

Memorandum



Date: July 30, 2014
To: IRP Intervenors
From: NS Power
Subject: 2014 IRP – Analysis Plan Update and June 25 Technical Conference

This memorandum provides a status update on the work that has taken place since the June 25 Technical Conference and NS Power’s response to feedback from interested parties.

1. Introduction

On March 7, 2014, NS Power hosted a Technical Conference at which it reviewed initial draft assumptions and discussed its preliminary thoughts on the analysis plan for the 2014 Integrated Resource Plan (IRP) to obtain feedback from participants.

On March 14, 2014, NS Power circulated draft basic assumptions for feedback. The Company also circulated additional assumptions details in response to requests from Larry Hughes, PhD., the Industrial Group and the Nova Scotia Department of Energy. The March 14th material included a memo describing the five steps NS Power proposed for the Analysis Plan.

On April 11, 2014, NS Power circulated final assumptions which were developed in collaboration with UARB staff and their consultants. The April 11 memo included a brief discussion of NS Power’s proposed approach to completing the Analysis Plan, specifically to model a limited number of Candidate Resource Plans, sensitivities and worlds that bound the wide range of possible permutations and combinations that have been suggested. The Company released draft assumptions for Wind Capacity Value and Variable Generation Integration on April 23 and May 1, 2014, respectively, for stakeholder feedback.

On June 5, 2014, NS Power circulated an Analysis Plan update that proposed assumptions/attributes for the Reference World drawn from the April 11 set. They are: the base load forecast, Scenario A emission constraints, 40% RES requirement in 2020 and Maritime Link+ economy energy purchases. The June 5th memo explained that NS Power, in collaboration with UARB staff and consultants, identified 30 draft resource plans. NS Power developed each draft resource plan based upon a general “theme” and on the existing resources and resource commitments in effect at the start of that plan.

The draft resource plans reflect different input assumptions for four key components:

- DSM levels
- Coal plant retirement dates
- Target levels of wind generation assets
- Potential for a large Power Purchase Agreement (PPA)

NS Power identified five of the 30 draft resource plans as Candidate Resource Plans for initial modelling in Strategist under the Reference World.

On June 25, 2014, NS Power hosted a Technical Conference to discuss the analysis plan and preliminary IRP results. The Company also solicited comments from interested parties with respect to Candidate Resource Plans, sensitivity testing and worlds to be modelled.

A record of IRP communications to date can be found at the following link:

<http://www.nspower.ca/en/home/about-us/electricity-rates-and-regulations/regulatory->

2. Progress since June 25 Technical Conference

Following discussions with interested parties and submissions from the June 25th Technical Conference, the Company has added several Candidate Resource Plans and proposed sensitivities. It is also proposing an additional alternative world. The details of the current set of CRPs, sensitivities and worlds are provided in Attachment 1 and discussed below.

Candidate Resource Plans

In collaboration with Synapse and based on feedback from interested parties, NS Power has selected 16 Candidate Resource Plans (from among an initial set of ~30) that it may ultimately evaluate under the Reference World and 2 CRPs under the High Load World. NS Power has identified these based upon:

- DSM levels
- Coal plant retirement dates
- Target levels of wind generation assets
- Mersey hydro incremental capacity capability
- DR levels
- Potential for a large Power Purchase Agreement (PPA)
- Tufts Cove unit retirements & repowering

As noted in the June 5th memo, and at the June 25th Technical Conference, the evaluation of this universe of Candidate Resource Plans is an iterative process. As of July 29, NS Power has modelled seven of the 18 CRPs. The results from modelling those initial CRPs, and the next several CRPs, will help NS Power determine which of the remaining CRPs it should model.

CRP 1	Low DSM, Maximum Coal Use, Base Wind
CRP 2-1	Base DSM, Maximum Coal Use, Base Wind
CRP 2-No-DR	Base DSM, Maximum Coal Use, Base Wind, no DR
CRP 2-50 (FGD)	Base DSM, Maximum Coal Use, Base Wind, with FGD
CRP 3	Base DSM, Maximum Coal Use, Medium Wind
CRP 3-Wind_cap	Base DSM, Maximum Coal Use, Medium Wind with optimized wind capacity credit
CRP 4-1 (FGD)	Base DSM, Medium Coal Use, Base Wind, with FGD
CRP 4-1	Base DSM, Medium Coal Use, Base Wind
CRP 5	High DSM, Maximum Coal Use, Base Wind
CRP 5-No-DR	High DSM, Maximum Coal Use, Base Wind, no DR
CRP 6	High DSM, Minimum Coal Use, High Wind
CRP 7	High DSM, Minimum Coal Use, Medium Wind
CRP 8	Base DSM, Minimum Coal Use, High Wind
CRP 9	Base DSM, Minimum Coal Use, Medium Wind
CRP 10	Base DSM, Medium Coal Use, Medium Wind
CRP 21	Base DSM, Maximum Coal Use, Medium Wind, PPA (<i>High Load World</i>)
CRP 31	Base DSM (performance limited to 50% peak reduction, 100% energy), Maximum Coal Use, Medium Wind
CRP 32	Base DSM (performance limited to 50% peak reduction, 100% energy), Maximum Coal Use, Medium Wind, PPA (<i>High Load World</i>)

For the above plans, “Base Wind” refers to the currently planned 582MW of wind, “Medium Wind” is a total of 732MW, and “High Wind” is a total of 882MW of wind. Please refer to Attachment 3 for assumed retirement dates for each of the coal retirement levels in the various CRPs.

Sensitivity Analysis

The purpose of a sensitivity analysis is to test plan robustness; it does this by computing the change in revenue requirements for a given set of CRPs given a change to key input assumptions. In these sensitivity analyses, NS Power holds all capital investments and build-outs constant, and thus effectively limits the evaluation to a re-dispatch of the resources available under the given CRP.

S1: Scenario B emissions*Run across all CRPs*

S1 sensitivity analysis will be performed using the Scenario “B” emissions constraints assumptions.

S2: Scenario C emissions*CRP 2-1, CRP 2-No_DR, CRP 2-50(FGD),
CRP 4-1, CRP 4-1(FGD), CRP 6, CRP 8,
CRP 9, CRP 21*

S2 sensitivity analysis will be performed using the Scenario “C” emissions constraints assumptions.

S3: High natural gas price, High import price*Run across all CRPs*

S3 sensitivity analysis will be performed using the “high” forecast assumptions for natural gas and import prices.

S4: Low natural gas price, Low import price*Run across all CRPs*

S4 sensitivity analysis will be performed using the “low” forecast assumptions for natural gas and import prices.

S5: Regional Coordination Approach*CRP 3, CRP 3-Wind_cap, CRP 6, CRP 7,
CRP 8, CRP 9, CRP 10, CRP 21, CRP 31,
CRP 32*

S5 sensitivity analysis will reflect a “regional coordination” approach, lowering only the New Brunswick import prices, representing a situation where there is more coordination between NB and NS to allow better wind integration.

S6: Low cost, high sulphur coal*CRP 2-50(FGD), CRP 4-1(FGD)*

S6 sensitivity analysis will be performed by making high sulphur coal available at a low cost.

S7: High cost, high sulphur coal*CRP 2-50(FGD), CRP 4-1(FGD)*

S7 sensitivity analysis will be performed by making high sulphur coal available at a high cost.

S8: Higher DSM cost

Run across all CRPs

S8 sensitivity analysis will be performed by increasing the cost of the DSM program.

S9: Optimistic wind

CRP 3, CRP 3-Wind_cap, CRP 6, CRP 7, CRP 8, CRP 9, CRP 10, CRP 21, CRP 31, CRP 32

S9 sensitivity analysis will be performed by modelling wind with a lower cost and higher output.

S10: Optimistic natural gas CTs

CRP 1, CRP 2-1, CRP 2-No_DR, CRP 2-50(FGD), CRP 5, CRP 5-No_DR, CRP 6, CRP 8, CRP 21

S10 sensitivity analysis will be performed by modelling natural gas CTs with a lower cost and lower heat rate.

Worlds

The selection of worlds is intended to reflect what could happen if load in the future is significantly higher than the load assumed in the Reference World. The Company wants to analyze what may happen if the Reference World does not materialize. The worlds are not intended to be an exhaustive analysis of all potential futures. Rather, they are meant to “bracket” the range of possible futures.

In these analyses, NS Power runs Strategist and allows it to change the build-out. NS Power expects to identify a CRP or CRPs different from the 16 identified under the Reference World because of the higher load requirements.

High Load World (World 2)

CRP 21 Base DSM, Maximum Coal Use, Medium Wind, PPA

CRP 32 Base DSM (performance limited to 50% peak reduction, 100% energy), Maximum Coal Use, Medium Wind, PPA

The CRP, sensitivity and worlds selection represent an effort to reflect the broad views of the stakeholder group. Certain sensitivities and CRPs are intended to test the bounds of the planning exercise and are outliers in the analysis process.

3. Responses to feedback on June 25 Technical Conference materials

The Company would like to thank interested parties for their feedback.

Attachment 2 provides a detailed response to the feedback received on the Company's analysis plan. Following is a synopsis of the Company's responses on several common comments:

Basis for selection of initial Candidate Resource Plans (CRPs) from 30 draft resource plans

The initial Candidate Resource Plans were selected from the 30 draft resource plans based on the goal of developing a set of CRPs that span a reasonable range of plausible resource choices (the IRP Terms of Reference at page 3 specify that NS Power is to assess "a reasonable, but not unlimited, number of alternative plans"). The sequence in which NS Power made this selection, and the criteria it considered at each stage of the sequence, is summarized below:

- NS Power, in collaboration with UARB staff and consultants, began by identifying 30 draft resource plans (see Attachment 1 to June 5, 2014 memo to stakeholders). Each draft resource plan began with the existing resources and resource commitments in effect as of 2015. Those draft resource plans differed in terms of four major input variables/components that were expected to have the potential to significantly change the results of the plan (e.g. revenue requirements, robustness). Those four key input variables/components were: DSM level, variable generation level (e.g. wind), fossil unit retirement dates (coal, Tufts Cove) and potential for a large Power Purchase Agreement (PPA) – please refer to the June 5th memo to stakeholders and its Attachment 2, slide 12.
- NS Power then identified five of the 30 draft resource plans to model in Strategist as initial CRPs under the Reference World. The initial CRPs were selected to begin developing a set of CRPs that spanned a reasonable range of plausible, and materially different, resource choices. They were selected to reflect three different levels of DSM, two levels of variable generation (e.g. wind), and two levels of coal retirements. NS Power expected that the results from modelling these five initial CRPs would help it determine which of the remaining draft resource plans it would need to model in order to evaluate a reasonable range of plausible, and materially different, CRPs and which it would not need to model because they would not produce materially different results.
- Based upon the results of modelling the initial five CRPs and upon further examination of the components that can most affect the results of CRPs, NS Power has identified an additional 11 initial CRPs to model under the Reference World. These 11 additional CRPs are included in the list of CRPs described earlier in this memo. These additional

initial CRPs were again selected as part of the process to develop a set of CRPs that span a reasonable range of plausible, and materially different, resource choices. The additional 11 CRPs reflect higher levels of wind, earlier coal plant retirement and different DSM levels. They complement the initial five CRPs by representing a further range of differences in levels of DSM, variable generation, levels of coal retirements, Demand response levels, Tufts Cove unit retirements and repowering and PPAs. The Company has also identified two additional CRPs to be modelled under the High Load World.

Basis for choosing to use Plexos to perform more granular analyses of certain CRPs

NS Power uses Strategist to identify the optimal resource additions for a given CRP and to model the operation of its system over the 25 year planning period for that CRP (see June 25, 2014 slide deck, slides 38 to 45). Strategist models “typical week” profiles for loads and non-dispatchable resources, but it does not conduct an hourly dispatch simulation of thermal resources.

Modelling the NS Power system at this level of detail in Strategist is typically a sufficiently accurate representation for CRPs composed primarily of DSM resources and dispatchable supply resources. However, modelling the NS Power system at this level of detail may not be a sufficiently accurate representation for CRPs with high levels of non-dispatchable or intermittent resources such as wind and solar. As a result, NS Power expects to use Plexos to model the operation of its system in selected years for certain CRPs (see June 25, 2014 slide deck, slide 85).

Plexos is a system simulation model designed to analyze a full spectrum of system attributes in each of the 8,760 hours that make up a given year. The Company proposes to use Plexos to examine certain CRPs (i.e. high wind, high DSM, Scenario “C” emissions) to evaluate key system operational attributes that Strategist does not evaluate, such as dispatch within generating unit commitment constraints, transmission system constraints, dynamic reactive reserve requirements, wind generation curtailment, and other chronological system constraints. The analysis may show that the system needs reinforcement or that, although Strategist has indicated that a given CRP meets the system’s annual capacity, generation and emissions needs, the CRP does not satisfy the system’s hourly operational needs. NS Power will use its engineering judgment, in collaboration with Synapse, to determine which CRPs require Plexos analysis. NS Power will document its rationale for choosing to apply Plexos to specific CRPs. It will also identify any CRP that it excludes from further consideration based upon the Plexos assessment and the reasons for that exclusion.

Basis for Selection of the Preferred Resource Plan

NS Power will present stakeholders with the results of its analyses of the CRPs on or before the Technical Conference scheduled for September 12, 2014. In those materials, NS Power will present for discussion the Preferred Resource Plan it is proposing to select from those CRPs and the basis for that selection.

The primary criterion for selection of the Preferred Resource Plan will be cumulative present worth of the annual revenue requirements of the resource plan over the planning horizon, as specified on page 3 of the IRP Terms of Reference approved by the UARB. When applying that criterion, NS Power will consider the robustness of the CRPs under consideration by assessing their results under the sensitivity analyses and the other worlds.

NS Power will also consider additional criteria, including system reliability requirements, flexibility, future regulatory emissions outlook, timing and rate effects and end effects beyond the planning horizon. NS Power will attempt to quantify each of these additional criteria for each of the CRPs it considers in the selection of the Preferred Resource Plan in monetary terms where possible, but otherwise in physical terms. One of the issues for discussion at the September 12 Technical Conference will be the relative weights to give each of these additional criteria.

NS Power invites stakeholders to submit suggestions for developing physical and/or monetary values for the additional criteria, as well as the weights to be given to each additional criterion. NS Power will discuss these suggestions in the September Technical Conference.