Project Description and Objective

Parks Canada Agency (PCA) is undertaking the planning of upgrades to the existing electrical power generation system at Main Station on Sable Island National Park Reserve (SINPR) with the goal of significantly reducing the consumption of diesel fuel by the power generation system. Parks Canada is investigating the feasibility of implementing renewable power generation technologies, electricity storage technologies, means of increasing the efficiency of diesel generators, and other strategies that would help to achieve their goal.

The Proponent is required to complete a detailed investigation of power generation and storage technologies that can be integrated into the Main Station within a Schematic Design Report. **The primary project goal is to reduce the overall use of fossil fuels from all operational activities at Main Station by at least 50% below the 2019 levels.** In 2019 Sable Island consumed 95,325L of diesel fuel. Of this amount, 86% (81,795 L) was used to run the generators, 9% (9,020 L) to heat the buildings, and 5% (4,510 L) as fuel for vehicles. **The deadline for the final version of the Schematic Design Report is three months after contract award.**

To complete this analysis, the Proponent Team will need to leverage the expertise of individuals with a detailed understanding of renewable power generation technologies, electricity storage technologies, high efficiency diesel power generation technologies, modeling of these technologies, implementation and operation of these technologies in a harsh marine weather environment on a remote site. The consultant team shall include, but may not be limited to, electrical engineer(s), renewable energy specialist(s), structural engineer(s), mechanical engineer(s), and a third-party cost consultant.

Electrical power at Sable Island is currently produced by a main power plant composed of three 70 kW, 120/240V 1PH diesel generators, and a backup diesel generator of the same size. The power plant runs 24/7, 365 days per year. The current electrical load is such that only one of the four generators needs to run at any given time. The peak electrical power measured at the automatic transfer switch from June 2018 to November 2019 was 45 kW. During this time period the weekly energy consumption ranged from a low of 1,816 kWh for the week of Sept 23, 2019 to a high of 5,780 kWh for the week of Feb 18, 2019. The average weekly energy consumption for this time period was 3,118 kWh.

In order to reduce the consumption of diesel fuel on Sable Island PCA is considering changing the heat source in the buildings from oil-fired (diesel in this case) appliances to electrical appliances in the future.

Project Goals

- Reduce diesel fuel consumption on the island
- Increase reliability of power generation system, eliminate power outages, generator failures, and time spent by PCA employees on emergency maintenance
- Power generation system needs to be simple, very robust, durable, easily serviceable by PCA employees
- Infrastructure shall be resilient to the harsh weather environment
- Have the ability to switch off the power generation system and leave the island for extended periods of time.

Site Access

Sable Island is a remote location in the Atlantic Ocean that requires air transportation for travel on and off the island.

- Sable Island has a unique weather environment that can be difficult to predict and can change within a short period of time. The Proponent **must** be prepared to experience delays getting to and getting off the island.
- Access to the site will be granted only with PCA permission.
- PCA will provide flights to and from Sable Island from Halifax Stanfield International Airport with Sable Aviation. Proponent to coordinate with PCA, as travel is non scheduled, weather dependent, and flight reschedules are very common.
- Sable Aviation aircraft has a max payload of 1,400 lbs, inclusive of people and cargo. Aircraft can hold the pilot and up to seven passengers, dependent of the 1,400 lbs max payload limit.
- Proponent to minimize plans for trips to Sable Island to reduce schedule risk.
- Proponent will be responsible for travel to the Halifax Airport and back to catch the flights and return.
- Transportation on Sable Island itself will be provided by PCA.
- Accommodations for consultants will be provided by PCA at no cost to the Proponent, if required.
- Accommodations will be in available housing on the island in shared "dormitory" style rooms with common kitchen, two washrooms, and lounge areas and private or semi-private bedrooms. Whether bedrooms will be shared is dependent on building occupancy. There can be as many as 4 to a room in busy times. Proponent staff may be asked to group together in bedrooms at any time as required by the PCA Operations Coordinator.
- All Proponent staff are required to supply their own bedding, including pillows, towels and toiletries. There are laundry facilities on site and soap is provided. Toilet paper is provided. All Proponent staff must supply their own food; however, kitchen facilities and potable water are provided. Glass bottles are discouraged, Proponent is requested to transport goods in recyclable plastic containers or cans where possible. Basic dishes, utensils, appliances, cleaning supplies, etc. are provided. Proponent staff shall leave the facilities clean. Garbage and recycling are picked up by PCA staff. At the conclusion of your stay your rooms and refrigerators will be checked by the Operations Coordinator to ensure they are clean and you have taken all belongings and left-over food back to the mainland with you.
- Proponent staff must provide a 20-metre buffer between personnel and wildlife, which includes horses, seals and bird colonies. Should wildlife approach personnel while on the island or while working, you must attempt to safely move away and continue to provide a 20-metre buffer. Should wildlife become an issue, or you observe wildlife in distress, contact the Operations Coordinator.

Scope of Work

The Proponent will be required to provide the necessary Architectural and Engineering consulting services to produce a schematic design report as detailed below.

The Proponent will participate in **weekly** collaborative conference calls/meetings with Parks Canada and at various stages of the project to ensure that Parks Canada's expectations are met and to provide feedback, e.g., project initiation phase, pre site survey, post site survey, draft report, final report. Proponent shall include one visit to the island by their team. The Proponent will submit a final draft version of the report that will be reviewed by Parks Canada. Comments will be provided in form of a quality assurance report.

The Proponent will review available documentation pertaining to the electrical systems on SINPR. This includes, but is not limited to, reports, sketches, drawings. These items have been attached in appendices.

Required Services

1. RS 01 Schematic Design Services

1.1. PCA will:

1.1.1. Provide all available background reports and technical data;
1.1.2. Provide all available drawings and plans;
1.1.3. Review and Approve the detailed work breakdown structure for the project;
1.1.4. Review and approve the list of proposed design schemes;
1.1.5. Review and provide a quality assurance report on the final draft of the Proponent's Schematic Design Report;
1.1.6. Review revisions and Proponent rebuttal to the PCA quality assurance report;
1.1.7. Review and Approve the final Schematic Design Report.

1.2. Schematic Design Report is to be presented in narrative format, fully integrated and supported by three or more distinctly different engineering solutions, along with massing models, site photographs, sketches (single line, to scale) and narrative description.

1.3. The objective of the Schematic Design stage is to explore three or more distinctly different design schemes, to allow comparison, analysis against project requirements and selection of a design direction for preparation of a final design concept in a future phase of the project.

The Proponent scope and activities shall include but are not limited to the following:

1.4. Administrative:

1.4.1. Provide information and advice during the Project Start-up meetings, workshops;
1.4.2. Outline the Quality Assurance/Quality Control (QA/QC) process for the Proponent;
1.4.3. Confirm that all necessary pre-design documentation required for this project is available. Notify PCA of any missing and /or out-of-date reports.

1.5. Regulatory Analysis:

1.5.1. Review and analyze regulatory and statutory requirements;

1.5.2. Identify and verify all authorities having jurisdiction over the project;
1.5.3. Identify applicable codes, regulations and standards; and
1.5.4. Prepare Regulatory Analysis section of the Schematic Design Report

1.6. Schematic Design Report

1.6.1. Schematic Design documents illustrate the functional relationships of the project elements as well as the project's scale
1.6.2. The Proponent shall prepare and submit a Draft Schematic Design Report including a minimum of three options for review and acceptance by the Departmental Representative.

.1 Review the options to be explored with PCA prior to the start of developing that stage of the report for approval to proceed.

1.6.3. Revise the draft Schematic Design Report as requested by the Departmental Representative and resubmit for formal acceptance.
1.6.4. The Proponent shall deliver a presentation of the Schematic Design Report at session arranged by the Departmental Representative.
1.6.5. The Proponent shall prepare Schematic Design Report which includes at least the following sections:

.1 Introduction
.2 Background information
.3 Requirements
.4 Options Analysis
.5 Recommendation
.6 Conclusions

The following is a more specific list of scope items to be included:

1.7. Types of Technology

1.7.1. Identify an exhaustive list of the types of power generation and energy storage technologies that would be feasible to be utilized on Sable Island. This should include:

.1 Solar PV
.2 Wind turbines
.3 Other renewable energy production technologies, such as wave power
.4 Variable speed generators
.5 Batteries and other types of energy storage

1.7.2. Have a review meeting with PCA at this stage prior to finalizing the options

.1 Departmental Representative will give clear direction on any additional options required to be included in the Proponents analysis.

1.7.3. Highlight advantages / disadvantages / special features of each option
1.7.4. Technologies must be reviewed against the constraints of SINPR including:

.1 Remote site location (transportation, installation, repair, reliability).
.2 Day to day maintainability by Parks Canada staff with limited experience in electrical and renewable energy production infrastructure
.3 Modularity to adapt to future changes (increase or reduction) of the electrical power demand
.4 Electrical power is needed 24/7 365 for fire and life safety
.5 Local weather impact on power generation potential
.6 Impact on equipment due to harsh weather of Sable Island (high wind, big storms, fog, sand, salt, washouts)
.7 Wildlife: what are the impacts of equipment on the birds, horses, seals population. The Island has the world's biggest breeding colony of grey seals. More than 350 species of birds have been recorded on the Island, with sixteen species known to breed there. There are over 500 wild horses on Sable Island.

1.8. Modeling

1.8.1. The goal of the modeling is to assess and compare the site specific electrical power generation potential of different technologies or combination of technologies, and also their initial and ongoing annual costs.
1.8.2. The Proponent shall use an industry recognized software tool such as Natural Resources Canada's RETScreen® Expert software, and/or others to estimate site specific electrical power generation potential for the various technologies based on site specific conditions.
1.8.3. Where new/innovative technologies are not supported by modeling software, manufacturer data can be used, but based on site-specific weather conditions,
1.8.4. Provide assumptions: variation of daily solar radiation values throughout the year, variations in mean wind speed and mean power density throughout the year, wave power data.
1.8.5. Calculate the energy potential for the proposed renewable energy technologies taking into account site-specific weather conditions, e.g., average daily solar radiation levels for each month of the year (kWh/m2/d).
1.8.6. Provide power and energy curves for proposed wind turbines
1.8.7. For the proposed renewable energy technologies calculate the probable peak electrical power production (kW) and range of monthly and annual electrical energy production (kWh), taking into account all of the system losses.
1.8.8. Provide data on proposed battery banks: e.g., type of battery, capacity, maximum charge, minimum charge, discharge depth, probable cycling regime, life span, operating temperature range.
1.8.9. Provide pdf copies of the software model's output as appendix to the report.

1.9. Location and Site Analysis

1.9.1. Review and analyze all available reports, studies and data provided by PCA including:

.1 Existing site conditions
.2 Existing site plans

.3 Historical site features
.4 Archaeological features
.5 Site Ecology

1.9.2. Review with PCA ecology team and PCA archaeology team prior to selecting potential locations
1.9.3. Identify on a site plan: areas that can be utilized to install new power generation and storage equipment.
1.9.4. Provide images/renderings that show proposed renewable power generation locations. Clearly identify setbacks (around equipment, for health and safety, etc…)
1.9.5. Review and provide analysis of how proposed equipment will be affected by and will affect local wind and sand.
1.9.6. Review and recommend how the proposed equipment will be supported on Sable Island geology. Provide foundation recommendations. Include a geotechnical engineer recommendation for support if required. The island is entirely composed of sand with no bedrock or other geological features.

1.10. Electrical Infrastructure Review and Design

An electrical condition assessment in currently underway by a consultant. The contents of their report will be provided for use by the successful Proponent of this project. The scope of work of the electrical condition assessment is attached as an appendix.

The Proponent scope and activities shall include but are not limited to the following:

1.10.1. Analyse the suitability of existing electrical infrastructure and recommendation on upgrades and replacements required including but not limited to: existing generators, primary and secondary distribution systems, panel and switch boards, transformers, grounding and bonding.
1.10.2. Accessibility of existing or integration of new access to electrical wiring.
1.10.3. Use of batteries for energy storage including location and required infrastructure to support.
1.10.4. Effect on power factor.
1.10.5. Controls

.1 Propose controls that will allow PCA employees and external technicians to monitor, supervise and troubleshoot the power generation systems and equipment from the island, and remotely from the mainland.
.2 Propose monitoring features that would facilitate preventive maintenance activities to minimize the risk of unexpected failures.

1.11. Financial and Schedule Analysis:

1.11.1. Prepare a 25-year lifecycle cost analysis (LCCA), including identifying all of the following:

.1 Class 'C' Estimate of capital cost of installation. The capital cost will include all costs to be incurred to support an installation including transportation and installation on a remote island.
.2 Operating and Maintenance Costs
.3 Replacement cost of components. For components that wear and require replacement, identify replacement costs and frequency of replacement.
.4 Identification of any incentives or rebates available to offset costs.
.5 Residual value: Identify the expected useful life of all equipment.

1.11.2. Review and analyze the cost estimate and schedule data, constraints and opportunities.
1.11.3. Advise and recommend budget and schedule modifications and outline risk implications and mitigation strategies

1.12. Prepare and present a comparative analysis of procurement and project delivery models for the upcoming phases of design and construction. The comparative analysis shall include, as a minimum, consideration of advantages and disadvantages in regards to design, constructability, schedule, risk analysis and mitigation measures, costs, and suitability for the remote location. Provide final recommendations on the most and least suitable delivery model.

1.12.1. Review should include:

.1 Design-Build
.2 Modified Design-Build versions
.3 Traditional Design-Bid-Build

1.12.2. Other delivery methods may be proposed by the Proponent.

Appendices

1. Sable Island – Power and Energy Monitoring Report, NRCAN, May 2019
2. Sable Island NPR Sketches and Single Line Diagrams, Parks Canada, February 19, 2020
3. Excerpt of Consultant Scope of Work for Sable Island Electrical Review
4. Energy Analysis Report, Energy Instrumentation Sales, May 2011

Reports Available Upon Award

1. Fuel Storage Tank System Underground Piping Identification Report, Dillon Consulting, March 2016
2. Sable Island Preliminary Generation Design Package, CBCL, February 2013
3. Scans of Main Station drawings from 1981
4. Ongoing Updated Power Usage Data