BATES WHITE
ECONOMIC CONSULTING

Bates White Economic Consulting's Comments On Nova Scotia Power, Inc.'s Final Integrated Resource Plan Report

Presented to:
The Nova Scotia Utility and Review Board

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I. Introduction

Bates White Economic Consulting ("Bates White") appreciates the opportunity to provide these comments regarding Nova Scotia Power, Inc.'s ("NSPI") 2020 Integrated Resource Plan ("IRP") report ("2020 IRP Report"). Bates White's has been serving as a Board Consultant throughout the IRP process, which began in the summer of 2019. In that role, we have had regular discussions throughout the IRP process with NSPI, Board Staff, Board Consultant Synapse, Inc. ("Synapse"), and Energy Environmental Economics, Inc. ("E3"), NSPI's consultant on the IRP. We have also attended and participated in the stakeholder sessions held at various points in the process.

Our comments here serve multiple purposes. First, we provide our assessment of NSPI's compliance with certain Bates White recommendations made in our 2016-2017 FAM Audit Report, where we recommended that NSPI conduct an IRP. We included numerous recommendations about the IRP process. This discussion addresses the IRP process, such as NSPI's transparency in the IRP process and its efforts to include input from the Board, Board Consultants, and stakeholders; and NSPI's IRP analysis and results. Second, we provide comments on various aspects of the 2020 IRP Report. This section includes further assessment of NSPI's analysis and IRP results, as well as additional areas which we believe deserve additional context in the report. We also include a discussion of NSPI's action plan.

Overall, we found NSPI's IRP work to be done in a largely transparent, collaborative way that produced important information that can be used to strategically plan NSPI's resource mix going forward. It is important to place our comments into proper context. In evaluating an effort as large and complex as an IRP process for an electric utility such as NSPI, it is not feasible, nor necessary, for us to validate and endorse every aspect of NSPI's work, assumptions, and conclusions, nor every page of the 2020 IRP Report. There will necessarily be areas of disagreement, even if it is something as minor as the tone of the 2020 IRP Report's discussion of a particular issue. It is also not possible for us to go through each line of the 2020 IRP Report, noting our concurrence or disagreement with each point. Given this reality, it is our purpose in these comments to provide (a) precise findings on NSPI's compliance with each of our FAM Audit recommendations related to the IRP and (b) key areas in the 2020 IRP Report that we believe require our additional input.

II. Assessment of IRP Compliance with FAM Audit Recommendations

We begin by assessing NSPI's compliance with certain Bates White recommendations made in our 2016-2017 FAM Audit Report. That Report, filed on July 24, 2018 in M08195,

contained 40 recommendations, three (3) of which related to this IRP process. Specifically, Recommendations IX-1, XIV-5, and XIV-6 were to be addressed in the IRP process, and until such time as the IRP process was complete, it would not be possible to judge NSPI's compliance with those audit recommendations. With the IRP process now complete insofar as NSPI has filed its 2020 IRP Report, we provide our assessment of NSPI's compliance with these recommendations.

A. Recommendation IX-1: IRP Planning

Recommendation IX-1 was a lengthy recommendation that included several subparts. We accordingly break up our review by the specific subparts of the recommendation.

1. Conduct Regular IRP Planning

Our recommendation stated that "NSPI should conduct regular and robust planning to help ensure that its resource fleet meets NERC and NPCC requirements without being over-capacity."[1] Accordingly, the "IRP planning should…be conducted regularly (e.g., every two years)."[2] NSPI accepted this recommendation, though did not agree to conduct an IRP as frequently as every two years and instead advocated for IRPs "to be triggered by major changes in [the] planning environment," such as policy changes, "rather than remodeling a long term outlook with only minor assumption changes."[3] We stated our amenability to this approach, noting our agreement that "one appropriate time to conduct an IRP is after a significant change in the planning environment."[4] We retained our recommendation's stress on the importance of regular IRP planning.[5]

In its 2020 IRP Report, NSPI has committed to "updating its long-term planning regularly, including in between IRPs," and has provided information about that work in its Roadmap.[6] We find this commitment responsive to this aspect of our recommendation. We opine further on the Roadmap and the "evergreen IRP process" contemplated by NSPI later in our comments.

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[1] Bates White 2016-2017 Audit Report ("Audit Report"), Recommendation IX-1.

[2] Bates White 2016-2017 Audit Report, Recommendation IX-1.

[3] Nova Scotia Power, Inc., "FAM Audit Nova Scotia Power Reply Evidence," Matter M08195, December 11, 2018 ("NSPI Reply Evidence"), pages 15 to 16.

[4] Bates White Rebuttal Evidence, Matter M08195, April 16, 2019 ("Bates White Rebuttal Evidence"), page 9.

[5] Bates White Rebuttal Evidence, page 10.

[6] 2020 IRP Report, section 7.3.

2. Determine the Optimal Planning Reserve Margin

Our recommendation addressed NSPI's use of a Planning Reserve Margin in the IRP process, recommending that NSPI look not just at the adequacy of the existing target Planning Reserve Margin of 20%, but its optimality. We stated:

> Determine the *optimal* planning reserve margin, not just reconsider whether a 20% planning reserve margin adequately meets NPCC or NERC standards. This will ensure that NSPI will be regularly determining the lowest planning reserve margin possible to meet NPCC requirements, rather than just assessing if "20%" remains in compliance.[7]

In the 2020 IRP Report, NSPI explains that it "will continue to use the [Planning Reserve Margin] calculated in the Pre-IRP Planning Reserve Margin and Capacity Value Study (20 percent) for future reference."[8] (NSPI explains that this 20% Planning Reserve Margin, as calculated on an installed capacity ("ICAP") basis, is the equivalent of a 9% Planning Reserve Margin as calculated on an unforced capacity ("UCAP") basis.[9]) NSPI explained that the "E3 planning and reserve margin study verified **was within the range** of [Planning Reserve Margins] consistent with the reliability criterion" of the 1-day-in-10-years loss-of-load expectation.[10] Later, NSPI noted that E3's Reliability Screening of its three initial resource plans "confirmed that the three resource plans met the 1-day-in-10-years reliability criteria through the end of the planning horizon (2045), and further that the indicated capacity surplus was relatively small in each case, indicating that the 9 percent UCAP criteria continues to be appropriate for planning purposes throughout the planning horizon and that the resource plans developed during the IRP are reliable."[11]

Notably, NSPI stops short of declaring a 20% Planning Reserve Margin (or, 9% UCAP Planning Reserve Margin) to be "optimal." We presume this is intentional, as we raised this issue with NSPI on multiple occasions during our regular interactions throughout the IRP process. As others have noted, it is not clear that NSPI's work to date is "sufficient to demonstrate that NS Power has achieved an 'optimal' planning reserve margin."[12] We tend to

[7] Audit Report, Recommendation IX-1.

[8] 2020 IRP Report, section 2.4.2.

[9] See, for example, section 3.1.1.

[10] 2020 IRP Report, section 3.1.1 (emphasis added).

[11] 2020 IRP Report, page 110.

[12] See, for example, Resource Insight Comments, November 16, 2020, page 13.

agree: to us, E3's July 2019 "Planning Reserve Margin and Capacity Value Study" demonstrated that a Planning Reserve Margin as low as 17.8% would allow NSPI to meet its reliability criteria; that study noted, in relevant part: "[I]n order to meet a 0.1 days/year loss of load expectation (LOLE) target, NSPI should maintain between a 17.8% - 21.0% planning reserve margin (PRM)."[13] Moreover, E3's August 24, 2020 "NS Power IRP PLEXOS Scenario Reliability Results," which "tested the reliability of the system in 2045 under three different PLEXOS scenarios"[14] showed that in all three scenarios, the achieved Planning Reserve Margin was in excess of the target.[15] Thus, in all three cases, the system had more capacity than it needed in 2045; the excess ranged from 32 MW to 77 MW.[16]

It becomes a matter of interpretation as to whether NSPI's position that it should retain its 20% Planning Reserve Margin, or whether a lower target Planning Reserve Margin – such as 17.8% – is optimal. The actual Planning Reserve Margin will vary, year to year, with the lumpiness of resource retirements and additions. And given the 25-year planning horizon considered in this IRP, it is not reasonable to expect NSPI to achieve a Planning Reserve Margin identical to its target in each year. That said, we are not convinced that the 20% Planning Reserve Margin is "optimal," insofar as optimality means the economically lowest cost solution that meets the reliability criteria to which NSPI is subject. In fact, NSPI has never made such a claim, so it is not clear that NSPI would disagree.

We do not believe that NSPI's 2020 IRP Report and its findings are fatally flawed by this Planning Reserve Margin issue. Overall, we can accept NSPI's approach since it does not suggest massive excess capacity overhangs during the planning horizon—indeed, the 2045 excess capacity is fairly modest. Nevertheless, as we noted in our Audit Report, Planning Reserve Margin is a crucial input into determining the size of NSPI's capacity resource portfolio going forward, and while a higher planning reserve margin will, in principle, increase resource adequacy and reliability beyond the NERC standard, such 'excess' reliability comes at a cost to end-use customers. The amount of additional margin to pursue should be determined based on incremental cost compared to the incremental value to customers of any reliability benefit. To recognize the importance of this cost-benefit relationship, NSPI should make the monitoring of its actual and target Planning Reserve Margins a key component of its IRP evergreen process,

[13] E3 November 2019 Capacity Study, page iv.

[14] E3, "NS Power IRP PLEXOS Scenario Reliability Results," August 24, 2020, slide 11.

[15] Ibid.

[16] Ibid.

and should be responsive to stakeholders that seek updates to the studies that underpin NSPI's selected target Planning Reserve Margin. In other words, a PRM of less than 9%/20% can be 'more optimal' and should be continue to be evaluated as part of future procurement efforts and the IRP evergreen process.

3. Provide Transparent Peak Load Forecast

Our IRP recommendation addressed NSPI's peak load forecast, another key determinant of NSPI's capacity needs going forward. We stated: "Provide a transparent forecast of peak load that can be fully vetted by the Board, the Board's consultants, and stakeholders, as applicable."[17]

In our view, NSPI fully complied with this part of our recommendation. In particular, NSPI considered a wide range of peak load scenarios in its modeling efforts.[18] NSPI received and incorporated input on peak load forecast scenarios, which should help increase confidence in the robustness of the results. This is particularly true in light of recent experience in NSPI's peak load forecasting results. Since 2016, NSPI's annual peak load forecast has overestimated peak load each year by as much as 112 MW, or 5.55%.[19] By considering a wide range of peak load forecasts, including forecast scenarios with little peak load growth, NSPI has enhanced the credibility of its IRP results.

4. Consider Full Costs, Benefits of All Investment Alternatives

Our recommendation next addressed NSPI's consideration of the menu of investment alternatives. We stated:

> Consider the full costs and benefits of all investment alternatives, including firm import capacity; transmission expansion; demand-side management; additional domestic and external hydro resources, including pumped hydro storage and additional hydro delivered over the Maritime Link; natural gas infrastructure investments; and emerging technologies as alternatives to traditional maintenance of existing generation or expansion of NSPI's portfolio.[20]

[17] Audit Report, Recommendation IX-1.

[18] See, for example, 2020 IRP Report, section 1.6.

[19] Bates White 2018-2019 Audit Report, Figure IX-26.

[20] Audit Report, Recommendation IX-1.

We find that NSPI was fully responsive to this recommendation. NSPI's IRP modeling considered renewable technologies (wind, solar, hydro), imported power (both firm and non-firm), demand response, energy efficiency, battery storage, distributed generation, and traditional thermal plants and related infrastructure.[21] While we make some additional points below in Section III related to certain investment alternatives, we consider NSPI as having been fully responsive to our recommendation.

5. Conduct Proper Assessment of Natural Gas Infrastructure Investments

Our recommendation then focused on available natural gas-related investment alternatives:

> Regarding natural gas infrastructure investments (e.g., natural gas-fired combined cycle generation, firm pipeline capacity), include use the variable cost of gas (commodity, fuel, and variable pipeline charges) as the input into PLEXOS model runs, and not include the capital costs of the investment in commitment and dispatch costs, but instead add the fixed costs to the cost of generation subsequent to the PLEXOS runs. NSPI should also evaluate potential changes to its generation fleet by including updated, combined-cycle technology as a generation option.[22]

NSPI was fully responsive to this aspect of our recommendation. NSPI considered new natural gas resource options,[23] coal-to-gas conversions,[24] and firm pipeline capacity expansion options.[25] As part of its Action Plan, NSPI will develop a plan for the redevelopment or replacement of existing natural gas-fired generation.[26]

6. Address Effect of PHP Load

Next, our recommendation addressed the modeling of the effect of Port Hawkesbury Paper ("PHP") load:

[21] See, for example, 2020 IRP Report, Figure 6.

[22] Audit Report, Recommendation IX-1.

[23] 2020 IRP Report, sections 4.3.3.1, 4.3.3.3.

[24] 2020 IRP Report, section 4.3.3.2.

[25] See, for example, NSPI 2020 Integrated Resource Plan: Draft Assumptions Set, January 20, 2020.

[26] See, for example, 2020 IRP Report, section 1.9.1.

> Explicitly address the effect of PHP load. The LRT requires that NSPI exclude PHP from its planning considerations. NSPI should assess the effect of incorporating PHP load in resource planning to ensure that PHP load does not impose net costs on FAM customers over a longer time horizon.[27]

Since issuance of our Audit Report, NSPI's contractual relationship with PHP – its largest customer, representing about 10% of Nova Scotia load – has changed. The parties replaced the expiring Load Retention Tariff ("LRT") with the so-called Extra Large Industrial Active Demand Control ("ELIADC") Tariff. According to NSPI, "the primary element of the ELIADC is its functionality as a demand response rate in that the fundamental behavior of the Tariff serves to provide Nova Scotia Power with a significant tool in the management of its entire system load. This is a potentially significant benefit because the demand flexibility acts like an additional generator in Nova Scotia Power's generation fleet."[28] NSPI thus "modeled PHP's load profile separately in the PLEXOS model" based on historical data, and then "shaped PHP's load, shifting load away from periods of system peak demand and toward periods of lower demand, on both an hourly and seasonal basis, emulating the behavior anticipated under the ELIADC Tariff."[29] Moreover, because PHP is considered a "Priority Interruptible" customer, NSPI states that PHP and other interruptible customers "do not contribute" to NSPI's firm peak load "and are not included in the firm peak load demand forecast in the IRP;" thus, "these customers do not impact capacity planning requirements in the long-term resource plans."[30]

We recognize that the landscape has shifted since we made our audit recommendation in July 2018. It is potentially the case that this aspect of our audit recommendation is moot, insofar as the LRT is defunct and the ELIADC Tariff is intended to prevent PHP from contributing to NSPI's firm peak load. Thus, for purposes of NSPI's compliance with this aspect of our recommendation, we consider this item closed. However, we note that the actual experience with the ELIADC, including NSPI's administration of and PHP's performance under the new tariff, remains to be seen.

[27] Audit Report, Recommendation IX-1.

[28] 2020 IRP Report, page 55.

[29] Ibid.

[30] Ibid.

7. Consider Full Costs and Benefits of Maintaining NSPI's Existing Fleet

Our recommendation then addressed NSPI's existing generating asset fleet and the costs and benefits associated with maintaining each generating unit:

> Consider the full costs and benefits of maintaining all of NSPI's existing generating assets. This would include the environmental costs/benefits, the sustaining capital costs, OM&G projections, capital expenditures to address fuel transportation and handling infrastructure, decommissioning costs, NSPI's return of and on capital related to each plant, and FAM cost impacts, among potentially many others.[31]

In our view, NSPI complied with this aspect of our recommendation, which was the subject of a particularly rich discussion during the IRP process. In our discussions and communications with NSPI, we identified numerous concerns with the initial forecasts of sustaining capital and fixed operating and maintenance ("O&M") costs for the existing fleet. In some cases, NSPI made adjustments or supplemented its data. Most importantly, NSPI agreed to conduct what they described as a "high" sustaining capital cost forecast, which increased the base case assumptions by 50%.[32]

Notably, in the high sustaining capital cost scenario, a coal retirement is advanced by ten years (from 2040 to 2030) and one additional gas steam unit is retired in 2026.[33] NSPI is correct that in this scenario, there are no dramatic changes in the optimal resource plan. Nevertheless, NSPI should not lose sight of the importance of its assumptions around sustaining capital and fixed O&M over the planning horizon in shaping the outcome of the optimal resource portfolio. These are real and significant costs: for example, NSPI will seek to spend tens of millions of dollars on Trenton 5 in sustaining capital over the next three years, and during that three-year period, the forecasted annual capacity factor for Trenton 5 ranges between 14% and 16%.[34]

[31] Audit Report, Recommendation IX-1.

[32] 2020 IRP Report, section 6.8.5.

[33] 2020 IRP Report, section 6.8.5.

[34] Bates White Rebuttal Evidence, M09288, August 29, 2019, page 26.

8. Determine Reasonable Effective Load Carrying Capability of Wind

Our recommendation then addressed the determination of a reasonable effective load carrying capability ("ELCC") of wind. We stated: "Determine a reasonable effective load carrying capability for both existing and new wind resources."[35]

NSPI fully complied with this aspect of our recommendation. As part of its pre-IRP deliverables, NSPI commissioned E3 to complete a planning reserve margin and capacity study,[36] which took an industry-standard approach to estimating ELCC for a number of resource technologies, including wind.

9. Allow for Board and Stakeholder Review and Input

Our recommendation concluded by addressing the involvement of the Board and stakeholders in the IRP process. We stated:

> Allow for Board and stakeholder review and input. IRPs are only as useful as the assumptions that drive them, so it is important that NSPI's IRP methodology and assumptions be vetted by third parties and experts.[37]

NSPI fully complied with this important aspect of our recommendation. Bates White, Board Staff, and Synapse were in regular contact with NSPI throughout the IRP process, and NSPI provided for an open dialogue with its key personnel and the E3 team. While all parties did not agree on every issue, NSPI was responsive to questions and requests for substantive discussions. In addition, NSPI engaged stakeholders through a series of workshops featuring NSPI and E3 presentations, with time for questions and answers as well. Stakeholders also had access to the library of IRP documents and were invited to submit written comments at various points in the process. Lastly, as evidenced by proceeding M08929, the Board will have its chance to review the 2020 IRP Report, as well as any public comments filed in this docket.

B. Recommendation XIV-5: Biomass Plant Value Analysis

We included two other additional recommendations in our Audit Report that tied to the IRP. Specifically, Recommendation XIV-5 stated:

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[35] Audit Report, Recommendation IX-1.

[36] E3, "Planning Reserve Margin and Capacity Value Study," July 2019.

[37] Audit Report, Recommendation IX-1.

> **Recommendation XIV-5:** NSPI should perform a standalone analysis to determine the value of the Biomass Plant to FAM customers, looking forward, in the absence of PHP load. Such a study would establish whether any of the costs of the facility are appropriately considered incremental to PHP load and would inform considerations of how to shield FAM customers from such costs.[38]

Similar to our discussion of PHP's new ELIADC Tariff with NSPI, we understand NSPI's position that under the ELIADC, PHP imposes no incremental costs on FAM customers. Again, that may be so, but the ELIADC is in its early innings. We simply state here that FAM customers should not be required to pay for additional capital investment and other fixed costs at the Port Hawkesbury biomass unit, the justification for which is predicated on indefinite continuation of PHP load.

C. Recommendation XIV-6: Combustion Turbine Analysis

The third and final additional recommendation related to the IRP addressed the economics of NSPI's seven existing diesel-fired combustion turbines:

> **Recommendation XIV-6:** In the Power Plant Performance chapter of this report, we have a recommendation to implement more regular and robust IRP planning. Subject to identifying the need for peaking and fast ramping resources in that study, NSPI should compare the economics of preserving the serviceability of its CT current fleet to the economics of replacing them with newer CTs or another type of fast ramping generation.[39]

To test the economics of the existing combustion turbines, E3 conducted a "screening" analysis using its capacity expansion optimization in its RESOLVE model. The model compared scenarios in which the diesel combustion turbines were included with scenarios in which the combustion turbines were removed—in which case the model selected the cheapest resources to replace any missing capacity needed to meet peak load plus the planning reserve margin. This was another area of particularly in-depth discussions with NSPI and E3: specifically, we requested a series of additional runs that removed just one unit (instead of all seven), as well as runs that included a lower planning margin (17.8%, instead of 20%). In all cases, the modeling showed that sustaining the existing fleet was lower cost than the cost of replacing needed capacity with gas peakers.

[38] Audit Report, Recommendation XIV-5.

[39] Audit Report, Recommendation XIV-6.

Overall, NSPI's work in this area was responsive to our recommendation, and we agree that the outcome of the modeling suggests sustaining the existing units. Going forward, however, the results of the IRP screening analysis should neither be a mandate to operate and maintain the units in perpetuity, nor should it be considered a blank check from customers to pay all requested capital investment associated with these units. As we noted in our most recent audit report, NSPI's reliance on the combustion turbines to provide energy has far outpaced forecasts; moreover, we identified concerns with the performance of those units.[40] NSPI's modeling of the combustion turbines in the screening analysis was relatively simplistic – e.g., in assuming that the units respond when called upon, and in not differentiating among the seven individual units, regardless of their condition or location. The actual value of the combustion turbines could be significantly different than modeled if the units continue to be operated in a manner that substantially differs from forecasts, if the sustaining capital and/or fixed O&M costs differ from forecasts, or if the variable cost of operating the units changes. To that end, we agree with Resource Insight's recommendations on this issue, made in its September 13, 2020 comments.[41]

III. Other Comments on the IRP

As noted above, an effort as large and complex as NSPI's IRP process is not likely to find uniform agreement over all assumptions and conclusions. It is also not feasible for us to go through each line of the 2020 IRP Report, noting our concurrence or disagreement with each point. Given this reality, it is our purpose in this section to identify key areas in the 2020 IRP Report that we believe require our additional input. Silence on a particular aspect of the IRP should not be interpreted as agreement or otherwise.

[40] See Bates White's 2018-2019 Audit Report, chapter IX.

[41] Specifically, Resource Insight recommends that NSPI (a) provide further evidence in the FAM audit proceeding regarding the performance of its refurbished diesel combustion turbine units; (b) provide data comparing the modeled operational profile (capacity factor, operating hours, number of unit starts, etc.) to recent historical data; (c) further evaluate the longer-term sustaining capital forecast for the diesel CT fleet as part of its evergreen IRP process; and (d) periodically re-evaluate CT economics as the cost of energy storage falls, and especially if the units are using substantial amounts of fuel and the cost of that fuel rises significantly. Resource Insight, "Comments on Draft IRP Report," September 13, 2020, page 14.

A. Areas in IRP Report Requiring Additional Context

1. Coal retirements also mean savings on Sustaining Capital, Fixed O&M costs.

NSPI appropriately explains that it will "transform its generation portfolio over the planning horizon" in part by "eliminat[ing] coal generation…from its portfolio."[42] NSPI further explains that its "coal plants provide firm capacity, energy, and essential grid services to the system" and that retirement of these units would require "additional firm generating capacity to ensure that the system is reliable with sufficient supply available to meet expected demand, especially during periods of low renewable generation and peak loads."[43] While the environmental benefits of the coal retirements are explained, the cost savings in sustaining capital and fixed O&M costs associated with the existing coal-fired generating units, which often have relatively high fixed going forward costs, are not examined. While likely not an intentional omission, it is worth underscoring the fact that sustaining the existing thermal units incurs costs that are otherwise avoidable if those units are mothballed or shut down.

The IRP modeling made certain assumptions about the levels of sustaining capital and fixed O&M for the existing fleet. Should those costs be significantly higher than expected, the optimality of this IRP's preferred portfolio may be undermined and it will be ratepayers who will be asked to pay the costs. Indeed, NSPI is not guaranteeing the estimates of the costs of sustaining existing units, nor are they assuming risk should those estimates turn out to be too low. Moreover, as we noted above, the high sustaining capital cost scenario results in both the acceleration of a coal unit retirement by ten years (from 2040 to 2030) and one additional gas steam unit retirement in 2026.[44] While these are not dramatic changes in the optimal resource plan, they demonstrate the materiality of these assumptions.

2. NSPI's existing combustion turbines differ substantially from new combustion turbines.

NSPI's discussion of "combustion turbines" toggles between "new" combustion turbines – which NSPI accurately describes as "the lowest-cost domestic source of new firm capacity" – with its "existing combustion turbines," which NSPI describes as "provid[ing] similar services

[42] 2020 IRP Report, page 18.

[43] 2020 IRP Report, page 21.

[44] 2020 IRP Report, section 6.8.5.

and economic benefit to customers."[45] Significant differences exist, however, between the lowest-cost new frame combustion turbines and NSPI's 45-year-old existing assets. The new turbines are gas-fired and 50 MW[46] (as opposed to NSPI's fleet of 33 MW, 45-year-old diesel-fired units[47]). The new resources would likely strongly outperform the existing assets[48] across a range of performance factors, such as heat rate, forced outage rate, and availability factor.

3. Battery storage is not limited from providing firm capacity.

NSPI described battery storage by stating that it "provides firm capacity and can support the integration of variable renewable generation, *however its ability to substitute for firm capacity resources is limited by its relatively short duration*."[49] This statement should be placed into a broader context. It is true that battery storage is subject to duration limitations, with many battery storage systems offering between four- and eight-hour durations. (NSPI modeled a four-hour battery.) However, this does not necessarily limit the ability of storage to substitute for capacity resources. Examples abound: Florida Power & Light is building a 409 MW solar-plus-storage facility to accelerate the retirement of two 1970's-era fossil fuel-fired plants;[50] Vistra Corporation's two-phase Moss Landing 400 MW battery storage project will provide capacity to Pacific Gas & Electric;[51] and Plus Power's 185 MW, four-hour battery storage project on Oahu will replace a retiring 180 MW coal plant.[52] Further, these projects do not have to be large or provide capacity, *per se*, to provide value. For example, FlexGen's 12 MW battery storage project in Indiana will enhance a utility's black start capabilities while replacing diesel-fired generators, which used to provide that service.[53]

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[45] 2020 IRP Report, page 22.

[46] 2020 IRP Report, page 70.

[47] We refer here to Burnside units 1 through 4, Victoria Junction units 1 and 2, and Tusket unit 4.

[48] See, for example, Bates White 2018-2019 Audit Report, Figure IX-15, which shows the forced outage rates and availability factors for each of NSPI's seven diesel-fired combustion turbines.

[49] 2020 IRP Report, page 23 (emphasis added).

[50] *PRNewswire,* "FPL announces plan to build the world's largest solar-powered battery and drive accelerated retirement of fossil fuel generation," March 28, 2019.

[51] Vistra Corp., "Vistra Announces Next Phase of Battery Energy Storage Systems at its Moss Landing Facility," May 19, 2020.

[52] *UtilityDive*, "Hawaiian Electric asks regulators to approve nearly 2 GWh storage, 300 MW solar contracts," September 18, 2020.

[53] *Energy Storage News,* "Batteries replace diesel for jumpstarting Indiana natural gas plants," July 1, 2020.

B. Other Comments on IRP Results

1. The results generally demonstrate a reliance on firm imports and a preference for regional coordination through transmission expansion, which introduces a key risk.

NSPI considered two transmission expansion options in the IRP: (1) a "Reliability Tie," would be a second 345 kV tie between Onslow and Salisbury, New Brunswick, and (2) "Regional Integration," which considered either a high-voltage, direct current connection to Quebec or a 345 kV alternating current line from Salisbury to Coleson Cove, New Brunswick. The Reliability Tie option would allow NSPI to interconnect additional inverter-based generation reliably. The Regional Integration option would enable additional firm capacity and energy imports, some of which are considered zero emissions energy.[54]

In its IRP Report, NSPI summarized the modeling results as it relates to these transmission expansion options:

> Regional Integration was modeled as availability of both firm capacity and energy from jurisdictions external to Nova Scotia. The model was able to procure each resource (capacity and energy) to the level required once it had made the capital investment in required transmission infrastructure. Nova Scotia Power observes the model utilizing this flexibility in the results, as firm capacity purchases are generally added gradually as coal units are retired….Like the Reliability Tie, Regional Integration was selected economically in every resource plan where it was offered to the model…[55]

NSPI's quote is borne out in the results as demonstrated by the substantial reliance on firm imports in the modeling results—see Figures 11 and 12 of the 2020 IRP Report. We think it is positive that NSPI is embracing regional solutions for capacity additions and clean energy. Greater interregional coordination and stronger transmission interconnections can have numerous benefits for Nova Scotia.

We do note, however, that resource solutions that are considered "regional" introduce a key risk in that they require voluntary cooperation from at least one other third party, be it utilities, regulators, governments, or some combination of the three. Securing third-party voluntary cooperation involves risk, since other parties are not under the control of NSPI.

[54] Specifically, imports to Nova Scotia from other Canadian provinces are considered emissions-free, while imports sourced from the interconnection at Coleson Cove include an emissions factor. 2020 IRP Report, page 76.

[55] 2020 IRP Report, page 106.

Securing that cooperation may also come at a cost, perhaps in the form of less favorable cost allocation for any joint investments. That cooperation may only come, too, after significant delay. NSPI's pre-IRP regional integration efforts have not always proved fruitful or expedient, underscoring this risk.

NSPI has appropriately included development of a "Regional Integration Strategy" as its number one action item in its Action Plan.[56] This is crucial, as time is of the essence in pursuing regional solutions due to the risks noted above.

In addition, in light of the risks associated with regional solutions, we think it will be important for NSPI to take three actions. First, in its evergreen process, NSPI should have a circuit breaker built in if progress on regional solutions reach an impasse. This will allow NSPI to pivot away from regional solutions should it become apparent that they will not be developed in a timely, economic manner. Second, NSPI should not link any thermal unit retirements to the success of its regional strategy. While it is important to develop any necessary replacement capacity in harmony with planned capacity retirements, the latter should not be reliant on the timing of the delivery of firm imports. Third, and relatedly, NSPI should consider how competitive procurement could help spur the success of the Regional Integration Strategy. For example, an all-source RFP would allow a head-to-head assessment of an import/regional solution against domestic alternatives, while also requiring a binding bid from the external regions' entities. It would also remind those entities that they are not NSPI's exclusive option for replacement capacity, a motivating *aide-mémoire* that would increase the likelihood of timely, economic capacity replacement outcomes.

2. Electrification futures are uncertain and have a significant impact on resource portfolio optimality.

The IRP process stressed the relevance of the electrification of the transportation and heating sectors. Electrification, generally, was identified as an integral part of "economy-wide deep decarbonization" in line with provincial regulations.[57] To plan for the potential increase in electrification of transportation and heating, but to recognize the uncertainty of the electrification trajectory over the planning period, the IRP considered three levels of electrification. The "high" case assumes almost complete electrification of heating in the province by 2050 while also assuming that 100% of light duty vehicle sales will be electric by 2040. The "mid" case assumed

[56] 2020 IRP Report, page 112.

[57] 2020 IRP Report, page 7.

that half of the heating sector will be electric by 2050 and 50% of all vehicle sales will be electric by 2040. The "low" case assumed "continuation of the current pace of growth in building and transportation electrification."[58]

We recognize that, throughout the IRP process, stakeholders and NSPI alike have debated the appropriate trajectory of electrification. We wish, here, to underscore the level of uncertainty associated with electrification of the heating and transportation sectors. Electrification of the heating sector will likely be influenced by provincial policy and rate design, which can raise issues of customer equity and require complex accounting to understand what level and tenor of electrification should be considered "beneficial," and what amount of electrification should be considered otherwise.

Electrification of the transportation sector is also uncertain. Today, "significantly less than 1% of new vehicle sales" in Nova Scotia are electric,[59] and 90% of Nova Scotia dealerships in the province have zero electric vehicles for purchase.[60] Estimates of electric vehicle penetration vary widely and depend on policy and legislative outcomes: for example, Dunsky Energy Consulting (on behalf of Ecology Action Centre) projects anywhere between 13% and 32% electric vehicle penetration in Nova Scotia by 2030, depending on provincial and federal incentives and mandates.[61]

All this is to say that electrification trajectories remain uncertain, and the wide range of scenarios considered by NSPI in the IRP process, while appropriately capturing the scope of that uncertainty, demonstrates just how different these future scenarios can be. It is our view that in the face of such uncertainty, NSPI's IRP evergreen process must enable NSPI to adjust its resource portfolio investments as electrification data accumulates through time. NSPI has appropriately included electrification in its Action Plan,[62] but those efforts focus more on spurring and accommodating electrification, rather than tracking the observed electrification trajectory. We note, too, that the main difference between the optimal resource portfolio selection between 2.0C and 2.1C is electrification, where 2.1C involves pursuit of electrification as a policy goal. Should electrification follow the low trajectory in reality, the optimal portfolio would differ—Point Aconi, for example, would retire ten years earlier, among other differences.

[58] 2020 IRP Report, page 13.

[59] Dunsky Energy Consulting, "Electric Vehicle Adoption in Nova Scotia 2020-2030," June 2020, page 1.

[60] Ibid.

[61] Ibid., Figure ES-1.

[62] 2020 IRP Report, pages 112 to 113.

As for the pursuit of "beneficial" electrification, we see this as an issue that may be exogenous to NSPI's decision-making. Incentives and mandates for transportation electrification are likely to originate from the legislative realm, while rate designs to encourage electrification of the heating sector will require Board review and approval. That said, we think NSPI has put forth a reasonable outline of how to judge whether electrification is beneficial. NSPI cites a policy paper which suggests six principles for evaluating electrification strategies.[63] These principles include efficiency, optimizing timing of energy usage, and assessment of competitive alternatives, among others.[64]

3. Sensitivity results demonstrate the importance of new resource cost assumptions.

One of the most significant areas of comments and discussion among stakeholders and NSPI related to specific assumptions for future supply options that would be modeled in the IRP. NSPI relied upon the E3 Resource Options Study for the assumptions of future resource costs.[65] At various points in the process, numerous parties raised questions about some of these assumptions, especially new wind resources and new battery storage projects. To help address these concerns, NSPI took the reasonable step of conducting modeling sensitivity runs testing, for example, low case costs of new onshore wind and battery storage systems.[66]

The results of these sensitivity runs are illuminating. Scenarios 2.1C.WIND-1, which is the low wind cost case, and 2.1C.WIND-2, which is the low wind and battery cost case, both result in an optimal portfolio that has significant differences from the base 2.1C case. These cases see the advancement of significant installations of wind from the 2030s (in 2.1C) to the 2024/2025, as well as the acceleration of the retirement of an additional coal unit from 2036 to either 2026 (low wind, low battery case) or 2030 (low wind case).[67] Greenhouse gas emissions also fall significantly compared with the base case, by 20-27% for the entire planning period.[68] These results show the optimal portfolio's sensitivity to wind and battery costs, which

[63] Regulatory Assistance Project, "Beneficial Electrification: Ensuring Electrification in the Public Interest," June 19, 2018.

[64] Ibid.

[65] 2020 IRP Report, Appendix B.

[66] 2020 IRP Report, page 80.

[67] 2020 IRP Report, Appendix K pages 156 to 159.

[68] 2020 IRP Report, Appendix K pages 157, 159.

underscore the importance of ensuring future procurement efforts solicit offers from the market to ensure the best and most timely pricing possible.

The sensitivity results also show the importance of the Reliability Tie in the composition of the optimal portfolio, most specifically in its role in integrating renewable generation and providing inertia. In the low wind and battery cost cases, the model chooses to build the Reliability Tie earlier (as early as 2023)[69] so as to allow the additional wind build.[70] The suggestion here is that not only does the Reliability Tie help keep the system reliable at higher penetrations of intermittent generation, but it does so at the lowest modeled cost. Moreover, in a sensitivity run in which the Reliability Tie option was not available (2.0A.IMPORT-2), the model selected to build domestic battery storage systems and synchronous condensers to support additional wind and provide inertia.[71] These findings underscore the importance of our discussion of the Reliability Tie and NSPI's regional coordination efforts in B.1 above.

4. Lingering discomfort with IRP assumptions about technology costs, benefits, and limits can be addressed through competitive procurement.

As we noted above, it is unlikely that we – or any other stakeholder – would agree with every aspect of every assumption made by NSPI in the IRP. This is the case despite NSPI's sensitivity analyses, which sought to determine the results in certain future conditions, such as lower prices for new wind resources or higher commodity prices. Stakeholders have suggested, for example, that the IRP overstated the cost and/or understated the benefits of renewable resources and battery storage, with some noting the "rapid" change in "prices, technologies and business models."[72]

It is important to note that the pricing assumptions associated with new resources used in this IRP are not guarantees, or even price ceilings. They are simply estimates of what such resources would cost at a specific point in time. Transitioning from these estimates to firm, fixed price offers is a crucial step, and we share the concern that reductions in the cost and advancements in the capability of certain new resource technologies can result in "stale" IRP assumptions that no longer reflect a reasonable expectation of what these resources will cost.

[69] 2020 IRP Report, Appendix K pages 156 to 159.

[70] 2020 IRP Report, page 100.

[71] 2020 IRP Report, Appendix K page 169.

[72] See November 11, 2020 comments of Envigour Policy Consulting, Inc. See also November 11, 2020 comments of the Canadian Renewable Energy Association.

Addressing this concern, in our view, is best done through the use of best practices competitive procurement. (We explain what we mean by "best practices" in section C below.) While the IRP can be a useful guide in terms of quantities and technologies for solicitation, good competitive procurement will not introduce needless barriers to competition that prevent optimal outcomes for customers. The procurement would displace the lingering uncertainty around new resource pricing with firm, fixed price offers that would allow for a fair comparison in resource investment alternatives that both fit within the IRP's guidelines but also allow for the advances in technology (and reduction in costs) to benefit customers. We provide more commentary on this below in section C.

5. Natural gas and power import price sensitivities show robustness of optimal portfolio, though caution is advised.

NSPI notes that its "high-sensitivity case for both natural gas and import power prices" indicate that "the common plan elements seen across IRP key scenario results are robust to a high commodity price environment."[73] This is because the results of this "2.1C.PRICES-1" sensitivity "show only minor adjustments to the resource plan in the face of higher prices."[74] We agree with NSPI's assessment of the results, which do not show major shifts in the optimal resource portfolio,[75] but we add an important caution. This sensitivity run tested natural gas and power import prices that were only about 25% higher than the base case and may not capture sea-change events that prognosticators have missed in the past (e.g., the emergence of shale gas). Note, too, that the price of imports (particularly those in New England) are historically correlated with natural gas prices, so a major shift in natural gas prices could be exacerbated by an associated shift in import power prices. It is therefore advisable to recognize the limits of the sensitivity runs and not conclude that the IRP results are robust across all future fuel and power price possibilities.

[73] 2020 IRP Report, page 103.

[74] 2020 IRP Report, page 103.

[75] 2020 IRP Report, Appendix K page 71.

C. Assessment of NSPI's Action Plan and Roadmap

1. NSPI's proposed Action Plan and Roadmap include a reasonable set of important commitments.

NSPI's Action Plan[76] and Roadmap[77] each include several important commitments that should stand to benefit NSPI customers. NSPI has laid out a series of actions that will translate the findings of the IRP into resource decisions regarding resource investments, development, procurement, and retirement. NSPI has also identified the key variables that will require monitoring going forward, particularly as part of its proposed "evergreen" IRP process.[78] While some details remain unspecified, and aspects of the Action Plan and Roadmap could be improved beyond what NSPI provided in its IRP Report, the Action Plan and Roadmap are overall a reasonable approach to next steps to be taken as the IRP process concludes.

2. The IRP is a guide (not a blank check), which does not obviate NSPI's burden to substantiate investment decisions.

NSPI appropriately states that "the IRP serves as a directional roadmap to guide future decision making but does not prescriptively predetermine actions over the coming years and decades."[79] NSPI continues:

> The IRP identifies several resource plans that could meet long-term goals and requirements, which vary in the type, quantity, and timing of resource changes. As Nova Scotia Power continues to study resource options and obtain new information, including costs for specific project options, it will use these resources plans as a guide but will adapt as necessary to best serve customers. The IRP Findings, Action Plan and Road Map are based on common insights across the scenarios studied, to ensure a 'no-regrets' approach is taken in the follow-up next steps.[80]

We agree with NSPI's discussion here. The IRP should serve as a guide for NSPI in its decision-making over the coming years, but should never be considered a mandate to make certain investments (i.e., Mersey hydro redevelopment) or as sufficient evidence to support

[76] 2020 IRP Report, pages 112 to 114.

[77] 2020 IRP Report, pages 114 to 115.

[78] 2020 IRP Report, page 115.

[79] 2020 IRP Report, page 11.

[80] 2020 IRP Report, page 11.

capital applications before the Board. Regarding capital applications, the IRP results are likely to be useful in supporting a particular request, but would likely require NSPI to demonstrate that the context in which a particular capital expenditure made sense in the IRP still holds at the time of the capital application. Such applications are likely to also require a comparison of competitive alternatives which, in our view, is best demonstrated through competitive procurement, not through utility-based estimates of alternatives.

3. NSPI should consider including certain common-sense suggestions, including some made by stakeholders, in its next steps.

While NSPI has put forth a reasonable overall Action Plan and Roadmap, NSPI should incorporate common-sense suggestions by some stakeholders.

The first common-sense suggestion relates to the incorporation of continued assessment of the diesel-fired combustion turbines as part of the evergreen IRP process. Resource Insight, for example, suggests that NSPI "[f]urther evaluate the longer-term sustaining capital forecast for the diesel [combustion turbine] fleet as part of its evergreen IRP process" and "[p]eriodically re-evaluate [combustion turbine] economics as the cost of storage falls, and especially if the units are using substantial amounts of fuel and the cost of their fuel rises significantly."[81] Heritage Gas also endorses "ongoing monitoring" of the combustion turbines "considering the recent history and vintage of these units"; Heritage suggests that NSPI should incorporate such "monitoring and reporting on the results" into the evergreen IRP process, "particularly in light of the value of new gas fired [combustion turbines] evidenced by the IRP analysis."[82]

A second suggestion is to take immediate action related to the first item in NSPI's Action Plan, which is related to the Regional Integration Strategy. The work involved in this action item is substantial: it includes "immediate commencement" of the "development" of both the Reliability Tie and Regional Interconnection "via an appropriate regulatory process;" it also includes "working with neighboring jurisdictions" and "conducting detailed engineering and economic studies for firm import options requiring new transmission investment and strengthened regional interconnections, including evaluations of availability and security of supply, emissions intensity, and dispatch flexibility."[83] Given (a) the demonstrated benefits of these regional solutions and (b) their unique risks, NSPI should follow through on its

[81] Resource Insight, Comments on Draft IRP Report, November 13, 2020, page 13.

[82] Heritage Gas, Comments on Draft IRP, November 13, 2020, page 5.

[83] 2020 IRP Report, page 25.

commitment to "immediate" action, including taking Heritage Gas' reasonable suggestion to conduct the detailed engineering and economic studies in the near term.[84]

A third suggestion is to take near term action on the first Roadmap item, identified as "engineering study work on coal to gas conversions at Trenton and Point Tupper Generating Stations."[85] The IRP results suggested that coal-to-gas conversions were economic in the majority of scenarios.[86] NSPI should consider these conversions as resource options alongside new resource alternatives (generation, demand-side management, battery storage, etc.) in meeting future capacity needs. Thus, to the extent that NSPI will seek to convert existing coal-fired generation to natural gas-fired generation, they should be ready to submit such a proposal in a competitive procurement solicitation in which such an option can be evaluated fairly alongside other market proposals. Being "ready" will likely mean completing this Roadmap item, and thus should be a strong impetus for completing this work in the near term.

A fourth (and similar) suggestion is to complete the system stability studies contemplated in the Action Plan meant to "determine whether additional dynamic system inertia constraints, operating limits, and/or provision of alternate services like Fast Frequency Response (FFR), are required to enable higher levels of wind integration on the Nova Scotia system, particularly in advance of the commissioning of integration measures such as the Reliability Tie."[87] As recommended by the Canadian Renewable Energy Association, NSPI should begin work on these studies "soon given the value that additional wind offers Nova Scotia customers."[88] We agree, and we note that these studies will likely precede a competitive solicitation, making their completion a priority.

One last suggestion relates to the Planning Reserve Margin and is a topic covered earlier in our comments. As we stated earlier, NSPI should make the monitoring of its actual and target Planning Reserve Margins a key component of its IRP evergreen process and should be responsive to stakeholders that seek updates to the studies that underpin NSPI's selected target Planning Reserve Margin. In other words, a PRM of less than 9% (UCAP)/20% (ICAP) could

[84] Heritage Gas, Comments on Draft IRP, November 13, 2020, page 4.

[85] 2020 IRP Report, page 28.

[86] 2020 IRP Report, page 109.

[87] 2020 IRP Report, page 113.

[88] CanREA November 13, 2020 Comments on Draft IRP, page 3.

be 'more optimal' and should continue to be evaluated as part of future procurement efforts and the IRP evergreen process.

4. NSPI should also commit to using best-practices competitive procurement.

We conclude our comments with what is likely our most important comment on the Action Plan and Roadmap. We strongly recommend NSPI employ competitive procurement to meet incremental energy and capacity needs at least cost, as some stakeholders have suggested.[89]

We make this as a general recommendation, recognizing that the timing, size, and specifications of the procurement(s) would require definition and additional thought. However, we wish to make a few basic points about key best practices in competitive procurement that NSPI should pursue.

First, NSPI should pursue competitive procurements that solicit binding offers – not indicative bids – from interested and qualified entities. This will allow NSPI to compare competitive alternatives that clearly identify the costs of a given proposal.

Second, NSPI should consider use of all-source RFPs, which would allow competition between disparate resources to provide common, defined products, such as replacement capacity for retiring thermal generation. Resources such as DSM, distributed energy resources, utility-sponsored coal-to-gas conversions, wind-plus-storage projects, and any number of qualifying projects that can provide what NSPI requires can and should be welcome to bid in such an RFP, allowing for a fair and complete comparison of these alternatives so as to minimize cost and risk to ratepayers while meeting system reliability requirements.

Third, to the extent NSPI conducts technology-specific RFPs (e.g., on-shore wind generation, as suggested in Roadmap item 3[90]), NSPI should recognize the interaction between the price of the solicited resource and the optimal quantity. For example, Scenarios 2.1C.WIND-1, which is the low wind cost case, and 2.1C.WIND-2, which is the low wind and battery cost case, see advancement of significant installations of wind from the 2030s (in 2.1C) to the 2024/2025, as well as the acceleration of the retirement of an additional coal unit from 2036 to either 2026 (low wind, low battery case) or 2030 (low wind case).[91] These results show the optimal portfolio's sensitivity to wind and battery costs, which underscore the importance of soliciting offers from the market to ensure the best and most timely pricing possible. Thus, NSPI

[89] See, for example, Resource Insight's November 13, 2020 Comments on the Draft IRP.

[90] 2020 IRP Report, page 113.

[91] 2020 IRP Report, Appendix K pages 156 to 159.

should avoid setting an RFP quantity target that is too restrictive, since doing so would deprive its customers of the benefits of cheaper wind that the market was willing to offer—even if NSPI did not foresee the attractiveness of those offers in conducting the IRP. Addressing this complexity in the context of a competitive procurement is possible, for example through use of a "price-to-beat" benchmark or cost-effectiveness test.

Fourth, competitive procurements can be designed to include bids from external control areas that could provide incentive for regional cooperation on transmission investment. Doing so could incentivize entities offering projects external to Nova Scotia to cooperate on broader regional coordination, including additional transmission investments.

Fifth, competitive procurement can also accommodate full participation by utility-sponsored projects and projects proposed by utility affiliates. This can allow customers to benefit from the development experience and capabilities of NSPI and its affiliates, while also providing customers with the benefits of competition from third-party developers.

Sixth, the competitive procurement can and should account for the reasonable expected value of any excess emissions allowances. NSPI appropriately recognized in its Roadmap the importance of the Cap-and-Trade Program and the potential for "value from incremental allowance sales."[92] Incorporating this value into competitive procurement will help ensure a more accurate accounting of projects' costs and benefits, and thus a more optimal outcome for ratepayers.

[92] 2020 IRP Report, page 29.