Matter No. M10366

In the Matter of an Application by Nova Scotia Power Incorporated (NS Power) for approval of its Annual Capital Expenditure Plan (ACE Plan) for 2022

EVIDENCE OF

JOHN D. WILSON

ON BEHALF OF

THE CONSUMER ADVOCATE

Resource Insight, Inc.

FEBRUARY 24, 2022

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I. Identification & Qualifications

Mr. Wilson, please state your name, occupation, and business address.

A: I am John D. Wilson. I am the research director of Resource Insight, Inc., 10 Court St., Arlington, Massachusetts.

Q: Summarize your professional education and experience.

A: I received a BA degree from Rice University in 1990, with majors in physics and history, and an MPP degree from the Harvard Kennedy School of Government with an emphasis in energy and environmental policy, and economic and analytic methods.

I was deputy director of regulatory policy at the Southern Alliance for Clean Energy for more than twelve years, where I was the senior staff member responsible for SACE's utility regulatory research and advocacy, as well as energy resource analysis. I engaged with southeastern utilities through regulatory proceedings, formal workgroups, informal consultations, and research-driven advocacy.

My work has considered, among other things, the cost-effectiveness of prospective new electric generation plants and transmission lines, retrospective review of generation-planning decisions, conservation program design, ratemaking and cost recovery for utility efficiency programs, allocation of costs of service between rate classes and jurisdictions, design of retail rates, and performance-based ratemaking for electric utilities.

My professional qualifications are further summarized in Attachment JDW-1.

Q: Have you testified previously in utility proceedings?

A: Yes. I have testified more than thirty times before utility regulators in California, Colorado, Nova Scotia and the Southeast U.S., and appeared numerous additional times before various regulatory and legislative bodies.

Q: Have you previously testified in other proceedings before this Board?

A: Yes. I have filed testimony in eleven matters. I have also assisted the Consumer Advocate in preparing comments and developing positions in numerous proceedings and stakeholder processes.

Q: On whose behalf are you testifying?

A: My testimony is sponsored by the Nova Scotia Consumer Advocate.

II. Introduction and Summary

Q: Please summarize NS Power's application.

A: NS Power is seeking Board "approval of 24 capital work orders with total project investment of $70.6 million and the 2022 capital routine program of $110.5 million for an aggregate total of $181.1 million."[1] Together with capital projects under $1,000,000 and Point Aconi projects that do not require NSUARB approval, carryover spending, capital routines, and subsequent submittal items, NS Power's overall 2022 capital budget amount is $531.6 million.

If the forecast is fully realized, the $531.6 million expenditure would be 37% higher than the current expenditure forecast of $387.6 million for 2021.[2] Whether this level of spending occurs depends on the submittal of the Eastern Clean Energy Initiative (ECEI) -- $120 million is forecast in 2022 for those four subsequent submittal ECEI projects.[3] If the ECEI expenditures do not occur in 2022, then the resulting $411.9 million forecast would be 6% higher than the current 2021 expenditure estimate.

Some of the other key information that NS Power has submitted includes:

- A management plan for the autotransformer fleet, as directed by the Board in 2021 (Appendix G);[4]
- A 2017–2020 Contingency Report (Appendix E); [5] and
- Examples of cost minimization practices (Section 11.1.5);[6]

Notably, NS Power has not completed or submitted any internal post-project reviews since its willingness to do was welcomed by the Board in its 2020 ACE Plan Decision.[7]

Although not submitted in its 2022 ACE Plan Application, NS Power submitted an update to its Non-Binding Contingency Guidelines as an attachment to its 2021 Stakeholder Engagement Report.[8]

[1] Exhibit N-1, Application, p. 7, lines 14-17.

[2] *Id.*, p. 17, Figure 2; Exhibit N-5, NS Power response to NSUARB IR-7(i).

[3] Exhibit N-5, NS Power response to NSUARB IR-6.

[4] NSUARB Order, 2021 ACE Plan, Matter No. M09920 (June 10, 2021), Order Paragraph 1.

[5] NSUARB Order, 2021 ACE Plan, Matter No. M09920 (June 10, 2021), Order Paragraph 3.

[6] NSUARB Order, 2021 ACE Plan, Matter No. M09920 (June 10, 2021), Order Paragraph 4.

[7] NSUARB Decision, 2020 ACE Plan, Matter No. M09499 (June 25, 2020), p. 25.

[8] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, p. 16.

It is also worth noting that the Mersey Hydro System Re-Development project is included as a subsequent submittal project ($6 million cost estimate for 2022), as it was in the 2017 ACE Plan and each subsequent plan.

Q: What is the purpose of your testimony?

A: I have reviewed most of the issues identified by the Board as well as the specific projects that NS Power seeks approval in its Annual Capital Expenditure Plan for 2022. Throughout my testimony, I will give particular attention to two themes: the Board's concerns about (a) cost overruns on capital projects and (b) alignment of 2022 ACE Plan with the 2020 IRP and more recent provisional and federal legislation.

I also raise concerns about the VJ1 Generator Refurbishment (CI C0029693) and VJ1 Control System Upgrade (CI 0029691) projects, which appear to have an excessive budget contingency and whose procurement process may not have minimized costs.

Q: What steps has the Board taken to address cost overruns?

A: Cost overruns can and will occur because "unforeseen conditions and issues often arise in capital construction projects."[9] However, on average, cost overruns should be balanced by cost savings. The reasons that NS Power has much more frequent and larger cost overruns than projects under budget are either that NS Power has "inadequate ... capital cost estimating/budgeting practices, inadequate cost minimization efforts, or a combination of both."[10]

In 2020, the Board expressed its intent to verify the adequacy of NS Power's cost minimization practices by

- Recognizing the "importance of adequate information being made available to satisfy ratepayers and the Board that NS Power adheres to its mantra that cost minimization is at the forefront of its activities";
- Welcoming "NS Power's willingness to do 'internal post project reviews"; and
- Directing NS Power "to provide examples of cost minimization during execution and construction from the prior year's projects, with specific cost minimization being fully described".[11]

[9] NSUARB Decision, 2020 ACE Plan, Matter No. M09499 (June 25, 2020), p. 31.

[10] NSUARB Decision, 2021 ACE Plan, Matter No. M09920 (June 10, 2021), p. 24, para. 56.

[11] NSUARB Decision, 2020 ACE Plan, Matter No. M09499 (June 25, 2020), p. 25. In 2021, the Board clarified that it wished the projects selected for cost minimization review need to be more defined to ensure that they vary in overall cost and asset type. NSUARB Decision, 2021 ACE Plan, Matter No. M09920 (June 10, 2021), p. 32, para. 70.

In its 2020 Decision, the Board also indicated its concerns that there may be "general issues with NS Power cost estimating practices, under-scoping of projects at the original approval submission stage and/or use of inadequate project contingencies," and that where an ATO is not required, "overspending amount does not require Board approval and goes to NS Power's rate base upon which the company earns a return."[12] In its 2021 Decision, the Board observed that the opposite can also be true: it noted that some examples of cost savings may not "represent examples of proactive cost minimization practices by the company, but instead would be a result of NS Power simply overestimating units/quantities when it prepared capital cost budget estimates."[13]

Also in its 2020 Decision, to verify the adequacy of NS Power's budgeting practices, the Board directed NS Power to:

- "Develop non-binding guidelines describing how it determines when a capital cost estimate contingency amount is merited and at what level";
- Track and file certain information regarding project budgets, costs, and contingencies; and
- Provide information to "review the relationship between various capital expenditures" related to thermal generation.[14]

As noted above, NS Power has updated its non-binding contingency guidelines following the 2021 stakeholder engagement.[15]

In its 2021 Decision, the Board also clarified its guidance with respect to internal post-project reviews. The Board rejected NS Power's proposed threshold of capital projects over $5 million in costs and observed "that cost minimization opportunities, as well as the likelihood of project overspending, can vary across projects of varying sizes."[16] In its 2021 Stakeholder Engagement Report, NS Power agreed to also conduct such reviews for projects between $1 million and $5 million that meet criteria addressing (i) new technology, (ii) safety or environmental issue, (iii) schedule/budget over/underperformance, and (iv) project manager recognition.[17]

[12] NSUARB Decision, 2020 ACE Plan, Matter No. M09499 (June 25, 2020), pp. 31-32.

[13] NSUARB Decision, 2021 ACE Plan, Matter No. M09920 (June 10, 2021), p. 35, para 74.

[14] NSUARB Decision, 2020 ACE Plan, Matter No. M09499 (June 25, 2020), pp. 33-37.

[15] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, pp. 12-13. NS Power provided the current guidelines in Exhibit N-4, NS Power response to CA IR-15, Attachment 1.

[16] NSUARB Decision, 2021 ACE Plan, Matter No. M09920 (June 10, 2021), pp. 35-36, para 76.

[17] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, p. 4.

NS Power has also determined that its post project review template will be used to track lessons learned, in response to the Board's direction that NS Power implement the Consumer Advocate's recommendation for a "framework and reporting protocols for a capital cost 'lessons learned' business practice."[18] NS Power further agreed to include this information in its annual capital program workshops.[19]

Q: Please summarize your recommendations.

A: The Board should direct NS Power to:

1. Demonstrate that the levels of investment in proposed Eastern Clean Energy Initiative projects are supported by an optimal resource plan based on a scenario similar to 2020 IRP Scenario 3.1C, and that NS Power has engaged directly with stakeholders in developing this demonstration prior to filing its subsequent submittals. (Pages 10 and 43)
2. Further clarify the Contingency Guidelines to avoid relying on the expected accuracy range to set a contingency, considering an approach I suggest for application of the predetermined guidelines method when used to determine a contingency. (Page 29)
3. Include the following documents with every capital work order and application.
    - Project maturity classification checklist
    - Statement of the basis for the contingency guidelines including, as applicable:
        a. Predetermined guidelines – reference to or statement of documented basis for use of a standard "single contingency" or other referenced practice;
        b. Subject matter expert judgement – documented reasons for the determination, including a supporting risk register; and
        c. Other, more technical methods - Supporting analysis as described in the Contingency Guidelines. (Page 29)
4. Include projects procured through a sole sourcing process (only one qualified source for equipment, software, etc.) with budgets or costs over $1 million and a sample of projects with costs below $1 million in the post-project review process. (Page 30)
5. Make all, or a reasonably sized sample, of the post-project reviews available as part of the 2023 ACE Plan filing. The Board should then identify as issues in the 2023 ACE Plan proceeding (a) whether the post-project reviews are useful and effective, and (b)

[18] NSUARB Decision, 2021 ACE Plan, Matter No. M09920 (June 10, 2021), p. 38, para. 81.

[19] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, p. 5.

what information from those reviews (such as a summary) NS Power should submit on an annual basis. (Page 35)

6. Provide cost minimization information that is more useful for identifying lessons learned in the 2023 ACE Plan. The Board should then identify as an issue in the 2023 ACE Plan proceeding the determination of what cost minimization information would be useful (and worth the effort) to compile and file, or whether it may be more efficient to consolidate the cost minimization report with information summarized from the post-project reviews into a single requirement. (Page 36)
7. Submit a 10-year TCO for each IT project with a budget of over $1 million, unless an EAM has been prepared. (Page 41)
8. Include a sensitivity analysis in the Mersey EAM, at a minimum, that includes the full cost of decommissioning the facility at the end of the analysis period. (Page 44)

I also recommend that the Board take three actions, as follows:

9. In its review of NS Power's 2021 Report on its Affiliate Code of Conduct, the Board should request documentation of NS Power's evaluation of its asset management objectives and an explanation regarding the current rating as well as past determinations that the target performance level has been met. (Page 39)
10. The Board should select an independent consultant to investigate alternative autotransformer replacement strategies in coordinating with NS Power's subject matter experts. (Page 48)
11. The Board should reject the proposed project budgets for the VJ1 Generator Refurbishment (CI C0029693) and VJ1 Control System Upgrade (CI 0029691) and require NS Power to resubmit the capital work orders to address the deficiencies identified in my testimony after reviewing its procurement methods and costs to determine if there are further opportunities for cost minimization. (Page 50)

III. Alignment of 2022 ACE Plan with the 2020 IRP

Q: How should the 2022 ACE Plan be aligned with the 2020 IRP?

A: The 2022 ACE Plan should be aligned with the 2020 IRP in at least two ways. First, the sustaining capital costs for generation units should be consistent with the plan, as updated

to reflect recent provisional and federal legislation. Second, new investments called for in the 2020 IRP, as updated, should be included.

Q: How has the 2020 IRP been updated?

A: On January 21, 2022, NS Power filed its first update to the 2020 IRP, reflecting what it described as an "Evergreen process intended to refine the IRP Action Plan and Roadmap on an ongoing basis."[20] Some of the key updates are as follows:

- The Province of Nova Scotia amended the Renewable Energy Regulations in July 2021. The 2030 Renewable Energy Standard requires NS Power to supply customers with 80% renewable energy, including 1,100 GWh from independent power producers. The Province initiated a procurement of 350 MW of renewable resources, which should leave a balance of 10% renewable energy to be obtained by 2030.[21]
- The Province also amended its GHG reduction targets in October and November of 2021. By 2030, NS Power is to meet GHG reduction targets of 53% below 2005 levels and retire all coal-fired electricity generation.[22]
- The Government of Canada updated its carbon pricing benchmark to $65/tonne in 2023, rising to $170/tonne in 2030. The Province has not yet announced its compliant provincial program.[23]
- NS Power determined that it will be unable to obtain 150 MW of near-term firm transmission capacity over the existing interconnections to New Brunswick and Newfoundland.[24] NS Power states that as a consequence, the planned retirement of Trenton 5 will need to be postponed from 2023 to 2024, when NS Power believes it will be feasible to add one or more combustion turbine units.[25] NS Power will implement operational restrictions on Trenton 5 operation to avoid a turbine major refurbishment, which will allow the unit to operate through the winter of 2023/2024.[26]

[20] NS Power, IRP Action Plan Update letter (January 21, 2022), Matter No. M08929, p. 2.
[21] NS Power, IRP Action Plan Update (January 2022), Matter No. M08929, p. 6.
[22] *Id.*, p. 7.
[23] *Id.*, p. 8.
[24] *Id.*, p. 13.
[25] *Id.*, p. 39.
[26] *Id.*, p. 40.

- NS Power is also evaluating potential deployments of up to 200 MW of battery storage. It is not clear from the update whether this is a complement or alternative to the combustion turbine capacity under study.[27]
- NS Power has continued to evaluate the possible conversion of coal-fired units at Point Tupper and Trenton generating stations to natural gas supply. NS Power has made progress towards confirming the availability of gas and appears to believe that the conversions are a cost-effective source of dispatchable firm capacity, although this was not firmly established in the 2020 IRP (particularly since the IRP did not reflect subsequent regulatory guidance).[28]

The update also indicates that diesel CT sustaining capital is projected to be within the range tested and found cost-effective in the IRP.[29] NS Power has deferred its stakeholder engagement session on the IRP update, so I have not been able to clarify the ambiguities in the report.

Q: Are the sustaining capital costs for generation units in the 2022 ACE Plan aligned with the 2020 IRP?

A: Yes. As the Consumer Advocate stated in comments on the 2021 System Outlook Report, the recent federal and provincial policy developments support shifting the reference plan from IRP Scenario 2.0C to 3.1C.[30] NS Power has not identified which scenario will be used as its reference plan for evaluation purposes,[31] but states that it intends to update its modeling assumptions in 2022.[32] Nonetheless, NS Power presents evidence in its 2022 ACE Plan that its sustaining capital cost forecast is consistent with IRP Scenario 3.1C through about 2024,[33] and NS Power states that its "updated sustaining capital spending plan [is] reflective of [legislation for 2030 coal retirement]."[34]

[27] *Id.*, pp. 38-39.

[28] *Id.*, pp. 51-53.

[29] *Id.*, p. 55.

[30] William L. Mahody, Consumer Advocate, Letter providing comments on NS Power's 2021 10 Year System Outlook Report (September 23, 2021), Matter No. M10178.

[31] Exhibit N-4, NS Power response to CA IR-4(a).

[32] NS Power, IRP Action Plan Update (January 2022), Matter No. M08929, p. 85.

[33] Exhibit N-1, Application, pp. 124 – 128. NS Power states that "sustaining capital investment begins to be reduced after 2025" under a 2030 coal retirement scenario, but Figures 63 and 64 appear to indicate that the reduction begins by 2025 and perhaps earlier.

[34] Exhibit N-4, NS Power response to CA IR-1.

Q: Are the new resource investments in the 2022 ACE Plan aligned with the 2020 IRP?

A: Not yet. The new resource investments identified in the IRP update are either included as subsequent submittals—as part of the Eastern Clean Energy Initiative—or, in the case of the combustion turbine unit(s), not yet listed in the ACE Plan. The information included in the application is insufficient to demonstrate alignment.

IV. Eastern Clean Energy Initiative (ECEI) and Impact of Recent Provisional and Federal Legislation on Proposed Spending

Q: What is the ECEI?

A: The ECEI is NS Power's "plan to transition away from coal...and realize 80 percent renewable energy in Nova Scotia by 2030."[35] It includes four subsequent submittals:

- C0044391 ($352 million): Some or all of the Atlantic Loop, "a series of transmission expansion projects that would increase transfer capabilities between Hydro Québec and New Brunswick (HVDC), and between New Brunswick to Nova Scotia (345kV AC) ... [that] is anticipated to provide up to 550 MW of capacity and 2+ TWh of renewable energy to NS Power."[36]
- C0044392 ($32 million): Conversion of "one existing coal-fired boiler to fire primarily on natural gas, retaining the ability to fire on Heavy Fuel Oil (HFO) as a secondary fuel," either Point Tupper or Trenton 6. The submittal will not include a potential second boiler conversion.[37]
- C0044771 ($83 million): Wind assets, including 350 MW from a provincial RFP and up to 160 MW of "onshore wind energy in partnership with one or more Mi'kmaq communities."[38]
- C0045132 ($171 million): Up to 200 MW of battery energy storage system (BESS).[39]

[35] Exhibit N-1, Application, p. 8, lines 7-10; Exhibit N-5, NS Power response to NSUARB IR-5.

[36] Exhibit N-1, Application, p. 17, lines 10-11; p. 35, Figure 10. NS Power states that "portions" of the Atlantic Loop are included in C0044391, suggesting that NS Power may intend to bring further portions of the Atlantic Loop forward in further capital submittals. NS Power, IRP Action Plan Update (January 2022), Matter No. M08929, p. 16.

[37] Exhibit N-1, Application, p. 35, Figure 10; Exhibit N-4, NS Power response to CA IR-3(a); Exhibit N-5, NS Power response to NSUARB IR-5.

[38] Exhibit N-1, Application, p. 35, Figure 10; Exhibit N-5, NS Power response to NSUARB IR-5; NS Power, IRP Action Plan Update (January 2022), Matter No. M08929, p. 47.

[39] Exhibit N-1, Application, p. 35, Figure 10; NS Power, IRP Action Plan Update (January 2022), Matter No. M08929, p. 43.

While the general outline of the ECEI is described by NS Power, it falls a bit short of being a "plan." When complete, the ECEI plan will effectively replace components of the 2020 IRP.

Q: How is NS Power planning to demonstrate the cost-effectiveness of its four subsequent submittals?

A: NS Power has not explained how it will be analyzing the projects. It states that it intends to submit each project as a "separate capital filing," without indicating that it would evaluate the ECEI as a comprehensive plan.[40] This is somewhat concerning as the characterization of resource alternatives in the 2020 IRP encountered significant technical challenges. I recommend against evaluating the four ECEI projects on a stand-alone basis, such as by using the Economic Analysis Model (EAM).

Q: What analysis of the ECEI do you believe should be conducted?

A: The ECEI projects should be demonstrated to be part of a reasonable resource plan in an IRP update based on a scenario similar to 2020 IRP Scenario 3.1C. While I agree that the general concepts outlined in the ECEI are consistent with the 2020 IRP Action Plan, the specific amounts of resource investments were subject to substantial discussion in comments submitted by the parties, including the Consumer Advocate. For example, the optimal level of wind resources depended significantly on the assumed construction costs or purchased-power prices for new wind resources. To explore these issues, NS Power will need to engage directly with stakeholders, rather than simply provide discovery responses that explain EAM findings.

Q: What stakeholder engagement has NS Power conducted in developing the ECEI?

A: Since the 2020 IRP was completed, I am unaware of any stakeholder engagement NS Power has conducted in developing the ECEI or any of its elements.

Q: Do you recommend that NS Power initiate stakeholder engagement in the ECEI prior to filing its subsequent submittals?

A: Yes. NS Power is proposing major changes to its 2020 IRP. The scale of these changes is justified by the changes to the policy environment. NS Power should seek to engage stakeholders in this process as thoroughly as it did for the 2020 IRP.

[40] Exhibit N-4, NS Power response to CA IR-2.

However, I am concerned that any such engagement will be late in the process and that NS Power may merely go through the motions of consultation. Thus, while I recommend that the Board encourage NS Power to engage in meaningful stakeholder engagement, if NS Power feels that it has missed the opportunity for that engagement and needs to file its subsequent submittals, then that engagement can occur through the Board's proceedings.

V. Cost Minimization: Review of Evidence

Q: Please summarize your review of NS Power's cost minimization evidence.

A: I will begin with a review of the effectiveness of NS Power's cost minimization practices using two data sets. Using the contingency directive data in Appendix E, I will show that for projects placed in service through roughly the end of 2019, NS Power has not shown any material improvement in the accuracy of project cost estimates.

Using a longer-term data set that is focused on hydroelectric projects with substantial civil engineering components, I will show that while cost variances for most of those projects are reasonably close to expectations, that is not true for five high-overspend ATOs. The Board is currently dealing with one of these high-overspend ATOs, the Tusket Main Dam Refurbishment ATO (M10197). I will also review the Board's response to these and other ATOs, in which the Board has clearly put NS Power on notice that it expects projects that are presented for approval to include project cost estimates based on competent initial investigations, accurate project designs, and well-supported cost estimates.

A. Effectiveness of NS Power's Cost Minimization Practices

Q: Does the new data in the 2022 ACE Plan demonstrate improvement in NS Power's underestimating of project costs?

A: No. NS Power has filed new data for 57 completed capital projects, in addition to the 154 projects previously listed; these additional projects also demonstrate that the original budgets substantially underestimated project costs.[41]

[41] NS Power also updated the actual spend for 11 projects. The only project with a material update is CI 49891. Its actual spend was updated from $138,465 to $208,008, compared to an approved estimate of $319,649.

The 57 new projects were mainly approved in the 2018 and 2019 ACE Plans; a few were approved in 2017 and one was approved in 2020. The in-service dates for these projects range from August 2017 to October 2020, with the majority of the projects having in-service dates in 2019. NS Power included 14 projects placed in service in 2017 or 2018 in Appendix E of the 2022 ACE Plan that were missing from the 2021 ACE Plan, without explaining why.

The following summary updates the Board's review of the 2020 ACE Plan proceeding, utilizing the 2022 ACE Plan data filed in Appendix E.[42]

- The average variance for listed projects amounts to approximately +9.5% of the original submission approved cost estimate, slightly decreased from 10% in 2020 and 2021;
- The total variance of $20,137,705 for the listed projects is over and above the total contingency amount of $11,791,484 included in the total of the original submission approved cost estimates (for newly listed projects, these values are $4,101,005 and $4,010,771);
- The average contingency amount for the listed projects has increased slightly to 5.5% of the original submission approved cost estimate, with the newly listed projects having an average contingency of approximately 6%;
- Considering all 211 projects (the 57 newly listed projects):
  - 28% (39%) had a negative variance;
  - 72% (61%) had a positive variance; and
  - Two newly listed projects required an ATO submission to the Board, including the L5027B Replacements and Upgrades (CI 49782) and TUC HFO Piping Refurbishment (CI 51808).
- For projects that have a negative variance, the total variance amount is approximately -$6.78 million, or -14.4% of the original approved cost estimates (for newly listed projects, these values are -$2.93 million and -16.8%);
- For projects that have a positive variance, the total variance amount is approximately $26.92 million, or 16.3% of the total of the original approved cost estimates; for newly listed projects, these values are $7.03 million and 14.7%.

NS Power did not include any projects with an originally approved estimate of less than $250,000.

[42] NSUARB Order, 2020 ACE Plan, Matter No. M09499 (June 25, 2020), pp. 29-31. The calculations were performed as described in the evidence, but similar information is provided by NS Power in a response to an information request. Exhibit N-1, Application, Appendix E.

In comparison to my review of the contingency data provided by NS Power in the 2021 ACE Plan Proceeding, the new data continue to show that NS Power appears, on average, to underestimate project costs, inclusive of estimated contingency amounts. While the 2021 data showed a slight increase in this tendency, the 2022 data show a slight decrease in this tendency. It appears that for projects placed in service through late 2019, there has been no material improvement in the accuracy of project cost estimates.

I have also noticed that NS Power may have omitted some relevant projects from Appendix E. Relevant data for CI 48022, CI 51526, and CI 51711 were supplied in response to information requests,[43] but are not included in Appendix E.

Q: Are there any particular project types that NS Power should focus on?

A: Yes, as shown in Table 1, about three-quarters of high-overspend costs occurs in steam generation plant projects. I identified the steam generation plant projects in a review of the contingency directive to determine what types of projects had the greatest cost overruns. I focused on high-overspend projects: those with variances above 30%.[44] In addition, my review of civil hydroelectric projects (as opposed to turbine and generator projects) identified a number of high-overspend projects, as discussed in Sections V.B and V.C below. NS Power should thus focus on cost minimization in its steam generation plant and civil hydroelectric projects.

Table 1: Contingency Directive Projects with Variance Above 30%

	Approved Estimate	Contingency		Actual Spend	Variance to Approved Est.	
General	411	24	6%	653	242	59%
Hydro Generation	1,395	112	8%	2,378	983	70%
Transmission	2,461	164	7%	3,675	1,214	49%
Distribution	2,468	103	4%	4,010	1,542	62%
Steam Generation	9,979	500	5%	21,601	11,622	116%
Total	**16,714**	**903**	**5%**	**32,318**	**15,603**	**93%**

In addition to representing about three-quarters of the cost, the 24 steam generation projects are disproportionately represented among the 38 high-overspend projects. While

[43] Exhibit N-4, NS Power response to CA IR-17, Attachment 1, and CA IR-23(e).

[44] A 30% threshold is appropriate for identifying high-overspend projects because the majority of projects are submitted at a Class 3 estimate. This threshold has been adopted by NS Power for its capital cost sensitivity in EAM studies. NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, p. 17.

steam generation plant projects represent only 37% of the total approved cost estimates in the contingency directive data, they represent 60% for the group of high-overspend projects. As shown in Table 1, the 116% variance for the steam generation projects is much higher than the other four categories of high-overspend projects.

Considering the proposed ECEI investments, I also reviewed NS Power's variances for renewable energy projects and new or upgraded transmission and distribution facilities. The three renewable energy projects identified in response to an information request had actual spend that was near the approved estimate.[45]

The information request for data on transmission and distribution facilities focused on new facilities or investment in the replacement of existing facilities at a substantially upgraded level of service as measured by voltage, capacity or reliability metrics with in-service dates of 2012-2021. NS Power's response identified 43 transmission and 13 distribution projects representing $196 million and $198 million, respectively, through manual review.[46]

Those 43 transmission and 13 distribution projects had almost no cumulative variance. One transmission project exceeded the 30% threshold at 33%, and one distribution project had overspending of 74%, but it was a relatively small project budgeted at about $1 million.[47] Thus, while there were 5 transmission and 7 distribution projects listed among the high-overspend projects in Table 1, those projects appear to have been replacements or rebuilds – and even if those high-overspend projects were added to the 56 new facility/replacement projects, the cumulative variance would still be only about 1% because the actual spend on the high-overspend projects listed in Table 1 represents only about 15% of the total.

In comparison with the pattern I note above with respect to steam generation projects and below with respect to civil hydroelectric projects, it appears that NS Power has a good track record with cost estimates in the renewable, transmission and distribution project areas, with high-overspend projects occurring at a lower frequency than steam generation projects and with less dramatic financial consequences than the high-overspend civil hydroelectric projects.

[45] Exhibit N-4, NS Power response to CA IR-16, Attachment 1.

[46] Exhibit N-4, NS Power responses to CA IR-17, Attachment 1 and IR-18, Attachment 1.

[47] *Id*.

B. Cost Overruns in Civil Hydroelectric Projects[48]

Q: How closely has NS Power's actual spending on civil hydroelectric projects matched with the original project budgets?

A: For most civil hydroelectric projects, NS Power's project budgets are reasonably reflective of actual spending, but a group of high-overspend projects indicates a significant cost-estimation problem.

Over the past decade, NS Power has completed 42 hydroelectric projects involving civil engineering or civil works construction.[49] Three of those projects had actual spend that was more than double the cost estimate (excluding contingency).[50] Average spending for the remaining 39 projects was 3 percent above the cost estimate, or 2 percent below budget (including contingency).

As illustrated in Figure 1, for all but the three outlier projects, the actual cost of projects is distributed in a range from -27 to +26 percent of the cost estimate.[51] This is roughly consistent with the AACE International expected accuracy range for hydroelectric projects: For Class 3 cost estimates, the typical variation in low and high ranges at an 80 percent confidence level is -20 to +30 percent of the cost estimate.

AACE's expected accuracy range suggests that a histogram of those variations should be a roughly symmetrical curve, rather than one that is skewed heavily to the high-cost side. Excluding the three high-overspend outlier projects, the main group of 39 projects averages just 3 percent above the cost estimate. Thus, in spite of the skew, those 39 projects exhibit a reasonably close correspondence to AACE's expected variation in project costs.

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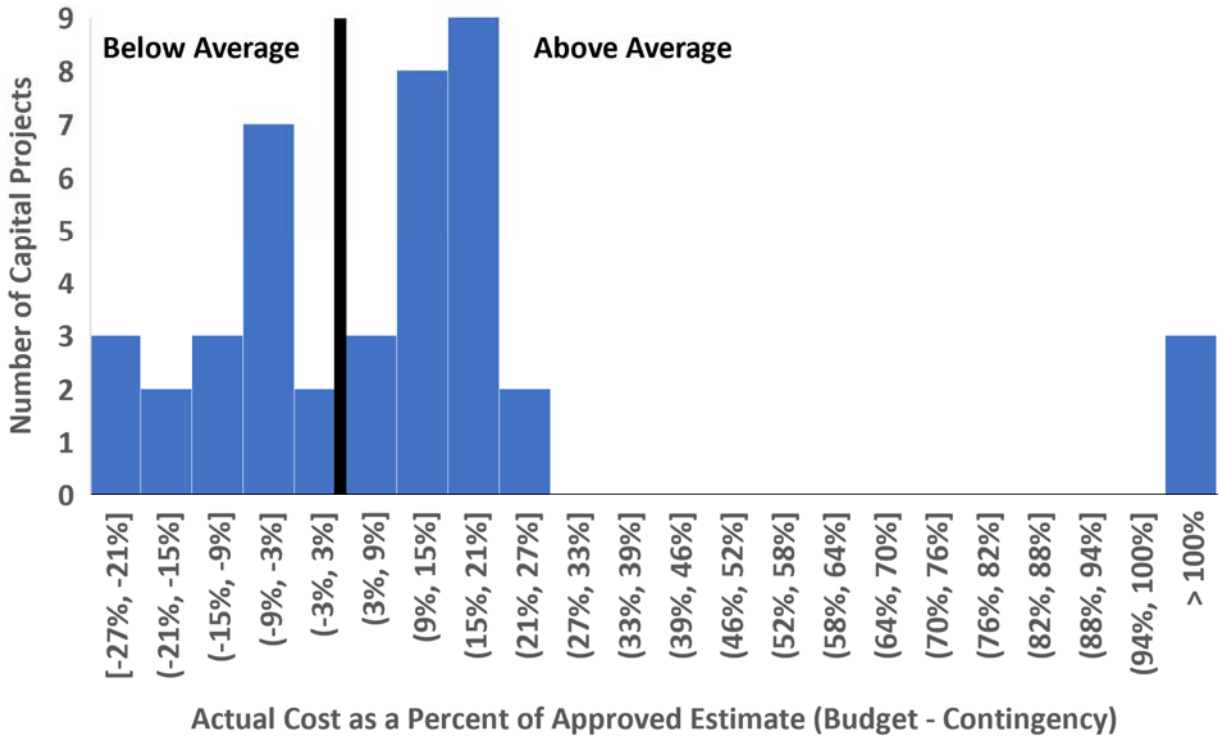
[48] The evidence in this subsection has been submitted in the Tusket ATO matter (M10197). It is broadly applicable to NS Power's cost minimization practices, so I am submitting it in this matter as well.

[49] Exhibit N-4, Tusket ATO, Matter No. M10197, NS Power response to CA IR-4, Attachment 1. The specific request covered projects with in-service dates of 2012-2021 and approved budgets of $500,000 or more. Three projects with in-service dates of 2019 or 2020 where work is ongoing are excluded from the analysis in this testimony. Notably, the Gaspereau ATO project is not included in this analysis because it is not yet in-service. Based on a spot check of FIN reports, the contingencies for CI 31246 and 40308 were corrected. The spot check also indicated that the contingencies for CI 41143 and 40282 are likely to be incorrect, but the actual values were redacted from the 2012 ACE Plans. I did not attempt to verify contingency values for all 39 projects.

[50] I use the term "cost estimate" to indicate the original budget excluding contingency and "budget" where I am also including contingency. This distinction is important for evaluation against AACE International standards.

[51] AACE accuracy ranges are compared with the cost estimate, not budget. AACE considers contingency to be an important component of a project budget, but the contingency is not included for purposes of establishing the accuracy range. This practice differs from the filing requirement for an ATO, which does include the contingency in considering whether the overspend amount triggers an ATO filing.

Figure 1: Actual Cost Compared to Approved Estimate, NS Power Completed Hydro Capital Projects 2012–2021



Source: Exhibit N-4, Tusket ATO, Matter No. M10197, NS Power response to CA IR-4, Attachment 1. (See footnote 49.)

While the cost variances for most of the historical projects are reasonably close to expectations, that is not true for the three projects with overspending in excess of 100 percent, as well as two ATO projects that are under construction. The Gaspereau ATO decision approved total spending of $22.7 million over five times the original approval of $4.4 million, and the Tusket ATO application has been suspended.[52] I will refer to these five hydroelectric projects with an ATO in excess of 100 percent of the original cost estimate (excluding contingency), as summarized in Table 2.[53]

[52] NSUARB, Board Decision, Gaspereau Dam Safety Remedial Works ATO (December 21, 2020), M09579; NSAURB, Board Letter (February 2, 2022), Matter No. M10197.

[53] If the budget (including contingency) is used instead, four of the ATO's are over 100%, and the Wreck Cove ATO spend was 89% above the original budget, over five times the overrun for the worst of the 39 non-high-overspend ATOs.

Table 2: NS Power Hydro ATO Projects with More than 100 Percent Overspending

ATO Project	Weymouth Falls Tailrace Deck Refurbishment[54]	Sissiboo Pipeline Replacement[54]	Wreck Cove Fire Suppression Upgrades[54]	Gaspereau Dam Safety Remedial Works[55]	Tusket Main Dam Refurbishment ATO[56]
Matter	M07459	M07554	M07662	M09579	M10197
Planned In-Service	2013 / 09	2014 / 10	2015 / 10	2008 / 06	2019 / 10
Actual In-Service	2016 / 11	2015 / 12	2017 / 1	2021 / 12	TBD
Months of Delay	**38**	**14**	**15**	**162**	**40**
Budget	$ 371,469	$ 475,082	$ 1,034,915	$ 4,354,889	$ 18,157,609
Contingency	2,000	-	104,824	-	77,694
Cost Estimate	369,469	475,082	930,091	4,354,889	18,079,915
Actual Spend	840,914	955,561	1,952,660	22,703,451[a]	36,826,119[b]
Overspend	**128 %**	**101 %**	**110 %**	**421 %**	**103 %**

(a) The actual in-service date and actual spend is not yet known; the ATO approved in-service and cost estimate is provided. NS Power has informed the Board that although the archaeological mitigation program began in May 2021, in late Q3 2021, NS Power was informed by the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) that the Assembly of the NS Mi'kmaq Chiefs (Assembly) were no longer supportive of the project. As a result of these developments, NS Power paused work.[57]

(b) The actual in-service date and actual spend is not yet known; the ATO proposed cost estimate is provided, although NS Power has indicated that it will refile its ATO and the cost estimate may increase substantially.[58]

[54] Exhibit N-4, Tusket ATO, Matter No. M10197, NS Power response to CA IR-04, Attachment 1. Note that the Wreck Cove Fire Suppression Upgrades involved construction of a water tank, and the ATO related to geological issues at the proposed site.

[55] NSUARB, Board Decision, Gaspereau Dam Safety Remedial Works ATO (December 21, 2020), M09579; NS Power, 2007 Annual Capital Expenditure Plan, p. 24.

[56] Exhibit N-1, Tusket ATO Application, Matter No. M10197, p. 7, Appendix C, p. 3; Exhibit N-1, Application, M08162, p. 21.

[57] NS Power, Letter to the Board (February 4, 2022), M09579.

[58] NS Power, Project Update (February 23, 2022), M10197.

In Annual Capital Expenditure Plan decisions, the Board has expressed concern about the large number of projects with high overspending. For example, in 2021, the Board observed that 14 percent of capital projects "incurred overspending beyond the AACE +30% upper accuracy limit for Class 3 estimates. This exceeds the 10% expectation prescribed by AACE."[59]

C. Past Board Response to ATOs

Q: Has the Board approved NS Power's full ATO request for the high-overspend ATOs and, if so, why?

A: Yes. In three cases, the Board approved the full ATO request because it found that NS Power learned of additional costs after project approval during detailed engineering, but prior to beginning construction. Generally, the Board has found that the costs included in NS Power's ATOs would have been required even if the design changes had been identified prior to the original application. At least, this is what occurred in nine of the ten ATOs I reviewed for this portion of my testimony.

For example, in the Tufts Cove 6 Waste Heat Recovery Project ATO ("TUC6 ATO"), the Board recognized that "it is a matter of judgment as to how much effort in, and funding of, engineering design should be put into a project at the preliminary stage as opposed to detailed engineering."[60] But the Board did not answer that question in its decision, since it appears to have been convinced that changes discovered during the detailed design phase, as one witness described, did not represent "a cost that you would have been able to avoid."[61]

Similarly, in the Board's decision regarding the Wreck Cove Fire Suppression Upgrades ATO, the Board found that the RFP process determined costs to be much higher than the original third-party estimate. The Board accepted that:

> All costs associated with the ATO application would have been incurred regardless of whether a more accurate estimate had been provided for the original application.[62]

[59] NSUARB, Board Decision, 2021 Annual Capital Expenditure Plan (June 10, 2021), M09920, para 51.

[60] Nova Scotia Power Incorporated (Re), 2010 NSUARB 220, para 58.

[61] *Id.*, para 57.

[62] NSUARB, Board Decision, Wreck Cove ATO (December 23, 2016), M07662, p. 2. Another decision with similar findings is NSUARB, Board Decision, Sissiboo ATO (August 15, 2016), M07554, p. 2.

In a third example, the recent Gaspereau ATO decision, NS Power did not request recovery of some costs that might not have been approved by the Board. In the Gaspereau ATO, the Board stated, "NS Power might have come to the Board earlier for approval of overspending and approval of a scope change."[63] Even though the Board was concerned that "NS Power proceeded with significant spending on archaeology and Mi'kmaq engagement related activities without prior Board approval," the Board approved the amount requested by NS Power because it found that NS Power incurred additional costs as a result of significant archaeological finds. The Board did not disallow the overspending but noted that, because the overspending was not included in its regulated rate base from 2012 to 2020, the Company did not request (nor receive) $627,543 in foregone earnings on unapproved spending.[64]

In the only case I reviewed where the Board found that better information in the original application would have resulted in lower costs, the Board did make significant disallowances. In the Trenton Ash Lagoon ATO, the Board made significant disallowances because NS Power relied on incorrect information (causing extra costs resulting from delays), improperly specified materials, and inaccurate estimates of required wet ash handling.[65] The Board decision includes thorough analysis of the factors weighing in favor of full disallowance and mitigating factors, and determined that for each issue, a partial disallowance would reflect a fair and reasonable assignment of the extra costs to ratepayers and NS Power.

Q: Has the Board been concerned with inaccurate project cost estimates in high-overspend ATO decisions?

A: Yes. In the Wreck Cove ATO, the Board stated, "The Board is concerned with the inaccurate explanation of the project cost variance prior to receiving the clarification noted in the third set of IRs." It also stated, "The Board fully expects project cost estimates (upon which capital item approvals are submitted) to be fairly representative of expected final costs. In fact, the Board notes that economic analysis modelling of project alternatives and selection of

[63] *Id.*, p. 3.

[64] NSUARB, Board Decision, Gaspereau Dam Safety Remedial Works ATO (December 21, 2020), M09579, p. 5.

[65] NSUARB, Board Decision, TRE Ash Lagoon ATO (January 15, 2018), M08180, pp. 2-3, 4, 7.

preferred economic options can be skewed incorrectly by inaccurate project cost estimates."[66] Similarly, in the Sissiboo ATO, the Board stated,

> In the Board's view, a proper on-site inspection by qualified personnel should have identified conditions at the Sissiboo location requiring changes to the design and installation. This omission appears to have largely contributed to the resulting over-expenditure and grossly underestimated the scope and cost of the project when it was presented for approval. The Board expects NSPI's capital expenditure applications to accurately describe and justify the scope of work and the associated cost being submitted for approval.[67]

Q: Has the Board expressed concerns about budget preparation and project management in other ATOs that did not meet your high-overspend threshold?

A: Yes. In addition to the concerns summarized above for the Tufts Cove 6, Gaspereau, Wreck Cove, and Sissiboo ATOs, I am aware of nine other ATOs where the Board has expressed concerns about NS Power's project management.

- Tidewater Unit 1 and Methals ATOs: The Board's decision commented on additional expense in two projects. Both budgets increased due to unbudgeted engagement of full-time construction supervisor, whose regular base was considerably distant from the construction site. The Board stated, "these instances may indicate a weakness in NSPI's project management and resource planning."[68]
- Weymouth and Sissiboo Electrical Refurbishment ATOs: The Board expressed concern "that in both instances NSPI failed to complete a proper and timely investigation of the scope of work and associated costs related to these projects. The Board expects NSPI to undertake proper on-site inspections by qualified personnel to accurately describe and justify the scope of work and associated cost being submitted for approval."[69]
- Trenton Ash Lagoon ATO: The Board stated that, "NS Power's reliance on information shown to be incorrect does not relieve NS Power of its responsibility and duty to confirm land ownership prior to proceeding with construction. This confirmation could have been obtained by NS Power ... it is fair and reasonable that

[66] NSUARB, Board Decision, Wreck Cove Upgrades ATO (December 23, 2016), M07662, p. 2.

[67] NSUARB, Board Decision, Sissiboo Pipeline Replacement ATO (August 15, 2016), M07554, p. 2.

[68] NSUARB, Board Decision, Tidewater Unit 1 Overhaul ATO (December 6, 2016), M07683, p. 2.

[69] NSUARB, Board Decision, Weymouth Electrical Replacement ATO (July 11, 2017), M08053, p. 2. See also NSUARB, Board Decision, Sissiboo Powerhouse Electrical Refurbishment ATO (April 11, 2017), M07939.

the claimed extra costs resulting from the delay ... be shared equally between ratepayers and NS Power."[70]

- Burnside Unit 4 ATO: "Board reviews of this project, and several other projects ... indicate that NSPI might not have a full grasp of the scope of work and costs required to refurbish these units. Significant changes in the scope of work and increased costs raise questions related to the quality of NSPI's asset management methodology and its project management."[71]
- TUC2 Generator ATO: "NS Power should have completed a more thorough review of this project before declaring it 'similar' to CI 44592."[72]
- Spider Lake Substation ATO: In spite of performing a site inspection, NS Power's original application relied on the 'historical experience' approach and overlooked conditions that "would require much more effort and resources than would be expected by simply using the "historical experience" approach."[73]
- PTMD Dock and Conveyor Replacement ATO: Relying on a "preliminary third party quote" in its cost estimate, the final project was almost twice the approved amount, with some of the increase "attributed to procurement inefficiencies."[74]

I would also note that out of these nine ATO's where the Board expressed concerns, the TUC2 Generator and PTMD Replacement ATO are the only two ATOs listed in the contingency directive data. The contingency directive data also include eight other ATOs in which the Board accepted the spending increase as a consequence of unanticipated scope increases discovered during the project.

Q: What conclusions do you draw from your review of NS Power's track record on cost estimation and the Board's decisions on ATOs?

A: My review of these ATOs indicates that the Board was correct to identify both "inadequate NS Power capital cost estimating/budgeting practices [and] inadequate costs minimization efforts by NS Power" as factors in driving the overall trend in overspending.[75] The Board clearly expects NS Power's initial application to include all relevant information that would

[70] NSUARB, Board Decision, TRE Ash Lagoon Site Closure ATO (January 15, 2018), M08180, pp. 2-3. In this decision, the Board also disallowed costs related to replacement of improperly specified materials and additional wet ash handling (pp. 4, 7).

[71] NSUARB, Board Decision, Burnside Unit #4 Restoration ATO (January 19, 2018), M08293, p. 2.

[72] NSUARB, Board Decision, TUC2 Generator Bushing Replacement ATO (July 26, 2018), M08637, p. 1.

[73] NSUARB, Board Decision, Spider Lake Substation Addition ATO, M09110, p. 6.

[74] NSUARB, Board Decision, PTMD Dock and Inhaul Conveyor Replacement ATO (January 26, 2018), M08295, p. 1.

[75] NSUARB, Board Decision, 2021 Annual Capital Expenditure Plan (June 10, 2021), M09920, para 56.

allow for approval of a cost estimate, including contingency, that is generally sufficient to achieve the project objectives. When the Board has critiqued NS Power in an ATO, it has usually expressed concern about shortcomings in initial investigations and an overreliance on historical experience.

Many ATOs are approved by the Board on the basis of a significant increase in scope uncovered during the project, and that NS Power asserts could not be foreseen.

In the Gaspereau ATO, the archaeological findings resulted in a change to the project objectives, which presented unique circumstances. NS Power's decision to forego AFUDC earnings in that case pre-empted Board decision on the scope of earnings that should be disallowed when major project design changes occur.

As discussed in Section V.B (see Figure 1), the evidence indicates that for roughly 90 percent of its hydro capital projects, NS Power has completed work at costs that are statistically consistent with its approved estimates. However, in the cases where those costs vastly exceed the approved estimates, the Board has clearly put NS Power on notice that it expects projects that are presented for approval to include project cost estimates based on competent initial investigations, accurate project designs, and well-supported cost estimates.

VI. NS Power's Cost Minimization Practices

Q: Has the Board previous found that NS Power needs to improve its cost minimization practices?

A: Yes, in its decision on the 2021 ACE Plan, the Board expressed several "concerns associated with the effectiveness of NS Power's capital cost minimization and budgeting practices."[76] The Board directed NS Power to enhance its capital project tracking, specifically as it relates to lessons learned. The Board did not direct NS Power to engage a third-party expert to review cost minimization practices, but indicated that such a review may be appropriate in the future if the concerns continue.

Q: Do you still believe that a third-party expert review is necessary?

A: Not at this time. NS Power has agreed to implement a number of significant reforms, and the Board should closely follow the impact of those reforms. As discussed above, the Board

[76] NSUARB, Board Decision, 2021 ACE Plan, Matter No. M09920 (June 10, 2021), p. 37, para. 79.

has expressed its concern about competent initial investigations, accurate project designs, and well-supported cost estimates. I note that this concern is focused on the planning phase, rather than the execution phase. (The Tusket ATO may be a significant exception in which there have been issues with both planning and execution.)

The Board has directed NS Power to implement several significant cost minimization reforms:

- In the planning phase, the Board has directed or encouraged NS Power to revise its contingency practices and to use non-biding contingency guidelines;
- Throughout the project, and during execution, NS Power is to track and report cost minimization activities; and
- In the post-project phase, NS Power is formalizing its post-project review with criteria, a template, and a process for socializing lessons learned across its staff.

Furthermore, NS Power is updating several pre-existing cost minimization practices. NS Power's risk management practices are documented in its Risk Identification Checklist Template and its Risk Register Template. Currently, its value engineering and benchmarking practices are not "prescribed beyond good practice such as Project Management Institute (PMI) practice guidance."[77] NS Power explains these updates as follows.

> As part of commitments made during the 2021 ACE Plan stakeholder engagement process, NS Power is reviewing and updating Project Management guidance documentation (which includes the above-noted documentation). Updates to this documentation will be incorporated into a new NS Power Project Delivery Model (PDM), which is currently being developed. The PDM will include guidance and recommended practice for risk management, value engineering and benchmarking, to ensure these tools are identified and applied appropriately. The PDM will be provided as the Project Management standard guidance for capital projects at NS Power through 2022. The PDM will be scalable and include guidance as to the appropriate application of tools depending on inputs such as project values, stakeholder impacts, regulatory elements, and safety. NS Power can have over 700 active projects at a given point in time with a range of scope, complexity and estimated cost; therefore, it will be important that project management rigor be scaled proportionally to project complexity, scope and estimated cost.[78]

[77] Exhibit N-4, NS Power response to CA IR-9.

[78] *Id*.

A. Contingency and Contingency Guidelines

Q: Please summarize the purpose of a budget contingency and the key steps for setting the contingency.

A: NS Power's Non-Binding Contingency Guidelines state, "Contingency is an amount added to an estimate to allow for items, conditions, or events for which the state, occurrence, or effect is uncertain and that experience shows will likely result, in aggregate, in additional costs."[79]

Some of the key steps in setting the contingency are:

1. Determining the maturity level of the estimate – NS Power has created a checklist to classify project maturities[80].
2. Determining the risk exposure facing the project – NS Power uses a risk register template to document the assessment of the probability of the risk and its potential impact on the project, treatment of the risk, and control of the risk [81].
3. Determining the contingency – Most often, NS Power states that it uses expert judgement and predetermined guidelines (see below), but its guidelines provide for the use of more technical methods.

The Contingency Guidelines also discuss the potential use of a project management reserve to "address strategic project risk or scope items not yet identified."[82] A project management reserve is a distinct concept from contingency (see Figure 2 below) and should not be used interchangeably.

Q: Has NS Power aligned the Contingency Guidelines with AACE guidance following the 2021 ACE Plan Stakeholder Engagement?

A: For the most part, yes. The adoption of the checklist to classify project maturities is a significant improvement that will assist in review of applications and capital work orders submitted to the Board. The Contingency Guidelines also include a figure that clarifies the relationship between the base estimate, contingency, and actual cost.

[79] NS Power Non-Binding Contingency Guidelines (filed in Exhibit N-4, NS Power response to CA IR-15, Attachment 1), p. 3. (Henceforth, "Contingency Guidelines.")

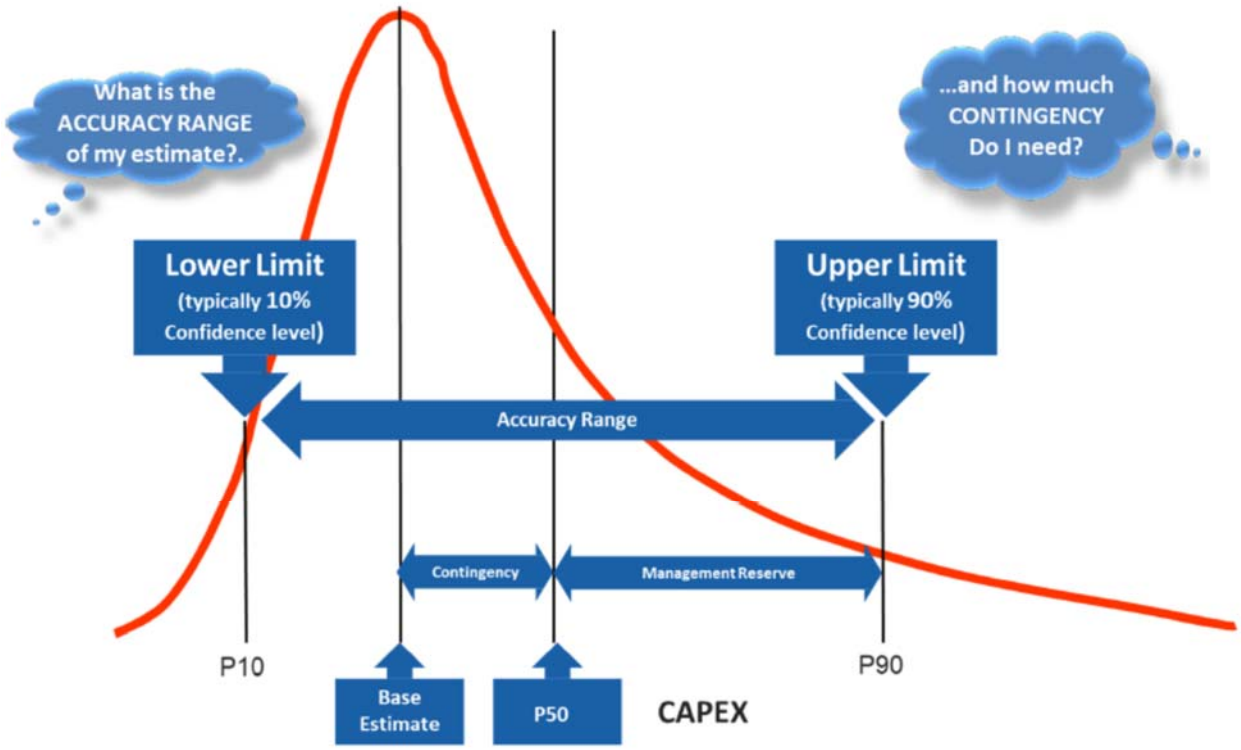
[80] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, p. 12; Contingency Guidelines, Attachment B.

[81] Contingency Guidelines pp. 18, 22; Exhibit N-4, NS Power response to CA IR-9.

[82] Contingency Guidelines, p. 18.

As shown in Figure 2 (labeled as Figure 1 in the Contingency Guidelines), the total submitted cost estimate includes the base estimate plus the contingency, representing the 50/50 expected total cost. The variance can be expressed relative to either the submitted cost estimate (including contingency) or the base estimate, depending on context.

Figure 2: Estimate Development Overview



Although the revisions to the Contingency Guidelines submitted with the Stakeholder Engagement report come close to aligning the document with AACE recommended practices, NS Power continues to conflate the expected accuracy range of the budget estimate with the contingency determination. The Contingency Guidelines now state:

> NS Power recognizes that AACE makes no correlation between the contingency and the upper limits of the estimate accuracy, however, the level of a project maturity and hence the estimate class is directly related to the level of Uncertainty inherent in the project budget estimate; as a result, there are varying levels of contingency that can be applied and although NS Power starts with using the AACE recommended upper limits of the estimate accuracy range to establish the range for the probable contingency, as project progression develops, NS Power will take into account evidence such as budgetary quotes, RFP responses, further detailed design, construction assessments and other

> insight as necessary to narrow the proposed AACE accuracy where possible for a given class of estimate.[83]

This paragraph seems contradict itself by first conceding that the contingency and the expected accuracy range are distinct concepts ("no correlation") and then stating that, "NS Power starts with the expected accuracy range to establish the range for the probable contingency."

NS Power's continued reliance on AACE's expected accuracy range to set contingency values is demonstrated by the Nictaux Canal Crest Rebuild project. NS Power justified its contingency as follows:

> A 15 percent contingency was utilized in the project budget. It is based on the assumption that since contract pricing was received prior to submittal, and represents 85 percent of total project cost prior to Contingency, that this provides a sufficient project maturity to qualify as a Class 3 Estimate. *Contingency was placed on the lower end of the 10-30 percent range for this estimate class* due to the high percentage of contract spend to the overall project budget. This contingency allowance covers risks such as quantity assessments as there is no risk related to cofferdam or dewatering, which would have increased the contingency to the higher end of the contingency range.[84] (*emphasis added*)

As emphasized in the quote, NS Power relied on the expected accuracy range to set the contingency value, referencing both the upper limit and, incongruously, the lower limit (as if the contingency should never be below 10%).

Q: How could NS Power improve its contingency determination process?

A: It appears to me that this new paragraph overly complicates the contingency determination process. While AACE's expected accuracy range is useful as a benchmark for testing the overall effectiveness of cost estimating practices, as NS Power acknowledges there is "no correlation" between this concept and the contingency.

While there is "no correlation," the expected accuracy range plays a small role in setting the contingency: As shown in Figure 2, the contingency should never be larger than the expected accuracy range. Other than serving as an upper limit, the expected accuracy range should not inform the selection of a contingency.

[83] Contingency Guidelines, p. 10.

[84] Exhibit N-4, NS Power response to CA IR-22.

It appears to me that NS Power almost always states that its contingency determination relies on subject matter expert judgement and predetermined guidelines. This is a reasonable approach, if it can be reviewed in some manner to demonstrate that it is not an arbitrary decision. The predetermined guidelines method is defined in NS Power's Non-Binding Contingency Guidelines as follows: "This method may be as simple as providing a single contingency or float value (e.g., percentage of base cost or duration) for use on all estimates or schedules of a certain type to complex tables or scoring mechanisms that employ elements of parametric modeling."

In other words, the predetermined guidelines method provides for adoption of a standard "single contingency" amount based on its past performance. For example, as shown in Figure 1, NS Power's average actual cost for civil hydroelectric costs (excluding high-0verspend projects) has been about 3% above its approved estimate, excluding the contingency. (The average cost in Figure 1 corresponds to the P50 point in Figure 2.) Thus, for an average civil hydroelectric project, it appears appropriate to use a 3% contingency as a "single contingency" starting point. The 3% contingency could then be modified up or down for each project based on expert judgement as aligned with the project's risk register.

I recommend that the Board direct NS Power to clarify the Contingency Guidelines to avoid relying on the expected accuracy range to set the contingency, and to consider the approach I have suggested above for application of the predetermined guidelines method, with further application of documented subject matter expert judgement.

Q: Is NS Power tracking the scope of the cost estimate for each project?

A: No. In response to an information request, NS Power was unable to identify the classification of projects included in the contingency directive. NS Power states that it, "strives to submit projects for approval at a Class 3 estimate."[85]

It is important that NS Power track the scope of the cost estimate for each project so that it can (a) select a contingency value that is within the expected accuracy range and (b) appropriately assess whether the actual cost remained within the expected accuracy range given the maturity level classification of the cost estimate. This is particularly important on large projects that may have components or phases whose cost estimates are based on different maturity level classifications.

[85] Exhibit N-4, NS Power response to CA IR-5.

Q: Is NS Power effectively implementing the non-binding contingency guidelines in this application?

A: No. Although NS Power has committed to "document use of expert judgement when setting contingencies by applying predetermined guidelines,"[86] I have seen no evidence that the guidelines are being implemented.

For example, the basis for the contingency in eight of the 24 projects submitted in the 2022 ACE Plan is stated as, "Contingency determined using a combination of internal subject matter expert judgment and predetermined guidelines which have been gained over many years, including greater uncertainty for unique site conditions. Risks are well understood based on past experience."[87]

When asked to provide the project-specific "predetermined guidelines" referenced in each instance of this boilerplate language, NS Power responded that, "The predetermined guidelines refer to NS Power's Non-Binding Contingency Guidelines."[88] This is nonsensical self-reference.

As discussed above, predetermined guidelines "may be as simple as providing a single contingency or float value [or] complex tables or scoring mechanisms." It should have been obvious to NS Power that the questions requested the "single contingency or float value" or the "complex tables or scoring mechanisms" as used to determine each project's contingency value. Based on NS Power's failure to produce such evidence, I suspect that NS Power has not directed or enforced use of the Non-Binding Contingency Guidelines when establishing contingency amounts.

With respect to fulfilling its agreement to elaborate on its use of expert judgement when used to determine contingency, NS Power indicates that three projects to be submitted later in 2022 "will incorporate and elaborate on the use of expert judgement in determining contingency."[89]

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[86] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, p. 13.

[87] VJ1 Generator Refurbishment (CI C0029693), VJ1 Control System Upgrade (CI 0029691), Lower Great Brook Switchgear Replacement (CI C0036368), Fourth Lake Switchgear Replacement (CI C0024484), LIN1 L-0 Blade Replacement (CI C0038747), PHB – 2022 Turbine Refurbishment (CI C0041906), TUC Generator Refurbishment (CI C0030529), and 2022 Line Retirement Program (CI C0041804). Exhibit N-1, Application, pp. 197, 200, 209, 221, 225, 249, 318, 378

[88] Exhibit N-4, NS Power responses to CA IR-23 through IR-28

[89] Exhibit N-4, NS Power responses to CA IR-15(d).

In addition to the lack of documentation on the implementation of the Contingency Guidelines, the limited justifications for contingency levels provided by NS Power demonstrate inconsistency. In Section XI, I will provide a summary of several similar generator refurbishment projects whose varying contingency levels bear no apparent relation to project circumstances.

Q: What is your recommendation to the Board?

A: To address the contradictions in the contingency determination method, I recommend that the Board direct NS Power to further clarify the Contingency Guidelines to avoid relying on the expected accuracy range to set a contingency, and to consider the approach I have suggested above for application of the predetermined guidelines method when used to determine a contingency.

To address the lack of documentation for the level of maturity and the contingency documentation, I suggest that the Board direct NS Power to include the following documents with every capital work order and application.

1. Project maturity classification checklist
2. Statement of the basis for the contingency guidelines including, as applicable:
    a. Predetermined guidelines – reference to or statement of documented basis for use of a standard "single contingency" or other referenced practice;
    b. Subject matter expert judgement – documented reasons for the determination, including a supporting risk register;
    c. Other, more technical methods - Supporting analysis as described in the Contingency Guidelines.

B. Post Project Review and Institutionalization of Lessons Learned

Q: What is NS Power's post-project review?

A: NS Power has historically conducted post-project reviews as part of the ATO and FIN processes if the project variance exceeds the greater of 5% or $250,000. NS Power has agreed to extend that process to projects with approved estimates or actual spend greater than $5 million and $1 - 5 million projects that meet one of the four criteria, including:

- unique or first-time undertaking (new technology);
- significant safety or environmental event or risk management deployed;
- significant schedule under or over performance; and/or

- project manager initiated for sharing or recognition.[90]

NS Power has committed that:

> The post-project review will assess the project against a template of key project elements and expected outcomes. The product of the review will be a summary report with any recommendations for correction, improvement, standardization, or training as applicable. The review will be conducted by the project team and applicable internal stakeholders.[91]

Q: What does NS Power believe will be the benefits of post-project reviews?

A: NS Power states,

> "NS Power believes the post project review for projects with a total spend greater than $5M and projects less than $5M that met the criteria will be an important element in a continuous improvement process. It will serve to identify gaps in project management practice and also as a tool to update or strengthen practices where learnings are identified. Supporting this continuous improvement process with post project reviews for applicable projects is expected to provide value to NS Power's customers."[92]

Q: Do you believe a sufficient breadth of projects are included in the post-project review process?

A: No. I recommend that the Board direct NS Power to also review projects procured through a sole sourcing process (only one qualified source for equipment, software, etc.). NS Power's position is that these projects already go "through robust procurement selection processes in accordance with internal procurement guidelines."[93] I also recommend that the Board direct NS Power to include a sample of projects with costs below $1 million in its post-project review process.

Q: Why do you recommend that sole sourced projects be included in the post-project review process?

A: Cost minimization is more difficult in a sole source procurement because of the lack of competition and because it is more difficult to form an independent estimate of cost.

[90] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, p. 10.

[91] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, Appendix E, p. 11.

[92] Exhibit N-4, NS Power response to CA IR-10(b).

[93] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, p. 4.

Contractors may refuse to provide a cost analysis to justify pricing, particularly with respect to software maintenance contracts.

Another issue is that during the procurement process, the contractor often has more information about the project requirements. NS Power may lack the internal expertise to identify unnecessarily expensive methods or project components. Similarly, a sole source contractor who has essentially specified the project requirements may underplay project risks, and NS Power may lack the internal expertise to identify those risks. If change orders are executed during the project, resulting in higher costs or schedule delays, it may be difficult to assign accountability for those changes between the contractor and NS Power due to this information asymmetry. In contrast, competitive procurement provides other bidder's pricing and terms that can be referenced when considering major change orders.[94] Whether the cause of the change order was a truly unanticipated condition, or a risk that could have been better managed or anticipated should be evaluated by NS Power in a post-project review.

Finally, in hindsight, NS Power may determine that there were, in fact, alternatives to the sole source procurement. In testimony on behalf of the Small Business Utility Advocates, I analyzed several capital investments by Southern California Edison in software related to wildfire mitigation.[95] Initially, they chose a sole source procurement because they had found that other products did not meet their objectives. When that product failed, they conducted a competitive procurement, evaluating products that had not even been considered in the initial procurement process because they had revised the project objectives based on their experience with the first software product.

In summary, I do not agree that NS Power's position that its procurement process is "robust" and therefore sole source projects between $1 million and $5 million should not warrant special post-project review attention. While I do find it reasonable to limit the focus of the post-project reviews for projects with budgets or costs under $5 million to projects

[94] For example, in the Tusket ATO proceeding, NS Power stated, "When NS Power initially issued an RFP ... [it] only received two proposals ... [as] three contractors subsequently advised NS Power that the project scope was beyond their expertise and declined to submit a proposal. At the time of the award of the RFP, the price difference between the two proposals was approximately $[redacted] to the benefit of customers. Even when considering the re-negotiated values with NS Power's existing vendor, pricing remains approximately $[redacted] less than pricing from the other bidder based on 2017 estimates." Exhibit N-8, NS Power response to NSUARB IR-1 (October 22, 2021).

[95] *Direct Testimony of John D. Wilson on Behalf of Small Business Utility Advocates*, California PUC Docket A.19-08-013, Track 2 (Errata Version September 4, 2020) and Track 3 (August 20, 2021).

that are most likely to yield useful "lessons learned," I believe that sole source procurements should receive a higher, not lower, level of management scrutiny because of the potential for unnecessarily high costs that may not be detected through an overspending lens.

Q: Why do you recommend that a small sample of projects with budgets under $1 million projects be included in the post-project review process?

A: The Consumer Advocate has also encouraged NS Power to conduct post-project reviews for a small sampling of projects with budget and costs between $250,000 and $1 million. As the Board noted in 2021, even projects with approved cost estimates less than $250,000 have a track record of final costs being 10% higher originally submitted.[96] As the Board also noted, for projects of this size, NS Power could overspend between 25% and 100% of the project's estimated cost before requiring an ATO application, and that "this issue presents another potential reason for the Board to question the effectiveness of NS Power's capital cost minimization efforts.[97]

NS Power agrees that there is a potential for overspend on projects less than $1 million, but "given the magnitude and diversity of projects less than $1M, the practice of post project reviews must be scaled appropriately to ensure project resources are effectively applied and focus in areas that yield the most benefit."[98]

In order to address the magnitude and diversity of projects, I suggest that the Board direct NS Power to select a certain number – perhaps five – projects in this size range in areas of particular interest to the Board. Based on the evidence I presented in Section V.A above, I suggest that the Board focus NS Power's attention on steam generation projects.

The lessons learned from projects with costs below $1 million and projects with costs above $5 million may be very different.[99] By their nature, larger projects will have more

[96] NSUARB, Board Decision, 2021 Annual Capital Expenditure Plan (June 10, 2021), M09920, pp. 14-15, para. 39. See also para. 41 for similar concerns regarding projects with budgets between $250,000 and $1 million.

[97] *Id.*, p. 24, para. 55.

[98] Exhibit N-4, NS Power response to CA IR-10(e)(i).

[99] NS Power has objected to compiling and maintaining the contingency directive data (Appendix E) for projects with costs or budgets between $250,000 and $1 million. NS Power states that it manually compiles and validates this information, and that compiling these same data for projects "under the approval threshold would be administratively burdensome as it is a resource and time intensive exercise." NS Power suggested that it might require "possible software investments/upgrades to automate the tracking of that data on a go-forward basis once compiled in a single source." Exhibit N-8, NS Power response to CA IR-8, revised.

Including projects with costs below $1 million in the post-project review process would help the Board determine whether the administrative burden of ongoing compilation of budget, contingency, actual spend, and in-service date data would be of benefit to its oversight responsibilities.

internal staff attention during the project and available to participate in the post-project review than smaller projects. The post-project review process for smaller projects could identify shortcomings in project planning or execution that may have been overlooked by the project team. Furthermore, lessons learned that apply to the management of smaller projects could have a larger impact, since there are more small projects than large ones.

Q: Why is now the time to modestly expand the projects included in the post-project review process?

A: Already, it has been nearly two years since NS Power committed to begin post-project reviews, and yet no review has been made available to the Board. Clearly, it takes years between the time that the Board directs action and results can be reviewed. Waiting for even one or two years of results from this process before modestly expanding the projects included could mean waiting five or six years to see any meaningful results.

Q: Has NS Power completed any post-project reviews?

A: No. Some reviews are in process.[100]

Q: What is your opinion of the post-project template?

A: During the Stakeholder Engagement Process, NS Power shared its post-project assessment template for informational purposes. The template appeared fairly general and did not include checklists or questions that would clearly lead to lessons learned. My review of some publicly-available post-project reviews (from various disciplines) suggested the following questions should be answered during a post-project assessment.

1. Did the project fully meet the objective, or were further requirements identified during the project planning and implementation that require additional projects?
2. Compare final cost, labor-hour, and schedule performance reports for the project to the planning estimates used in the ACE Plan submission.
3. Did internal coordination meetings and other governance activities occur as scheduled throughout the entire project?
4. Was a risk register (list of identified project risks) prepared at the outset and updated based on unanticipated information?

[100] Exhibit N-4, NS Power response to CA IR-10(a).

5. Survey key internal stakeholders to determine how well they feel the project addressed their needs and their assessments of project team and project manager performance.
6. Survey any external stakeholders (e.g., Mi'kmaq, adjacent property owners) regarding the degree to which project implementation met expectations.
7. Identify each significant unanticipated problem that occurred during the project. Were all relevant staff (and external parties, if applicable) notified promptly and responsive with timely adjustments to their plans and budgets?
8. For any cost overruns resulting from defective equipment supplied by a vendor, were there any missed opportunities to test and identify the defects prior to the attempted installation?
9. Was there an efficient transition to operations? Were operations personnel engaged in testing or training at appropriate points prior to the formal transition to operations?
10. Were all lessons learned from the above questions captured for future application?

While NS Power declined to revise its template in response to those comments,[101] it did confirm that,

> The post project review process will address all [of the above] elements ... when they are applicable to the project. In some cases, all elements may not be applicable to a particular project in which a post projects review is completed (for example, a project may not have external stakeholders).[102]

I would further note that these questions apply equally to projects with budgets over $5 million and to projects with much smaller budgets.

In addition to the questions listed above, NS Power's post-project review should also evaluate whether the project may have been over-scoped at the original cost estimate stage. As the Board noted in its 2021 decision, project with substantial underspending may indicate "project over-scoping at the original cost estimate stage, or a significant reduction or cancellation of the originally planned work scope.... However, the Board is sometimes not

[101] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, p. 6.
[102] Exhibit N-4, NS Power response to CA IR-10(c).

made aware of the reasons for large underspending."[103] During questioning from the Board, NS Power Witness Dandurand acknowledged that some of the cost minimization examples associated with a reduction in the number of units could be either "a result of how the project was executed in the field" or "not needing [the] level of material" that was included in the original cost estimate.[104]

Q: What is NS Power's plan to ensure that lessons learned are institutionalized?

A: NS Power's Stakeholder Engagement Report states that it will provide guidance on the cost optimization and post-project review process during the annual capital program workshops. NS Power has further suggested that the Board "give these processes time to develop/evolve prior to recommending that any additional documentation is required."[105]

NS Power indicates that, "Training on the use of new practices and reporting tools to capture information related to cost minimization is planned to be completed in the first half of 2022. ...Capital and project management workshops are planned for 2022 to discuss elements of NS Power's capital planning and execution and project management practices."[106]

Q: What is your overall response to NS Power's post-project review and plans to institutionalize lessons learned?

A: Overall, NS Power has committed to take what could be very effective measures to address chronic cost control issues. I recommend that the Board direct NS Power to increase the projects included in its post-project review process to include sole source procurements below $5 million and a sampling of smaller projects with costs between $250,000 and $1 million. My modest recommendation should be considered as a voice in support of the overall direction that NS Power has committed to undertake, and I look forward to reviewing the impact of this reform in next year's filing.

In furtherance of that review, I recommend that the Board direct NS Power to consider making all, or a reasonably sized sample, of the post-project reviews available as part of the 2023 ACE Plan filing. That will provide intervenors with the opportunity to submit

[103] NSUARB, Board Decision, 2021 Annual Capital Expenditure Plan (June 10, 2021), M09920, pp. 25-26, para. 58.

[104] *Id.*, pp. 28-29, para 65.

[105] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, pp. 5, 9.

[106] Exhibit N-4, NS Power response to CA IR-11.

information requests on those reviews. The Board should then identify as issues in the 2023 ACE Plan proceeding (a) whether the post-project reviews are useful and effective and (b) what information from those reviews (such as a summary) NS Power should submit on an annual basis, understanding that the ACE Plan submission is not the proper venue for review of all post-project reviews as an ongoing matter.

C. Cost Minimization Report

Q: Please summarize the purpose of the cost minimization report.

A: Beginning with the 2019 ACE Plan decision, NS Power has been directed to provide specific examples of cost minimization practices used during the prior year's projects.

Q: How has this information been useful?

A: The information has provided the Board with context, providing concrete information regarding what is meant by NS Power's cost minimization efforts.

NS Power reports $13.4 million in cost savings, primarily from the procurement process and negotiated savings. While indicating that NS Power views its procurement process as the main opportunity to achieve cost minimization, the cost minimization report does not provide much further explanation. Nearly all of the procurement process savings are explained as, "Procurement process resulted in lower pricing," or words to that effect. In most cases, the cost savings appear to simply be the difference between the winning bid and another bid or the original budget.[107] In one case, it was noted that a new RFP led to the savings and in another, a non-OEM product was located.[108] Otherwise, this information does not provide lessons learned.

Q: What do you recommend?

A: I recommend that the Board encourage NS Power to provide cost minimization information that is more useful for identifying lessons learned in the 2023 ACE Plan. The Board should then identify as an issue in the 2023 ACE Plan proceeding the determination of what cost minimization information would be useful (and worth the effort) to compile and file, considered in the context of information from the initial post-project reviews. It may be that a two-tier approach (simple cost minimization data plus more in-depth post-project

[107] Exhibit N-5, NS Power response to NSURB IR-77(b).

[108] Exhibit N-1, Application, Appendix F.

reviews) is useful, or it may be more efficient to consolidate the cost minimization report with information summarized from the post-project reviews into a single requirement.

D. Execution of ACE Objective in NS Power's Balanced Score Card

Q: What is NS Power's Balanced Score Card?

A: NS Power's Balanced Scorecard (BSC) is the foundation for the short-term incentive portion of NS Power's employee compensation program, which is applicable to non-union employees. The BSC includes financial and operational metrics (health and safety, customer satisfaction, reliability, asset management and employee objectives). The metrics are developed annually with ascending performance levels of Threshold, Target and Stretch.

Each metric in the BSC is assigned a weighted percentage of the overall BSC. If the Company meets the Target level for a metric, then the payout is based on that individual metric percentage, and higher or lower levels are paid for Threshold and Stretch levels.

The BSC is developed by management and subsequently reviewed and approved by the Nova Scotia Power Board of Directors at the beginning of each year.[109]

Q: Please describe the BSC target for asset management.

A: The asset management target includes several elements. Of relevance to this proceeding is the "Execution of ACE" objective in the 2020 BSC, "90% of projects > $1.0M are executed in 2020 with total spending within plus 2.5% or minus 10% of total project budget". I have excerpted the full 2020 asset management target element in Figure 3.

Figure 3: NS Power 2020 Balanced Score Card Asset Management Target[110]

ASSET MANAGEMENT Modernize our asset base by implementing next generation technologies to better service our customers and continue active management of our generation resources to the benefit of customers	Objectives Included: • Execution of ACE: 90% of projects >$1.0M are executed in 2020 with total spending within plus 2.5% or minus 10% of total project budget. • Successful completion of IRP deliverables in 2020 and the 2020 cyber security plan. • Achieve Fleet Average DAFOR <5%. • Achieve winter average DAFOR (Nov to Mar) <2% from the 5 high capacity factor generating units.	20	Target	20

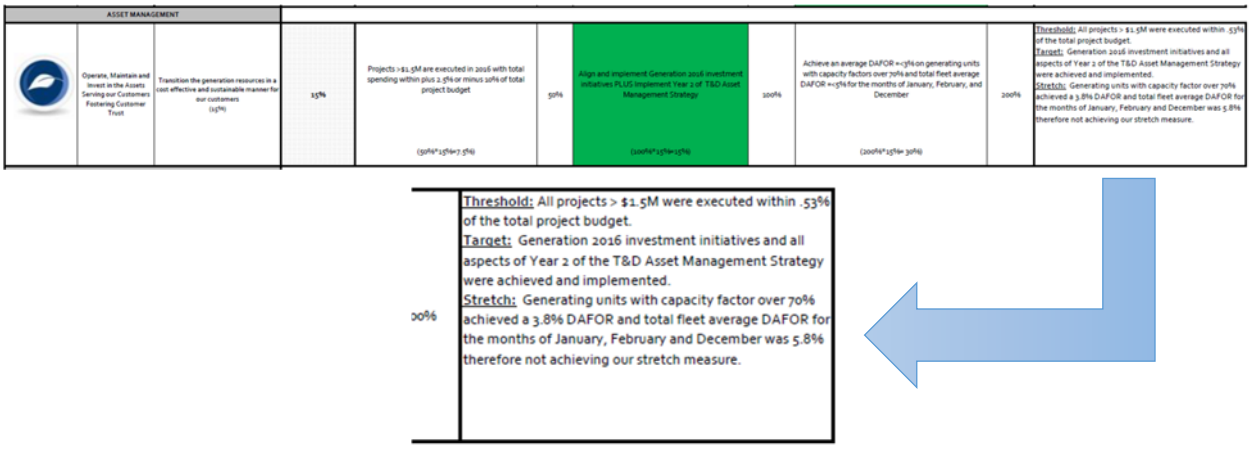
NS Power's 2020 BSC does not specify the threshold, target, and stretch performance levels. However, I located the same ACE execution objective in NS Power's 2016 BSC. As

[109] Answer paraphrased from: NS Power, Affiliate Code of Conduct, 2020 Report (April 30, 2021), M10108, Appendix B, p. 1.

[110] NS Power, Affiliate Code of Conduct, 2020 Report (April 30, 2021), M10108, Appendix B, p. 1.

shown in Figure 4, the ACE plan execution objective is stated as a threshold performance level objective.

Figure 4: NS Power 2016 Balanced Score Card Asset Management Target[111]



Q: Has NS Power met the BSC target for asset management?

A: No. In its 2021 ACE Plan Board Decision, the Board stated:

> In addition, during the hearing, the Board questioned NS Power about what incentives it has in place for project managers to keep capital project spending within budget. Mr. Dandurand responded that on NS Power's Balanced Score Card specific to capital projects, the goal for projects that have budgets greater than $1 million is to execute those projects such that at least 90% are completed within -10% and +2% of budget. He noted that all NS Power employees and project managers working on those projects are directly incented by that goal, which is designed to minimize costs for customers in the execution of those projects. The Board finds that NS Power's average capital project overspending of 7% beyond budget does not match this goal. This is concerning to the Board, as it suggests that the company's noted incentive may not be particularly effective. Alternatively, it may suggest that NS Power's cost minimization efforts and practices are not effective at achieving this goal.[112]

As discussed in Section V.A above, NS Power's recent performance falls well outside the objective of "90% of projects >$1.0M ... with total spending within plus 2.5% or minus 10% of total project budget." With respect to 2020 performance, as shown in Table 3, NS

[111] NS Power, Affiliate Code of Conduct, 2016 Report (May 31, 2017), M08041, Appendix B, p. 1.

[112] NSUARB, Board Decision, 2021 Annual Capital Expenditure Plan (June 10, 2021), M09920, pp. 22-23, para. 53.

Power placed four projects in-service with budgets greater than $1.0 million in 2020, but only two of those fell within the objective range.[113]

Table 3: Approved Estimate vs Actual Spend, Projects In-Service in 2020, Actual Spend Greater than $1 million[114]

CI Number	Project Title	In-Service Date	Approved Estimate	Actual Spend	Variance
C0021805	IT - Microsoft Enterprise Agreement 2020	10/31/2020	3,139,727	3,307,541	167,814 (5.3%)
C0004058	HYD - Tidewater 2 Overhaul	2/28/2020	1,916,321	1,959,940	43,619 (2.3%)
49874	CT - BGT Replace Halon Fire Protection	5/20/2020	1,149,153	1,116,164	-32,989 (-2.9%)
C0010957	HYD - Malay Falls Unit 6 Overhaul	2/24/2020	1,273,280	1,117,203	-156,077 (-12.3%)

Referring back to Figure 3 and Figure 4, if the ACE execution objective is a threshold performance level objective in the 2020 BSC, then it appears that NS Power's Board made an exception to its stated objective when it approved performance incentive payments to its executives based on achieving a target performance level.

Q: What is your recommendation to the Board regarding the BSC?

A: In its review of NS Power's 2021 Report on its Affiliate Code of Conduct, the Board should request documentation of NS Power's evaluation of its asset management objectives and an explanation regarding the current rating as well as past determinations that the target performance level has been met.

VII. Total Cost of Ownership for Information Technology (IT) Projects

Q: Why might the Board desire to obtain total cost of ownership (TCO) estimates for IT projects?

A: Expensive IT projects represent an increasing share of capital investment by NS Power (and other utilities). In addition to the project budget, NS Power will expect to recover on-going operational costs, renewal of licenses after the initial period, potential warranty extensions, and annual costs for maintenance, support and subscriptions.

[113] Six other projects with actual spending between $0.2 and $1.0 million were placed in-service in 2020. Only one of those six projects fell within the objective range. Exhibit N-1, Application, Appendix E.

[114] Exhibit N-1, Application, Appendix E.

When NS Power proposes to build a new generation unit, its economic justification includes the total cost of ownership, such as fuel and O&M costs.

In the case of IT projects, since the lifetime of software is considerably shorter than other capital assets, the scope of the TCO analysis should be relatively brief and mainly encompass anticipated costs for software updates, licenses, and service agreements. In many cases, the additional information in the TCO analysis may simply clarify items that are already included in the project budget, but with assumptions about pricing beyond the term of the proposed contract(s).

However, in some cases, NS Power may reasonably anticipate that the software will require significant upgrades in the future that are out of the current project scope. For example, if the software will require customization to integrate with the anticipated upgrade of some other IT system, that future work should be included in the TCO. Because that customization is out of scope, it would be reasonable for the TCO analysis to be conducted at a Class 1 or 2 level of project maturity.

Q: Can you give an example of how a TCO might be useful to the Board?

A: Yes. As an example from Resource Insight's experience, Southern California Edison is in the process of replacing its Vegetation Management System, a software system that was briefly used to coordinate tree trimming and other contracted work. The software requires replacement for two reasons. First, the software was inadequately evaluated during the procurement process and, upon deployment, fatal flaws were discovered. Second, SCE has since identified additional capabilities that it requires, but were not identified during the initial procurement process.

As a result of identifying those additional capabilities, SCE revised its procurement objectives and considered options that were not included in the original list of feasible alternatives when the Vegetation Management System was procured. It appears to me that the reason the narrower list of procurement objectives was used in that procurement is that the focus was on near-term requirements, and a longer-term view as to how the Vegetation Management System would need to integrate with other IT systems was overlooked.

This example illustrates that if NS Power adopts a TCO perspective for its projects, not only could the Board be better informed, but NS Power could also take a longer perspective on the potential requirements for the project. In those circumstances, there may be

occasions where this perspective reveals a need to revisit the original procurement objectives and avoid a costly mistake.

Q: Does NS Power agree that it should take a longer perspective on IT projects than is strictly required in its applications?

A: No. In its 2021 Stakeholder Engagement Report, NS Power stated that it would provide a TCO only if an "alternative is identified that the Company confirms is technically feasible and not otherwise prohibitively expensive," and then only "on request."[115] There are three problems with NS Power's position.

1. Other parties or the Board may have a different opinion on whether a proposed project is the only technically or economically feasible alternative;
2. The opportunity to obtain a TCO "on request," presumably in response to the only information request opportunity, denies parties the opportunity to question NS Power regarding the assumptions and methods it used to develop the TCO; and
3. Even if there is no alternative to the proposed project, parties and the Board should understand the full implications of project approval. For example, the assumptions included in the TCO may indicate constraints that parties may wish to question in light of other planned investments by NS Power. Such review ensures that NS Power can demonstrate a full understanding of the requirements to maintain and further develop its IT investments.

Q: What is your recommendation?

A: I recommend that the Board require NS Power to submit a 10-year TCO for each IT project with a budget of over $1 million, unless an EAM has been prepared. The TCO may rely on Class 5 cost estimates but should provide sufficient detail regarding cost assumptions to demonstrate NS Power's expected utilization of the IT resources over the next 10 years and any anticipated integrations, expanded uses, or other major cost drivers.

[115] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, p. 7.

VIII. Economic Analysis Model (EAM)

A. Replacement Energy Cost

Q: What changes has NS Power made with respect to the replacement energy cost used in its EAM?

A: NS Power has made the following changes:

1. The replacement energy cost has been updated to align with the IRP, based on reference scenario 2.0C. NS Power has also committed to being "responsive as the planning landscape continues to evolve."
2. The energy cost sensitivity will be "updated to indicate that this represents an approximate P67/P33 range, based on alignment with IRP fuel price sensitivities." This sensitivity level is currently 10%.
3. The capital investment sensitivity will be updated to a 30% value, representing the top end of the expected range of accuracy for a project budgeted at a Class 3 maturity level.[116]

Q: What is your opinion of the changes made?

A: I believe these changes are appropriate. Further adjustments may be warranted in two areas.

First, I would note that the energy cost sensitivity does not reflect the same range of risk as the capital investment sensitivity. NS Power's evaluation indicates that shifting to a +/-15% sensitivity would represent something similar to a P80/P20 range. A P80/P20 or even a P90/P10 range would be more consistent with the capital investment sensitivity, which is effectively a P90/P10 range sensitivity.

Second, as discussed in Section III, I recommend that NS Power's capital planning shift from IRP Scenario 2.0C to Scenario 3.1C (or something reasonably similar). These changes should be made immediately given the updated legislative and regulatory circumstances. The relationship between the +/- 10% energy cost sensitivity and the P67/P33 range should be confirmed for the updated reference case.

[116] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, p. 16-17.

B. Accounting Treatment of Decommissioning Costs

Q: How is NS Power treating decommissioning costs in its accounting and EAM?

A: NS Power maintains two accounts, Asset Retirement Obligations (AROs) and Cost of Removal (COR). AROs are revenues that have been set aside to fund future costs associated with certain legal obligations, such as PCB removal costs. It is our understanding that COR account balances are not necessarily intended to be sufficient to cover the full cost of decommissioning.[117]

Furthermore, it is our understanding that if NS Power were to decommission a generation facility, the COR funds are not being separately held in an account that can be drawn upon. Rather, COR is a regulatory liability created by collection of revenues from customers. If decommissioning costs are incurred, and that regulatory liability is removed, then the effect on NS Power's books would be to require additional cash flow to maintain the same net position. That cash flow requirement could be met through increased rates or increased debt.

For this reason, NS Power views decommissioning costs as an expense from a cash flow perspective in the EAM.

Q: What are your continuing concerns about the treatment of decommissioning costs in the EAM?

A: When considering reinvestment in generation assets, particularly in hydroelectric facilities, the net benefit of such projects is often substantially or wholly driven by the benefit of deferring the decommissioning of the facility. Essentially, today's customers are being asked to fund a capital investment in a project that will not show any net benefits other than delaying the ultimate obligation to decommission the facility.

NS Power has argued that such reinvestment could continue again and again, postponing decommissioning for many years. NS Power rejects the relevance of *future* decommissioning costs as being similar to a *sunk cost*, as follows:

> The Company's economic analysis should only consider future cash flows and the comparisons of reinvestment versus decommissioning options in the EAM remain appropriate.

[117] This topic was discussed during the Stakeholder Engagement.

> At the start of the analysis period, the decommissioning liability is the same under either a reinvestment or decommissioning scenario. The future revenue requirement associated with a decommissioning liability will only vary between the two options to the extent that future cash flows between the two options are different. These changes in revenue requirement due to future expected spending are captured in the economic analysis model through the change in depreciation expense, financing costs and tax impacts. Including the decommissioning liability incurred to date will not impact the economic analysis. This is similar to the reason that prior capital investments associated with a generation facility are not included in the economic analysis model; they are a sunk cost, have occurred in the past and are not relevant for decision-making or comparative purposes.[118]

I remain unclear as to whether the revenue requirement to fully fund future decommissioning (via ARO or COR accounts) is currently included in the revenue requirement assumed for generation reinvestment (lifetime extension and modernization) projects. If avoiding decommissioning today is considered a benefit, then there must also be a cost associated with decommissioning that project at some date in the future. For some facilities, postponement of retirement and decommissioning may continue for many decades or even centuries (judging from some Roman engineering), but most projects will reach a point at which deferral will no longer be cost-effective.

Q: What are your recommendations to the Board regarding the treatment of decommissioning costs in the EAM?

A: The Board should direct NS Power to include a sensitivity analysis in the Mersey EAM, at a minimum, that includes the full cost of decommissioning the facility at the end of the analysis period. Including this information in the project application will enable parties to ask information requests about this analysis and the assumptions regarding future decommissioning costs. NS Power can provide whatever opinions it may have about the validity of that sensitivity compared to its preferred representation of long-term cost obligations, and that will help clarify the Board's options.

This is particularly important because NS Power is continuing to evaluate the Mersey Redevelopment project, whose estimated budget has increased from $160 million to $189 million over the past year.[119] Our prior analyses of this project suggest that deferred

[118] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, pp. 18-19.

[119] Exhibit N-1, Application, p. 24, Figure 6.

decommissioning is likely to be the primary benefit of the project, and that its costs cannot be justified solely on the basis of expected carbon-free generation. Given the scale and risk of such a large undertaking, the Board should be fully informed as to the potential financial scenarios regarding the system's ultimate decommissioning.[120]

C. Monte Carlo Analysis

Q: When does NS Power use a Monte Carlo analysis to evaluate project cost-effectiveness?

A: NS Power states that, "The Decision Analysis process that supports the Monte Carlo analysis is only used in unique scenarios where multiple sensitivities are required for several inputs to properly evaluate the risk."[121] In most EAMs, NS Power does not use a Monte Carlo analysis.

A Monte Carlo decision analysis is a quantitative approach to evaluating projects with multiple uncertainties, some of which may be correlated with each other. It is particularly important when the uncertainty in project cost is large or is not normally distributed around the expected value in a bell-curve shape. Based on the analysis presented in Section V.B above, it would seem that many or all civil hydroelectric projects should be evaluated using this method.

It is my understanding that NS Power has or will utilize a Monte Carlo-based decision analysis process to determine the optimal strategy for investment or decommissioning of the Mersey hydro system.

Q: What are your recommendations with respect to Monte Carlo decision analysis?

A: I do not recommend that the Board direct NS Power to use – or not use – Monte Carlo decision analysis. In general, the EAM provides a suitable basis for economic analysis. In certain cases, it may be advisable to study alternatives directly in NS Power's full suite of resource planning model tools. A Monte Carlo analysis may be a useful intermediate level of

[120] Similarly, the Small Business Advocate requested, "a numeric example that shows how NSPI recognizes, in its accounts, the Cost of Removal of an asset it expects to decommission in the future; how it records adjustment to depreciation reserves in the intervening years; and show how the latter changes in the year in which the asset is decommissioned." NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, Appendix J, p. 3.

[121] Exhibit N-8, NS Power response to NSUARB IR-26(a)(i), Matter No. M10197 (October 22, 2021).

sophistication and complexity that is particularly appropriate for complex hydro projects or new technologies.

IX. Impact of COVID-19 Pandemic

Q: What has NS Power learned from the COVID-19 pandemic?

A: NS Power provided a brief list of its actions related to safety and project deferral, which it characterized as "effective." Perhaps most significant for non-health-related issues, NS Power established and implemented back-up control rooms for generating stations. Otherwise, NS Power did not identify any adjustments to its existing capital and asset management processes.[122]

In its 2021 Stakeholder Engagement Report, NS Power stated that it would "consider whether delaying thermal projects are appropriate, particularly in light of expected operating horizons. Operating horizons and near-term risks to thermal units will be considered to obtain the appropriate balance between safe cost deferrals and ensuring near term reliable operation of the power system."[123] This appears to a response to the Small Business Advocate's suggestion that, "consideration should be given to whether delaying projects should be part of the assessment process for repairs/replacements ... in light of the plan for coal elimination."[124]

It is a reasonable conclusion that the experience gained from managing assets during COVID-19 should give NS Power greater confidence in managing the transition from coal to other resources.

X. Spare Autotransformer Report

Q: What was the Board's expectation regarding the Autotransformer Management Plan?

A: The Board Decision states:

[122] NS Power, 2021 ACE Plan Stakeholder Engagement Report, (October 1, 2021), M09920, Appendix L, pp. 7-11.

[123] *Id.*, p. 16.

[124] *Id.*, Appendix J, p. 1.

> The Board cautions NS Power that it appears prudent to develop a comprehensive replacement plan with respect to autotransformers as soon as possible. If the autotransformer approved in this application needs to be deployed, such a plan might well form an integral part of any consideration with respect to the purchase of a subsequent unit.
>
> In response to NSUARB IR-46, the company indicated it was working on an update to its transformer and systems spares study this year. The Board anticipates this study will provide guidance on what is required with respect to the autotransformer fleet, which is one of the systems being reviewed. In the circumstances, the Board directs NS Power to report back to the Board as to the status of the management plan for the autotransformer fleet, as part of the 2022 ACE Plan filing.[125]

Q: Please summarize the Autotransformer Management Plan.

A: NS Power's plan explains that failures of any of its ten similar-sized 138-69 kV autotransformers in service would be replaced with a system spare in the case of an unplanned failure, combined with planned replacement of the aging assets over the next several years.

NS Power does not intend to run its autotransformers to failure. NS Power's intent is to proactively replace units as their condition reaches a level where they are considered unacceptable to remain in-service. NS Power does not plan to replace any in-service autotransformers until at least 2023.

NS Power will use the flexibility provided by the critical spare in the event that a replacement cannot be procured in a timely enough fashion to remove any high-risk asset from service, or in the event of an unplanned outage that is out of sequence with the rest of the autotransformer management plan. NS Power has not determined whether to replace the spare if it is used, delaying that decision until the spare is used, in light of the asset risk and system conditions at that time.[126]

Q: Does it appear to you that the Board's expectations were met?

A: No. The Board stated that it would be prudent for NS Power to develop a plan and pointed to NS Power's information that it was working on a plan. The two-page document submitted

[125] NSUARB Decision, 2020 ACE Plan, Matter No. M09499 (June 25, 2020), p. 11, para 28-29.

[126] Exhibit N-1, Application, Appendix G; Exhibit N-4, NS Power response to CA IR-13.

in Appendix G shows no sign of analysis or further thought beyond information provided in the 2021 ACE Plan proceeding.

One reason that NS Power might have difficulty in providing EAM results to the Board for this plan is that it considers it challenging to predict the probability of failures for autotransformers. While the Capital Expenditure Justification Criteria define condition scores in terms of probabilities of failure,[127] NS Power states that it does not apply those failure probabilities to the risk alignment matrix condition scores for its autotransformers and instead relies on subject matter experts to determine the rating (on a scale of 1-5).[128]

In response to information requests, NS Power defers any further consideration of the issues raised by the autotransformer replacement plan to the future (e.g., NS Power "will provide appropriate justification at that time"), without explaining how that decision will be made.[129] If NS Power decides to purchase a replacement spare autotransformer, it will have to wait until the purchase is approved by the Board.

Q: What is your recommendation to the Board?

A: In the 2021 ACE Plan proceeding, it was evident that NS Power had not considered alternatives to the replacement strategy outlined above. NS Power has still not considered such alternatives. Purchasing, commissioning, and storing a spare autotransformer is costly. It remains unknown whether a more aggressive replacement strategy that does not require indefinite maintenance of a spare might be less costly.

Considering that NS Power seems unwilling to investigate this itself, I recommend that the Board select an independent consultant to investigate alternative autotransformer replacement strategies in coordinating with NS Power's subject matter experts.

[127] For example, a "likely" Condition 4 failure is defined as "Failure or occurrence is likely (76-90%). Available data, past experience and or subject matter expert input indicates an expected occurrence rate between once per year and 1 in 10 operating years." Nova Scotia Power Inc. Capital Planning & Capital Expenditure Justification Criteria Summary Document (March 12, 2020), M08984 and M09229, p. 16.

[128] Exhibit N-4, NS Power response to CA IR-14.

[129] Exhibit N-4, NS Power response to CA IR-13.

XI. VJ1 Generator Refurbishment and Control System Upgrade

Q: Please summarize the VJ1 Generator Refurbishment and Control System Upgrade projects.

A: These are the two most costly of seven related refurbishment projects at the Victoria Junction Unit 1 Combustion Turbine with a total budget of $7.1 million. The budget for the generator refurbishment project (CI C0029693) is $5.9 million, including a 20% contingency of $0.9 million.[130] Roughly half of the pre-contingency cost is related to three materials and support contracts with the same vendor. NS Power justified these projects in its 2020 IRP.[131]

Q: Do you have any concerns with these projects?

A: Yes. I have three concerns with the generator refurbishment project, which also arise to some extent for the controls project.

First, I see no indication that the contracts were competitively bid. NS Power does state that it evaluated contract vs internal labor and found internal resources to be less expensive.[132] If the materials and supply contracts are sole sourced, the capital work order should have provided a reason.

Second, the project budget is significantly larger than two similar CT generator replacement projects, whose costs were $3.3 and $3.9 million.[133] This raises additional concerns that NS Power may not have obtained competitively priced materials and support contracts.

Third, NS Power is proposing a 20% contingency for this Class 3 project, which seems excessive. As noted above, NS Power has experience with two similar projects. The two similar CT generator replacement projects had contingencies of 8.2% and 9.5% relative to the budget excluding contingency. Both projects came in within 2% of budget, including contingency, so the contingencies were fully utilized.[134]

[130] Exhibit N-1, Application, p. 249.

[131] Exhibit N-4, NS Power response to CA IR-23(f).

[132] Exhibit N-1, Application, p. 247.

[133] Exhibit N-4, NS Power response to CA IR-23(e).

[134] *Id.*

In its capital work order, NS Power states that "Risks are well understood based on past experience."[135] No "unique site conditions" are identified, and it is unclear why this project is considered to have a Class 3 level of maturity since vendor quotations and resource estimates appear to be at an advanced stage.

Two other capital work orders appear to take a very different approach to refurbishment contingencies.

- NS Power selected a lower 15% contingency for a PHB turbine refurbishment, considered to be a Class 3 project, even though a planned RFP has not been conducted and there have not been any prior turbine refurbishments that are considered relevant history.[136]
- NS Power selected a 10% contingency for a TUC3 generator refurbishment project, also estimated at a Class 3 level.[137] Similar to the VJ1 project, NS Power is able to draw on experience from a 2014 project "which included a similar scope."[138]

While the PHB refurbishment project seems less certain than the VJ1 refurbishment project, the TUC3 generator refurbishment seems more certain. Yet both projects have a lower contingency.

Based on the available information, a 20% contingency seems excessive for the generator refurbishment project, and NS Power did not provide any reasonable basis for the contingency, as discussed in Section VI.A.

The budget for the controls upgrade project (CI 0029691) is $1.02 million, including a 20% contingency of $0.16 million.[139] With respect to the controls upgrade project, I have similar concerns. I see no indication that its contracts were competitively bid, and if sole source procurement was used, I see no justification. The 20% contingency is also thinly justified.

Q: What is your recommendation to the Board?

A: I recommend that the Board reject the proposed project budgets for the VJ1 Generator Refurbishment and Control System Upgrade and require resubmittal of the capital work orders to address the deficiencies. NS Power should be encouraged to review the

[135] Exhibit N-1, Application, p. 249.

[136] Exhibit N-1, Application, p. 221; Exhibit N-4, NS Power response to CA IR-26; Exhibit N-5, NS Power response to NSUARB IR-62(e)

[137] Exhibit N-1, Application, p. 225.

[138] NS Power response to CA IR-27(c).

[139] Exhibit N-1, Application, p. 249; Exhibit N-5, NS Power response to NSUARB IR-63(a).

procurement methods and costs to determine if there are further opportunities for cost minimization.

Q: Does this conclude your testimony?

A: Yes.

Exhibit JDW-1

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SUMMARY OF PROFESSIONAL EXPERIENCE

2019–Present **Research Director, Resource Insight, Inc.** Provides research, technical assistance, and expert testimony on electric- and gas-utility planning, economics, and regulation. Reviews electric-utility rate design. Designs and evaluates conservation programs for electric utilities, including conservation cost recovery mechanisms and performance incentives. Evaluates performance of renewable resources and designs performance evaluation systems for procurement. Designs and assesses resource planning and procurement strategies for regulated and competitive markets.

2007-19 **Deputy Director for Regulatory Policy, Southern Alliance for Clean Energy.** Managed regulatory policy, including supervision of experts in areas of energy efficiency, renewable energy, and market data. Provided expert witness testimony on topics of resource planning, renewable energy, energy efficiency to utility regulators. Directed litigation activities, including support of expert witnesses in the areas of rate design, resource planning, renewable energy, energy efficiency, and resource procurement. Conducted supporting research and policy development. Represented SACE on numerous legislative, utility, and private committees across a wide range of climate and energy related topics.

2001–06 **Executive Director, Galveston-Houston Association for Smog Prevention.** Directed advocacy and regulatory policy related to air pollution reduction, including ozone, air toxics, and other related pollutants in the industrial, utility, and transportation sectors. Served on the Regional Air Quality Planning Committee, Transportation Policy Technical Advisory Committee, and Steering Committee of the TCEQ Interim Science Committee.

2000–01 **Senior Associate, The Goodman Corporation.** Provided transportation and urban planning consultant services to cities and business districts across Texas.

1997–99 **Senior Legislative Analyst and Technology Projects Coordinator, Office of Program Policy Analysis and Government Accountability, Florida Legislature.** Author or team member for reports on water supply policy, environmental permitting, community development corporations, school district financial management and other issues – most recommendations implemented by the 1998 and 1999 Florida Legislatures. Edited statewide government accountability newsletter and coordinated online and internal technical projects.

1997 **Environmental Management Consultant, Florida State University.** Project staff for Florida Assessment of Coastal Trends.

1992-96 **Research Associate, Center for Global Studies, Houston Advanced Research Center.** Coordinated and led research for projects assessing environmental and resource issues in the Rio Grande / Rio Bravo river basin and across the Greater Houston region. Coordinated task force and edited book on climate change in Texas.

EDUCATION

BA, Physics (with honors) and history, Rice University, 1990.

MPP, John F. Kennedy School of Government, Harvard University, 1992. Concentration areas: Environment, negotiation, economic and analytic methods.

PUBLICATIONS

"Urban Areas," with Judith Clarkson and Wolfgang Roeseler, in Gerald R. North, Jurgen Schmandt and Judith Clarkson, *The Impact of Global Warming on Texas: A Report of the Task Force on Climate Change in Texas*, 1995.

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"Bringing Clean Energy to the Southeastern United States: Achieving the Federal Renewable Energy Standard," Southern Alliance for Clean Energy, February 2008.

"Cornerstones: Building a Secure Foundation for North Carolina's Energy Future," Southern Alliance for Clean Energy, May 2008.

"Yes We Can: Southern Solutions for a National Renewable Energy Standard," Southern Alliance for Clean Energy, February 2009.

"Green in the Grid: Renewable Electricity Opportunities in the Southeast United States," with Dennis Creech, Eliot Metzger, and Samantha Putt Del Pino, World Resources Institute Issue Briefs, April 2009.

"Local Clean Power," with Dennis Creech, Eliot Metzger, and Samantha Putt Del Pino, World Resources Institute Issue Briefs, April 2009.

"Energy Efficiency Program Impacts and Policies in the Southeast," Southern Alliance for Clean Energy, May 2009.

"Recommendations for Feed-In-Tariff Program Implementation In The Southeast Region To Accelerate Renewable Energy Development," Southern Alliance for Clean Energy, March 2011.

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"Cleaner Energy for Southern Company: Finding a Low Cost Path to Clean Power Plan Compliance," Southern Alliance for Clean Energy, July 2015.

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"Tracking Decarbonization in the Southeast, 2019 Generation and CO_2 Emissions Report," with Heather Pohnan and Maggie Shober, Southern Alliance for Clean Energy, August 2019.

"Seasonal Electric Demand in the Southeastern United States," with Maggie Shober, Southern Alliance for Clean Energy, April 2020.

"Making the Most of the Power Plant Market: Best Practices for All-Source Electric Generation Procurement," with Mike O'Boyle, Ron Lehr, and Mark Detsky, Energy Innovation Policy & Technology LLC and Southern Alliance for Clean Energy, April 2020.

"Monopsony Behavior in the Power Generation Market," *The Electricity Journal* 33, with Mike O'Boyle and Ron Lehr (2020).

"Review of Nova Scotia Power's 2020 Integrated Resource Plan," prepared for the Nova Scotia Consumer Advocate, NSUARB Matter No. M08059, with Paul Chernick (January 2021).

"Implementing All-Source Procurement in the Carolinas," prepared for Natural Resources Defense Council, Sierra Club, Southern Alliance for Clean Energy, South Carolina Coastal Conservation League and Upstate Forever, for submission in NCUC Docket E-100, Sub 165, and SCPSC Dockets 2019-224-E and 2019-225-E (February 2021).

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PRESENTATIONS

"Clean Energy Solutions for Western North Carolina," presentation to Progress Energy Carolinas WNC Community Energy Advisory Council, February 7, 2008.

"Energy Efficiency: Regulating Cost-Effectiveness," Florida Public Service Commission undocketed workshop, April 25, 2008.

"Utility-Scale Renewable Energy," presentation on behalf of Southern Alliance for Clean Energy to the Board of the Tennessee Valley Authority, March 5, 2008.

"An Advocates Perspective on the Duke Save-a-Watt Approach," ACEEE 5th National Conference on Energy Efficiency as a Resource, September 2009.

"Building the Energy Efficiency Resource for the TVA Region," presentation on behalf of Southern Alliance for Clean Energy to the Tennessee Valley Authority Integrated Resource Planning Stakeholder Review Group, December 10, 2009.

"Florida Energy Policy Discussion," testimony before Energy & Utilities Policy Committee, Florida House of Representatives, January 2010.

"The Changing Face of Energy Supply in Florida (and the Southeast)," 37th Annual PURC Conference, February 2010.

"Bringing Energy Efficiency to Southerners," Environmental and Energy Study Institute panel on "Energy Efficiency in the South," April 10, 2010.

"Energy Efficiency: The Southeast Considers its Options," NAESCO Southeast Regional Workshop, September 2010.

"Energy Efficiency Delivers Growth and Savings for Florida," testimony before Energy & Utilities Subcommittee, Florida House of Representatives, February 2011.

"Rates vs. Energy Efficiency," 2013 ACEEE National Conference on Energy Efficiency as a Resource, September 2013.

"TVA IRP Update," TenneSEIA Annual Meeting, November 19, 2014.

"Views on TVA EE Modeling Approach," presentation with Natalie Mims to Tennessee Valley Authority's Evaluating Energy Efficiency in Utility Resource Planning Meeting, February 10, 2015.

"The Clean Power Plan Can Be Implemented While Maintaining Reliable Electric Service in the Southeast," FERC Eastern Region Technical Conference on EPA's Clean Power Plan Proposed Rule, March 11, 2015.

"Renewable Energy & Reliability," 5th Annual Southeast Clean Power Summit, EUCI, March 2016.

"Challenges to a Southeast Carbon Market," 5th Annual Southeast Clean Power Summit, EUCI, March 2016.

"Solar Capacity Value: Preview of Analysis to Date," Florida Alliance for Accelerating Solar and Storage Technology Readiness (FAASSTeR) meeting, Orlando, FL, November 2017.

"Making the Most of the Power Plant Market: Best Practices for All-Source Electric Generation Procurement," Southeast Energy and Environmental Leadership Forum, Nicholas Institute for Environmental Policy Solutions, August 2020.

"Making the Most of the Power Plant Market: Best Practices for All-Source Electric Generation Procurement," Indiana State Bar Association, Utility Law Section, Virtual Fall Seminar, September 2020.

"Resource Adequacy, Reserve Margin, & Seasonal Planning," 2022 Georgia IRP Training and Roundtable Series, February 2022.

EXPERT TESTIMONY

2008 **South Carolina PSC** Docket No. 2007-358-E, surrebuttal testimony on behalf of Environmental Defense, the South Carolina Coastal Conservation League, Southern Alliance for Clean Energy and the Southern Environmental Law Center. Cost recovery mechanism for energy efficiency, including shareholder incentive and lost revenue adjustment mechanism.

2009 **North Carolina NCUC** Docket No. E-7, Sub 831, direct testimony on behalf of Environmental Defense Fund, Natural Resources Defense Council, Southern Alliance for Clean Energy, and Southern Environmental Law Center. Cost recovery mechanism for energy efficiency, including shareholder incentive and lost revenue adjustment mechanism.

Florida PSC Docket Nos. 080407-EG through 080413-EG, direct testimony on behalf of Southern Alliance for Clean Energy and the Natural Resources Defense Council. Energy efficiency potential and utility program goals.

South Carolina PSC Docket No. 2009-226-E, direct testimony in general rate case on behalf of Environmental Defense, the Natural Resources Defense Council, the South Carolina Coastal Conservation League, Southern Alliance for Clean Energy and the Southern Environmental Law Center. Cost recovery mechanism for energy efficiency, including shareholder incentive and lost revenue adjustment mechanism.

2010 **North Carolina NCUC** Docket No. E-100, Sub 124, direct testimony on behalf of Environmental Defense Fund, the Sierra Club, Southern Alliance for Clean Energy, and Southern Environmental Law Center. Adequacy of consideration of energy efficiency in Duke Energy Carolinas and Progress Energy Carolinas' 2009 integrated resource plans.

Georgia PSC Docket No. 31081, direct testimony on behalf of Southern Alliance for Clean Energy. Adequacy of consideration of energy efficiency in

Georgia Power's 2010 integrated resource plan, including cost effectiveness, rate and bill impacts, and lost revenues.

Georgia PSC Docket No. 31082, direct testimony on behalf of Southern Alliance for Clean Energy. Adequacy of consideration of energy efficiency in Georgia Power's 2010 demand side management plan, including program revisions, planning process, stakeholder engagement, and shareholder incentive mechanism.

2011 **South Carolina PSC** Docket No. 2011-09-E, allowable ex parte briefing on behalf of Southern Alliance for Clean Energy, South Carolina Coastal Conservation League, and Upstate Forever. Adequacy of South Carolina Electric & Gas's 2011 integrated resource plan, including resource mix, sensitivity analysis, alternative supply and demand side options, and load growth scenarios.

South Carolina PSC Docket Nos. 2011-08-E and 2011-10-E, allowable ex parte briefing on behalf of Southern Alliance for Clean Energy, South Carolina Coastal Conservation League, and Upstate Forever. Adequacy of Progress Energy Carolinas and Duke Energy Carolinas' 2011 integrated resource plans, including resource mix, sensitivity analysis, alternative supply and demand side options, cost escalation, uncertainty of nuclear and economic impact modeling.

2013 **Georgia PSC** Docket No. 36498, direct testimony on behalf of Southern Alliance for Clean Energy. Adequacy of consideration of energy efficiency in Georgia Power's 2013 integrated resource plan, including cost effectiveness, rate and bill impacts, and lost revenues, economics of fuel switching and renewable resources.

South Carolina PSC Docket No. 2013-392-E, direct testimony with Hamilton Davis in Duke Energy Carolinas need certification case on behalf of the South Carolina Coastal Conservation League and Southern Alliance for Clean Energy. Need for capacity, adequacy of energy efficiency and renewable energy alternatives, and use of solar power as an energy resource.

2014 **South Carolina PSC** Docket No. 2014-246-E, direct testimony generic proceeding on behalf of the South Carolina Coastal Conservation League and Southern Alliance for Clean Energy. Methods for calculating dependable capacity credit for renewable resources and application to determination of avoided cost.

2015 **Florida PSC** Docket No. 150196-EI, direct testimony in Florida Power & Light need certification case on behalf of Southern Alliance for Clean Energy. Appropriate reserve margin and system reliability need.

2016 **Georgia PSC** Docket No. 40161, direct testimony on behalf of Southern Alliance for Clean Energy. Adequacy of consideration of renewable energy in Georgia Power's 2016 integrated resource plan, including portfolio diversity,

operational and implementation risk, analysis of project-specific costs and benefits (including location and technology considerations), and methods for calculating dependable capacity credit for renewable resources.

2019 **Georgia PSC** Docket Nos. 42310 and 42311, direct testimony with Bryan A. Jacob in Georgia Power's 2019 integrated resource plan and demand side management plan on behalf of Southern Alliance for Clean Energy. Adequacy of consideration of renewable energy in IRP, retirement of uneconomic plants, and use of all-source procurement process. Shareholder incentive mechanism for both renewable energy and DSM plan.

2020 **Nova Scotia UARB** Matter No. M09519, direct testimony with Paul Chernick in Nova Scotia Power's application for approval of the Smart Grid Nova Scotia Project on behalf of the Nova Scotia Consumer Advocate. Cost classification, decommissioning costs, justification for software vendor selection, and suggested changes to project scope.

Nova Scotia UARB Matter No. M09499, direct testimony with Paul Chernick in Nova Scotia Power's 2020 annual capital expenditure plan on behalf of the Nova Scotia Consumer Advocate. Potential to decommission hydroelectric systems, review of annually recurring capital projects, use of project contingencies, and cost minimization practices.

Nova Scotia UARB Matter No. M09579, direct testimony with Paul Chernick in Nova Scotia Power's application for the Gaspereau Dam Safety Remedial Works on behalf of the Nova Scotia Consumer Advocate. Alternatives to proposed project, project contingency factor, estimation of archaeological costs, and replacement energy cost calculation.

Nova Scotia UARB Matter No. M09707, direct testimony with Paul Chernick on Nova Scotia Power's 2020 Load Forecast on behalf of the Nova Scotia Consumer Advocate. Impacts of recession, application of end-use studies, improvements to forecast components, and impact of time-varying pricing.

California PUC Docket A.19-10-012, direct and rebuttal testimony with Paul Chernick in San Diego Gas & Electric's application for the Power Your Drive Electric Vehicle Charging Program on behalf of the Small Business Utility Advocates. Ensuring that utility-installed chargers advance California goal for electric vehicles. Budget controls. Reporting requirements. Evaluation, monitoring and verification processes. Outreach to small business customers.

California PUC Docket A.19-08-013, direct testimony in Southern California Edison's 2021 general rate case (track 2) on behalf of the Small Business Utility Advocates. Reasonableness of remedial software costs to be included in authorized revenue requirement.

Georgia PSC Docket Nos. 4822, 16573 and 19279, direct, rebuttal and surrebuttal testimony in Georgia Power Company's PURPA avoided cost review

on behalf of the Georgia Large Scale Solar Association. Reviewing compliance with prior Commission orders. Application of capacity need forecast in projection of avoided capacity cost. Calculation of cost of new capacity. Proposal of standard offer contract.

California PUC Docket A.19-11-019, direct, reply, responsive, and reply to responsive testimony with Paul Chernick in Pacific Gas & Electric's 2021 general rate case (phase 2) on behalf of the Small Business Utility Advocates. Cost of service methods. Rate design, including customer charges, demand charges, real time pricing tariffs, TOU differentials and periods.

Nova Scotia UARB Matter No. M09548, direct testimony on the audit of Nova Scotia Power's Fuel Adjustment Mechanism on behalf of the Nova Scotia Consumer Advocate. Reasonableness of fuel contract costs. Scope of study on dispatch practices. Impact of greenhouse gas shadow pricing. Compliance issues related to resource planning.

2021 **California PUC** Docket R.20-11-003, direct and reply testimony on rulemaking to ensure reliable electric service in the event of an extreme weather event on behalf of the Small Business Utility Advocates. Modifications to Critical Peak Pricing programs and Time of Use periods. Modifications to load management programs.

Nova Scotia UARB Matter No. M09898, direct testimony on Nova Scotia Power's Annually Adjusted Rates on behalf of the Nova Scotia Consumer Advocate. Effect of delays in power contract. Unit modeling assumptions. Variable capital costs. Application of Time-Varying Pricing.

Nova Scotia UARB Matter No. M09920, direct testimony on Nova Scotia Power's Annual Capital Expenditure Plan for 2021 on behalf of the Nova Scotia Consumer Advocate. Cost minimization. Project contingency. Economic analysis model. Analysis of specific projects.

Nova Scotia UARB Matter No. M09777, direct testimony on Nova Scotia Power's Time-Varying Pricing Tariff Application on behalf of the Nova Scotia Consumer Advocate. Effect of proposed TVP tariffs on load, capacity savings, and energy costs. Recommended CPP tariffs. Treatment of demand charges in TVP tariffs. Implementation and evaluation of TVP tariffs. Lost revenue adjustment mechanism.

South Carolina PSC Docket Nos. 2019-224-E and 2019-225-E, surrebuttal testimony on 2020 Integrated Resource Plans filed by Duke Energy Carolinas and Duke Energy Progress. All-source procurement process. Process for resolution of disputed issues in IRP proceedings.

California PUC Docket A.20-10-011, direct and reply testimony with Paul Chernick in Pacific Gas & Electric's Commercial Electric Vehicle Day-Ahead Hourly Real Time Pricing Pilot on behalf of the Small Business Utility

Advocates. Rate design for real time pricing tariff. Marketing to small businesses. Evaluation plan.

California PUC Docket R.20-08-020, direct and reply testimony with Paul Chernick in rulemaking to revisit net energy metering (NEM) tariffs on behalf of the Small Business Utility Advocates. Rate design for NEM tariff. Method for analyzing NEM tariff program.

California PUC Docket A.20-10-012, direct testimony with Paul Chernick in Southern California Edison's 2021 general rate case (phase 2) on behalf of the Small Business Utility Advocates. Cost of service methods. Rate allocation and design, including customer charges and real time pricing tariffs.

Nova Scotia UARB Matter No. M10176, direct testimony on Nova Scotia Power's Smart Grid Nova Scotia Solar Garden Pilot Rate Rider on behalf of the Nova Scotia Consumer Advocate. Addressing risks associated with future cost changes.

Nova Scotia UARB Matter No. M10110, direct testimony on Nova Scotia Power's Wreck Cove hydroelectric project on behalf of the Nova Scotia Consumer Advocate. Reasonableness of project and unresolved issues.

California PUC Docket A.19-08-013, direct testimony in Southern California Edison's 2021 general rate case (track 3) on behalf of the Small Business Utility Advocates. Reasonableness and prudence of remedial and replacement software costs to be included in authorized revenue requirement.

Nova Scotia UARB Matter No. M10197, direct testimony on Nova Scotia Power's Tusket Main Dam Refurbishment Authorization to Overspend application on behalf of the Nova Scotia Consumer Advocate. Whether the project should proceed and whether full cost recovery is justified.

Colorado PUC Proceeding No. 21AL-0317E, answer testimony in Public Service Company of Colorado's 2021 general rate case (phase 1) on behalf of Energy Outreach Colorado. Reasonableness of capital project costs, choice of test year, adjustment to load to reflect effects of pandemic.

2022 **California PUC** Docket A.21-05-017, direct testimony with Paul Chernick in Liberty Utilities Calpeco 2022 general rate case on behalf of the Small Business Utility Advocates. Marginal cost study, revenue allocation, rate design.