Green Energy Coalition

Evidence in Support of a Greener Alternative to Ontario's Proposed Integrated Power System Plan

September 2008

The following are summaries of evidence submitted to the 2008 Ontario Energy Board hearing on the Integrated Power System Plan (IPSP) on behalf of the David Suzuki Foundation, Eneract, Greenpeace, the Sierra Club of Canada, WWF-Canada, the Pembina Institute and the Ontario Sustainable Energy Association. They were filed as EB-2007-0707: Exhibit L, Tab 8, Schedules 1 through 9.

Background

The Ontario Energy Board is conducting hearings on a proposed plan for meeting the province's electricity needs over the next 20 years.

The Ontario government set out the broad parameters of this plan in a June 13, 2006 Directive issued to the Ontario Power Authority, which was tasked with developing the plan. In August 2007, the OPA released a proposed Integrated Power System Plan (IPSP) that pursues the minimum amounts of conservation and renewable energy allowed for in the Directive, as well as the maximum amount of nuclear power permissible.

This proposal is now before the Ontario Energy Board, an arms length agency created by the provincial government to regulate Ontario's natural gas and electricity industries, for formal hearings on whether it is a cost-effective and prudent strategy for meeting the terms of the Directive. Breaking from historical precedent, the government exempted the IPSP from the requirements of the Environmental Assessment Act, but it has required the OPA to ensure due consideration of environmental sustainability in the development of the Plan.

The OPA has recognized that the conservation and renewable components of the IPSP could be increased, and nuclear reduced, should such an outcome be found to be cost-effective and prudent. Hence the fundamental issues at stake in the hearings, and which are addressed in these expert reports, are:

- Should OPA be required to include, at a minimum, all of the conservation resources that its own expert reports say is achievable and more cost effective than generation?
- What are realistic nuclear costs?
- Should OPA be allowed to plan based on optimistic industry estimates of future nuclear costs and performance while ignoring the trend of cost reduction for options like wind, solar and energy storage?
- Should OPA be required to place greater priority on dispersed generation (especially generation from renewable and waste heat utilization technologies) that have lower environmental impacts and reduce the need for new transmission or distribution capacity?
- Should environmental impacts and sustainability count in planning?

For more information on these reports, please contact Keith Stewart of WWF-Canada at (416) 489-4567 xt. 7257.

Schedule 1: Green Resource Portfolios: Development, Integration and Evaluation. Evidence prepared by Paul Chernick, Jon Wallach and Richard Mazzini of Resource Insight Incorporated.

Drawing on the authors' experience with electricity system planning processes in the U.S. and the other expert testimony presented on behalf of the environmental and renewable energy organizations (Schedules 2 through 9, outlined below), this report identifies five major flaws in the Ontario Power Authority's (OPA) planning model.

The IPSP's flaws include:

1. Unreasonable input estimates, especially with respect to the cost and performance of nuclear resources. The OPA is assuming that new nuclear plants can be built at $2900/kW, but a more reasonable estimate (based on actual and projected costs in other jurisdictions) is at least $5000/kW. Assuming an 85% capacity factor and 8% social discount rate, this translates into a cost of 15.4 cents/kWh for electricity from new nuclear reactors.
2. The failure to systematically select resources to minimize costs or environmental impacts, especially with respect to Conservation and Demand Management resources where the OPA is pursuing only 65 per cent of the resources it has identified as cost-effective and achievable.
3. Understating or ignoring the multiple benefits of dispersed local resources located close to load. These include Conservation and Demand Management and community-scale energy systems, particularly waste-energy recycling, Combined Heat and Power, small wind, and biogas. Those benefits include avoiding transmission-and-distribution investments, reducing line losses, improving local reliability, and (in the case of Combined Heat and Power) providing thermal energy.
4. An unnecessarily constrained view of the power-planning process that ignores opportunities to guide and drive markets where they are not responding efficiently and effectively.
5. Modeling and planning decisions that lead to outcomes starkly different from the OPA's stated goals. For example, the OPA's expressed concern about meeting planning contingencies becomes a justification for operating Ontario's coal plants to serve export markets, while the large amount of planned nuclear capacity crowds out renewables.

The report then advances alternative green resource portfolios that would meet the terms of the government's directive at lower financial and environmental cost, and with less risk. The green resource portfolios proposed include a greater emphasis on energy efficiency, renewable energy such as wind and solar power, and Combined Heat and Power. They require no new nuclear resources, and would have lower greenhouse gas emissions than the OPA's proposed plan.

Ontario's coal plants could start being placed in cold shut-down by 2011 (but available for re-start should planned resources not be available in time) rather than being used to serve export markets, and could be eliminated by 2013.

In terms of costs, substituting a mix of greater Conservation and Demand Management as per the VEIC report (Schedule 2, below), 10,000 MW of wind power, and additional clean resources for planned nuclear capacity dramatically lowers the cost to reliably serve Ontario load. Relative to the OPA Reference Case, the Green Base Case provides net-present-value savings of about $21 billion, or about 24%, at a 4% real social discount rate (and about $11 billion at an 8% social discount rate). Even when using OPA's unrealistic estimate for nuclear construction cost, eliminating capital-intensive nuclear investments from the resource portfolio reduces costs over the 20-year planning horizon by $8 billion, or about 11%. Actual savings may be even greater than we estimate, given the high risk of nuclear construction costs.

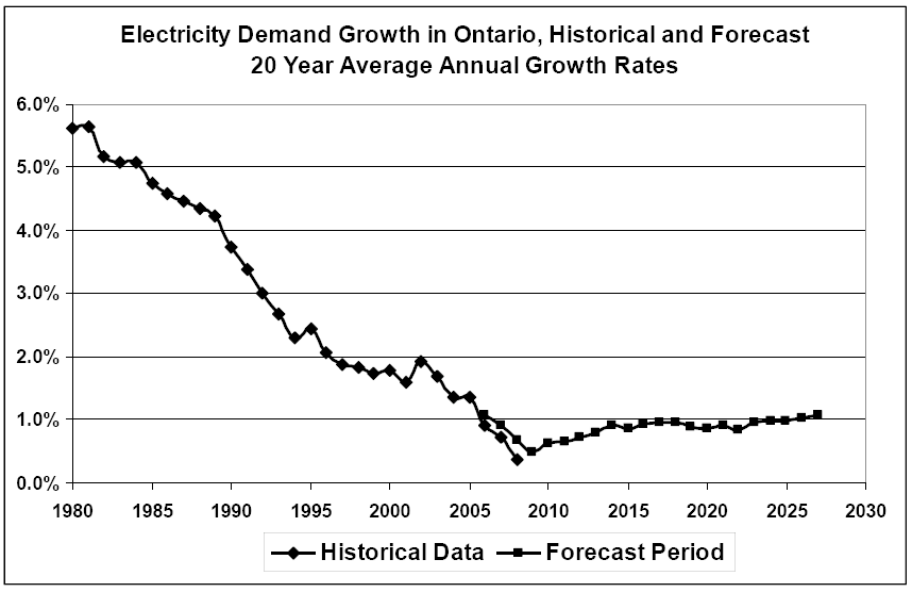
Schedule 2: Review of Ontario Load Forecast in the Integrated Power System Plan (IPSP). Evidence prepared by Ralph Torrie and Doug Morrow, ICF Consulting.

Flaws in long range forecasting of electricity demand have been the central reason that previous attempts at electric power investment planning in Ontario have failed. The great power system expansion plans put forward by Ontario Hydro in the mid-1970's and then again in the late 1980's never materialized because they were based on forecasts that turned out to be so far off the mark that none of the dozens of power plants proposed in those earlier efforts was ever built.

In fact, the forecasts that underpinned those planning efforts proved to be so wrong so quickly after they were done that the reviews and associated public hearings associated with those earlier planning efforts (the Royal Commission on Electric Power Planning in the 1970s, the Environmental Assessment of Ontario Hydro's Demand Supply Plan in the early 1990s) did not even run their course before the proposals were withdrawn or shelved indefinitely.

These forecasts of future demand were too high because they failed to capture (or even attempt to capture) the underlying dynamics of the electricity commodity market. For example, in the mid-1970's when the total consumption of electricity was in the range of 85 terawatt hours (TWh), Ontario Hydro's load forecast projected it would grow to more than 325 TWh by 1997. Electricity demand in 1997 was 140 TWh. In 1988, when the *Providing the Balance of Power* supply plan was put forward by Ontario Hydro, annual electricity consumption in the province was 140 TWh and forecast to grow by some 85 TWh by 2005, to 225 TWh. By 2005 the actual demand grew by only 15 TWh, to 155 TWh.

A close examination of the forecast used in the IPSP reveals a significant departure from recent trends. For example, the forecast predicts that the rate of demand growth, which has been falling for decades, will turn around and begin increasing, with electricity demand growth actually accelerating over the forecast period.



The report then assesses the IPSP demand forecast, to see if this reversal is likely. It finds that the end use calibration of the OPA forecast does not provide a convincing case that history will not repeat itself in this current round of long range electric power planning. It finds a number of instances where the demand growth derives from assumed or unsubstantiated departures from historical trends with respect to the growth of the activity drivers, with respect to the relationship between the activity drivers and electricity demand, and with respect to the relative growth rates of end uses with variable "natural conservation" potential.

The electricity growth in the residential and commercial sectors is highly concentrated in a couple of end uses -- almost all residential electricity growth is in the "other appliance" category and nearly 90% of commercial sector electricity growth is for lighting, but the underlying justification for this lopsided distribution of growth is not convincing. In the industrial sector the forecast growth rests on the assumed departure from recent trends toward greater electricity productivity, and instead assumes deterioration in electricity productivity.

Schedule 3: Optimizing the Conservation and Demand Management Resources in Ontario. Evidence prepared by Scudder H. Parker of the Vermont Energy Investment Corporation.

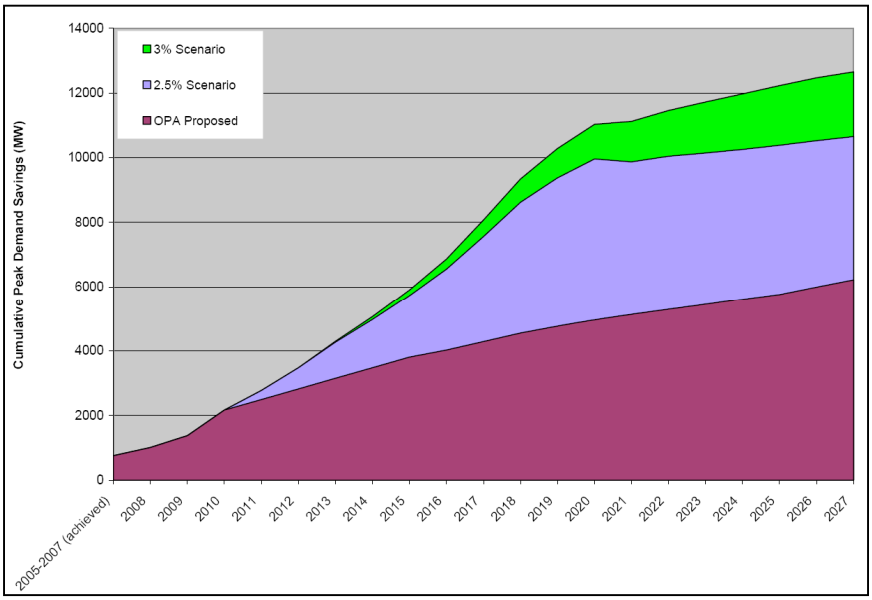
Ontario has a unique opportunity to become a North American leader in the new energy economy because the Province has put in place many of the elements necessary to protect both the climate and economic well-being by dramatically increasing energy efficiency and energy production from decentralized, renewable resources. This would create new industries and employment while reducing energy use and environmental harm.

The principal barrier to capitalizing on this opportunity is the outdated approach to Conservation and Demand Management (CDM) taken by the Ontario Power Authority in the Integrated Power System Plan. If not corrected, the Plan's failure to secure all cost-effective conservation opportunities will increase future costs, risks, and harmful environmental impacts.

The OPA itself acknowledges that it is pursuing only 65% of the CDM resources it has concluded are cost-effective and achievable. Its current plan projects an aggressive ramp-up of the programs through 2010, and then a dramatic and sustained decline in savings levels over the next fifteen years that purports to meet (but not exceed) the 2025 target.

It also notes that the OPA, in its early implementation and in its long-term planning, ignores numerous lessons gained in the past decade of CDM implementation, stating "OPA appears to have approached the planning process as though it had been wakened from ten years of deep sleep and commenced its work with the assumption that the world had not changed and no real learning about efficiency investment strategies had taken place during the elapsed decade." This failure makes it very likely that its IPSP will result in unnecessary repetition of many CDM implementation errors that could be avoided.

Figure 15: Estimation of cumulative peak MW savings for enhanced scenarios.



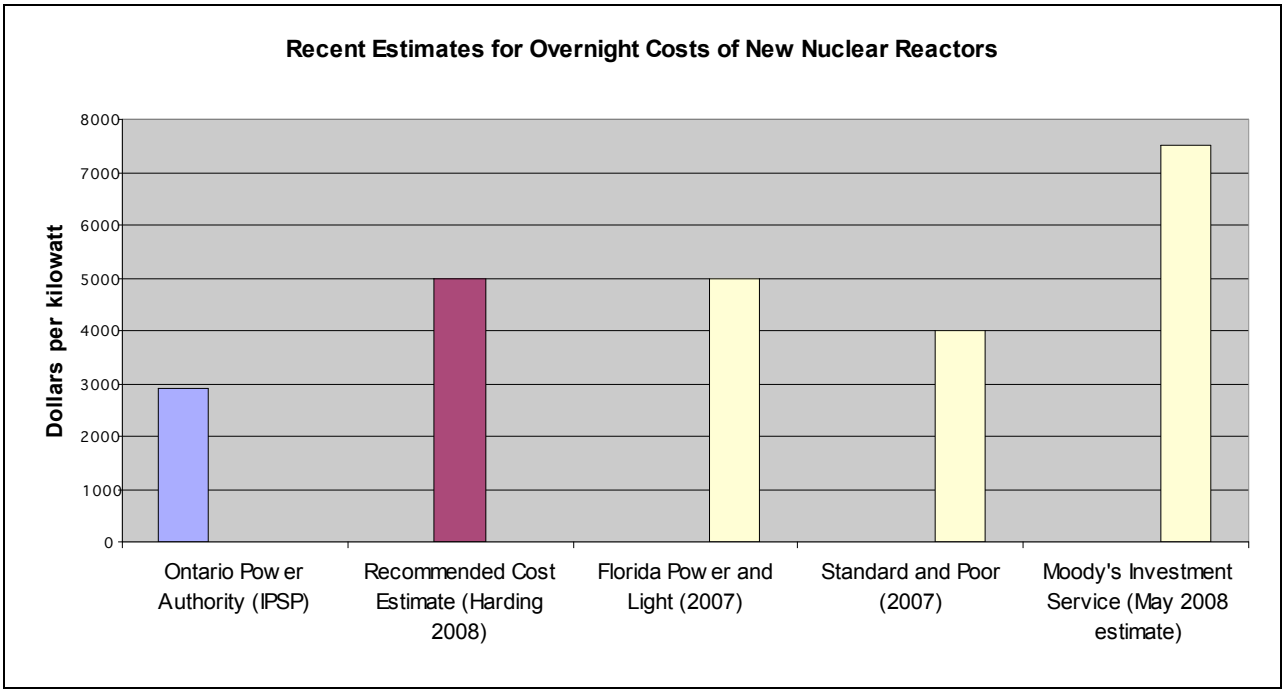
Those errors will result in significant lost savings, but they may also have the additional harmful effect of damaging relationships and creating mistrust with market participants such as engineers, the design community, vendors and installers; with Local Distribution Companies and other potential program implementation partners; and with customers, all of whom will be essential to effective sustained CDM resource acquisition.

The author identifies strategies for achieving deeper, sustained reductions in energy demand based on best practices in other jurisdictions, including the hallmarks of an appropriately aggressive approach to securing CDM and key lessons learned from CDM delivery systems elsewhere.

He then recommends that the OEB not approve the IPSP, and require the OPA to re-submit the Plan with an integrated proposal to deliver a savings level from all CDM components of 2.5% and as much as 3% of Ontario system sales and system peak per year after a reasonable ramp-up period. That CDM component should then be incorporated into the overall IPSP.

Schedule 4: Overnight Costs of New Nuclear Reactors. Evidence prepared by Jim Harding, Harding Consulting.

The report assesses recent cost estimates for new nuclear plants from utilities and investment firms and concludes that that $5000/kW is a reasonable overnight cost, including a modest contingency. This estimate is in line with recent US utility estimates, but is also below some utility and investment firm estimates.



Cost estimates for new reactors have been rising at an extremely rapid rate in the US and Europe. Reasonable ranges of overnight (i.e., without interest or real escalation during construction) cost estimates for a new reactor have increased from $2000-2500/kW in the early to mid 2000s, to $3000-4000/kW in 2007 and $5000/kW in 2008.

The rapid estimated increase in construction costs has a great deal to do with bad estimates in the 2002-2005 period. During that time, virtually no utilities worldwide were seriously considering reactor construction. The estimates were primarily done by governments and academic institutions, and were usually R&D targets rather than genuine estimates. It was only when utilities and vendors invested serious time and money that significantly larger numbers emerged. Other reasons for this cost escalation include rising raw and finished materials costs, supply chain imbalances for skilled labour forging capacity and sub-suppliers with nuclear quality assurance programs. These issues affect reactor designs and building costs in all nations.

Translating overnight construction costs into power prices is complicated. Using overnight cost estimates from Florida Power and Light, a range of real escalation rates, and reasonable assumptions for fuel cost, capacity factor, decommissioning, and operations and maintenance, the author finds that one can get more than a factor of two difference in levelized life cycle cost for electricity from new nuclear plants, ranging from 11 cents/kWh to 23 cents/kWh.

Schedule 5: Cost Implications of Residual Radiological Risk of Nuclear Generation of Electricity in Ontario. Evidence prepared by Dr. Gordon R. Thompson, Institute for Resource and security Studies at Clark University.

This report addresses the cost implications of the residual radiological risk posed by nuclear generation. "Radiological risk" refers to the potential for, and consequences of, unplanned releases of radioactive material to the environment or within a nuclear facility. "Residual" refers to the risk remaining after implementation of regulations regarding the safety and security of nuclear facilities.

Future operation of the existing nuclear power plants in Ontario, and of the new plants whose construction in Ontario is now being considered, would pose a significant residual radiological risk. The Canadian Nuclear Safety Commission's acknowledges that an unplanned release could be caused by an accident or malevolent act beyond the design basis of existing or new nuclear power plants. The International Atomic Energy Agency and regulators in other countries have also acknowledged this potential. CNSC's criteria for the design of new nuclear power plants include resistance to attack as a design objective, but it has not yet specified the threats that will be considered in applying these design criteria.

Atmospheric releases from a plant are of particular concern from a public-health perspective, because an airborne plume of radioactive material could travel downwind for tens or hundreds of km, affecting large areas. The plume could cause adverse health effects in exposed persons, and could create lasting contamination of the environment.

An unplanned release of radioactive material at a nuclear power plant could create adverse impacts at the plant itself, whether or not the release reaches the environment. Plant personnel could receive radiation doses that yield adverse health effects, which could be translated into monetized costs. Additional costs could arise for site cleanup, repair of damaged portions of the plant, purchase of replacement power during the period when the plant is out of service, and write-off and decommissioning of the entire plant if repair is not cost-effective.

Two categories of cost are examined (summarized in Table 7-7). The first is costs that arise from efforts to reduce the residual radiological risk posed by nuclear power plants, which are influencing trends in construction costs for new Generation III nuclear plants. Occurrence of a substantial unplanned release of radioactive material at any nuclear power plant worldwide would lead to public pressure on the nuclear industry and regulators to increase their efforts to reduce residual radiological risk, as occurred after the Three Mile Island accident. Enhanced efforts would follow, involving increases in capital/construction costs for new nuclear power plants and increases in annual capital additions at existing plants. Those increases would occur, to varying extents, in Ontario and elsewhere.

The second category of cost is related to the non-insured risk costs associated with offsite and onsite impacts of potential unplanned releases of radioactive material.

Table 7-7
Risk Costs of Nuclear Generation in Ontario: Summary of this Report's Findings

Category of Impacts from Unplanned Releases of Radioactive Material	Category of Risk Costs and the Insurance Premiums that are Paid to Provide Coverage of these Costs	Magnitude of Risk Costs and Insurance Premiums	
		For an Existing CANDU Plant	For a New Generation III Plant
Offsite Impacts	Risk Costs (2008 Can cent per kWh)	2.7 to 5.4	1.5 to 15.4
	Insurance Premiums (2008 Can cent per kWh)	0.02	As for existing CANDU plant?
Onsite Impacts	Risk Costs (2008 Can cent per kWh)	2.7 to 5.6	Smaller amount than for existing CANDU plant
	Insurance Premiums (2008 Can cent per kWh)	No explicit premium is evident	No explicit premium is evident

Schedule 6: Shifting to Renewable Generation: Planning Recommendations for Ontario. Evidence prepared by Hermann Scheer.

The development of the Integrated Power System Plan presents Ontario with an unprecedented opportunity to switch from an energy system based on polluting, risky, finite, and in the long run, expensive, fuels, to an energy system that relies on clean, safe, emission-free, abundantly available and cost decreasing, renewable energy sources.

The OPA plan, if accepted, will miss this opportunity through its adherence to an outdated centralized system and its limited understanding of alternative energy systems.

Premier McGuinty has declared climate change to be "the defining issue of our generation" and highlighted how this environmental crisis is also an economic opportunity – a chance to develop the new green economy that we need to thrive in the 21st century. The electricity sector has been singled out as the largest source of reductions in Ontario's climate plan. Despite these policy goals, OPA's plan largely ignores the potential of new, green energy systems in favour of a system dominated by large nuclear plants, backed up by heritage hydro facilities and new relatively inefficient centralized natural gas plants, with new renewables and conservation pegged at the minimum allowed by the government's directive.

More specifically, the OPA is unduly pessimistic about renewable generation costs and technology development when it assumes that there will be no improvements of renewable technology in the next 20 years. Whereas traditional energy technologies tend to be nearing the end of their potential for technological development, so that we can only expect diminishing returns from their optimization, renewable energy technology is at the start of its development, so that each of its varieties harbours a huge potential for optimization, and new storage technologies will follow.

The macroeconomic advantages of renewable energy reside:

- in its indigenous availability, which leads to fewer energy imports.
- in the replacement of commercial fuels by free primary energy. Technology is substituted for fuel costs, creating new jobs for installing power facilities that, unlike large power plant construction, can be distributed in almost every country, every region and even every community.
- in the avoidance of infrastructure costs and losses through regionalized energy production that is then used in the same region.
- in the promotion of crafts and agriculture that comes from solar construction and biomass utilization, which stabilizes small- and medium-sized businesses and thus regional economic structures.
- in the broad distribution of income because of the emergence of decentralized entrepreneurial forms.
- in the avoidance of ecological follow-up costs, *inter alia* by reducing health costs and costs for catastrophe prevention and compensation.
- in the avoidance of local and international security costs.

In addition, the OPA is unduly pessimistic about energy efficiency achievement and unduly optimistic about nuclear cost and performance. It has also introduced flaws in its procurement strategy, particularly for CDM and for distributed renewable and high efficiency gas generation.

The government's directive set out targets for conservation and renewable generation that were minimums while its limit on nuclear production was a cap. Yet the OPA has in effect treated the targets for both conservation and renewable energy as caps and has proceeded to lay the groundwork for an increase in nuclear capacity, ignoring its many shortcomings. As a result, the IPSP not only fails to recognize and encourage the faster, increasingly cost-effective, more secure and environmentally necessary future of renewable power, it also risks displacing the opportunity for such a shift for decades to come.

Schedule 7: The Role of Recycled Energy and Combined Heat and Power (CHP) in Ontario's Electricity Future. Evidence prepared by Thomas R. Casten, Chairman of Recycled Energy Development LLC.

The proposed IPSP has failed to identify and promote the least cost/lowest pollution approach to providing Ontario's heat and power, because OPA has not made any attempt to identify the market for Combined Heat and Power (estimated here at 11,400 MW), has ignored the waste energy recycling potential, and has offered no programs that would test either market. In summary, the IPSP:

- Fails to identify the potential to avoid transmission and distribution expenses and line losses by the local generation of both heat and power.
- Fails to address the substantial potential (i.e. 3,000 MW) to recycle presently wasted industrial energy streams into useful heat and power that use no fossil fuel, emit no pollution, and have the local generation advantages noted above.
- Stacks the analytical deck in favour of the lowest return on capital resources - central nuclear generation - by applying a 4% 'social discount' rate to all choices, even though actual capital costs will range from 12% to 15%. By artificially ignoring the true cost of capital, the report favours the highest capital cost and riskiest option.
- Stacks the deck in favour of the 'no fossil fuel' nuclear approach by ignoring the 'no fossil fuel' recycled energy approach and then biasing analysis against 'low fossil fuel' combined heat and power (CHP). The IPSP assumes that local generation will perform significantly worse in efficiency and load factor than the least efficient local generation plant the author's companies have ever built.
- Bases recommendations on the wrong metric, costs of power at the generation plant, instead of the right metric, the delivered costs of power.
- This choice of the wrong metric automatically understates the value of local generation by:
    - Ignoring the value of avoided T&D capital investment when generation is local and the peak line losses associated with remote central generation that force the system to generate 18% to 20% more power at peak than the system demand.
    - Ignoring the difference in redundancy requirements between a system of a few very large generating stations (18% to 21% redundancy of generation and transmission) and that required for a system of multiple smaller generators closer to load (3 to 5% for comparable reliability).
    - Refuses to test the market for clean energy by limiting long-term contracts to plants with generation capacity of less than 10 MW (and not yet offering contracts to any local generation).

These biases and flaws undermine OPA's conclusions and will result in a reliance on dirty and costly coal generation, add costs for new T&D, add inefficient peak shaving, greatly deepen Ontario's bet on nuclear, and raise the cost of local manufacturing. This would drive jobs and profits out of the province.

By contrast, a strategy designed to capture clean local energy will unleash a flood of creativity that will spawn new centres of excellence and create multiple benefits, including:

- Development of new technology to recycle more of the waste energy.
- Creation of new local industries to manufacture the various forms of equipment needed to capture waste energy and to export such equipment from the province.
- Significant reduction of the costs of manufacturing at most provincial manufacturers, inducing added production, jobs, and provincial tax collections.
- Slashing of CO2 emissions, while improving the provincial economy, making Ontario a focal point of world climate change policy.

Schedule 8: Storage Options in Planning. Evidence prepared by Tim Hennessy, Chairman and CEO of VRB Power Systems.

Energy storage systems, which absorb energy during times when excess capacity exists so that it can be released later when needed, will offer numerous system benefits and can help Ontario transition from a polluting, high risk central generation model to a more decentralized, resilient, renewable system.

Energy storage is a key component of intelligent (or "self healing") grids, along with fast acting communication and controls, dynamic intelligent protection systems, and refined computer modelling for system stability. These intelligent grids allow for greater distributed and renewable generation, which are key to environmental and socially responsible planning.

Energy storage can be hydroelectric (pumped storage), mechanical (flywheels/compressed air), thermal (molten salts or hot water) or electrochemical (batteries and hydrogen). The benefits of storage include:

Enabling greater amounts of intermittent generation from wind and solar power: Larger quantities of intermittent resources like wind or solar power can be accommodated on a system by including storage capacity. For example, wind power produced overnight when the wind is blowing but demand is low can be made available later when demand is high, but the wind isn't blowing.

Peak shaving: By reducing the peak of a customer's energy load, the use of electrical grid assets can be improved and line losses reduced.

Ancillary Services for Utilities: Energy storage can provide reserves that are available in the event of a loss of output from a supply source or an unexpected change in system demand, can provide reactive power to maintain voltage balance, black start capacity in the event that the grid must be re-energized after a blackout, and frequency control.

Electrical power arbitrage: Power can be bought and stored during off peak times and sold back into the market during peak price times. In addition unused off-peak renewable energy (wind often blows more at night) can be shifted to daytime use gaining added value.

Enables greater Distributed Generation: Storage overcomes the main technical limitation to connecting generators to the distribution grid.

Improved Power Quality and Reliability: Uninterruptible power supply and voltage support.

Remote Area Power Supply: Helps to minimize the use of diesel generation.

Emission Control: Reducing the need for fossil-fired generation to meet peak energy demand.

However, for market participants to offer innovative services like storage, planners and regulators must place appropriate value on the various benefits that the system and society accrues from such technologies. Planners must anticipate the changing make up of generation resources and the changing role of the grid and procure or enable markets to provide technologies that address the changing reality.

By omitting anticipation of distributed storage and the other innovations referred to above, OPA is effectively promulgating the status quo. The OPAs planning:

- Fails to consider or evaluate the range of benefits that storage offers in addition to peaking capacity.
- Fails to consider the combined benefits of storage and increased renewables.
- Allows that generators could bundle in storage but offers no means for developers to be compensated for the added benefits (apart from capacity) it would bring to the system.
- Does not consider storage that is procured or developed and located separately from generation to address a variety of system needs.
- Fails to consider the cost and technology improvements that can reasonably be anticipated.
- Appears to consider only pumped storage.

Schedule 9: An Analysis of the Ontario Power Authority's Consideration of Environmental Sustainability in Electricity System Planning. Evidence prepared by Dr. Robert B. Gibson, Dr. Mark Winfield, Tanya Markvart, Kyrke Gaudreau and Jennifer Taylor

Ontario Regulation 277/06 requires the Ontario Power Authority (OPA) to ensure due consideration of environmental sustainability in the development of the Integrated Power System Plan. In this report, Dr. Gibson (who is the co-author of the *Sustainability Assessment: Criteria and Processes* approach adopted by the OPA to fulfill this regulatory requirement) and colleagues undertook an assessment comparing what the OPA did with what should reasonably be expected of them in light of Dr. Gibson's framework.

They found that the regulatory requirement for ensuring meaningful consideration of environmental sustainability in the development of the Integrated Power System Plan was not met, and that due attention to sustainability requirements would favour a quite different plan.

Their report highlights eight core deficiencies in the OPA's consideration of environmental sustainability in the development of the IPSP. In sum, the OPA's selected "context specific" planning and evaluation criteria appear to rest on traditional concerns of power system planning, rather than on a direct effort to specify the recognized generic core sustainability requirements. The result was a compilation of considerations that are not sufficiently comprehensive or well integrated to cover basic sustainability requirements in a systemic way.

The report outlines the fundamentals of an appropriate approach and provides an illustrative application to clarify the differences between this approach and the approach taken by the OPA. It states that meaningful consideration of sustainability requirements would support coal phase-out as in the IPSP, but in contrast to the IPSP it would emphasize the following gains and associated plan components:

- Fewer and less significant adverse present and future effects on socio-ecological integrity within and beyond Ontario achieved by pursuing the province's maximum achievable CDM potential, and increasing reliance on renewable supply resources that avoid the major upstream and downstream biophysical and social effects and the ecological, economic and political risks associated with uranium, coal and natural gas fuel cycles.
- Increased system resilience, reliability and adaptive capacity and reduced cost risks achieved by placing greater emphasis on adding supply resources incrementally and employing technologies that have shorter planning and construction timelines (less than 5 years) and that can be deployed on a modular and distributed basis.
- Greater system efficiency and cost-effectiveness achieved by reducing the role of low-efficiency uses of natural gas (e.g. single cycle gas turbines) though demand response measures and placing greater emphasis on high efficiency uses of natural gas, particularly cogeneration for intermediate and baseload supply.
- Lower path dependency, fewer technological and economic risks, and greater adaptive capacity achieved by reducing the role of large centralized supply resources, particularly nuclear power plants, with long planning and construction timelines and long facility lifetimes. Where nuclear resources are considered, refurbishment projects, with their lower path dependency, technological and economic risks, would be preferred over new build projects.

The authors recommend that those aspects of the plan that are evidently compatible with sustainability objectives, including the plan's CDM and low-impact renewable energy components and the phase out of coal-fired generation, could be accepted on an enhanced basis. In the areas of significant conflict between the proposed IPSP and the likely conclusions of planning flowing from sustainability-based evaluation, including the plan's nuclear components and low-efficiency applications of natural gas, the OEB would be justified in requiring the OPA to reconsider these options in light of comprehensive, properly specified and carefully applied sustainability criteria and trade-off rules, and to submit a suitably revised IPSP for the next triennial review.