Resource Insight Inc.

MEMORANDUM

To: Linda Lefler, Senior Project Manager, Regulatory Affairs

Nova Scotia Power

From: John D. Wilson and Paul Chernick

Date: February 5, 2020

Subject: Input on Scenarios and Evaluation Criteria

On behalf of the Consumer Advocate, Resource Insight would like to submit some initial suggestions related to scenarios and evaluation criteria. Our official comments on the Draft Analysis Plan will come later, but we wanted to offer this input since NSP is working on developing draft scenarios for circulation.

1. Input on Scenarios

While it is appropriate to consider a limited number of scenarios, the objective should be to spread out the resulting portfolios, so that each preferred portfolio will be tested under all scenarios. For example, does the preferred portfolio from Scenario A test well in Scenarios B-F? What preferred portfolio tests well in a wide range of portfolios?

Scenarios should test uncertainties in key drivers that are generally beyond the control of the utility. The key areas of uncertainty are resource alternatives (preferences for or constraints on options) and the load served (total energy and load shape). While most utility scenarios focus on testing baseline and its alternatives, we also suggest testing "spliced" scenarios to understand what portfolios might be most resilient.

With respect to generation, the drivers should include the following.

- Corporate push for earmarked renewables (large customers who wish to procure renewable energy directly, or via RECs associated with utility-supplied electricity)
- Potential for development of on-site storage, with storage levels potentially exceeding those suggested by utility benefit-cost analysis
- Regional transmission enhancement
- Regional energy development initiatives, such as, offshore wind, or additional development at Gull Island
- Policies or costs that drive levels of DER technologies
- Varying levels of CO_2 regulation

- Varying costs for storage, solar and wind development, hydro sustaining capital and LEM projects, and fossil fuels
- Varying costs for mitigation to achieve net zero carbon emissions by 2050 as required by the Sustainable Development Goals Act
- Mandatory Coal retirement by Dec 31, 2029 (i.e., assuming Equivalency Agreement is not extended beyond 2024)

In terms of scenarios that tie these drivers together, we suggest three.

- **Business as Usual**
- **Aggressive Carbon Policy** – substantially more steeply sloped carbon allowance constraints and pricing (including a clean fuel standard), with federal policies driving electrification and DERs; in addition to the direct effects of the policies (potentially including federal technology incentives), costs for renewables and electrification-related technologies should be lower than the BAU case due to higher demand
- **Transformative Regional Energy Policy** – bundle corporate renewables push, regional transmission enhancement, regional energy development initiatives, enhanced DERs, lower net cost for storage (and potentially solar and wind), mandatory coal retirement by 12/31/29

With respect to load, several suggestions were made during the workshop related to drivers, here are our thoughts.

- Economic drivers, both general (personal income, retail sales, employment) as well as regional or local industrial activity
- Electrification of both building and transportation (on-road, rail and marine)
- Energy efficiency adoption rate

With respect to the energy efficiency adoption rate, according to the Assumptions Set, NSPI intends to use the four scenarios provided by EfficiencyOne's Potential Study as a load modifier. Ideally, there would be a distinction between those actions undertaken as a matter of policy by Efficiency Nova Scotia and NSP initiatives, and all other sources of energy efficiency (consumer behavior, codes/standards, technological developments, etc.). We suggest that the DSM levels identified in the Assumptions Set be considered as alternative Board/utility strategies, rather than externally driven scenarios. In other words, the different DSM program levels should be tested across all scenarios.[1]

[1] Ideally, this would be done in a manner similar to supply side resources. However, if NSP follows the load modifier approach, then it could select a relevant DSM level for

In terms of tying these drivers together into scenarios, we suggest two additional scenarios:

- **Electrification and Industrial Growth** – building and transportation electrification, plus additional industrial growth – this would test both higher load as well as a shift in the load shape
- **Efficient Economy** – a high rate of energy efficiency (driven by customer adoption, codes & standards, etc.) and BTM solar, with modest or low economic growth offsets moderately enhanced electrification, resulting in load below the baseline forecast

Our suggestion for "spliced" scenarios is a little unconventional. The two scenarios we suggest are:

- **Major Natural Disaster** – Baseline scenario for the first 10-15 years, followed by a major natural disaster involving destructive flooding and wind damage to the NSP system and vulnerable fuel supply infrastructure, and also considering a sudden change in population (either an increase or decrease).
- **Delayed Carbon Policy** – Splicing the Electrification and Industrial Growth scenario for the first 10-15 years (assuming current legislative requirements remain in place), followed by a sudden shift to an Aggressive Carbon Policy.

The "spliced" scenario concept is that in the interest of generating very diverse portfolios for evaluation, these two scenarios could generate very unusual portfolios. Given that system planning models have perfect foresight, the model answers the question, "If NSP 'knew' that these events would happen, what portfolios would be most favorable?"

- The Major Natural Disaster scenario would result in a portfolio that performs well in the short run, while minimizing investment in vulnerable infrastructure, and perhaps over-invests in redundancy.
- The Delayed Carbon Policy scenario would be useful if there were stark differences between the Baseline and Aggressive Carbon Policy scenarios. This scenario would result in a portfolio that performs well in the short run, while investing in resources that will perform adequately when carbon policy is suddenly implemented.

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each scenario initially, and then re-evaluate the most useful scenarios using alternative DSM levels to identify an optimal level. This step needs to occur during capacity planning so that the resource mix is optimized to the DSM level.

Then, if the resulting portfolios perform well when tested against the other scenarios, one could say that such portfolios are resilient to natural disaster or sudden carbon policy shifts.

2. Evaluation Criteria

We generally support the evaluation criteria, but suggest three changes: modification of the rate effects and robustness metrics, and the addition of a qualitative resiliency metric.

First, the rate effects metric should be revised to a bill effects metric since customers are more concerned about the bills they pay than the underlying rates. The metric could be calculated as follows:

- Allocate the revenue requirement to customer classes using a simplified allocation metric
- Calculate the average monthly bill by customer class based on forecast customer count and forecast demand by customer class

Second, while we see a role for sensitivity analysis, a more effective method for measuring robustness is to calculate an explicit measure of risk. It appears from the description that Plexos will be utilized to model deterministically, and its capability for stochastic analysis will not be utilized. We would like to understand whether NSP could utilize these capabilities to explicitly model the financial risk, or uncertainty around the cost of the risk of the plan.

Any driver that affects the financial metrics of the plan comes with uncertainty. The stochastic analysis capability of Plexos can be used examine how the uncertainty of these drivers affects the portfolio cost. A risk/benefit ratio could be calculated by comparing the cost of above average cost outcomes with the benefit of below average cost outcomes.

In addition to measuring risk with stochastic analysis, sensitivity analyses could be done to clarify the specific effect of adjusting individual drivers (e.g., high or low fuel price forecasts). These sensitivity analyses could be done in deterministic or stochastic mode as well.

Third, we suggest adding a resiliency metric. This would be a qualitative metric that considers how the leading portfolio alternatives perform in the two resiliency scenarios (and perhaps across all scenarios). Some simple quantitative metrics might help inform this review, but ultimately this is a judgement call since there is not really a good method for quantifying the probability of each scenario.

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MEMORANDUM

To: Linda Lefler, Senior Project Manager, Regulatory Affairs

Nova Scotia Power

From: John D. Wilson and Paul Chernick

Date: February 26, 2020

Subject: Input on Draft Scenarios, Strategies and Sensitivities

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On behalf of the Consumer Advocate, Resource Insight would like to submit some comments on the draft scenarios, strategies and sensitivities.

Scenarios

As we understand the plan, NS Power intends to use Plexos for its full modeling, but it will also use E3's RESOLVE capacity expansion model to pre-screen the scenarios. As we understand it, the intent is to use RESOLVE to test whether the different scenarios produce significantly different capacity expansion plans. We strongly support this idea, as we have observed too many IRPs test scenarios that result in almost identical capacity expansion plans.

We recommend considering the following scenario instead of Scenario 2 (Net Zero – High Electrification):

- Accelerated 1.0 Mt 2050 / High Electrification + Higher Industrial/Marine Demand / Coal End 2030

We infer that Scenario 2 is probably the maximum build case. Our suggested modifications would further differentiate this scenario, expanding the decision space in a useful manner. We are suggesting three rationales.

First, we suggest this scenario should have an early coal end. Policies to achieve high electrification would logically be promoted in concert with accelerated coal phase-out. The argument for switching load to electricity is much stronger if the electric supply is cleaner. A 1.0 Mt target seems realistic, given the rate of load growth and required renewable buildout.

Second, the Pathways report excluded the industrial and marine sectors from electrification or other drivers of load growth. Global technology trends will tend to shift more industrial energy use to electricity, for 3D printing, automation and the like. The improvements in batteries and electric propulsion that promote electric road vehicles will also support electrification of marine vessels and such

industrial vehicles as forklifts. Offshore wind development around Nova Scotia could further increase the development of battery-powered support vessels. From the perspective of the IRP, industrial and marine electrification would be modeled as higher loads, with high load factors and/or largely off-peak charging.

Third, NSP has not proposed to test the early coal closure date with the "current landscape" strategy, only with the "regional integration" strategy. Phasing out coal early may be economic (or have only a small incremental cost), even without major changes in policy or utility infrastructure plans. Our alternative scenario suggestion, above, would address that gap. If NSP does not want to add a scenario to consider this option, some scenario/strategy pairing(s) should be modified to get at this question.

Strategies

The strategies seem to cover an appropriate range of policy directions. We would like to better understand the components of the regional integration strategy; we may have further comments, once we see more detail.

We question the decision to test only one strategy under the comparator case.[1] The comparator case is the scenario that best reflects current clean energy policy. The Board should be provided with information about the relative performance of several resource strategies under the current policy scenario.

The "no new emitting resources" strategy might be better tested as a portfolio sensitivity to other strategies, rather than a distinct strategy. It is currently included in only one of the preliminary modeling runs, paired only with regional integration. It might make sense to hold it out and see what new emitting resources are built in the modeling runs, then apply it as a portfolio sensitivity to a few selected runs to see what the non-emitting alternative would be in those scenario/strategy pairs. Depending on how diverse the results were, one or more of those alternative portfolios could then be carried forward.

This may increase the number of preliminary modeling runs. However, as stated above, we support the concept of using RESOLVE to assess the modeling runs and narrow them down to ensure that resources are devoted to assessing significantly different portfolios.

Sensitivities

Regarding sensitivities, should there be a sensitivity regarding the price paid for power exported *from* Nova Scotia? Is that price modeled to follow import price? Is

[1] Also, the term "comparator case" isn't as clear as the rest of the scenario descriptions.

there a reasonable future in which Nova Scotia will have significant exports, such as increased transmission and wind development?

We also appreciate the suggestion to include resiliency testing, which appears to be a response to one of our "spliced scenarios." As we understand it, the idea is to test the impact of a net zero carbon constraint policy on a portfolio built to the "comparator case" scenario. We suggest that the reverse sensitivity should also be tested: test the impact of "comparator case" policy on a portfolio built to one of the "net zero" scenarios. In each case, the idea would be to test the cost of anticipating the wrong scenario.

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MEMORANDUM

To: Linda Lefler, Senior Project Manager, Regulatory Affairs
Nova Scotia Power

From: John D. Wilson and Paul Chernick

Date: February 26, 2020

Subject: Input on Draft Analysis Plan

On behalf of the Consumer Advocate, Resource Insight would like to submit some additional comments on the draft analysis plan.

Previously, we suggested including resiliency testing related to a major natural disaster. We have reflected on this and, while we think the model could be used to explore such a potential future, it may not be the best way to address this issue.

Instead, we suggest adding a new section or subsection to the IRP discussing the potential impact of an extreme natural disaster on Nova Scotia's energy supplies. We suggest imagining if sea level rise accelerates at the high end of projections over the next 10–15 years, and a category 5 hurricane makes it as far north as Nova Scotia (or a similarly destructive winter storm). Our thinking is guided in part by the hurricane that has left Puerto Rico in such dire circumstances.

Of course, NS Power's equipment and staffing are better than PREPA's, and likely to fare better in similar circumstances. Nonetheless, decisions about resource planning may help NS Power prepare better for events that cannot be dismissed, given the surprising rate at which some climate changes are occurring.

The review would consider:

- Which thermal plants are most likely to be damaged by flooding?
- Would the hydro system assets function adequately under worst-case flooding?
- How much damage might solar and wind facilities incur?
- What would be the potential impact on Nova Scotia's transmission and distribution infrastructure of winds and flooding?
- Would power-plant fuel supplies be disrupted?
- How long would restoration of the T&D system take?
- Would restoration be affected by damage to other energy supplies or key infrastructure?
- Would adequate generation be available to serve load as the T&D system is restored?

These questions could be answered in the context of evaluating the strategies that NS Power is considering in the IRP. Are some strategies more resilient than others? Are there specific investments or technology choices that would be preferred? Would BTM solar and storage (or even wind and storage) improve resilience?