


ONTARIO POWER AUTHORITY

November 10, 2006


Ontario's Integrated Power System Plan

Discussion Paper 6: Sustainability

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November 10, 2006

To Ontario's Electricity Consumers and Stakeholders:

Today, I am pleased to deliver for your consideration, "Discussion Paper #6: Sustainability," the Ontario Power Authority's (OPA's) sixth of eight papers on the Integrated Power System Plan (IPSP).

Building on the OPA's "Scope and Overview" paper (#1) released in June, each paper in this series focuses on specific aspects of power system planning. Together, the papers provide our current assessment of the building blocks for the IPSP, and the feedback they generate will be important guidance for the development the eventual regulatory filing. The table on the next page outlines the complete list of IPSP discussion papers.

The purpose of this paper is to elicit discussion on the OPA's approach to considering sustainability, along with environmental protection and safety, in developing the IPSP. Together with the elements presented in the rest of the discussion papers, sustainability considerations will be critical to ensuring the highest success in meeting Ontario's need for a secure and adequate supply of electricity that is acceptable to Ontarians over the long term.

For details on how to participate and provide input (and other IPSP matters), please see the OPA's dedicated IPSP web page (www.powerauthority.on.ca/IPSP/).

In the stakeholder event on November 22nd to 24th and in the months ahead, I look forward to receiving your advice, thoughts and comments and to sharing with you the other planning documents. In addition to the comprehensive report we are releasing today, the OPA has released papers 2, 3 and 4, and, over the coming days, will be releasing papers 5 and 7 covering other components of the plan.

I strongly believe that developing a shared understanding of the planning challenges and the concrete steps needed to address them will focus the discussions, improve the dialogue and ultimately result in a better plan for the benefit of all Ontarians.

Yours sincerely,

Amir Shalaby
Vice-President, Power System Planning

OPA's IPSP Discussion Papers

#	Discussion Paper Title	Release
1	Scope and Overview	June 29
2	Load Forecast	Sept. 07
3	Conservation and Demand Management	Sept. 22
4	Supply Resources	Nov. 9
5	Transmission	Nov. 13
6	**Sustainability**	**Nov. 10**
7	Integrating the Elements - A Preliminary Plan	Nov. 14
8	Options for Procurement	TBD

NB: For details on stakeholder input and participation opportunities (and other IPSP matters), please see www.powerauthority.on.ca/IPSP/, the OPA's dedicated IPSP web page.

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Acknowledgements

The Ontario Power Authority wishes to thank the following people who contributed to this paper as part of an Advisory Group on sustainability matters: Robert Gibson, University of Waterloo; George Greene, Stratos, Inc.; Heather MacLean, University of Toronto; Gordon McBean, University of Western Ontario; Marc Rosen, University of Ontario Institute of Technology; and Ian Rowlands, University of Waterloo.

The Advisory Group members participated in their individual capacities. The OPA intends to seek further input from the Advisory Group before finalizing the IPSP, including review of feedback from the stakeholder consultations. Although their perspectives were greatly appreciated, the views expressed in this paper are those of the Ontario Power Authority and not the Advisory Group.

1. Summary and Introduction

Ontario is at a critical crossroads in planning its energy future – decisions about the province's electricity system must be made today that will have a profound impact on its economy, environment and society for decades to come.

In developing a 20-year Integrated Power System Plan (IPSP), the Ontario Power Authority (OPA) has the opportunity to set the province's electricity system on a path towards sustainability. The OPA's contribution is to consider electricity supply and demand in an integrated manner, including conservation and demand management (CDM), generation from renewable and conventional sources, and transmission infrastructure.

The benefit of performing an integrated evaluation is that it allows for development and evaluation of the plan against a broad range of sustainability criteria that fit the context of power system planning – feasibility, reliability, cost, flexibility, environmental performance and societal acceptance – as well as adhering to Ontario's policy requirements.

This discussion paper is the sixth in a series of eight intended to guide and inform the OPA's IPSP stakeholder engagement process. Collectively, they address the range of considerations in preparing the IPSP. What the reader can expect from this paper is an appreciation of how the OPA is giving consideration to sustainability in the IPSP. The application of the criteria and requirements is found in the integration paper (# 7).

Given the lack of precedent with respect to formally considering sustainability in electricity planning, the OPA is strongly encouraging Ontario's consumers, businesses and other stakeholders to become involved in the planning process and the discussion of sustainability. What the reader will find in this paper is an explanation of our:

- approach to sustainability
- responsibilities for considering safety, environmental protection and environmental sustainability in developing the IPSP
- responsibilities for establishing the rationale for alternatives to electricity projects proposed in the IPSP
- criteria used for integration of the elements of the long-term plan and to facilitate progress towards sustainability.

The focus on sustainability has been a common theme in electricity sector development for a number of years in Ontario. The OPA's planning builds upon the foundation of knowledge and sustainability goals established in public policy through several recent initiatives, including:

- Select Committee on Alternative Fuels
- Electricity Conservation and Supply Task Force
- Conservation Action Team
- Electricity Restructuring Act

- Establishment of the Ontario Power Authority and the Conservation Bureau
- Supply Mix Advice Report
- Ministerial Directive on Supply Mix.

Although some of these policy developments have not explicitly referred to sustainability, the high-level objectives of the reports, legislative and regulatory enactments and ministerial directives are consistent with sustainability goals. The emphasis is on a long-term perspective and concern for the well-being of future generations, and includes the phase out of coal-fired generation, the development of a culture of conservation in Ontario and a substantial increase in renewable sources.

Request for Stakeholder Comment

Stakeholder engagement is a valuable and integral component of the process to develop the IPSP. Stakeholders have participated in and made valuable contribution to this process since the OPA began to develop the supply mix advice in 2005. We therefore invite stakeholders to provide their input, in this case on the OPA's focus on sustainability and planning criteria.

In addition to the questions raised in this paper, the OPA is seeking comment from stakeholders and interested parties on whether its approach for considering sustainability in the IPSP is appropriate and how it might be improved.

For the OPA to give proper consideration to advice and comments from stakeholders and interested parties, submissions must be made in writing and submitted to the OPA through one of the two following channels:

- Electronic submissions can be made through the on-line form at the following website link, which includes instructions for sending submissions as attachments: http://www.powerauthority.on.ca/ipsp/Page.asp?PageID=751&SiteNodeID=231&BL_ExpandID=155\
- Submissions by regular mail or courier can be sent to: IPSP Submissions, Ontario Power Authority, 120 Adelaide Street West, Suite 1600, Toronto, ON M5H 1T1

Submissions must be received through these channels; given the volume of correspondence, submissions sent to specific individuals at the OPA cannot be assured of review and consideration.

2. Approach to Sustainability

The appearance of the term sustainability in policies, statutes and regulations, including the IPSP regulation, demonstrates the need for a practical, relevant approach to measure and assess progress toward sustainability in power system planning.

The OPA's approach to considering sustainability moves from broad concepts to principles to context specific decision-making criteria for long-term electricity system planning. We have placed these sustainability considerations in the policy context in which this IPSP must be framed.

Considering sustainability includes making a point-in-time comparison to demonstrate which areas the plan makes a positive contribution to the betterment of Ontario over its 20-year horizon. In doing so, we are applying a framework that acknowledges that electricity planning interacts critically with economic, environmental and social dimensions.

Given the lack of a completed precedent with respect to considering sustainability in long-term electricity planning, an emphasis has been placed in this stage of describing the essential elements of the framework rather than providing complete details.

2.1 Concept of Sustainability

The concept of sustainability has evolved from relative obscurity over the past few decades to become a term widely used by governments, businesses and organizations in Ontario and in Canada and abroad. The fact that sustainable development, a term popularized by the World Commission on Environment and Development (Brundtland Commission) in 1987, has been so readily adopted by such a broad and diverse range of institutions worldwide reflects the significant contribution expected from its application.

Most observers would recognize that sustainability is becoming more widely acknowledged and understood despite continued debate on its specific details. Public awareness and concern over resource use, environmental degradation and socio-economic inequity have increased the prominence of sustainability imperatives in public policies, statutes and regulations, and these issues are of concern to the Ontario government and Ontarians.

Defining sustainability has been challenging because it depends on values and perspectives of various stakeholders that are subject to change over time. As noted in one of the more current and comprehensive works on the subject, many variations of sustainability have been applied in practical initiatives while researchers have spent years pursuing a robust definition. The results have been both diverse and at times conflicting.[1]

Many interpretations will always exist, but almost all involve the simultaneous consideration of economic, social and environmental imperatives and considering impacts of development on future generations. Sustainability goals emphasize a long-term perspective and concern for the well-being of future generations.

The path toward a common understanding of sustainability has been complex and lengthy. Early on, the 1972 United Nations Conference on the Human Environment in Stockholm struggled with whether the environment and development were at odds. By 1987 the Brundtland Commission arrived at the definition of sustainability as, "(d)evelopment that meets the needs of the present without compromising the ability of future generations to meet

[1] Robert B. Gibson, *Sustainability Assessment: Criteria and Processes* (London: Earthscan, 2005), pp.206-16.

their own needs".[2] In 1992, the United Nations Conference on the Environment and Development in Rio de Janeiro explicitly framed sustainability within the context of development, including in its declaration the statement "(i)n order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it."[3]

The Brundtland definition has appeared in several instances of Canadian federal legislation, such as the *Canadian Environmental Assessment Act* and the *Canadian Environmental Protection Act*. While it has been criticized for vagueness, the Brundtland definition has "constructive ambiguity" that is credited for keeping stakeholders who normally may not interact with one another – including governments, industries and advocacy groups – at the discussion table.[4]

While the Brundtland definition is not reflected in Ontario legislation, the emphasis of the Rio Declaration is evident in the Ontario Government's IPSP regulation, which requires that environmental and sustainability considerations be considered in developing the IPSP.

2.2 Sustainability Principles

For the application of sustainability to the IPSP, we find utility in Robert B. Gibson's sustainability principles in his recent work *Sustainability Assessment: Criteria and Processes*.[5] Having been drawn from the rough consensus of more than two decades of debate, the usefulness of these principles is their flexibility in permitting simultaneous evaluation of interrelated and often conflicting economic, environmental and social imperatives and implications.

In order for the OPA to assess the sustainability of the IPSP in an integrated manner, a comprehensive view of the economic, social and environmental implications of the plan is necessary. The OPA's approach to considering sustainability is to derive context specific evaluation criteria that encompass Gibson's sustainability requirements. This transition to specific criteria has proven effective in other complex undertakings, such as the Mackenzie Valley pipeline.[6]

Gibson's principles are operationalized through eight sustainability requirements and six trade-off criteria, which together are intended to provide a basis for uncovering potential trade-offs, mitigations and improvements to implementation decisions. The eight sustainability requirements are presented in Table 2.1, with a fuller explanation in Appendix 1.

[2] World Commission on Environment and Development, *Our Common Future* (New York: Oxford, 1987).
[3] Agenda 21, The Rio Declaration on Environment and Development, http://habitat.igc.org/agenda21/index.html.
[4] Ann Dale, *At The Edge: Sustainable Development in the 21st Century* (Vancouver: UBC Press, 2001), p. 34.
[5] B. Gibson, op. cit.
[6] Robert B. Gibson, *Sustainability-Based Assessment Criteria and Associated Frameworks for Evaluations and Decisions: Theory, Practice And Implications For The Mackenzie Gas Project Review, A Report Prepared For The Joint Review Panel For The Mackenzie Gas Project* (26 January 2006).

Table 2.1 – Description of Sustainability Requirements

Sustainability Requirements	Description
Socio-ecological System Integrity	Maintain resiliency of ecosystems and consider linkages between economic, environmental and social impacts
Livelihood Sufficiency and Opportunity	Provide robust basis to improve livelihoods and help individuals and communities avoid economic despair
Intra-generational Equity	Seek to prevent disproportionate burdens on particular regions, groups or industries
Intergenerational Equity	Create an environment for future generations that satisfies or enhances opportunities for sustainable livelihoods
Resource Maintenance and Efficiency	Reflect resource scarcity, environmental and socio-economic impacts in planning decisions and encourage end-use and process efficiencies wherever practical
Socio-ecological Civility and Democratic Governance	Promote open, public discourse among stakeholders and encourage behaviour that internalizes sustainability objectives
Precaution and Adaptation	Develop dynamic decision-making processes that can adapt to a range of future scenarios and contingencies
Immediate and Long-term Integration	Enable progress towards sustainability by integrating all relevant considerations concerning current and future generations

Source: OPA adapted from Gibson.

Recognizing that some trade-offs are inherent to the nature of integrated resource planning, how the plan deals with trade-offs is critical. Gibson's approach to difficult choices and trade-offs are presented and described in Table 2.2, with a fuller description also in Appendix 1.

Table 2.2 – Description of Trade-off Criteria

Trade-off Criteria	Description
Maximum Net Gains	Facilitate the greatest net betterment given relevant scope and circumstances
Burden of Argument on Trade-off Proponent	Responsibility of advocate to provide sufficient justification
Avoidance of Significant Adverse Effects	Prevent or mitigate impacts that undermine socio-ecological system integrity
Protection of the Future	Give preference to decisions that avoid or minimize adverse impacts on future generations
Explicit Justification	State objectives transparently and comprehensively
Open Process	Engage stakeholders to develop a shared understanding of key issues and concerns

Source: OPA adapted from Gibson.

In order to assess the sustainability of the IPSP in an integrated manner, the OPA extends its approach to context specific evaluation criteria consistent with Gibson's sustainability requirements. These are outlined in the next section.

2.3 Context Specific Evaluation Criteria

As an exercise in integrated resource planning, the IPSP considers conservation and demand management (CDM), supply and transmission in an integrated manner. For sustainability to be considered in this context, the integration of plan elements requires a practical set of context specific criteria for long-term integrated electricity planning that are consistent with the application of the sustainability requirements. These context specific criteria, which are assessed in terms of the sustainability requirements and trade-off criteria in Part 3, are as follows:

Feasibility: This is comprised of technical feasibility, commercial availability, technological maturity, sufficient infrastructure and lead time and compliance with regulations, all of which must be present if resources are to be incorporated in the IPSP.

Reliability: Resource adequacy and system security, which make up the components of this criterion, are necessary to maintain system reliability at all times throughout the planning horizon.

Cost: This encompasses cost of options on the planning horizon, the value of conservation, cost of services to consumers and impact on customers' bills.

Flexibility: This includes the flexibility of options in the future and the robustness of the plan to be sufficiently adaptable to a range of future scenarios.

Environmental Performance: This includes the amounts of greenhouse gas (GHG) emissions, conventional contaminant air emissions, radioactivity, water use and wastes generated.

Societal Acceptance: This includes the matters that have significant socio-economic implications.

The significance of these context specific criteria is that they both support sustainability and would be applicable under an integrated planning scenario in another jurisdiction. With these established, the next step is to test them against the Ontario specific policy parameters.

2.4 Ontario's Emphasis on Sustainability

Sustainability in Ontario's power system originates well before the creation of the OPA, as was noted in the supply mix advice.[7] Although some policy develops through explicit pronouncements, the requirement for considering sustainability in the IPSP reflects a rich story in gradual and implicit policy development in Ontario.

While a longer history exists and a more detailed explanation is provided in Appendix 2, the recent emphasis on sustainability in the electricity industry can be traced back to the all-party Select Committee on Alternative Fuels, which recommended in 2002 that coal-fired electricity generation in Ontario be replaced by 2015.

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[7] OPA, *Supply Mix Background Reports, Volume 3*, pp. 13-28 (December 2005).

In the same period, the Electricity Conservation and Supply Task Force (ECSTF), which had been appointed by the government to address warnings of a looming supply shortage in a competitive generation market, recommended that conservation, not just supply, and long-term planning had to be part of the solution. The sustainability emphasis in both was intricately interconnected because the treatment of conservation as a resource requires integrated resource planning.

While this was transpiring, the Government's Conservation Action Team, which performed a wide-ranging assessment of all government policies and programs throughout 2004, forwarded numerous recommendations to advance the conservation agenda in its 2005 report, many of which have subsequently become practice or government policy.

These elements came together in the *Electricity Restructuring Act, 2004*, which, by amending the *Electricity Act, 1998*, created the OPA, the Conservation Bureau within the OPA, and the IPSP as a key responsibility of the OPA. With planning and conservation helping to facilitate progress towards sustainability, the OPA was established, in essence, to put the electric industry on a path towards sustainability.

When the Minister of Energy issued the May 3, 2005, request for "supply mix advice", sustainability was manifested in the instructions to the OPA. The OPA was required to determine, in sequence, the extent of available CDM, the available supply from renewable sources, and only then consider how to fill in the remaining supply with conventional resources. Further, this process was to respect the government's policy on the replacement of coal-fired generation. The instructions, which also required the OPA to solicit stakeholder and public input, were manifestly sustainability-focused without mentioning the term.

In its December 2005 supply mix advice, the OPA gave explicit recognition to three sustainability-focused government policies: the long-term goal of the creation of a conservation culture, a preference for renewable sources of energy, and the replacement of coal-fired generation for environmental and health reasons. In addition, the OPA outlined its six principles for planning, including as its second: "choices and directions need to be put on a path to sustainability – for Ontario's environment, economy and people – over the long term."[8]

Within the framework of these policies and principles, the OPA gave consideration to the environment and sustainability in the supply mix advice by assigning relative weights to various impacts of generation and conservation technologies. On this basis, the OPA addressed the environment and sustainability in each of the four volumes of the report.

The Minister of Energy's June 13, 2006, directive for the IPSP was based on advice the OPA had provided on supply mix, and the prescriptive nature of the directive is a reflection of the sustainability intent of the Minister and the OPA. The directive sets an aggressive goal of 6,300 megawatts (MW) of CDM and 15,700 MW of renewable energy, which is double its current capacity, while keeping nuclear at 2005 capacity, natural gas for high value applications,

[8] OPA, *Supply Mix Advice Report, Volume 1*, pp. 3-4 (December 2005). See Appendix 1 for a detailed summary of the sustainability focus and initiatives in the supply mix advice, including the research and consultation.

and removing coal entirely. The directive is a reflection of the commitment to sustainability in government policy.

Ontario Regulation 424/04 governs the IPSP and requires that sustainability be considered in the plan. Of the regulation's eight paragraphs, fully four are focused on issues of sustainability, and others could be said to be contributing. Of the greatest significance, the OPA must ensure that safety, environmental protection and environmental sustainability are considered in the plan. While the sustainability initiatives inherent in the directive are not reviewable by the Ontario Energy Board (OEB), these directives form the context for sustainability within the plan. The IPSP must comply with the directive, and in making decisions regarding the plan's development in light of the directive, the OPA will consider safety, environmental protection and environmental sustainability.

In addition, the OPA must provide for a sound rationale for near-term projects that trigger individual environmental assessments and include an analysis of their environmental impact based on a specific definition of environment and a reasonable range of alternatives. The OPA must also consult with stakeholders and others and accelerate the implementation of conservation, energy efficiency and demand management measures.

In Part 3, the analysis of sustainability is made context specific to long-term planning of the Ontario electricity system. These context specific criteria and their sub-sections are created to present salient issues in a straightforward format. They should not obscure the purpose of the analysis, which has been, and continues to be, to recognize interconnections between the elements and to integrate them rather than conduct a simple balancing of issues.

3. Evaluation Criteria

The six OPA context-specific decision-making criteria have been designed to be applied throughout the formulation of the IPSP. In this part, each of the six criteria are expanded upon to provide a sense of the key issues that each encompasses and to convey a deeper understanding of their linkage to sustainability principles.

3.1 Feasibility

Feasibility, along with reliability, is one of two absolute decision-making criteria upon which decisions made for the IPSP are based. Feasibility can apply both at a plan level and to the constituent components that make up the plan. In relation to power system planning, feasibility refers to the practicality of decisions, for example, having sufficient infrastructure to support a particular resource choice. For individual resources, it refers to technical and commercial availability, project lead times and compliance with all regulations.

All planning decisions, whether related to conservation, supply or transmission necessarily must be feasible if they are to be included in the IPSP, especially in the near term. If confidence in the near-term feasibility of individual resources (e.g., for a particular technology choice) cannot be established, the resource is identified as having potential for the longer term, pending further development of technology or resolution of issues surrounding its availability.

At the plan level, there must always be sufficient resources to meet Ontario's requirements. At the very least, to be incorporated into the IPSP, options must be practically functional and appropriate for their intended purpose. The IPSP seeks to ensure that supply resources are used effectively by developing the appropriate levels to meet base, intermediate and peak requirements and operability requirements.

Besides technical feasibility and maturity, plan components must also be commercially available to be incorporated in the near-term part of the plan. This entails being available in the market at a cost that is not economically prohibitive and where the means for it to be brought to market exists. Assessments about the feasibility of emerging technologies are made for later stages of the plan, even where their commercial availability remains uncertain. For instance, developing technologies with potentially desirable characteristics, such as gasification, currently have some scope within the Preliminary Plan, but their commercial unavailability restricts them from the early part of the planning horizon.

There must be confidence that suppliers have sufficient production and delivery capability at the scale required by the plan. In a broader context, a skilled workforce must be trained and developed to ensure that enough human capital is in place to execute potential projects. Physical resources and materials must also be available in satisfactory quantities.

In addition to the technical and commercial feasibility, decision making is also based on whether there is infrastructure to support the implementation of various projects. For instance, potential natural gas plants are more likely to be built if they are located in close proximity to existing pipelines that can be accessed cost-effectively.

There is also a timing component to feasibility. Conservation, supply and transmission projects are associated with various lead times that must be accounted for in the development of the IPSP. Each project differs in length of time required before it can come online due to diverse construction requirements, regulatory approvals, environmental assessment obligations, municipal zoning considerations, and so on.

One other aspect of feasibility is the confirmation that regulatory, environmental and safety requirements for implementation, which are discussed further in Part 3, can be met. Appropriate regulatory and review capability are another integral facet of feasibility in the context of the IPSP evaluation criteria.

Feasibility is a condition that places constraints on planning decisions. It is not a criterion that can be traded off against other planning considerations.

3.2 Reliability

In addition to feasibility, reliability is the other criterion that must be invariable in its application of the decision-making criteria: system reliability cannot be compromised at any time during the plan. In the context of the IPSP, reliability has two key dimensions: resource adequacy and system security. There must always be sufficient resources to meet demand and the system must be configured such that it can withstand various kinds of system disruptions. Reliability is critical to the principle of enhancing livelihood sufficiency and opportunity for Ontarians.

A central priority of reliability is to ensure blackouts are avoided. Reliability must be ensured both in the aggregate and at the regional level and must be maintained throughout the planning horizon at all times. This requires a sufficient level of supply and conservation at all times to meet demands with confidence. It also means that there must be sufficient energy at all times.

In order to maintain resource adequacy, reserve margins must be maintained. Towards this end, the IPSP must follow formal reliability criteria that have been established by the North American Electric Reliability Council, the Northeast Power Coordination Council and the Independent Electricity System Operator (IESO).

In addition, the OPA uses analytical methods to systematically evaluate uncertainty. It allows different variables and scenarios to be assessed by means of simulation analysis to obtain a better understanding of the range of possibilities that may arise.

The second component of reliability is system security. The system must be designed to withstand various contingencies, such as the failure of a generating unit, a lightning strike or extreme weather, and be able to recover quickly so that a reliable flow of power is not interrupted. Ensuring system security is consistent with the principle of precaution and adaptation.

System reliability is considered non-negotiable. In terms of sustainability, the fact that reliability cannot be traded off inherently protects future generations.

3.3 Cost

The affordability of electricity is a component of sustainability, including intra-generational equity, livelihood sufficiency, resource maintenance and efficiency and precaution and adaptation. Individual conservation, supply and transmission projects will be selected based on their cost-effectiveness.

The integrated analysis of costs from various perspectives is consistent with the requirement for immediate and long-term integration. In order to evaluate fully the cost implications of the IPSP, four measures are considered in the following subsections.

Cost of Options over the Planning Horizon

Levelized unit energy cost (LUEC) analysis is used to screen and assess the relative cost of each generation alternative. LUECs reflect the constant real price per kilowatt-hour that needs to be charged over the lifetime of a particular generating unit to recover all the capital, fuel, operating, maintenance and decommissioning costs incurred over its operating lifetime, at a given discount rate.

LUEC analysis can screen options that have different patterns of expenditures, service lives and operating characteristics. This is useful for the initial selection of options to minimize total costs.

A useful analysis emerging from the LUEC calculation is a break-even analysis, which determines the average capacity factor at which each generation alternative is most cost-effective. This was carried out for the supply mix advice.[9] Nuclear, combined-cycle natural gas, single-cycle natural gas and gasification options were evaluated. This kind of assessment can identify cost-effective supply resources depending on the requirements, which contributes to improving efficiency and resource maintenance.

Options suited for baseload supply are those with lower variable costs, even if initial capital costs are high, since they need to be operational most of the time. Generation alternatives with lower capital costs have higher variable costs and are more appropriate for peak load generation.

The break-even analysis has considered the relative magnitude of fixed and variable costs for each generation alternative and various discount rates. The objective was to determine the most desirable generation alternative depending on the circumstances that can minimize total costs and financial risk (i.e., fixed plus variable) in order to maximize gains, and better mitigate uncertainties, which is consistent with precaution and adaptation. A present value analysis also captures long-term costs.

The Value of Conservation

The total resource cost (TRC) test is used to analyze the cost-effectiveness of conservation programs. Conservation contributes to socio-ecological civility and democratic governance and builds a sense of community and social responsibility. These initiatives reduce stress on socio-ecological systems by reducing the need for electricity. It is also consistent with precaution and adaptation and intra-generational equity.

CDM programs are subject to the same analytical rigour as supply alternatives to assess whether they are cost-effective and whether their actual demand reduction is verifiable and durable. In practice, the TRC test is used to evaluate the costs and benefits of CDM initiatives. The TRC test measures avoided costs (i.e., the benefits) that would be incurred in the absence of CDM adoption, such as generation, transmission and distribution capacity investments, energy production costs and transmission and distribution losses. It then compares these benefits

[9] OPA, *Supply Mix* Analysis *Report*, *Volume 2*, p. 244, (December 2005).

against the cost of each particular CDM initiative. The method being used to determine TRC is based on the OEB's Total Resource Cost Guide.[10]

The TRC test has been used to estimate the economic potential of CDM in the development of the IPSP. Currently, it is being calculated for individual programs, and, along with other measures, will be used to select and design economically prudent CDM programs. This can contribute to a culture of conservation in Ontario in which growth at a sustainable scale is more likely to occur.

The TRC test inherently incorporates economic trade-offs into the evaluation of CDM programs. The test is designed to maximize net gains through a form of cost-benefit analysis.

Cost of Services to Consumers

This factor measures the cost impact of the proposed IPSP on consumers. All consumers throughout the province are affected by electricity prices, but there may be specific implications for households with modest means and by businesses with energy intensive operations. While this will have a direct impact on livelihood sufficiency and opportunity, there will also be opportunities to reduce expenditures through conservation programs, including deferring use to off-peak periods. An increase in electricity prices may have adverse macroeconomic effects on the provincial economy in terms of employment losses and may hinder the effectiveness of Ontario businesses that compete outside of the province.

In order to limit the significant adverse effects, the prospective IPSP supply mix is comprised of an appropriate level of base, intermediate and peak load generation alternatives. This reduces wastage, since too much baseload generation, which cannot adapt quickly enough to changing demand levels, would be generated unnecessarily. Conversely, too much intermediate and peak load generation, although able to ramp up and down sufficiently, exhibits larger variable costs and, therefore, would not be economically prudent and cost-effective to install and employ.

Although an increase in the cost to consumers is anticipated, consumers will have opportunities to reduce their electricity costs through the emphasis in the plan on a conservation culture.

3.4 Flexibility

Flexibility involves ensuring that the plan is robust, meaning that the IPSP needs to perform well under a range of possible futures, even after the commitment of new supply, transmission and CDM resources. Hedging financial and other risks is also part of a robust plan. Flexibility also means developing a plan that is able to adapt as circumstances and assumptions change before the commitment of resources. Flexibility is built into the OPA's mandate to create a new IPSP every three years.

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[10] For a more comprehensive explanation of the TRC calculation, refer to IPSP Discussion Paper #3 on conservation and demand management. The OEB Total Resource Cost Guide is available at: http://www.oeb.gov.on.ca/documents/cdm_trcguide_141005.pdf

Over a 20-year horizon, circumstances will inevitably unfold differently from the future envisioned at present. Forecasts and assumptions change due to forces external to the plan, such as fuel commodity prices, provincial economic performance or changes in public policies. It is important, therefore, to develop strategies to ensure that, over the course of the IPSP, changing circumstances do not hinder Ontario's developing power system from providing reliable, affordable and sustainable power.

Several strategies for developing the IPSP can help to ensure the adaptability and robustness of the future power system, including planning for diversity in supply and CDM resources. Another facet of diversity is to enhance the geographical diversity of supply resources. For resources with long lead-times, approvals processes need to be initiated early to help keep options open on shorter notice. One trade-off that could be encountered with respect to increasing diversity is the extent to which emerging technologies are able to be included in the early part of the planning horizon. The benefits of particular emerging technologies and the diversity benefits offered must be weighed against feasibility and reliability criteria.

The timing of new resources is also critical, so the IPSP includes as a precautionary measure, an overlap between mature facilities going offline and capacity expansion coming online. Finally, within contract limits, the acquisition of new resources has the flexibility of being delayed, suspended or mothballed if demand slows or reverses, or, alternatively, current resource utilization may have to be altered.

Ensuring flexibility supports the sustainability requirement of precaution and adaptation. This is a challenging task for the OPA not only for the development of the first IPSP, but also at every stage of plan development, implementation and revision. Long-term planning, which is characterized by uncertainty, is analogous to navigating uncharted waters. By emphasizing flexibility, the OPA maximizes the chances that the IPSP will result in a power system able to withstand changing assumptions regarding the numerous uncertainties that affect the timing, feasibility, cost-effectiveness and public acceptability of the resources making up Ontario's electricity system.

Planning for the implementation of new projects also considers the extent to which particular projects can be reversed if and when circumstances change. The advantage of smaller scale, modular alternatives is that they can be more responsive to unexpected changes in demand forecasts and can mitigate the risk of overbuilding capacity. Large-scale alternatives, however, also present a number of benefits, especially where there are economies of scale, so trade-offs between the two kinds of options exist. Consequently, the appropriate combination of large-scale and small-scale options to achieve mutually beneficial gains is part of the flexibility required in assembling the plan.

Flexibility also involves anticipating and providing for life-cycle impacts of options. This is consistent with intergenerational equity and resource maintenance and efficiency. It is most applicable to nuclear and fossil fuel use.

3.5 Environmental Performance

All forms of electricity generation, transmission and use have effects on the natural environment. The energy sources from which electricity is derived flow from nature, and resulting emissions and waste products are either assimilated back into the environment or require long-term management. The effects of power system development and operation vary in terms of where they occur and in the time it takes for potential adverse effects to become apparent. Accordingly, the OPA places significant importance on evaluating and understanding the potential impacts on the environment.

The OPA is integrating environmental considerations directly into planning decisions by preferring new developments on existing sites and rights-of-way over creating new land disturbances, and by evaluating options for upgrading, expanding or refurbishing existing facilities. This is consistent with resource maintenance and efficiency.

With respect to environmental performance, the OPA's framework applies the Canadian Environmental Sustainability Indicators (CESI) in the context of the Ontario power system. The CESI indicators are useful because they have been adapted for Canada by the federal government with a focus on air quality, freshwater quality and GHG emissions as the primary indicators.

The indicators proposed for consideration for the environmental performance in the IPSP's sustainability analysis are described below. These indicators have been carried forward from the supply mix advice and are grounded in other efforts to measure progress toward sustainability.

Greenhouse Gas Emissions

Risks of climate change are strongly linked to GHG emissions caused by energy production and, as a result, have implications for intergenerational equity and socio-ecological system integrity as well as livelihood sufficiency in the longer term. Addressing GHG emissions in the energy sector is a public policy priority. GHG emissions are one of the three CESI indicators and were considered the most important environmental category in the supply mix advice. The method for evaluating GHGs has not been changed for the IPSP. This GHG indicator, while similar in principle to CESI, differs in that it considers three primary greenhouse gases, rather than the six constituents of the CESI indicator.[11] For electric utility operations, data for the three additional GHGs are not available. This indicator is proposed as part of the IPSP sustainability analysis, and its method of measurement and application are described in more detail in the integration paper (# 7).

Even before the sustainability analysis is complete, several inferences can be drawn for the IPSP based on the OPA's experience in developing the supply mix advice. Since fossil fuel generation has the highest GHG emissions of the generation resources (primarily from combustion at the

[11] OPA's method considers carbon dioxide, methane, and nitrous oxide. The CESI indicator also considers sulphur hexaflouride, perflourocarbons and hydroflourocarbons as GHG constituents.

generating plant), phasing out coal plants, as mandated through government policy, will result in decreased levels of GHG emissions. An apparent trade-off exists with respect to increasing the capacity of gas, which would increase GHG emissions. This is acceptable given that the directive prioritizes gas for high-efficiency and high-value applications, which means the “smart gas” strategy will contribute to reducing GHG emissions overall.

The new hydroelectric reservoir developments in the north are notable because hydroelectric dams have GHG emissions associated with the flooding of tracts of land, as well as with construction activities and materials. For some forms of renewable generation, this means that there may be a trade-off in the GHG emissions category.

Nuclear power emits significantly fewer GHGs per unit of energy produced, even when considered over its entire life-cycle. Although it is associated with some GHG emissions up and downstream, there are none emitted at the electricity generation stage. The operation of nuclear power plants is virtually GHG emission free, and GHG emissions associated with uranium mining and transport and power plant construction and decommissioning are mitigated on a per unit energy basis, due to the high energy production capacity of nuclear plants. The only other baseload option with as low a carbon intensity as nuclear is run-of-river hydroelectric.

Wind and solar produce no GHGs during their operation, but some emissions are associated with construction, maintenance and decommissioning of these facilities. Life-cycle GHG emissions from wind and solar facilities appear large when expressed per MWh, primarily due to these facilities producing comparatively less energy over their operating lives.

Most biomass resources have the potential to be GHG neutral. This is true of waste materials that would otherwise decompose in the atmosphere and of energy crop plantations, which offer greater potential for sequestering carbon dioxide in a closed-loop growth cycle.

Fewer GHG emissions support the requirement of socio-ecological system integrity. This may be especially true for Ontario's northern communities. Northern Ontario risks being disproportionately disadvantaged by the effects of climate change, which can affect surface waters and river flows, forest productivity and other subsistence lifestyle activities. Since global climate change carries the potential for drastic, long-term consequences that could alter the ability of future generations to meet their basic needs, actively reducing GHG emissions will make a primary contribution to intergenerational equity.

The evaluation of the Preliminary Plan's GHG implications has yet to be finalized, but this is addressed in more detail in the integration paper (# 7).

Conventional Contaminant Air Emissions

Several compounds emitted to the air from power generation activities are associated with known adverse human health and ecological effects. Achieving cleaner air for the people of Ontario is an important objective, even if emissions related to power production are only a part of the problem. The other parts are transportation and industrial emissions.

Clean air, which has recently been made a priority in federal government policies, is also a CESI indicator. This indicator is the same as in the supply mix advice. In the IPSP, however, it differs from the CESI indicator because it considers a broader range of air pollutants; the CESI indicator only considers seasonal ozone concentrations to reflect the potential for long-term health impacts.[12]

Multiple air emissions are measured in a disaggregated fashion and combined into an aggregate index. This indicator, its method of measurement and application to the IPSP analysis, are described in more detail in the integration paper (# 7).

Contaminant air emissions can be reduced by altering the resource mix, by installing emissions abatement technologies on existing plants, or by both. For example, replacing coal-fired generation with cleaner sources will result in fewer contaminant air emissions. In addition, installing emissions abatement technologies on coal units, such as selective catalytic reduction, flue gas desulphurization, bag houses or electrostatic precipitation, has been proven to mitigate contaminant air emissions. The primary trade-off for both methods relates to higher costs. For example, producing electricity from cleaner replacement technologies costs more than power from the existing coal plants, which may not be justified since they are being phased out. In addition, emissions abatement equipment entails capital costs and reduces overall efficiency of power plants.

Reducing contaminant air emissions over the life of the plan supports the requirement of socio-ecological system integrity. For example, reducing harmful emissions can mitigate harmful effects to people, plants, animals and crops. Acid precipitation and some hazardous air pollutants can also damage construction materials. The health effects of air pollution include respiratory ailments and asthma, among others, which can affect livelihood sufficiency and opportunity by decreasing productivity and the ability of people at work.

In terms of intragenerational equity, contaminant air emissions from large point source power plants disproportionately affect communities downwind and near these facilities. In some cases, these groups bear the burden of air pollution, while others receive the benefits of the energy. Over a longer time period, intergenerational equity can be affected by ecosystem damages by air pollution that can affect ecological services available to future generations.

Precaution and adaptation are two of the driving forces behind reducing air pollution. While some uncertainties exist regarding the role that power generation plays in causing health and ecological effects, these activities nonetheless are significant contributors. There is still a desire to reduce air pollution despite the fact that many of these emissions are created by other sectors, including industry and transportation.

Radioactivity

This indicator considers the potential for radiological effects on populations. Various radionuclides are released from activities related to the nuclear and coal fuel cycles and reducing these emissions is important for making progress toward sustainability. For the

[12] The OPA's indicator includes the following air contaminant emissions for electricity generation options (where applicable): oxides of nitrogen, sulphur dioxide, fine and ultra-fine particulate material, benzene, formaldehyde and mercury.

nuclear fuel cycle, radon gas from mining and milling is the primary source of emissions, with uranium isotopes from refining, conversion and fuel fabrication being the primary source. Radionuclides released from nuclear reactors vary from reactor to reactor, but include noble gases, radioactive particulates and tritium. Radiological emissions for the coal fuel cycle are primarily related to coal mining and combustion at the plant.

The indicator proposed to reflect radioactive air emissions for the IPSP is the same as in the supply mix advice. This indicator, its method of measurement and application are described in more detail in the integration paper (# 7). While government policy takes the decision out of the IPSP, phasing out coal-fired generation results in the release of fewer radioactive air emissions. In fact, populations impacted by coal plants can receive many times the dose of radioactivity than populations impacted by nuclear plants because the emissions at a nuclear plant are tightly controlled.

In terms of the requirements for sustainability, the release of radioactive air emissions, primarily from point-source operations such as mining and combustion, affects intragenerational equity. The effects of exposure to radiological air emissions can burden some populations disproportionately, such as those near to or downwind of the source of the emissions and workers.

Water Use

The water use indicator is intended to capture the consumptive and non-consumptive use of water by generation options.

Hydraulic and thermal power generation technologies use a lot of water. While much of this water is not consumed because it simply passes through the system, there nevertheless may be downstream effects. The impacts of water use on freshwater ecosystems include not only the physical withdrawal of water, but also potential effects on aquatic biology and changes to characteristics such as temperature and dissolved oxygen. Since the IPSP is only examining the generic before and after impacts of the plan, an indicator based on the collection of samples at actual locations is not possible at this time. The proposed indicator is the same as the water use indicator evaluated in developing the supply mix advice.

Similar to the other indicators that were used in the supply mix advice, some inferences can be made regarding water use even before the IPSP analysis is complete. Increased development of hydroelectric resources means some trade-offs resulting in additional water withdrawal and consumption will occur. If water impacts increase, then strategies will need to be explored, identified and put in place to ensure that the impacts to watersheds are avoided, minimized or mitigated. This indicator, its method of measurement and application are described in more detail in the integration paper (# 7).

Reducing consumptive and non-consumptive use of water supports the requirement of socio-ecological system integrity because effects on surface water quality can directly impact watersheds and freshwater habitats, which provide ecological services over long timeframes.

Water use can affect livelihood sufficiency, especially in northern Ontario where some people’s subsistence lifestyle depends on healthy fish stocks and recreational tourism brings economic gains to remote communities. Water use in hydroelectric facilities can impact multiple downstream uses, such as irrigation for agriculture. In addition, water that passes through generation facilities without being consumed can carry with it heat from thermal facilities, or cold from some hydroelectric facilities. While the water is not contaminated, the changes can have effects on ecosystem characteristics downstream.

Water use from hydroelectric developments may impact First Nations as well as affect cultural heritage resources. In order for there to be intragenerational equity, proponents of waterpower developments that affect First Nations will need to identify and mitigate potential impacts to watershed and cultural features.

Reducing impacts to watersheds, lake levels or stream flow characteristics also supports the requirement for intergenerational equity. Watershed damage and impacts to freshwater ecosystems can be permanent, thus mitigating activities in the present can preserve the functioning of these ecosystems for future generations.

Wastes Generated

Waste generated by electricity generation activities is an important impact of electricity sector activities. This indicator is similar to the indicator used in developing the supply mix advice. There is no CESI indicator reflecting wastes. This indicator, its method of measurement and application are described in more detail in the integration paper (# 7).

Reducing the amount of waste products resulting from power generation, transmission and end-use activities contributes to maintaining or enhancing socio-ecological system integrity. This both reduces the amount of waste produced per unit of electricity producing (i.e., by increasing conversion efficiencies) and reduces the amount of waste produced overall.

Nuclear power, which produces highly toxic wastes that require long-term management, has intergenerational equity impacts. To mitigate these impacts, the capability needs to be in place to manage these wastes, which is in the hands of the Canadian Nuclear Safety Commission and the Nuclear Waste Management Organization, both of which fall under federal jurisdiction.

Supporting the requirement of resource maintenance and efficiency is an additional benefit of producing fewer wastes, when waste reduction is achieved through increases in conversion efficiency. In fact, any advance in the efficiency of electricity generation, transmission or end use results in fewer wastes being produced.

This indicator is intended to include all wastes generated during station operation, but makes no distinction between the level of toxicity of the wastes. Certain common wastes are not included in this indicator, including conventional solid or chemical wastes such as containers, cardboard, paper, newspaper, plastic, metals and glass, office or cleaning products.

3.6 Societal Acceptance

In terms of assessing societal acceptance, there are several indicators upon which to judge whether the IPSP will have a favourable impact among individuals and between communities in Ontario. Meeting the expectations and gaining acceptance of stakeholders, customers and communities who may be impacted by various projects is a key priority for the OPA. An open process that results in feedback, as part of the development of the IPSP, can provide an early indication of public acceptability concerns. The stakeholder engagement's purpose is to bring forth the integration-related issues at a formative stage in the development of the IPSP. The Preliminary Plan presented in the integration paper (#7) is intended as a starting point for discussion, not a final position.

The societal acceptance of the plan also encompasses cultural impacts, contributions to livelihood sufficiency and regional development, effects on public health and safety considerations. Favourable developments in these areas could promote both intragenerational equity and intergenerational equity.

Openness

The operation of the OPA and its development of the IPSP are premised on openness, transparency and accountability, which themselves are a trade-off criterion. The process by which the IPSP is developed has been, and continues to be, carried out in a transparent manner whereby stakeholders and all interested parties are invited to share their views on components of the plan. Through the formulation of the IPSP and its implementation, we are working in close coordination with a broad range of organizations within the electricity, environmental and municipal sectors to advance policy related to power system planning and development.

The IPSP stakeholder engagement process seeks to establish a shared understanding on sustainable development issues with respect to plan design and implementation as well as the explicit justifications for trade-offs. The OPA's papers and workshops allow such views to be considered and incorporated within an iterative planning process, which includes the *Supply Mix Advice Report*, the Preliminary Plan, the Draft Plan and the regulatory filing.

The IPSP stakeholder engagement process is integral for developing awareness of linkages between energy use and environmental quality through meaningful and informative consultation exercises. Besides seeking a result of maximum net gains, a key objective of this process is to build capacity for stakeholders to contribute to future decisions in an effective, coordinated and integrated fashion.

The consultation process provides a forum for stakeholders to express local, regional and provincial concerns and preferences and to raise issues that need further assessment from their perspective. The broad scope of the consultation is meant to facilitate public discourse so that a shared understanding of key problems is established and so that a consensus on areas of mitigation may be identified. Nevertheless, as the proponent for the plan, the burden of argument for its benefits is on the OPA. Stakeholder engagement also serves to build capacity for long-term adaptation throughout the IPSP planning period, creating an effective framework for future IPSPs to build upon and progress towards sustainability.

Given that some generation and transmission projects are likely to encounter varying degrees of community resistance, the stakeholder engagement process is intended to continue dialogue with communities that may be affected by such projects, to provide avenues for the effective consideration of input from local communities. This process is designed to support the sustainability requirement of socio-ecological civility and democratic governance, to address public acceptability concerns wherever possible before the plan is implemented. In addition, the IPSP is identifying where potential adverse environmental and socio-economic effects of large electricity projects can be prevented, mitigated or managed.

The assessment prepared for the Preliminary Plan builds on previously conducted public studies, public policy documents and consultations. In particular, the OPA is relying upon the open process of the supply mix advice, which was founded on "listening, sustainability, flexibility, embracing the future, managing risks and prudence". Moreover, open processes will continue beyond IPSP filing: all interested parties will have an opportunity to participate in the independent OEB regulatory hearing, in OPA procurement processes and in the functioning of the wholesale electricity market. All contributions to the development of the IPSP will be documented transparently and decisions taken by the OPA will reflect the best information gathered throughout the development process.

Conservation Culture

The benefits of CDM include the ability to reduce or defer the need to expand peak capacity and transmission and to increase system efficiency and reliability, all of which are critical to achieving progress towards sustainability. A conservation culture can motivate individuals and organizations collectively to use energy more wisely. This can help realize energy sufficiency for all and encourage sustainable livelihoods.

A conservation culture encompasses conservation, efficiency measures, demand management, fuel switching, self-generation and cogeneration and instilling a sense of collective ecological and community responsibility through educational programs. This is built, for instance, through CDM programs, pricing that more adequately reflects the marginal costs of electricity production, energy and environmental education. By avoiding creation of additional supply, it is an example of protection of the future and seeking maximum net gains. CDM initiatives that promote a reduction of materials and energy use per unit of benefit support a conservation culture.

One of the key components of developing a conservation culture is the implementation of smart meters in every household province-wide by the end of 2010 in conjunction with time-of-use pricing, which will provide consumers with an incentive to consider and shift electricity consumption habits. CDM programs encourage efficient growth, which can occur even as fewer resources are used. This advances sustainability because it can enhance resource maintenance and efficiency.

The Preliminary Plan promotes a conservation culture by pulling together the benefits of a number of interrelated initiatives, such as revisions to the building code and prospects for combined heat and power where there is urban intensification.

The OPA is in the process of coordinating with a wide variety of electricity sector institutions in developing and communicating the IPSP, including the IESO, OEB, Hydro One Networks, OPG and local distribution companies (LDCs), as well as with consumers, investors, advocacy groups, academics, consultants and media organizations. For example, the OPA is working into the plan the potential for cogeneration facilities and district heating and cooling systems in the larger urban municipalities, which is leveraging the province's "Places to Grow" plans for redevelopment through intensification. Both are considered important sustainability objectives in municipal planning and increase livelihood sufficiency for large urban areas.

Livelihood Sufficiency

Electricity utilization is a fundamental contributor to livelihood sufficiency. The blackout that affected eastern North America in 2003 reinforced the significance of electricity as an easily overlooked, but utterly essential, part of modern society. At a basic level, there is a positive correlation between electricity service sufficiency and human welfare; electric service assists with providing necessities and life-enhancing services such as heating, cooling, refrigeration and lighting, which allow human development to flourish. Reliability itself is crucial to the foundation for livelihood sufficiency and opportunity.

Future generations can benefit from the long-term outlook, with an explicit justification, being taken regarding expansion of transmission infrastructure. Since it will be available for future use and supports maximum net gains, as was the case with Ontario Hydro's transmission planning, it contributes to intergenerational benefits. Based on the additions required, transmission projects may also generate significant intra-generational employment benefits in northern and native communities, but the exact locations and the mitigation of specific effects have yet to be finalized.

Specific employment benefits are also anticipated from CDM programs and capacity expansions outlined in the Preliminary Plan. As with transmission, job creation benefits will vary by how quickly the jobs can be created and by how long they are expected to last, but most of the opportunities will be in the large load centres, which are the larger urban centres. Conversely, the coal phase-out will affect the jobs of coal plant workers. Although, the impacts may be avoided in instances where converting coal plants to biomass is possible, such mitigation or avoidance of social, economic and environmental impacts may not be achievable in all cases.

Promoting clean technologies can result in various benefits, which include improving environmental performance, stimulating economic growth, adding highly-skilled and high-technology jobs, enabling technology transfer to other jurisdictions, learning by doing and progressing along the experience curve so that future generations can improve on current benchmark levels.

Regional Development

The OPA is cognizant of the implications of the plan on employment and opportunities to facilitate growth in urban, rural, northern and First Nations' communities. While projects or programs can be advantageous, mitigations and trade-offs are required as well. Addressing regional development concerns can nevertheless contribute to intra-generational equity, which is required to satisfy sustainability objectives.

In southern Ontario, CDM will be targeted especially in the major urban load centres, which will help enable development in rapidly growing regions such as the Kitchener-Waterloo-Cambridge-Guelph corridor, Ottawa and the Greater Toronto Area. Large scale CDM programs will have their own spin-off effect in these local economies. The "smart gas" strategy will also be targeted at reducing transmission bottlenecks in large urban centres.

Expansion of renewables, which has an explicit justification in the Minister's directive, will have benefits for rural and northern communities, both from the generation activity and from the improvements to transmission and distribution systems to support the renewable resources, which also support livelihood sufficiency.

Renewable and other generation sources, while contributing to maximum net gains, can also have significant adverse effects. Wind power, for example, has raised concerns in some communities for aesthetic reasons. While gas, coal and nuclear plants have health concerns for some people, the communities with coal and nuclear plants have constituencies that are arguing for their respective retention and refurbishment.

Acceptable Land Use

Obtaining broad public acceptance for power generation and transmission projects may be difficult, despite the necessity of electricity to support livelihoods. Public acceptability concerns relate to visual intrusion, noise impacts, perceptions of safety risks, effects on property values, or combinations of these. These concerns change with respect to the type of project and the type of community affected, and all relate to sustainability of the IPSP. In the supply mix advice, the OPA used a measure for land use as a proxy indicator for these types of public concerns.

For the IPSP, the land use indicator is being expanded to include transmission lines. In addition, a more detailed set of modifiers is being developed to account for different types of land and the specific nature of the land impacts associated with different supply and transmission resources. For generation options, the land occupied by the footprint of facilities or the creation of reservoirs is considered, but data limitations regarding the land impacts arising from other life-cycle stages, including mining or road construction have been documented.[13] The indicator proposed for the IPSP sustainability analysis, its method of measurement and application, are described in more detail in the integration paper (# 7).

Even before the current analysis for the IPSP is complete, inferences can be drawn from understanding the land effects of various resources. Electricity generation utilizing fossil fuels requires relatively limited amounts of land compared to most renewable options. Renewable

[13] For additional details, see: OPA, *Supply Mix Analysis Report, Volume 2*, p.175 (December 2005).

energy is generally land intensive, but its land use requirements vary. For instance, wind farms occupy large land areas, but it is common for 95 percent or more of the areas occupied by wind facilities to be available for other land use activities such as farming.[14] The land use requirements of renewable energy may stimulate the need for additional transmission to develop these resources and transport the power to load centres.

The land use for transmission to support moving renewable energy to load, while it has an explicit justification, has significant adverse effects that require mitigation. The approach to alternatives in the IPSP, as discussed in the transmission paper (#5), is to avoid significant geographic and cultural features.

These effects relate to intra-generational equity because the expansion of renewable energy will disproportionately impact particular communities. Some communities will bear the costs of developing renewable resources and transmission lines, but some of the benefits, such as cleaner air, will flow to all Ontarians.

There are also issues related to the social acceptability of conventional supply options. For instance, some residents oppose the siting of generating units in their communities while other communities have voiced their support for the continued operation, and for the expansion or installation of new generation.

Public Health

In the context of IPSP evaluation criteria, human health is intricately connected to livelihood sufficiency, intra-generational and intergenerational equity and precaution and adaptation. Electricity generation options are associated with various emissions and waste by-products that could result in adverse health impacts if not prevented or mitigated sufficiently. Consequently, the resources included in the IPSP must adhere to all regulations that are relevant to human health. As the proponent for the plan, the burden of argument is on the OPA as the proponent of the plan where the Minister's directive has not provided the explicit justification.

The IPSP will be evaluated on a number of environmental impact indicators, which are related to adverse human health impacts to determine the plan’s performance relative to baseline figures. For instance, GHG emissions, which are linked to climate change, sulphur emissions, which are a precursor to acid rain, and mercury emissions, known to bioaccumulate in the food chain and associated with neurological damages in humans, are assessed. If the performance of these indicators can be demonstrated to improve as a result of the IPSP, this will increase the likelihood of a correspondingly favourable effect on public health.

There is concern in some quarters about the potential adverse effects from nuclear plants. While nuclear power is explicitly included in the Minister's directive, the nuclear industry is regulated under federal law by the Canadian Nuclear Safety Commission. Nuclear also contributes to maximum net gains for public health because of the contribution it can make to cleaner air.

The IPSP must also account for local and regional health impacts depending on the location of particular generation units and transmission projects. In considering safety, environmental

[14] *Preliminary Assessment of the Impacts on the Natural Environment of the IPSP* (SENES Consultants Limited, 2006).

protection and environmental sustainability, siting of projects should seek to prevent or mitigate adverse health impacts on the public.

Safety

The integration paper (# 7) evaluates the Preliminary Plan's possible results with respect to air, land and water-based indicators, which demonstrates the effect on environmental quality and public health, although these are aspects of safety and environmental protection. To evaluate safety more comprehensively, other potential occupational impacts associated with electricity generation have to be considered as well.

There are safety risks associated with generation, transmission and use of electricity. Many of these risks are acute, stemming from injuries or fatalities to workers in the electricity sector or to the public. With respect to high voltage transmission lines, there have been concerns in some communities about low frequency electromagnetic fields (EMF), which are suggested to be a potential carcinogen. While there is some anxiety over the potential adverse health impacts, there have not been any long-term studies on EMF impacts at the levels associated with transmission lines. In addition, a number of standards and regulations are in place to ensure the safety of workers and the public.

Safety is addressed in the IPSP through the fact that participants in electricity sector activities are required to comply with legislation, rules, regulations, including meeting the requirements of all regulatory authorities, such as the Electrical Safety Authority, Canadian Standards Association, Workplace Safety and Insurance Board and the Canadian Nuclear Safety Commission. In addition, all projects developed as a result of the IPSP are similarly required to meet all industry standards, such as those prescribed by the IESO, the North American Electric Reliability Council and the Northeast Power Coordinating Council.

4. Conclusions

Building on the results of previous deliberations and the richness of sustainability literature, this paper outlines the OPA's approach to considering sustainability in the development of the IPSP. The approach is rooted in broad conceptualizations of sustainability and the contexts of long-term electricity system planning and that of current public policy in Ontario. The intent of the OPA's approach to sustainability includes the application of consistent, practical and relevant evaluation criteria to the decisions that drive the IPSP's development.

The sustainability evaluation criteria specific to the context of long-term electricity system planning are feasibility, reliability, cost, flexibility, environmental performance and societal acceptance. The IPSP-specific criteria embody the broader concept of sustainability in that they ground IPSP decisions within the relevant economic, environmental and social dimensions.

This approach is intended to accommodate the multivariate and complex nature of decisions concerning the development of Ontario's complex electricity system. Some criteria are applied at the level of the individual elements of the plan, such as the feasibility of resources to be included in the plan, while others are applied at the plan level, such as environmental performance. Some criteria are considered non-negotiable, such as system reliability and feasibility, while others allow for some degree of discretion, such as in accepting higher costs in exchange for improved environmental performance or social acceptability.

The scope of the sustainability assessment has been shaped by legislation, regulations and ministerial directives relating to the IPSP's development and final supply mix requirements. Recognizing that the supply mix for the IPSP has largely been prescribed, there will still be decisions for which the sustainability criteria need to be applied. The context specific evaluation criteria are consistent with the scope that has been determined for this IPSP by the Ontario government, but are broad enough in their applicability to facilitate future IPSPs.

While the main features of a sustainability assessment framework have been described in this paper, the application of these principles takes place in the integration paper (# 7). The complexities involved in IPSP choices require a level of analysis that is both comprehensive and consistent. In dealing with this complexity, the OPA believes that establishing and implementing clear frameworks to guide decision making are a necessary precursor to making progress toward sustainability.

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Appendix 1: Sustainability Requirements and Trade-off Criteria

Sustainability Requirements

The following italicized sections are Robert Gibson's description of his eight sustainability requirements and the text that follow these are an annotation of their implications.

Socio-ecological System Integrity: *Build human-ecological relations to establish and maintain the long-term integrity of socio-biophysical systems and protect the irreplaceable life support functions upon which human as well as ecological well-being depends.*

Maintaining ecological integrity provides a basis for the preservation of socio-economic integrity. Environmental impacts must remain within the adaptive capacity of surrounding ecosystems such that the resiliency of life sustaining functions is upheld. Social and economic interconnections should also be considered in relation to ecological impacts and marginal impacts should be assessed both in terms of their incremental effects and in relation to potentially adverse cumulative effects.

Livelihood Sufficiency and Opportunity: *Ensure that everyone and every community has enough for a decent life and has opportunities to seek improvements in ways that do not compromise future generations' possibilities for sufficiency and opportunity.*

Provide individuals with the opportunity to be gainfully employed so that they are capable of procuring fundamental human necessities. Ensure that the economy is sufficiently robust and ecosystems are sufficiently resilient as to be able to allow individuals, communities and institutions to avoid experiencing economic despair.

Intra-generational Equity: *Ensure that sufficiency and effective choices for all are pursued in ways that reduce dangerous gaps in sufficiency and opportunity (and health, security, social recognition, political influence, etc.) between the rich and the poor.*

Ensure that undesirable social, economic and environmental impacts that are unavoidable do not disproportionately burden particular industries, geographic regions, communities, groups or individuals. Similarly, aim to encourage the equitable distribution of benefits, where possible.

Intergenerational Equity: *Favour present options and actions that are most likely to preserve or enhance the opportunities and capabilities of future generations to live sustainably.*

Protecting the integrity of ecosystems for future generations and avoiding significant environmental disruption is believed to be a prudent course of action given the associated uncertainty and limited understanding of the complexity of ecological processes.

Resource Maintenance and Efficiency: *Provide a larger base for ensuring sustainable livelihoods for all while reducing threats to the long-term integrity of socio-ecological systems by reducing extractive damage, avoiding waste and cutting overall material and energy use per unit of benefit.*

Resources should be allocated efficiently so that resource scarcity and environmental and social impacts are reflected in planning decisions. Wherever plausible, unnecessary waste should be eliminated and process and end-use efficiencies should be encouraged. This will provide future generations with a larger stock of resources and a greater capacity for ecosystems to assimilate the cumulative effects of pollution damages over time.

Socio-ecological Civility and Democratic Governance: *Build the capacity, motivation and habitual inclination of individuals, communities and other collective decision-making bodies to apply sustainability principles through more open and better informed deliberations, paying greater attention to fostering reciprocal awareness and collective responsibility, and more integrated use of administrative, market, customary and personal decision making practices.*

Encourage community members and institutions to internalize sustainability principles and incorporate them into routine behaviour and decision making processes.

Precaution and Adaptation: *Respect uncertainty, avoid even poorly understood risks of serious or irreversible damage to the foundations for sustainability, plan to learn, design for surprise, and manage for adaptation.*

Build flexibility into decision making processes and include provisions to adapt quickly in the event that actual results diverge from expectations.

Immediate and Long-term Integration: *Attempt to meet all requirements for sustainability together as a set of interdependent parts, seeking mutually supportive benefits.*

Sustainability is a concern for current and future generations and depends not only on the ends achieved but also on the means used to achieve such ends.

Trade-off Criteria

The following italicized sections are Robert Gibson's description of his six trade-off criteria and the text that follow these are an annotation of their implications.

Maximum Net Gains: *Any acceptable trade-off or set of trade-offs must deliver net progress towards meeting the requirements for sustainability; it must seek mutually reinforcing, cumulative and lasting contributions and must favour achievement of the most positive feasible overall result, while avoiding significant adverse effects.*

Ensure that overall gains are maximized in the short and long-term and avoid transitory benefits in favour of durable contributions to sustainability. Recognize that maximizing any one criterion may not be possible, but appropriate choices may require accepting some compromise on all criteria and consider interconnections, feedback loops and potential cumulative effects.

Burden of Argument on Trade-off Proponent: *Trade-off compromises that involve acceptance of adverse effects in sustainability - related areas are undesirable unless proven (or reasonably established) otherwise; the burden of justification falls on the proponent of the trade-off.*

The burden is on the trade-off advocate to justify how the gains outweigh the losses of a particular decision or activity. Identify priorities for dealing with trade-offs and acknowledge that different stakeholders may have different views about acceptable courses of action.

Avoidance of Significant Adverse Effects: *No trade-off that involves a significant adverse effect on any sustainability requirement area (for example, any effect that might undermine the integrity of a viable socio-ecological system) can be justified unless the alternative is acceptance of an even more significant adverse effect. (See Gibson, 2005, for the fuller description).*

Prevent or mitigate significant unfavourable effects that have the potential to undermine the resiliency of socio-ecological systems. Consider that various impacts may be context specific and the priorities developed to prevent and mitigate unfavourable effects are often context specific as well.

Protection of the Future: *No displacement of a significant adverse effect from the present to the future can be justified unless the alternative is displacement of an even more significant negative effect from the present to the future.*

Preference is given to decisions that do not transfer unfavourable impacts from present to future generations. Recognize that some impacts may be unavoidable, in which case, they should be minimized as much as possible to respect future generations.

Explicit Justification: *All trade-offs must be accompanied by an explicit justification based on openly identified, context specific priorities as well as the sustainability decision criteria and the general trade-off rules. (See Gibson, 2005, for the fuller description).*

Develop a broad-based understanding of the significant role that environment and sustainability considerations occupy in the conception of the IPSP. Provide stakeholders with a deeper understanding of the context in which electricity is utilized and convey IPSP objectives clearly.

Open Process: *Proposed compromises and trade-offs must be addressed and justified through processes that include open and effective involvement of all stakeholders. (See Gibson, 2005, for the fuller description).*

Provide a forum for public discourse to identify shared understanding of problems and to identify areas of consensus. Maintain an open, transparent manner whereby stakeholders and all interested parties are invited to share their views on all components of the plan.

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Appendix 2: Context for Sustainability

A substantial amount of thinking and effort has gone into the consideration of sustainability for the IPSP. In this appendix, the OPA outlines for the interested reader the detail in the background that led up to the IPSP, the legislative and regulatory requirements, and the work that was performed for the supply mix advice.

This is a rich history that moves from an industry that historically focused on supply planning, because supply had to keep ahead of demand, to giving consideration to demand management as a technique to better manage supply, to consideration of the environmental harm of coal and benefit of renewable energy and the establishment of conservation and renewable resources as a priori considerations in electricity planning in Ontario.

Sustainability Background to IPSP

The emphasis in post-war Ontario history for the electric industry's sustainability begins with the Royal Commission on Electric Power Planning. When it reported in 1980, the commission recommended that demand management was an important element of electricity planning, and that planning supply alone had cost and inflexibility risks when demand growth could not be known with certainty.

With Ontario having an excess supply of power throughout most of the 1980s, this approach was not used until Ontario Hydro issued its 25-year "demand-supply" plan in late 1989. Notably, this push to integrated resource planning was only possible with the advent of the software to do the modelling. The downturn in the economy in the early 1990s and the move to markets and away from planning in the late 1990s meant, however, that CDM was not institutionalized in the Ontario electricity system.

The return of the emphasis on sustainability, even if not explicitly cast as such, occurred through two developments in 2002. The Minister of Energy's Market Surveillance Panel had warned that growth in demand and retirement of facilities was leading to a supply shortage in Ontario. In addition, the all-party Select Committee on Alternative Fuels recommended replacement of coal-fired electricity generation in Ontario by 2015. With a different date, this recommendation subsequently became government policy, and more recently the OPA has been asked to develop a plan through the IPSP that phases out coal.

In response to the supply shortage, which was coincident with the movement away from the market and administered prices, the government appointed the Electricity Conservation and Supply Task Force (ECSTF). When it reported in 2004, the ECSTF recommended that conservation, and not just supply, had to be part of the solution. In addition, it recommended that long-term planning needed to be overlain onto the existing market structure. The recommendations for the two were intricately interconnected because the inclusion of conservation as a resource requires integrated resource planning, and both have a sustainability emphasis.

While this was transpiring, the Conservation Action Team (a committee of Parliamentary Assistants -- the elected politicians who assist ministers with their portfolios) was performing a wide-ranging assessment of all government policies and programs throughout 2004. In its 2005 report, the Conservation Action Team forwarded numerous recommendations to advance the conservation agenda, many of which have subsequently become practice.

All of these elements came together in the *Electricity Restructuring Act, 2004,* which by amending the *Electricity Act, 1998*, created the OPA, the Conservation Bureau within the OPA, and the IPSP as a key OPA responsibility. With planning and conservation filling a void for sustainability, the OPA was established, in essence, to put the electric industry on a path towards sustainability.

Soon after the creation of the OPA, the Minister of Energy issued a request to the OPA to develop "supply mix advice" to inform a directive for the IPSP. What was notable about this request is that it provided for a hierarchy of considerations that had an underlying focus of sustainability. In essence, the Minister asked the OPA to determine the extent of CDM that was available, and, after that, the amount of renewable resources that were available, and after CDM and renewable resources, establish how to fill in the remaining amount of supply required. Notably, the OPA was to accomplish this task while respecting the government's policy on the replacement of coal-fired generation.

Now in operation for nearly two years, the OPA has had an opportunity to develop and refine its strategic objectives, which include both conservation and long-term planning.

Environment and Sustainability in the Supply Mix Advice

In the *Supply Mix Advice Report* provided to the Minister of Energy in December 2005, the OPA began the process of integrated planning. Two key elements brought environmental and sustainability considerations into the planning at the outset and were subsequently carried through the four volumes and 1,100 pages of the supply mix advice to the minister. The first element was the recognition of three government policies, and the second was the OPA's principles underlying the supply mix advice.

Three government policies are evident in *The Electricity Restructuring Act, 2004*, the creation of the mandate of the OPA, and in the request for advice on the supply mix. They are:

- the long-term goal of the creation of a conservation culture
- a preference for renewable sources of energy, and
- the replacement of coal-fired generation for environmental and health reasons.

From these policies, the OPA outlined six principles for planning, including as its second:

- Sustainability: Choices and directions need to be put on a path to sustainability – for Ontario's environment, economy and people – over the long term.[15]

[15] OPA, *Supply Mix Advice Report, Volume 1*, pp. 3-4 (December 2005).

Within the framework of these policies and principles, the OPA proceeded with an environment and sustainability assessment of the supply mix scenarios by assigning relative weights to various generation technologies. On this basis, the OPA addressed the environment and sustainability in each of the four volumes of the report.

Supply Mix Advice Report (Volume 1)

The *Supply Mix Advice Report* weighed the environmental impacts of various supply sources and potential supply mixes of generation options by using a life-cycle assessment (LCA) approach. The environmental implications of transmission lines and transformer stations were not included because they are plan dependent and would later be addressed in the IPSP.

The OPA's LCA approach to the environment and sustainability, which was drawn largely from the ExternE framework, looks at the environmental impact of all stages of the life cycle of energy systems, including the full fuel cycle (resource extraction, processing, transport, and wastes plant construction, operation, and decommissioning). It evaluates each stage and estimates a life-cycle impact.[16]

To allow comparisons, the analysis grouped the environmental impacts of various supply sources into seven categories: greenhouse gases (GHGs), contaminant emissions, radioactivity, land, water, waste and resource availability. The method produced both absolute and relative scores of impact.

The ranking of composite scores produced some clear results, as follows: "run-of-the-river" waterpower has the lowest impact on the environment, and waterpower generally has a favourable score; other renewable resources, particularly wind, also have relatively low impact; nuclear ranks at a level similar to biomass; technologies that burn fossil fuels have the greatest environmental impact; coal is responsible for higher radioactivity impacts than nuclear – primarily due to release of radon gas in mining coal; and, conventional coal-fired generation is approximately triple the impact of higher-efficiency natural gas-fired generation.[17]

Supply Mix Analysis Report (Volume 2)

In Volume 2 of the *Supply Mix Advice Report*, the OPA addressed the environment and sustainability in almost every part.

- Part 2.2: This overview of the "Ontario Context" included how the paths of environmentalism and electricity have evolved.
- Part 2.3: This documentation and review of stakeholder and public presentations and submissions, including those by numerous environmental groups, included an overview of four issue areas on which the OPA solicited comments. Three of the four focus on the environment or sustainability, including: advice on appropriate analytical planning approaches that focus on assessment of risks, environmental attributes and cost characteristics of various portfolios; advice on appropriate approaches to constructing conservation and demand management (CDM) portfolios for inclusion in long-term plans;

[16] For additional details, see: OPA, *Supply Mix Analysis Report, Volume 2*, pp.171-79 (December 2005).
[17] OPA, *Supply Mix Advice Report*, *Volume 1*, p. 32 (December 2005).

and, advice on appropriate methods to assess the impact on the natural environment of supply options.

- Part 2.4: This assessment of integrated resource planning (IRP), renewable energy and CDM initiatives, and environmental assessment approaches and results in other jurisdictions assisted in forming the supply mix and IPSP approach.
- Part 2.5: This assessment of the supply and demand challenges in Ontario compared portfolios in terms of both absolute impacts and environmental loading scores.
- Part 2.6: This statement of methodology and assumptions detailed the approach to and scoring of environmental impacts.
- Part 2.7: This assessment of resources and impacts detailed the performance, cost and environmental impact of each technology.
- Part 2.9: This analysis of results for five scenarios arrived at notable findings on environment and sustainability, including: portfolios that use less fossil fuel resources present lower costs and environmental impacts and are less exposed to risk; these portfolios are more robust, performing better under different possible futures except under a future with low gas prices.

Supply Mix Background Reports (Volume 3)

Environmental and sustainability issues were addressed in a number of the background reports of the *Supply Mix Advice Report*. In parts 3.1 and 3.2, the OPA addressed, respectively, the origins of IRP and sustainability principles in integrated planning. In part 3.2 specifically, the OPA first reviewed the environmental impacts from the various sources of electricity generation in their historical order of appearance in Ontario. The OPA then addressed sustainability concepts, referring to their use in the supply mix advice, and the development of environmental assessment policy in Ontario as it relates to electricity generation.

Supply Mix Consultant Reports (Volume 4)

One of the four supply mix consulting reports was prepared by SENES Consultants Ltd.[18] The terms of reference for SENES was to provide the OPA with a methodology to assess the impacts of generation options on the natural environment. SENES was asked to use a method that would identify and quantify relevant environmental factors and be able to assess long-term planning, capture cumulative impacts and provide an indication of the environmental impacts associated with generation options and supply mix plans.

While the terms of reference for the engagement were extensive, SENES provided a raw score, by technology, for the life-cycle environmental impact of each generation technology on each category. A technology with no impact on a category was assigned a score of 0, while the worst-performing technology in that category rated a 10. To determine the total environmental

[18] SENES Consultants Ltd., *Methods to Assess the Impacts on the Natural Environment of Generation Options* (November 2005). Electronically published by OPA as *Supply Mix, Volume 4*, Part 4: http://www.powerauthority.on.ca/Storage/25/2082_Part_4.4_SENES_Updated_Final_Report_(November).pdf

loading score for a given technology, the relative weight of each environmental category also had to be determined.

SENES recommended a weighting scheme based on the European Commission's exhaustive study of the life-cycle impacts of different generation options. It is considered to be a robust and well-researched study. In particular, the recommended weights were based on the monetized environmental impacts in France and the Netherlands.

The OPA adopted the SENES results, which involved multiplying the raw score in each category – greenhouse gases, contaminant emissions, radioactivity, land use, water use, waste generation and resource availability – by weights that reflect the relative environmental impact of each category. By adding the weighted score in each category together, a total environmental score for each technology was calculated to give an indication of its total environmental loading. This allows for meaningful comparisons of the environmental impacts of the different options.

Legislative and Regulatory Context for Sustainability in IPSP

The IPSP, as outlined in detail in Part 2.1 of the *Supply Mix Analysis Report*,[19] is a requirement the OPA must fulfill under the *Electricity Act, 1998*. Beyond this broad instruction, the legislation provides both for regulations, as approved by Cabinet, that permit the government to provide requirements for how the plan will be shaped, and for directives from the Minister, also approved by Cabinet, for goals to be achieved in the plan.

The regulation governing the content of the IPSP, Ontario Regulation 424/04, has four elements that fall under the broad heading of promoting or ensuring environment and sustainability. These are paragraphs 1, 2, 7 and 8 of Section 2(1) of the regulation, as reproduced in Figure 4.2.

Of the four sustainability requirements under the IPSP regulation, paragraphs 7 and 8 are the ones directly related to the environment. They include an assessment of the environmental considerations related to the integrated plan and an analysis of the impact to the environment of specific electricity projects, including their alternatives. Paragraphs 1 and 2 address consultation requirements and the obligation to promote conservation. These requirements are described in further detail in the sub-sections below.

Ontario Regulation 276/06, approved on June 12, 2006, also concerns the IPSP. It states that the plan itself is not subject to an assessment under the *Environmental Assessment Act*, but that certain projects within the plan may require an assessment.

While electricity, like other natural resources, is under provincial jurisdiction and subject to provincial laws and regulations, all matters with respect to the nuclear industry have constitutionally been deemed to be of national dimensions and are thereby under federal jurisdiction and subject to federal laws and regulations. Accordingly, environmental assessments for nuclear power plants fall under the *Canadian Environmental Assessment Act*, licensing and commissioning of nuclear plants is the responsibility of the Canadian Nuclear

[19] OPA, *Supply Mix Analysis Report, Volume 2*, pp. 1-8 (December 2005).

Safety Commission (CNSC) and waste management is the responsibility of the Nuclear Waste Management Organization (NWMO).

Figure 4.1 – Excerpts from Ontario Regulation 424/04 (as amended)

Development of Integrated Power System Plan

2. (1) In developing an integrated power system plan under subsection 25.30 (1) of the Act, the OPA shall follow directives that have been issued by the Minister under subsection 25.30 (2) of the Act and shall do the following:

1. Consult with consumers, distributors, generators, transmitters and other persons who have an interest in the electricity industry in order to ensure that their priorities and views are considered in the development of the plan.
2. Identify and develop innovative strategies to accelerate the implementation of conservation, energy efficiency and demand management measures.
7. Ensure that safety, environmental protection and environmental sustainability are considered in developing the plan.
8. Ensure that for each electricity project recommended in the plan that meets the criteria set out in subsection (2), the plan contains a sound rationale including,

i. an analysis of the impact on the environment of the electricity project, and

ii. an analysis of the impact on the environment of a reasonable range of alternatives to the electricity project.

(2) For the purposes of paragraph 8 of subsection (1), the following are the criteria:

1. An environmental assessment of the electricity project under Part II of the Environmental Assessment Act must be required.
2. The electricity project, based on the recommended date for completion of the project in the plan, will in the opinion of the OPA require that an application for approval for an undertaking be made under the Environmental Assessment Act within five years after the approval of the plan by the Board.

(3) In this section,

"electricity project" means a project that includes one or more of a transmission line, generation facility, transformer station or distribution station;

"environment" means air, land, water, plant life and animal life, including human life and "environmental" has a corresponding meaning.

Analysis of the Plan

Paragraph 7 of section 2(1) of Ontario Regulation 424/04 requires the OPA to "ensure that safety, environmental protection and environmental sustainability are considered in the plan." A plan-level assessment generally entails less detailed information than project-level screening.

In defining the scope of this plan-level assessment, the OPA intends to be guided by developments and effective practices that have evolved at the national and international level to address sustainability. (The framework for this assessment is outlined in section 3 of this paper.)

For the *Supply Mix Advice Report*, the OPA hired SENES Consultants Limited to provide a generic assessment of the relative environmental impacts of generation options. The OPA is using SENES again to supplement its work for the IPSP. As will be noted in the integration paper (# 7), SENES will be applying a framework similar to that used in the *Supply Mix Advice Report* to the resource mix and the transmission requirements of the IPSP to arrive at a measurable indication of the environmental impact of the IPSP.

Analysis of Major Projects

Paragraph 8 of section 2(1) of Ontario Regulation 424/04 addresses the need, as established by the government, for an initial review of certain large projects recommended by the plan. More specifically, it requires the OPA to do this review for each electricity project recommended in the plan that will require an individual assessment under Ontario's *Environmental Assessment Act* where the application for approval will be made within five years of the approval of the IPSP.

The OPA is required to provide a "sound rationale" for these projects in the plan and provide "(i) an analysis of the impact of the electricity project on the environment, and (ii) an analysis of the impact on the environment of a reasonable range of alternatives to the project." The definitions of "environment" and "electricity project" are noted in Figure 4.1.

The electricity projects that require individual assessments under the *Environmental Assessment Act* have been codified in Ontario Regulation 116/01 and are outlined in Table 4.1. The electricity projects meeting the requirements of the IPSP regulation (sec. 2(1), para 8) are discussed in the integration paper (# 7). Notably, projects that are under federal jurisdiction, such as nuclear generation, fall under the *Canadian Environmental Assessment Act* and are outside the scope of Ontario Regulations 116/01 and 424/04.

The OPA has retained Hardy Stevenson and Associates Limited to undertake the required assessments of projects. Hardy Stevenson is completing the assessments at a level of detail that is consistent with a strategic environmental assessment (SEA) rather than at the level of detail that a project proponent would undertake when completing an individual Environmental Assessment.

Table 4.1 – Electricity Projects Requiring Individual Environmental Assessments

Electricity Project Type	Conditions for Individual Assessment
Transmission lines	> 115 kV and < 500 kV and > 50 km ≥ 500 kV > 2 km
Transformer stations	> 500 kV
Hydroelectric facilities	≥ 200 MW
Oil facilities	≥ 5 MW
Coal facilities	All
Municipal solid waste	Incinerating MSW from ≥ 1,500 persons domestic waste or > 100 tonnes of waste per day
Liquid industrial or hazardous waste	Sites receiving and incinerating off-site generated waste

Source: Ontario Regulation 116/01 and Ministry of Environment, Guide to Environmental Assessment Requirements for Electricity Projects (March 2001). NB: Requests can be made for other electricity projects to be subject to individual environmental assessments.

Consultation Requirements

The requirements for consultation, while not directly impacting the environment as electricity plans and projects do, nonetheless are critical for gaining a deeper understanding and adequately considering the environment and sustainability. The duty to consult with key stakeholders is not only a legal requirement, but also an integral part of the process of discovering and evaluating options.

In OPA's experience, decision-making has been enhanced through the more open, transparent process of consulting with others. The benefits of consulting with interested parties can also include developing a shared understanding of issues and beginning a public discourse to work towards a consensus on key issues.

OEB Regulatory Approval

The OPA has been assigned the responsibility of developing the IPSP and submitting it for approval to the OEB and the OEB has been assigned responsibility for reviewing and approving the IPSP. The OEB is a quasi-judicial tribunal that operates within established rules and procedures. According to the *Electricity Act, 1998*, the OEB will review the IPSP to determine whether it meets the directive and is economically prudent and cost-effective. As a requirement of the Regulation 424/04, the OEB must also assess whether the OPA has given sufficient consideration to safety, environmental protection and environmental sustainability. For the IPSP, the OEB will establish certain procedures for the hearing and guidelines for the filing, which are yet to be decided.

Ministerial Directive

As noted above in the Legislative and Regulatory context section, the Minister of Energy, with the approval of Cabinet, has the authority to issue directives to the OPA on the IPSP.

The Ministerial Directive on the supply mix for the IPSP, issued on June 13, 2006, very much shapes the plan, including how the plan addresses issues on the environment and sustainability. As evident in Figure 4.2, the notable feature of the directive is the degree to which, although issued in response to OPA advice, it is prescriptive, with the areas where there is OPA discretion being relatively narrow.

Figure 4.2 – Ministerial Directive June 13, 2006

The Government directs the OPA to create an Integrated Power System Plan to meet the following goals:

1. The goal for total peak demand reduction from conservation by 2025 is 6,300 MW. The plan should define programs and actions which aim to reduce projected peak demand by 1,350 MW by 2010, and by an additional 3,600 MW by 2025. The reductions of 1,350 MW and 3,600 MW are to be in addition to the 1,350 MW reduction set by the government as a target for achievement by 2007. The plan should assume conservation includes continued use by the government of vehicles such as energy efficiency standards under the Energy Efficiency Act and the Building Code, and should include load reduction from initiatives such as: geothermal heating and cooling; solar heating; fuel switching; small scale (10 MW or less) customer-based electricity generation, including small scale natural gas fired co-generation and tri-generation, and including generation encouraged by the recently finalized net metering regulation.

2. Increase Ontario's use of renewable energy such as hydroelectric, wind, solar, and biomass for electricity generation. The plan should assist the government in meeting its target for 2010 of increasing the installed capacity of new renewable energy sources by 2,700 MW from the 2003 base, and increase the total capacity of renewable energy sources used in Ontario to 15,700 MW by 2025.

3. Plan for nuclear capacity to meet base-load electricity requirements but limit the installed in-service capacity of nuclear power over the life of the plan to 14,000 MW.

4. Maintain the ability to use natural gas capacity at peak times and pursue applications that allow high efficiency and high value use of the fuel.

5. Plan for coal-fired generation in Ontario to be replaced by cleaner sources in the earliest practical time frame that ensures adequate generating capacity and electricity system reliability in Ontario.

The OPA should work closely with the IESO to propose a schedule for the replacement of coal-fired generation, taking into account feasible in-service dates for replacement generation and necessary transmission infrastructure.

6. Strengthen the transmission system to:
- Enable the achievement of the supply mix goals set out in this directive;
- Facilitate the development and use of renewable energy resources such as wind power, hydroelectric power and biomass in parts of the province where the most significant development opportunities exist;
- Promote system efficiency and congestion reduction and facilitate the integration of new supply, all in a manner consistent with the need to cost effectively maintain system reliability.

7. The plan should comply with Ontario Regulation 424/04 as revised from time to time.

Source: Letter to Jan Carr, CEO, Ontario Power Authority, from Dwight Duncan, Minister of Energy, June 13, 2006.

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