

April 19, 2018

Helmar Prent, VP, Finance and Claims Services
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ATTENTION: LDC Tomorrow Fund

Subject: LDC Tomorrow Fund 2017 Project Funding Final Report

Mr. Prent:

Ontario Power Generation Inc. (OPG) entered into a funding agreement with the Local Electricity Distribution Companies (LDC) Tomorrow Fund in December 2016 for the support of the Definition Phase of the Gull Bay Diesel Offset Micro Grid project.

The deliverables identified for the 2017 funding support the completion of deliverables associated with the detailed engineering and design work for the project in preparation for construction and included the following activities:

- Solar PV system design
- Battery Energy Storage System design and testing requirements
- Remotes interconnection requirements design

Background - Gull Bay First Nation Diesel Offset Micro Grid Project

The Gull Bay First Nation Diesel Offset Micro Grid will create a community micro grid by integrating new solar photovoltaic generation, battery energy storage, and micro grid control technology with the existing on-site diesel generators that currently supply the community's entire energy needs.

The Kiashke Zaaging Anishinaabek (KZA) / Gull Bay First Nation (GBFN) Reserve is located on the western shore of Gull Bay on Lake Nipigon and includes the lower reaches of the Gull River. The Reserve is known as Gull River 55 and comprises a land area of 3,940 ha (AANDC, 2014), within the Robinson Superior 1850 Treaty area. KZA has a population of approximately 350 community members living on the Reserve.

At the KZA Reserve, the electricity grid is supplied by three diesel generators operated by Hydro One Remote Communities, Inc. (Remotes). KZA has been identified as one of four remote communities uneconomic to connect to the transmission grid. Ontario Power Generation (OPG) and KZA are in the developmental phase for planning an advanced renewable micro grid on the reserve. The micro grid project will construct a solar photovoltaic (PV) array, connect it with a new Battery Energy Storage System (BESS) and integrate each with the existing Remotes diesel generators via a Micro Grid Master Controller (MGMC) to feed into the electrical distribution system.

The primary goal of the project is to achieve maximum renewable generation penetration, (up to 100% in diesel-off mode), into an off-grid community for the purpose of reducing diesel consumption in the community. By reducing diesel usage the project will reduce the environmental and safety concerns associated with diesel. This project is expected to reduce annual diesel consumption by up to 25% or over

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110,000 L annually at Gull Bay. Reducing diesel consumption by 25% equates to approximately 340 tonnes of CO₂ emissions avoided annually.

The project also has several other parties collaborating on the project that are providing in-kind and technical support including;

- Hydro One Remote Community Inc. (Remotes)
- MaRS Advanced Energy Center
- ABB Inc.
- Kiashke Zaaging Anishinaabek (KZA)

Summary of the Project Components

The Micro Grid System will have the following components:

- A ground-mounted fixed angle PV array with an installed DC capacity of 360 kWdc;
- A battery energy storage system with a power capacity of 300 kWac and an energy capacity of 300 kWh;
- Micro Grid Master Control (MGMC) system for the integration of the micro grid system with existing Remotes generators and distribution grid; and
- A control building to host the MGMC.

These components are further broken down as follows:

PV array

- Minimum total DC Capacity (kWp): 360 kWp
- Minimum total inverter AC nameplate rating (kWAC): 300 kWac
- DC:AC Ratio (kWp/kWac): 1.20
- Approximately number of panels: 1000
- Approximately land required: 2.2 acres

BESS

- Power capacity: 300 kW
- Energy capacity: 300 kWh
- Technology: Lithium Ion
- Structure: Self contained building with dedicated HVAC system
- Approximate weight: 6,800 – 9,100 kg, with a peak loading of 1,470 kgf/sq m.
- Approximate size: 6.1 m length x 2.5 m width x 2.6 m height

Micro Grid Master Controller (MGMC)

- Integration: MGMC will interface with the diesel generators, solar PV plant and BESS
- Controller: ABB Microgrid Plus Control system
- Number of inverters supported: up to 19

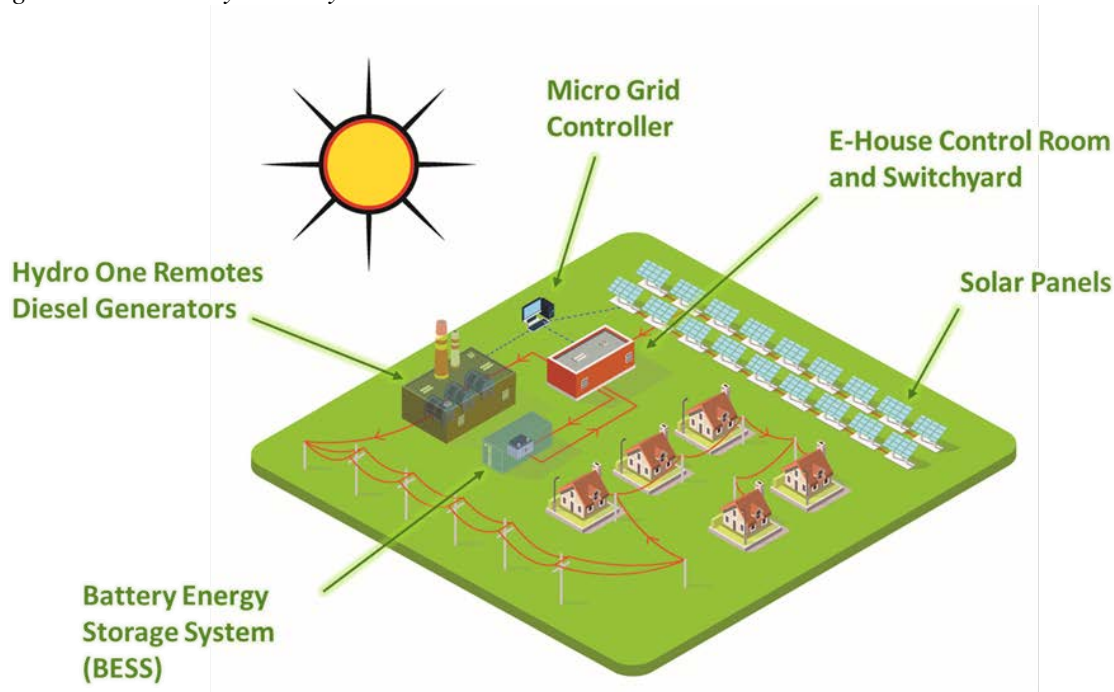
Control Building

- DAS/SCADA monitoring point/station
- MGMC
- Power Meter: Acuvim II power meter; this meter will provide power and frequency information to the MGMC at high update rates

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- Other equipment as deemed reasonable
- Storage for recommended spare parts

Figure 1: General System Layout



System Operation

The MGMC is programmed with an algorithm that monitors community demand and each of the energy resources, including solar PV, BESS state of charge and Remotes diesel generators. The MGMC then sends a signal to the Remotes control system to dispatch the resources in real time against the variability of demand and renewable output to meet the community's electricity demand.

Further, unlike a simple solar-only installation or a behind-the-meter alternative, all resources in this project "speak" to each other, allowing the MGMC to optimize the operations of the entire system with the goal of maximizing the use of renewable generation from the PV and BESS and ultimately shutting down the diesel generation when possible and supply the community with 100% renewable energy. The solar PV/BESS system is expected to reduce annual diesel fuel consumption by approximately 25%/year.

Ownership

Once operational, KZA will own and operate the micro grid. KZA will receive revenues from energy delivered by the project through the Remotes Renewable Energy INnovation DiEsEl Emission Reduction (REINDEER) program. OPG will gain project management experience in micro grids and access to operational data for the life of the Project.

LDC Tomorrow Fund 2017 - Funding to support the completion of deliverables associated with the detailed engineering and design work for the project in preparation for construction

Based on the project's contracting strategy to secure a contract for the solar plus balance of plant through an Engineer Procure Construct (EPC) approach, along with individual supply contracts for the BESS and micro grid controller, OPG had separate technical specifications drafted for each work package.

OPG has defined three work packages to facilitate the construction and commissioning of the project as follows:

- Work Package 1: Design, engineering, supply/delivery, commissioning, and testing of the BESS
- Work Package 2: Design, engineering, supply/delivery, commissioning, and testing of the MGMC, and commissioning and testing of the integrated system
- Work Package 3: Contractor to take on the role of "constructor" during construction at site
 - Engineering, procurement, and construction of the PV array
 - Engineering, procurement, and construction of the Control Building
 - All civil and electrical works required for mechanical and electrical completion of the BESS
 - All electrical works for connecting the MGMC to other system components, composed of Remotes diesel generators, PV, and BESS
 - Engineering, procurement, and construction of the final interconnection of the micro grid system to the Point of Interconnection with Remotes micro grid, including completing Remotes CIA

OPG hired DNV GL to provide engineering support through the Definition Phase of the project. DNV GL developed the functional technical specifications for the EPC Solar and BESS work packages.

Solar PV system design

The Solar / BoP technical specification included the following sections for the proponents to consider when responding to the RFP.

- Exhibit A: Scope of Work and Technical Specifications
 - Industry Standards and Codes
 - Project Details
 - General Requirements
 - Electrical requirements
 - Civil and Structural Requirements
 - Communications and Metering Requirements
 - Equipment Specifications
 - On-Site Buildings
 - Spare Parts
- Exhibit B: Developer or Third-Party Provided Facilities and Services
 - This Exhibit defines the facilities and services that shall be provided by the Developer and are therefore outside the Contractor's Scope of Work for the Project
- Exhibit C: Interconnection requirements

- Requirements to complete CIA with Remotes
- Exhibit D: Contractor Deliverables Table
 - Detailed list of all submissions required from the contractor
- Exhibit E: Preliminary studies
 - Background information on the Project
- Exhibit F: Commissioning Requirements
 - This specification defines the minimum requirements for field inspection and testing of electrical equipment for the Project (Commissioning Requirements).
 - Testing of all equipment for the collection systems, transformer, and interconnection facilities are included.
- Exhibit G: Acceptance Tests
 - These Acceptance Tests are intended to verify that (i) all components of the Project production capacity exceeds the Capacity Guarantee and (ii) that the Project satisfies the Availability Guarantee over the Availability Test Period, in each case under predefined weather conditions likely to occur when each Acceptance Test is conducted
- Exhibit H: Form of Mechanical and Electrical Completion Certificate
 - Sign-off verification for mechanical and electrical completion
- Exhibit I: Form of Phase Completion Certificate
 - Sign-off verification that the system is complete
- Exhibit J: Form of Final Acceptance Certificate
 - Sign-off verification that all contractor project work is complete
- Exhibit K: Performance Guarantee
 - This test is intended to verify that the energy production of the Project meets the Energy Performance Guarantee as calculated with the recorded weather conditions over the course of one year of operation of the Project

Alltrade has been selected as the EPC contractor for this project.

Battery Energy Storage System design and testing requirements

The BESS technical specification included the following packages for the proponents to consider when responding the RFP.

- Exhibit A: Scope of Work and Technical Specifications – BESS
 - Supply of BESS, including inverter and all auxiliary components, to meet the operational requirements laid out in this specification
 - Transportation, commissioning, and testing of the BESS
 - Collaborative effort with other parties designated by Developer for the commissioning of the Project
- Exhibit B: Developer or Third-Party Provided Facilities and Services
 - This Exhibit defines the facilities and services that shall be provided by the Developer and are therefore outside the Contractor's Scope of Work for the Project
- Exhibit C: Interconnection Requirements
 - To be supplied following CIA results
- Exhibit D: Supplier's Deliverables Table
 - Detailed list of all submissions required from the contractor
- Exhibit E: Integrator's BESS Requirements

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- Functional specification for integration with the Micro grid Master Controller
- Exhibit F: Commissioning Requirements
 - This specification defines the minimum requirements for field inspection and testing of the BESS in concert with the Project as a whole (Commissioning Requirements).
- Exhibit G: Acceptance Tests
 - This Exhibit provides minimum requirements for the site acceptance testing of the BESS.

ABB has been selected as the BESS supplier for this project. ABB was also previously selected as the supplier for the micro grid controller.

Remotes interconnection requirements design

OPG submitted the initial application to Remotes for the CIA. The detailed CIA process with Remotes will occur in the final engineering and design stage of the Execution Phase. The CIA will be completed with the EPC, alongside the final engineering and design. By doing this, the CIA will be tailored specifically to the final design, with the technical specifications of the specific components and equipment (e.g. inverters) procured by the EPC incorporated into the CIA.

Project Status

The Project has completed a number of key milestones necessary to advance to the execution phase and complete the construction of the micro grid.

- Environmental Assessment complete and approved by INAC
- Project Development Agreement approved by Gull Bay First Nation and OPG
- Execution Phase Business Case Summary approved by OPG
- Purchase Order issued for the EPC Contractor
- Purchase Order issued for the BESS and micro grid controller

Mobilization is set to begin in April 2018.

Sincerely,



Matt MacDonald
OPG Director, Corporate Business Development