

Integrated Resource Plan (IRP) Report

Volume 1

Nova Scotia Power Inc.

July 2007

TABLE OF CONTENTS

Executive Summary	i
1.0 INTRODUCTION	1
2.0 NSPI RESOURCE PLANNING CONTEXT	2
3.0 ISSUES TO BE ADDRESSED	7
4.0 IRP PROCESS OVERVIEW	8
5.0 RESULTS AND IRP CONCLUSIONS	18
6.0 SUMMARY	34
7.0 STAKEHOLDER COMMENT ON IRP	39
8.0 ACTION PLAN.....	41

APPENDIX 1 - IRP TERMS OF REFERENCE

APPENDIX 2 - NSPI SYSTEM DIAGRAM

APPENDIX 3 - BOARD CONSULTANT COMMENT

APPENDIX 4 - LIST OF FORMAL INTERVENORS

APPENDIX 5 - IRP ANALYSIS FLOWCHART

Executive Summary

In collaboration with Nova Scotia Utility and Review Board (“UARB”, “Board”) staff and its consultants, and with Integrated Resource Plan (“IRP”) process stakeholders, Nova Scotia Power Inc. (NSPI) has developed a long-term resource plan for the Board’s consideration. The recommended plan integrates supply and demand-side options to provide a strategic framework for meeting environmental legislation and regulations, cost effectively and reliably.

The current context for integrated resource planning in Nova Scotia centers on the need to concurrently meet the growing requirements for electricity, while accomplishing significant near term and longer term reductions in emissions of key air pollutants. Actions are needed to meet established 2010 emissions regulations. Significant additional actions will also be needed to meet the expected, but as yet unspecified, longer term air-emissions goals. Today’s rapidly evolving air-emissions regulatory policy requires a thoughtful, flexible approach.

The central theme of the recommended IRP is achieving reductions in NSPI air-emissions and meeting forecast increases in NSPI customer load. It appears this can be accomplished most cost-effectively through investment in demand-side management (“DSM”) programs and renewable generation as well as through upgrades to NSPI’s existing generation fleet.

To address specific issues raised during the IRP process, the analysis concludes the following:

- Based on experience in other jurisdictions and the limited DSM currently in place in Nova Scotia, an increase in spending in this area appears economically sound. The IRP analysis suggests positive benefits accrue at levels of spending up to five percent of total revenue.
- Renewable generation appears to be cost-effective compared to certain new fossil-based capacity. The technical and economic viability of achieving large amounts of intermittent resource across Nova Scotia requires further work in order to ultimately determine the amounts to pursue in Nova Scotia.

- Generation from existing NSPI base load fossil-fuel plants remains low cost compared to alternatives, even with added investments needed for emissions control. Continued operation of the fossil fuel fleet at high capacity factors appears economic. Incremental investment to increase the capacity and environmental performance of these units is cost-effective.
- The addition of a scrubber to the Lingan plant by 2020 appears economic. In the interim, emissions can be managed cost-effectively through utilization of lower-sulphur fuels. Emerging Federal Government sulphur dioxide emissions regulations, as previewed in the April 26th “Regulatory Framework for Air Emissions” could change this outcome. This development will continue to be monitored.
- NSPI likely has a two year window (2010 timeframe) before a decision needs to be made with respect to the need for a large-scale generation capacity addition.
- The implementation of “hard carbon caps” with limited availability of offsets significantly alters the IRP analysis in the post 2020-period. If aggressive changes in this regard are introduced, the IRP resource plan for later years will likely need to be revised. The early years’ recommended resource plan would remain robust.

The IRP process identified three key areas where additional information, not available today, is required:

- How fast can DSM effectively and economically ramp up in Nova Scotia?
- How much intermittent capacity can be placed reliably and economically on the electrical system in Nova Scotia?

- What will be the requirements arising from pending emissions regulation being contemplated or put forth by the Governments of Canada and Nova Scotia?

There is much to be done by 2010. An Action Plan has been developed which is designed to: assess the opportunity for DSM and renewables in our Province; optimize existing generation assets; and monitor ongoing developments with respect to emissions regulation and emerging technologies. The Action Plan contains the following components:

- NSPI should undertake to design a comprehensive DSM program, considering earlier work and the IRP. The program will, in the initial years, need to reflect the status of DSM development in Nova Scotia. A primary initial objective will be to assess the longer term level of DSM that is sustainable both economically and in terms of stakeholder acceptance. This can be accurately assessed through targeted DSM program activation coupled with appropriate measurement and verification.
- NSPI will continue to support work to complete a Wind Integration Study. This work will inform the potential of large-scale intermittent generation in Nova Scotia.
- NSPI will apply to the UARB for the approval of capital investments to optimize the capacity and environmental performance of existing generation assets.
- NSPI will continue to actively monitor technology developments both with respect to low impact generation technologies and environmental retrofit technologies.
- NSPI will continue to explore opportunities to obtain additional clean power sources from within and outside the province.

- NSPI will continue to participate in the development of the Federal Regulatory Framework for Air Emissions as well as provincial developments to the benefit of Nova Scotia.
- NSPI will update the IRP as more specific information on DSM and renewables is available. A report to the UARB on the status of items included in the Action Plan will be filed in approximately two years.

The IRP process has achieved its objective. The recommended reference plan is robust and provides a clear direction for addressing electric energy and environmental needs in the coming years.

The IRP process has served to highlight the complexity and dynamic nature of utility planning today. The resultant Action Plan sets forth a direction which will enable NSPI and customers to seize current opportunities and manage effectively through an uncertain future.

1.0 INTRODUCTION

The IRP Terms of Reference (Appendix 1) as approved by the Nova Scotia Utility and Review Board contains the following objective:

“To develop a resource plan which utilizes supply-side and demand-side options, to enable NSPI to meet future emissions and other requirements in a cost-effective and reliable manner.”¹

NSPI, Board staff and the Board’s consultants have collaborated to develop the resource plan referenced in the IRP objective. This process, and the analysis and recommendations flowing from it, are the subject of this report.

To provide a complete record of the IRP development this report is presented in three volumes. Volume 1 provides a description of the IRP process, analysis results and recommendations, with a focus on presenting the recommended action plan. Volume 2 is a compilation of material issued to Intervenor throughout this process. Volume 3 provides copies of Intervenor comment on the IRP results and final report.

The IRP development is a strategic exercise. The IRP provides important strategic direction, as opposed to proscriptive solutions. Tactics presented in the Action Plan, including increased investment in Demand-Side Management and investment in utility plant, require formal application to the Utility and Review Board by NSPI. These filings will require UARB approval to fund the initiatives as part of customer rates.

¹ IRP Terms of Reference, approved by UARB on July 24, 2006.

2.0 NSPI RESOURCE PLANNING CONTEXT

NSPI Overview

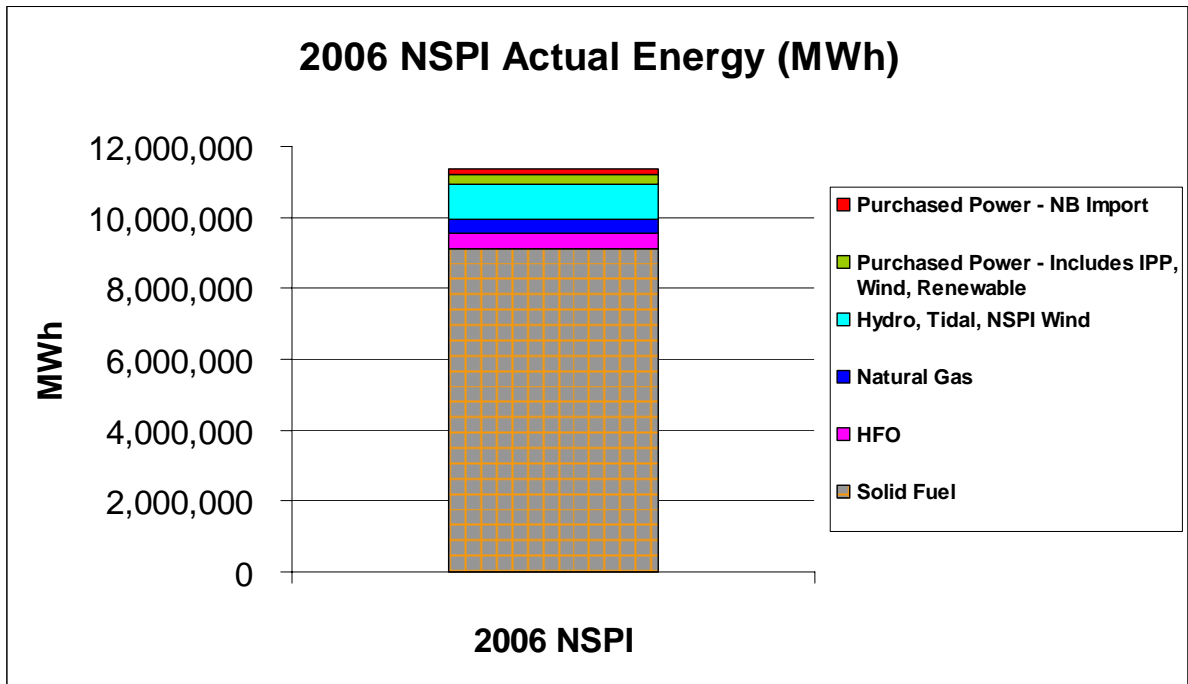
NSPI is a vertically integrated electric utility, regulated by the Nova Scotia Utility and Review Board. The Company serves 470,000 residential, commercial, industrial and municipal customers across Nova Scotia. In 2006, peak load was 2,085 megawatts. Total energy produced was 11,352 gigawatt hours.²

A diagram of the Company's power system is provided in Appendix 2. The NSPI transmission system spans the Province and is interconnected with the New Brunswick power system across a 345 kilovolt inter-tie. The inter-tie can allow for sharing of reserves and economic exchange of energy. The maximum capacity of the inter-tie is 300 megawatts import, 350 megawatts export.

The table and chart below summarize the resource mix of NSPI's generation fleet. The Company's generation portfolio is primarily fossil fuel based, the majority of which is low-cost coal and petroleum coke.

<i>As of IRP Basic Assumptions</i>	
Generation Type	Capacity (Firm MW)
Hydro & Tidal	397
Natural Gas	98
LFO	222
HFO & Natural Gas	321
Coal & Petcoke	1252
SUB TOTAL NSPI Installed	2290
Contract IPP pre 2001	26
New Renewables post 2001 contracted firm capacity on peak (mostly wind)	18
SUB TOTAL Contracted Firm	44
TOTAL	2334

² For 2006 a major customer was off-line for a portion of the year.



Over the past decade all NSPI generation additions have been either natural gas fired or renewable. NSPI has reduced emissions of sulphur dioxide by 25 percent since 2005. It has also recently initiated a program to install Low NO_x Combustion Firing Systems on its solid fuel units. This technology can reduce NO_x emissions by 40 percent or more. The installation at Lingan 3 is complete. Lingan Units 2 and 4 installations are under construction, with applications to the UARB anticipated for Pt. Tupper, Trenton and Lingan. In addition, NSPI has filed applications with the UARB to install a baghouse and replace the generator for Trenton 5.

Air Emissions Legislation and Regulation

Fossil fuel plants emit sulphur dioxide, nitrogen oxides, mercury and carbon dioxide (a greenhouse gas). All are the subject of increasingly stringent legislation and regulations, both at the provincial and federal government levels.

NSPI reported the following emissions for 2005 and 2006³:

	2005	2006
Sulphur dioxide	103,772 tonnes	106,617 tonnes
Nitrogen oxides	32,305 tonnes	28,040 tonnes
Mercury	105 kilograms	162 kilograms
Carbon dioxide (equivalent) ⁴	10,648,422 tonnes	9,745,204 tonnes

The Nova Scotia Air Quality Regulations⁵ specify the following maximum emission levels for nitrogen oxides and sulphur dioxide:

- 2009 Nitrogen oxides 21,365 tonnes
- 2010 Sulphur dioxide 72,500 tonnes

The recently released Federal Government's Regulatory Framework for Air Emissions proposes the following additional reductions for the electricity sector from 2006 emission levels (specific limits for NSPI have not been developed and could be different than the sectoral averages listed below):

- 2012-2015 Sulphur dioxide 60% reduction
- 2012-2015 Nitrogen oxides 59% reduction
- 2012-2015 Mercury 48% reduction
- 2010 Greenhouse gases intensity 18% reduction (CO₂e)
- 2015 Greenhouse gases intensity 28% reduction (CO₂e)
- 2020 Greenhouse gases intensity 38% reduction (CO₂e)

In addition to the above, legislation has been enacted within Nova Scotia which requires NSPI to increase the proportion of total energy generated from renewable sources constructed after December 31, 2001 to 5 percent of sales by 2010 and 10 percent of sales

³ 2005 emissions reduction regulations came into effect March 1, 2005. Emission levels for 2006 are not fully representative since a major customer was off-line for a significant portion of the year.

⁴ Carbon dioxide (equivalent) includes CO₂ and other greenhouse gases.

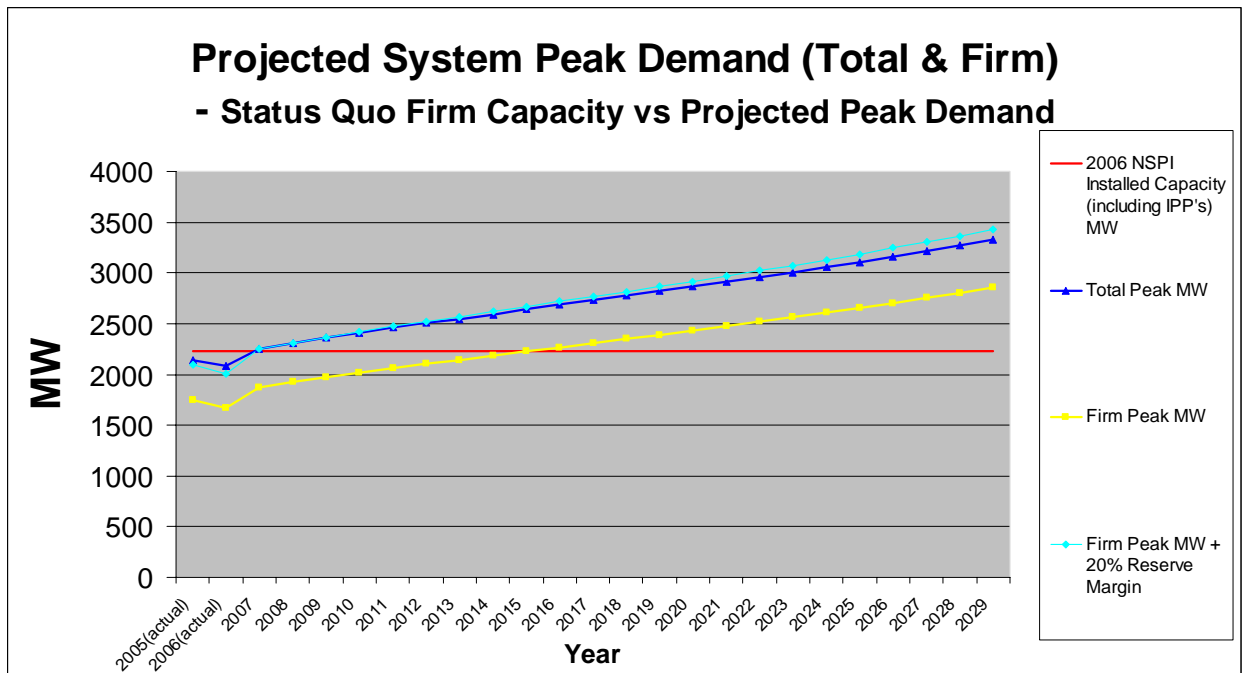
⁵ Air Quality Regulations made under Section 112 of the Environment Act, effective March 1, 2005.

in 2013. Currently, renewable generation constructed after December 31, 2001 accounts for 2.8 percent of NSPI's net system peak and approximately 1.4 percent of energy.

Nova Scotia's Environmental Goals and Sustainable Prosperity Act provides additional guidance to potential future emissions regulations. The legislation established a goal for Nova Scotia to reduce greenhouse gas emissions to 10 percent below 1990 levels by the year 2020. It is unclear how this provincial goal might be translated into limits for NSPI, the transportation sector and other significant sources of greenhouse gases (such as home heating).

NSPI Load Growth and Planning

Nova Scotia's electric load has been growing to meet customer demand for electric energy. The chart below provides NSPI's forecast annual total and firm peak demands and compares this to the Company's current installed capacity (chart reflects pre-IRP DSM).



NSPI planning criteria requires a 20 percent reserve margin (i.e. NSPI must maintain installed capacity which exceeds forecast firm load by 20 percent). Firm load refers to NSPI customers other than those who are on interruptible rates. Customers on interruptible rates receive a rate credit for agreeing to have their service interrupted in the event of a supply shortfall.

As is evident from the chart, as demand grows, reserve margins decline. Reduced reserve margins constrain the operating flexibility of the utility system and ultimately can reduce reliability of service to our customers. As well, increasing load without additions to capacity increases the cost of serving customers as more expensive generation must be dispatched during peak periods.

A utility has three options to address these circumstances. It can take measures to reduce customer load or it can add generation capacity, or it can do both. The first is referred to as Demand-side Management; the second is a supply-side response. The resource planning exercise which seeks to optimize the two alternatives is referred to as Integrated Resource Planning (IRP).

3.0 ISSUES TO BE ADDRESSED

In addition to the development and presentation of a Preferred Resource Plan for NSPI, the IRP analysis was conducted to provide strategic insight into planning issues. These include:

1. The potential to invest in scrubber technology versus switching to lower sulphur fuels, in order to meet sulphur dioxide limits;
2. The amount of demand-side management spending which is economically sound and acceptable to stakeholders in Nova Scotia;
3. The amount of renewable generation, beyond current targets that may be economically and technically viable in Nova Scotia;
4. The timing of the next major generation addition;
5. Identification of near-term supply and environmental additions;
6. The use of carbon offsets/credits versus the requirement for physical reductions in carbon emissions.

4.0 IRP PROCESS OVERVIEW

NSPI/UARB Staff and Consultant Collaboration

NSPI's IRP has been developed as a collaborative effort between NSPI and UARB staff and its consultants. This collaboration has included all aspects of the IRP from designing key assumptions, to design of the analysis framework, selection and assessment of resource plans, analysis of model results, development of conclusions and ultimately the compilation of this report.

The IRP expertise brought to this project by Board staff, the Tellus Institute and Synapse Energy Economics, Inc. along with NSPI technical and analytical expertise and that of its consultants, including DSM consultant Summit Blue, and IRP consultant, La Capra Associates, has produced a comprehensive IRP for Nova Scotia. The key outcomes are a resource plan and an action plan which defines a direction to enable NSPI to meet customer needs and environmental obligations during a period of substantial uncertainty.

The views of the Board's consultants on this project are presented in Appendix 3.

Stakeholder Consultation

In accordance with the IRP Terms of Reference, stakeholders were consulted throughout the IRP process (see Appendix 4 for the list of formal intervenors). Specific consultations included:

1. Stakeholder input on the IRP Terms of Reference;
2. Three technical conferences covering IRP processes, IRP assumptions development and analysis results;
3. Development of a File Transfer Protocol (FTP) site for Intervenors which provided IRP Intervenor access to support documentation;
4. Replies to queries issued by Intervenors throughout the process concerning assumptions development, model design and analysis results;

5. Incorporation within the IRP analysis of requests for sensitivities and consideration of alternative modeling scenarios (e.g. the “Deep Green World”);
6. Stakeholder input on IRP conclusions;
7. Stakeholder input on IRP final report;
8. Informal contact between NSPI and individual stakeholders during the IRP process;
9. Direct engagement by stakeholders with UARB’s representatives.

The foundation for the IRP conclusions and the Action Plan have benefited from this significant stakeholder engagement. The plan has been enhanced by the participation of these stakeholders.

Analysis Process

NSPI’s IRP included the following key stages:

- Development of Basic Assumptions
- Analysis of Basic Assumptions to create resource plans
- Sensitivity analysis of resource plans
- Worlds analysis of resource plans
- Compilation of results

These stages are illustrated in the flowchart provided in Appendix 5.

The development of the Basic Assumptions took place over several months and involved collaboration with Board staff and consultants, as well as consultation with stakeholders. Each of the basic assumptions included a most likely or base assumption as well as a range of high and low values. The basic assumptions included:

- Load forecast – energy and peak load;

- Fuel forecasts for coal, petcoke, natural gas and heavy fuel oil;
- Future environmental emissions constraints for sulphur dioxide, nitrogen oxides, mercury, and carbon dioxide. (In addition to constraints on carbon, cost of carbon credits was also included);
- Future supply side and environmental control options which included a range of capital costs;
- Demand side management options which included alternative levels of spending to achieve different energy and demand savings;
- Financial assumptions including discount rate and foreign exchange.

Once the Basic Assumptions were agreed on these were used to create the resource plans. To fulfill the purpose of integrated planning it is important that alternative resource plans be significantly different. They must be reasonable plans that include a variety of options. At the same time each alternative needs to meet criteria including system reliability and environmental constraints. The Company, Board Staff and consultants agreed on the following themes for the base resource plans:

- Coal
- Natural Gas
- DSM
- Renewables

Several hundred candidate plans were created, by the modeling software, for each theme. Ultimately the resource plans that were selected for further study were those plans that met the criteria referenced above and were the least cost plans among each theme's set of candidate plans. This led to the following six base resource plans:

2% DSM⁶ + Coal Plan (FGD 2020) – referred to as the Coal Plan

2% DSM + Coal Plan (FGD 2012) – referred to as the Coal Plan (FGD 2012)

2% DSM + Natural Gas Plan – referred to as the Gas Plan

⁶ 2 percent and 5 percent DSM refer to annual DSM spending as a percentage of electric revenue.

2% DSM + Renewables beyond the RPS- referred to as the Renewables Plan

5% DSM – referred to as the DSM Plan

5% DSM + Renewables beyond the RPS- referred to as the Reference Plan.

Of these six plans, the 5 percent DSM Plan + Renewables beyond the RPS was identified as the least cost plan overall. This means the plan's net present value of costs⁷ over the study period is lower than any of the other plans under the “most likely” (i.e. Base) assumptions. Said another way, over the course of time, this plan if completed based on IRP assumptions, would be the least expensive way to meet electric energy demand and environmental requirements.

If there were certainty that the World described in the Basic Assumptions (“most likely” scenario) would unfold as is, then we would not need to do further analysis. However, there is considerable uncertainty in all of the basic assumptions including how load will change, or how fuel prices will change or how environmental regulations may develop. This is the reason the basic assumptions include a range of values and not simply a single view of an assumption.

This uncertainty requires analysis of each of the six resource plans to ensure the best outcome. The best path is the one that not only meets the least cost measure and other criteria but also is robust enough to withstand changes to the basic assumptions.

This analysis was conducted in two ways: sensitivity analysis and world analysis.

The purpose of the sensitivity analysis was to understand which of the six resource plans was most price sensitive and to determine if an assumption change would cause one of the resource plans to become more attractive (on a net present value of cost basis). Specifically, for each resource plan one assumption was varied at a time. All others were held constant and the effect on the plan's total net present value documented. The sensitivities analyzed were:

⁷ Costs include utility costs as well as customer costs for DSM.

1. Capital costs
2. Carbon dioxide (CO₂) credit costs
3. Coal costs
4. Gas prices
5. Discount rates
6. Heavy Fuel Oil (HFO) costs
7. DSM program costs

For each of the six plans, each of the high and low values of the above sensitivities was analyzed. With six plans, seven variables, and high and low cases, the total number of sensitivities amount to 84 model runs. By changing one of the above assumptions, the cost of the plan increased or decreased. Under this approach, resource plans are fixed (i.e. no addition or removal of resources). Sensitivity analysis shows how the specific plan reacts to a change in a price based assumption. For example, increasing the cost of coal had a greater price effect on the two coal plans than it did on any other plans.

The results of the sensitivity analysis are discussed later in the report.

The world analysis broadens the sensitivity analysis. In this analysis, assumptions change to reflect different futures such that the resource plan itself is altered. The world analysis assesses which plans are most flexible to changing conditions. In order to respond to these changing conditions, we allow the model⁸ freedom, unlike above, to add or remove resources so that an optimal solution to the new world is created. For example, in examining a future where load is higher than in the most likely case the scenario cannot be solved without adding more resources to a plan. The model must have freedom to add resources to serve the new load otherwise it is not able to solve the problem. The results of the world analysis show how consistent certain resource additions are over a variety of worlds.

⁸ The model used in the IRP was New Energy Strategist version 4.06-Strategic Corporate Planning System.

The worlds that were examined were the following:

- High and low load scenarios;
- Highest (most stringent) and lowest (least stringent) emissions constraints;
- Several variations to the costs and benefits of DSM;
- Hard carbon caps with and without credit constraints.

The results of the world analysis are presented later in this report.

The combination of the analyses included in the above sensitivities and worlds means that almost all possible variations to the Base, Low and High assumptions have been analyzed. How plans react to these changes informs as to how robust the plans are.

Assumptions

NSPI developed initial assumptions in a variety of relevant areas. With input from stakeholders, NSPI and the Board consultants developed a collaborative consensus about the Basic Assumptions. Comment on key aspects of the modeling assumptions follows.

Demand-Side Management Modeling

Over the past decade NSPI has worked successfully with customers to establish demand response programs. The programs have been primarily rate design-driven and today include interruptible pricing for large industrials, time of day pricing for residential customers with systems to shift heating loads, and the Extra Large Industrial Two Part Real Time Pricing rate for NSPI's two largest customers. NSPI also provides customers educational materials regarding energy efficiency and conservation and supports a variety of small scale initiatives across Nova Scotia each year.

As part of its 2006 Rate Application, NSPI proposed to invest an incremental \$5 million in conservation and energy efficiency programs. NSPI submitted a proposed 2006

Conservation and Energy Efficiency Plan. In its March 10, 2006 Decision, the UARB concluded that the plan would benefit from additional design work. The Board directed NSPI “to retain an outside consultant and to complete the Plan’s design and development”⁹.

On September 8, 2006, NSPI filed its Direct Evidence on DSM including its Revised DSM Plan (Proposed General DSM Programming) and Summit Blue’s DSM report (Consultant’s DSM Report). On September 28, 2006 the Board advised NSPI that it would reserve its decision on whether or not to hold a hearing with respect to NSPI’s revised DSM Plan filing until the IRP process was completed.

For the purpose of modeling DSM within an IRP, DSM program cost and energy and capacity savings information was required, ideally across the various customer segments. NSPI relied on the work of consultants, Summit Blue Consulting, LLC for this information. In its DSM report Summit Blue recommended spending on DSM programs by NSPI equal to 2 percent of electric revenue. The consultant also provided a forecast of energy and demand savings at this level of spending. To test alternative DSM spending levels in the IRP the consultant extrapolated these energy and demand savings to spending levels of 1 percent and 5 percent of electric revenue, corresponding to lower/higher achievement of the economic DSM potential identified in its September 2006 DSM report.

The tables below present the annual DSM information as developed by Summit Blue at a 2 percent and 5 percent spending level. The third table below illustrates spending levels for 1 percent, 2 percent and 5 percent DSM through the planning period.

⁹ Decision, Nova Scotia Utility and Review Board, March 10, 2006, page 306.

2 percent of Revenue Program Spend (costs in 2006 dollars)

TOTALS	22 Year Total	Year 1	Year 2	Year 3	Year 5	Year 10	Year 15	Year 20	Year 22
Demand Savings (MW)		6.5	10.4	17.5	26.4	34.2	36.4	41.0	43.4
Cumulative (MW)	705.1	6.5	16.9	34.4	84.0	248.4	424.8	619.5	705.1
Energy Savings (GWh)		44.5	71.2	106.8	142.4	166.8	169.8	183.9	192.6
Cumulative (GWh)	3419.4	44.5	115.6	222.4	489.3	1313.3	2151.6	3038.7	3419.4
Utility Costs (\$Millions)	589.1	6.6	10.5	16.5	23.3	28.7	29.8	32.9	34.6

5 percent of Revenue Program Spend (costs in 2006 dollars)

TOTALS	22 Year Total	Year 1	Year 2	Year 3	Year 5	Year 10	Year 15	Year 20	Year 22
Demand Savings (MW)		11.4	18.2	30.6	46.2	57.9	56.2	57.0	60.0
Cumulative (MW)	1113	11.4	29.6	60.2	147.0	431.9	715.0	997.5	1113.0
Energy Savings (GWh)		77.8	124.5	186.8	249.2	282.1	258.2	245.8	243.4
Cumulative (GWh)	5354.9	77.8	202.4	389.2	872.0	2283.7	3617.1	4867.1	5354.9
Utility Costs (\$Millions)	1372.8	16.4	26.3	41.3	58.3	70.1	68.4	70.1	71.5

Summary: DSM 1, 2, 5 percent Revenue Spend Program Projections (costs in 2006 dollars)¹⁰

DSM Spending as % of Annual Revenue		Residential	Commercial	Industrial
~ 2%	Utility Cost (\$Millions)	290.0	118.4	180.7
	Customer Cost (\$Millions)	205.1	234.4	431.8
	Total Resource Cost (\$Millions)	495.1	352.7	612.6
	Demand Savings (MW)	226.4	170.3	308.5
	Energy Savings (GWh)	886.4	763.7	1769.3
~ 1%	Utility Cost (\$Millions)	145.0	59.2	90.4
	Customer Cost (\$Millions)	102.5	117.2	215.9
	Total Resource Cost (\$Millions)	247.5	176.4	306.3
	Demand Savings (MW)	113.2	85.1	154.2
	Energy Savings (GWh)	443.2	381.8	884.7
~ 5%	Utility Cost (\$Millions)	725.0	295.9	351.9
	Customer Cost (\$Millions)	141.4	321.4	487.6
	Total Resource Cost (\$Millions)	866.4	617.3	839.5
	Demand Savings (MW)	396.1	298.0	418.9
	Energy Savings (GWh)	1551.2	1336.4	2467.3

¹⁰ Utility costs are those DSM costs recovered in electric customer rates. Customer costs are direct customer costs to implement DSM initiatives.

Modeling of Renewables

Provincial legislation requires NSPI, by 2010, to produce 5 percent of its energy from renewable resources constructed after December 31, 2001. NSPI forecasts this to equal approximately 690 Gigawatt-hours (GWh) in 2010. By 2013 when the RPS increases to 10 percent, post 2001 renewable generation will account for approximately 1,450 GWh.

The current state of renewable technology suggests that most of this energy is expected to be provided by wind generation. Wind generation depends on weather conditions. It is intermittent and cannot be dispatched. It is modeled accordingly.

For the purposes of the IRP it is assumed incremental renewable generation will come mostly from wind and will provide a “capacity equivalent” of 32 percent of generator nameplate (manufacturer’s suggested maximum capacity). The resource is modeled at a contract price of \$.085/kWh for the 2010 RPS, \$.08/kWh for 2013. Beyond the amount required to comply with the RPS, additional renewable generation is driven by economics at a price of \$.092/kWh¹¹. Renewable generation beyond the RPS is added in the Renewable Plan, the Reference Plan and in some of the Worlds analysis.

Environmental Assumptions

Annual limits for sulphur dioxide and nitrogen oxide have been established and modeled as fixed constraints. Modeling of carbon dioxide is more complex and involves significantly more uncertainty.

For carbon dioxide, the fixed constraints have been calculated according to “intensity-based targets”. It is expected the Federal Government, as an alternative to specific CO₂ limits, will require that over time generation from older plants meet tighter emissions levels. Based on this approach the IRP forecasts carbon constraints which will be in place over the planning period for NSPI’s established generators.

¹¹ This consists of a renewable energy charge and backup cost (given the variable nature of the wind resource). The actual cost of backup will be informed, in part, through the Wind Integration Study.

In addition, it is expected that future compliance with CO₂ caps may be attained, at least in part, through an emissions trading system or technology funds. Such a trading system is assumed to be the source of the allowances that are applied in the model with a range of carbon credit costs assumed. NSPI also modeled the implementation of carbon dioxide caps (i.e. physical limits).

The influence of carbon on the IRP analysis and the acknowledged uncertainty of this assumption required broad IRP modeling in this area. Additional cases in which the use of carbon credits is constrained are explored in the Worlds analysis.

5.0 RESULTS AND IRP CONCLUSIONS

The table below summarizes the Resource Plans developed in the IRP and identifies the capacity¹² associated with each demand or supply option included in each.

All six Resource Plans contain investment in demand-side management, and renewable generation sufficient to meet the RPS requirements. All plans meet emissions constraints, reserve margin and other regulatory requirements.

In addition, all plans include investment in existing NSPI plants to increase the capacity of these units (i.e. uprates, waste heat utilization and Hydro improvements). Five of the plans include Tufts Cove Waste Heat Recovery project which represents the capacity added by using the waste heat energy from the two existing Tufts Cove single-cycle gas turbines (Tufts Cove 6). The inclusion of these resources in the various base plans confirms they are economic across a broad range of alternative scenarios.

2007 IRP RESOURCE PLANS: SCHEDULE OF FIRM SUPPLY or DSM MW's

	Reference Plan	DSM Plan	Renewables Plan	Coal Plan	Coal Plan (FGD in 2012)	Gas Plan
New Resources 2008-2014						
DSM	256	256	146	146	146	146
TUC 6	50	50	0	50	50	50
LM 6000						
Uprates	20	20	20	20	20	20
Hydro	4.3	4.3	4.3	4.3	4.3	4.3
RPS	166	166	166	166	166	166
Additional Wind	16		16			
SUBTOTAL	512.3	496.3	352.3	386.3	386.3	386.3
New Resources 2015-2029						
Additional Wind	144		144			
Pulverized Coal*				400	400	
LM 6000						
Combined Cycle			280			560
DSM	857	857	559	559	559	559
SUBTOTAL	1001	857	983	959	959	1119
TOTAL FIRM SUPPLY & DEMAND MW's OVER PLANNING PERIOD	1513.3	1353.3	1335.3	1345.3	1345.3	1505.3

¹² For DSM capacity refers to reduction in demand.

The net present worth of the cost of each plan is provided in the following table. The accumulation of costs over the planning period is shown in the chart which follows. The table confirms that under the Base Assumptions, the 5 percent DSM plus Renewables Beyond the RPS Plan is the least-cost plan (the Reference Plan).

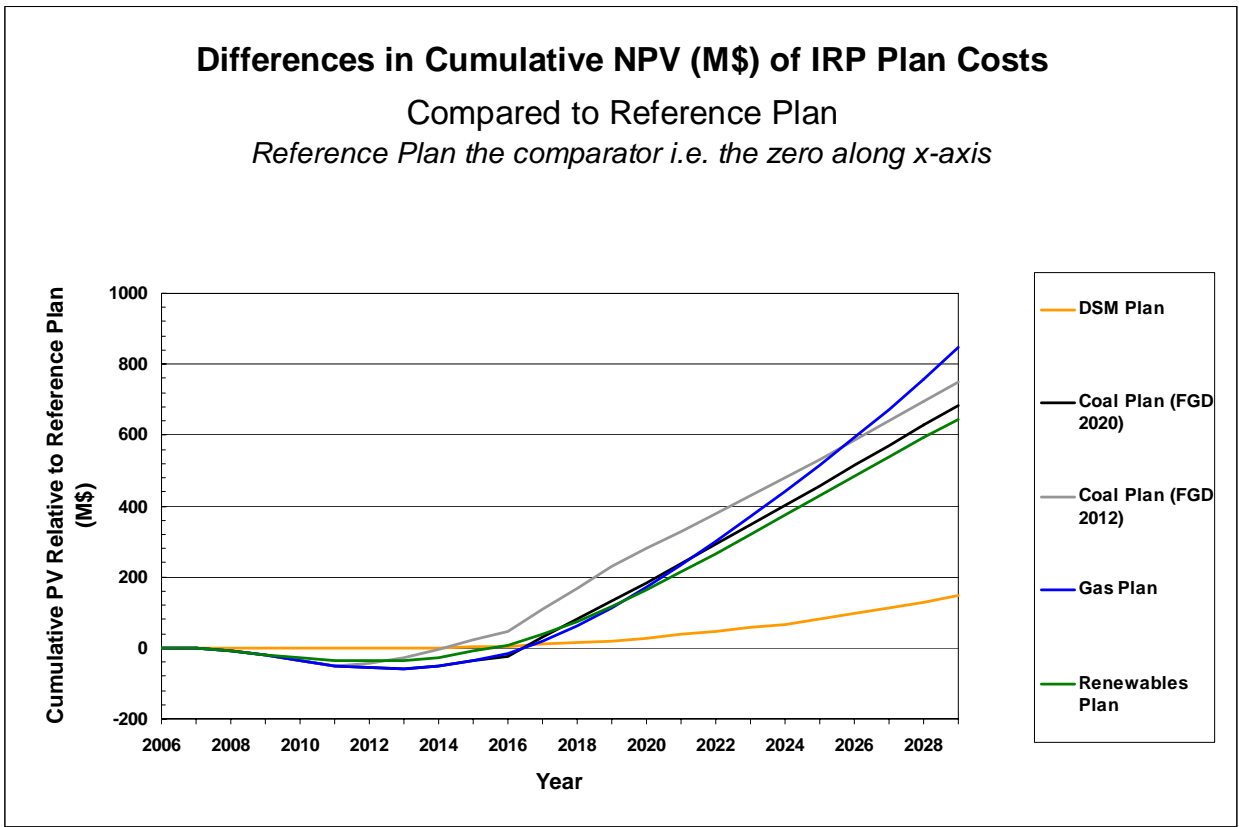
Resource Plan Cumulative Present Worths (millions of dollars).

Plan	Study Period¹³ NPV	Increase from Reference Case
Reference Plan	\$14,479.9	
DSM Plan	\$14,747.7	\$267.8
Coal Plan (FGD 2020)	\$15,503.7	\$1,023.8
Coal Plan (FGD 2012)	\$15,551.4	\$1,071.5
Gas Plan	\$15,925.4	\$1,445.5
Renewables Plan	\$15,435.2	\$955.3

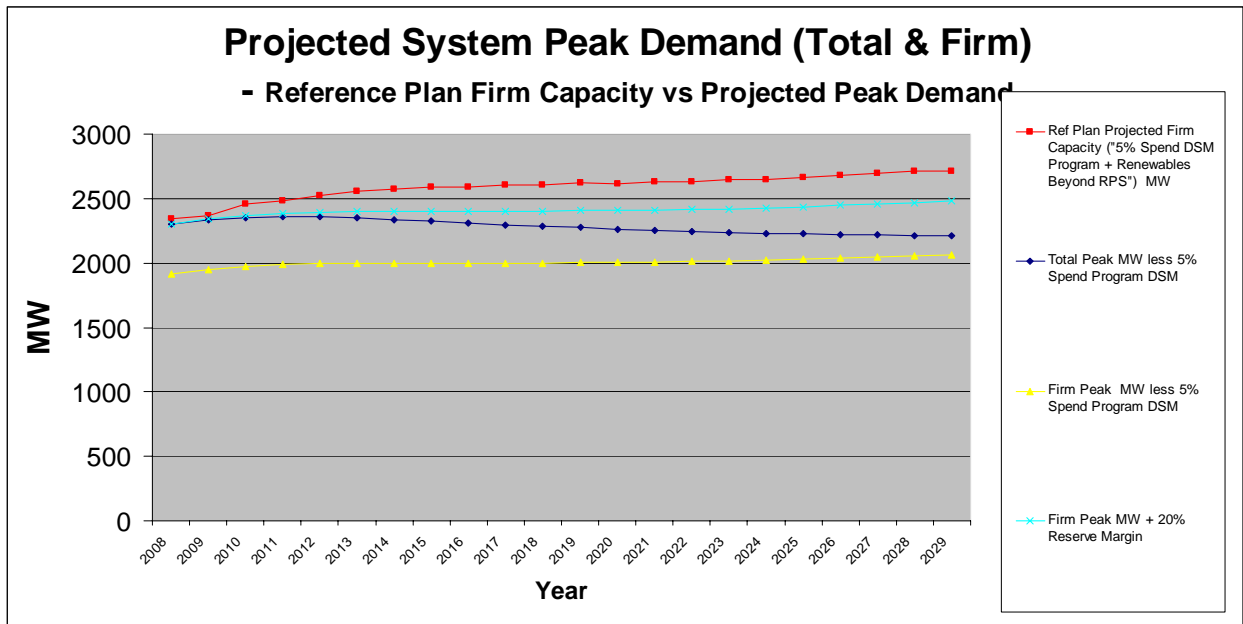
Most striking about this information is the difference between the two lowest cost plans and the fossil based plans. The key components of the Reference Plan and the DSM Plan are the same; spending on DSM programs at 5 percent of electric revenue and high penetration of renewables.

The profile presented below shows the present values of the plans over the planning period compared to the Reference Plan, which is represented by the X axis. While the fossil-based plans are forecast to be lower cost by a small margin in the early years, this is overcome by the plans with 5 percent of annual revenue spending on DSM assuming the forecast savings available from these plans emerge.

¹³ Study Period represents cost over the Planning Period plus end-effects. End-effects calculations are used to account for the cost of replacing the resources and for differences in operating costs beyond the Planning Period. The Planning Period is the range of years (in the IRP 2007-2029) over which all feasible combinations of resources are analyzed.

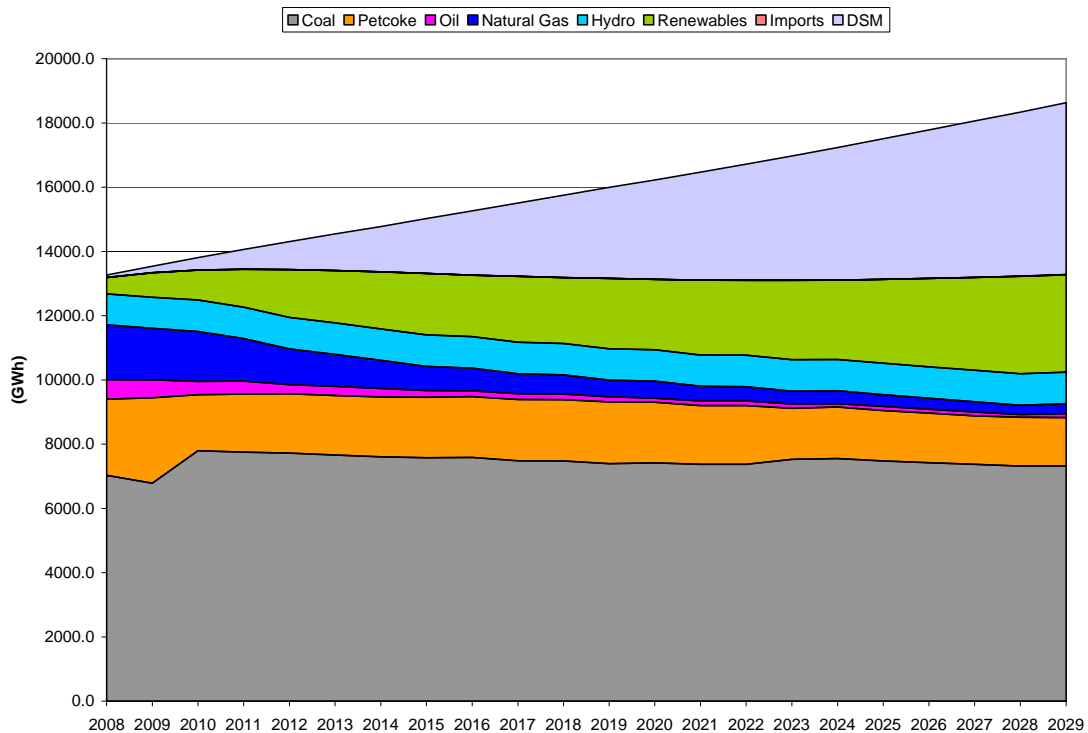


Consistent with the modeling assumptions, reserve margins are maintained throughout the planning period. In the Reference Plan, this is achieved through demand-side management and the addition of renewable generation. The chart below summarizes forecast installed capacity and firm and total demand over the planning period.



The resource portfolio for the lowest cost Reference Plan under the Base Assumptions is presented below.

Energy – Reference Plan “5% Spend DSM & Renewables beyond RPS”



The above graphic depicts the following:

- Under this plan, DSM energy and demand savings are forecast to offset load growth over the planning period;
- Generation from oil and natural gas is expected to decline, replaced by renewable generation;
- Coal and petroleum coke (petcoke) generation remains essentially unchanged over the planning period.

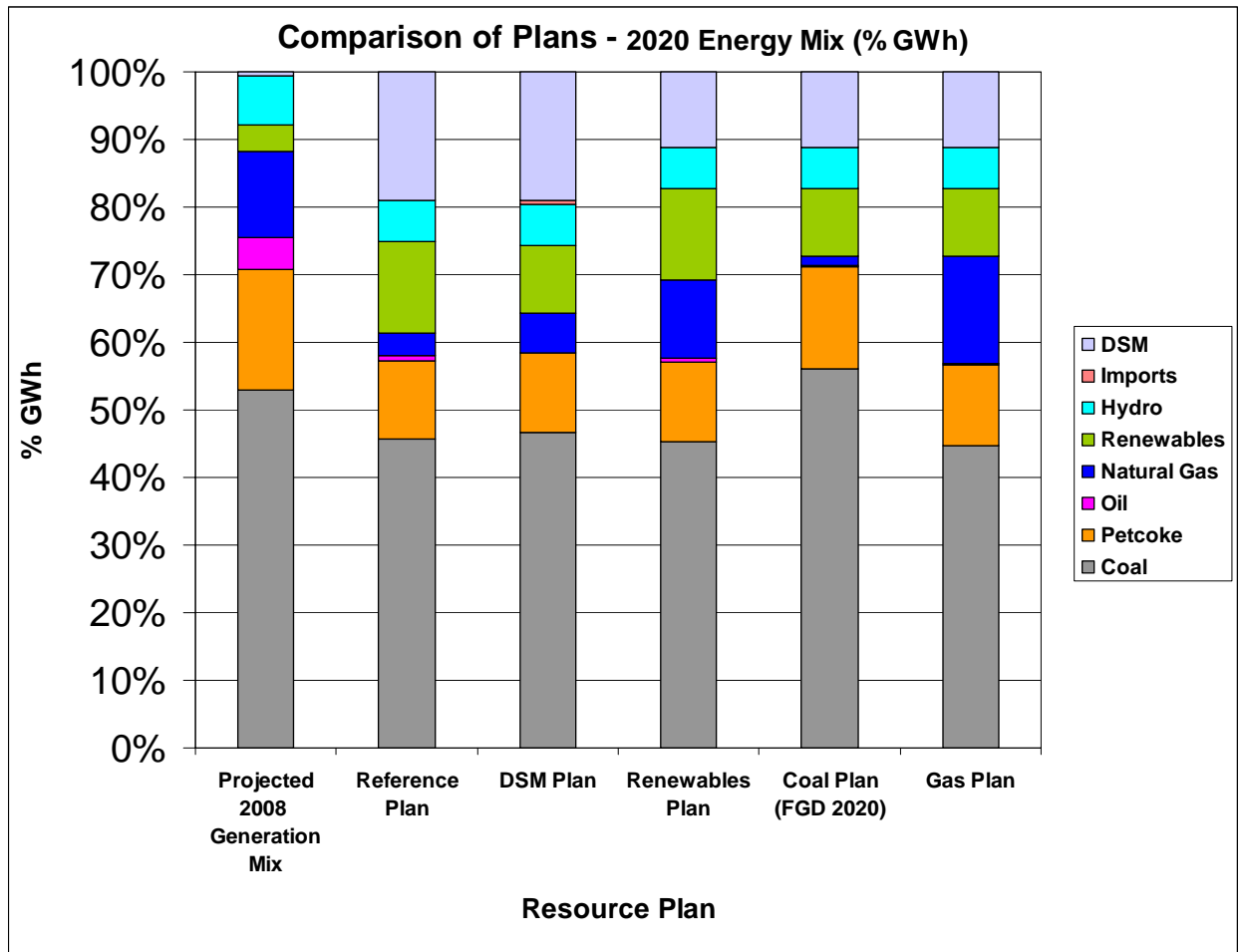
This fuel mix outcome is related to the relative cost relationship among fossil fuels, which is forecast to be largely unchanged over the planning period. Petcoke and coal are expected to remain low-cost compared to oil and natural gas even when allowance for carbon cost is included. Therefore generation from the existing solid fuel facilities remains economic, so long as the emissions constraints can be met through fuel switching, purchase of carbon offsets and other means at these plants, together with the emissions displacement associated with the addition of renewable generation and DSM.

With respect to new generation, half the contribution from renewables has been defined through Provincial legislation. In addition to meeting the requirement of the RPS, this renewable energy acts to reduce emissions.

The addition of renewable energy, investment in DSM and investment in environmental controls allow NSPI to meet its emissions constraints under this plan, while continuing to generate from low cost fossil units. Under the Base Assumptions, this is the low cost plan.

For comparison purposes, the energy mixes of the Resource Plans under the Base Assumptions are provided below (2020 used as comparison year). The results do not vary substantially across the plans. Existing coal and pet-coke fired generating stations continue to provide base load generation. Renewables and DSM are also established as

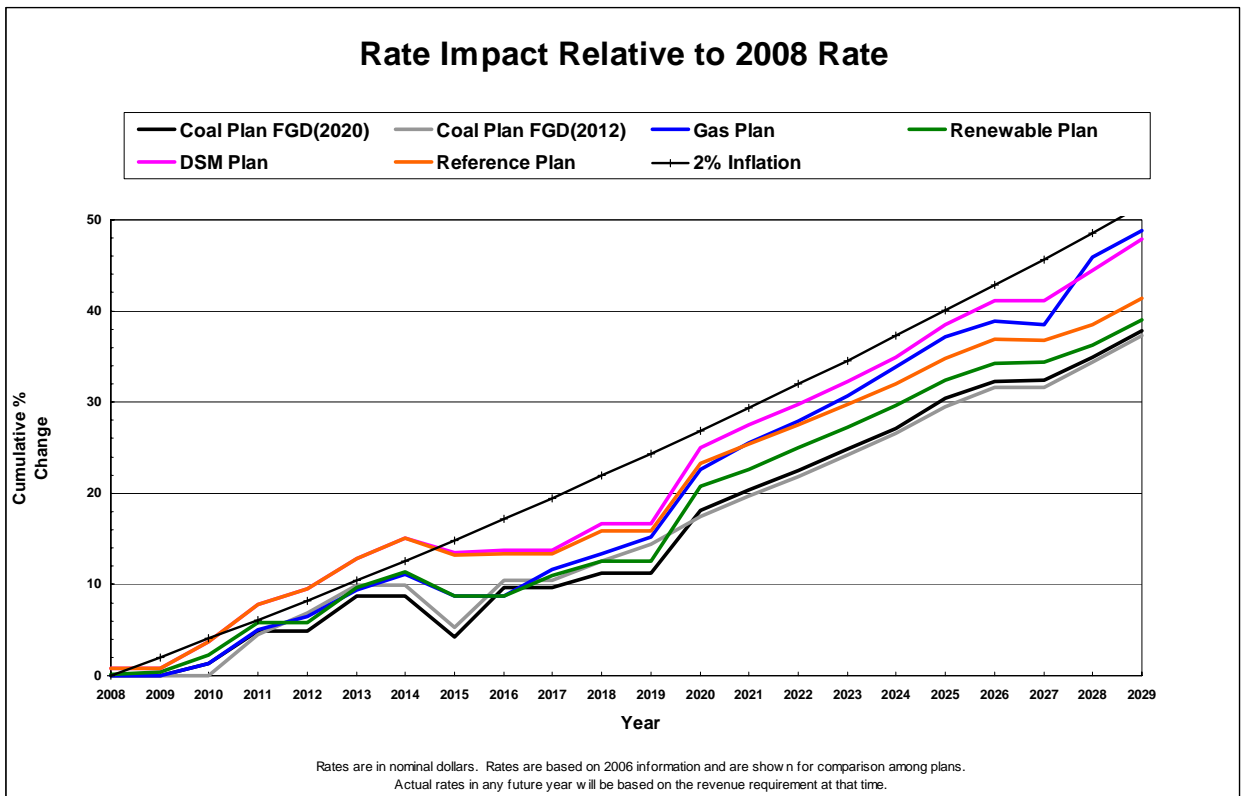
major components, driven by emissions constraints and project economics compared to competing higher cost gas-fired generation and new solid fuel generation.



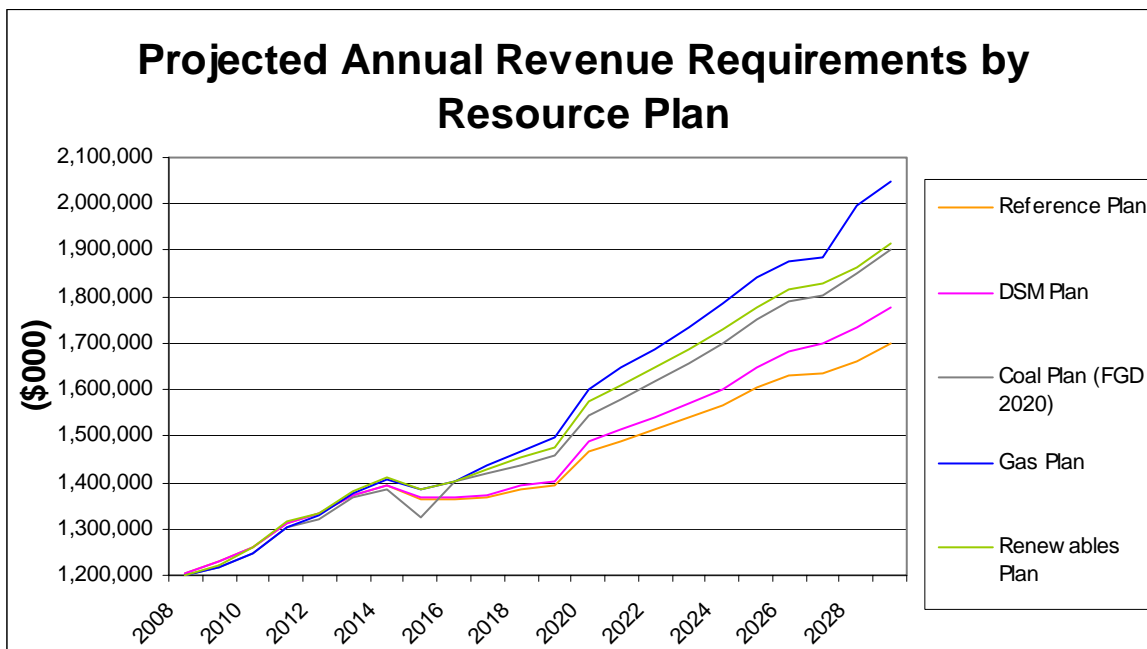
The relative effect of the resource plans on customer electric rates over the planning period is estimated in the chart below. The plans track closely over the planning period. The coal-based plans are shown to provide the lowest cost per kilowatt hour. This is to be expected because the DSM-based plans, while lower in total resource cost, result in a reduction in customer sales. The result is an increase on a per unit basis (i.e. under 5 percent spend DSM plans, rates are forecast to increase, but due to reduced energy usage, total customer cost will be less than for alternative plans).

The rate projections assume power purchases and DSM are expensed. Plant additions are capitalized. The chart shows that over the planning period, rates track inflation. It is

important to note that the rates forecast are based on the 2006 Basic Assumptions over the planning period. Actual customer rates in future years are dependent on the revenue requirement at that time. This chart compares alternative resource plans under consistent assumptions. It is not intended to predict future electricity rates.



The chart above depicts a percent rate increase comparison among the various resource plans. The chart below compares the annual revenue requirement in thousands of dollars for each resource plan. The annual revenue requirement chart shows that the plans track closely for the first six years and separate post 2014 once the plans' resource additions diverge.



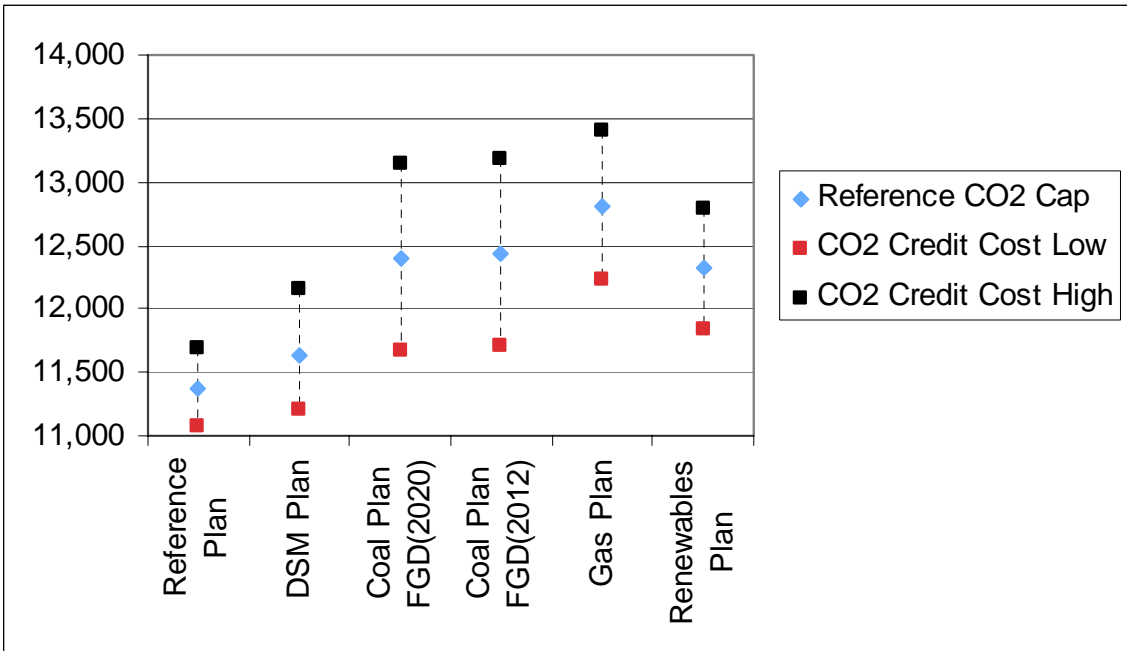
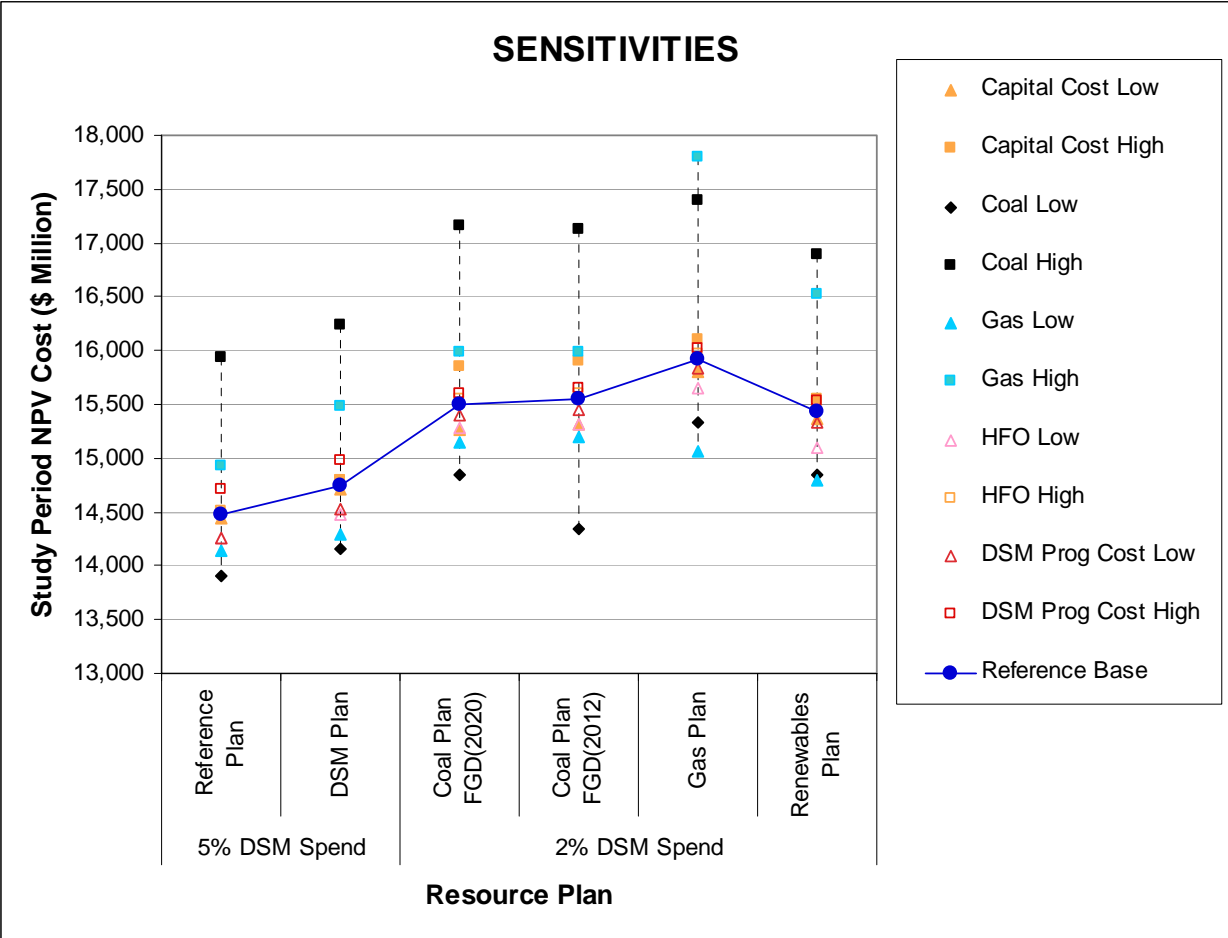
Variance in the trends between the Rates and Revenue Requirement charts is due to reduced customer load resulting from DSM, i.e. the difference between per unit and absolute revenue requirement.

Sensitivity Analysis

The base assumptions analysis shows the Reference Plan is the most economic. In order to assess the robustness of the plan, it and the other resource plans were assessed against changes to key assumptions.

The results across sensitivities for the six resource plans are presented in the charts below.¹⁴ Due to the magnitude of the cost, the results are presented in two charts. In the non carbon dioxide sensitivities, plans all include the cost of purchasing credits from zero emissions to the carbon dioxide level produced in each plan. The carbon dioxide credit cost sensitivity is presented in a separate graph as only the cost of purchasing required credits (i.e. to buy down to a cap as opposed to zero) is included. This separate presentation does not affect the ranking of the plans.

¹⁴ Discount rate sensitivity was not included in the chart as results were similar across all plans.



The Sensitivity Analysis provides the following insights:

In all cases the Reference Plan and the DSM Plan are ranked as the lowest and second lowest cost plans respectively:

- The largest changes in resource plan present worth of costs are driven by changes to fuel prices and CO₂ credit prices;
- The overall ranking of plans by net present value is unaffected by most sensitivities. Exceptions included the following:
 - Under the low capital cost sensitivity, low CO₂ credit prices or low coal price assumptions, the Coal Plans are lower cost than the Renewables Plan;
 - Under low gas price assumptions the Gas Plan is lower cost than the Coal plans;
 - Under high gas price assumptions the Coal Plans are lower cost than the Renewables Plan.

The above suggests the plans that include 5 percent (of revenue) DSM spending are robust and the least cost overall. Among the fossil fuel-based plans, cost is largely a function of fuel prices.

With respect to the preferred plan, the Sensitivity Analysis reinforces the conclusions presented under the Base Assumptions.

Worlds Analysis

Through the development of alternative modeling “worlds”, the IRP was able to examine the effect of differing assumptions on the various resource plans. Where the Sensitivity Analysis identified the cost effect of changing assumptions against a fixed plan, the Worlds analysis sought to identify where changing assumptions would change the selected supply/demand configurations and the cost of these configurations.

Worlds were created to examine the following:

1. A high load future
2. A low load future
3. Differing DSM program profiles
4. High and low environmental constraints
5. The implementation of “hard-cap carbon” worlds.

1. A High Load Future

For this world the plan with 5 percent DSM plus Renewables beyond the RPS was applied. The additional load requirement is met through the addition of two gas turbines in 2008 and 2009; two 150 MW gas units in 2013 and 2014 (one converted gas turbine) and two 400 MW coal units in 2016 and 2020.

The analysis illustrates the substantial change in cost that can arise if load growth should escalate substantially. It also serves to provide insight to the rapid advancement of capacity requirements which can arise should actual load growth exceed the forecast by a significant margin over an extended period. Based on the lead times necessary to construct new large-scale capacity, this needs to be carefully monitored.

2. A low load future

For this world, load was considerably lower than the base assumptions resulting from the departure of a large industrial customer from the NS system and from decreased load in the residential and commercial sectors. Because of the magnitude of decreased load, the model was offered 0, 1 or 2 percent spending on DSM. This resulted in the 2 percent spend on DSM being the economic solution. As the reserve margin in this scenario was well above the normal range, additional DSM was not considered as it would have increased reserve margins to 100 percent.

With 2 percent DSM and the RPS included, the low load world requires little additional generation. The analysis indicates that a reduction in costs can result if a significant amount of load does not materialize.

3. Differing DSM program profiles (timing of program start and magnitude of benefits)

To test the effect of delays in initiating the DSM program or the achievement of lower than forecast DSM benefits, world runs were created which assumed a two year lag in the program (lag in costs and benefits); 20 percent lower than expected energy and capacity savings (costs are the same and benefits are 20 percent less); and the exclusion of the pulp and paper sector from the DSM program (exclusion of costs and benefits).

In all cases, despite the reduced DSM benefits, high investment in DSM is confirmed as the key element of the low cost strategy. The gap between the high DSM plans and the competing plans continues to be wide. The substantial gap between the cost of the Worlds plans and the plans as developed under base assumptions reinforces the potential value of DSM and the additional cost which may be incurred should these programs be delayed. The additional cost arises

from having to place additional supply side resources on the system to meet load requirements.

4. High and Low Environmental Constraints

Worlds analysis, both more stringent (“high”) and less stringent (“low”) than the base environmental assumptions, were prepared to determine the effect on investment in environmental additions.

While the costs of the plans differ substantially over the planning period, the investment in available environmental technologies in the period prior to 2019 does not. The addition of Low NO_x technologies at Lingan, Pt. Tupper and Trenton and the addition of the baghouse at Trenton 5 are economically attractive.

The addition of the FGD at Lingan by 2020 and the addition of Low NO_x technology at Trenton 6 is less clear. These options are not selected by all resource plans.

5. The implementation of “hard-cap carbon” worlds requiring physical carbon reductions in 2020 (vs. the opportunity to purchase offsetting carbon credits).

All of the plans and analyses discussed above rely to varying degrees upon the purchase of “credits” to meet carbon dioxide emission reduction goals.

In order to explore the sensitivity of the IRP to the possibility that physical carbon dioxide emissions reductions might be required, the Worlds analysis was utilized to assess the effect of firm carbon caps at different levels, with carbon credit availability constrained in 2020.

The CO₂ emissions reduction levels were analyzed at three levels with credits constrained from 2020 and beyond for each:

Case	Approximate CO ₂ Emissions (Million tonnes)				
	2010	2015	2020	2025	2030
Base	10.0	9.5	9.1	7.7	6.4
Kyoto	6.4	5.6	4.8	4.5	4.1
Deep Green World	6.44	4.93	3.43	2.95	2.53

In order to solve for some of these scenarios, it was necessary to add new options to the model (e.g. carbon sequestration, offshore wind) beyond those contemplated in the Basic Assumptions. These are summarized in the table below. Costing and availability of these options entail more uncertainty than is inherent in the IRP Basic Assumptions in general.

Option	Comment	Cost
Purchase Power Agreement – from non-emitting source	300 MW firm	Energy \$108/MWh (esc 2% annually). Capital = \$300M for tie-line upgrade.
Carbon Sequestration – New	400MW	Capital = \$1,378.8M. Incremental O&M: \$13.78M (esc 2% annually).
Carbon Sequestration – Retro Fit	300MW* - Lingan (2 units)	Capital cost = \$333M (to capture & sequester CO ₂). Incremental O&M = \$ 9.2M (esc 2% annually).
Additional Gas	280CC	Consistent with IRP Assumptions
Offshore Wind	100 MW blocks, 35 MW firm	Energy \$150/MWh (includes wind back-up @ \$12/MWh, no escalation)
Biomass	20MW Unit, 85% CF	Capital cost = \$48M. Annual O&M \$2.7M (esc 2% annually). Fuel \$4.80/mmbtu (esc 2%).

* A station service power penalty of 30 percent is reflected in the modeling of this option.

It is important to note that some of these new low carbon dioxide emitting options are beyond the control of NSPI or the Province (e.g. the zero emission power purchase) or are not commercially available today (e.g. carbon capture and sequestration from pulverized or Integrated Gasification Combined Cycle (IGCC) coal generation). Although these options are not available today, they were modeled in order to allow the model to solve for the carbon hard cap/credit constrained Worlds. Therefore the results of these Worlds over the longer-term must be critically considered; the feasibility, performance, and costs of these

options require further study. In the short-term, all of the carbon-constrained worlds rely on investment in DSM to meet load.

The results of the Worlds analysis are summarized in the attached table. The table presents the cost of each of the plans under the various Worlds. The left-most column in the table identifies the World analyzed. The two middle columns identify the plans assessed and the characteristics of the plans. The right-most column identifies the change in cost under the worlds compared to the Reference Plan previously identified as the least cost plan under the Base Assumptions. In order to manage the volume of analysis, judgment was applied in order to limit this analysis to the most viable plans (i.e. not all plans are presented for all Worlds).

Resource Plan	Plan Type	Comments	Study Period NPV	Delta to Reference Case
Base Plans	Reference Plan		\$14,479.9	
	DSM Plan		\$14,747.7	\$267.8
	Coal Plan (FDG 2020)		\$15,503.7	\$1,023.8
	Coal Plan (FDG 2012)		\$15,551.4	\$1,071.5
	Gas Plan		\$15,925.4	\$1,445.5
	Renewables Plan		\$15,435.2	\$955.3
Low Load	2%Spend DSM		\$9,621.1	-\$4,858.8
High Load	Reference Plan	RPS advanced 1 year + additional generation	\$19,029.0	\$4,549.1
Low Air Emissions	DSM Plan	Low air emission limits and CO2 credit costs	\$11,921.7	-\$2,558.2
High Air Emissions (High air emission limits and CO2 credit costs)	Coal Plan	No FGD	\$17,694.8	\$3,214.9
	Reference Plan		\$17,336.5	\$2,856.6
	Gas Plan		\$17,791.4	\$3,311.5
	Gas Plan	Option to retire existing units	\$17,901.8	\$3,421.9
Base CO2 Limits (CO2 Credit Constrained starting in 2020)	Reference Plan	Existing Options	\$14,981.8	\$501.9
	Reference Plan	Existing Options & New CO2 Mitigation Options	\$14,645.6	\$165.7
	DSM Plan	Existing Options & New CO2 Mitigation Options	\$14,857.6	\$377.7
Kyoto Case CO2 Limits (CO2 Credit Constrained starting in 2020)	Reference Plan	Existing Options & New CO2 Mitigation Options	\$14,714.0	\$234.1
	DSM Plan	Existing Options & New CO2 Mitigation Options	\$15,002.0	\$522.1
Deep Green Case CO2 Limits (CO2 Credit Constrained starting in 2020)	Reference Plan	Existing Options & New CO2 Mitigation Options	\$14,976.1	\$496.2
	DSM Plan	Existing Options & New CO2 Mitigation Options	\$15,298.2	\$818.3
DSM Delayed 2 Years	DSM Plan		\$15,129.8	\$649.9
	Coal Plan (FDG 2020)		\$15,771.5	\$1,291.6
	Renewables Plan	TUC 6	\$15,719.3	\$1,239.4
DSM -20% Benefits	DSM Plan		\$15,418.6	\$938.7
	Coal Plan (FDG 2020)		\$15,956.6	\$1,476.7
	Renewables Plan	TUC 6	\$15,907.5	\$1,427.6
Remove P& P Portion of DSM	DSM Plan		\$15,138.1	\$658.2
	Coal Plan (FDG 2020)		\$15,765.0	\$1,285.1
	Renewables Plan	TUC 6	\$15,749.3	\$1,269.4

High Air Emissions Worlds include high CO₂ credit costs. Low Air Emissions World includes low CO₂ credit costs. All other worlds include base CO₂ credit costs. This difference contributes to the difference in the NPV values. Each solution to reduce CO₂ to more stringent levels (Kyoto and Deep Green Worlds) requires additional investigation before costs, timing and feasibility could be confirmed.

The analysis confirms that for all Worlds:

1. The high DSM investment continues to be selected in the low cost solutions;
2. Investment in renewables is pursued to meet the requirements of the RPS;
3. Investment in Low NO_x technologies and the Trenton 5 baghouse reduce the overall cost to customers.

These are all elements included in the Reference Plan. The findings of the Worlds analysis reinforce the Sensitivity Analysis findings and the analysis results under the Base Assumptions. The Reference Plan is a robust plan (certain near-term investments are common to it and most other resource Plans and Worlds), and it remains the low cost plan under a broad range of assumptions.

6.0 SUMMARY

The IRP analysis provides support that the Reference Plan, 5 percent DSM Plan with Renewables beyond the RPS should be the Preferred Plan. In addition, to being the low cost plan the Preferred Plan also meets the other criteria set out in the UARB approved Terms of Reference.

1. System reliability requires that all resource plans at a minimum must meet reserve margin requirements. The Preferred Plan meets these criteria for the lowest cost.
2. Plan robustness is the ability of a plan to withstand realistic potential changes to key assumptions. The sensitivity analyses tested plan robustness. The analyses showed that across all sensitivities the Preferred Plan and the DSM Plan retained their first and second place rank respectively.
3. Cash flow measures the timing and magnitude of benefits relative to the timing and magnitude of required expenditures. While the Coal Plans, Gas Plan and Renewables Plan are slightly less expensive in the early years, the increased cost of those four plans beyond 2014 outpaces the cost of the Preferred Plan and the DSM plan. This indicates that the Preferred Plan and DSM plan are more favourable than alternative resource plans.
4. Flexibility is the absence of constraints on future decisions arising from the selection of a particular plan. The Preferred Plan is the most flexible of all resource plans. Unlike the Coal Plans, Gas Plan or Renewables Plan, the Preferred Plan would not require NSPI to commit to large scale generation in the next several years. It allows a two year window for additional, necessary information and experience to be collected. There is time to assess the potential and cost for additional renewable wind energy in Nova Scotia through the Wind Integration Study. It also allows time for

DSM to be implemented, monitored and evaluated. If the Wind Integration Study shows that the even higher levels of renewables contemplated in the Preferred Plan cannot economically be accommodated on the system, there is flexibility to reflect this in an IRP update. Similarly, if DSM experience in Nova Scotia indicates a level of savings less than that projected in the Plan, alternative plans can be considered during these two years.

5. Future regulatory emissions outlook requires that all plans must meet current and future emissions requirements. The Preferred Plan is the low cost method of meeting those requirements.

In addition to the above resource questions, the IRP analysis provides insight to the specific resource planning issues raised earlier. Each is summarized below with comment.

1. The requirement to invest in a scrubber in order to meet sulphur dioxide limits versus switching to lower sulphur fuels;

The Lingan scrubber addition by 2020 appears economic. Prior to this, sulphur dioxide emissions can be managed cost-effectively through utilization of fuel switching to lower-sulphur fuels. Should Federal Government regulations introduce more stringent sulphur regulations than are currently in place in Nova Scotia, the FGD may be required sooner.

2. The amount of demand-side management spending which is economically viable in Nova Scotia;

Based on DSM achievements in other jurisdictions, and assuming an extrapolation of the costs and benefits, to higher levels, the IRP analysis provides direction as to the potential benefits for NSPI customers of large-scale investment in DSM. Whether the forecast level of savings can be

achieved at the projected cost in Nova Scotia will not be known until specific initiatives are undertaken and the foundation for a comprehensive DSM program is established and monitored.

Under this extrapolation, total spending equivalent to 5 percent of revenue was shown to be economically sound within the IRP. Because of the implications of DSM implementation on near-term capacity reserve margins, it is essential that a further assessment of DSM's potential be completed within the next two years.

3. The amount of renewable generation beyond the provincially legislated Renewable Portfolio Standard (RPS) which is economically viable in Nova Scotia;

The potential of additional renewable energy is encouraging. The analysis completed to date is narrow in scope, amounting to a comparison of the all-in cost of renewable supply additions to the alternative DSM or fossil-based opportunities.

This analysis needs further work to consider the effect of variable, intermittent generation, on operating costs (i.e., backup supply) and the stability of the power system.

The capacity additions required by the RPS will result in a total installed capacity of approximately 240 MW (10 percent of total system peak) by 2010 and approximately 510 MW (20 percent of total system peak) by 2013. This means that by 2013 there could be many hours in the year where 40 percent of the load is being served by a variable source. This has significant technical, reliability and cost implications.

The Preferred Plan includes additional wind beyond 2013. It is expected the recently undertaken wind integration study will inform this decision.

NSPI is actively engaged with the Provincial Government in this process. Once the study is complete, the potential for renewables in Nova Scotia can be more precisely assessed.

4. The timing of the next major generation addition;

The Preferred Plan does not include a major generation addition before 2029. This is a result of all load growth being accommodated by aggressive DSM, renewable generation and uprates to existing facilities.

Should the projected penetration of DSM and/or renewable generation prove unachievable in Nova Scotia, the plan will change and a generation addition may be required. In this regard, it is important to note that the Coal Plan, which also has allowance for 2 percent DSM, identifies the addition of 400 MW of new capacity in 2016 to economically meet system requirements. (The Coal Plan calls for this addition in 2016 because it would be economic though not yet required for capacity in that year. 2018 is the year in which the addition would be required for capacity.) To meet this plan, an eight year lead time for permitting and construction of such plants suggests work would need to begin in 2010. This suggests NSPI has a window to make this assessment.

5. Identification of near-term supply and environmental additions;

The Preferred Plan primarily relies on DSM and Renewables additions to meet load growth.

The absence of investment in new (large) generating capacity, combined with the uncertainty with DSM and expansion of the renewables portfolio, means the reliability of existing NSPI generation becomes increasingly significant and economic opportunities to maintain and increase the capacity of existing units should be pursued.

Consistent with this, the IRP results have confirmed that the capacity uprates to existing units and the Waste Heat Recovery Project at Tufts Cove are cost effective. As well the IRP Preferred Plan includes the addition of Low NO_x equipment to Lingan, Pt. Tupper and Trenton.

6. The effect of carbon offsets/credits versus the requirement for physical reductions in carbon emissions.

The IRP analysis examined the effect of hard caps and credit constraints as part of reducing carbon dioxide emissions. In order to achieve this result, additional supply and (unproven) technologies were added. These were at least, in part, speculative solutions as the options were not all commercially available.

If aggressive hard caps are implemented and credits are constrained, the later years of the overall resource plan will need to be reevaluated.

7.0 STAKEHOLDER COMMENT ON IRP

Since the initiation of the IRP in July 2006, stakeholders in the IRP have been consulted and provided input on the IRP analysis framework, assumptions, conclusions, action plan and content for this final report. Intervenor views have been diverse, reflecting a variety of interests, concerns and experience with the matters considered by the IRP.

A complete copy of Intervenor comments on the draft report is provided in Volume 3. NSPI respects that there are many perspectives about the matters raised by the IRP.

In general, stakeholder comments fall into three categories:

- The extent to which Intervenor comments have been considered in the IRP process;
- DSM investment levels and implementation issues; and
- Matters that will be addressed in subsequent NSPI applications.

For the first category, NSPI, with UARB Staff and consultants, has sought to address these through the implementation of a broad IRP analysis framework. In addition the IRP analysis incorporated specific input from stakeholders. Examples include:

- The addition of the DSM Worlds with Pulp and Paper sector benefits removed as recommended by Stora Enso Port Hawkesbury Limited and Bowater Mersey Paper Company Limited;
- The creation of the Deep Green World as recommended by Ecology Action Centre; and
- The addition of an action item to explore clean energy import opportunities as recommended by Dr. Larry Hughes.

As noted by several Intervenors, the resultant analysis involves uncertainty, in particular DSM, intermittent generation and future environmental regulation. NSPI acknowledges

this and has sought to address this in the development of the action plan presented in this report. Intervenors appear to agree with NSPI that more work needs to be done in these key areas.

With respect to the second category, the analysis selected DSM as the economic choice over supply side alternatives because the levelized cost of DSM is lower than the next best alternative. This underscores the importance of testing energy and demand savings projected in the IRP, as the DSM program advances. This is reflected in the Action Plan. Matters of DSM implementation will be addressed in a separate DSM process. NSPI welcomes stakeholder input in this process.

The third category raises future generation issues that will be addressed upon specific applications being filed with the UARB. This includes capital work order submissions. The UARB retains oversight of the process for each future application. NSPI views the IRP as consistent with the UARB practice with respect to approval of applications as it has been previously established.

The IRP can serve as a helpful guide and reference plan for all stakeholders, the Company and the UARB as future applications are considered. Ultimately NSPI investments, approved by the UARB, can affect the prices our customers pay. With this in mind the Company welcomes stakeholder input on major capital investment associated with the IRP.

8.0 ACTION PLAN

Three key conclusions have emerged from the IRP process:

1. Investment in demand-side management and renewable generation can provide savings to customers, though the long-term potential for these two resource options requires more careful exploration and study;
2. The existing fossil fuel fleet will continue to play a central role in meeting NSPI customer requirements and
3. The context for resource planning beyond 2010 remains dynamic, due to the potential for significant changes in environmental or other requirements.

There is a window, during which NSPI can act on these conclusions and which provides time before a firm decision needs to be made with respect to investment in a new major capacity addition. The IRP analysis suggests this window is two years.

An action plan is required to achieve the potential benefits presented in the Preferred Plan while controlling our customers' exposure to costs associated with uncertainty with the longer-term effects of demand-side management and expansion of renewables generation. A flexible approach is required, in essence a "no regrets" strategy.

The steps of the IRP Action Plan are:

1. NSPI will initiate the development of a comprehensive DSM program, aimed at realizing the potential indicated in the IRP analysis. The ramp-up proposed in the IRP analysis can serve as a benchmark for the plan. The program is expected to include reporting mechanisms to track expenditures and assess changes in electricity demand and energy across the various customer segments to capture the effect of significant 'ramp up'.

2. NSPI will continue to work with the stakeholders to complete the Wind Integration Study. Once this is complete, the potential for the penetration of intermittent generation across our Province can be more precisely addressed.
3. NSPI will apply to the UARB for approval to commence with economic capital programs necessary to optimize the capacity and environmental performance of its existing generation fleet. These investments may include:
 - a. Addition of Low NO_x combustion firing equipment to Lingan, Pt. Tupper and Trenton;
 - b. Capacity upgrades to Lingan Units 1-4;
 - c. Incremental hydro additions and
 - d. Conversion of Tufts Cove 4 and 5 to waste heat recovery operation.
4. NSPI will continue to actively monitor technology developments both with respect to low impact generation technologies and environmental retrofit technologies.
5. NSPI will continue to explore opportunities to obtain additional clean power sources from within and outside the province.
6. NSPI will continue to participate in the development of the Federal Emissions framework.

NSPI plans to update the IRP analysis once information from DSM implementation and the wind integration study is available and further clarity on the emissions framework is

obtained. A report to the UARB on the status of the items included in the Action Plan will be filed in approximately two years.

APPENDIX 1

NSPI Integrated Resource Plan-2006 Terms of Reference

Objective

To develop a resource plan which utilizes supply-side and demand-side options, to enable NSPI to meet future emissions and other requirements in a cost-effective and reliable manner.

Approach

In developing the IRP NSPI will:

- Collaborate with Dr. Stutz;
- Use the IRP framework as described in the Scope below;
- Maintain compliance with the UARB regulatory framework;
- Maintain compliance with the environmental regulatory framework;
- Employ assumptions, where needed, to plan for environmental compliance;
- Consult with stakeholders; and
- Utilize available information whenever it is possible and appropriate to do so. Provide the UARB and stakeholders (and their respective advisors) who sign applicable confidentiality undertakings with designated confidential information as necessary to support the planning process.

Scope

The IRP will consider a 23-year Planning Horizon (2007-2029).

Primary steps of the Integrated Resource Planning process are:

1. Develop a set of criteria for evaluation of various plans.
2. Develop a load forecast of future supply requirements.

3. Develop realistic supply-side and demand-side alternatives to meet future emissions and other requirements.
4. Perform a screening analysis to determine which alternatives are to be evaluated further in the IRP process and which can be removed from further consideration.
5. Evaluate alternative plans in order to determine the best option. The objective function is the cumulative present worth of the annual revenue requirements over the planning period adjusted for end effects.
6. Perform sensitivity analysis to determine the effect of realistic variations in input assumptions.
7. Develop a recommended emissions control plan based upon the above analysis.
8. Identify actions required over the next 3 to 5 years to meet load projections as well as regulatory and environmental requirements.

IRP Framework

Process

The objective will be the minimization of the cumulative present worth of annual revenue requirements, adjusted for end effects, and subject to a number of considerations, including:

- System reliability requirements;
- Plan robustness - the ability of a plan to withstand realistic potential changes to key assumptions;
- Cash flow - the timing and magnitude of benefits relative to the timing and magnitude of required expenditures;
- Flexibility - the absence of constraints on future decisions arising from the selection of a particular plan; and
- Future regulatory emissions outlook.

Modeling assumptions will include financial analysis assumptions, emissions constraints, load forecast, supply-side options and demand-side options. Where appropriate, NSPI will address contrasting views about reasonable assumptions through sensitivity analyses.

NSPI will consider technically and economically viable supply-side technologies including operating characteristics, capital and operating costs and operational assumptions.

The potential role of demand-side management in a resource plan will be carefully assessed. Estimated DSM costs and load effects will be included in the IRP analysis.

NSPI's strategic planning model, Strategist, will be employed to evaluate alternative plans and complete the integration of supply and demand-side options. Once specific, realistic plans are identified, they will be assessed against the objective and the final criteria.

IRP Deliverables

1. Load Forecast

NSPI develops econometric load forecasts which provide annual energy consumption by customer sector and annual peak system demand.

Twenty-year demand and energy projections are provided as inputs to Strategist. Beyond this period an average annual growth rate is applied to the remaining planning horizon.

The distribution of energy and demand is profiled within Strategist through the application of the total energy and demand figures to the NSPI load curves. The load curves are developed based on data acquired through NSPI's load research sampling.

2. Supply-side Options

NSPI will provide a summary of viable supply-side options, including emissions abatement technologies. The summary will identify the cost and operating characteristics of the various technologies and discuss the opportunity and limitations of these within the NSPI power system.

A screening of the technologies will be completed, focusing on:

- System stability;
- Cost;
- Flexibility;
- Available, commercialized technology;
- Fuel considerations;
- Regulatory emissions outlook;
- Ability to obtain regulatory approval.

Included in the supply-side assessment will be:

- Optimization of existing generation;
- Conventional solid fuel generation;
- Gas-fired generation;
- Emissions management options including abatement technologies, fuel choice and other options;
- Renewables;
- Distributed Generation;
- Emerging technologies, particularly those expected to be commercially available by 2010;
- Enhanced interconnection and power purchasing.

3. Demand-side Options

This process will identify a viable role and approach to demand-side management initiatives that could be implemented in Nova Scotia in the coming years. NSPI will consider DSM initiatives and load forecasting.

NSPI will develop a preliminary assessment of the potential for DSM including cost, load, and usage effects and utilize this for the purpose of IRP development. While the

analysis of DSM will be more detailed for the period through 2010, the cost and potential impact of DSM will be considered for the entire period through 2029.

4. Basic Assumptions

NSPI will file a Basic Modeling Assumptions document containing a consolidation of all modeling assumptions.

5. Plan Integration

Plan scenarios will be developed based on combinations of supply-side and demand-side options per items 1 through 3 above. The alternative plans will be assessed using the Strategist Tool. Strategist will rank the plans according to net present worth of the revenue requirements.

6. Sensitivity Analysis

The IRP process involves adoption of a variety of assumptions, some of which may involve significant uncertainty. Views on these assumptions may vary significantly.

Reflecting this, sensitivities will be identified against which to assess the various competing resource plans. Ultimately the test of the soundness of the recommended plan is its ability to withstand changes to assumptions, across a reasonable range.

7. Final IRP Report with Recommendation

The IRP will culminate in a written report to the UARB which will address the following areas:

1. Background/Process Overview.
2. Criteria for evaluation of the various plans.
3. Load forecast of future supply requirements.

4. Sets of alternative supply-side and DSM alternatives to meet future emissions and other requirements.
5. Screening analysis to determine which alternatives are to be evaluated further as Plans in the IRP process.
6. Evaluation of alternative plans in order to determine the least cost plan.
7. Sensitivity analysis on the least cost plan and other selected plans to determine the robustness of the plans to variations in input assumptions.
8. Selection of recommended plan to meet future emission requirements.
9. Actions required over the next 3 to 5 years to meet load projections and other regulatory and environmental requirements.

Stakeholder Engagement

The IRP framework and the resultant plan will form the foundation for the Company's future investment decisions. Stakeholder input will be an integral part of the process.

While the IRP process will provide increased structure and enable direct stakeholder input to NSPI's planning process, it is important to acknowledge that uncertainty will continue to exist in key areas. Despite this uncertainty, decisions will need to be made.

The integrated resource planning process is technical in nature and time-consuming. NSPI will consult with stakeholders at appropriate points in the planning process and in a manner which delivers value to the planning process.

Confidentiality

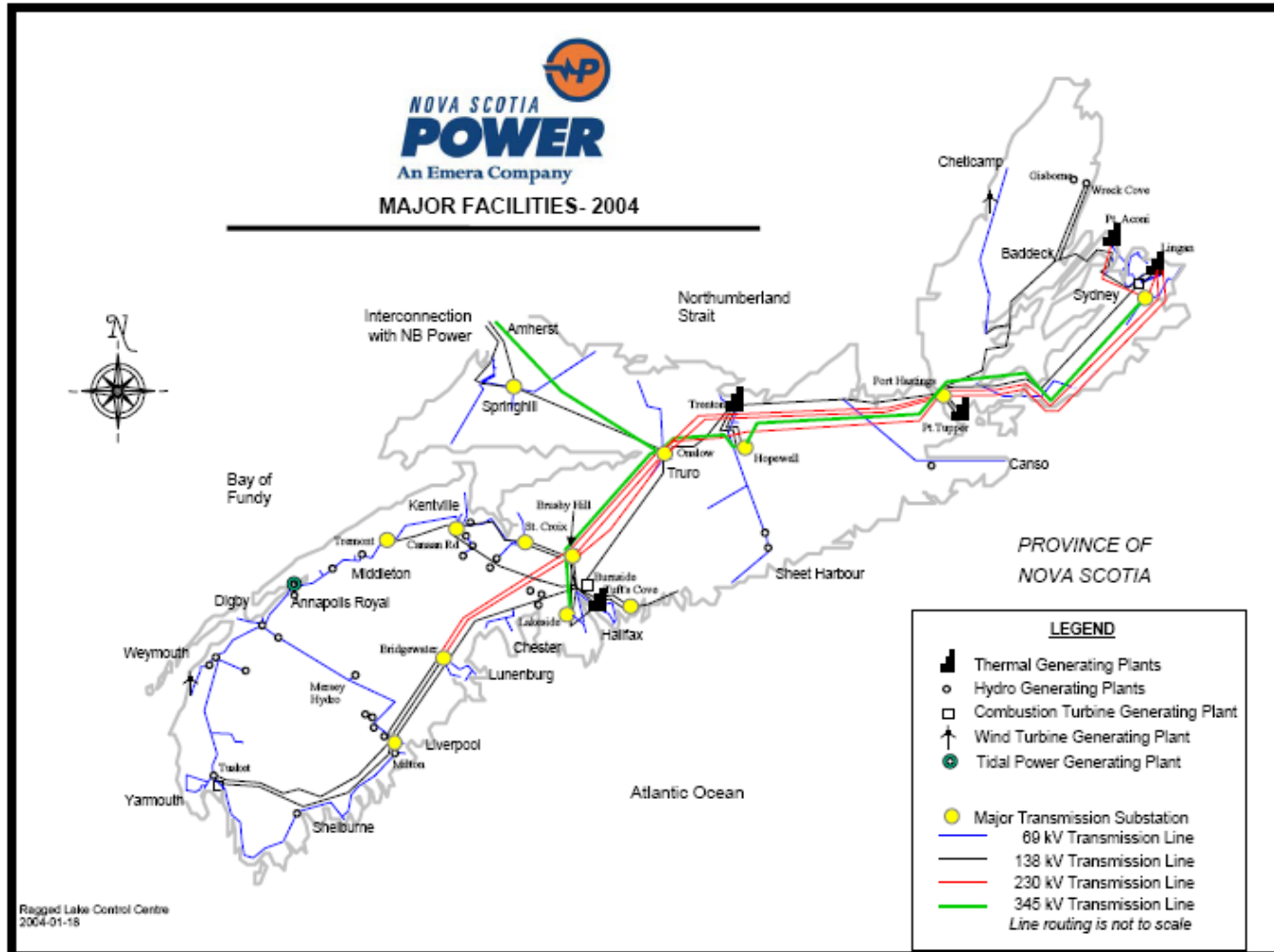
The IRP process involves the compilation of confidential data concerning NSPI's existing and anticipated operating environments. Components include actual operating characteristics of our assets and power system as well as strategic initiatives the Company may undertake. It is important to recognize this planning process takes place in an environment of future competitive generation, according to current government policy.

To the extent reasonable, without threatening NSPI's long-term competitive or financial position, information will be presented in a fashion designed to engage all stakeholders. Certain confidential information, such as detailed data from modeling software, may be limited to the Board. Summary reports will be more widely available.

IRP Process Timeline Summary

- | | |
|--|-------------------------------------|
| 1. Terms of Reference submitted to UARB for approval | July 4, 2006 |
| 2. UARB approval of Terms of Reference | July 21, 2006 |
| 3. Public advertising | Dates to be determined by the Board |
| 4. Notice of Intention to Participate by Interested Parties | September 1, 2006 |
| 5. Basic assumptions including load forecast, supply and demand side options compiled and issued to stakeholders along with modeling assumptions | September 15, 2006 |
| 6. Technical Conference to discuss basic assumptions | September 22, 2006 |
| 7. Stakeholder input on key deliverables and modeling assumptions | October 6, 2006 |
| 8. Final consolidated modeling assumptions issued | January 19, 2007 |
| 9. Base scenarios for alternative Plans established and sensitivities identified | March 2, 2007 |
| 10. Results of Technical Analysis (i.e. scenarios) | May 11, 2007 |
| 11. Technical Conference on analysis results | May 23, 2007 |
| 12. Stakeholder input on analysis results | June 13, 2007 |
| 13. Draft report to stakeholders for comment | July 4, 2007 |
| 14. Stakeholder comments on draft report | July 11, 2007 |
| 15. Final report filed with UARB | July 25, 2007 |

APPENDIX 2



APPENDIX 3



STATEMENT CONCERNING IRP DEVELOPMENT, RESULTS AND RECOMMENDATIONS

John Stutz and Bruce Biewald

July 16, 2007

Integrated Resource Planning (IRP) is a process used to develop resource plans for electric utilities. It differs from older planning approaches in two key respects—consideration of demand as well as supply-side resources, and use of a wide range of analyses to address uncertainty. An IRP effort usually leads to the identification of a **Preferred Resource Plan** which describes the utility’s strategy for meeting its resource needs over the planning period. Based on the Preferred Plan, a short-run **Action Plan** is developed. This plan sets the tasks to be accomplished between the completion of the current IRP and its subsequent review in two or three years.

The IRP developed by NSPI was governed by the Terms of Reference (TOR) provided by the UARB. These TOR called for collaboration with UARB Staff and Consultants, and consultation with other interested parties. A team of consultants supervised by Dr. Stutz, led by Mr. Biewald, and assisted by Mr. Ross Young of Board Staff participated fully in all aspects of the IRP process. Other parties were provided with IRP work products including assumptions, plans for scenario analysis, modeling results, and proposed action plans. Based on discussion at Technical Conferences and written comments, significant modifications were made. As a result, it is our view that the process requirements set in the TOR have been fully met.

Selection of the Preferred Plan was made through a three-stage procedure. First, based on the most likely planning assumptions, a large number of resource plans were developed by, in effect, offering the Company’s computer planning model (Strategist) different sets of resource options for meeting future needs and constraints. Based on this effort, a Reference Case—the plan that minimized the Net Present Value of costs—along with five other Base Resource Plans were identified. Second, in the Sensitivity Analysis, the six Base Resource Plans were rerun using a wide range of assumptions, not just those judged most likely. Third, in the Worlds Analysis, Base Resource Plans were modified to reflect worlds which, in various respects, differ from the future assumed in the modeling leading to the selection of the six Base Resource Plans.

Throughout all of this analysis the Reference Case proved to be quite robust. It was the “least-cost choice” throughout the Sensitivity Analysis and, with suitable additions, it generally provided a least-cost choice in the Worlds Analysis. (We say “generally” only because, in the Worlds Analysis, the Reference Case was, for technical reasons, sometimes replaced by a similar plan with somewhat less renewable resources.) Based on these results, the Reference Case was selected as the Preferred Plan.

The Preferred Plan which emerged from NSPI’s IRP effort has established a clear strategy for meeting the Company’s future resource needs:

- Anticipated growth in energy consumption and peak demand is offset by an aggressive Demand-Side Management (DSM) program that quickly ramps up to expenditures of roughly 5% of Company revenues (5% DSM).
- Renewable resource additions meet and then substantially exceed the requirements of the Renewable Portfolio Standard (RPS), provide all of the new generating capacity.
- Upgrades to a number of existing generating facilities, to boost output and address environmental concerns, are required.

We strongly support adoption of the Preferred Plan—referred to in the IRP report as “5% DSM + Renewables”—as the strategy for meeting NSPI’s future resource needs. That being said, there are a number of uncertainties which need to be acknowledged:

- The level of savings in the 5% DSM spending is a very aggressive target. NSPI has little experience in the development and implementation of DSM. It is unclear at present whether we can ramp up successfully to achieve the savings projected for this case.
- The renewable resources considered in the IRP consist largely of wind. Because of its intermittent nature, the integration of wind in large amounts into a utility system creates technical challenges.
- The environmental constraints under which NSPI needs to plan depend on Federal and Provincial regulations, some of which are currently in flux. Some of the results obtained in the IRP analysis—such as the possibility of economic delay in investment in Flue Gas Desulfurization (FGD) until 2020—could be affected by changes in these regulations.

Over the next two years the results of the IRP indicate that there is a “window of opportunity” during which these and perhaps other uncertainties can be addressed. How to do this while also making substantial progress in resource planning and acquisition is addressed in the Action Plan

In light of the uncertainty discussed above, it is appropriate to defer consideration of a hearing or other formal review of the IRP results for about 2 years. During that period the uncertainties can be addressed—by gaining experience with DSM, through required studies of

integration of renewables and, hopefully, by the evolution and clarification of the regulation framework. To preserve options the actions taken over the next 2 years should meet a “no regrets standard.” In particular, while DSM activity should be sufficiently vigorous to test our ability to meet the 5% target, it should be compatible with meeting lesser targets as well. Moving quickly and vigorously on DSM is particularly important since, as the IRP results show clearly, any significant delay in DSM development is likely to be accompanied by significant increases in costs. To move work along on DSM we suggest continuation of the process which has served us well in developing the IRP—collaboration and consultation under the general direction of Dr. Stutz.

APPENDIX 4

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INTEGRATED RESOURCE PLAN
P-884**

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(High Liner Foods Incorporated)
(Imperial Oil Limited)
(Intertape Polymer Inc.)
(J. D. Irving Ltd., Saw Mills Division)
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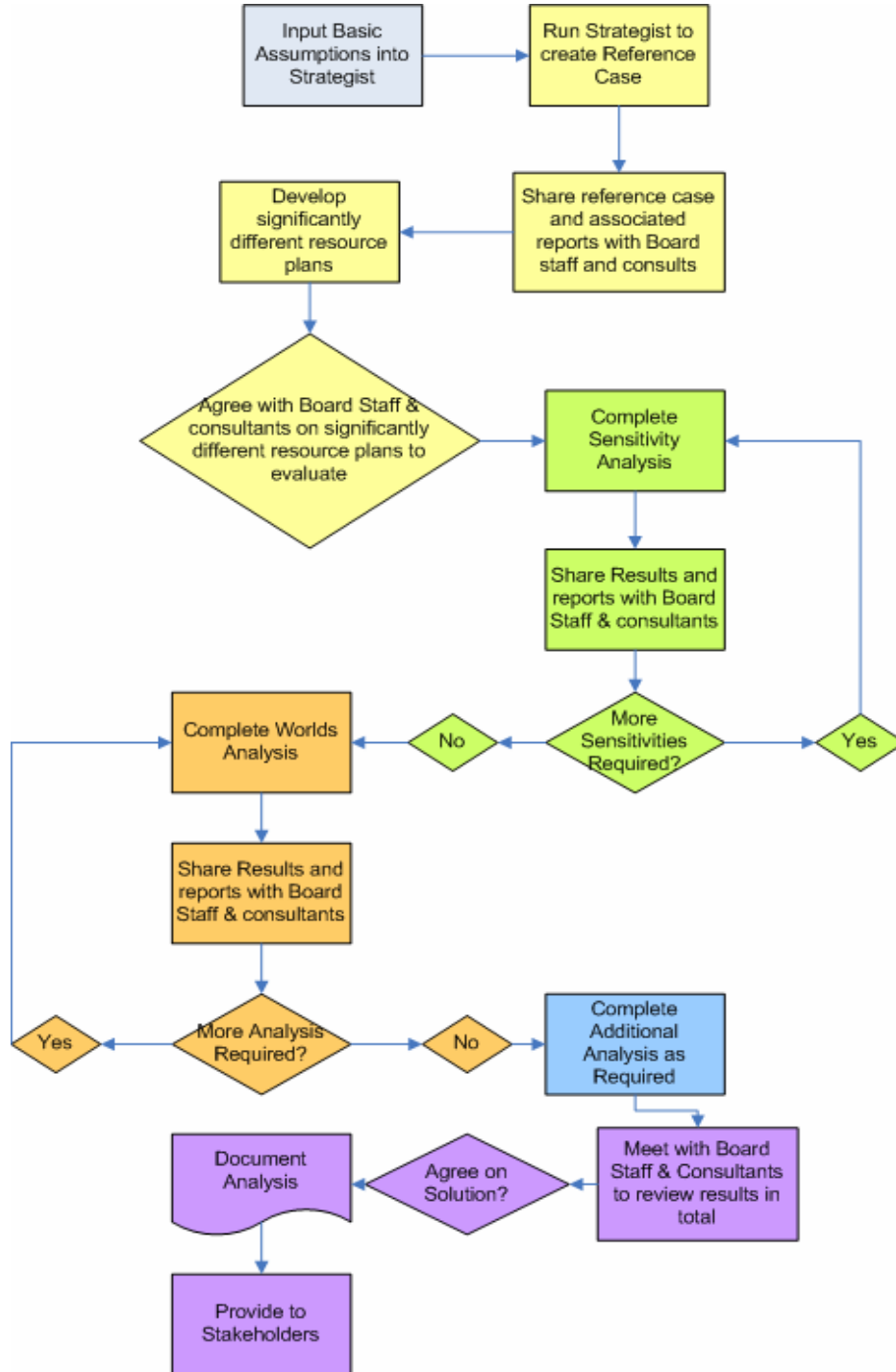
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APPENDIX 5

NSPI's IRP Analysis Flowchart



*Stakeholders were consulted throughout the IRP process. This included issuance of draft materials, participation in technical conferences, response to questions and informal discussions.