MARITIME ELECTRIC
A FORTIS COMPANY

February 19, 2019

Ms. Cheryl Mosher
Island Regulatory & Appeals Commission
PO Box 577
Charlottetown PE C1A 7L1

Dear Ms. Mosher:

2018 Storm Post-Modem
Response to Interrogatories from Commission Staff

Please find attached the Company's response to Interrogatories from Commission Staff with respect to the 2018 Storm Post-Mortem filed on January 21, 2019.

Yours truly,

MARITIME ELECTRIC

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GCC09
Enclosure

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I N T E R R O G A T O R I E S

Responses to Interrogatories from Commission Staff

November 29, 2018 Storm Post-Mortem

Submitted February 19, 2019

IR-1 Both of the two main transmission lines [Y-111 and Y-109] failed within an hour of each other due to tree contact. What regular process of tree or branch removal exists to protect these transmission lines? To what extent is this different from the tree/branch removal process to protect distribution lines?

Response

Maritime Electric's transmission inspection guidelines require a detailed ground inspection and removal of trees every four years. Because of the importance of the transmission system the frequency of vegetation management is higher than for the distribution system. The transmission lines Y-109 and Y-111 share a common right-of-way (ROW) for the majority of their distance. This ROW was cleared in 2017.

The Y-111 trip resulted from a tree contact, and a crew was dispatched and cleared the tree from the line. This tree was located outside the ROW but was tall enough to make contact with the line when it fell over. The tree contact damaged a section of conductor, and this had to be replaced before the line could be reenergized. The repair work delayed the re-energization of line Y-111 until midday on November 30.

The Y-109 trip at 07:28h was recorded as a phase-to-phase fault. The cause was initially assumed to be a tree contact because the line tripped and reclosed four times in the span of 3 seconds, before tripping a fifth time and remaining off. However, responding crews found no tree onsite, and reported that the conductors were coated with ice. Maritime Electric believes this trip could have been caused by either debris from a tree (or otherwise) that bridged the gap between the phases, or a phase to phase contact due to galloping lines.

IR-2 Was the failure of supply from New Brunswick at 8:54 a.m. on November 29, 2018, related to the initial failure of MECL's CT3 generator and its inability to dispatch generation to counteract loading on the remaining active NB generation system?

Response

The first attempted CT3 start occurred at 07:55h, after the loss of both Y-109 and Y-111, in order to restore supply to eastern and central PEI. This 'blackstart' failed when Maritime Electric's Energy Control Centre (ECC) attempted to first connect the generator to the system.

Transmission line T-1 was then reenergized in order to supply station service to CT3 so it could be started with system supply. The NB ECC contacted the Maritime Electric ECC at 08:54h to start CT3 and the generator start sequence was promptly initiated. Loss of the NB system supply at 0858h deprived CT3 of station service, causing the unit to abort its startup sequence. Thus the loss of supply from New Brunswick was the root cause of CT3's failure to start just before 09:00h.

Even if CT3 had been successfully operating at 08:58h, it is unlikely that its output would have prevented the NB system from failure:

- ECC's operating procedure is to use CT3 to reenergize and supply central and eastern PEI load, which had been lost due to the Y-109 and Y-111 outages.
- In addition, ECC would likely have been using line T-1 (supplied from NB via Sherbrooke) to restore the supply to remaining eastern and central PEI load that was out, with local voltage support being provided by CT3. As a result, there would have been at least the same, if not more, energy being imported from NB at the time the NB transmission lines started tripping.
- If the NB ECC had instead directed the Maritime Electric ECC to shed load, Maritime Electric would have shed up to the 80 MW of load that was still being supplied. This may not have been sufficient to negate the overload on the remaining NB line.

In the event that CT3 was operating and the NB system supply was still interrupted due to line overloading, CT3 would have attempted to pick up the entire load on PEI, which would have caused a significant drop in frequency and the unit would have tripped.

IR-3 What caused the voltage on CT3 to be low and unable to be increased?

Response

CT3 is capable of two modes of operation; islanded ('isochronous') mode and droop mode. Droop mode is the normal operating mode for CT3 (and most generators) when connected to a larger electrical grid, as there are many system generators sharing the burden of regulating system frequency. Islanded generators are typically operated in isochronous mode, with a single generator primarily responsible for sustaining the grid's frequency and voltage. This was the case during the blackout experienced during this storm.

When CT3 was supplied from General Electric (GE) in 2005 it was supplied with control functions that unknowingly limited the output in isochronous mode. Maritime Electric had commissioned and tested CT3 in isochronous mode in the past; however, the unit had never been loaded to full winter output (49 MW) in isochronous mode prior to this storm[1]. ECC was limited to the amount of load it could supply from CT3 as they found that the unit could not maintain adequate system voltage above a certain load level. This was not expected and the root cause was only discovered during the post-storm investigation. The devices/wiring that limited the voltage output from CT3 in isochronous mode have been removed (in consultation with GE) to enable full output from CT3 in isochronous mode.

[1] Testing CT3 at full load in isochronous mode would be difficult and would jeopardize customer supply throughout the test as it would require a significant amount of load to be islanded with the generator. This type of test is not typical for utilities.

IR-4 The Storm Post-Mortem indicates that the issues which caused the low voltage were addressed in December 2018. If CT3 was working at optimal levels for the November 29, 2018 storm, what affect would this have had on the restoration efforts?

Response

CT3 could have supplied approximately 15 MW of additional load during the late morning and afternoon of November 29.

IR-5 Is the operation of CT3 necessary to start the CTGS units? Was CTGS used during this power outage?

Response

The CTGS requires a source of electricity – known as station service - to start generation. This station service power will power pumps, fans, and controls to enable the plant operators to bring one of the four available generators online. Once one of the CTGS generators is online, the CTGS can then power itself and start to supply power to the system.

Under normal conditions, the CTGS' station service is supplied from the system. However, in the event of a blackout, Maritime Electric is capable of black-starting CT3 to energize the Charlottetown Substation, which then can be used to supply station service to the CTGS. The Borden CTs can also be used to provide station service power to the CTGS provided that interconnecting transmission is available.

A decision was made to start the CTGS around 10:00h due to the uncertainty of the day. However, the CTGS is a conventional heavy fuel oil fired plant and under normal operating conditions requires 12 to 16 hours to start and several additional hours before full load can be achieved. It would not have been available until late evening on November 29 even if all systems within the CTGS had operated as expected, and therefore would not have made any significant impact on the restoration efforts. This is in contrast to CT3 which is a combustion turbine and can be supplying power to the system within ten minutes of the initial request to start.

IR-6 What processes exist to verify, on a periodic basis, that CT3 is operational and capable of operating in the event of an Island-wide shutdown?

Response

Maritime Electric has two fulltime combustion turbine operators and a supervisor who are dedicated to maintaining and operating the Company's three combustion turbines. These individuals oversee monthly operational testing including a monthly test run which includes connecting to the grid and carrying minimal load for a short duration. They also perform monthly testing of the black-start system including the operation of the diesel blackstart generators.

There are also annual outages on each combustion turbine where further electrical and mechanical testing is completed, including an internal borescope inspection and fire suppression system testing. Maritime Electric also follows OEM recommended timelines for major maintenance such as engine and generator overhauls.

IR-7 Do the four transmission lines feeding the Memramcook substation in New Brunswick share common support towers?

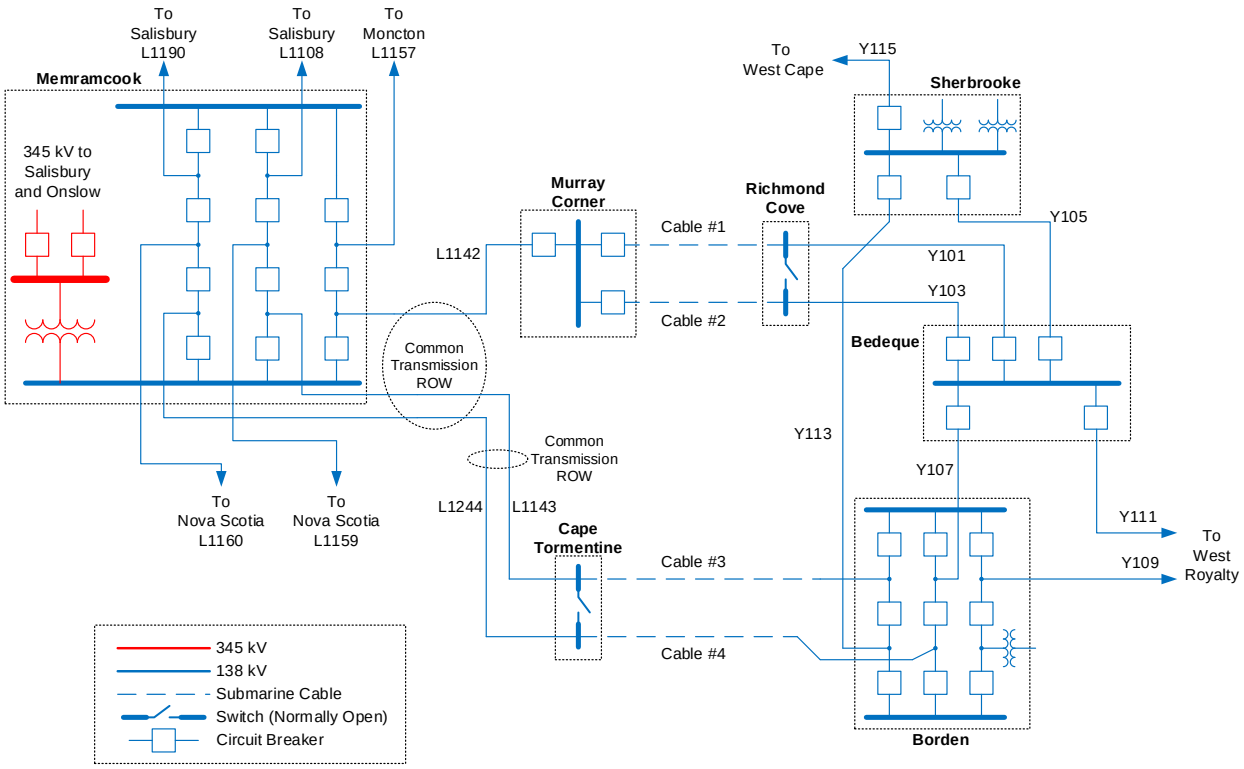
Response

Two of the lines feeding the Memramcook substation share a tower for a short section near a river crossing. There is no other sharing of common support towers for these four transmission lines.

IR-8 How many independent transmission lines run from the Memramcook substation to the submarine cables?

Response

There are three independent transmission lines from Memramcook to the two cable riser stations in Murray Corner and Cape Tormentine. The three lines follow a common right of way (ROW) for roughly 40 kilometres before separating in Melrose, NB. One line continues to Murray Corner and the remaining two lines follow a common ROW to Cape Tormentine. The single line diagram below illustrates the arrangement:



NB Power follows good utility practice in siting transmission lines in a common ROW.

IR-9 Is there any redundancy in the transmission system from Memramcook to the submarine cables? If yes, please provide full details. If no, please provide justification for the lack of redundancy.

Response

There are three lines between Memramcook and the two riser stations in Murray Corner and Cape Tormentine. The Island can be fully supplied if any one line (and associated submarine cable(s)) is out of service. In addition, the Memramcook Substation has incorporated redundancy into its design scheme, which improves its supply reliability. The Island has two terminal stations at Bedeque and Borden which provides both geographic and electrical redundancy for the connection to the NB system.

IR-10 The Storm Post-Mortem states that MECL was preparing for the impending storm for several days. Please provide full details of the preparations made by MECL.

Response

Management monitors and internally circulates Environment Canada Storm Warning Alerts on an ongoing basis. A personnel review was completed to ensure adequate staff and resources (travel/vacation schedules, etc.) were available for the forecasted storm period. Local contractors were also contacted to confirm that their line and tree-trimming crews were available if required. Consideration was given to providing hotel accommodations for key personnel but a decision was made to watch the weather closely from home. Vehicles were prepared for a storm response by ensuring they were fully equipped and fueled.

Once outages began, arrangements were made to provide additional outage management and crew dispatching/monitoring resources in the eastern and western district offices. Storm Supervisors and Customer Service opened the Contact Centre at 02:30h on November 29 and remained open 24 hours a day until power was restored to all customers.