

POWER's flexible approach provides customized solutions to meet your specific needs and long-term goals for islanded energy storage.

December 17, 2021



Virgin Islands Water and Power Authority

PV Interconnection Power System Study, St. Croix

CONTACT:

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A proposal from:





POWER ENGINEERS, INC.
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PHONE 208-288-6100
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December 17, 2021

Nicole M. Aubain, Contract Administration Manager
Virgin Islands Water and Power Authority
9720 Estate Thomas, 3rd Floor
Al Cohen Plaza St. Thomas, VI 00802

Subject: PR-11-22 PV Interconnection Power System Studies for St. Croix, USVI

Dear Nicole:

On behalf of POWER Engineers ("POWER"), it is my pleasure to present our proposal to the Virgin Islands Water and Power Authority ("VIWAPA") for the *PV Interconnection Power System Studies for St. Croix, USVI* project. POWER has the requisite expertise to complete the terms of reference. We have identified our team of internal experts all of whom are available to begin work immediately upon execution of a mutually acceptable Professional Service Agreement.

POWER has supported the development of more than 25,000 MW of renewable energy capacity on projects in over 100 countries and across five continents. Our experienced staff is particularly well-prepared for the challenges and new opportunities that operators of island grids face today.

As an industry leader in power delivery and generation, our team brings strength and expertise to the multi-faceted technical needs associated with island systems. We provide energy storage design, interconnection/integration, system studies, site selection support, substation protection/control, grid/microgrid planning and design, and engineering support for both new and existing generation. Our deep experience in design and planning for island grids provides POWER with an important perspective on the stringent social, political, and economic factors that grid operators must balance.

Thank you for your consideration of POWER's proposal. We look forward to being part of your team. If you have any questions, please feel free to reach out at +1 208-788-0371 (office) or via email at matthew.kavanagh@powereng.com.

Sincerely,

A handwritten signature in black ink, appearing to read "Matthew Kavanagh", is written over a light gray rectangular background.

Matthew Kavanagh
Senior Project Manager

1. COMPANY INFORMATION



At POWER, we provide a full spectrum of multidiscipline engineering services for clients around the world.

From master planning to expert building and infrastructure design to comprehensive startup and commissioning, we offer start-to-finish engineering services.

COMPANY BACKGROUND/HISTORY

POWER Engineers Inc. (POWER), founded in 1976, is a nationally ranked consulting and engineering firm providing services for the generation, transmission, and distribution of electricity. As an industry leader in power delivery, our team brings strength, depth and expertise to the multi-faceted technical needs associated with energy storage projects. Across the U.S. and in more than 50 countries, POWER has delivered commercial, military, and federal projects and with more than 750 electrical engineers, has the capacity to execute multiple projects concurrently.

We provide industry-leading technical expertise in storage and renewables interconnection and integration, system studies, site selection support, distributed generation, substation protection and control, and microgrid engineering and design. In addition, we have the infrastructure to support the non-technical needs of any storage project or program, such as use case analysis and program management. This ranges all the way from tendering to project execution, resulting in cost-effective and reliable projects.

POWER has completed complex electrical design engineering projects throughout the Indo-Pacific theater (Pacific, Hawaii, Far East and Marianas) and therefore understands the stringent design requirements needed in Caribbean facilities to ensure their effectiveness and capability, but also to withstand the rigorous requirements of a tropical environment. POWER is particularly sensitive to and has experience with the demands of tropical environments, including critical wind load, seismic design, the impact of coral soil on structural design, and corrosive environment requirements that affect tropical locations. POWER's experience would allow for a proactive response to the Virgin Islands Water and Power Authority (VIWAPA) requirements and would provide streamlined project delivery.

Predicting electrical system performance under normal and abnormal conditions is a vital component in planning, permitting, designing, operating, and protecting the system. POWER has the tools and expertise to model power system performance from power flow and stability of the grid down to the transient analysis needed to specify insulation and equipment. POWER's team also performs the increasingly important task of assessing the impact of generation plants, traditional and non-traditional, on the transmission grid.



Our team has the experience to provide a full range of services for various storage technologies, from studies and modeling to grid analysis, interconnection design, and microgrid engineering.

Combining multi-discipline strengths, we offer **industry-leading technical expertise** to help our clients navigate diverse and complex energy storage challenges.



POWER's island experience (right) includes approximately 100 projects in island regions. POWER has executed projects on Pacific atolls, throughout the Caribbean, and in nations such as Indonesia, Iceland, Madagascar, and Bermuda. Worldwide, POWER has experience on every populated continent across multiple disciplines (above).

POWER'S ENERGY STORAGE SERVICES

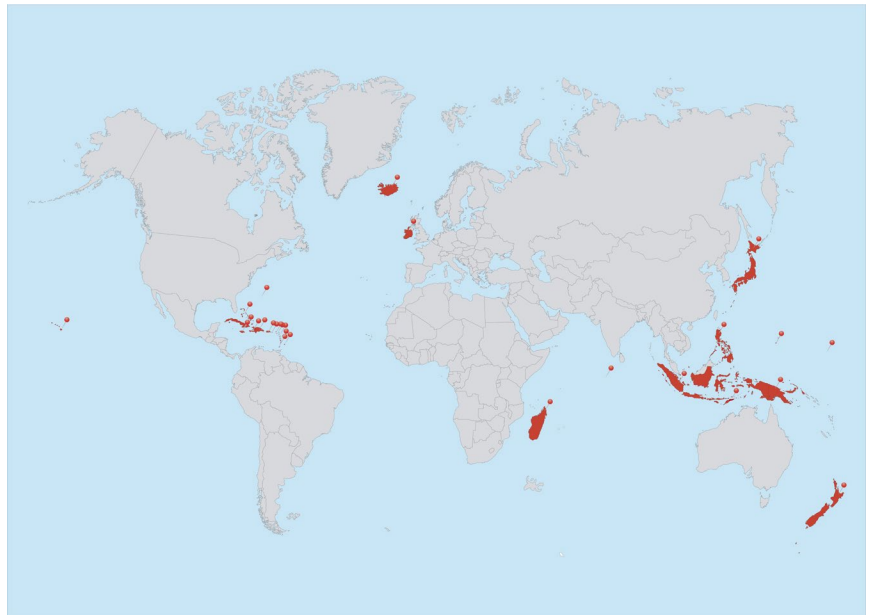
Project Development



Project Execution

- Owner's engineering
- System impact studies
- Feasibility studies
- Use case analysis
- System analysis and modeling
- System protection
- SCADA interface
- Environmental studies
- Project permitting
- Site selection assistance
- Technology screening
- Detailed design
- Construction management
- Testing and commissioning

READY FOR THE UNIQUE CHALLENGES OF ISLAND SYSTEMS



POWER has supported the development of more than 10,000 MW of renewable capacity on projects in over 100 countries and across five continents. Our experienced staff is particularly well-prepared for the challenges and new opportunities that operators of island grids face today.

POWER's team has worked with private sector developers, leading international lenders, and development organizations, including the World Bank, the U.S. Trade and Development Agency, the U.S. Agency for International Development, the Inter-American Development Bank, Overseas Private Investment Corporation, and the African Development Bank for more than 20 years.

2. RESUMES

POWER PROJECT TEAM

POWER has developed a team tailored to meet Virgin Island Water and Power Authority's project goals. These team members have been chosen because they have familiarity with similar projects, and their cumulative experience will provide invaluable insight throughout the life of the project.

Detailed resumes for each of POWER's team members follows.

Matthew Kavanagh Project Manager

Mr. Kavanagh is a seasoned project manager with more than 20 years of professional experience in the public and private sectors. He has developed and managed infrastructure projects in excess of \$3 billion and has demonstrated success negotiating key project agreements, including EPC contracts, Joint Venture Agreements, and Power Purchase Agreements. Mr. Kavanagh has led teams on major engineering projects, including power generation, transmission, and distribution projects throughout Africa, Asia, and Latin America. With a career spent primarily in emerging markets, he has extensive experience with governments and multilateral/bilateral development agencies on project development, management, and finance opportunities. Mr. Kavanagh is a strategic and results-driven leader with proven ability to motivate multidisciplinary, cross-cultural teams to deliver complex public and private projects.

As POWER Engineers' Federal Global Department Manager, Mr. Kavanagh develops and executes market strategies to promote business development with the US government, multilateral development banks, utility companies, and private sector developers. Mr. Kavanagh brings to POWER Engineers commercial creativity and a client satisfaction mind-set.

Todd A. Haynes, P.E. Project Manager

Mr. Haynes is an experienced project manager with a deep background in the renewable energy sector. His experience includes Owner's Engineering for utility-scale energy storage systems; feasibility studies for energy storage co-located with PV and wind; wind farm project development; wind and solar SCADA systems; investigation of emerging renewable and storage technologies; and collaboration with multiple stakeholders to execute complex renewable energy projects. He

co-created and led POWER's Energy Storage Focus Group. He has a successful track record providing oversight for CAISO new resource implementation, SCADA commissioning, operation support of existing energy projects, wind farm permitting, contracting, due diligence, landowner engagement, construction management, operations and other technical, regulatory and financial issues.

Chris Mouw, P.E.
Electrical Studies Engineer

Mr. Mouw is an Electrical Engineer with a focus on power systems modeling. He has specialized capabilities with power systems engineering for distributed energy resources and has modeled both large (high inertia) and small (microgrid) electric power systems with multiple interconnected generators such as wind, hydro, solar and battery-inverter storage. In addition, he specializes in performing DER sizing based on electrical and financial factors. Prior to joining POWER, he worked for several years at Northern Plains Power Technologies.

Chris Postma, P.E.
Electrical Engineer

Chris Postma is a Professional Electrical Engineer who specializes in the analysis and design of advanced power delivery system facilities. His background includes utility system studies, electrical system modeling, transient analysis, grounding design, and protective relaying performance and design. His experience includes performing transmission studies using PSS/E, PSLF, and PowerWorld Power Flow software, transient analysis work using PSS/E, PSLF, and PowerWorld Dynamics, impact and transfer studies using TARA, equipment life cycle estimation, grounding design, transferred voltage analysis, and lightning protection design and analysis. He has served the role of client and project lead for multiple clients within the disciplines of transmission planning and design studies. He is serving as the vice-chair for the IEEE PES Subcommittee Reliability Impact of Inverter Based Resources (IBR) Working Group.

Stanley Sostrom
Senior Project Engineer

Mr. Sostrom is recognized as one of POWER's leading specialists for BESS engineering and project management. His broad experience covers all aspects of a BESS project from initial studies through design, construction, testing, commissioning and maintenance. As a Project Engineer/Design Engineer, Mr. Sostrom brings deep technical skill to a variety of projects including those using leading-edge technologies such as battery energy storage systems (BESS), STATCOM, and static var compensators (SVC). He often functions in a QA/QC role responsible for quality control and adherence to standards. As a Project Manager, he has successfully guided some of POWER's most challenging assignments. These challenges have included aggressive schedules, technical complexity, and stringent design requirements. In addition to project roles, Mr. Sostrom also is successful under a variety of contract delivery methods, whether POWER's role is as an EPC prime, owner's engineer, or contracted engineer. Whether a project's demands are

technical or managerial in nature, Mr. Sostrom applies the needed expertise to achieve successful results.

Steve L. Harris
Senior Project Manager

Mr. Harris is an accomplished project manager with wide-ranging power generation experience. In particular, he is skilled in battery energy storage systems (BESS), simple and combined cycle combustion turbine design, coal and gas-fired steam plants, reciprocating engines, permitting and regulatory support, and control system upgrades. His background as an engineering manager for an independent power producer offers a unique perspective regarding operation and maintenance of existing plants, capital project evaluation and implementation, and equipment assessment and procurement. Mr. Harris is skilled in developing and managing large, multidiscipline generation engineering projects. He has experience working with a variety of clients including state and federal entities, independent utilities, and private corporations.

MATTHEW KAVANAGH

PROJECT MANAGER

YEARS OF EXPERIENCE

23

EDUCATION

- M.A., International Relations, Brussels School of International Studies, University of Kent, 2003
- B.A., History, Hobart College, 1996
- Course Work, History and International Conflict Resolution, National University of Ireland, 1995

AREAS OF EXPERTISE

- Project management and market analysis
- Contract management (e.g., FIDIC Red, Yellow, and Silver Books)
- Project financial management
- Procurement strategy and processes
- Management of subcontractors, joint venture partners, and clients
- Track record of generating steady department and corporate revenue.

AFFILIATIONS

- American Council of Engineering Companies (ACEC) - Serving on the Water, Energy, and Environment Committee
- U.S. Exim Bank's Sub-Saharan Africa Advisory Committee (2019-2020)

EXPERIENCE SUMMARY

Mr. Kavanagh is a seasoned project manager with more than 20 years of professional experience in the public and private sectors. He has developed and managed infrastructure projects in excess of \$3 billion and has demonstrated success negotiating key project agreements, including EPC contracts, Joint Venture Agreements, and Power Purchase Agreements. Mr. Kavanagh has led teams on major engineering projects, including power generation, transmission, and distribution projects throughout Africa, Asia, and Latin America. With a career spent primarily in emerging markets, he has extensive experience with governments and multilateral/bilateral development agencies on project development, management, and finance opportunities. Mr. Kavanagh is a strategic and results-driven leader with proven ability to motivate multidisciplinary, cross-cultural teams to deliver complex public and private projects.

As POWER Engineers' Federal Global Department Manager, Mr. Kavanagh develops and executes market strategies to promote business development with the US government, multilateral development banks, utility companies, and private sector developers. Mr. Kavanagh brings to POWER Engineers commercial creativity and a client satisfaction mind-set.

Refurbishment of Songo HVDC Converter Station, Hatch Limited, Mozambique

Leader of the POWER team responsible for supporting Hatch in the execution of the Songa HVDC Refurbishment project for Hidroelétrica de Cahora Bassa (HCB) in Mozambique. POWER was responsible for specifying and estimating the cost of equipment, engineering, procurement and construction work needed to implement the results of a System Impact Study. POWER developed the PSSE load flow and dynamic studies required for the development of the specification, as well as provide (a) technical review of the Contractor's designs and equipment specifications (HVDC equipment); and (b) technical support during the tender process and contract negotiations, as well as general technical support during contract implementation.

Wind Power Plant and Battery Storage Feasibility Study, Delphos International, United States Trade and Development Agency (USTDA), Ventos de Inhambane Mozambique

Leader of the POWER team and its preparation of a feasibility study of a 30 MW wind power plant that will be one of the only utility-scale wind power plants in the country. The feasibility helped determine the technical, financial, and commercial practicality of the project. POWER's team conducted a wind resource assessment, energy storage technology and commercial review, and an electrical interconnection study. POWER also provided a conceptual design, cost estimate, power plant preliminary site

design, and owner's engineer support for the finalization of project agreements.

Integrated Solar and Energy Storage Feasibility Study, United States Trade and Development Agency (USTDA), Blue Solar Farm 1, Co., Thailand

Leader of the POWER team and its preparation of a feasibility study of a 42 MW solar photovoltaic (PV) power plant with integrated 12 MW energy storage system (ESS) in Thailand. The primary objective of the study was to assess the technical, economic, financial, and other key elements of the project and provide the project developer with necessary data, analysis and recommendations required for financing and implementation of the project.

Sirui Wind Feasibility Study, Delphos International, United States Trade and Development Agency (USTDA), Kenya

Leader of the POWER team and its preparation of a USTDA funded study to determine the technical, financial, and economic feasibility of a 50-megawatt wind power plant with integrated battery storage capacity being developed in Kajiado, Kenya. POWER is responsible for carrying out electrical interconnection studies, an assessment of the wind resource, design of the plant, integration and optimization of the storage component, and a comprehensive plan for implementing the project. POWER's technical feasibility analysis will be utilized by the developer to assess the plant's commercial feasibility and prepare key documents to support financing for the project.

400 kV Transmission Line and Substations Project, Stantec Consulting, Nepal

Leader of POWER's project engineering transmission line, substations, and system & studies teams. POWER was responsible for completing project preparation and tender level designs for a high-voltage transmission project in Nepal funded by the US Government's Millennium Challenge Corporation (MCC). POWER completed the grid studies and preliminary engineering for 300 kilometers of 400 kV transmission lines and three 400 kV substations. This work included developing designs and technical specifications needed to create tender documents for design-build (FIDIC Yellow Book) construction packages.

Technical Advisory Services to the Government of the Republic of The Gambia, Norton Rose, The Gambia

Leader of the POWER team responsible for providing technical advisory services to the Government of The Gambia as a subcontractor to Norton Rose, as assisted by the African Legal Support Facility (ALSF). POWER is the engineering partner on Norton Rose's team providing the Government of The Gambia (i) capacity building to negotiate Power Purchase Agreements and related agreements and the preparation of an "IPP toolkit;" (ii) advisory services with respect to the tender process of two priority IPP projects; and (iii) the negotiation of two IPP contracts.

HVAC/HVDC Line Conversion Pre-Feasibility Study, Ingeniería Especializada (ieb), Chile

Project Manager responsible for overseeing project scope, schedule, budget, and client management. Leader of the POWER team and its preparation of a preliminary study to assess the feasibility of converting the existing Nueva Pan de Azúcar - Polpaico 2x500 kV AC transmission line to an HVDC transmission line owned and operated by INTERCHILE (ISA-Chile).

Electromagnetic Field and Corona Study of Planned 132 kV Transmission Line, Scatec Solar ASA, Bangladesh

Project Manager responsible for overseeing project scope, schedule, budget, and client management. Leader of the POWER team and its preparation of a study to calculate field effects for a planned 132 kV transmission line associated with a 50 MW solar project in Bangladesh.

PREVIOUS WORK HISTORY

Amaryllis Infrastructure Advisors LLC, Washington, DC

Managing Partner

Provided advisory services on a range of corporate growth and transactional issues in emerging markets. Developed strategies to mitigate risk for independent power producers (IPPs) and institutional investors.

Symbion Power LLC, Dubai, United Arab Emirates and Johannesburg, South Africa

Senior Vice President and Head of Global Business Development

Identified energy investment opportunities within target markets in Sub-Saharan Africa and the Middle East. Grew a new IPP business to a 900 MW pipeline of multi-fuel (thermal and renewable) projects, including putting three long-term concession agreements and Power Purchase Agreements in place in Kenya, Rwanda, and Madagascar.

Millennium Challenge Corporation (MCC), Dar es Salaam, Tanzania and Washington, DC

Deputy Resident Country Director, Operations

Oversaw implementation of an \$840 million U.S. government funded infrastructure program (energy, roads, water) with the Tanzanian Government. Responsible for the full life cycle of project development and implementation.

TODD A. HAYNES, P.E.

PROJECT MANAGER

YEARS OF EXPERIENCE

19

EDUCATION

- M.Eng., Mechanical Engineering, Boise State University, 2007
- B.S., Mechanical Engineering, Boise State University, 2003
- B.A., Journalism, San Jose State University, 1990

AREAS OF EXPERTISE

- Wind and Solar SCADA systems
- Utility-scale wind energy project development
- Grid integration of intermittent renewable energy
- Energy storage
- Wind energy forecasting

LICENSING

- P.E., Mechanical: Idaho

HARDWARE/SOFTWARE

- MATLAB

AFFILIATIONS

- Idaho Strategic Energy Alliance Wind Task Force
- Idaho Wind Working Group
- Advisory Committee for College of Southern Idaho's Wind Energy Technician Program
- Advisory Committee for Portland Community College's Renewable Energy Systems Program
- American Wind Energy Association's Education Working Group
- American Society of Mechanical Engineers (ASME)

HONORS

- Wind Powering America's Carpe Ventem (Seize the Wind) Award, 2007

PUBLICATIONS

- Haynes, Todd; 20 co-authors; Federal Support for Electricity Storage

EXPERIENCE SUMMARY

Mr. Haynes is an experienced project manager with a deep background in the renewable energy sector. His experience includes Owner's Engineering for utility-scale energy storage systems; feasibility studies for energy storage co-located with PV and wind; wind farm project development; wind and solar SCADA systems; investigation of emerging renewable and storage technologies; and collaboration with multiple stakeholders to execute complex renewable energy projects. He co-created and led POWER's Energy Storage Focus Group. He has a successful track record providing oversight for CAISO new resource implementation, SCADA commissioning, operation support of existing energy projects, wind farm permitting, contracting, due diligence, landowner engagement, construction management, operations and other technical, regulatory and financial issues.

Portland General Electric, Coffee Creek Substation Energy Storage Owner's Engineering, Wilsonville, Oregon

Project Manager responsible for owner's engineer services to develop RFP specifications and evaluate engineer, procure and construct (EPC) proposals for a 20 MW/80 MWh energy storage system at a 13 kV distribution substation. POWER's services included defining EPC scope and project schedule from project kick-off through turn-over to utility, developing technical specifications based on OPUC use case requirements and providing steady-state and dynamic models as well as technical inputs in support of the interconnection request application.

PacifiCorp, Rocky Mountain Power STEP/UIT Panguitch Solar + Storage Project, Utah

Project Manager for owner's engineer services for RMP's Sustainable Transportation Energy / Utah Innovative Technology (STEP/UIT) project. The project involves up to 650 kW of solar photovoltaic and 5 MWh of battery storage installed at the Panguitch substation in southern Utah. This project aims to improve voltage conditions and mitigate costs associated with connection on the 69 kV bus at the substation. POWER's scope includes PSS/E system load flow studies; small generation interconnect application support; permitting and licensing support; specification review and preparation; coordination with federal, state and local agencies; EPC RFP support; and reporting.

Castalia Strategic Advisors, U.S. Trade and Development Agency, Pele Green Energy, 75 MW Solar PV Technical Due Diligence, South Africa

Renewable Energy Engineer responsible for leading the independent engineering analysis of the proposed BESS, providing an analysis of the multiple battery chemistries and technologies available for integration into the project, identifying four relevant use cases, and then studying each case's

Solutions, July 2018, prepared for the U.S. House of Representatives Bipartisan Advanced Energy Storage Caucus

- Haynes, Todd; Dawson, Paul; and Nuss, Kevin; Forecasting for Wind Energy, February 2010, prepared for Bonneville Power Administration
- Shively, Dustin; Gardner, John; Haynes, Todd; and Ferguson, James; Carbon-Free, Site Independent Energy Storage for Grid Integration, presented at the American Wind Energy Association WINDPOWER 2009 Conference & Exhibition
- Shively, Dustin; Gardner, John; Haynes, Todd; and Ferguson, James; Energy Storage Methods for Renewable Energy Integration and Grid Support, Proceedings of IEEE Energy 2030 Conference, 2008
- Russell, Alan; Nuss, Kevin; Dawson, Paul; and Haynes, Todd; Application of WRF and Fluent for Wind Energy Forecasting, presented at the American Wind Energy Association WINDPOWER 2009 Conference & Exhibition
- Russell, Alan; Dawson, Paul; and Haynes, Todd; Application of Fluent for Atmospheric Flow: Comparison to WAsP in Complex Terrain, presented at the American Wind Energy Association WINDPOWER 2008 Conference & Exhibition
- Gardner, John; Haro, Nathaniel; and Haynes, Todd; Active Drivetrain Control to Improve Energy Capture of Wind Turbines, presented at the American Wind Energy Association WINDPOWER 2007 Conference & Exhibition
- Dorr, J. Lars, and Haynes, Todd; Re-Powering the Wind Turbines at Lewandowski Farms, August 2006, prepared for Idaho Department of Water Resources Energy Division
- Jackson, Brian D., and Haynes, Todd; Permitting of Small & Medium Sized Wind Turbine Projects in Idaho, November 2005, prepared for Idaho Department of Water Resources Energy Division

costs and benefits. POWER's BESS report made recommendations included technical recommendations on how best to integrate the BESS into an updated project design and how best to manage permitting and negotiation with the utility to monetize the BESS. POWER led an engineering feasibility analysis of proposed 75MW grid-connected solar PV plant in South Africa. POWER reviewed plant design and technical configuration, modeled and reviewed anticipated energy yield and technical considerations for panels, inverters, and rack mounts/trackers. POWER also produced a PVsyst model to analyze proposed system energy yield.

Delphos International, USTDA 50 MW Siruai Wind Power Plant with Integrated Storage Feasibility Study, Kajiado, Kenya

Project Engineer for this project. In its continuing efforts to improve reliability for its customers, Kenya's Craftskills Energy Limited launched a USTDA-funded feasibility study for the Siruai Wind Power Plant, a 50 MW wind and integrated battery energy storage system. As a subcontractor to Delphos International, POWER was selected to execute the technical study and assess the practicality of the project.

POWER's scope of services in the study includes elements such as preparing a wind resource assessment, plant engineering and design, battery storage size selection and commercial uses, a grid connection study, and engineering, procurement, and construction bid document preparation.

At the completion of the study, it will be submitted to prospective lenders to show the bankability of the project. This is an essential piece of Craftskills' ability to close out the development process, sign project agreements, and apply for financing.

The Siruai project will be located in Kajiado, Kenya, approximately 70 kilometers southwest of Nairobi. It will provide greater grid reliability, control of voltage, and usage of renewable energy for Kenyan utilities.

Delphos International, USTDA 30 MW Wind and Battery Storage Feasibility Study, Praia de Rocha, Mozambique

Project Engineer responsible for technical analysis and feasibility assessment of a battery energy storage system in support of a proposed, 30MW wind farm in southern Mozambique. Feasibility assessment of the battery energy storage system required accommodating southern Mozambique's aged and overburdened electrical grid, a combination of grid codes in practice, and design requirements that shifted to accommodate wind resource confirmation and wind turbine specifications.

USTDA provided a grant to Ventos de Inhambane to execute a feasibility study for a proposed 30 MW wind farm with battery energy storage. Delphos International performed the study and POWER supported Delphos with conceptual design and OE services for the wind farm, BESS, and 33 kV transmission line. POWER led confirmation of the previous wind resource assessment, reviewed and updated the grid impact study, supervised field site condition and geotechnical assessments, and studied the logistics and feasibility of importing and transporting wind turbine equipment to the remote coastal site.

E.ON Climate & Renewables, Iron Horse Solar + Storage Project, Arizona

Project Manager for owner’s engineer services for a 10 MW battery energy storage system and 2 MW photovoltaic array. POWER provided 50% and 90% electrical design reviews for the project, which is connected to a 13.8 kV distribution center at the University of Arizona Science and Technology Park. Services included a preliminary one-line for the Interconnection Application; design review for the battery BOP electrical, electrical collection and switchyard, and substation grounding.

PREVIOUS WORK HISTORY

Terna Energy USA, Mountain Air Wind Projects, Idaho

Terna Energy Regional Manager responsible for project development of wind farms in Idaho totaling 138 MW and involving six separate Power Purchase Agreements (PPAs). Duties included Balance of Plant (BOP) contract management totaling approximately \$33 million; managing relationships with Siemens, Idaho Power, lenders/investors, regulatory bodies, attorneys and landowners; assembling and supervising operations staff, including managing 11 Terna engineers and construction managers and hiring a business manager and two technicians to provide BOP operations and maintenance (O&M) services; and working with the BOP contractor to fulfill federal, state and local Conditional Use Permit (CUP) requirements; utility and pipeline crossing agreements; and Federal Aviation Administration (FAA) requirements.

CHRIS MOUW, P.E.

ELECTRICAL STUDIES ENGINEER

YEARS OF EXPERIENCE

13

EDUCATION

- B.S., Electrical Engineering, South Dakota State University, 2008

AREAS OF EXPERTISE

- Distributed energy resources
- Power system modeling and engineering
- IEEE 1547 Anti-islanding testing
- Load-rejection and ground-fault overvoltages
- Development of code-based tools in Matlab/Simulink

LICENSING

- P.E., Electrical: Colorado

SEMINARS

- Presenter, "Dynamic Behavior of Islanded Distributed Energy Sources." 2018 Minnesota Power Systems Conference, 2018.
- Presenter, "Risk of Unintentional Islanding in the Presence of Multiple Inverters or Mixed Generation types." Minnesota Power Systems Conference, 2015.

HARDWARE/SOFTWARE

- Matlab/Simulink
- PSCAD
- ATP-EMTP
- PSS/E
- CYME
- Synergi

AFFILIATIONS

- IEEE, Power and Energy Society

PUBLICATIONS

- SAND2019-0499. "Evaluation of Multi-Inverter Anti-Islanding with Grid Support and Ride-Through and

EXPERIENCE SUMMARY

Mr. Mouw is an Electrical Engineer with a focus on power systems modeling. He has specialized capabilities with power systems engineering for distributed energy resources and has modeled both large (high inertia) and small (microgrid) electric power systems with multiple interconnected generators such as wind, hydro, solar and battery-inverter storage. In addition, he specializes in performing DER sizing based on electrical and financial factors. Prior to joining POWER, he worked for several years at Northern Plains Power Technologies.

Castalia Strategic Advisors, U.S. Trade and Development Agency, Pele Green Energy, 75 MW Solar PV Technical Due Diligence, South Africa

Studies Engineer responsible for leading the financial and technical modeling of the project, with and without a battery energy storage system (BESS) in place, to identify the potential costs and benefits of the BESS under four usage scenarios. POWER led an engineering feasibility analysis of proposed 75MW grid-connected solar PV plant in South Africa. POWER reviewed plant design and technical configuration, modeled and reviewed anticipated energy yield and technical considerations for panels, inverters, and rack mounts/trackers. POWER also produced a PVsyst model to analyze proposed system energy yield.

Fayda Engineering & Energy Solutions, Delaware Army National Guard Biden Headquarters Campus Microgrid, Delaware

Electrical Engineer responsible for using HOMER software to size battery storage to maintain a 14-day microgrid when paired with local photovoltaic and natural gas sources. Also provided cost-effective analysis that was performed on various DER configurations which considered fuel and energy prices as well as loading and climate.

United States Energy Association, Oserian Geothermal Tech Assessment, Kenya

Electrical Engineer on this project. The Oserian Development Corporation operates several <2 MW geothermal units and a 1 MW solar PV plant. In addition, Oserian uses one well to heat freshwater for use in heating and flower growing operations. Carbon dioxide harvested from geothermal steam is used to stimulate growth in the greenhouses. The complex truly is a "resource park" that makes best use of its varied assets. Oserian has plans to host manufacturing companies, food production facilities and other facilities. POWER and K&M Advisors evaluated various electrical and thermal power production options to expand the industrial park to a total of 8 MW of demand over the coming years. The power production options were evaluated using HOMER software based on the use of energy storage options to supplement the baseload geothermal and intermittent solar generation.

Investigation of Island Detection Alternatives.”

- SAND2018-8431. “Unintentional Islanding Detection Performance with Mixed DER Types”. Sandia Report 2018.
- Co-author. “Ground Fault Overvoltage with Inverter-Interfaced Distributed Energy Resources.” IEEE Transactions on Power Delivery, special issue “Contemporary Problems in Power Quality”, 32 (2), April 2017.
- Co-author. “On the Sizing and Benefits of Grounding Transformers with Distribution-Connected Inverters.” Proceedings of the IEEE Transmission and Distribution Conference and Exposition, April 2018.
- Co-author “Voltage Changes Caused by Distributed Energy Resources and Their Impact on Hosting Capacities”, 53rd Minnesota Power Systems Conference, November 2017.
- Co-author. “Single Line Open Detection in the Presence of Distributed Energy Resources.” Western Protective Relay Conference, October 2017.
- Co-author. “Detailed Simulation Studies as a Solution to 21st Century Power System Challenges.” 52nd Annual Minnesota Power Systems Conference, November 2016.
- With M. Ropp. “Negative Sequence Relaying and Islanding Detection in Inverter-Based Distributed Energy Resources.” Proceedings of the 2016 Western Protective Relay Conference, October 2016.
- Co-author. “Risk of Unintentional Islanding in the Presence of Multiple Inverters or Mixed Generation Types.” 51st annual Minnesota Power Systems Conference, November 11, 2015.
- Co-author. “Lessons Learned in Implementing Battery System Controls in Low-Inertia Systems.” 51st annual Minnesota Power Systems Conference, November 11, 2015.
- Co-author. “Practical Considerations in Application of Correlation-Based Islanding Detection with Synchronphasors.” Proceedings of the 42nd IEEE Photovoltaic Specialists Conference, June 2015.

Distribution options were evaluated using PSS/E to determine the preferred strategies to increase capacity and microgrid stability. These evaluations culminated in capital and operating cost estimates for a matrix of options and calculations of the levelized costs of energy, including sensitivity analysis. Oserian is proceeding to upgrade their grid and expand their generation capacity along the lines of the recommendations.

Avista Utilities, Clean Energy Fund 3 - Transactional Network Project, Spokane, Washington

Engineer for an Avista Utilities transactive model system to explore how price signals can provide an incentive for consumers to lower power demand while supporting the distribution grid. Responsible for developing the modeling test platform that included solar PV, battery storage, thermal generation and storage, electrical and thermal loadings, and grid interaction. Developed several use cases involving the dispatch of generation, storage, and loading aspects and incorporated into the model for testing. Avista engaged POWER for a resilient, scalable and secure software platform to control distributed energy resources (DER) and building management systems as part of the transactive model system. POWER is executing the conceptual plan and technology roadmap for Avista. The plan’s object is to demonstrate how performance of DER and building management systems can be improved with seamless connections to data and devices, and with decisions based on consumer preferences.

California Client, High Fire Protection Study, California

Engineer for a project to validate the minimum pickup settings for the fast-trip overcurrent protection scheme our Confidential Client used to prevent a dangerous rise in conductor temperature and to reduce the risk of wildfires. Responsible for using MATLAB and Simulink to model 15 distribution feeders in the Confidential Client’s territory. Developed custom load models used to replicate stalling effect of single-phase compressor motors. Also responsible for testing of Fault-Induced Delayed Voltage Recovery events. POWER analyzed the protection scheme using CYME, MATLAB and Simulink software to determine the lower thresholds of the minimum pickup settings, which then could be applied to all feeders.

PREVIOUS WORK HISTORY

Madison Gas and Electric, Morey Airport Interconnection Study, Wisconsin

Studies Engineer responsible for conducting interconnection study which included developing MATLAB-Simulink model, rotating and inverter distributed generation (DG), transient voltage analysis of GFOV and LROV, risk of islanding analysis, and fault current contribution. Report was delivered to MGE on behalf of Northern Plains Power and Technologies who was contracted for the work.

- Co-author. "Simulation Study of a Dynamic VAr Compensator as a Solution to a Large Motor Start Problem." 50th Annual Minnesota Power Systems Conference (MiPSyCon), November 2014.
- "Simulation Study of Islanding in Two Synchronous Generator DG Applications." Proceedings of the IEEE PES General Meeting, July 2014.

Sandia National Laboratories, SAND2019-0499, Multiple Locations

Studies Engineer responsible for developing models, model validation, generating results, analysis, and reporting. Project studied how advanced grid-support features such as volt-var, frequency-watt, and ride-through affect voltage and frequency deviations on a circuit containing inverter-based anti-islanding. Results are publicly available as SAND2019-0499.

Sandia National Laboratories, SAND2018-8431, Multiple Locations

Studies Engineer responsible for developing models, model validation, generating results, analysis, and reporting. This project classifies different types of anti-islanding techniques into groups and then tests the ability of those groups to detect an electrical island when paired with either another group type or synchronous generation. The results are publicly available as SAND2018-8431.

EPRI, Risk-of-Islanding Sensitivity Study, Various Locations

Studies Engineer responsible for developing models, model validation, generating results, analysis, and reporting. This project studied the sensitivity of a pair of inverter-based anti-islanding techniques against a set of variables such as rated power vs actual power, load distribution, phase-to-phase imbalance, circuit impedance, and different loading types.

Black Hills Power, Denbury Large Motor Start with DVAR, South Dakota

Studies Engineer responsible for developing models, model validation, generating results, analysis, and reporting. A set of large machines were fed by approximately 80 miles of transmission line. A DVAR as well as additional capacitors were to be added to support the start-up of these machines. The system was modeled and the DVAR and amount of capacitance were sized to accommodate the startup of the machines for multiple conditions.

NorthWestern Energy, GFOV and Generation to Load Ratio, Montana

Studies Engineer responsible for developing models, model validation, generating results, analysis, and reporting. Due to a concern of transient overvoltage on the Butte circuits from an increase in the generation to load ratio, a study was conducted to determine the point at which mitigation would be required.

CHRIS POSTMA, P.E.

ELECTRICAL ENGINEER

YEARS OF EXPERIENCE

15

EDUCATION

- Doctoral Candidate, Electrical Engineering, University of Missouri, 2022
- M.S., Electrical Engineering, University of Missouri, 2007
- B.S., Electrical Engineering, University of Missouri, 2006

AREAS OF EXPERTISE

- Load flow and transient analysis
- Grounding design
- Lightning protection
- System protective relaying
- System modeling to incorporate renewables
- Transmission planning
- Grounding analysis

LICENSING

- P.E., Electrical: Missouri
- P.E., Electrical: Texas
- P.E., Electrical: Kansas

HARDWARE/SOFTWARE

- PSS/E
- PSLF
- PowerGem TARA
- ASPEN
- ETAP
- CDEGS
- WinIGS
- PSCAD
- AcSELeRator Quickset

PUBLICATIONS

- "Synchrophasor Implementation to Establish Dynamic Line Rating Paired with Adaptive Distance Relaying Protection." PAC World Americas Conference, Raleigh, North Carolina, 2018.
- "Synchrophasor Implementation to Monitor Dynamic Changes in Thermal

EXPERIENCE SUMMARY

Chris Postma is a Professional Electrical Engineer who specializes in the analysis and design of advanced power delivery system facilities. His background includes utility system studies, electrical system modeling, transient analysis, grounding design, and protective relaying performance and design. His experience includes performing transmission studies using PSS/E, PSLF, and PowerWorld Power Flow software, transient analysis work using PSS/E, PSLF, and PowerWorld Dynamics, impact and transfer studies using TARA, equipment life cycle estimation, grounding design, transferred voltage analysis, and lightning protection design and analysis. He has served the role of client and project lead for multiple clients within the disciplines of transmission planning and design studies. He is serving as the vice-chair for the IEEE PES Subcommittee Reliability Impact of Inverter Based Resources (IBR) Working Group.

Oncor, System Impact Study for Solar GIR, Western Texas

Electrical Engineer responsible for performing the system impact study for the interconnection of a new solar generator with Oncor's western Texas transmission system. Assessed multiple fault scenarios to determine if this interconnection compromise the stability of the system. POWER performed steady state and dynamic analysis for the system interconnect study to analyze the impact of new solar generation being interconnected in the western Texas region.

Garland Power & Light, Specification of STATCOM for Voltage Violation, Texas

Electrical Engineer on this project responsible for reviewing and specifying STATCOM settings to address ERCOT identified fault induced delayed voltage recovery violations under contingency conditions.

Evergy, CIP-014 Study, Northwestern Missouri/Central Kansas

Electrical Engineer responsible for analyzing fault scenarios for multiple qualifying BES stations using near-term and far-term cases to determine susceptibility of Evergy's system to cascading failure. POWER acted as independent review as required under NERC CIP-014.

MK Engineers, NAVFAC HI, Puuloa Network N-1-1 Mitigation Study, Joint Base Pearl Harbor Hickam, Hawaii

Electrical Engineer responsible for performing N-1-1 analysis using PSS/E to determine output constraints for new solar interconnect. Determined curtailment levels for solar output to prevent thermal overloads on the Puuloa network. POWER Engineers provided a mitigation report for the N-1-1 contingency study. The study was for the Pearl Harbor Puuloa 11.5 kV network to determine if the network could perform with the addition of new

Line Loading," Power & Energy Automation Conference, March 2018.

- Ph.D. Dissertation (December 2022): Risk relationship between system security and the impact of severe weather.

large scale photovoltaic arrays. Our team looked at two solutions to the overloaded station tie circuits under certain PV array maximum output conditions. It was determined that there needed to be up to two (2) additional 11.5 kV station tie circuits that would have to be constructed depending on the size of the photovoltaic arrays. We also recommended the possibility of using battery energy storage for time shifting the output of the PV array as an alternative to adding the station tie circuits.

USAID, Transmission Planning, Afghanistan

Engineer responsible for identifying energization sequence to enable power imports to Kabul from neighboring national grids. Engineer responsible for building out model of southern Afghanistan transmission system. Also performed checking analysis of strength of Afghani power systems. Assessment consisted of determining system penetration power of multiple sources and the ability to service multiple levels of system loading using PSS/E.

Xcel Energy, Dynamic Wind Farm Model Conversion, Rush Creek Wind, Colorado

Electrical Engineer responsible for converting received PSS/E dynamic files into PSLF format. Model conversion required modification of parameter settings and identifying conversion errors between the software packages. Near in fault simulation performed to validate dynamic model response between software packages.

NYISO Bus Flow Analysis, New York, New York

Electrical Engineer responsible for performing bus flow analysis to identify existing circuit breakers that require replacement under N-1 or N-1-1 contingency conditions following interconnection of new generation at existing substation using PSS/E. POWER Engineers assessed the impact of multiple interconnection configurations.

DTE Energy, Generation Interconnect Feasibility Study, Michigan

Electrical Engineer responsible for performing cluster steady state feasibility analysis using PSS/E to identify potential thermal or voltage violations that occur as a result of the interconnection of wind and landfill gas resources.

Confidential Client, Transmission System Expansion Study, Wyoming/Utah

Electrical Engineer responsible for performing reactive compensation analysis to identify new levels of compensation needed to accommodate the addition of multiple GW of wind generation to load new extra-high voltage series compensated line. Performed steady state and dynamic analysis to identify the need, size, and placement for new reactive compensation to facilitate secure operation of the system. Engineer responsible for performing swing current studies to identify the protection level for the series capacitors on the compensated lines in the system. Engineer responsible for performing closing angle studies to identify required breaker capabilities for closing into the system following a fault.

STANLEY SOSTROM

SENIOR PROJECT ENGINEER

YEARS OF EXPERIENCE

43

EDUCATION

- B.S., Electrical Engineering, South Dakota School of Mines and Technology, 1978

AREAS OF EXPERTISE

- Project management
- Substation engineering
- Compensation systems
- Battery energy storage

AFFILIATIONS

- IEEE

EXPERIENCE SUMMARY

Mr. Sostrom is recognized as one of POWER's leading specialists for BESS engineering and project management. His broad experience covers all aspects of a BESS project from initial studies through design, construction, testing, commissioning and maintenance. As a Project Engineer/Design Engineer, Mr. Sostrom brings deep technical skill to a variety of projects including those using leading-edge technologies such as battery energy storage systems (BESS), STATCOM, and static var compensators (SVC). He often functions in a QA/QC role responsible for quality control and adherence to standards. As a Project Manager, he has successfully guided some of POWER's most challenging assignments. These challenges have included aggressive schedules, technical complexity, and stringent design requirements. In addition to project roles, Mr. Sostrom also is successful under a variety of contract delivery methods, whether POWER's role is as an EPC prime, owner's engineer, or contracted engineer. Whether a project's demands are technical or managerial in nature, Mr. Sostrom applies the needed expertise to achieve successful results.

Golden Valley Electric Association, Battery Energy Storage System, Alaska

Project Manager responsible for owner's engineer services for the addition of a 40MW/20min battery energy storage system (BESS) to provide spinning reserve and var system support at the northern terminal of the new northern intertie in Fairbanks. The BESS is connected to the system via a 15-138 kV transformer located in the new 138 kV substation. The BESS facility used an existing storage building to house the batteries, power conversion system and associated controls. Complete rework of the existing building HVAC and auxiliary AC and DC station services were specified. POWER was responsible for the turnkey specification.

National Grid, Bunker Road Repowering Program, Massachusetts

Senior Project Engineer for Owner's Engineer services for a hybrid battery/gas turbine project on the island of Nantucket. Provided technical support for preparation of the BESS technical specification and assisted in conducting bid evaluations and formulating award recommendations. Providing ongoing technical support for the BESS during design and implementation of the project, and will provide submittal review from the BESS vendor. The 6 MW/48 MWh BESS and 12 MW gas turbine at National Grid's Bunker Road site are replacing two aging diesel generators and will provide emergency backup power for the island.

PacifiCorp, Rocky Mountain Power STEP/UIT Panguitch Solar + Storage Project, Utah

Project Engineer responsible for owner's engineer efforts on the project substation and grid interconnection, and for supporting development of the technical specifications for the BESS use cases and corresponding control specs. As part of the Sustainable Transportation Energy/Utah Innovative Technology (STEP/UIT) project, RMP is developing a set of distributed energy resources near the town of Panguitch. POWER is owner's engineer for the project, which includes 2 MW, 5 MWh of battery energy storage and 650 kW of solar PV. The project is being designed to resolve voltage issues and defer or eliminate traditional capital investments on a 69 kV transmission line and the interconnecting 12.47 kV distribution system.

Portland General Electric, Battery Energy Storage System Specifications, Oregon

Project Engineer responsible for developing an EPC specification for a 100 MW, 400MVA battery energy storage system (BESS). The scope of work included specifications for lithium ion batteries, power conversion system, auxiliary equipment, buildings, controls and operating modes. The BESS will be used as a peaking generation source to minimize the need for gas fired turbines.

Imperial Irrigation District, 30 MW / 20 MWh Battery Energy Storage System (BESS), El Centro, California

Project Engineer for the addition of a 30 MW/20MWh BESS to provide system support due to a high level of photovoltaic generation. Project responsibilities included siting and sizing studies for the BESS, determination of operating modes and a turnkey specification. POWER also acted as owner's engineer and construction monitor for the project, one of the first of its size in North America and the first major storage project for IID. The project was completed ahead of schedule on a compressed time frame, helping IID to meet a critical FERC deadline for increasing overall system reliability.

Puget Sound Energy, 3.3 MW/6.6 MWh Bainbridge Island Battery Energy Storage System Project, Washington

Project Engineer for owner's engineering services to support the EPC delivery of a 3.3 MW/6.6 MWh battery energy storage system (BESS) installation. Provided technical support for preparation of the BESS technical specification. PSE is seeking to defer the need for a new substation by adding a battery energy storage system to an existing substation to provide peak-shaving services. PSE hired POWER as their Owner's Engineer to work with their team to develop the EPC specifications, assist with the interconnection process, and provide technical review of EPC submittals and consulting throughout the EPC delivery.

Puget Sound Energy, Clean Energy Fund Tenino Demand Energy Response Microgrid, Washington

Project Engineer responsible for providing technical support for the 1MW/2MWh battery energy storage system portion of the project to facilitate delivery of a microgrid integrated with an existing 150kW photovoltaic solar

array. While providing back-up power to the community during an outage, this collaboration with PSE, Pacific Northwest National Laboratory and the Electric Power Research Institute will demonstrate that distributed energy resources reduce greenhouse gases while providing safe, reliable and affordable electrical service.

Portland General Electric, Coffee Creek Substation Energy Storage Owner's Engineering, Wilsonville, Oregon

Project Engineer responsible for QA/QC and support for the development of RFP specifications and evaluate engineer, procure and construct (EPC) proposals for a 20 MW/80 MWh energy storage system at a 13 kV distribution substation. POWER's services included defining EPC scope and project schedule from project kick-off through turn-over to utility, developing technical specifications based on OPUC use case requirements and providing steady-state and dynamic models as well as technical inputs in support of the interconnection request application.

STEVE L. HARRIS

SENIOR PROJECT MANAGER

YEARS OF EXPERIENCE

40

EDUCATION

- B.S., Mechanical Engineering, Gonzaga University, 1980

AREAS OF EXPERTISE

- Hydrogen Production and Storage
- Battery Energy Storage Systems
- Simple and Combined Cycle Combustion Turbine Design (large frame and aeroderivative)
- Coal and Gas-fired Steam Plant Design
- Reciprocating Engine Power Generation Design
- Concentrated Solar Thermal Power Generation Design
- Permitting and Regulatory Support
- Operation and Maintenance Experience with Operating Plants
- Capital Project Evaluation and Implementation at Operating Plants
- Owner's Engineer Experience
- Control System Upgrades
- Unique Owner's Perspective

AFFILIATIONS

- American Society of Mechanical Engineers, Associate Member

EXPERIENCE SUMMARY

Mr. Harris is an accomplished project manager with wide-ranging power generation experience. In particular, he is skilled in battery energy storage systems (BESS), simple and combined cycle combustion turbine design, coal and gas-fired steam plants, reciprocating engines, permitting and regulatory support, and control system upgrades. His background as an engineering manager for an independent power producer offers a unique perspective regarding operation and maintenance of existing plants, capital project evaluation and implementation, and equipment assessment and procurement. Mr. Harris is skilled in developing and managing large, multidiscipline generation engineering projects. He has experience working with a variety of clients including state and federal entities, independent utilities, and private corporations.

PREVIOUS WORK HISTORY

GWF Power Systems, Pittsburg, California

Engineering Manager responsible for capital project implementation, operations, and maintenance support for an independent power producer in Northern California with a generation capacity of 550 MW of capacity. Generation assets included six fluid bed combustor plants burning petroleum coke, three simple cycle natural gas combustion turbine plants, and a wood fired biomass facility.

Major accomplishments included the design and implementation of a major fuel handling modification to the fluid bed plants to burn an alternate fuel (delayed coke) and the design and installation of a truck loading system which was built at a local refinery fluid coke storage and ship loading facility to maintain the plant fuel supply during refinery outages.

Mr. Harris provided technical support for the permitting and design of the combined cycle conversion of the Tracy combustion turbine plant. The Tracy plant consists of two GE Frame 7EA combustion turbines operating in simple cycle. He prepared the technical sections of the EPC proposal that was used to select the EPC contractor. Mr. Harris reviewed the technical specifications used to purchase the major equipment and actively participated in the bid evaluations and commercial award process. He reviewed the preliminary design documents for the plant including the heat balances, general arrangement drawings, and the piping and instrumentation diagrams.

The Automation Group, Benicia, California

General Manager responsible for The Automation Group's (TAG's) Engineering group. The group was responsible for performing process automation design projects for power plants and oil refineries. TAG is a

Houston-based engineering company specializing in distributed control system retrofits and PLC upgrades.

Duke Engineering and Services/Impell Corporation, San Ramon, California

Operations manager for the Energy and Infrastructure Group's San Ramon office, responsible for managing 25 multi-discipline engineers. The San Ramon office provided consulting and design services for the electric utility industry in the western United States. This office also provided operations and maintenance support for the Duke Energy Moss Landing, Morro Bay, Oakland, and South Bay (formerly owned by SDG&E) power plants while operated as a part of Duke Engineering and Services.

Notable projects include:

- City of Riverside, Springs Generation Project. Mr. Harris served as Owner's Engineer for the City of Riverside. The Springs Generation Project consists of four 10 MW GE combustion turbines. Mr. Harris reviewed the detailed engineering design, procurement, and construction activities performed by the EPC contractor. He also participated in a combustion turbine selection study for another planned generation facility by the City of Riverside.
- Thums Long Beach Company, 47 MW Simple Cycle Power Plant. Mr. Harris served as the Project Manager responsible for the overall plant design. The plant consists of a single unit GE LM6000 combustion turbine and the associated auxiliary systems. The Thumbs Long Beach plant is designed to burn natural gas obtained from their off-shore oil wells in addition and the utility gas supply. It was built adjacent to a wall board manufacturing plant and was designed to allow the combustion turbine exhaust to be utilized to dry the wall board during the manufacturing process.
- Healy Clean Coal Project (HCCP) Retrofit Evaluation, Alaska. Mr. Harris served as Project Manager with overall responsibility for the project. HCCP is a 50 MW coal-fired plant built with funding from the Department of Energy Clean Coal Program and the State of Alaska. Following a failed test of the experimental combustor technology, an evaluation was completed to determine the feasibility and cost to replace the experimental combustor technology with conventional pulverized coal low NOx burners and the addition of a selective catalytic reduction (SCR) system.
- Duke Energy North America, Moss Landing 1500 MW Power Plant, Monterey, California. Mr. Harris served as the Project Manager responsible for the design and construction of a new Energy Management Center for the 1500 MW Duke Energy North America Moss Landing Power Plant located near Monterey, California. The new control center replaced the existing control room for Moss Landing Units 6 and 7 and also serves as the new control room for the 1000 MW combined cycle plant which was constructed adjacent to the existing units.
- California Independent System Operator, Remote Intelligent Gateway Project, Folsom, California. Mr. Harris served as the Project Manager with overall responsibility for the Remote Intelligent Gateway Project (RIG) for the California Independent System Operator (ISO) located in Folsom, California. Mr. Harris managed the prototype and pilot site testing for a new control system gateway which is being used by the ISO to remotely monitor real time data obtained directly from electrical generating plants in California. The RIGs are also used to receive and implement the

Automatic Generation Control (AGC) signals that are sent to the individual plants bidding regulation.

- Facilities Modification, California Independent System Operator, Folsom California. Mr. Harris served as the project manager in charge of the facilities modification for the California Independent System Operator (ISO) facility located in Folsom, California. In this role, Mr. Harris managed the 15 million dollar construction project for the 79,000 square foot facility which controls the entire California electrical grid. He provided technical overview of the design effort and managed all project budget and scheduling activities for this fast track project.
- Boiler Retrofit Project, State of California Department of Corrections. Mr. Harris served as the project manager for the State of California Department of Correction's boiler retrofit. This project was a state-wide effort to modify the central plant boilers at various correctional facilities to achieve compliance with the local air quality district NOx emission limits.
- Central Plant Expansion, San Francisco International Airport. Mr. Harris served as the Project Engineer for the San Francisco International Airport central plant expansion to support the international terminal expansion. Mr. Harris was responsible for the design of the airport central plant. He provided permitting and construction management services for the installation of the new high temperature hot water boiler which was added to the existing airport central plant.
- Circulating Water Treatment System Modification, Sierra Pacific Power Company, North Valmy Generating Station. Mr. Harris was the Project Engineer responsible for the modification of a circulating water treatment system at the North Valmy Generating Station for the Sierra Pacific Power Company. This project consisted of modifications to the cooling water makeup system and side stream treatment system for the circulating water system to reduce blow down to evaporation ponds. North Valmy is a twin unit 500 MW coal-fired power plant.
- Consultant, North Power Company, Oakland, California. Mr. Harris participated in a design team which evaluated the feasibility of several fluidized bed power plants to be located in the east coast which would burn petroleum coke. Mr. Harris worked with engineering personnel from the Combustion Power Company to develop plant cost estimates and heat rate models.
- Central Plant Modification, Stanford University. Mr. Harris served as the Project Engineer for a modification to the Stanford University central plant to meet the lower emission standards required by the Bay Area Air Quality Management District. He supervised the design team during development of the design documents and provided support to the construction contractor during the modification of the steam boilers.
- Truck Project Facility Expansion, New United Motor Manufacturing. Mr. Harris was the Project Engineer for a New United Motor Manufacturing truck project. He coordinated a 25 person design team during a two year design effort to prepare over 300 design drawings and associated construction specifications for a 700,000 square foot facility expansion of an automotive manufacturing plant.
- Rancho Seco Nuclear Generating Station Auxiliary Boilers and Emergency Generators, Sacramento Municipal Utility District. Mr. Harris served as System Engineer for the start-up of two 3,500 KW emergency diesel generators and the replacement of two auxiliary steam boilers at the Sacramento Municipal Utility District's Rancho Seco Nuclear Generating Station. In this role, he interfaced with the various plant managers and was responsible for the permitting, design, and construction activities. He

evaluated the existing auxiliary steam system and made changes to reduce steam consumption and improve system efficiency.

Bechtel Power Corporation

Mr. Harris served as a Mechanical Engineer while employed with the Bechtel Power Corporation. Notable projects:

- Startup and Commercial Operation, Diablo Canyon Nuclear Power Plant, Pacific Gas & Electric. Mr. Harris was a member of the on-site engineering group during the startup and commercial operation of the Pacific Gas and Electric Diablo Canyon Nuclear Power Plant. In this role he resolved various problems which arise during testing and initiated numerous design changes to improve plant reliability and efficiency.
- 1500 MW Colstrip Units 3 and 4, Montana Power Company. Mr. Harris was a member of the mechanical engineering design team for the Montana Power Company 1500 MW Colstrip Units 3 and 4. He developed flow diagrams, P&IDs, and system descriptions. Mr. Harris performed numerous calculations to size pumps, fans, heat exchangers and other mechanical components.

3. PROJECT EXPERIENCE - DESCRIPTIONS

References for most recent, relevant comparable work – project descriptions.

Project 1

CASTALIA STRATEGIC ADVISORS

U.S. Trade and Development Agency, Pele Green Energy, 75 MW Solar PV Technical Due Diligence, South Africa

The USTDA awarded a grant to Pele Green Energy, a South African independent power developer based in Johannesburg, to perform an independent engineering analysis of a proposed 75MW solar PV plant in the Free State province of South Africa.

The objective of the independent engineering analysis was to provide Pele Green Energy with the necessary analyses required to prepare a competitive proposal for the next round of South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and to assess other options for the project to sell its output directly to interested public and private sector off-takers.

As part of the analysis, POWER Engineers reviewed the project's feasibility analysis, financial model, and design, performance, and technical development studies. POWER reviewed the proposed EPC and O&M draft forms of contracts, the draft EPC tender packages, and the status of all required licenses, permits, and other legal requirements. POWER also reviewed the environmental and social impact studies performed to date. Lastly, POWER completed an analysis of technical and operational feasibility of potential integration of a battery energy storage system (BESS). POWER studied four different use cases and made recommendations for how best to integrate BESS into an updated project design.

POWER assisted Castalia LLC, an independent economic and financial advisory firm, in conducting the feasibility study.

Project 2**FAYDA ENGINEERING & ENERGY SOLUTIONS**

Delaware Army National Guard Biden Headquarters Campus Microgrid, Delaware

The Delaware Army National Guard (DEARNG) was instructed by the government to create a microgrid at its Biden National Guard Headquarters Campus. The microgrid allows the Guard to better respond to emergencies by guaranteeing a reliable source of energy, independent of the standard power grid. The DEARNG needed to include sustainability and demonstrate top-of-the-line microgrid technological capabilities to provide a leading example to National Guard facilities around the country. Their primary engineering consultant, Fayda Engineering & Energy Solutions, teamed with POWER to engineer the solution. The project was broken up into two phases, Title 1A and Title 1B services. POWER was awarded Title 1A services with the goal of executing Title 1B following approval of the microgrid design by DEARNG.

PROJECT FEATURES

- Multi-discipline project involving evaluating 12 kV and 480 kV electrical distribution and secure communications network for microgrid controls
- Distributed energy resources (DER) resources that include fuel cells, diesel, and natural gas reciprocating engine technologies
- Technical solutions and financial analysis for both islanded operation and grid connected services
- The campus can be disconnected from the main utility grid and island itself for a minimum of 14 days

PROJECT SERVICES

- Evaluation of DER for technical and financial feasibility for the site-specific application
- Evaluation of new BESS and existing PV DER technologies
- HOMER analysis reports
- DEARNG Design Basis Document
- Project estimates
- Preliminary one-line and distribution protection engineering for distribution circuits

CHALLENGES AND ACCOMPLISHMENTS

- Flexible response to client requests: Multiple HOMER analysis model reports and distribution topology changes provided in response to the client's needs.
- Leading by example: POWER's thorough evaluations helped the DEARNG set the standard for other National Guard microgrid facilities.

Project 3**JCM POWER**

USTDA, Feasibility Study for 17.5-40 MW Solar PV Plant, Golomoti, Malawi

To support the United States Trade and Development Agency (USTDA) in its mission to provide energy infrastructure in East Africa, POWER provided an installation and feasibility study for a 17.5-40 MW grid-connected PV solar plant near the village of Dezde in the Golomoti region of Malawi. POWER acted as a subconsultant to JCM Power. The plant will sell its electrical energy output to the Electricity Supply Corporation of Malawi Limited (ESCOM) under a long-term Power Purchase Agreement (PPA). POWER evaluated the technical feasibility and input data to support the completion of the environmental/social impact assessment (ESIA) for the plant.

In-addition, POWER developed specifications for a turn-key engineer-procure-construct (EPC) contract. The technical feasibility analysis, EPC contract, and ESIA were utilized by the Grantee to assess the plant's commercial feasibility. They also used POWER's deliverables to develop commercial analysis and prepare key documents to support financing for the project.

KEY ACTIVITIES

- Preparation of 30% design for solar plant and interconnection including optimized PV array layout and generation modeling using SolarGIS data and regional met data.
- Interconnection study and preliminary design of solar and BESS interconnection to 132 kV transmission system via ESCOM Golomoti Substation.
- Dynamic modeling of solar plant up to 40 MW with BESS augmentation for grid stability using DigSilent Power Factory power system analysis tool.
- Preparation of Class IV EPC cost estimates for solar plant, BESS, and interconnection facilities.
- Preparation of EPC tender package and contract documents, and evaluation of bids received.

ADDITIONAL RELEVANT PROJECT EXPERIENCE

MK ENGINEERS

Naval Facilities Engineering Command Hawaii, Renewable Energy Interconnection Requirements Modeling Study, Kuahua Network, Joint Base Pearl Harbor-Hickam, Hawaii

POWER Engineers was tasked by MK Engineering to provide a Renewable Energy Interconnection Modeling study of the Kuahua network throughout various locations of Joint Base Pearl Harbor Hickam (JBPHH) Navy Electrical System (NES). The scope of this interconnection study included a review and analysis of Naval Facilities Engineering Command's (NAVFAC) advanced metering infrastructure (AMI) and SCADA data to develop SKM/PTW models capturing load distribution within the electrical network under normal operation. This scope was before and after interconnection of the proposed Solar Powered Generating Systems (SPGS). POWER estimated SPGS generation during seasonal peak and off-peak hours to include existing and proposed SGPS sources using the PV Syst program. In-addition, we developed a PSS/E model to facilitate evaluation of circuit overloading, under-voltage and over-voltage conditions, within the Kuahua network. The model evaluated the electrical circuits from N-0 (normal operation), N-1 (planned maintenance), and N-1-1 [unplanned outage (fault) during N-1 operation] electrical feeder combinations. POWER developed a PSCAD model to investigate temporary over-voltage/under-voltage conditions resulting from islanded operation of the SPGS or a ground fault within the electrical distribution network.

POWER conducted the required studies and produced a report which summarized the study efforts, results, and then recommended mitigations to facilitate interconnection of 9.9 MWDC (5.9 rooftop and 4.0 carport) of new solar power generating systems (SPGS) on the JBPHH Kuahua 11.5 kV network. The modeling showed that some SPGS installations cause thermal violations under normal operating conditions (without a contingency applied) when the circuits were in a N-1-1 state. Specifically, the modeling showed this under weekday and weekend peak scenarios. POWER recommended that the Navy limit the solar inverter AC capacity at these locations to avoid overload conditions. POWER identified the thermal violations on transformers and recommended that AC generation at these sites be curtailed. Additional overvoltage conditions were identified in the system. The low-cost short-term strategy was to curtail the amount of generation that could enter the NES. POWER provided additional longer-term, more costly fixes that included adding new circuits to the NES. This allowed the full generating capacity of the SPGS to be utilized. POWER recommended approaches to mitigate the identified over-voltage conditions. This included modification of inverter control systems to curtail generation during islanded operation, controlling the ratio of generation to load below 1.0, installing rapid shutdown inverters to detect/isolate solar generation under islanding conditions, and

deployment of battery energy storage to increase load on selected feeders.

MK ENGINEERS

Navy Facilities Engineering Command Hawaii, Puuloa Network N-1-1 Mitigation Study, Joint Base Pearl Harbor-Hickam, Hawaii

MK Engineers tasked POWER to update the PSS/E model previously developed to assess the Navy's 11.5 kV Puuloa Network Electrical System (PNES) performance. This assessment was for an N-1-1 study.

POWER's scope was to assess the PNES under a max loading case without the addition of the 11 MW Solar Power Generating System (SPGS). In-addition, POWER's scope also comprised three other cases that included the addition of the SPGS. POWER used the PNES PSS/E model developed for the initial Waipio Interconnect Study, and then revised system loads based on the Navy provided updated load data.

The study report revealed that with the addition of the two new station tie circuits, up to 15 MW of PV could be accommodated in the Puuloa network before tie circuits started to experience current more than target values under N-1-1 contingency conditions.

POWER monitored bus voltages at 11.5 kV busses for N-1-1 contingencies between the range of 0.9 per unit and 1.1 per unit voltage. The Station M switchgear was located inside a 70 + year old bombproof concrete structure with 4-foot-thick walls and there was insufficient space to add switchgear sections. The age of the Station M switchgear required the use of bus transition sections.

POWER's study identified Battery Energy Storage Systems (BESS) was one alternative to provide a buffer that could absorb excess PV Array generated energy. POWER also showed that limiting the PV Array output was another way to avoid problems with N-1-1 condition.

4. WORK PLAN

DETAILED DESCRIPTIONS OF ANTICIPATED ACTIVITIES

This work plan consists of:

- Task Outline
- Task Descriptions

The Task Outline is a list of all tasks required to support the St. Croix PV Interconnection Power System Study.

Following the Task Outline is the main body of the Work Plan – Task Descriptions that define the activities or events that POWER must perform or have accomplished to complete this project efficiently.

A BASIS FOR PROJECT REPORTING

With this work plan, we can track tasks and deliverables throughout the life of the project. Project status reports and project review checklists assist us in communicating and coordinating internally throughout the project.

VIWAPA AND POWER REVIEW

We invite you to review and revise this document with us before the project starts. This joint review will provide optimum coordination among all involved parties as the project progresses.

| | |
|---------------|--|
| Task 0 | Project Management |
| Subtask 0.1 | Project Supervision and Control |
| 0.2 | Data Collection |
| Task 1 | Root Mean Square (RMS) Impact Studies |
| Subtask 1.1 | Model Development |
| 1.2 | Load Flow |
| 1.3 | Contingency Analysis |
| 1.4 | Short Circuit Calculation |
| 1.5 | Transient Stability |
| 1.6 | Reporting |
| Task 2 | Electromagnetic Transient (EMT) Impact Studies |
| Subtask 2.1 | Model Development |
| 2.2 | Harmonic Analysis |
| 2.3 | Energization & Inrush |
| 2.4 | Reporting |
| Task 3 | Battery Energy Storage System (BESS) Optimization |
| Subtask 3.1 | Model Development |
| 3.2 | Synchronous Reserve Strategy |
| 3.3 | Microgrid Support |
| 3.4 | Reporting |
| Task 4 | System Review & Upgrades |
| Subtask 4.1 | Identification of Upgrades |
| 4.2 | Cost Estimates |
| Task 5 | Reporting |
| Subtask 5.1 | Draft Report |
| 5.2 | Final Report |

TASK 0

PROJECT MANAGEMENT

Objectives:

- To manage POWER's scope of services per VIWAPA's expectations and POWER's procedures.
- To coordinate with VIWAPA and to direct the smooth flow of project communications.
- To manage the work plan, schedule, and budgets for on-time completion of the project within approved parameters.

Prerequisites:

- Purchase Order (P.O.)
- Notice to Proceed

SUBTASK 0.1 PROJECT SUPERVISION AND CONTROL

Responsibility: POWER

Deliverable:

- Supervision Management

Communicate, supervise and coordinate project participants (within POWER's purview) to complete all tasks and activities as outlined in the approved scope of work. Establish and maintain with VIWAPA the project schedule for engineering related tasks. Track deliverables progress and completion relative to schedule. Monitor the work and budget and document work scope variances, if there are any, for VIWAPA review. Prepare a Monthly Status Report to be attached to the Monthly Invoice which will summarize the status of deliverables, schedule and cost. Summarize the work performed in the reported billing period as well as work expected to be performed in the next billing period. Address problems, risks, trends and/or delays and the actions being taken to bring those areas back on schedule or budget.

Direct and coordinate POWER's project team with emphasis on:

- Compliance with VIWAPA stated procedures and standards
- Adherence to budget, scope, and schedule
- Compliance with the Project Procedures and Design Criteria
- Adherence to POWER's Quality Control and Quality Assurance procedures.

Assumptions:

- Budget includes project team members' attendance at one (1) hour project progress biweekly conference calls for the duration of the project to coordinate with VIWAPA.
- Meeting agendas and notes will be prepared to run meetings effectively.

- Project duration of 160 days from Purchase Order to Final Deliverable Report with Models

SUBTASK 0.2 DATA COLLECTION

Responsibility: VIWAPA /POWER

Deliverables:

- Request for Information (RFI) (by POWER)
- Requested information (by VIWAPA)

To conduct the studies, POWER will need detailed data on the system and its major components. A request for information (RFI) will be created to ascertain the required information. Information requested will be comparable to the requirements laid out in IEEE Std. 1547.7-2013. Given the scope and schedule on the project, it may be necessary to conduct multiple RFIs throughout the project.

Assumptions:

- POWER will develop an RFI of data needed within a week of the project kick-off meeting
- VIWAPA will provide needed information to POWER within two (2) weeks of receipt of RFI. Delays to this will have an impact on schedule.
- If information is unknown or unavailable, VIWAPA will work with POWER to agree upon reasonable assumptions.

TASK 1**ROOT MEAN SQUARE (RMS) IMPACT STUDIES****Objective:**

- Perform system impact studies utilizing the RMS software PSS/E

Prerequisite:

- Notice to Proceed

SUBTASK 1.1 MODEL DEVELOPMENT**Responsibility:** POWER

A number of the studies will be conducted using the RMS power modeling software PSS/E. VIWAPA will provide an existing model of the system along with generation dynamics as well as system case contingencies. POWER will update this model to include the new PV generation as well as BESS. Standard dynamic library models will be used for these added components. These models will be tuned and validated against system data and/or test reports provided by VIWAPA.

Assumptions:

- Receipt of data collection RFI.
- VIWAPA will provide existing PSS/E model with supporting dynamic files for existing generation as well and case contingencies. POWER assumes that all thermal and electrical ratings as well as voltages in the system are reflective of nominal conditions.
- The new PV and BESS generation models as well as plant controllers will need to be developed by POWER. Standard dynamic library models will be used for this.
- VIWAPA will provide data to support system validation modeling such as system one-lines with equipment specifications, manufacturer test reports, and system event data.
- PSS/E model provided by VIWAPA will include positive and zero sequence impedances.

Deliverable:

- Updated PSS/E model including new PV and BESS generation.

SUBTASK 1.2 LOAD FLOW**Responsibility:** POWER

POWER will conduct load flow simulations using the developed PSS/E model to ensure that system elements such as generators, overhead lines, underground cables, switchgear, and transformers operate within steady state thermal limits. Voltage regulation will also be monitored to remain within acceptable limits. If thermal or voltage violations are found, they will be documented and appropriate mitigation will be recommended.

Assumptions:

- Completion of Task 1.1
- Four (4) load conditions shall be analyzed for each of the three (3) PV scenarios.

Deliverables:

- Single line diagrams and tables will be used to document and present all load flow results.
- Documentation of thermal or voltage violations along with recommended mitigation.
- Results will be part of the RMS Impact Study findings.

SUBTASK 1.3 CONTINGENCY ANALYSIS**Responsibility: POWER**

POWER will perform contingency analysis in PSS/E for three (3) PV scenarios. VIWAPA will provide contingency files for all cases to be analyzed. Scenarios will be monitored for thermal and voltage violations according to VIWAPA criteria. For each case, the following outages will be analyzed:

- N-1 single outage of line or transformer
- Loss of one (1) thermal plant
- Loss of largest generator
- Loss of largest load

Assumption:

- Completion of Task 1.1

Deliverable:

- Contingency analysis as portion of the RMS Impact Study findings.

SUBTASK 1.4 SHORT CIRCUIT CALCULATION**Responsibility: POWER**

POWER will use PSS/E to perform three-phase and single-phase faults at the POI as well as at adjacent buses. This will be done with and without the new PV installation. Current protection settings for affected devices will be provided by VIWAPA for the basis of determining limit violations. If any operational or security limits are found, POWER will work with VIWAPA and recommend mitigation strategies.

Assumptions:

- Completion of Task 1.1
- Three-phase and single-phase fault studies will be done at the POI as well as adjacent buses.
- IEC 60909 will be used along with a voltage factor $c = 1.1$.
- VIWAPA will provide current protection for affected equipment.

- POWER will recommend mitigation if relevant operational and security limits are violated.

Deliverable:

- Short circuit calculations will be part of the RMS Impact Study findings.

SUBTASK 1.5 TRANSIENT STABILITY**Responsibility:** POWER

POWER will perform transient stability of the system with the added PV and BESS. As noted in Task 1.1, the PV and BESS components within PSS/E will use standard dynamic library models. A total of seven (7) system disturbances will be modeled:

- 3ph fault at the main substation for peak loading at night, peak loading during daytime, as well as at minimum loading condition.
- An outage of the largest generator for peak loading at night, peak loading during daytime, as well as at minimum loading condition.
- Cloud-passing transient for the PV plant.

Assumptions:

- Completion of Task 1.1
- PSS/E dynamics of existing generation will be provided by VIWAPA.
- Simulation durations will be a minimum of twenty (20) seconds.
- VIWAPA will provide breaker diagrams and typical clearing times.

Deliverable:

- Transient stability results will be part of the RMS Impact Study findings.

SUBTASK 1.6 REPORTING**Responsibility:** POWER

POWER will collect all findings from the RMS Impact Studies into either a section of one larger report encompassing the entire study or else into a smaller, standalone report focusing on the RMS Impact Studies. This will be determined based upon VIWAPA's preference at the onset of the project.

Assumption:

- Completion of Tasks 1.1 – 1.5.

Deliverable:

- Results will be compiled into either a separate RMS Impact Studies report or as a larger portion of the Draft Report per preference from VIWAPA.

TASK 2

ELECTROMAGNETIC TRANSIENT (EMT) IMPACT STUDIES

Objective:

- Perform system impact studies utilizing the EMT software PSCAD.

Prerequisite:

- Notice to Proceed

SUBTASK 2.1 MODEL DEVELOPMENT

Responsibility: POWER

Select studies will be conducted using the EMT power modeling software PSCAD. POWER will develop this model based upon the PSS/E model developed under Task 1.1. This PSCAD will be tuned and validated against system data and/or test reports provided by VIWAPA as well as comparable results from the PSS/E modeling.

For the new PV and BESS installations, POWER will work with VIWAPA to acquire manufacturer supplied PSCAD models. If these cannot be readily obtained, then generic models will be tuned and used to represent the system. POWER also assumes generic models will be tuned and used to represent the existing generation components of the system.

Assumptions:

- Receipt of data collection RFI.
- Completion of Task 1.1.
- POWER will work with VIWAPA to acquire manufacturer supplied models of the new PV and BESS installations. It is recommended that manufacturer supplied models be acquired to best represent the system. If these cannot be obtained, generic models will be tuned and used by POWER. However, it should be noted that generic models may not be the best representation of the inverter-based resource (IBR) performance and associated dynamics such as ride-thru capability.
- POWER assumes studies associated with Risk of Islanding (ROI) as well as switching transient overvoltages such as Ground Fault Over Voltage (GFOV) and Load Rejection Over Voltage (LROV) are not within the scope of this work. VIWAPA and POWER can discuss if these should be included following awarding of work.

Deliverable:

- PSCAD model including new PV and BESS generation.

SUBTASK 2.2 HARMONIC ANALYSIS

Responsibility: POWER

POWER will conduct a harmonic analysis of the system utilizing the PSCAD model developed in Task 2.1. Harmonic contribution from individual generating units will be modeled based upon either harmonic spectrum data provided by VIWAPA or reasonable assumptions based upon best engineering practices. Compliance with IEC and IEEE standards on voltage and current harmonics will be tested and documented.

Assumptions:

- Completion of Task 2.1.
- Harmonic spectrum data and THD for all generation existing and new will be provided by VIWAPA.

Deliverable:

- Results will be compiled into either a separate EMT Impact Studies report or as a larger portion of the Draft Report per preference from VIWAPA.

SUBTASK 2.3 ENERGIZATION & INRUSH

Responsibility: POWER

POWER will use the PSCAD model developed in Task 2.1 to conduct energization and inrush simulations of the system. The objective will be to observe transient over voltages and voltage depressions associated with transformer energization events.

Assumptions:

- Saturation curves of relevant transformers will be provided by VIWAPA. If these curves are unavailable, then reasonable assumptions will be made.
- Line and cable parameters as well as equipment adjacent to energizing devices will be provided by VIWAPA.
- Energization simulations will be done at both maximum and minimum system strength for up to five (5) transformer energization scenarios.

Deliverable:

- Results will be compiled into either a separate EMT Impact Studies report or as a larger portion of the Draft Report per preference from VIWAPA.

SUBTASK 2.4 REPORTING

Responsibility: POWER

POWER will collect all findings from the EMT Impact Studies into either a section of one larger report encompassing the entire study or else into a smaller, standalone report focusing on the EMT Impact Studies. This will be determined based upon VIWAPA's preference at the onset of the project.

Assumption:

- Completion of Tasks 2.1 – 2.3.

Deliverable:

- Results will be compiled into either a separate EMS Impact Studies report or as a larger portion of the Draft Report per preference from VIWAPA.

TASK 3

BESS OPTIMIZATION

Objective:

- Analyze the electrical and financial impacts of utilizing the proposed BESS to optimize solar PV dispatch as well as provide reserves to the system for stability. This is to be done for both grid-tied and microgrid configurations where it's reserves capability will be compared to the use of thermal generation.

Prerequisite:

- Notice to Proceed

SUBTASK 3.1 MODEL DEVELOPMENT

Responsibility: POWER

POWER will develop an electrical and financial model of the system using HOMER Pro software which specializes in this specific type of study. Multiple BESS sizes (MW/MWh) will be evaluated to assess capabilities and costs associated with minimizing PV curtailment as well as providing synchronous reserves to the system. These will be done for both grid-tied and microgrid operation. The financial impacts of using the BESS for synchronous reserves will be compared to using thermal generation for which fuel costs and maintenance will be accounted.

The system model will incorporate local meteorological data based upon reliable weather databases (NASA and/or NREL). This will account for typical cloud cover, irradiance, and temperature which affect PV production. Load data for the area will be provided by VIWAPA which can be in the form of recorded hourly data (8760 data) or monthly energy usage with estimates on seasonal maximum and minimum loading data. With reasonable hourly and seasonal projections on generation and load, the BESS storage will be sized.

Assumptions:

- VIWAPA will provide guidance on spinning and non-spinning reserve policy.
- VIWAPA will provide any pertinent tariffs and other financial considerations to aid in the decisions on BESS sizing & dispatch.
- VIWAPA will provide loading data as well as estimates on load growth for the next five (5) years.
- While it is understood 10 MW / 20 MWh is the initial design size, POWER will investigate multiple MW and MWh sizes to investigate the potential for an improved design. CAPEX and OPEX of the proposed sizes will be provided.
- The BESS sizing will be optimized assuming a fixed PV size of 18 MW; additional PV penetration levels can be considered on a time and expense basis if requested.

Deliverable:

- HOMER Pro model

SUBTASK 3.2 SYNCHRONOUS RESERVE STRATEGY

Responsibility: POWER

The model developed in Task 3.1 will be used to perform grid-tied modeling studies with an emphasis on providing synchronous reserves to the system. This will be compared to the incorporation of thermal generation for the purpose of providing synchronous reserves to the system. Over a five (5) year period, CAPEX and OPEX of both solutions will be compared. An optimum BESS size will be determined to meet the system electrical constraints as well as provide the lowest financial cost.

Assumption:

- VIWAPA will provide guidance on the frequency and duration of synchronous reserve support needed by the system.

Deliverable:

- Comparison of optimized BESS vs thermal generation regarding providing synchronous reserves for a grid-tied configuration.

SUBTASK 3.3 MICROGRID SUPPORT

Responsibility: POWER

The model developed in Task 3.1 will be used to perform microgrid modeling of the BESS along with PV and associated load on the microgrid. Two types of studies will be performed. The first will be to demonstrate what durations a microgrid could be sustained for a 10 MW / 20 MWh BESS given various microgrid formation times throughout the year. Second, an optimum BESS size will be determined to sustain a microgrid for a pre-determined amount of time. The size of the BESS will be considered along with the possibility of added thermal generation to support the microgrid. Cost comparisons among these options will be presented.

Assumption:

- VIWAPA will provide guidance on the durations of microgrid formations.

Deliverables:

- Estimates on microgrid durations capable from a 10 MW / 20 MWh BESS along with the proposed 18 MW PV plant.
- Comparison of optimized BESS vs thermal generation regarding support of a microgrid configuration.

SUBTASK 3.4 REPORTING

Responsibility: POWER

POWER will report findings on BESS sizes, dispatch options, CAPEX, OPEX, and microgrid durations for the scenarios studied in Tasks 3.2 and 3.3.

Assumption:

- Completion of Tasks 3.1 – 3.3.

Deliverable:

- Results will be compiled into either a separate BESS Optimization report or as a larger portion of the Draft Report per preference from VIWAPA.

TASK 4

SYSTEM REVIEW & UPGRADES

Objective:

- Review system upgrades/changes identified in Tasks 1 – 3 and compile a list of costs associated with each upgrade.

Prerequisite:

- Completion of Tasks 1 – 3

SUBTASK 4.1 IDENTIFICATION OF UPGRADES

Responsibility: POWER

Following the findings and recommendations made in Tasks 1 – 3, POWER to compile a list of upgrades to the St. Croix system and the proposed PV and BESS interconnection. These may include line upgrades for thermal violations, transformer upgrades or additional reactive equipment to mitigate system over voltages, or the additional of thermal generation for synchronous reserve support.

Assumption:

- POWER and VIWAPA will discuss the findings of Tasks 1 – 3 and determine feasible upgrades and changes to consider.

Deliverable:

- List of system upgrades and additions.

SUBTASK 4.2 COST ESTIMATES

Responsibility: POWER

Following agreement on feasible system upgrades and changes, POWER will provide cost estimates on the proposed items found in Task 4.1.

Assumption:

- Completion of Task 4.1.

Deliverables:

- Basis of Estimate and Key Cost Assumptions
- Table of costs associated with identified upgrades from Task 4.1.
- This will be included in the summary reports described in Task 5.

TASK 5 REPORTING

Objective:

- Compile all findings from this study for VIWAPA into one (1) deliverable. This may be one all-encompassing report for the entire study or it may be broken down into individual reports with one overall summary report. This will be agreed to between VIWAPA and POWER upon project initiation.

Prerequisite:

- Completion of Tasks 1 – 4.

SUBTASK 5.1 DRAFT REPORT

Responsibility: POWER & VIWAPA

POWER will consolidate reporting on Tasks 1 – 3 as well as upgrades and costs identified in Task 4 into a deliverable report to VIWAPA. This can be a single report containing all items of Tasks 1 – 4 or it could be a summary report of the individual reports compiled in the tasks. This will be determined at kickoff of the project with VIWAPA.

This will be considered a draft report for review and comment by VIWAPA.

Assumptions:

- Completion of Tasks 1 – 4
- VIWAPA will provide comments on the draft report to POWER within ten (10) business days.

Deliverable:

- Draft report for review and comment by VIWAPA.

SUBTASK 5.2 FINAL REPORT

Responsibility: POWER

Upon receipt of comments by VIWAPA on the draft report, POWER will update the report and findings into a final version of the report.

Assumptions:

- Receipt of comments by POWER from VIWAPA on Task 5.1 Draft Report.
- VIWAPA and POWER have conducted a meeting to review comments and questions.

Deliverable:

- Final report

5. SCHEDULE

PROPOSED PROJECT SCHEDULE

The included project schedule shows how we plan to accomplish the project tasks in the timeframe you have requested. It was developed by our proposed project team using the anticipated start and end dates, our understanding of the project requirements, and our experience with similar projects.

The listed activities correspond to the tasks in our project work plan. Please note most tasks can be done in parallel.

The schedule assumes receipt of RFI within two weeks.

| TENTATIVE MILESTONE SCHEDULE | | |
|------------------------------|----------------|----------|
| DESCRIPTION | START DATE | DURATION |
| Task 0 | NTP | 22 Weeks |
| Task 1 | NTP + 2 Weeks | 12 Weeks |
| Task 2 | NTP + 2 Weeks | 8 Weeks |
| Task 3 | NTP + 2 Weeks | 4 Weeks |
| Task 4 | NTP + 14 Weeks | 4 Weeks |
| Task 5 | NTP + 18 weeks | 4 Weeks |

6. BUDGET

PROJECT BUDGET

POWER developed the proposed budget based on our understanding of this project's scope of work and our experience with similar projects. The tasks listed below correspond to the tasks described in our proposed work plan. The table summarizes the budget for services to be provided on a FFP basis for **\$141,491.00**.

| BUDGET SUMMARY BY TASK AND SUBTASK | | | | |
|------------------------------------|------------|---------------|------------|---------------|
| TASK DESCRIPTION | HRS | LABOR \$ | EXP \$ | TOTAL \$ |
| 0.01 Project Management | 50 | 13,380 | 134 | 13,514 |
| 0.02 Data Collection | 4 | 1,040 | 10 | 1,050 |
| 0.03 Client Meetings | 24 | 6,360 | 64 | 6,424 |
| 0.04 PMA | 24 | 3,840 | 38 | 3,878 |
| TASK 0 TOTAL | 102 | 24,620 | 246 | 24,866 |
| 1 RMS Impact Studies | | | | |
| 1.1 Model Development | 56 | 10,900 | 109 | 11,009 |
| 1.2 Load Flow | 5 | 975 | 10 | 985 |
| 1.3 Contingency Analysis | 10 | 1,950 | 20 | 1,970 |
| 1.4 Short Circuit Calculation | 10 | 1,950 | 20 | 1,970 |
| 1.5 Transient Stability | 115 | 22,125 | 221 | 22,346 |
| 1.6 Reporting | 62 | 12,020 | 120 | 12,140 |
| TASK 1 TOTAL | 258 | 49,920 | 499 | 50,419 |
| 2 EMT Impact Studies | | | | |
| 2.1 Model Development | 56 | 10,900 | 109 | 11,009 |
| 2.2 Harmonic Analysis | 16 | 3,100 | 31 | 3,131 |
| 2.3 Energization & Inrush | 16 | 3,100 | 31 | 3,131 |
| 2.4 Reporting | 28 | 5,570 | 56 | 5,626 |
| TASK 2 TOTAL | 116 | 22,670 | 227 | 22,897 |
| 3 BESS Optimization | | | | |
| 3.1 Model Development | 16 | 3,040 | 30 | 3,070 |

| BUDGET SUMMARY BY TASK AND SUBTASK | | | | |
|------------------------------------|------------|----------------|--------------|----------------|
| TASK DESCRIPTION | HRS | LABOR \$ | EXP \$ | TOTAL \$ |
| 3.2 Synchronous Reserve Strategy | 20 | 4,120 | 41 | 4,161 |
| 3.3 Microgrid Support | 26 | 5,240 | 52 | 5,292 |
| 3.4 Reporting | 16 | 3,280 | 33 | 3,313 |
| TASK 3 TOTAL | 78 | 15,680 | 157 | 15,837 |
| 4 System Review & Upgrades | | | | |
| 4.1 Upgrades Identification | 32 | 8,000 | 80 | 8,080 |
| 4.2 Cost Estimates | 24 | 5,840 | 58 | 5,898 |
| TASK 4 TOTAL | 56 | 13,840 | 138 | 13,978 |
| 5 Reporting | | | | |
| 5.1 Draft | 40 | 8,160 | 82 | 8,242 |
| 5.2 Final | 26 | 5,200 | 52 | 5,252 |
| TASK 5 TOTAL | 66 | 13,360 | 134 | 13,494 |
| PROJECT TOTAL | 676 | 140,090 | 1,401 | 141,491 |

APPENDIX A: PROJECT RELEVANCE

| POWER PROJECT | RELEVANT ANALYSIS | | | | | | | CLIENT | CONTRACT AMOUNT \$ | YEAR COMPLETE |
|---|------------------------|------------------------------|----------------------------|---------------------|-------------------|----------------------------------|------|---|--------------------|---------------|
| | Load Flow Calculations | N-1 Contingency Calculations | Short Circuit Calculations | Transient Stability | Harmonic Analysis | Transformers/Cables Energization | BESS | | | |
| Castalia USTDA Pele Solar PV | | | | | | X | | Castalia Strategic Advisors | 130,000 | 2021 |
| Ounalashka Makushin Geothermal Plant OE | | | | | | | X | OCCP, LLC | 157,900 | 2021 |
| ConnectGen – Sandy Pond BESS | | | | | | | X | ConnectGen, LLC | 36,000 | 2021 |
| Hawaiian Electric Protection Studies | X | | X | | | | | Hawaiian Electric | 285,000 | 2020 |
| NEPDI Bhikki Combined Cycle Power Plant | X | | X | | | | | Northeast Electric Power Design Institute | 1,100,000 | 2020 |
| BTU Long Range Planning Study | X | X | | | | | | Bryan Texas Utilities | 110,000 | 2020 |
| Denny Distribution Network | | X | | | | | | Seattle City Light | 3,500,000 | 2020 |
| Stanton Reliability Center | | | | | | | X | Stanton Energy Reliability Center, LLC | 382,100 | 2020 |

| | | | | | | | | | | |
|---|---|---|---|--|--|--|---|---|------------|------|
| ConnectGen – Cross Road BESS | | | | | | | X | ConnectGen, LLC | 36,700 | 2020 |
| ConnectGen – South Wrentham BESS | | | | | | | X | ConnectGen, LLC | 22,000 | 2020 |
| SCE Microgrid/BESS Support | | | | | | | X | Southern California Edison | 25,000 | 2020 |
| MKE, NAVFAC HI, Station F8B, JBPHH | | | X | | | | | MK Engineers | 17,000 | 2019 |
| SCE Arc Flash Automation Tool | | | X | | | | | Southern California Edison | 92,000 | 2019 |
| USTDA PV Solar PV Study Malawi | | | | | | | X | JCM Power | 127,200 | 2019 |
| USEA Oserian Geothermal Tech Assessment | | | | | | | X | United States Energy Association | 185,000 | 2019 |
| Biden Headquarters Campus Microgrid | | | | | | | X | Fayda Engineering & Energy Solutions | 75,000 | 2019 |
| ENMAX Feasibility Study Sub No. 1 | | X | | | | | | ENMAX Corporation | 76,500 | 2019 |
| MEPPI ITC Toll Road SVC | | X | | | | | | Mitsubishi Electric Power Products | 1,200,000 | 2019 |
| OHSU Microgrid Feasibility Study | X | | | | | | | Portland General Electric | 76,000 | 2019 |
| MVQMP Expansion Detailed Design | X | | | | | | | Magic Valley Quality Milk Producers Cooperative | 740,500 | 2019 |
| Denny Way Substation Program | X | | X | | | | | Seattle City Light | 28,800,000 | 2019 |

| | | | | | | | | | | |
|---|---|---|---|---|--|--|---|--|-----------|------|
| Nantucket BESS – Bunker Road OE | | | | | | | X | National Grid | 3,700,000 | 2019 |
| Arroyo Huinala - Pemcorp IE Due Diligence | | | | | | | X | Arroyo Energy Investment Partners, LLC | 350,000 | 2019 |
| National Grid Northport Repowering | | | | | | | X | National Grid | 58,300 | 2019 |
| Kittitas Feasibility Study (Calaway) | X | | | | | | | Public Utility District No. 1 of Kittitas County | 25,000 | 2018 |
| PGE Distributed Energy Resources Study | X | | X | | | | | Portland General Electric | 18,500 | 2018 |
| Juneau Interconnection Feasibility Study | X | | X | | | | | Alaska Electric Light & Power | 88,000 | 2018 |
| MK Engineers Arc Flash Studies Schofield | X | | X | | | | | MK Engineers | 463,000 | 2018 |
| Cooperative Moselle Startup Transformer | X | | X | | | | | Cooperative Energy | 264,500 | 2018 |
| Solar PV Farms Interconnect Studies | X | | | X | | | | Radiant Energy Limited | 826,000 | 2018 |
| Transmission Planning Study | | X | | | | | | Upshur Rural Electric Cooperative | 79,000 | 2018 |
| MK Engineers Interconnect Study Kuahua | | X | | | | | | MK Engineers | 381,500 | 2018 |
| DTE DER Interconnect Study | | | X | | | | | DTE Energy | 16,500 | 2018 |
| DTE Distribution System Resiliency | | | X | | | | | DTE Energy | 350,000 | 2018 |

| | | | | | | | | | | |
|---|---|---|---|---|---|--|---|---|-----------|------|
| Protection Grading Study Assistance | | | X | | | | | ADM Engineers | 243,500 | 2018 |
| Diamond North Bergen Generating 1200 MW | | | X | | | | | Diamon Generating Corporation | 3,900,000 | 2018 |
| Fort Rock Solar System Impact Studies | | | X | | | | | Portland General Electric | 136,500 | 2018 |
| SDG&E Escondido BESS Owner's Engineer | | | | | | | X | San Diego Gas and Electric | 149,300 | 2018 |
| NAVFAC PAC AMD 5 P-101 & P-102 Solar PV | | | | | | | X | Naval Facilities Engineering Command Far East | 1,100,000 | 2018 |
| IHI Battery Energy Storage System | | | | | | | X | IHI Corporate | 18,300 | 2018 |
| NRG Headquarters Microgrid Studies | | | | X | X | | | NRG Energy | 250,000 | 2017 |
| Chugach – Soldotna and Dave's Creek SVC | | | X | | | | | Chugach Electric Association | 100,500 | 2017 |
| Nantucket BESS and CTG Impact Study | | X | X | | | | X | National Grid | 56,000 | 2017 |
| Colington Substation STATCOM | | X | | | | | | Mitsubishi Electric Power Products | 753,600 | 2017 |
| 230 kV Undersea Cable Loading Analysis | | X | | | | | | Matanuska Electric Association | 56,000 | 2017 |
| Siemens Chattahoochee GT Upgrade 2 | | X | | | | | | Siemens Energy | 98,000 | 2017 |
| BBEC – 5-year Work Plan | X | | | | | | | Big Bend Electric Cooperative | 84,000 | 2017 |

| | | | | | | | | | | |
|--|---|---|---|---|--|--|---|--|---------|------|
| BBEC – Existing N-1 Contingency Analysis | X | X | | | | | | Big Bend Electric Cooperative | 50,000 | 2017 |
| Grande Prairie Wind Farm | X | | X | | | | | BHE Renewables | 176,000 | 2017 |
| NextEra Waipio Transmission Line Hickam | X | | | | | | | NextEra Energy Resources | 775,000 | 2017 |
| Wilmington Refinery Main Station | X | | | | | | | Marathon Petroleum Company LP | 217,000 | 2017 |
| Ormat Pomona Battery Storage Project | X | | X | | | | X | Ormat Technologies | 658,500 | 2017 |
| EWEB Microgrid Grid Edge Demo | | | | | | | X | Eugene Water & Electric Board | 176,200 | 2017 |
| TEP Iron Horse Energy Storage Project | | | | | | | X | Tucson Electric Power Company | 163,000 | 2017 |
| Small Hydro Electrical Interconnect | X | | | | | | | I & F Engineering CC | 21,000 | 2016 |
| Distribution PV Interconnection Studies | X | | | | | | | Intermountain Rural Electric Association | 46,000 | 2016 |
| Northern Lights CWP & LRP | X | | X | | | | | Northern Lights, LLC | 93,000 | 2016 |
| IID BESS Owner's Engineer | X | | | X | | | X | Imperial Irrigation District | 804,000 | 2016 |
| IREA Long Range Plan | X | | | | | | | Intermountain Rural Electric Association | 374,500 | 2016 |
| Pasco County N-1-1 Screening Study | | X | | | | | | Duke Energy | 48,500 | 2016 |

| | | | | | | | | | | |
|--|--|---|--|---|--|---|---|---|-----------|------|
| NAVFAC HI, Puuloa Network N-1-1 Mitigation Study, JBPHH | | X | | | | | | MK Engineers | 142,000 | 2016 |
| PNM Rio Puerco SVC Owner's Engineer | | | | X | | | | Public Service Company of New Mexico | 3,300,000 | 2016 |
| ECS NAVFAC PAC Diego Garcia Solar PV | | | | | | X | X | ECS – Electrical Engineers | 374,000 | 2016 |
| Review and Optimize Design Standards | | | | | | | X | Transelec S.A. | 700,000 | 2016 |
| Barbers Point Campbell Industrial BESS | | | | | | | X | Hawaiian Electric | 39,500 | 2016 |

APPENDIX B: VIWAPA FORMS, OFFEROR'S QUESTIONNAIRE & SCHEDULE OF CHARGES

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VI. OFFEROR'S QUALIFICATION STATEMENT

Name of License Holder: POWER Engineers, Inc.

Name of Company/DBA (if any): POWER Engineers

Legal Status: (check one) Corp. X LLC ___ Partnership ___ Sole Proprietorship ___

Business Location (office): Hailey, Idaho United States

Mailing Address: 3940 Glenbrook Drive Hailey, ID 83333

Telephone Number: 208-288-6100 Email: matthew.kavanagh@powereng.com

Website address (if any): powereng.com

Number of Years licensed to conduct business 45

Number of Construction Management Services completed in the last 5 Years 26,


Average value of these Contracts \$ 128,096,174

Do you have current Liability Insurance Coverage? ☒ Yes ☐ No If yes, value
\$ 10,000,000

Have you ever failed to complete a project, been fired and/or sued by one of your clients? No
(If yes, explain on another sheet, the circumstances and outcome)

Are there or have there been any Claims, Arbitration, Judgments or Liens against you? No
(If yes, explain on another sheet, the circumstances and outcome)


Complete the following pages for information related to your current and past projects references/client listing.

Certification of truth of the above Statements by: 

Title: Project Manager Date: 12/17/2021

Provide at least three (3) references for the most recent, relevant work comparable to the scope requested in this RFP. At a minimum, one of the three (3) references must be for the prime Contractor.

| # | Name of Client | Project Title | Project Description | Specific Deliverables | Contract Value | Contract Start and End Date | % Complete | Reference Contact Name | Phone and Email of Reference Contact |
|---|---|--|------------------------------------|---|----------------|--|------------------------------------|--|--|
| 1 | Castalia Strategic Advisors (Project Owner) | USTDA, Pele Green Energy, 75 MW Solar PV Technical Due Diligence, South Africa | SEE SECTION 3 - PROJECT EXPERIENCE | -Analyzed technical & operational feasibility of BESS -Reviewed project feasibility analysis -Reviewed financial models & technical development studies -Recommended how to integrate BESS into updated project design. | \$130,066 | Start: 06/01/2019 End: 07/03/2021 | 100% | Patrick Longmire, Castalia LLC | 703-945-2317 202-466-6790 patrick.longmire@castalia-advisors.com |
| 2 | Fayda Engineering & Energy Solutions | Delaware Army National Guard Biden Headquarters Campus Microgrid, Delaware | SEE SECTION 3 - PROJECT EXPERIENCE | -Evaluated 12 kV & 480 kV electrical distribution -Provided Title 1A services -Considered Distributed Energy Resources (DER) -Evaluated technical & financial feasibility -Created HOMER analysis reports | \$74,972 | Start: 10/20/2019 Estimated end: 12/25/2021 | Title 1A Services 100% complete | Edward Fayda, Fayda Engineering & Energy Solutions | 302-999-1060 302-690-8998 efayda@faydaees.com |
| 3 | JCM Power (Project Owner) | USTDA, Feasibility Study for 17.5-40 MW Solar PV Plant, Golomoti, Malawi | SEE SECTION 3 - PROJECT EXPERIENCE | -Feasibility study for 17.5-40 MW grid-connected PV solar plant -30% design for solar plant & interconnection including optimized PV array layout & modeling using SolarGIS data -Completed class IV EPC cost estimates for plant, BESS, facilities | \$127,283 | Start: 09/01/2018 End: 12/28/2019 | 100% | John Bahen, JCP Power | 647-963-0893 647-352-5657 jbahen@jcmcapital.ca |

Certification of truth of the above Statements, by: 

Title: Project Manager

VII. OFFEROR'S PROPOSAL FORM

The Offeror must complete and submit the attached PROPOSAL sheets with their proposal.

Name of the Offeror: POWER Engineers

(Individual, Partnership, or Corporation, as case may be)

Date of Offer: 12/17/2021

To: The Virgin Islands Water & Power Authority

- A. Pursuant to and in compliance with the Request for Proposals and other Contract Documents relating to the following:

Terms of Reference for PV Interconnection Power system Studies for St. Croix, VI

The undersigned, having carefully read, examined and having become familiar with the proposed project, scope of work, and local conditions affecting the performance and cost of the work at the proposed work-site; hereby, proposes and agrees to fully perform the work in accordance with the proposed contract documents. This includes furnishing all labor, materials, tools, supervision, equipment, and insurance necessary to complete said project in accordance with the contract documents.

The above-named Offeror affirms and declares that:

1. The Offeror is of lawful age and that no other person, firm, or corporation has any interest in this Proposal or in the Contract proposed to be entered into.
2. This Proposal is made without any understanding, agreement or connection with any other person, firm, or corporation making a Proposal for the same purposes, and is in all respects fair and without collusion or fraud.
3. The Offeror is not in arrears to the Virgin Islands Water & Power Authority, upon debt or contract, and is not a defaulter, as surety or otherwise, upon any obligation to the Virgin Islands Water & Power Authority.
4. No officer, employee or person whose salary is payable in whole or in part from the Virgin Islands Water & Power Authority currently is, shall be, or will become interested, directly or indirectly, as a contracting party, partner, stockholder, surety or otherwise, in this Proposal, in

the performance of the Contract, in the supplies, materials, equipment, work, or labor to which it relates, or in any portion of the profits thereof.

5. The Offeror has familiarized himself of the locations for where the scope of work is clearly defined herein and, from their own investigations, has satisfied himself as to the nature, accessibility, general and local conditions, and all difficulties to be encountered; and all other items which may, in any way, affect the work or its performance.

6. All proposals shall remain firm for a period of one hundred and twenty (120) days following the opening Proposal date.

7. The undersigned, as Offeror, also declares that he has carefully examined and fully understands all the component parts of these Contract Documents and agrees that he will execute the Contract and will completely perform the work in strict accordance with the terms of the Contract and the Contract Documents therein referred to for the following lump sum Proposal price.

B. TOTAL LUMP SUM PROPOSAL PRICE:

\$ 141,491.00
Numbers

One hundred forty-one thousand four hundred ninety one dollars
Words

NOTE:

1. The amount in Article B shall be shown in both words and figures; and in the case of discrepancy, the amount shown in words shall govern. Also, in the event of a discrepancy between the total of the items and the total stated, the total of the items shall govern. The Offeror must also completely fill out the Proposal Form and the sum total indicated there must match the amount shown in Article B.

2. Interlineations, alteration, or erasure may void the Proposal. The prices shall be typewritten or written by hand in ink.

3. The proposed payment schedule is based on a subdivision of the proposed contract price and the successful project completion.

4. Payments will be made on a Net sixty (60) day schedule.

C. ADDENDA

- i. Addendum No. PR-11-22 Addendum II MK
 - ii. Addendum No. _____
 - iii. Addendum No. _____
- 1. (Insert addendum (a) numbers and initial)
 - 2. The OFFEROR certifies that the above addendum (a) has been received and that changes covered by the addendum (a) have been taken into account in the Proposal.

D. ACCEPTANCE

This offer shall be open to acceptance for one hundred and twenty (120) days from the date of Proposal opening.

E. CONTRACT DURATION

If this Proposal is accepted, we will complete the Work in (160) calendar days from Notice to Proceed.

F. PRINCIPALS INVOLVED

(If OFFEROR is a partnership, fill in the following blanks)

Name of Partners _____

Partners Address (If OFFEROR is a corporation, fill in the following blanks)

Organized under the laws of the State of _____

Name and address of President _____

Name and address of Vice President _____

Name and address of Secretary _____

Name and address of Treasurer _____

VIII. ITEMIZED PROPOSAL TABLE

| SERVICE | Price (\$) | Est. Duration (weeks) |
|---|------------------|-----------------------|
| Project Management | \$24,866 | 22 |
| RMS Studies <ul style="list-style-type: none"> - Load Flow Calculations - N-1 Contingency Calculations - Short Circuit Calculations - Transient Stability | \$50,419 | 12 |
| EMT Studies <ul style="list-style-type: none"> - Harmonic Analysis - Energization & Inrush Study | \$22,897 | 8 |
| Battery Energy Storage System Analysis | \$15,837 | 4 |
| Facility Cost Estimates | \$13,978 | 4 |
| Draft and Final Reporting | \$13,494 | 4 |
| Total | \$141,491 | 22 |

OFFEROR'S QUESTIONNAIRE

The undersigned guarantees the truth and accuracy of all statements and answers herein contained.

1. How many years has your organization been in business as a General Contractor, Subcontract?

POWER has been providing A/E services as both a prime and subconsultant for 45 years.

2. Have you ever failed to complete work per contract specifications or within the time limits of a contract awarded to you?

POWER has not failed to complete work per contract specifications or within the time limits of a contract awarded to us.

3. Name three (3) contracting jobs your company has performed that relate to this scope of work. Supply project names, locations, how it applied to this job, contracted amount, completed amount, and contact person on the owner side for verification for each of the three submittals.

| | |
|-------------------|---|
| Project Name | U.S. Trade and Development Agency, Pele Green Energy, 75 MW Solar PV Technical Due Diligence |
| Location | South Africa |
| Relevant Scope | Analysis of proposed 75 MW solar PV plant that included analysis of technical and operational feasibility of potential integration of a battery energy storage system (BESS). POWER studied four different use cases and made recommendations for how best to integrate BESS into an updated project design. Scope included a HOMER simulation. |
| Contracted Amount | \$130,066 |

| | |
|------------------|--|
| Completed Amount | \$130,066 |
| Contact Person | Patrick Longmire Senior Advisor SEAF 202-466-6790 703-945-2316 |

| | |
|-------------------|---|
| Project Name | Delaware Army National Guard Biden Headquarters Campus Microgrid |
| Location | New Castle, Delaware |
| Relevant Scope | Evaluation of Distributed Energy Resources for technical and financial feasibility for the site-specific application, evaluation of new battery energy storage system and existing PV DER technologies, and HOMER analysis reports. |
| Contracted Amount | \$74,972 |
| Completed Amount | \$74,972 |
| Contact Person | Edward Fayda President Fayda Engineering & Energy Solutions 302-999-1060 302-690-8998 |

| | |
|-------------------|--|
| Project Name | U.S. Trade and Development Agency, Feasibility Study for 17.5-40 MW Solar PV Plant |
| Location | Malawi |
| Relevant Scope | Dynamic modeling of solar plant up to 40 MW with BESS augmentation for grid stability using DigSilent Power Factory power system analysis tool. Scope included a HOMER simulation. |
| Contracted Amount | \$127,283 |

| | |
|------------------|---|
| Completed Amount | \$127,283 |
| Contact Person | Jon Bahen Director, Project Development JCM Power 647-963-0893 647-352-5657 |

4. What equipment or software do you own that is available for this work?

HOMER, PSS/E, PSCAD, ASPEN, CAPE, MATLAB

5. What equipment or software will you purchase for the proposed work?

POWER will not need to purchase any equipment or software to complete the proposed work.

6. What equipment or software will you rent for the proposed work?

POWER will not need to rent any equipment or software to complete the proposed work.

7. Have you included any exceptions with your proposal? If yes, elaborate.

Yes. As part of the Battery Optimization Study, the RFP requests the offeror to *Recommend a battery power management system suitable in the context of renewable energy integration and estimate the cost benefits of such a management system*. In practice, the battery management system will be provided either by the BESS OEM or by a BESS integrator. Stand-alone/3rd party battery management systems are not commonly available for utility-scale energy storage systems. Regarding *estimating the cost benefits of a management system* – a power management system is required for the BESS to function, so the cost benefit question doesn't apply in this case. Given the above, POWER takes exception to this bullet in the RFP. We are happy to discuss this exception during the review period.

8. Have you included a preliminary project schedule with your proposal?

Yes, see Section 5 – Schedule.

9. Have you included the professional resume of your intended project manager with your proposal?

Yes, see Section 2 – Resumes.

10. Will you subcontract out any part of this contract? If yes, what parts and who will be subcontractor(s).

POWER does not anticipate needing any subcontractors at this time.

11. Please add any relevant information you believe is important to this proposal questionnaire that has not been asked in a previous question.

- a. **The business is a sole proprietorship, partnership, or corporation (circle one).**
- b. **The physical address of principle place of business is:**
3940 Glenbrook Drive
Hailey, ID 83333
- c. **The names of the corporate officers, or partners, or individuals doing business under a trade name as follows:**

| APPOINTMENT TITLE | DIRECTORS** | NAMES |
|-------------------------------------|-------------|--------------------|
| Chairman of the Board, Executive VP | Director | Ron Carrington** |
| CEO, President, CAO | Director | James Haynes** |
| COO, Executive VP | | Holger Peller |
| CFO, Treasurer, Senior VP | | Chuck Kemp |
| CIO, Vice President | | Keith Horn |
| CHRO, Senior VP | | Mark Mary |
| CSO, Executive VP | | Randy Grass |
| Executive VP | | William Hansen |
| Executive VP | Director | Gerard Murray** |
| Executive VP | Director | Timothy Ostermeier |
| Vice President | | Maria Gou |
| Vice President | | John Gunst |
| Vice President | | Christopher Kensel |
| Vice President | | David Leslie |
| Vice President | Director | Bruce Truxal** |
| Vice President | Director | T. Shayne Wright** |

(OFFEROR's Signature)



**POWER ENGINEERS INC.
SCHEDULE OF CHARGES – 2022**

This standard Schedule of Charges is for professional services. Unless agreed otherwise, charges for work on continuing projects will be based on the then current Schedule of Charges. A new Schedule of Charges will be issued to be effective January 1 of each new year and as necessary on an intermediate basis to accommodate new items or revised charges. Invoices will be submitted monthly and/or upon completion of the work and will be due and payable when issued. All accounts not paid within thirty (30) days after Owner's receipt of the invoice will bear a **SERVICE CHARGE OF 1.0% PER MONTH** for each month the invoice is unpaid.

| GRADE | PERSONNEL CLASSIFICATION | |
|--------------|---------------------------------|--------------|
| 13 | President | \$305.00/hr. |
| | Executive Vice President | |
| | Senior Project Manager IV | |
| 12 | Project Manager Director | \$300.00/hr. |
| | Senior Project Manager III | |
| 11 | Senior Project Manager II | \$290.00/hr. |
| | Senior Program Manager II | |
| | Principal Engineer II | |
| 10 | Senior Project Manager I | \$270.00/hr. |
| | Senior Program Manager I | |
| | Senior Project Engineer III | |
| | Senior Project Lead III | |
| | Strategic Consultant III | |
| | Principal Engineer I | |
| 9 | Project Manager III | \$260.00/hr. |
| | Senior Project Lead II | |
| | Construction Manager III | |
| | Senior Project Engineer II | |
| | Strategic Consultant II | |
| | Senior Consultant III | |
| | Senior Engineer II | |
| 8 | Project Manager II | \$230.00/hr. |
| | Senior Project Lead I | |
| | Strategic Consultant I | |
| | Senior Consultant II | |
| | Senior Project Engineer I | |
| | Construction Manager II | |
| | Senior Engineer I | |
| 7 | Project Manager I | \$200.00/hr. |
| | Project Lead II | |
| | Construction Manager I | |
| | Environmental Specialist IV | |
| | Project Engineer II | |
| | Engineer IV | |
| | Designer V | |
| | Project Administrator III | |
| | Senior Consultant I | |
| 6 | Project Lead I | \$190.00/hr. |
| | Project Engineer I | |
| | Engineer III | |
| | Designer IV | |
| | Environmental Specialist III | |
| | Procurement Specialist III | |
| | Scheduling Specialist III | |
| | Project Administrator II | |
| | Consultant III | |
| 5 | Engineer II | \$175.00/hr. |
| | Designer III | |
| | Technician IV | |
| | Environmental Specialist II | |
| | Procurement Specialist II | |
| | Scheduling Specialist II | |
| | Project Administrator I | |
| | Consultant II | |
| 4 | Engineer I | \$160.00/hr. |
| | Designer II | |
| | Drafter IV | |
| | Technician III | |
| | Environmental Specialist I | |
| | Procurement Specialist I | |
| | Field Representative IV | |
| | Scheduling Specialist I | |
| | Project Managers Assistant III | |
| | Consultant I | |
| 3 | Designer I | \$140.00/hr. |
| | Drafter III | |
| | Technician II | |
| | Field Representative III | |
| | Staff Assistant II | |
| | Project Managers Assistant II | |
| 2 | Drafter II | \$115.00/hr. |
| | Staff Assistant | |
| | Field Representative II | |
| | Project Managers Assistant I | |
| 1 | Drafter I | \$95.00/hr. |
| | General Office Assistant | |
| | Field Representative I | |

Personnel with specialized experience are employed by or on retainer to POWER. Charges for these specialists are negotiated on an individual basis depending on the assignment. Professional time for depositions and testimony is charged at 1.5 times the rate for services; full-day minimums apply.

2022 Fees (10/12/2021)

**POWER ENGINEERS INC.
SCHEDULE OF CHARGES – 2022**

This standard Schedule of Charges is for professional services. Unless agreed otherwise, charges for work on continuing projects will be based on the then current Schedule of Charges. A new Schedule of Charges will be issued to be effective January 1 of each new year and as necessary on an intermediate basis to accommodate new items or revised charges. Invoices will be submitted monthly and/or upon completion of the work and will be due and payable when issued. All accounts not paid within thirty (30) days after Owner's receipt of the invoice will bear a **SERVICE CHARGE OF 1.0% PER MONTH** for each month the invoice is unpaid.

REPRODUCTION**Drawings – Black & White**

| | |
|-------------------------------|------------|
| Large Scale Drawings (C Size) | \$1.90/ea. |
| Large Scale Drawings (D Size) | \$3.30/ea. |
| Large Scale Drawings (E Size) | \$5.50/ea. |

Drawings – Color

| | |
|-------------------------------|-------------|
| Large Scale Drawings (C Size) | \$6.00/ea. |
| Large Scale Drawings (D Size) | \$10.90/ea. |
| Large Scale Drawings (E Size) | \$17.50/ea. |

Documents – Black & White

| | | |
|---------------------|-------------------|--------------------|
| Single-sided Copies | 8 x 11 \$0.11/ea. | 11 x 17 \$0.17/ea. |
| Double-sided Copies | 8 x 11 \$0.22/ea. | 11 x 17 \$0.34/ea. |

Documents – Color

| | | |
|--------------------------------------|-------------------|--------------------|
| Single-sided Copies | 8 x 11 \$0.50/ea. | 11 x 17 \$1.00/ea. |
| Double-sided Copies | 8 x 11 \$1.00/ea. | |
| Spiral Comb | | \$2.65/ea. |
| 3 Ring Binder | Dependent on size | |
| Special Copy Center Projects (Labor) | | \$45.00/hr. |

SURVEY EQUIPMENT

| | | |
|-------------------------------------|--------------|--------------|
| Survey Equip. to support field crew | | \$70.00/day |
| GPS Equipment 2 Units | \$60.00/hour | \$350.00/day |
| GPS Equipment 3 Units | \$80.00/hour | \$450.00/day |

Other expenses including but not limited to subcontractors, airfare, lodging, meals, postage and shipping, purchases, rentals, are charged at cost plus a carrying and handling charge of 10%.

Communication Charge - including but not limited to VOIP charges, file sharing cloud services, and web collaboration sites, charged at 1% of labor billing charges.

CAD and Software Usage Charge – charged at 3% of labor billing charges. This charge covers CAD application and design software including: AutoCAD, MicroStation, Autodesk Revit, PLS-Cad, Smart Plant P&ID, electrical studies software, and other design software as required.

As an industry leader in power delivery and generation, our team brings strength, depth, and expertise to the multi-faceted technical needs associated with your islanded energy storage project.

Why POWER?

- POWER's teams have performed approximately 100 projects in island locations in island regions including Hawaii, the Virgin Islands, Indonesia, Cuba, Bermuda, the Philippines, New Zealand, Ireland, Japan, Madagascar, Guam, and many others.
- Our teams have supported the development of more than 25,000 MW of renewable capacity on projects in over 100 countries and across five continents.
- With offices in Hilo and Honolulu in Hawaii, POWER is uniquely qualified to understand the project needs and challenges related to island work.