance ensuring required preventive maintenance and internal/external audits are completed in accordance with highest operating standards.
- Provided technical support for plant operations and maintenance programs, reducing impact of equipment failures and downtime.
- Provided direction and leadership in development and documentation of safety and craft training programs.

LEADER, PROJECT RETIREMENT (MARCH 2019- MAY 2021)

- Manage and lead overall demolition activities of the Elk River Resource Recovery Project (ERRRP), ensuring the achievement of project targets for safety, environmental stewardship, efficiency, and cost.
- Lead the core project team to establish project timelines, apply for necessary permits, contract management, and ensure environmental requirements are met.
- Reduce incident rates by creating an atmosphere that embrace safe work practices by implementing scheduled “tail-gate” safety talks, reporting of near-misses and daily job safety analysis.

- Develop and manage a communication plan to inform internal and external stakeholders of important time sensitive communications.
- Deliver on established budget of \$13M.
- Manage three facilities located separately and includes site security, building and grounds maintenance, and landfill management.

PLANT MANAGER (2016 – MARCH 2019)

- Managed and lead overall plant operations, including facilities management and security, ensuring the achievement of plant targets for safety, efficiency, service, cost, and set a new all-time production record 303,449 tons of Refuse Derived Fuel (RDF) burned in 2018.
- Led the plant workforce to maximize productivity and teamwork. Recommends and coordinates the daily and long-term plant operating schedules considering the power production needs, maintenance priorities, and fuel storage capacity and availability.
- Delivered on established budget of \$18.5M, holding 0% increase over past 2 years while maintaining high level record unit availability.
- Effective, cost-efficient planning and utilization of manpower, materials and equipment resulting in reduced planned outage duration and optimization/coordination of resources.
- Reduced incident rate by creating an atmosphere that embraced safe work practices by implementing scheduled “tail-gate” safety talks, reporting of near-misses and regular job safety analysis.
- Developed and implemented training resources for plant personnel development of electrical and instrumentation training manual allowing apprentices to become fully qualified journeyman workers.
- Oversaw the plant’s environmental compliance ensuring required preventive maintenance and internal/external audits are completed in accordance with highest operating standards.
- Provided direction and leadership in development and documentation of safety and craft training programs.
- Provided technical support for plant operations and maintenance programs, reducing impact of equipment failures and downtime.
- Implemented and directed plant efficiency efforts to optimize plant performance.
- Led and ensured growth of company’s culture by providing resources, participating in teams, and coaching and mentoring teams as needed.
- Communicated monthly production performance of the project to plant personnel and senior management, to insure alignment of project performance metrics and goals.
- Represented the plant operations and initiatives at internal and public meetings, forums, trade organizations.

Education

UNIVERSITY OF PHOENIX 2018 – PRESENT

BS Business Management – May 2021

Project Management Certificate Completed July 2020

DUNWOODY INSTITUTE

Electrical Construction and Maintenance

UNITED STATES NAVY, NAVAL FIRE CONTROL TECHNICIAN SCHOOLS

Basic and advanced electronics, troubleshooting and maintenance techniques of AN/SPG 53F Radar system, update radar maintenance skills and techniques.

PROFESSIONAL LICENSES AND CERTIFICATIONS

Project Management Professional Certification 2908938

Licensed Class A Master Electrician, MN License AM007599

Licensed Class A Journeyman Electrician, MN License AJ015176

Certificate of completion of Apprenticeship Instrument Technician-Electrician MN

William P. Gallagher

(612) 805-8820 (mobile)

wgallagher1998@gmail.com

EDUCATION:

University of Wisconsin - Madison
College of Engineering
Madison, WI
Bachelor of Science in Mechanical Engineering, May 1994

EXPERIENCE:

Great River Energy – Maple Grove, Minnesota

Portfolio Project Manager – Power Supply Division - (04/12 – Present)

Responsibilities include:

- Perform financial analysis of operating scenarios with diverse fuels (coal, oil, gas, biomass, and RDF) and biofuel steam customers for Business Development Division
- Maintaining all capital project schedules and spend forecasts utilizing Primavera (P6) for the Power Supply Division
- Generating monthly variance reports for Project Management Office (PMO)
- Establishing and administering capital project prioritization process for Power Supply Division portfolio review
- Participating in Enterprise Project Management Office (EPMO) monthly capital review
- Preparing annual capital budget and long-term capital forecasts for Finance Division and Senior Staff
- Communicating year-end summary and capital project review to Board of Directors – Power Supply Subcommittee
- Administering budget approval process for new and incremental capital spending

Senior Project Manager - (01/08 – Present)

Responsibilities included:

- Mechanical engineering and project management support - All generating facilities, focus on Spiritwood Station (99 MW Coal Fired Combined Heat & Power (CHP))
- Project Manager - \$4.25M Utility Metering Facility, Spiritwood Station
- Construction Management & Commissioning Engineer - Spiritwood Station
- Construction Management & Commissioning Engineer - Elk River Peaking Station (185 MW Simple Cycle)
- Project Management and Project Engineer - Lakefield Junction Station (120 MW Combined Cycle Conversion Analysis)

Bixby Energy Systems – Brooklyn Park, Minnesota

Engineering Manager and Technical Support Manager - (01/04 – 12/07)

Responsibilities included:

- Managing and maintaining department staffing, workload, budget, and schedule
- Developing and implementing department processes and documents (i.e., personnel review process, drawing development process, engineering change process, job descriptions, etc.)
- Ensuring that appropriate design standards and quality checks are in place
- Maintaining a positive, creative, and rewarding work environment
- Researching alternative biomass technologies (pyrolysis and gasification)
- Acting Project Engineer for cost reduction phase of current biomass stove product

Project Engineer - (11/03 – 12/07)

Responsibilities included:

- Participating in product design process (market research, conceptual design, prototyping, agency testing, production, and continuous improvement) for three new Bixby products
- Providing technical guidance for engineers developing Bixby Energy's biomass stove products
- Creating, reviewing, and approving engineering changes for Bixby Energy's products
- Creating and maintaining project schedules and prioritizing project tasks for Bixby Energy's biomass stove projects
- Researching biomass fuels and potential applications

Deltak LLC - Plymouth, Minnesota

Project Engineer – (09/03 – 11/03)

Assigned to Specialty Boiler System Division.

Responsibilities included:

- Maintaining engineering budget and schedule
- Resolving technical issues
- Interfacing with the customer and Project Manager for all technical requirements of the project
- Requisitioning auxiliary boiler equipment such as emission reduction catalysts, fans, pumps, and burners
- Approving engineering documents and customer submittals

Mechanical Engineering Supervisor & Senior Mechanical Engineer – (11/98 – 09/03)

Assigned to Gas Turbine Heat Recovery Steam Generator (HRSG) Division.

Responsibilities included:

- Maintaining desired staffing levels and the Mechanical Engineering (ME) Department schedule
- Approving and guiding individual ME training activities
- Providing annual performance reviews and salary adjustments
- Conducting the thermal and hydraulic design of industrial heat recover steam generators
- Troubleshooting field erection, startup, and operational issues for the customer, plant managers, plant engineers, and plant operators
- Training recently hired engineers
- Presenting boiler operator training seminars to plant operations and plant engineers
- Checking mechanical engineering documents and customer submittals
- Evaluating onsite HRSG performance

Black & Veatch - Kansas City, Missouri

Mechanical Engineer – (07/95 – 10/98)

Assigned to Mechanical System Engineering Division.

Responsibilities included:

- Designing compressed air, fire protection, and fuel oil systems for a coal fired power block
- Developing equipment specifications and administering contracts with suppliers
- Evaluating the condition of mechanical equipment such as compressors and chillers at several chemical plants
- Designing and implementing a city potable water system at a coal fired plant

Joint Warfare Analysis Center - Dahlgren, Virginia

Mechanical Engineer – (07/94 – 07/95)

Cleared for top-secret information and granted access to sensitive compartmentalized information based on a special background investigation completed by DIS on 02/27/95

Responsibilities included large-scale systems analysis and development of simulation models

Northern States Power Company - Sherburne County Generating Facility - Becker, Minnesota

Engineering Intern – (08/91 – 01/93)

Responsibilities included design calculations, project estimates and proposals, small project supervision, and plant maintenance

ADDITIONAL INFORMATION:

- Primavera (P6) Administrator
- Adept Document Management Administrator
- Passed EIT, Intern Engineer No. 12135

EATHAN R. GUMKE

(701)-301-1639

1301 15th Ave SW
Jamestown, ND 58401

egumke@grenergy.com

SUMMARY

I am an engineer with an achieving nature that strives to improve myself, others, and things around me. My engineering knowledge allows me to make analytical decisions and have strong insights about thermo plant processes. Utilizing these skills, I enjoy optimizing plants to ensure they run at their best.

EDUCATION

| | | |
|---------------------|---|------------------------|
| <i>2020-Present</i> | M., Business Administration <i>University of North Dakota</i> | <i>Grand Forks, ND</i> |
| <i>2018</i> | B.S., Mechanical Engineering <i>North Dakota State University</i> | <i>Fargo, ND</i> |

WORK EXPERIENCE

| | | |
|---------------------|---|--|
| <i>2020-Present</i> | Engineer II at Great River Energy Spiritwood Station <ul style="list-style-type: none">▪ Thermal plant performance▪ Plant control design▪ Plant optimization▪ Large project & budget management▪ Plant outage management▪ Procedure development | <i>Spiritwood, ND</i> |
| <i>2018-2020</i> | Engineer I at Great River Energy Spiritwood Station <ul style="list-style-type: none">▪ Lead projects with increasing scope▪ Mechanical system troubleshooting▪ Process system troubleshooting▪ Coal boiler optimization | <i>Spiritwood, ND</i> |
| <i>2017-2018</i> | Mechanical Engineering Intern at Great River Energy Spiritwood Station <ul style="list-style-type: none">▪ Created and managed P&ID drawing system▪ Mechanical system troubleshooting▪ Lead projects with limited scope | <i>Spiritwood, ND</i> Lead projects with increasing scope |

SKILLS

- Independent
- Time management
- Teamwork driven
- Peer development
- Demonstrable communication skills
- Demonstrable work ethic and fast learner
- Problem Solver
- Proficient with Microsoft Office, Word, Excel, Outlook, PowerPoint
- Proficient with industry-related programs CREO Parametric, AutoCAD 2019, ABB Symphony +

Appendix C: Tax Liability Affidavit

STATE OF MINNESOTA)
) ss.
COUNTY OF MILLE LACS)

AFFIDAVIT REGARDING APPLICANT

I, Steve Leyh, under oath or affirmation make the following statements:

1. Steve Leyh is the Controller of Great River Energy, a Minnesota cooperative corporation, the corporation named as applicant in the "Front End Engineering and Design (FEED) Study for Creosote Treated Railroad Ties at Spiritwood Station."
2. Said applicant's principal place of business is at 12300 Elm Creek Blvd, Maple Grove, Minnesota.
3. Applicant has no outstanding tax liability owed to the state of North Dakota or any of its political subdivisions.

Affiant knows the matters herein stated are true and makes this affidavit for the purpose of meeting the application requirements set forth in North Dakota Administrative Code chapter 43-03-04, section 1.15.



Steve Leyh

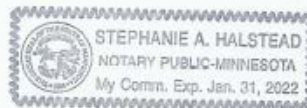
Subscribed and sworn to before me

by Steve Leyh
this 19th day of January, 2022.

This instrument was drafted by:

GREAT RIVER ENERGY
12300 Elm Creek Blvd
Maple Grove, MN 55369-4718


Notary Public



Appendix D: FEED Proposal Document

ENCLOSURE B. RESUMES



Mark H. Dittus, P.E.

Mark Dittus is the Operating Asset Modifications & Upgrades Portfolio Manager and a Project Director within Black & Veatch's Energy & Process Industries business line. He has experience executing plant upgrade projects on domestic and international power facilities. His experience encompasses feasibility analysis, conceptual design, detailed design and field experience for operation, troubleshooting, and construction.

GREAT RIVER ENERGY PROJECT EXPERIENCE

Great River Energy; SWS Turbine Control System Replacement; North Dakota, United States; 2018-In-Progress

Project Manager - Black & Veatch. Developed detailed design documents and technical material procurement and installation specifications for a replacement Turbine Control System on the Spiritwood Generating Station.

Great River Energy; Stanton Station Steam Turbine Addition Study; North Dakota, United States; 2007

Project Manager - Black & Veatch. Responsible for development of conceptual design on a 70 MW steam turbine addition to an existing facility. The facility consists of two steam generators feeding one steam turbine. The conceptual design included developing all BOP facilities required to operate the plant as two independent units, including separate condensate systems, feedwater systems, and auxiliary electrical systems. A site arrangement and detailed cost estimate were developed for the complete project.

Great River Energy; Stanton Station Soot Blower Regulating Station Relocation & Deaerator Dump System Modifications; North Dakota, United States; 2006

Project Manager - Black & Veatch. Responsible for the relocation of a soot blower regulating station and deaerator dump system modifications. Included complete design of modifications, preparation of material purchase orders, and preparation of installation details on 1 x 200 MW PC steam generator.

Great River Energy; Fuel Switch Study; Stanton Station; North Dakota, United States; 2004-2005

Mechanical Engineer - Black & Veatch. Responsible for designing the steam inerting system to allow switching from lignite to PRB fuel. Responsibilities included design of arrangement, piping layout, and valve selection for two steam generators.

OTHER RECENT PROJECT EXPERIENCE

LG&E-KU; E.W. Brown Units 1 & 2 Isolation, Separation & Demolition Specification Package; Kentucky, U.S.; 2021-In-Progress

Project Consultant - Black & Veatch. Providing consulting support for the isolation, separation and demolition of coal fired Units 1 & 2 and associated facilities at the E.W. Brown Generating Plant. The project will identify

PROJECT DIRECTOR

EXPERTISE:

Air Quality Control; Biomass; Boiler Upgrades; Coal; Combustion Turbine; Consulting Engineering Services; Steam Generation Technologies

EDUCATION

Master of Business Administration, Business Administration, University of Kansas, 2001, United States
Bachelor of Science, Mechanical Engineering, North Dakota State University, 1993, United States

PROFESSIONAL REGISTRATION

License, Professional Engineer, Mechanical, #14898, Kansas, United States, 1998

TOTAL YEARS OF EXPERIENCE

28.5

BLACK & VEATCH YEARS OF EXPERIENCE

28.5

PROFESSIONAL ASSOCIATIONS

PTC 4.4 Committee - Member

LANGUAGE CAPABILITIES

English

OFFICE LOCATION

Overland Park, Kansas, USA

isolation and separation points between Units 1 & 2 and Unit 3, which currently remains in service. Project engineering activities will result in a separation, relocation and demolition specification package.

Doyon Utilities; DSI Design; Alaska, United States; 2020-In-Progress

Project Manager - Black & Veatch. Black & Veatch develop the initial concept and cost estimate for installation of a new Dry Sorbent Injection system for SO₂ control. Following approval of the conceptual design, detailed design activities began including balance of plant design, major equipment procurement, and project schedule development.

Kansas City Power & Light; Various Projects at La Cygne Generating Station; Kansas, United States; 2017-In-Progress

Project Manager - Black & Veatch. Black & Veatch has performed a multitude of small design and installation projects to support operation of the La Cygne generating station. The projects include panel replacements, battery upgrades, motor startup upgrades, high energy piping system evaluations and modifications, fan studies to improve unit heat rates, and auxiliary boiler replacement cost estimates. On these projects the scope has varied from conceptual design and cost estimating to detailed design, development of procurement documents, and providing technical assistance during installation.

Kansas City Power & Light; Auxiliary Cooling Water Heat Exchanger Study; Missouri, United States; 2013-In-Progress

Project Manager - Black & Veatch. Performing a system analysis for the existing auxiliary cooling water heat exchangers to develop a means of reducing pluggage issues. The system currently experiences significant buildup from debris brought in from the river, the study is determining alternative means of removing the debris.

Kansas City Power & Light; Various Retrofit and Plant Betterment Projects; Kansas, United States; 2013-In-Progress

Project Manager - Black & Veatch. Project Manager for various retrofit projects being performed at Iatan, Hawthorn, La Cygne, Lake Road, Sibley, and Montrose stations. Projects encompass a multitude of systems and equipment including MCC replacements, battery system replacements, relay system upgrades, startup valve replacements, and piping system modifications and reviews.

Muscatine Power and Water; Effluent Limitation Guideline Study; Iowa, United States; 2019-2020

Project Manager - Black & Veatch. Managed an ELG compliance study, which included a flow measuring and sampling plan to provide information for a plant water balance and subsequent design basis for alternative wastewater treatment alternatives. A screening study of identified options was performed.

Mark R. Bleckinger, P.E.

Mark R. Bleckinger is a Project Manager and the Thermal Generation Services (TGS) Resource Manager within the Black & Veatch Energy & Process Industries business line. He is involved in all aspects of the Black & Veatch Thermal Generation Services Technical Program. Mark's recent experience has been to manage 16 Steam Generator, AQC, Carbon Capture and Biofuels/Hydrogen subject matter specialists and to provide technical direction for engineering, procurement, and construction (EPC) proposals, conceptual/detailed designs, and multipollutant studies that have featured sulfur dioxide, NO_x, CO₂ and particulate air pollution control technologies. In addition, Mark's duties include supporting detailed design of AQC projects with technical and process support and maintaining updated knowledge of the regulatory environment associated with air quality compliance. Mark previously worked for Nooter-Eriksen as a Thermal Design Engineer designing heat recovery steam generators (HRSGs) and as a Process Design Engineer working on Enviroscrib multipollutant control technology and pressurized fluidized bed combustion (PFBC).

SELECTED PROJECT EXPERIENCE

Prairie State; WFGD Byproduct Dewatering Conceptual Design; Illinois, United States; 2021-2022

AQC Specialist - Black & Veatch. Conceptual design of a gypsum dewatering system. Prepared design basis for the horizontal belt filters, process flow diagrams, building layouts, tank sizing and cost estimates.

Various Clients; Direct Air Capture Technology Reviews; United States; 2021-2022

Engineering Manager - Black & Veatch. Led a team of specialists reviewing the design and technology maturation of multiple direct air capture technologies. Review included evaluating the status of the design and potential for scale-up and/or scale-out of the technology. Also reviewed technical economic analysis for the technologies.

Ameren Rush Island – WFGD Study; Missouri, United States; 2020

Engineering Manager - Black & Veatch. Evaluated and updated design criteria for existing plant operating conditions. Reviewed and updated equipment sizing and scope of work. Coordinated design review by civil, electrical and mechanical engineering.

NETL/DOE; Flexible Baseline Study; Missouri, United States; 2020-Ongoing

Boiler Specialist - Black & Veatch. Evaluated boiler design modifications to improve overall plant operating flexibility including startup, shutdown and unit turndown. Evaluated costs impacts for these modifications as well as overall impact on flexibility metrics.

PROJECT MANAGER AND THERMAL GENERATION SERVICES RESOURCE MANAGER

EXPERTISE:

Air Quality Control; CEMS Systems; Emissions Testing; Engineering Management

EDUCATION

Bachelor of Science, Chemical Engineering, Minor in Chemistry, University of Minnesota, 1996, United States

PROFESSIONAL REGISTRATION

License, Professional Engineer, Chemical, #2008002135, Missouri, United States, 2008

TOTAL YEARS OF EXPERIENCE

27.5

BLACK & VEATCH YEARS OF EXPERIENCE

15.5

LANGUAGE CAPABILITIES

English

OFFICE LOCATION

Overland Park, Kansas, USA

Vectren; Brown - Combined Cycle; Indiana, USA; 2018 -2019

HRSO Specialist - Black & Veatch. Prepared HRSO Specification including SCR and CO catalyst requirements and emissions performance guarantees.

PLN / Sumitomo; Tanjung Jati B Unit 5 & 6; Central Java, Indonesia;

2014-In-Progress

AQCS Engineer - Black & Veatch. Assisted Project team with specifications and design review. Technologies include Electrostatic Precipitator, Seawater FGD, and Gas to Gas Heater (GGH). 2 x 1000 MW coal fired power plant.

EVN / Sumitomo; Duyen Hai Unit 3 Extension; Tra Vinh, Viet Nam;

2014-2020

AQCS Engineer - Black & Veatch. Supported the project team with specifications and design review. Technologies include SCR, Seawater FGD, Electrostatic Precipitator, and GGH (gas to gas heater). 660 MW coal plant.

Samcheionpo 5; Korea, Republic of; 2018-2019

AQCS Specialist - Black & Veatch. Review Design Basis and specifications for WFGD, SCR, WESP and ESP.

PowerSouth; Lowman JBR Operation Efficiency Review; Alabama,

United States; 2016

AQCS Engineer - Black & Veatch. Reviewed Operational Data to identify operational issues effecting the performance of the JBR (WFGD). 2 x 236 MW coal fired power plant.

DTE Energy; DTE DSI Program; Michigan, United States; 2013-2016

Lead AQC Engineer - Black & Veatch. Prepared specification for DSI and ACI equipment, evaluated bids, and developed design basis for all units. Developed options for monitoring HCl and PM with CEMS.

KCP&L; Sibley 3 ESP Retrofit; Missouri, United States; 2015

AQCS Engineer - Black & Veatch. Reviewed bids for the ESP retrofit project for scope and material conformance. 420 MW Coal Plant.

Sam J. Riley, P.E.

Samuel J. Riley leads the Bulk Material Handling (BMH) section within Black & Veatch's Energy & Process Industries business and is a licensed engineer in the state of Minnesota. His responsibilities include all stages of project development, including feasibility studies, preliminary and final system design, specifications, and final design review of bulk handling systems. In addition, Sam manages the work load of the BMH section and the continual development of its specifications, datasheets, and procedures. He has 15 years of experience working domestically and abroad on bulk handling systems related to fly ash, bottom ash, biomass (pellets, chips, logs), waste (municipal solid waste [MSW], refuse derived fuel [RDF], feedstock, and pellets), coal, limestone, gypsum, and urea. Sam has taught the BMH portion of the University of Missouri-Kansas City Power Generation class, ME454, and given other presentations related to ash conversions and material handling.

SELECTED PROJECT EXPERIENCE

Prairie State; Saleable Gypsum Expansion; Illinois, United States; 2021-In-Progress

Bulk Material Handling Engineer - Black & Veatch. Conceptual design for an expanded saleable gypsum process. New conveyor arrangements, modification of the existing conveyor arrangements and a cost estimate.

City of Minneapolis; Quicklime Receiving, Storing, and Slaking

Retrofit Project; Minnesota, United States; 2019-In-Progress

BMH Engineer - Black & Veatch. Responsible for assisting the client with evaluating multiple technologies for quicklime handling. Scope included rail and truck deliveries, conveying by mechanical conveying and pneumatic conveying, and multiple storage configurations.

BULK MATERIAL HANDLING SPECIALIST

EXPERTISE:

Ash Handling; Biomass; Bulk Material Handling; Coal; Coal Combustion Residual (CCR) / Effluent Limitation Guidelines (ELG) Ash Conversions; Consulting Engineering Services; Gasification; Mentor; Waste to Energy (WTE), Refuse Derived Fuel (RDF)

EDUCATION

Bachelor of Science, Mechanical Engineering Technology, Mechanical, Michigan Technological University, 2004, United States

PROFESSIONAL REGISTRATION

License, Professional Engineer, Mechanical, #47939, Minnesota, United States, 2009

TOTAL YEARS OF EXPERIENCE

23

BLACK & VEATCH YEARS OF EXPERIENCE

16.5

PROFESSIONAL ASSOCIATIONS

Powder River Basin (PRB) Coal Users' Group - Member

LANGUAGE CAPABILITIES

English

OFFICE LOCATION

Ann Arbor, Michigan, USA

TVA; Coal Chutes and Load Zones Project; Kentucky, United States;

2019-2021

BMH Engineer - Black & Veatch. Responsible for supporting the client with engineering services to retrofit coal handling chutes, gates, and belt conveyor loading zones. Scope of work includes conceptual design development, detail design, and construction management.

Arizona Public Service Company (APS); Cholla Unit 1 Biomass

Conversion Study; Arizona, United States; 2019

BMH Engineer - Black & Veatch. Responsibilities include the following:

- Conceptual design of a wood handling system to receive wood chips.
- Storing, processing, drying, and shredding the chips, then delivering them

to the boiler.

Energy Works Hull; Waste to Energy (WTE) Gasifier Project; England, United Kingdom; 2018-2019

BMH Engineer - Black & Veatch. Responsible for supporting commissioning with technical assistance regarding start-up issues and technical support of a previously designed gasifier and material recovery facility.

Ince Biopower Limited; Biopower Project; England, United Kingdom; 2018-2019

BMH Engineer - Black & Veatch. Responsible for assisting the project team with troubleshooting and resolving material handling issues related to gasifier feed, level detection, dust collection, and ash handling.

Malinau Biomass Plant; Global; 2016

BMH Engineer - Black & Veatch. Responsible for providing conceptual layout of biomass wood chip handling system, including receiving logs, chipping, storage, reclaim, and delivery into the boiler.

Karen A. Whitehead, P.E.

Karen A. Whitehead is a Mechanical Engineer within Black & Veatch's Power business and the technical lead for Boiler & Air Quality subject matter within the Thermal Generation Services group. Her responsibilities include preparation of system analyses, system design, and performance evaluations for boiler equipment, draft equipment, auxiliary equipment, heat recovery steam generators (HRSGs), and slagging / fouling control equipment. Karen's additional skills include technical writing, specification development, combustion analysis, draft system analysis, and cost estimation.

SELECTED PROJECT EXPERIENCE

Ince Park; Cheshire, England, United Kingdom; 2018-2019

Gasifier / Boiler Engineer - Black & Veatch. Assisted in tuning and commissioning activities associated with this waste-to-energy facility firing construction and demolition (C&D) wood fuel. System consisted of a fluidized bed gasifier, combustion chamber, heat recovery boiler, draft equipment, and emissions reduction equipment. Primary involvement was on tuning of the gasifier and combustion system to reduce severe slagging issues. Coordinated combustion and fluid modeling activities performed.

E.On; Blackburn Meadows CFB Studies; Sheffield, England, United Kingdom; 2018-2019

Boiler Specialist - Black & Veatch. Assisted in several studies for the wood-fired CFB concerning the sand utilized, planned repairs to the waterwalls, and operational problems recently encountered. Provided recommendations for plant improvements.

STEAM GENERATION SECTION ENGINEER

EXPERTISE:

Air Quality Control; Biomass; Boiler / Heat Recovery Steam Generator (HRSG) Thermal Design; Boiler Upgrades; Boilers; Coal; Consulting Engineering Services

EDUCATION

Bachelor of Science, Mechanical Engineering, Minor: Mathematics, Bradley University, 2006, United States

PROFESSIONAL REGISTRATION

License, Professional Engineer, Mechanical, #21748, Kansas, United States, 2011

License, Professional Engineer Intern (EIT), Mechanical, #61.032626, Illinois, United States, 2006

TOTAL YEARS OF EXPERIENCE

18.5

BLACK & VEATCH YEARS OF EXPERIENCE

15.5

PROFESSIONAL ASSOCIATIONS

National Fire Protection Association - NFPA 85 NBB
Technical Committee Member - Alternate

National Fire Protection Association - NFPA 85 HRS
Technical Committee Member - Alternate

LANGUAGE CAPABILITIES

English

OFFICE LOCATION

Overland Park, Kansas, USA

Greif Brothers; Boiler Rerate Study; Virginia, USA; 2010-2014

Boiler Specialist - Black & Veatch. Provided design basis, calculations, and data analyses and developed cost estimates and performance impacts in support of a study to rerate a biomass fired stoker boiler to a higher steam flow rate. This analysis looked at existing equipment capacities as well as the potential for greatly increased emissions with the capacity increase.

Multiple Clients; ACE Heat Rate Assessments; United States; 2019-

2021

Lead Boiler Engineer - Black & Veatch. Lead a small team of boiler engineers to assist in more than 50 studies of coal fired power plants in support of the Affordable Clean Energy (ACE) rule. The team was responsible for estimating heat rate performance improvement and costs associated with boiler auxiliary system upgrades: air heater upgrades and draft fan variable frequency drive (VFD) installation. Our team worked with a number of other specialists to assess all required heat rate improvement categories required by the ACE rule.

Mike Sturdivan

Mike Sturdivan is a Principal Estimator within Black & Veatch's Power business. He is experienced in managing and executing all phases of various types of estimates, including lump sum engineering, procurement, and construction (EPC) proposals, definitive estimates, budget estimates, cost studies, etc. Mike has spent numerous years in the Water, and Gas, Fuels & Chemicals business lines of Black & Veatch, in a variety of estimating and management functions.

He has more than 40 years of experience in estimating and cost engineering for a broad range of industrial and heavy construction projects, for both domestic (U.S.) and international clients.

SELECTED PROJECT EXPERIENCE

Various Clients; Power Project Estimating; Various Locations, Global; 2018-In Progress

Lead Estimator - Black & Veatch. Overall estimating responsibility for both conceptual and study projects and EPC projects.

Nouritech; Project Atlantis; Tennessee, United States; 2016-2018

Lead Estimator - Black & Veatch. Primary estimating oversight and management.

QAFCO; Ammonia Revamp; Doha, Qatar; 2015-2016

Principal Estimator - Black & Veatch. Overall responsibility for preparation of \$808,000,000 LS EPC estimate.

Golden Valley Electric Association (GVEA); Healy SCR; Alaska, United States; 2014

Principal Estimator - Black & Veatch. Overall responsibility for preparation of \$93,000,000 LS EPC estimate.

Tampa Electric; Polk 2 CC Conversion; Florida, United States; 2012

Principal Estimator - Black & Veatch. Overall responsibility for preparation of a \$400,000,000 funding estimate.

Chicago Clean Energy; Substitute Natural Gas (SNG) Plant; Illinois, United States; 2010

Principal Estimator - Black & Veatch. Overall responsibility for preparation of a \$3,200,000,000 funding estimate.

GWF Energy LLC; Tracy, 2 x 1 Combined Cycle Plant; California, United States; 2009

Principal Estimator - Black & Veatch. Overall responsibility for preparation of a \$200,000,000 target price estimate.

PRINCIPAL ESTIMATOR

EXPERTISE:

Air Quality Control;
Ammonia; Combustion
Turbine; Gasification; LNG;
Oil & Gas

EDUCATION

Bachelors, Construction Science,
Kansas State University, 1978,
United States

TOTAL YEARS OF EXPERIENCE

43

BLACK & VEATCH YEARS OF EXPERIENCE

39

LANGUAGE CAPABILITIES

English

OFFICE LOCATION

Overland Park, Kansas, USA

Brazos Electric Power Cooperative; Jack County 2, 2 x 1 Combined Cycle Plant; Texas, United States; 2008

Principal Estimator - Black & Veatch. Overall responsibility for preparation of a \$550,000,000 lump sum EPC estimate.

American Electric Power; FGD Retrofit; Cardinal Unit 3; Ohio, United States; 2007

Principal Estimator - Black & Veatch. Overall responsibility for preparation of a \$240,000,000 lump sum EPC estimate.

Ontario Power Generation; Nanticoke Flue Gas Desulfurization (FGD) Studies; Ontario, Canada; 2007

Principal Estimator - Black & Veatch. Overall responsibility for preparation of multiple definitive estimates.

Gulf Power Co.; FGD Retrofit, Crist Plant; Florida, U.S.; 2006

Principal Estimator - Black & Veatch. Overall responsibility for preparation of a \$300,000,000 target price estimate.

American Electric Power; FGD Retrofit, Clifty Creek Units 1 through 6; United States; 2006

Principal Estimator - Black & Veatch. Overall responsibility for preparation of a \$485,000,000 target price estimate.

American Electric Power; FGD Retrofit, Cardinal Units 1 and 2; Ohio, United States; 2005

Senior Estimator - Black & Veatch. Overall responsibility for preparation of a \$265,000,000 lump sum EPC estimate.

Dayton Power & Light; FGD Retrofit, JM Stuart Station; Ohio, United States; 2004

Senior Estimator - Black & Veatch. Overall responsibility for preparation of a \$600,000,000 lump sum EPC / target price estimate.

Sacramento Municipal Utility District; SCR Retrofit, McClellan Plant; California, United States; 2003

Senior Estimator - Black & Veatch. Overall responsibility for preparation of a \$4,370,000 lump sum EPC estimate.

Indianapolis Power & Light; Selective Catalytic Reduction (SCR) Retrofit, Harding Street Station; United States; 2003

Senior Estimator - Black & Veatch. Overall responsibility for preparation of a \$45,000,000 lump sum EPC estimate.

Cinergy Corp.; FGD Retrofit, Gibson Unit 3; United States; 2003

Senior Estimator - Black & Veatch. Overall responsibility for preparation of a \$21,000,000 lump sum EPC estimate.

Griffin Karr

Griffin Karr is a Process Engineer for Black & Veatch with two years of engineering and industry experience. As a rotational engineer in the Black & Veatch EDGE program, Griffin's first rotation has been with the Thermal Generation Services (TGS) group, where he has worked on projects involving thermal performance; boiler and air quality; bio & waste energy; and carbon capture, utilization, and storage (CCUS).

Griffin performs calculation development, data analysis, document study and research, corresponds with clients and vendors, and collaborates on group reports. His broad project experience includes BACT analyses, fuel source availability studies, performance and degradation testing, combustion calculations using the stoichiometric combustion analysis tool (SCAT), and process review for emerging technologies (e.g. anaerobic digestion, direct air capture of CO₂, plastic separation and chemical recycling, and the concentration of Rare Earth Elements).

SELECTED PROJECT EXPERIENCE

Genesis Energy; Torrefied Biomass Availability Survey; New Zealand; 2021

Project Engineer - Black & Veatch. To assist in the biofuel test burn at Genesis Energy, performed the following:

- Performed broad survey of all torrefaction vendors and technology suppliers across the world.
- Contacted potential leads via email and phone calls, summarizing their availability of torrefied material in a summary table.
- Followed up with vendors on a consistent basis.

NOVUS Wood Group; Houston Renewable Natural Gas; Houston, Texas, United States; 2021

Project Engineer - Black & Veatch. Performed a biomass resource assessment. Activities were as follows:

- Reviewed existing NOVUS facility.
- Collected woody biomass data from federal and state databases including forestry biomass, mill residues, and urban wood waste.
- Corresponded with data specialists in the area.
- Performed market trend analysis on feedstock supply and competitors.
- Substantial data analysis plot development and report design.
- Independent development of summary report.

Prairie State Generating Company; Gypsum Technology Review; Marissa, Illinois, United States; 2021

Project Engineer - Black & Veatch. Performed the following:

- Reviewed existing studies regarding gypsum recovery for sale.
- Summarized key takeaways from report and performed engineering analysis.
- Opined on applicability of vendor technologies and recommendations.
- Independent development of brief summary report.

PROCESS ENGINEER

EXPERTISE:

VBA; Python; Arduino/Controllino (C Programming)

EDUCATION

Bachelor of Science, Chemical Engineering, Kansas State University, 2020, United States

PROFESSIONAL REGISTRATION

Certification, Intern Engineer, #19642, Kansas, United States, 2020

TOTAL YEARS OF EXPERIENCE

2

BLACK & VEATCH YEARS OF EXPERIENCE

1

LANGUAGE CAPABILITIES

English

OFFICE LOCATION

Virtual - Arkansas, USA

U.S. Department of Energy; Rare Earth Elements Assessment; United States; 2021-In-Progress

Project Engineer - Black & Veatch. To assist in the review of REE project proposals for DoE, performed the following:

- Reviewed complete proposal packages from several companies.
- Summarized key data and metrics from all documents into a table format.
- Provided report summaries of each proposal including technologies used and potential advantages and disadvantages of each.

Avnos Inc; Hybrid Direct Air Capture Technology Assessment; California, United States; 2021-In-Progress

Project Engineer - Black & Veatch. Performed the following:

- Reviewed Avnos technology documentation and supporting data regarding their HDAC system.
- Corresponded with Avnos team via a QA log to address discrepancies and concerns with the design.
- Assisted in the development of an assessment report, summarizing the existing technology design and potential challenges or opportunities for the technology as it scales.

Black Hills Power; Technical and Cost Evaluation for CCUS Technology; United States; 2021-In-Progress

Project Engineer - Black & Veatch. To assist in the technical and cost evaluation of CCUS technologies at the Wygen II and Neil Simpson facilities, performed the following:

- Reviewed and summarized existing site design and process flow.
- Reviewed and summarized potential carbon capture technologies and applicability at the existing facility.
- Performed CAPEX and OPEX cost estimations using reference costs from prior Black & Veatch studies.
- Assisted in the development of evaluation PowerPoint and report with Black & Veatch engineering team.

Prairie State Generating Company; Analysis of Dry Sorbent Injection System; Marissa, Illinois, United States; 2021-In-Progress

Project Engineer - Black & Veatch. Performed the following system analysis tasks:

- Reviewed existing DSI system and limitations.
- Corresponded with PSGC engineers, technology vendors and neighboring facilities to provide recommendations.
- Extensive data analysis and review from PSGC trials.
- Study of research articles and reports for fly ash quality and SO₃ measurement/removal.
- Independent development of extensive summary report.

ENCLOSURE C. BILLING RATES

