

TERMS OF REFERENCE
ENGINEERING SERVICES CONSULTANCY

1. BACKGROUND

1.01 DOMLEC is in the process of restoring its power system which suffered catastrophic damage from Hurricane Maria in September, 2017. DOMLEC has full responsibility for repairs to the T&D system. Electricity consumption (kWh) is at approximately 30% of pre-Maria levels compared to the same period in previous years. Current system peak load is close to 40% of the pre Maria peak. 19% of customers have had their electricity supply restored to date i.e. approximately 6,933 customers. The commercial sector is being restored first followed by residential customers. The Advanced Metering Infrastructure data centres were largely unaffected by the hurricane and meters are being read remotely by DOMLEC.

1.02 The T&D system is being rebuilt in accordance with DOMLEC's installation standards. All poles are being installed to the company standard specifications and pole classes have been upgraded. Prior to Maria, DOMLEC had implemented a policy to use LED lights for all new and replacement street lighting installations. This policy is being enforced for all street lighting replacements.

1.03 As of October 2017, 6 of 9 generation units at Fond Cole in Roseau were restored and able to service up to 9MW of load. The system load up to that time was 1MW. All 5 diesel generation units in Portsmouth were operational and able to supply loads of up to 6.5MW. Damages to the generation assets included storm exposure to three diesel units at Fond Cole and flooding of the Padu hydropower plant. There was also physical damage to the penstock and the turbines at the Padu hydropower plant. This represents a loss of about 1.3 MW of generation capacity and an additional fuel cost of around a quarter million US dollars per month. The water intake weir and penstock for the Padu hydropower plant will be repaired to bring the generation plant back online.

1.04 Support will be provided to improve the technical institutional capacity of DOMLEC in the short term to ensure that existing dispersed information and studies are used in system design evaluations. Structural analysis of the T&D system will be performed to inform the changing of infrastructural components in certain parts of the network to make it more resilient. A Climate Vulnerability and Risk Assessment will guide improvements to the system design to improve resilience to climate change impact

1.05 The Project will be implemented by DOMLEC over a 24-month period which started in September 2017. The project is being managed by the Transmission and Distribution Systems Engineer.

2. OBJECTIVE - T&D STRUCTURAL ANALYSIS

2.01 The objective of the consultancy is the structural evaluation of the transmission and distribution system to ensure correct component selection and installation specifications to meet design loading requirements. To such end, the consultant is required to ascertain the causes of failures of poles in Dominica as results of Hurricane Maria and based on this information determine the maximum wind speeds at which the structures were subjected. And conduct a structural analysis to define the pole's characteristics to ensure the transmission and distribution network will withstand category 5 hurricanes.

3. SCOPE OF WORK

3.01 The Consulting firm shall:

- (i) work closely with the Project Coordinator to ensure that the objectives of the structural analysis consultancy are met;
- (ii) learn from the damages caused by hurricane Maria, the consultant will study the causes of pole's failures and estimate the wind conditions that caused the collapse. He/she will design and conduct a random sample process for the selection of no less than six (6) types of poles and four (4) loading conditions to characterise the elements of the transmission and distribution network in Dominica.
- (iii) Conduct field surveys and analytical calculations to estimate the loads that prompted the failure. A sample of no less than 30 poles should be considered.
- (iv) Conduct analyses to recommend new design standards for poles in Dominica's transmission and distribution network. To such end, the consultant shall conduct a comprehensive sensitivity analysis including:
 - (aa) Sustained wind speeds in the range between 160 mph and 200 mph
 - (bb) At least 6 levels of exposure to the wind field;
 - (cc) No less than 6 types of soils; and
 - (dd) At least 4 typical static loads on the pole.
- (v) Conduct a cost-benefit analysis under the hypothesis that category 5 hurricanes have return periods of 40 years, 30 years, and 20 years, for discount rates in the range between 2 percent per year and 12 percent per year.
- (vi) verify and validate component selection and specifications for rebuilding of the T&D system including poles, power lines, transformers, etc. to ensure compatibility with system design loading requirements;
- (vii) provide guidance on network routing to minimize risk of being affected by land slippage, wind loading and other structural risks;
- (viii) train selected DOMLEC staff in use of the selected analytical software to perform future analyses for network building and configuration;
- (ix) be responsible for preparation of a completion report within two months after the date of completion of the analytical works and training.

4. OBJECTIVE – GEOTECHNICAL ANALYSIS

4.01 The objective of the consultancy is strengthening DOMLEC technical capabilities for the rehabilitation and reconstruction of Dominica's electric system. The geotechnical engineer will be integrated with DOMLEC reconstruction team and will: (a) support the supervision of the geotechnical studies underway as part of the natural hazards vulnerability assessment for Dominica. (b) develop geotechnical guidelines for the installation of transmission and distribution poles. (c) undertake the technical supervision of rehabilitation and reconstruction works and the engineering management of

rehabilitation and reconstruction contracts, as assigned by DOMLEC management. And, (d) provide basic training in soil classification methods and basic lab tests to DOMLEC personnel, as well as specific training on the geotechnical guidelines developed under (b).

4.02 The geotechnical engineer will be engaged by the project for a period of up to 18 month, depending on his/her performance.

5. SCOPE OF WORK

5.01 The individual consultant shall:

- (a) The geotechnical engineer will be a member of DOMLEC rehabilitation and reconstruction team. As such it is his/her responsibility to integrate into DOMLEC, follow procedures and guidelines as instructed by his/her supervisor, and document activities and results.
- (b) Work closely with the Project Coordinator assigned by DOMLEC, and other members of the CDB team to ensure that the objectives of the soil and geotechnical studies are met;
- (c) Draft a methodology and standards to perform soil sampling and testing at agreed T&D system sites to inform pole placement and networking routing decisions.
- (d) The geotechnical engineer will draft guidelines for proper excavation and fill material and compaction for poles foundation. In situ tests might be suggested to ensure proper material for backfill, water content and compaction. In such case training will be provided to DOMLEC personnel and its contractors.
- (e) Develop or update a database of soil types and geological characteristic including mapping of water table impacted zones and locations for integration into the company's GIS system.
- (f) Coordinate with the Climate Vulnerability and Risk Assessment team to produce a geotechnical hazards/risks map for the utility and identify potential impacts and possible mitigation measures;
- (g) Provide guidance on network routing to minimize risk of being affected by land slippage and other soil and geological risks;
- (h) Train selected DOMLEC staff in performing basic analyses for quick decisions involving soil and geological considerations;
- (i) Be responsible for preparation of a completion report within two months after the date of completion of the analytical works and training.

6. OBJECTIVE – ENGINEERING CERTIFICATION

6.01 The objective of the consultancy is the certification of works and submission of claims to the CDB.

7. SCOPE OF WORK

7.01 The Consultant shall:

- (a) work closely with the Project Coordinator to ensure that the objectives of the RRL project are met;
- (b) review all available relevant documentation and technical data relevant to the rehabilitation works;
- (c) visit the project site in Dominica to obtain and assess information required;
- (d) perform technical inspection of all the installation works to ensure compliance with contract provisions;
- (e) provide certification of work and issue of payment certificates;
- (f) Be responsible for preparation of monthly reports on the progress of the works indicating any difficulties affecting its efficient and timely execution commencing one month after the engagement of the consultant. Report content will include but not be limited to:
 - (i) descriptive paragraphs on component procurement, installations, and the maintenance aspects of the project;
 - (ii) an analysis of the project implementation management structure and function and recommendations for improvements; and
 - (iii) any other inputs required for completion of the consultancy.
- (g) be responsible for witnessing of testing and commissioning of the works;
- (h) Be responsible for preparation of a completion report within two months after the date of the issue of a certificate of practical completion.

8. QUALIFICATIONS AND EXPERIENCE

8.01 The selected firm should have at least 10 years of experience in electricity transmission and distribution systems structural analysis; 7 years of experience in soil and geotechnical analyses; at least 5 years power engineering experience in electricity transmission and distribution systems and project management. The assigned project engineers should have advanced degrees in structural engineering, geotechnical engineering, project management and at least 10 years of professional experience.

8.02 Relevant experience must include the preparation of project schedules and budgets, monitoring of project execution, and project reporting. Experience in mountainous, hurricane/tropical cyclone, volcanic and earthquake prone regions is essential. Excellent oral and written communication skills are necessary.