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Dear Sirs/Madam:

**Re: Newfoundland and Labrador Hydro - Reliability and Resource Adequacy Study Review - The Liberty Consulting Group First Monthly Monitoring Report on Integrating LCP Facilities into the IIS and Hydro Preparations for Winter**

Please find a copy of The Liberty Consulting Group *First Monthly Monitoring Report on Integrating LCP Facilities into the IIS and Hydro Preparations for Winter*.

If you have any questions, please do not hesitate to contact the undersigned.

Sincerely,

Sara Kean  
Assistant Board Secretary

SK/cj

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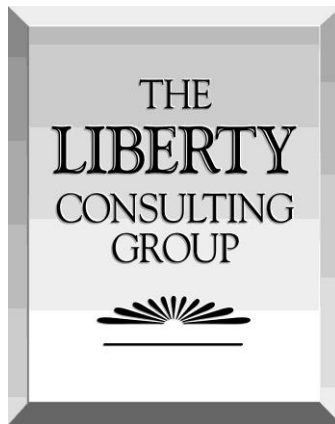
**First Monthly Monitoring Report on  
Integrating LCP Facilities into the IIS  
and Hydro Preparations for Winter**

**Presented to:**

**The Board of Commissioners of Public Utilities  
Newfoundland and Labrador**

**Presented by:**

**The Liberty Consulting Group**



**August 4, 2020**

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### **1. Report Summary**

This report comprises the first following two Board requested changes to our monitoring efforts: (a) moving to monthly from quarterly reporting on transitioning Lower Churchill Project (LCP) resources to operation, and (b) examining Hydro’s progress in activities to optimize availability of its supply resources for the coming winter. Our status reporting changes arose as significant risk continued that the Labrador Island Link (LIL) would not stand ready to provide off-Island supply through part or all of the coming winter. LCP completion progress has been made, but has consumed much of the time remaining before winter, without putting material uncertainty about commissioning of the LIL assuringly to rest. The remaining uncertainties continue to justify the LIL-unavailability risk level we reported in our May 2020 quarterly report. Somewhat encouragingly, Hydro remains on track to complete capital and O&M work important for making its supply resources ready for winter. Nevertheless, significant work remains, especially on Hydro’s capital projects.

General Electric (GE) followed its recently failed Factory Acceptance Testing (FAT) of the LIL control software with a retest, completed on July 24. We learned on the date of the filing of this report that, while some deficiencies remain, analysis of the results led Nalcor to grant GE permission to proceed with on-site LIL testing. Should installation of the software and this testing prove successful over the next several weeks, the next key LIL commissioning phase (Trial Operation) will follow. Trial Operation requires 30 days of uninterrupted LIL operation. The decision to proceed moves the LIL a significant step forward, materially increasing the chances of its availability for all or most of the coming winter. However, the nature and number of remaining activities and milestones needed to complete commissioning and the issues that have beset the LIL to date continue to warrant caution in relying on that operation.

It may even prove possible that the LIL can, even if commissioning cannot be completed, deliver limited (but enough) power this winter to contribute significantly to supply resources. However, doing so would require both verification of its ability to do so and GE approval.

The three synchronous condensers being installed at Soldiers Pond will support LIL power transfer at its full rated capability, when commissioned. Much progress has been made in addressing the vibration issues described in our most recent quarterly report. Nalcor has reported optimism based on observed significant reduction in vibrations following modifications, but again cannot conclude that the reduction is sufficient, with technical analysis of data accumulated during testing still underway. Should the analysis yield results that confirm Nalcor's optimism, time remains to complete modifications at all three synchronous condensers in time to support LIL Trial Operation.

Confirming the effectiveness of current vibration issues will take well into October, and perhaps November. However, no other immediate-term mitigation measures appear to exist, making the existence of alternate means for supporting LIL commissioning important. Generation at Holyrood can substitute for the Soldiers Pond synchronous condensers in providing the support needed both to commission the LIL and to permit its operation this coming winter. That operation will likely be at a fraction of the LIL's full capability, but, as noted above, sufficient to make the LIL a meaningful source of supply, if and as needed this winter.

Therefore, the risk that mitigation measures already planned will not sufficiently reduce vibration raises less immediate concern, but does have longer term implications. Nalcor considers that risk low, but nevertheless sufficient to pursue plans for alterations to the foundations supporting the equipment if necessary. Those plans have proceeded into design; preliminary estimates for completing the alterations would clearly make the Soldiers Pond synchronous condensers unavailable this coming winter. At the outside (as now estimated preliminarily) the need to undertake foundation work could threaten their availability into next winter.

Completion of generation units at Muskrat Falls has led and continues to lead the schedule for LIL completion. Assumptions have called for such generation to supply power transferred over the LIL during commissioning. Delays in completing the first units at Muskrat Falls now pose some (reportedly small) risk to those assumptions. Therefore, providing alternative sources of power to flow over the LIL has increasing importance if and as those delays continue much longer.

Recall power from Churchill Falls will exist in magnitudes sufficient to support LIL commissioning likely well into November. By then, however, electricity demands in Labrador will be growing substantially. Failure to complete LIL commissioning before those demands grow too great will require LIL commissioning this winter to rely on another supply source. If not Muskrat Falls generation, then arrangements involving Churchill Falls or transmission access agreements needed to transfer power into Labrador to move then across the LIL will be required. Both options are subject to as yet not reached agreement with commercial interests outside the province. Delays in completing those transmission agreements are now of very long standing and Nalcor professes inability to provide an expected date for completing them. We therefore do not consider their completion likely at present a reliable alternative.

Our work this month also addressed overall TTO progress, which has been affected by COVID-19 restrictions, and has been subjected to short-term work rearrangement to focus on significantly delayed work in areas less constrained by those limitations. Unfortunately, we continued to find

activity completion short of even readjusted plans. Our long-standing concern about the large number of other activities remaining as completion dates loom has not diminished.

We found Hydro's efforts to complete winter readiness work (capital projects, corrective and preventive maintenance, and readiness checklists) comprehensive, focused, and proceeding well. Its reports show no evident sources of delay, but we caution that much of the capital work has yet to begin. That work involves yet-to-come steps that will assess conditions and circumstances that will have strong bearing on resulting work requirements and time to complete them. Schedules for the work therefor bears close attention. We will also continue to address COVID-19 restrictions and needs, to which Hydro has been attentive and active.

## 2. Purpose of this Report

This report examines scheduled and completed activities undertaken as part of the TTO organization's role in integrating the LCP into the province's electrical system by planned in-service dates. We have conducted reviews on a quarterly basis before now. The Board has changed reporting to a monthly basis, in order to provide more current information about readiness of the LIL for the coming winter, and added to the scope of our reporting a review of Hydro's efforts to prepare its supply resources for availability this coming winter. This first report under the revised process addresses activities through late July. With another quarter elapsed since our last examination, this report also provides a broader update on overall status of TTO covering key elements of our normal quarterly reporting.

The scope of this monitoring effort has generally excluded a detailed review of Muskrat Fall's construction activities, although we have considered the impacts of the scheduling of those activities on the availability of power supply via the LIL. Delays now occurring in completion of Muskrat Falls generation, however, make its status material to supply of the power needed to commission the LIL at the levels planned. We therefore discuss the implication of continued delays in completing generation on LIL commissioning.

## 3. Background

The challenges facing management in the LCP transition to reliable operation have taken on added importance as the few months remaining until the onset of winter elapse. LIL control software and synchronous condenser vibration issues remain unresolved; they continue to impose significant risk to LIL availability and operation this winter and beyond. The Board recently authorized a transition from quarterly to monthly reporting, in order to bring more currency to status reporting and examining of reliability risks. Given continuing inability to complete LIL commissioning and reliable operation, the Board also asked that we review Hydro's efforts to complete capital and O&M work important to ensuring maximum availability of its generating resources for the coming winter.

This first monthly report addresses circumstances and events since our last, quarterly report, which covered the first quarter of 2020. We will follow it with regular monthly reports through the months remaining before the onset of winter. We have changed our processes to reflect COVID-19 travel restrictions and the lack of current, status information from the Muskrat Falls Integrated Project Schedule. Management stopped updating that schedule several months ago, citing

uncertainties imposed by COVID-19. We thus undertook the review leading to this report with no firm milestone dates against which to compare the TTO project schedule we have been using, which management has updated.

We employed a series of information requests and teleconferences, the last of which we held with Nalcor and Hydro on July 24, 2020. We had sought to complete this report sooner, but experienced difficulty in arranging meetings and securing some information. However, with the last meeting somewhat over a week ago, we are able to report on some critical events and circumstances as they occurred and existed well into July.

We stated in our last quarterly report that LIL control software provider GE had performed the FAT using an interim LIL control software version. That test produced failures in a number of areas that must pass to progress with commissioning activities. GE began a process of examining the sources of those failures, developing corrections, and seeking to ensure that those corrections did not engender any additional concerns, all in order to support reperformance of FAT testing. We also reported previously on Synchronous Condenser (SC) vibration issues having the potential to substantially restrict the power that the LIL may be permitted to carry. Activities to address those issues have continued since our report for the last quarter.

#### **4. LIL Status**

The LIL has remained out of service for over twelve months (since June 5, 2019). Ongoing and new issues and constraints continue to threaten delay completion delay. GE's longstanding delays in delivery of a suitable interim bipole software needed to support LIL commissioning and early operation remains a critical schedule driver.

GE was able to continue work on the software issues in its UK facilities in Stafford, and physical site work on the Soldiers Pond synchronous condensers has resumed. COVID-19 work restrictions, however, have continued to slow that work. In late May 2020, GE estimated the date for delivery of the interim software in early June 2020. It then moved to July 16, 2020 and then to July 31, 2020. GE completed reperformance of the FAT, a key step in getting the interim software ready, on July 24. Nalcor advised us on the date of this report's filing that it has determined that these latest FAT results will support the next key stages in LIL commissioning. This milestone makes it more likely that LIL operation by December 1 or shortly thereafter occur, but substantial risk that it will not remains.

Nalcor advised that deployment of the interim software by wireless transmission to the site would commence shortly following confirmation of acceptable FAT results. Plans exist to place a senior GE software engineer at a LIL converter station to support prompt identification and resolution of any issues observed during software installation and the start of LIL commissioning activities.

Following interim software delivery and installation, the LIL must undergo successful bipole commissioning at 225MW, after which a "Trial Operation" stage will commence. GE forecasts a 24-day commissioning duration. We consider that schedule too ambitious to set expectations having a high confidence level, but we, of course, hope that GE can achieve it nevertheless. Much work remains under a number of conditions that may affect schedule duration:

- Pole 2 has undergone only static commissioning, meaning that its converter valves have not operated while functioning as a converter
- Commissioning will include tests of the two poles, operating individually and in coordinated bipole operation
- Testing will include trips of each pole separately, to verify the capability of power transfer to the other pole
- The LIL has not yet operated at greater than 175MW
- Bipole commissioning will occasion the first operation of the electrode lines and sea electrodes at high power levels.

Nalcor has advised that a temporary fix remains in place to address another problem we described earlier, involving Common Neutral Protection. The problem, affecting a capability essential to bipole operation, caused unexpected LIL trips while in monopole operation more than a year ago. The interim software will not provide a final fix, expected to come only in the final software version. The ability of the temporary fix to sustain bipole operation in the meantime thus will prove important.

We have reported that a higher than expected in-rush current during energization of the converter transformers at Muskrat Falls led to plans for installation of point of wave switching relays. Successful completion of these installations may bear on the time needed to energize the transformers, with the potential for slowing commissioning activities (from a need to de-magnetize the transformers). We plan to address progress of the installation of these relays.

Successful completion of the post-commissioning Trial Operation phase requires 30 days of uninterrupted operation (*i.e.*, no trips). Any trips will require investigation, and may require correction of the causes discovered. Successive 30-day Trial Operation periods must then follow, until one produces no trips. Successful completion of Trial Operation will allow Nalcor to place the LIL in commercial operation.

Following successful completion of Trial Operation, the LIL may, subject to an important exception, operate at levels above 225MW, subject to any limits imposed by network conditions and power flows on the Maritime Link. Nalcor has yet to place any of the three Soldiers Pond Synchronous Condensers into service so far. Without support from at least some of them, the LIL may have to remain subject to a transfer limit well beneath its full 900MW capability, imposed because of the relatively low short circuit level at the converter station ac busbars.

The LIL will enter commercial operation under control by the interim software. When the final software will become fully functional remains unknown. We understand that no attempts to conduct the additional commissioning work required when the final control and protection software will be made until after the coming winter season, thus allowing LIL operation, assuming completion of required Trial Operation requirements.

The final software's added features will give operators important flexibility not available until its installation. For example, upon the failure of one pole, the overload capability of the remaining pole will support the LIL's transfer of power, while operators take immediate actions needed to



start any generation needed to prevent under frequency load shedding. Pending installation of the final software, Hydro must apply operating restrictions to avoid system collapse and UFLS (under frequency load shedding). The lack of the ability to provide frequency control offers another example of the need for operating limits pending installation of the final software.

We continue not to have direct access to sufficient information to assign probabilities to a December 1 LIL operation date. However, our pessimism about meeting that date or one later in the coming winter has not abated since our last quarterly report. Certainly, progress has been made, but with several more months of the limited time before winter elapsing. That progress has not as of this writing eliminated key uncertainties.

## 5. Synchronous Condensers

The availability of the three Soldiers Pond synchronous condensers to operate will prove critical to long-term LIL operation at its full capability of 900MW. Work in completing them has encountered three material problems - - binding, corrosion, and vibration. As we have previously reported, their commissioning prior to the beginning of this winter remains at risk.

However, continuing generation availability at Holyrood may substantially mitigate the consequences from any continuing unavailability of these three synchronous condensers. A recent study completed for Hydro by the firm TGS (“Operational Considerations with 0 and 1 SOP Synchronous Condensers”) shows that, as the number of generators operating at Holyrood increases, the LIL can transfer increasing amounts of power from Labrador. To the extent that such configurations result in less than the established minimum short circuit levels, GE approval, not yet granted as we understand the circumstances, will be required. Should GE approval be secured, continuing Holyrood generation, pending assurances of reliable Soldiers Pond synchronous condensers, would permit LIL transfers at less than its fully 900MW capability, but at levels that would very materially reduce service reliability risk this coming winter.

GE has been undertaking efforts to assess and resolve synchronous condenser binding issues for some time, with Nalcor very recently reporting them as resolved. At this point, no additional remediation steps are planned, apart from observing whether operation during commissioning, as this year progresses, validates resolution. We have seen no basis through the present to find a high degree of risk that it will not.

We also reported earlier that GE found corrosion on the bearing of Synchronous Condenser Unit 3. Inspection of the unit found the damage less significant than anticipated. Root cause analysis concluded that the use of ambient air cooling during earlier operation caused the corrosion. A hydrogen-based system will provide the ongoing source of cooling. It was not available during that operation, pending repairs to address the 2019 discovery of a pipe welding issue. GE has completed repair of corrosion damage. Nalcor expects that future use of the corrected hydrogen system, available recently after remediation of the piping issues, will avoid similar instances of corrosion in the future on the three synchronous condensers. We have seen no basis for substantial doubt about this expectation.

The third issue, vibration, remains more uncertain, but recent work supports cautious optimism that its resolution will not delay synchronous condenser commissioning past winter start. Two sources of vibration, lateral and longitudinal, have been undergoing analysis. Vibration measured on Synchronous Condenser Unit 3 exceeded those limits. Various remedial actions have been assessed, some of which, should they prove necessary, will take well past the current winter to complete, and may extend into the following winter season beginning in late 2021.

Synchronous Condenser Unit 2 has recently formed an important focus in assessing risk of delay. Work continues on the commissioning of this unit, now the most advanced of the three. GE began commissioning this second unit in late June, during which a sensor signaled a potential stoppage of hydrogen flow in a cooling system. The nature and significance of the issue underlying the alarm remains underway. Commissioning, however, continued, using ambient air as the cooling source.

GE successfully tested the unit while connected to the grid. Nalcor's observations during that test have produced optimism post-modification vibration remained within accepted tolerances. However, Nalcor reported also that the vibration data collected requires analysis (as yet not complete) before plans for further commissioning and potentially remedial activities can proceed. Nalcor correctly has concern about ensuring successful operation for extended periods without avoidable degradation of the three units. Given the corrosion at Synchronous Condenser Unit 3 following its operation with ambient air cooling, Unit 2 requires examination for potential corrosion to confirm it incurred no damage from such operation.

GE observed concerning levels of vibration when performing Unit 3 commissioning work. GE is now modifying the bearings of Unit 3 in an effort to reduce vibration to levels consistent with design specification and supportive of long-term operation without undue degradation. Scheduled delivery of the bearings to Soldiers Pond will permit installation to begin in mid-August. Timely delivery will permit Unit 3 commissioning to start in early October 2020. Should commissioning demonstrate the effectiveness of the redesigned elliptical bearings, Unit 1 and 2 bearings will undergo the same modification.

Nalcor reports that it does not consider it likely that this solution will fail; we have no reason to question that view. Nevertheless, GE continues to proceed in parallel with efforts to pursue changes to the foundations of the units, with work now proceeding through the design stage. That GE does so demonstrates the existence of enough uncertainty and consequence to justify aggressive pursuit of a foundation solution. Outside Canadian and U.S. experts continue this planning and design work. A preliminary schedule for completing it has been prepared. We had substantial difficulty in obtaining from Nalcor direct information about the dates it proposed - - with Nalcor citing its internal concerns about its duration as the reason.

Nalcor told us that it is pressing for a shorter duration to completion, if attainable. We have no reason to discourage efforts to shorten a schedule with service-affecting implications - - particularly a preliminary one. However, preliminary or not, the schedule that exists has clear bearing on examining the likelihood of delay in synchronous condenser operation. The best information for assessing that risk now is the schedule prepared by experts retained for their special

skills and experience in the work involved. Nalcor certainly has not offered an alternate set of milestone dates (Nalcor's, its consultant's, or GE's).

We therefore pressed Nalcor to provide the information, which it did after our multiple attempts to get it to do so. Nalcor first noted that:

*It is important to note that the design of the foundation remediation is currently less than 25% complete and thus the range of possible completion dates for each unit are largely meaningless for purposes of analysis at this stage.*

We would fundamentally disagree with any notion (should that be Nalcor's implication) that no analysis of schedule can or should occur until design passes a 25 percent threshold. Assessing the schedule of important facilities begins in prudent organizations at the earliest stages of conceptual design, undergoing refinement as design progresses. We would be most surprised to learn that Nalcor does not follow this practice itself.

The significance of design completion lies not in whether it should trigger schedule estimation (indubitably it should), but on how large a schedule range management should use to encompass the uncertainties involved. The expert, best, and in fact only specific schedule information we have been provided suggests an earliest start date of mid-October of this year and a 20- to 50-week duration to completion from that start date.

We hope that foundation work will not be required and that, should it prove necessary, Nalcor will have success in advancing its completion. We offer the following observations about risk as the best judgments that can be formed on the basis of current information:

- Commissioning activities in the coming several months (perhaps past the end of October) will provide information needed to confirm whether modifications made already or able to be made without further delaying commissioning support a conclusion that immediate and sustained Soldiers Pond synchronous condenser operation should proceed
- There exists some material risk (not quantifiable, but in our judgment likely well less than 50 percent) that it will take foundation work to provide that basis
- Should foundation work be required, it will
  - With essential certainty extend past the end of the coming winter
  - Create a small risk of extension into some portion of the following winter
- In any event, no actions beyond those already taken or executable in time to allow commissioning before the onset of this coming winter exist to mitigate further synchronous condenser availability delay
- The unavailability of any Soldiers Pond synchronous converters this winter requires Holyrood's generating capability to permit the LIL to transfer power levels over the LIL
- As few as one Holyrood generator operating in such cases will materially add to power supply resources by permitting LIL operation, if otherwise not operationally constrained, to operate at a substantial portion of its rated capability (increasing in magnitude with each additional Holyrood unit operating or Soldiers Pond synchronous condenser available).

Clear progress is being made, but one cannot conclude that options identified so far will reduce vibration to acceptable levels in the next several months. The work in addressing foundation-

related causes and solutions remains open-ended regarding the long-term magnitude of the problems caused by vibration and the means for addressing them.

## 6. Muskrat Falls Generators

LIL commissioning anticipates the transfer of power up to 225MW. These anticipated plans have called for LIL commissioning following operation of sufficient generation at the new Muskrat Falls generating units to support LIL operation at 225MW. Recognized delays at Muskrat Falls have not reached a level that yet threatens its ability to provide power flows needed for LIL commissioning, but their continuation makes it appropriate to consider alternatives. Limited construction work on the Muskrat Falls generators re-commenced late this past May, with contractor mobilization continuing through June. Work on the generators started in July, with Unit 1 commissioning expected to be completed and ready for operation first, in September. The current schedule calls for Unit 2 to follow in November.

A July 8, 2020 test run of Unit 1 disclosed unexpected movement between radial arms of the lower bracket and lower bracket sole plates. Analysis of the cause led to redesign and weld improvements, which have extended Unit 1's Ready for Operation date from August to September 2020. Hydro now expects to complete a resulting assessment of this delay's impact on the Muskrat Falls-Happy Valley interconnection by the end of this September. In addition, an inspection of Unit 1' upstream water passage found concrete debris in the water passage, but not of a nature or extent expected to delay commissioning. However, another inspection will occur this month.

These events do not directly threaten LIL commissioning, but time does not permit continuing sources of delay in making Muskrat Falls Unit 1 ready for operation. Should its delay extend sufficiently, LIL commissioning as scheduled will require alternate sources of power, which consist of:

- A portion of the Churchill Falls 300MW block of recall power
- Imports of power through Hydro Quebec's transmission system
- Using Churchill Falls to make power available to flow across the LIL.

Recall power totals 300MW, but goes first to supply loads in Labrador. Recall power should prove sufficient to support LIL commissioning's required 225MW, until November deepens, depending on the weather. As winter deepens, Labrador usage grows to more than 200MW, leaving only and expected 80-90MW as excess. Nevertheless, prior operation of the LIL (more than a year ago) in monopole mode indicates that, even without formal commissioning, it may be able to transport at least this excess.

Should neither Muskrat Falls nor recall power excess serve LIL commissioning, the remaining alternatives, imports from Quebec and use of Churchill Falls, both require arrangements in which Hydro Quebec has a say. The former requires execution of the Multi-Party Pooling Agreement (MPPA) and the Interconnection Operators Agreement (IOA), which address transmission access issues for power flows into and out of Labrador through Quebec. Scheduled for completion long ago, they remain subject to securing agreement from out-of-province interests. Nalcor can offer no date for completing agreement, producing a high risk that completion will not occur before or during winter. Nalcor reports that its and CLFCo's management see no technical or operating

concerns that cannot be resolved in very short order. However, as with the MPPA and IOA, out-of-province interests would play a substantial role in securing needed top-level consent to make Churchill Falls output available to support LIL commissioning.

The prudent conclusions to draw with respect to sourcing power for LIL commissioning are:

- The currently recognized delay length for Muskrat Falls Unit 1 commissioning does not yet directly threaten completion of LIL commissioning prior to this winter, but continuing delays have made planning for commissioning without it material
- Resolution of the software and condenser vibration issues and completion of LIL commissioning according to the current schedules would ordinarily permit LIL commissioning with the use of recall power through much of November
- After that point, rising loads in Labrador threaten to limit LIL operation to levels below the 225MW needed for commissioning as specified
- It is possible that, even so, the LIL can still provide 80-90MW or so of power transfer to the Island during this winter, but it must be recognized that the LIL, while it has transferred higher levels during past monopole operation, ceased that operation a year ago.
- The ability to commission the LIL without either Muskrat Falls generation or sufficient levels of recall power requires out-of-province engagement that does not appear likely to produce required agreements.

## 7. Overall Schedule Performance

Management's re-baselining of the TTO in May 2019 pushed back completion dates for many of its activities. Our previous quarterly reports noted that progress thereafter regularly and significantly fell below expectations. We saw similar results over the second quarter of this year.

The COVID-19-related work stoppage on March 17, 2020 has clearly affected physical work. The GE issues we have reported now for many quarters have continued to contribute strongly to difficulties in completing TTO activities. However, the COVID-19 restrictions also presented a partially compensating opportunity (discussed in our last quarterly report) to redirect resources toward completion of lagging TTO work items. Nalcor established a list of priority areas, and formed working groups to address their work tasks. For example, key items to prepare to support the LCP operations team included:

- Operating Procedures
- Operator Training (syllabus, logistics, scheduling, contracting, lessons learned/knowledge transfer workshops)
- Spares (contractor spares, recommended spares, special tools, surplus spares)
- Turnover preparation (documentation completion, operational review, NLSO acceptance criteria)
- Other (Grid Energization Procedures, Supports for O&M contracts etc.).

We expected this redirected focus to produce a significant increase in numbers of activities completed in the second quarter. However, our review of the latest TTO schedule does not bear

out that expectation. Limited progress has been made in the second quarter with many activities being rescheduled to later in 2020 and beyond.

*a. BTPO Training*

Training development and completion continued to lag, again adversely and substantially affected by GE resource availability and performance. The second quarter of 2020 saw only one training course completed. Five of the TTO work plan's 21 (24 percent) identified HVdc station GE operator training courses remain to be completed, as do two of the five (40 percent) GE synchronous condenser training courses. Management cited training during our last quarterly review as an area it would emphasize during the COVID-19-related restrictions on construction activities.

*b. Success in Meeting Key Second Quarter Milestones*

Key milestones extracted from the LCP Integrated Project Construction schedule provide the foundation for TTO's baseline integration schedule. Milestone dates tracked in the transition schedule represent the earliest date that the transition team will complete its work. Following the mid-March work stoppage, Nalcor stopped updating the Integrated Project Schedule for Muskrat Falls and the LIL, and still has not resumed normal updates. Management continues to update the TTO project schedule, but with limits, given the lack of a continuing flow of milestone information typically supplied by the Integrated Project Schedule. We would normally provide a chart showing nominally reported milestone progress measured from the new May baseline schedule. However, the lack of timely and accurate milestone date information normally extracted from the Integrated Project Schedules make such a comparison pointless until regular schedule updates resume.

However, it is clear that completion of planned activities has continued to lag by a very large margin; *i.e.*:

- The schedule called for completion of 46 baseline activities
- Management completed only 8 of those activities scheduled
- It completed only 6 unscheduled activities
- Even crediting the 6 unscheduled activities completed, the total of 14 activities completed comprises less than a third of the 46 scheduled for completion.

Ongoing work restrictions certainly continued to impair the ability to make progress, but the activities include some already substantially delayed and others reportedly the subject of increased focus and resources during those restrictions. These 46 activities slated for second quarter completion comprise:

- Critical activities - - those having an impact on critical path milestones
- Bulk activities - - those just requiring completion by the end of the project.

Management completed timely the only critical item schedule for second quarter completion. However, as noted, many other activities originally targeted for completion in prior quarters remain to be completed, along with those scheduled for later completion. The number of those activities continues to be much too large to support confidence in their effective completion in the schedule time remaining. In other words, activities consigned to the bulk category in practice

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become critical if they are not being “knocked down” at a sufficient pace as scheduled completion nears.

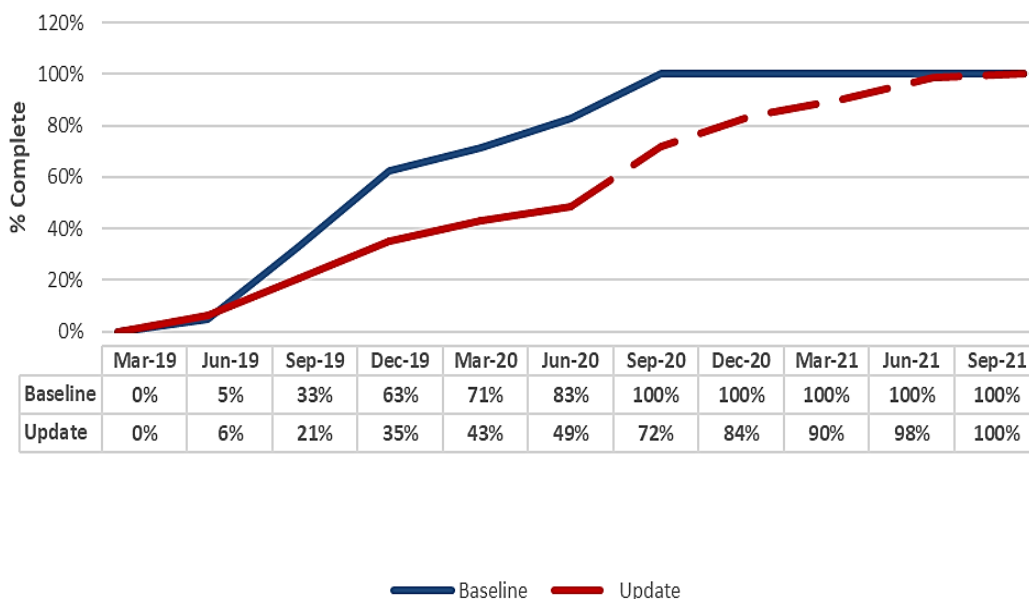
*c. Completion S-Curves*

We have been measuring progress in completing this large body of activities using a cumulative percent-complete “S-curve.” We began doing so early in our monitoring work because gaps in management’s schedule construction and reporting prevented a more informed approach. Percent complete as we have measured it equals cumulative number of activities scheduled for completion divided by total outstanding activities.

We re-initialized our curve to conform to management’s May 2019 schedule re-baselining. The re-results, depicted in the next chart, show second-quarter completion of 49 percent of total outstanding activities, versus a targeted completion of 83 percent. Ever greater levels of improvement continue to be required to meet completion expectations for the third quarter of 2020 (72 percent). Even should management achieve this very unlikely level of performance, it would still fall short of the third quarter baseline target (100 percent) established in May. Long and recent trends in performance give no basis for substantial confidence in attaining this level of achievement.

The next chart shows the increase in the gap between planned (Baseline) and actual (Update) through the second quarter of 2020. The chart also shows the much accelerated rate of performance required to complete remaining work. With progress impaired by a number of major issues, many of them lingering, we find the growing gap over the past several quarters grounds for further concern about TTO work completion schedule.

**Cumulative Progress Comparison**



Delays outside the scope of its work have continued to give TTO more time to complete its activities, but we continue to caution that confidence that this breathing room will remain sufficient continues to lessen without strong evidence that progress is growing as fast as remaining time is passing.

## 8. Hydro's Preparations for Winter

We added to our reporting this month an assessment of Hydro's efforts to prepare its supply resources for reliable winter operation, given continuing issues affecting completion of the additions that the LCP will bring. We conducted a teleconference with Hydro and we reviewed a series of documents Hydro provided in response to requests we made at or following that meeting. We focused on the status of four principal components of those preparations for Hydro's supply resources:

- Specific major capital projects
- Completion of planned corrective and preventive maintenance work items (CM and PM)
- Planned winter readiness activities
- COVID-19 work restrictions and needs.

We and Hydro held a supply resource readiness preparations call on July 16, 2020 to discuss action-item status. We reviewed the scope and content of Hydro's plans and schedules to prepare certain generation assets for winter readiness and the status of key activities.

### *a. Summary*

Hydro has planned and so far executed appropriate actions to address the major generation risks. However, material Bay d'Espoir penstock risk remains. Measures taken thus far have mitigated that risk but do not lead to permanent correction of the root cause - - corrosion of the Penstock walls. This is particularly important for the horizontal section of the Penstock 1 wall that has reduced thickness. This reduced thickness produces increased risk that stresses will result in further cracking along the weld joints. Hydro still needs to develop and execute long-term remedies. The probability of equipment failure at Stephenville or Hardwoods also remains high, as their ages would suggest.

We will be adding focus on the review of the Holyrood capital projects as they advance, beginning with the next monthly report. To support that effort, Hydro has agreed to provide:

- A summary of the seven Holyrood capital projects (supplemental and as approved in the annual capital program), including milestone level schedules, a high level discussion of findings, and significance of findings and/or corrective actions taken for the findings
- Copies of any interim or final vendor inspections reports.

### *b. Water Availability*

Hydro will rely strongly on its hydro generation sources this winter, making water availability an important issue. Management reported a healthy supply of water for these facilities, with a strong spring snow melt and rainfall levels. Energy represented by water in storage exceeds the levels of the past two years. Daily reviews of availability confirm continuing strength in supply and



management. Management believes that there is only a minimal chance that water supply will become a supply risk this winter.

Nalcor Energy Marketing continues to remain engaged in planning water use for generation at Hydro's units. We discussed with Hydro the roles, responsibilities, and accountabilities of each, given Energy Marketing's commercial interests in off-system sales compared with Hydro's need to optimize reliability over the coming winter. The two organizations work together to develop a weekly production plan, then monitor it daily to address changing system conditions and needs. Hydro reports that it both oversees development of that plan and has final accountability for its content and application as each week progresses. We will continue to monitor the focus on reliability versus economy in using water for generation.

*c. Bay d'Espoir Penstocks*

The penstocks have experienced failures, and continue to present a risk to unit availability. Penstock 1 experienced a September 22, 2019 failure along a previously repaired weld. An outside firm investigated the failure's root causes, performing reviews of metallurgical tests, previous issued reports, analysis of water chemistry, and water-pressure data. The firm's report identified high secondary and peak stresses at the longitudinal weld seam under internal pressure as the initiating causes of the 2019 failure, and of an earlier one in 2016. Hydro implemented several mitigation measures at the penstocks, established weekly Penstock Working Group meetings to review conditions and issues, and created another committee to review and propose long-term corrective actions.

*d. Holyrood Capital Projects*

We reviewed the status of four Holyrood reliability projects Hydro has scheduled for completion prior to the coming winter: boiler assessment and repair, overhaul of Unit 2's turbine control valves, overhaul Unit 3's main boiler feed pump, and overhaul Unit 2's main generator.

The Unit 3 assessment has already been completed, with the discovery of no material issues. Only the work on the Unit 1 boiler assessment project had begun at the time of our teleconferences with Hydro; management expects its completion by August 21. The Unit 2 assessment has a scheduled start date of August 3. The Unit 2 turbine valve and Unit 3 main boiler feed pump overhauls were scheduled to start on July 27 and the Unit 2 main generator overhaul on July 31.

While much of the work in these projects remains, the work completed so far has identified no issues with a significant probability of preventing the units from returning to service as scheduled.

*e. Corrective and Preventive Maintenance*

Examining the nature and number of maintenance backlogs provides important insight into plans and actions to optimize unit availability. Hydro has followed an integrated annual work plan that includes all O&M work activities. Management reports plan completion at 85 percent, placing work on schedule so far, and not subject to apparent risks to timely completion. A structured, process regularly assesses, sets, and, as necessary, adjusts work priorities. This "gatekeeper" process reviews work content, status, and materiality regularly, to set clear risk rankings and completion schedules. Management subjects any work not completed to a risk mitigation process,

supported by a change notice process. The forms supporting this process identify activities involved and the operational/reliability risk involved. Management develops mitigation measures to address those risks.

*f. Winter Readiness Checklist*

We discussed Hydro's winter readiness work plan with management. Hydro reported the plan at 89 percent complete and on schedule. Hydro has already placed 103 of the 106 planned contracts critical to winter operation, with the open three that remain on schedule for completion. Supply of critical parts and equipment also reportedly remained on track. Completion of the remaining three contracts remains on schedule. All critical parts are on track. Hydro has identified no critical risks to generation availability as of the start of the coming winter.

*g. COVID-19*

The portions of this report addressing TTO activities have discussed COVID-19-related work restrictions. They apply as well to the work that Hydro must accomplish. Hydro has taken a series of actions to prevent the introduction and spread of worker infection, including personnel screening, daily questionnaires, and contractor screening. Hydro has also implemented measures addressing the cleaning of tools and work areas, social distancing, minimizing control room access, frequent tours by safety personnel, and the acquisition and use of appropriate PPE.

*h. Stephenville Spare Engine*

We discussed with management the status of the Stephenville spare engine, which reportedly is now on site. Hydro also reported that its personnel witnessed by video the operational test of the engine at the repair facility.