

February 23, 2021

Ms. Kathryn H. Bowman
Executive Counsel
Louisiana Public Service Commission
Office of the General Counsel
602 North Fifth Street, 12th Floor (Galvez Building) (70802)
P.O. Box 91154
Baton Rouge, Louisiana 70821-9154

E-Mail: Kathryn.Bowman@la.gov

**Reference: RFP 21-03 - Docket U-35544, Louisiana Public Service Commission, ex parte, In re:
Prudence Review of the Cleco Power LLL St. Mary Clean Energy Center**

Dear Ms. Bowman:

PF Engineers is pleased to provide the Louisiana Public Service Commission (the “LPSC” or “Commission Staff”) with this proposal in response to the February 2nd Request for Proposal for an independent engineering consultant or project management consultant to assist Commission Staff in the prudence review of the St. Mary Clean Energy Center (the “Project”). In Commission Order No. U-33593, the Commission certified Cleco Power, LLC’s (“Cleco”) request to construct, own, and operate the Project, which is a 40 Megawatt (“MW”) waste heat recovery facility, which includes the application of a waste heat recovery steam generator, steam turbine generator, and ancillary balance of plant equipment.

Pursuant to Commission Order No. U33593 requires a prudence review of the Project after entering into commercial operation. This prudence review is to review Cleco’s actions regarding project management, cost controls, success in achieving stated objectives, and total capital expenditures for the Project.

Cleco filed the Closeout Report specifying that the Project was completed in August 2019.

SCOPE OF WORK

PF Engineers proposes to provide the following services to assist the Commission Staff and Henderson Ridge in the prudence review of the Project. These services are to include, but not limited to: the review and analysis of Cleco’s filing and supporting testimony, preparing data requests; review of testimony, participation in status conferences; conducting site visit; and preparing technical analysis as requested by Commission Staff.

The key services are detailed in more description as follows:

1 Site Inspection

PF Engineers will visit the Project to perform a one (1) day evaluation. This site visit will be general in nature and focus on the following:

- Quality of construction;
- Quality of engineering and general layout;
- Operations and Maintenance (“O&M”) including:
 - Staffing;
 - O&M plans and procedures;
 - Site quality and safety programs; and
 - Maintenance plans and systems.
- Overall Project assessment.

The site inspection in conjunction with the desktop findings from the Technology Review and the Construction Review is to enable PF Engineers to provide the Commission Staff with an overall assessment of the Project.

2 Technology Review

PF Engineers will review the design of the Project to include an assessment of the factors including, but not limited to:

- The major equipment utilized for the Project;
- Site preparation and utilization; and
- Evaluation of the Project performance, including the energy production, efficiency, water treatment facilities, and water usage.

We will focus on the quality of equipment utilized for the Project and the implications relative to the long term operation and emissions control capabilities to the benefit of the ratepayers.

3 Construction Review

PF Engineers will review the key documentation for the construction of the Project. This includes a review of the construction contract(s) and the monthly construction reports throughout the construction cycle. Through the review of this information, PF Engineers will provide an assessment of:

- The overall construction effort for the Project;
- The historical progress of the construction as it relates to the quality of the construction of the Project;
- The management of the budget and schedule during the construction of the Project; and
- How the completed Project met Cleco’s objectives.

The overall intent of this review is to ensure that the Project is built according to typical industry standards and supports the long term operation of the Project.

4 Operations and Maintenance Review

PF Engineers will provide a detailed O&M review of the Project. This review will add to the previous scope items to continue to include an evaluation of the following, but not limited to:

- Major Project Agreements
 - O&M Agreement
 - Offtake Agreement
 - Fuel Supply Agreement
- O&M Budget
- Monthly O&M reports
 - Historical performance (i.e. generation, heat rate, emissions, etc.)
 - Availability and forced outage rates
- Environmental
 - Permitting
 - Compliance record

The emphasis on this review is to evaluate Cleco's key Project contracts supporting the long term O&M for the Project to the benefit of the ratepayers.

5 Independent Engineering Report

PF Engineers will work with the Commission Staff to provide a report summarizing the results from the various reviews noted in this Scope of Work. This generally a combination of the technical requirements of the Project and how these requirement tie back to the financial requirements of the Project.

6 Support the Commission Staff

PF Engineers will support Commission Staff relative to any technical issues or concerns regarding Docket U-33593. This support includes, but is not limited to:

- Documentation
 - Develop any additional document requests for discovery and provide any specific memos or presentations relative to Project.
- Hearings/Testimony
 - Review any witness depositions/testimonies and assist the Commission Staff in the development of cross-examinations.
 - PF Engineers will travel to Louisiana to provide direct testimony to support Commission Staff.

PF ENGINEERS TEAM

PF Engineers provides primarily Independent Engineering and Expert Witness services for the energy industry. In response to RFP 21-03, the Scope of Work is to be completed by Trent J. Markell, P.E., the founder and Principal of PF Engineers. Mr. Markell has over 28 years of engineering experience in the power generation industry with approximately 20 years of experience performing Independent Engineering reviews.

Qualifications

Mr. Markell's experience as an Independent Engineer qualifies him for this assignment. Independent Engineers are well versed in reviewing construction projects, evaluating contracts, financial requirements, and governmental requirements, which provides unique mix of technical and financial capabilities and can satisfy the minimum requirements per Section IV of RFP 21-03.

Additionally, Mr. Markell has provided expert witness services for the Colorado PUC Staff and for the Department of Justice. These assignments include:

- Mr. Markell supported the assessment of the technical requirements of the Clean Air Clean Jobs Act for the Colorado PUC Staff. This technical review helped the Commission Staff to evaluate the potential application of environmental retrofits to the existing coal fired power plants in Colorado versus the retirement of said power plants in favor of new, utility owned, natural gas fired power plant(s).
- Mr. Markell supported the Colorado PUC Staff with the evaluation of a small combined cycle power plant that the utility was looking to acquire to roll into their rate base. Mr. Markell completed a site visit and an assessment of the asset for the Commission Staff along with a report summarizing his assessment.
- Mr. Markell has supported the US Department of Justice, for multiple cases, by providing Independent Engineering support, including detailed written reports, depositions, and direct testimony Federal Court in response to litigation relative to the US Treasury's grant program under Section 1603 of the American Recovery and Reinvestment Tax Act of 2009.

Detailed CV for Mr. Markell is included in Appendix B.

FEE STRUCTURE

PF Engineers is proposing to provide consulting services on a time and material basis plus any travel expenses required. The budgetary estimate for the Scope of Work is:

Budgetary Estimate Scope of Work for RFP 21-03	
<u>Description</u>	<u>Estimate</u>
Independent Engineering Services	\$60,000
Travel Expenses	<u>\$ 2,700</u>
Total Estimate	\$62,700

The above budgetary estimate is an estimate based on the Scope of Work to be provided. If the Scope of Work can be completed quick, PF Engineers will strive to do so. A detailed breakdown of the budgetary estimate is presented in Appendix A.

The hourly rate for the PF Engineers personnel assigned to this Scope of Work is defined in the table below.

PF Engineers Rate Sheet 2021⁽¹⁾		
<u>Name</u>	<u>Function</u>	<u>Hourly Rate</u>
Trent J. Markell, P.E.	Principal	\$375
<i>Notes:</i>		
1. All rates are in US Dollars are subject to annual change at the beginning of each calendar year to account for salary and cost of living adjustments.		

Expenses

All expenses are included, with the exception of travel and living expenses. All travel and living expenses will be billed at cost.

Change in Scope

In the situation where the Scope of Work changes, PF Engineers will work with the Commission Staff to develop a budgetary estimate for the revised Scope of Work prior to commencing with any revised or additional work.

Invoicing

Charges will be billed every calendar month with a detailed breakdown of the time spent by each PF Engineers' employee assigned to the project.



PROJECT COMMENCEMENT

To the best of our knowledge, PF Engineers does not have a conflict of interest that would prevent us from completing this work. PF Engineers' personnel are available to start immediately upon the proposed Scope of Work.

Please feel free to contact me via e-mail at trent.markell@pfengineers.com or by phone at 970-670-0187 if you have any questions. Thank you for considering PF Engineers.

Sincerely,

Trent J. Markell, P.E.
Principal

enc. Appendix A: Detailed Budget Estimate
 Appendix B: CV

APPENDIX A: Budget Estimate

Review Task	Hours	Budget	Expenses
Site Inspection			
Site visit (1-day) <i>Meeting with site management</i> <i>Condition assessment</i> <i>Construction quality assessment</i> <i>General environmental observations</i>	16	\$6,000	\$1,000
Technology Review			
Engineering/project design <i>General arrangement</i> <i>Heat/mass/water balances</i>	4	\$1,500	
Major equipment <i>Waste heat recovery boiler</i> <i>Steam turbine</i>	2	\$750	
Construction Review			
EPC Contract <i>EPC technical requirements</i> <i>Schedule</i> <i>Budget and change orders</i> <i>Guarantees/Warranties</i>	12	\$4,500	
Construction reports	16	\$6,000	
O&M Review			
Major Agreements <i>O&M Agreement</i> <i>Offtake Agreement</i> <i>Fuel Supply Agreement</i>	16	\$6,000	
O&M Budget <i>Staffing</i> <i>O&M expenses</i>	4	\$1,500	
Monthly O&M reports / Historical operations <i>Generation</i> <i>Availability/forced outage rate</i>	16	\$6,000	
Environmental permits and compliance	4	\$1,500	
Report			
Expert witness report	20	\$7,500	
LSPC Support			
Conference calls/general support	12	\$4,500	
In person meeting (<i>combined w/ site visit</i>)	4	\$1,500	
Deposition (<i>4-hours plus travel time</i>)	12	\$4,500	\$850
Review of others' depositions	6	\$2,250	
Testimony (<i>1-day plus travel time</i>)	16	\$6,000	\$850
Total Labor and Expenses (3-trips)			
	160	\$60,000	\$2,700

Total Budgetary Estimate: \$62,700.00

APPENDIX B: CV

TRENT J. MARKELL, P.E.

Principal

KEY QUALIFICATIONS

A registered professional engineer with over 28 years of experience in the engineering field, Mr. Markell has an extensive background in power generation, biofuels, and independent engineering services. As an independent engineer, he has a thorough knowledge of project design, contracting, construction, and operations and maintenance. He has led and/or been involved in the review of technologies including, but not limited to: coal, combined and simple cycle, cogeneration, landfill gas, nuclear, hydro, geothermal, wind, solar, ethanol, cellulosic ethanol, biodiesel, gasification, waste to energy, and biomass. Mr. Markell has been involved with over 76,000 Megawatts (“MW”) of power generation facilities and over 2 billion gallons per year of biofuels facilities.

Areas of expertise include:

- Independent Engineering Reviews
 - Project Finance
 - Liquidated Damages Analysis
 - Contract Analysis
 - Steam Turbine Design
 - Construction Budgets and Schedules
 - Ethanol Plant Design
 - Construction Management
 - Power Plant Design
 - Performance Testing and Test Protocols
 - Gas Turbine Technology
 - Plant Operations and Maintenance
 - Turbine Control Systems
 - Expert Witness Services
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EDUCATION AND PROFESSIONAL STATUS

MS (Mechanical Engineering), Union College
BS (Mechanical Engineering), Rochester Institute of Technology
Member of the American Society of Mechanical Engineers
Professional Engineer (Colorado)

EXPERIENCE RECORD

PF ENGINEERS, LLC

2012 – Present

Principal

Mr. Markell is the founder of PF Engineers, which was established to provide technical due diligence, engineering consulting, and development support for energy projects. The focus of PF Engineers is to provide an additional level of engineering support to help developers to finance projects and to help lenders to understand and to mitigate their technical risk on projects. Mr. Markell strives to provide value through the highest level of service and engineering expertise on a wide range of technologies.

MOTT MACDONALD GROUP

2011 – 2012

Senior Vice President

Mr. Markell worked with Mott MacDonald's senior executives to develop a US Independent Engineering practice and to expand Mott MacDonald's presence in North and South America. These responsibilities include managing the US IE practice, providing QA/QC reviews both internally and externally, sales/business development to promote the US IE practice, and all staffing for the IE practice. Mr. Markell also frequently supported project reviews as the project manager to maintain a presence in the market and to support Mott MacDonald's clients both in North America and throughout the world.

HARRIS GROUP INC.

2006 – 2011

Vice President/Head of Financial Consulting Business Unit

Mr. Markell was responsible for the P&L of Financial Consulting business unit, reporting directly to the CEO and the Board of Directors. Developed marketing plans and annual budgets to grow the independent engineering practice with annual revenues of approximately \$1.8M supported with a staff of seven people.

Provided internal Quality Assurance by providing detailed review of all reports prior to issuance to the client. Support the due diligence review of the project technology, contracts, construction, and Operations and Maintenance.

R. W. BECK

2001 – 2006

Project Manager

Managed the due diligence effort on a wide range of facilities and technologies ranging from greenfield power facilities to sludge handling systems. Mr. Markell was one of the primary reviewers for Operations and Maintenance of power generation facilities and maintained the firm O&M database. One of three engineering responsible for maintaining combustion and steam turbine technology reviews.

Supported many of Calpine's due diligence reviews including financing, construction monitoring, performance test monitoring, and annual operations and maintenance reviews.

EXPERIENCE RECORD - Continued

GENERAL ELECTRIC (formerly WOODWARD GOVERNOR)

1998 – 2001

Mechanical Systems Engineer

Performed mechanical retrofits for all types of turbine control systems, specializing in mechanical-hydraulic control retrofits for large main-line turbines. Interfaced with customer to support technical integration of new turbine controls and provided direction on the proper demolition of old hydraulic control system and installation of the new turbine control system.

Developed process to outsource all fabricated parts (i.e. valve actuators, manifolds, HPUs, etc.) and worked with purchasing and vendors to ensure an on-time delivery of mechanical components.

Supported the Woodward ISO9000 efforts by assisting with internal audits and acting as a mentor for other internal auditors on the quality team.

ZYGO (formerly NEXSTAR AUTOMATION)

1996 – 1998

Software Engineer/Project Engineer

Developed software to control the operation of state of the art automation systems. Lead junior software engineers in the development of controls software for the automation systems primarily for the hard drive industry.

Designed and engineered large, high volume automation systems. Maintained project budgets, bill of materials, purchased parts, drawings, and customer relations. Directed drafters, designers, other engineers, and technicians towards the completion of the design and installation of the automation systems.

COPPER MOUNTAIN RESORT

1995 – 1996

Full Time Youth Ski Instructor

GENERAL ELECTRIC

1992 – 1995

Steam Turbine Design Engineer

Designed new advanced-aero steampaths to provide efficiency gains for existing steam turbines and lead multi-disciplined engineering and drafting team to complete the design. In addition to overall steampath design responsibilities, also have experience in high-pressure casings, buckets, rotors, and cost reductions.

Performed a number of quality audits as a member of GE's internal ISO-9000 audit staff for the Power Generation division.

PROJECT EXPERIENCE

Traditional Power

Coal

Independent Engineering Reviews

- 1,300 MW operating pulverized coal unit in Indiana to retrofit enhanced dry sorbent injection
- 630 MW operating pulverized coal unit in Pennsylvania.
- 300 MW pulverized coal plant in Panama including a detailed analysis of the performance, design, and O&M requirements.
- 160 MW pulverized coal unit in Colombia including a detailed analysis of the performance, design, and O&M requirements.
- 650 MW ultra-supercritical coal unit in Morocco with an emphasis on the evaluation of the plant performance.
- 1,000 MW supercritical coal unit in Malaysia.
- Verification of construction modifications and system performance testing of a 500 MW lignite plant in Mississippi utilizing Alstom CFB boilers. The project is a mine mouth facility.
- 50 MW waste to energy facility, landfill, and the mining of lignite to support the facility in Haiti.
- Detailed O&M review for a 363 MW coal facility and potential repowering options located in the United Kingdom.
- 300 MW pulverized coal unit in Arizona including a detailed analysis of the performance, mechanical design, and material handling systems.
- Detailed O&M review of 280 MW pulverized coal facility in North Carolina utilizing wet and dry scrubber units.
- Technology review for the replacement of an existing coal facility in Ohio with an integrated coal gasification facility.
- Technology review for a 200,000 ton per year coking facility utilizing Chinese technology for implementation in Colombia.

Expert Witness with Testimony

- Review to support the Colorado Public Utilities Commission's review of Colorado's Clean Air, Clean Jobs legislation and the utilities' plan to retire 900 MW of coal facilities. Including a review of scrubber and NOx reduction retrofit options and installation costs.

Natural Gas (Combined Cycle and Simple Cycle)

Independent Engineering Reviews

- 830 MW combined cycle plant utilizing Siemens SGT6-8000H technology in Pennsylvania.
- 840 MW combined cycle plant utilizing Siemens SGT6-8000H technology in Pennsylvania.
- 340 MW simple cycle plant utilizing GE 7HA.02 technology in Massachusetts.
- 900 MW combined cycle plant utilizing GE 7HA.02 technology in Mexico
- 135 MW peaking facility utilizing LM6000-PF technology in Mexico.
- 1,000 MW combined cycle plant utilizing GE 7HA.02 technology in Pennsylvania.
- 1,000 MW combined cycle plant utilizing Siemens SGT6-8000H technology in Maryland.
- 1,000 MW combined cycle plant utilizing GE 7FA.05 technology in New York.
- 250 MW Portfolio of nine simple-cycle cogeneration facilities in California. These plants exported steam for Enhanced Oil Recovery (EOR) and utilized GE LM2500 and LM5000 technology.
- 2,200 MW combined facility located in California utilizing GE 7FA technology.
- 150 MW simple cycle facilities located in California utilizing Pratt & Whitney FT4 technologies.
- 45 MW cogeneration facility utilizing LM5000 technology in New York.
- 60 MW combined cycle facility utilizing GE Frame 6 technology in New York.
- 94 MW combined cycle facility providing 3 million gallons of desalinated water per year in Karachi, Pakistan utilizing Siemens V64.3A technology.
- 300 MW peaking facility utilizing GE 7FA technology in Colorado.
- Initial due diligence, construction monitoring, and performance test monitoring:
 - 325 MW cogeneration facility in Texas utilizing Siemens 501F technology and auxiliary boilers to provide 1-million pounds of steam per hour.
 - 375 MW combined cycle facility in Minnesota utilizing Siemens 501F technology.
 - 300 MW peaking facility in Colorado utilizing GE 7FA technology.
 - 1,050 MW combined cycle facility in Texas utilizing GE 7FA technology.
 - 800 MW combined cycle facility in Alabama utilizing Siemens 501F technology.
 - 795 MW combined cycle facility in Alabama utilizing Siemens 501F technology.
 - 720 MW combined cycle facility in Colorado utilizing Siemens 501F technology.
 - 630 MW combined cycle facility in South Carolina utilizing GE 7FA technology.
 - Portfolio of nine peaking facilities in California utilizing GE LM6000 technology.
- 875 MW combined cycle facility in Ontario utilizing GE 7FB technology.
- 1,000 MW combined cycle facility in Ontario utilizing Siemens 501F technology.
- 120 MW cogeneration facility in California utilizing GE 7EA technology.
- Annual O&M review of the MACH Gen facilities utilizing G-class technology.
- O&M review for 530 MW utility in Alaska utilizing various gas turbine technologies.
- 150 MW cogeneration facility in British Columbia utilizing Westinghouse W251 technology.

Natural Gas (Combined Cycle and Simple Cycle) - Continued

Owner's Engineering Support

- Proposed portfolio of Mexican facilities looking to utilize the current power generation sites to support the installation of H-class technology in excess of 2,400 MW.
- Technology review and development support for a 100 MW simple cycle facility to potentially utilize LM6000, LMS100, or TM2500 units near Panama City, Panama.

Expert Witness with Testimony

- Condition assessment and useful life evaluation of 213 MW combined cycle facility utilizing W251AA technology in Brush, Colorado.

Reciprocating Engines

Independent Engineering Reviews

- 2 MW biomass gasification facility utilizing Jenbacher J620 technology in California
- 152 MW Portfolio of reciprocating engine projects in Colombia utilizing Hyundai HiMSEN gas and dual fuel engines
- 12 MW cogeneration facility located in New York utilizing Hyundai HiMSEN engines supporting the production of approximately 60 tons of ice per day.
- 2.2 MW Landfill gas facility utilizing Jenbacher J616 technology in California
- 1.4 MW Landfill gas facility utilizing Jenbacher J420 technology in California
- 18 MW Portfolio of landfill gas facilities in California and Texas.
- 75 MW Portfolio of heavy fuel oil facilities in Saipan including a review of the technical performance and the O&M.
- Portfolio of reciprocating engine facilities in California ranging in size of less than 1 MW to over 6 MW utilizing Jenbacher engines to burn biogas.

Owner's Engineering Support

- Two 500 kW facilities utilizing Caterpillar engines in St. Croix.
- 18 MW facility utilizing Jenbacher engines in Virginia.
- Development of a project in Panama to use Jenbacher J920 engines.

Renewable Energy

Wind

Independent Engineering Review

- 228 MW facility utilizing Gamesa G80, G87, and G90 technology in Mexico.
- 100 MW facility utilizing Enercon E92 technology in Quebec.
- 168 MW Portfolio utilizing GE 1.6xle technology in India.
- 100 MW facility utilizing Vestas V82 technology near Oregon.
- 200 MW facility utilizing Gamesa G87 technology near Texas.
- 100 MW facility utilizing Vestas V82 technology near Minnesota.
- 100 MW facility utilizing Vestas V100 technology near Ohio.
- 200 MW facility utilizing Vestas V82 technology near Illinois.
- O&M and technology review of 125 MW facility utilizing Clipper Liberty 2.5 MW technology located in New York
- O&M and technology review of 30 MW facility utilizing GE 1.5sle technology in Hawaii.
- O&M and technology review of 42 MW facility utilizing GE 1.5sle technology in Maine.
- O&M and technology review of 35 MW facility utilizing Clipper Liberty 2.5 MW technology in New York.
- O&M and technology review of 57 MW facility utilizing GE 1.5sle technology in Maine.
- Review and Completion certification of 38 MW facility utilizing Nordex N90 technology in Pennsylvania.
- 73 MW facility utilizing Nordex N100 technology in Pennsylvania.
- 51 MW facility utilizing Repower technology in New York.
- Review and construction monitoring of a 22 MW facility utilizing GE 1.6xle technology located in Idaho
- Review and construction monitoring of two 1.0 MW community wind facilities in California utilizing GE 1.5xle technology.
- 150 MW facility utilizing Vestas V90 technology in California.
- Review and construction monitoring for a 6 MW facility utilizing GE 1.5sle technology located in Washington.
- 24 MW facility in California utilizing multiple Vestas technologies.

Solar

Independent Engineering Reviews

- 140 MW Solar thermal project utilizing a power tower located in California.
- 130 MW PV facility in California utilizing First Solar modules and GE/Conversol inverters.
- 150 MW PV facility in California utilizing First Solar modules with single axis tracking and SMA inverters.
- 40 MW PV facility in Idaho utilizing Jinko Solar modules with a single axis tracker and SMA inverters.
- Review and site inspection of a portfolio of seven PV facilities ranging from 3 MW to 6 MW in North Carolina utilizing Astronergy modules and Eaton inverters.
- Portfolio of four 5 MW PV facilities in North Carolina utilizing Silvantis modules and SMA inverters.
- 5 MW PV facility in North Carolina utilizing Canadian Solar modules and Eaton inverters.
- Portfolio of two 5 MW PV facilities in North Carolina utilizing Canadian Solar modules and inverters from Eaton and SMA.
- Independent engineering review of a 5 MW PV facility in Marshville, North Carolina utilizing Canadian Solar modules and SMA inverters.
- 5 MW PV facility in North Carolina utilizing Canadian Solar modules and Eaton inverters.
- 5 MW PV facility in North Carolina utilizing Canadian Solar modules and Eaton inverters.
- 5 MW PV facility in North Carolina utilizing Trina modules and SMA inverters.
- 5 MW PV facility in North Carolina utilizing Canadian Solar modules and SMA inverters.
- 5 MW PV facility in North Carolina utilizing Trina modules and TMEIC inverters.
- Annual O&M review for a 2.5 MW PV facility in Arizona utilizing Suntech modules with inverters from Satcon and Advanced Energy.
- 75 MW CPV facility utilizing Amonix technology to be located in South Africa.
- Portfolio of two 10 MW CPV facilities utilizing Amonix technology to be located in South Africa.
- Review and construction monitoring of a 3 MW PV facility located in Massachusetts.
- Portfolio of rooftop PV (10 MW) facilities throughout the US.

Owner's Engineering Support

- Support for the development of a 5 MW PV facility in Virginia.

Hydro

Independent Engineering Reviews

- 192 MW utilizing Francis technology in Vermont and New Hampshire.
- 167 MW utilizing Francis technology in Vermont and New Hampshire.
- 11 MW utilizing Kaplan technology in Vermont and New Hampshire.
- 41 MW utilizing Kaplan technology in Vermont and New Hampshire.
- 48 MW utilizing Francis technology in Vermont and New Hampshire.
- 36 MW utilizing Kaplan/Francis technology in Vermont.
- 5 MW utilizing Francis technology in Massachusetts.
- 41 MW utilizing Francis technology in Massachusetts.
- 6 MW utilizing Francis technology in Massachusetts.
- 14 MW utilizing Francis technology in Massachusetts.
- 6 MW utilizing Francis technology in Massachusetts.
- 7 MW utilizing Double-Francis technology in Massachusetts.
- 7 MW utilizing Double-Francis technology in Massachusetts.
- 3-Non-generation dams in New Hampshire and Massachusetts
- 3,000 MW pumped storage facility utilizing Francis-pump turbines in Virginia and West Virginia.
- Review including a review of the FERC Part 12 safety reviews, operations and maintenance, capital expenditures, and general site condition assessment for facilities in Michigan:
 - 1.6 MW utilizing Francis technology.
 - 2.5 MW utilizing Francis technology.
 - 4.1 MW utilizing Francis technology.
 - 8.5 MW utilizing Francis technology.
 - 4.4 MW utilizing Francis technology.
 - 2.0 MW utilizing Francis technology.
 - 12.2 MW utilizing Francis technology.
- Review, construction monitoring, performance test verification and Completion certification of a 34 MW hydro facility in Mexico utilizing pelton technology including over 5 kM of tunnels and multiple diversion dams. Included a review of the hydrology for the project.
- 14 MW run of the river facility in Mexico to use Pelton technology. Included a review of the hydrology and planned tunneling.
- 31 MW facility in New York utilizing Kaplan technology
- 2.4 MW facility in Virginia utilizing Kaplan technology.
- 2.6 MW facility in New York utilizing Kaplan technology.
- 1.8 MW facility in Rhode Island utilizing Francis technology.
- 1.9 MW facility in Virginia utilizing Francis technology.
- 5.5 MW facility in California utilizing Francis technology.
- 0.3 MW facility in New York utilizing Kaplan technology.
- 0.6 MW facility in New York utilizing Kaplan technology.

Owner's Engineering Support

- Development of a pumped storage facility with a capacity of 50 to 75 MW in Cyprus.

Biomass

Independent Engineering Reviews

- 2 MW biomass gasification facility utilizing a bubbling bed gasifier in California.
- 18 MW biomass facility, including the burning of tire derived fuel and railroad ties, utilizing stoker boilers with traveling grate in Michigan.
- 18 MW biomass facility, including the burning of tire derived fuel, utilizing stoker boilers with traveling grate in Michigan.
- 18 MW biomass facility utilizing stoker boiler with traveling grate in New Hampshire.
- 22 MW biomass facility utilizing stoker boiler with traveling grate in New Hampshire.
- 25 MW biomass facility utilizing a stoker boiler with vibrating grate in Vermont.
- Life expectancy evaluation for two biomass facilities in California.
- 66 MW biomass facility utilizing as stoker boiler in Florida.
- 21 MW biomass facility utilizing as stoker boiler in Quebec
- 37.5 MW biomass facility utilizing gasification technology in Connecticut
- 30 MW closed-loop biomass facility in Hawaii including an assessment of the construction progress, budget, and schedule.
- 30 MW biomass facility utilizing as stoker boiler in California.
- 50 MW biomass facility utilizing a circulating fluidized bed technology in California.
- 20 MW biomass facility utilizing as stoker boiler in California.
- 30 MW biomass facility utilizing as stoker boiler in California.
- 40 MW biomass facility utilizing as stoker boiler in Alberta.
- 15 MW biomass facility utilizing as stoker boiler in Georgia.
- 17 MW biomass facility to utilize a stoker boiler in Oregon.

Expert Witness

- 13 MW biomass facility utilizing a stoker boiler in Colorado.
- 495 kW biomass facility in North Carolina with deposition.
- 850 kW biomass facility in New York with testimony in Federal Court.
- 74 MW biomass facility providing steam and power to a pulp and paper mill in Virginia.

Other Renewable Technologies

Independent Engineering Reviews

- 7 MW closed loop anaerobic digester project to utilize Giant King Grass in St. Croix.
- Technology assessment review of a 2 MW waste to energy project processing approximately 1,000 tons of MSW and biosolids per week in Pennsylvania.
- 9.1 MW Landfill gas facility utilizing Solar Mercury 50 technology in California.
- Anaerobic digesters to be installed at numerous dairy farms in California ranging in size of less than 1 MW to over 6 MW.
- 150 MW coal facility conversion to fire on biomass with a revised output of approximately 80 MW located in Florida.
- O&M review for a 6 MW landfill gas facility in Rhode Island.
- Review and expert witness support of a 24.5 MW waste to energy facility in Pennsylvania.
- Fatal flaw review for a biosolid conversion technology facility to be located in California.
- Technology review for tidal turbine for application in rivers.

Other Technologies

Independent Engineering Reviews

- Biomass gasification to an oxy-combustion turbine with an associated carbon capture system on the back end. (Under Development)
- Natural Gas pipeline project utilizing over 500 miles of 42-inch pipe, four compressor stations, and multiple metering stations in Texas.
- Liquefaction LNG facility with a capacity of over 2 billion cubic feet per day in Texas.
- District heating and cooling system for large industrial/office complex in New York.
- Battery storage facility with 5MW/20MWh capacity in New York.
- Battery storage facility with 10MW/40MWh capacity in New York.
- Glass recycling facility with a capacity of processing 60,000 tons per year in California.
- Reverse osmosis desalination plant with a capacity of producing 54 million gallons of potable water per day in California.
- Subsea 400 kV HVDC transmission line with a capacity of 400 MW in California.
- Ice production facility with a capacity of 60 tons per day in New York.
- District Heating and Cooling system for the city of Omaha with steam production of over 735,000 pounds per hour.
- Activated carbon production facility with a capacity of over 100,000 tons per year in Louisiana.
- Subsea 345 kV HVAC transmission line with a capacity of 700 MW to New York City.
- Coke production facility with a capacity of 200 tons per day in Colombia.
- District Heating and cooling system for Starrett City (Spring Creek Towers) in New York.

Expert Witness

- 2.8 MW fuel cell facility in California.
- 1.4 MW fuel cell facility in California.

Biofuels

Independent Engineering Reviews

- Supported the engineering report for a DOE Part II loan guarantee application for a 120 MGY advance biofuel production facility utilizing wheat and barley in Montana including a gasifier to provide additional energy.
- Supported the engineering report for a DOE Part II loan guarantee application for an advance biofuel production facility producing jet fuel from camelina in California.
- Supported the engineering report for a DOE Part II loan guarantee application for an integrated commercial 25 MGY cellulosic ethanol and 100 MW biomass power project in Kansas.
- Technology and fatal flaw review of a biosolid gasification and clean diesel facility to be co-located with wastewater treatment facilities with pilot plant located in California.
- 50 MGY sugar cane to ethanol facility in Louisiana utilizing Praj technology.
- Review and construction monitoring of a 60 MGY corn to ethanol facility in North Carolina utilizing KATZEN technology.
- Review, construction monitoring, and performance test verification of a 110 MGY corn to ethanol facility in Kansas utilizing ICM technology.
- Review, construction monitoring and performance test verification of 88 MGY corn to ethanol facility in Nebraska utilizing Vogelbusch technology.
- Two-60 MGY barley to ethanol facilities in Virginia and South Carolina utilizing KATZEN technology
- Three 110 MGY ethanol facilities in Nebraska and Iowa utilizing Delta-T and fractionation technology.
- Completion certification of a 55 MGY ethanol facility located Ohio.
- 100 MGY corn to ethanol facility in Georgia utilizing ICM technology.
- 40 MGY corn to ethanol facility in Oregon utilizing Delta-T technology.
- 60 MGY corn to ethanol facility in Idaho utilizing Delta-T technology.
- 60 MGY corn to ethanol facility in California utilizing Delta-T technology.
- 40 MGY corn to ethanol facility in California utilizing Delta-T technology.
- 100 MGY biodiesel facility in Washington utilizing rapeseed and/or canola oil.
- 99 MGY corn to ethanol facility in Indiana utilizing POET technology.
- 105 MGY biodiesel facility in Texas utilizing fats and oils
- 90 MGY corn to ethanol facility in Illinois utilizing Vogelbusch technology.
- Fatal flaw review of a 4 MGY biodiesel facility utilizing yellow grease to be located in Colorado.

Expert Witness

- Supporting the litigation as an expert witness relative to the construction of a 10 MGY biodiesel facility in California.

Design

Steam Turbine Designs

- Paiton – 400 MW Advanced Aero steampath
- El Kureimat – 600 MW Advanced Aero steampath
- Jim Bridger – 530 MW Advanced Aero steampath
- Spurlock – 300 MW Advanced Aero steampath
- Tiger Bay Cogen – 160 MW High Pressure Casing
- Tepco ABWR - 1,350 MW High Pressure Casing support
- Coyote Springs – 150 MW Steampath support
- Smith Cogen – 100 MW Steampath support for barge mounted unit

Turbine Controls Retrofits

- Nine Mile – Two 750 MW oil fired facility utilizing Westinghouse steam turbines
- Plant Branch – 200 MW coal fired facility utilizing GE steam turbine
- Coastal Aruba – 35 MW oil fired facility utilizing Parsons steam turbine
- Plant Bowen – 200 MW of oil fired facility utilizing GE steam turbines
- Baxter Wilson – 400 MW oil/gas fired facility utilizing a Westinghouse steam turbine
- PEMEX compressor station – Frame 5 gas turbine system
- Plant McManus – 40 MW oil/gas fired facility utilizing GE steam turbine
- Kodak – 130 MW facility utilizing Dresser Rand steam turbine
- Long Lake – 71 MW hydro facility utilizing Francis units
- Little Falls – 32 MW hydro facility utilizing Francis units
- Mountain Creek – 400 MW oil fired facility utilizing GE steam turbines
- Huntington Beach – Two 220 MW Westinghouse steam turbines for oil fired facility

Expert Witness

- Engaged by Governor Control Systems as an expert witness on an issue related to the control system trip and the cause and effect of this trip on a system wide blackout on the island of Aruba.
- Engaged by Eagle Valley Clean Energy as an expert witness of litigation involving a construction and performance dispute with the EPC Contractor, *Wellons, Inc. vs. Eagle Valley Clean Energy*
- Engaged by the US Department of Justice as an expert witness for litigation involving a Section 1603 application for an open-loop biomass project, *Meadwestvaco Virginia Corp. vs. United States*
- Engaged by the US Department of Justice as an expert witness for litigation involving a Section 1603 application for an open-loop biomass project, *GUSC Energy, Inc. vs. United States*
- Engaged by the US Department of Justice as an expert witness for litigation involving a Section 1603 application for Fuel Cells, *RPI Fuel Cell, LLC and UTS SJ-1, LLC vs. United States*
- Engaged by the US Department of Justice as an expert witness for litigation involving a Section 1603 application for an open-loop biomass project, *W.E. Partners II, LLC vs. United States*
- Provided testimony to the Colorado PUC regarding the potential acquisition of an aging combined cycle facility to be incorporated into the Colorado rate base.
- Provided testimony to the Colorado PUC regarding the Clean Air Clean Jobs Act evaluating the retirement of 900 MW of coal facilities in Colorado.
- Engaged to provide expert witness support for litigation relative to an 800 ton per day, 22 MW waste to energy project in Harrisburg, Pennsylvania. Case settled out of court.
- Engaged to provide expert witness support for litigation relative to the construction of a 5 MGY biodiesel facility in Sante Fe Springs, California. Case settled out of court.

PUBLICATIONS/PRESENTATIONS/PATENTS

“Managing Technical and Resource Risk” – presented at Infocast Project Finance Tutorial Fall 2013.

“Managing Technical Risk on Thermal Generation Projects” – presented at Infocast Project Finance Tutorial Fall 2012 and Spring 2013.

“Biomass: Risk Mitigation” – presented at Infocast Project Finance Tutorial: 2011

“Is a Power Plant Shortage Looming” – published Greentech Media 2010

“Natural Gas Poised for Bigger Development” – published Denver Business Journal 2010

“The Energy Puzzle – How the Utility Industry Can Put the Pieces Together” – published epOverviews 2010

“Turbine Control Retrofits: Why, How, What and When” – presented at Power-Gen 2003

“Quality Assurance of Surface Treatments by Analysis of Substrate Surface Line Traces” – Patent for GE 1993