Alternatives to Advancement of the Wuskwatim Generating Station

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on behalf of

Time to Respect Earth's Ecosystems (TREE)

and

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1. Please provide a summary of your background and expertise.

I have been engaged in the analysis of energy supply and demand and of the environmental dimensions of energy use since my involvement with the Ontario Royal Commission on Electric Power Planning began in 1975. I hold an Honours B.Sc. from the University of Waterloo (Physics Major) and in the mid-1980's I was the Deputy Coordinator of the Energy Research Group of the United Nations University and the International Development Research Centre, a position that involved a comprehensive review of energy research and development issues throughout the developing world. For the past 29 years, I have been almost continuously involved in energy-related research, consulting and business ventures, comprising more than 200 individual projects and initiatives.

Much of this work has involved the analysis of demand side options as alternatives to supply side expansion of the energy system, starting in 1980 when I was the project manager and the principal researcher for Ontario in Canada's first national research project to determine the potential for conservation and renewable energy. Since then I have been involved in numerous assessments of the potential for demand side technologies and techniques, as well as retrospective analyses of the contribution that demand side options have already made to energy security. Most of this work has been centred in Canada, but I have also worked on assessments in the U.S. and in Australia, where I was a Visiting Associate at the National Institute for

Economics and Industry Research in a review of the potential for energy conservation and renewable energy to the year 2030 in the State of Victoria, Australia.

During the 1980's I was engaged in numerous electricity demand analyses in Ontario and most other provinces, and in 1987 I developed one of the first applications of the electricity conservation supply curve concept in Canada in an analysis of DSM as a strategy for reducing acid rain emissions in Ontario. I was intensively involved in a review of Ontario Hydro's Demand Supply Plan in the late 1980's and early 1990's until the utility withdrew its environmental assessment application when it realized it had grossly overforecast the need for new power plants and underestimated the growing contribution from the demand side. I also led a team that reviewed the demand analysis underlying Hydro-Quebec's proposed Great Whale project in the early 1990's, another megaproject proposal that was withdrawn when the utility realized the severity of the misjudgments in its demand analysis.

In addition to these and many other projects related specifically to electricity supply and demand patterns, my research interests include scenario analysis of possible sustainable energy futures, futures in which the greenhouse gas emissions and other environmental impacts of the energy system are brought within ecological limits. I was the invited author of the energy chapter of Canada's State of the Environment Report, and in 2002 I completed an analysis of a sustainable energy scenario for Canada in which greenhouse gas emissions are reduced by 50% over a 25 period while maintaining "business as usual" projections of population and economic growth, an analysis which remains the only study that shows how Canada could meet its commitments under the Kyoto Protocol.

I have been involved in the climate change issue since 1988 when, as the invited organizer and rapporteur of the Energy Working Group for the Conference on the Changing Atmosphere in Toronto, I drafted the "Toronto target" calling for a 20% reduction in global greenhouse gas emissions. I have a special interest in the role of local governments in bringing about

greenhouse gas emission reductions and throughout the 1990's served as the principal technical consultant to the energy and climate program of the International Council for Local Environmental Initiatives. This work included the development of methods and conventions for local government strategies for achieving targeted reductions of greenhouse gas emissions and air pollutants that are now used throughout the world. I led a team that developed software tools for supporting this work, software that has been translated into several languages and is used in hundreds of cities in North America, Europe, Australia, South America, Africa and Asia. I was the invited author of the Foundation Paper for the Municipalities Table in Canada's climate change consultative process, and in 2002 was the recipient of the Canadian Environment Silver Award for my work on climate change.

2. What is the background to and the purpose of the analysis presented here?

Resource Conservation Manitoba (RCM) and Time to Respect Earth's Ecosystems (TREE) approached me in 2003 and asked if I would help them assess Manitoba Hydro's case for the need for and alternatives to (NFAAT) the Wuskwatim Generating Project. The groups applied for and received intervenor funding to conduct this analysis for submission to the Manitoba Clean Environment Commission, and Torrie Smith Associates was retained to carry out the work. The funding application, which is in the public record, includes a proposed work plan. Essentially, the objective of the work has been to both assess Manitoba Hydro's NFAAT case and to explore the case for an alternative to the advancement of Wuskwatim dam that would be based on intensified investment in demand side management (DSM) and distributed generation (DG).

In preparing this submission, I have reviewed the material that Manitoba Hydro has provided to the Clean Environment Commission on the topic of the "need for and alternatives to" (NFAAT)

the Wuskwatim Generation Station[1] and the rationale for building it sooner than Manitoba Hydro forecasts it would otherwise be needed to meet the domestic demand for electricity in Manitoba. With the assistance of several colleagues, I prepared many of the interrogatories submitted on behalf of TREE/RCM and I have reviewed Manitoba Hydro's responses to those interrogatories, as well as the responses to other interveners' interrogatories related to the NFAAT aspects of Manitoba Hydro's case.

3. How would you summarize Manitoba Hydro's case for the need for Wuskwatim?

Manitoba Hydro starts with a forecast of the future demand for electricity in Manitoba that suggests the Wuskwatim dam will be needed around the year 2020 in order to help satisfy the demand for electricity in Manitoba. Given that the uncertainty in the forecast demand for electricity in 2020 is larger than the output of the Wuskwatim project, and that the dam could be built in five or six years from the commencement of construction, there is no case for approving the dam at this time on the basis of domestic need. Manitoba Hydro would not be before the Clean Environment Commission with this proposal if its only concern were meeting the need of Manitobans for electricity. To be clear on this point, throughout the rest of this submission, I refer to Manitoba Hydro's proposal as "Wuskwatim Advancement".

Manitoba Hydro's case for starting construction of Wuskwatim before it is needed is based on that part of their mandate that requires the utility "to market energy services, within and outside the province"[2]. As stated in the opening section of their NFAAT submission:

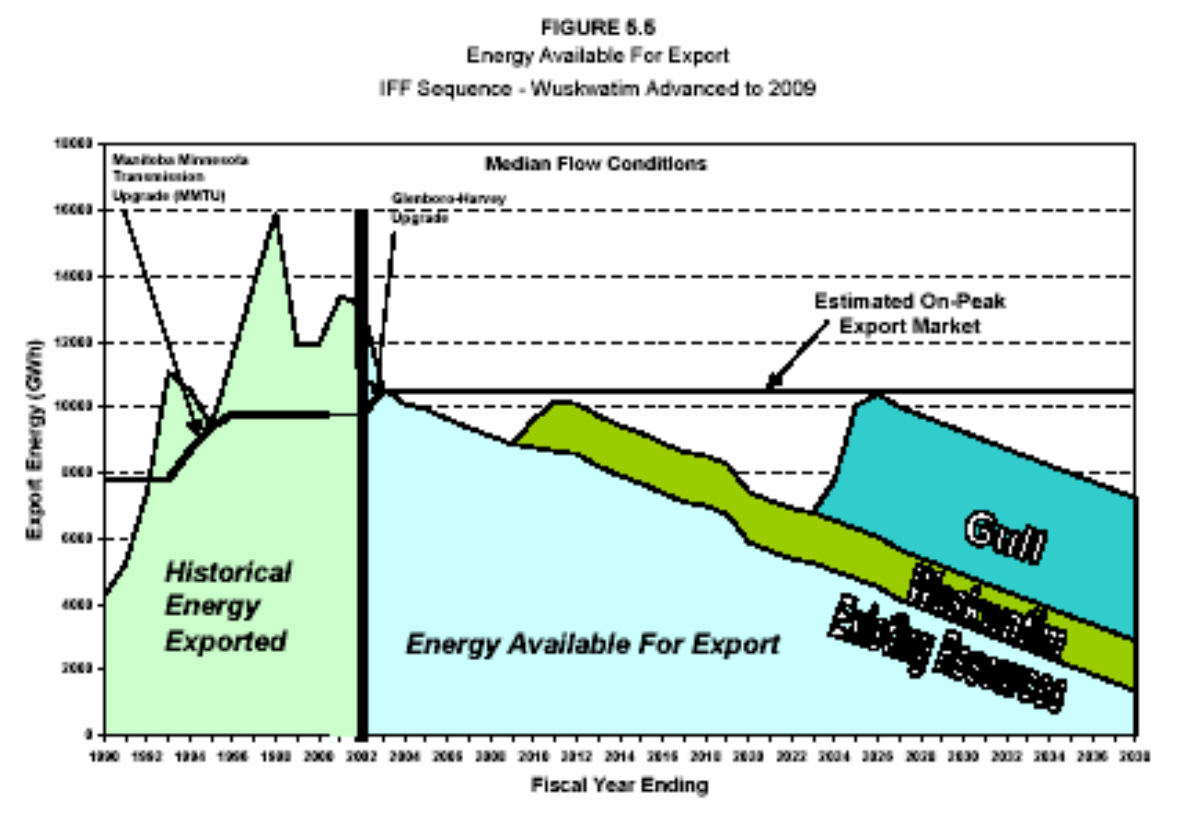
> *Proceeding with new generation will allow Manitoba Hydro to continue to benefit from export opportunities, which contribute to its ability to maintain low domestic rates. Advancement of Wuskwatim in-service date from 2020 to 2009 would be primarily to obtain additional export revenues and profits. Given that the Manitoba load is expected to continue to grow, less surplus power will be*

[1] Manitoba Hydro, "Submission to the Manitoba Clean Environment Commission: Need for and Alternatives to the Wuskwatim Project", Volumes 1 and 2, April 2003. Hereafter referred to as MH NFAAT Volt 1 and MH NFAAT Vol. 2.
[2] NFAAT Volt 1, Overview, page 4, line 8.

> *available for export and exports will inevitably decline. The additional power from Wuskwatim would assist in offsetting the decline in export levels and maintaining current export* revenues *and profits.*[3]

Other justifications for Wuskwatim Advancement are put forward by Manitoba Hydro (e.g. jobs will be created, atrophied capacity to design and build dams will be renewed, northern development will take place, and so on), but these are secondary rationalizations that are not unique to *advancement* of the project. As indicated in the above quote, the *primary* rationale for Wuskwatim Advancement is to "obtain additional export revenues and profits".

Manitoba Hydro's case for Wuskwatim Advancement is summarized by the following figure, taken directly from their NFAAT submission:[4]



[3] MH NFAAT Volt 1, Overview, p. 5, l. 5 ff.
[4] MH NFAAT Vol. 1, Chapter 5, p. 25.

First, the load forecast is used to predict a steadily declining amount of energy available for export, starting from the current situation where the amount available (under median water conditions) is about equal to the "estimated on-peak export market" of 10,500 GW.hours. As the estimated on-peak (5X16 power) export market remains constant over time (limited by operating and market conditions), it is the forecast growth in domestic demand for electricity that gives rise to the gap that begins to open up in 2004 (under median water conditions) between the on-peak export market opportunity and the amount of generation available for export.

Based on Manitoba Hydro's load forecast, these lost opportunities begin in 2004 (median water conditions) and by the time the advanced Wuskwatim project comes on line in 2009/10, the accumulated value of surplus interconnection capability is in the range of $300-$400 million.[5] Starting in 2009/10 and reaching its full potential in 2010/11, the completion of the Wuskwatim Advancement largely fills the "gap" between available generation and the on-peak export opportunity, but the gap then starts to grow again, reflecting the forecast of never-ending growth in domestic electricity consumption that underpins Manitoba Hydro's view of the future. By 2016/17, surplus interconnection capacity is once again higher than it is forecast to be in 2008/09, the year before the advanced Wuskwatim starts producing power. By 2020, the forecast surplus interconnection capacity is more than 3,000 GW.hours, valued at $161-$215 million per year, and, of course, growing. Then in 2023 they start to bring Gull on line and within a couple of years it reaches its 4,350 GW.h per year output and that virtually closes the gap, but again only momentarily. The gap once again begins to grow in the late 2020's, and presumably in the Manitoba Hydro outlook would continue to do so until Conawapa is completed. And so on, *ad infinitum*.

[5] TREE/RCM/MH/NCN II - NFAAT – 32b. Note that the inability of Wuskwatim Advancement to provide any relief before 2009/10 for the accumulating lost export revenue opportunity, not to mention relief of the cost of the current drought, represents a significant disadvantage of Wuskwatim Advancement as compared with DSM/DG alternative.

Against this outlook, Manitoba Hydro argues that over a wide variation in assumptions with respect to forecast domestic demand, DSM effectiveness, water conditions, distributed generation development and export market conditions and prices, Wuskwatim Advancement will yield a rate of return sufficient to justify the relatively low risk of the investment. What Manitoba Hydro does not do, however, is identify and analyze alternatives to Wuskwatim Advancement.

4. What would constitute an alternative to Wuskwatim Advancement?

That is of course a central question to any consideration of the need for and alternatives to the project, and as Manitoba Hydro stated in a response to the CEC on this very question:[6]

> *Manitoba Hydro interprets "alternatives to" to involve a demonstration that the project is more beneficial than other projects either similar in nature or significantly different but in all cases serving to meet the same need…. "Alternatives to" differs from "alternative means of developing the project" in that the latter would involve mutually exclusive options to undertake fundamentally the same development with a modified scope, design or approach.*

And yet, in the NFAAT materials Manitoba Hydro has tabled before the CEC, "alternatives to" the project are not analyzed, or even identified. It is not the possible, eventual need in Manitoba for the Wuskwatim dam that is at issue, but whether starting to build the dam now is the best alternative for realizing opportunities for increased export sales during the 2009-2020 period, or sooner than 2009 for that matter. Given this context, "alternatives to" the project (i.e. Wuskwatim Advancement) would consist of alternative ways of increasing export sales during this period.

In the context of the particular focus of TREE and RCM – demand side investment and distributed generation – a consideration of these options as alternatives to Wuskwatim Advancement would have included, as a minimum, a comparative assessment of how much

[6] CEC/MH/NCN I – NFAAT – 1a.

DSM/DG resource could be put in place with the investment that is earmarked for Wuskwatim and/or the alternative of mobilizing sufficient DSM/DG resources to achieve or exceed the export revenues that that Wuskwatim Advancement is predicted to achieve, and/or an integrated least cost analysis of the optimum investment strategy for minimizing surplus interconnection capability between now and 2020. The alternatives analysis would include the comparative impacts on cash flow and business risk, quantification of the benefits that results from the ability of the DSM/DG resource to deliver results much sooner than Wuskwatim Advancement, identification and quantification of other DSM/DG benefits including the immediate protection it provides against drought, and in general an assessment of what it would take to deliver with DSM and DG what Wuskwatim Advancement would deliver.

5. After reviewing Manitoba Hydro's submissions on the need for and alternatives to Wuskwatim Advancement, what overall conclusions have you reached?

Manitoba Hydro has not systematically identified and analyzed alternatives to Wuskwatim Advancement. While some evidence is presented indicating that some wind power and DSM would remain economic even if the Wuskwatim Advancement proceeds, this is not the same as analyzing alternative scenarios for achieving the export sales revenues that Manitoba Hydro predicts will be achieved by Wuskwatim Advancement, or if Wuskwatim Advancement is the best strategy for increasing export revenues in the short to medium term (i.e. 2004-2020). (The fact that Manitoba Hydro has concluded that some DSM and DG could still proceed economically even with Wuskwatim Advancement is not surprising and in fact is a reflection of the superior and robust nature of the DSM and DG investment alternatives.)

Both in the main NFAAT submissions and in various interrogatory responses, Manitoba Hydro makes it clear that they have not identified or analyzed a program of DSM/DG investments that would achieve the export sales revenues of Wuskwatim Advancement, that "no study has been

completed of the potential for distributed generation in Manitoba"[7], that Manitoba Hydro does not have an estimate of the level of DSM investment that would be required to produce 1,500 GW.h of incremental energy savings (in addition to the projected savings under Manitoba Hydro's current approved DSM plan)" or of "the level of incremental DSM investment that would be required to sustain export capability at 9,000 GW.hour per year or more"[8], that it will be long after the CEC hearings adjourn before they will have an updated program for DSM investment in the province, and that they have no idea what effect the newly announced "Efficiency Manitoba" agency might have on the case for Wuskwatim Advancement.[9]

Perhaps most significantly, in a candid admission of its rejection of market-based business planning, the utility states in response to one interrogatory:

> *Manitoba Hydro does not approach its economic analyses … by estimating the total value of the available market and then assessing which projects can be developed to achieve this value. Instead, Manitoba Hydro's economic analyses use a more direct, project specific approach, conducted to evaluate the value of a particular investment within the marketplace.*[10]

The utility rejects an end use based, market-oriented and customer-centred approach to business planning in favour of a forecast-driven, supply-oriented, project-by-project approach. In this frame, as reflected in the Manitoba Hydro NFAAT evidence, the preferred project is selected *first* (after a superficial and qualitative "screening" exercise), and an extremely limited range of "alternatives" is defined *later*, and then only for purposes of evaluating the already-selected preferred investment within the marketplace.

The only alternatives to Wuskwatim Advancement that are presented in Manitoba Hydro's NFAAT material are the possible advancements of other hydro dams before Wuskwatim, specifically Conawapa or Gull, and these are arguable not really "alternatives to" the project so

[7] TREE/RCM /MH/NCN I – NFAAT – 024a
[8] TREE/RCM /MH/NCN I – NFAAT – 025a
[9] TREE/RCM/MH/NCN II - NFAAT – 29d.
[10] TREE/RCM/MH/NCN II - NFAAT – 32b.

much as alternative means of carrying out what is essentially the same project (i.e. Wuskwatim-Gull-Conawapa vs. Gull-Wuskwatim-Conawapa). In any event, Manitoba Hydro quite easily and correctly dismisses these options as being even less appropriate than advancing Wuskwatim, but is it true that there are no other alternatives worth considering? There is an adage that "to a hammer every solution looks like a nail", and perhaps to Manitoba Hydro every solution looks like a hydro dam, but it seems to me a review such as this should take a more thoughtful approach to the question of the need for and "alternatives to" the project.

Putting forward and evaluating alternatives to the undertaking is a profoundly fundamental requirement of any environmental assessment, and any good business plan for that matter, and the onus for fulfilling that requirement is squarely on the proponent. Manitoba Hydro has neither defined nor analyzed alternatives to the Wuskwatim Advancement.

6. Have you considered the plausibility of alternatives to Wuskwatim Advancement?

Notwithstanding that the onus for presenting a NFAAT case rests with the proponent, and that the resources available to us were far too small to conduct the analysis that should have been in Manitoba Hydro's case[11], we have nevertheless attempted to provide a plausible case that there are real and we think preferable alternatives to Wuskwatim Advancement, even at this late date (with over $50 million already spent on the Wuskwatim project). We have done this by reviewing the materials that Manitoba Hydro has provided, supplemented with other sources of information, and by constructing a scenario of the future demand for electricity in Manitoba in which the DSM/DG resource is treated as a serious alternative to Wuskwatim Advancement. Our analysis has focused on four key areas:

1) A critical analysis of Manitoba Hydro's load forecast, supplemented by the construction of an alternative "end use based" scenario of electricity use in Manitoba under "business as usual" conditions (i.e. no new DSM programs by Manitoba Hydro, or anyone else).

[11] Actually the Wuskwatim Advancement would deliver its benefits between 2010 and 2020, whereas the DSM/DG resource would deliver its benefits starting immediately, and continuing indefinitely after 2020.

2) A critical analysis of the estimates of the economic potential for DSM included in Manitoba Hydro's evidence, and the construction of an alternative estimate
3) A critical analysis of the gap between the "economic" and the "achievable" DSM potential in Manitoba Hydro's evidence, a comparison of Manitoba Hydro's Power Smart program with current best practice, and an alternative evaluation of the achievable DSM potential in Manitoba between now and 2018

4) The development of an alternative scenario to Wuskwatim Advancement, showing the plausibility of a DSM/DG alternative, including the identification and analysis of some of the unique economic, business, environmental and social benefits such an alternative offers over Wuskwatim Advancement.

It bears repeating that our objective is not to do what Manitoba Hydro should have done, failed to do, and should still be compelled to do in presenting its case for Wuskwatim Advancement. Rather we are seeking only to establish the plausibility that there are real and substantive alternatives to Wuskwatim Advancement that have not been identified or analyzed by the utility, and the ignoring of such alternatives exposes Manitoba Hydro shareholders to business risks and Manitoba society in general to social and environmental risks that may very well be avoidable.

7. What is the importance of the load forecast in Manitoba Hydro's justification for the proposed Wuskwatim project?

The forecast of the future demand for electricity in Manitoba is one of the central pillars of Manitoba's rationale for proposing the Wuskwatim project, and for proposing that it be built now instead of when the forecast indicates Manitobans might need it. As already noted, Manitoba Hydro argues that starting in 2004 there will be a widening gap between the opportunity for export sales and the amount of electricity that will be available to take advantage of that opportunity. This gap is entirely the result of the forecast increase in demand for electricity in Manitoba and in this sense, Manitoba's case for advancing Wuskwatim is built on the foundation assumptions in the load forecast.

8. How would you characterize the assumptions underlying Manitoba Hydro's load forecast?

Manitoba Hydro's planning relies almost exclusively on a "forecasting approach" rather than a "scenario approach" to thinking about the future demand for electricity in Manitoba.[12] Even in the residential sector, where an end use model of electricity is maintained that could support scenario analysis, the method still centres on the forecasting of the end use model input variables. The result is an approach to the future demand for electricity which is both superficial and passive, and which fails to provide the business planning function in the organization with the type of rich and insightful analysis needed to properly prepare for uncertain futures or to allow planning to identify and exploit new opportunities for fulfilling the organization's business and public mandates.[13]

Most of the future demand for electricity in the Load Forecast is not only based on extrapolation of past trends, but the trends being extrapolated are generally high level correlations between electricity demand and variables such as the price of electricity and the Gross Domestic Product, variables which are themselves the result of uncertain forecasts. The mathematics of the forecasting method contains very little information and detail about the fine structure of these highly aggregate ratios (with the already noted exceptions of a part of the residential forecast and the Top Customer portion of the General Service Class), and this limits the utility of the Load Forecast as a tool for *understanding* the demand for electricity. These aggregate ratios can

[12] Manitoba Hydro, "Load Forecast Report 2003", prepared in May 2003. Submitted to CEC as Supplemental Response CCC/NFAAT/S/15, August 8, 2003.

[13] There is an interesting exception to the rule in Manitoba Hydro's Load Forecast, and that is the manner in which the future demand from the "Top Customers" in the Basic Service Class is treated. In this case, the individual customers are interviewed by Manitoba Hydro with respect to their future plans for expansion or contraction, and for other changes they may be contemplating that would impact their demand for electricity from Manitoba Hydro. This approach could be a type of "scenario analysis" if it really includes an open discussion about different possible futures and how they would affect electricity demand. Unfortunately, except at the aggregate level, the information involved is confidential, and there is an interest on the part of major power consumers to bias Manitoba Hydro's planning in the direction of more rather than less supply capacity. It would nevertheless be instructive for Manitoba Hydro to examine whether this approach yields a more "accurate" forecast than the correlative predictive techniques used throughout the rest of the forecast.

exhibit and have exhibited significant variation in the past, leading to wildly inaccurate load forecasts and poor utility investment decisions.

Planning on the basis of this type of "trend into destiny" forecasting is like driving a car with only the rear view mirror as a guide. It can work on short stretches of straight road when there are no obstacles or "surprises" that come along, but it breaks down when the road takes a sudden turn or a pedestrian or another vehicle crosses your path. The type of load forecasting practiced by Manitoba Hydro tends to predict a future that looks like the past; the forecast will turn out to be "accurate" when these highly aggregate ratios are stable or changing only slowly and smoothly, but will be "inaccurate" when those ratios are changing rapidly and "erratically".

9. Would you elaborate on the difference between the forecasting approach and the scenario approach to planning, and how it relates to the need for and alternatives to Wuskwatim Advancement?

In the forecasting approach to planning, the future is regarded as a fixed reality, waiting to be "revealed" within some "uncertainty boundary". The historical trends in the relations between the demand for electricity and various other indicators are projected into the future and used to predict the future level of demand for electricity. For example, in Manitoba Hydro's forecasting, electricity demand for the General Service Class Mass Market is predicted based on projecting that it will grow according to its historical relation to electricity price and Gross Domestic Product, both variables that must themselves be predicted to complete the forecast.

In the scenario approach to planning, most famously developed by Shell Oil in the early 1970's and now widely practiced as a business planning technique[14], the future is not regarded as a fixed reality, waiting to be "revealed" within some "uncertainty boundary", much like one might predict the probability of rolling a seven with a pair of dice. Instead, models (mathematical or otherwise) are used to describe different possible futures, and to identify both risks and

[14] For a more detailed discussion of scenario planning, see Peter Schwartz, The Art of the Long View: Planning for the Future in an Uncertain World, Doubleday, New York, 1991.

opportunities according to what could happen as the result of changes in the causal factors that determine, in this case, electricity demand. Scenario analysis considers the possibilities for changes in the variables that are both within and outside the control of the planning organization. The very act of developing an understanding of the underlying causal factors that give rise to the demand for electricity often reveals alternatives that would otherwise remain invisible under the aggregate, macroeconomic forecasting approach. In the case of electricity planning, these alternatives often represent new business opportunities on the demand side for meeting customer needs, alternatives which if pursued result in enhanced feasibility and lower risks for traditional commodity supply investments.

10. The forecast errors of the 1970's and 1980's seem to have given way to more accurate forecasts in recent years. Doesn't that suggest that the load forecast can once again be relied upon as a sound basis for investment decisions?

It is difficult if not impossible to say how close Manitoba Hydro's current load forecast will be to the actual demand for electricity in 2010 or 2020. To explore the basic plausibility of the Load Forecast, we have attempted to calibrate an electricity end use model to the forecast demand, and the results do cast some doubt on the Forecast. If one adopts the population and economic growth rates incorporated in Manitoba Hydro's Load Forecast, as well as the end use saturation rates, it is not possible to calibrate an end use model to Load Forecast totals without making what would appear to be unrealistic assumptions about either the activity variables (e.g. commercial sector floor areas by building type) or the base case (i.e. no new DSM programs) energy utilization intensities (EUI's).

For example, in the case of the commercial sector, we calibrated our end use model to the Manitoba Hydro Load Forecast to the year 2018, but to do this required assuming unrealistically high floor area growth. This is essentially how Manitoba Hydro's consultants were able to tune their model to the Manitoba Hydro forecast, with floor area growth that is considerably faster than economic output for the sector. While maintaining the consultants EUI's for the base case,

we replaced the floor area growth with rates that were based on historical growth in the output of the economic segments corresponding to the various building types. This may still overstate the likely floor area growth that would correspond to the economic growth rates incorporated in Manitoba Hydro's forecast, but this single adjustment results in a 450 GW.hour drop in commercial sector electricity demand in 2018, as compared with Manitoba Hydro's Load Forecast.

We completed a calibration of our end use model that adopts the economic and demographic growth from the Load Forecast, but substitutes lower values for activity variables (e.g. commercial sector floor area) or energy utilization intensities (e.g. industrial segment electricity productivities) where the calibration exercise resulted in unrealistically high values for these variables. The result is a "business as usual" scenario of Manitoba electricity use that is comparable to the Load Forecast, but totals considerably less electricity demand by the year 2018.

11. Turning now to Manitoba Hydro's estimate of the economic potential for DSM, have you reviewed the consultants' studies on the economic potential for DSM that were completed in 2003 for Manitoba Hydro?

Yes, we have reviewed these studies for the residential, commercial and industrial/agricultural sectors. We have incorporated the end use profiles in these studies as the base year end use profiles in our end use model, and we have also used most of the assumptions in these studies to create our reference (pre-DSM) scenario of future electricity demand in Manitoba.

12. Do you think these studies capture the potential for technically feasible and economic DSM and efficiency improvements in Manitoba?

First, the consultants did not attempt an assessment of the technical potential for DSM but rather the amount of DSM that could be delivered with an annualized cost of saved energy of 6.15 cents per kilowatt-hour or less. Given that 6.15 cents/kWh is the opportunity cost Manitoba Hydro calculates for the value of DSM in freeing up kilowatt-hours for the 5X16 export market, this approach would appear to constitute symmetrical treatment of the DSM resource as compared to

electricity supply. However, there are economic benefits associated with the DSM/DG resource that are not captured in the 6.15 cents/kW.hour evaluation, and as such I don't think that it represents an appropriate threshold value for assessing the economic attractiveness of the DSM resource. A kilowatt-hour saved is actually worth more than a kilowatt-hour supplied, and the screening threshold for characterizing DSM as economic should allow for the unique benefits of the DSM/DG resource.

There are also some cases where we believe the consultants have failed to identify DSM technologies that are economic, even accepting the 6.15 cents per kilowatt-hour threshold. For example, the potential for efficiency improvements in office and commercial building equipment and plug load has been underestimated. There are also opportunities for "cost tunneling" in certain circumstances (e.g. new commercial buildings) in which the cost of saved electricity collapses for very high levels of efficiency relative to business-as-usual.

Finally, it appears that not all of the technologies that have been identified by the consultants as being economic have been included in the "roll-up" analysis of the total amount of DSM that is economic. Our analysis indicates that a full application of all the technologies that consultants have identified as economic would yield a substantial increase in the estimate of DSM that is available compared to that presented in the consultants' studies, even at the cut-off threshold of 6.15 cents per kilowatt-hour.

13. Are their other conclusions from your review of the individual sector DSM reports that are relevant to your overall assessment of the potential for DSM in Manitoba?

We identified a number of questionable assumptions and methods in the individual sector DSM reports that add to an overall impression that the economic potential for DSM has been underestimated. For example, in the industrial sector reference case, electricity productivity declines across all subsectors, and in the commercial and residential reports it appears that not all

the technologies identified as economic have been included in the roll-up of the total economic potential. Documentation of these and other points could be provided if requested.

14. Given the above comments, to what extent do you believe Manitoba Hydro is underestimating the economic potential for DSM?

To answer this question, we developed a scenario of electricity use in Manitoba in which all the technologies identified by Manitoba Hydro's consultants as being economic are fully deployed by 2018, plus some additional technologies identified by us as missing from the consultants' review. We began with the "modified load forecast" developed as part of our analysis of the load forecast, so that the final demand scenario in 2018 incorporates, without double counting, both the effect of a full application of the DSM opportunities identified as economic, as well as the adjustments to the baseline (i.e. pre DSM program) level of demand that resulted from tuning our end use model to Manitoba Hydro's forecast levels of population and economic activity. When applied against our modified version of the reference case, the result is a scenario of electricity demand between now and 2018 that is significantly lower than Manitoba Hydro's post-DSM level of demand, partly the result of our modified (lower) forecast and partly the result of our higher assessment of the economical potential for DSM. Documentation of this scenario could be provided on request.

15. Turning now to the difference between the "economic DSM" and what Manitoba Hydro calls the "achievable DSM", would you comment on this distinction and on its relevance to the question of the need for and alternatives to Wuskwatim Advancement?

It is the large gap between the potential for DSM that Manitoba identifies as both technically feasible and economic and the amount that they deem "achievable" that best illustrates the asymmetrical approach taken by the utility to demand vs. supply side resources. Although Manitoba Hydro labels its preferred DSM program the "All Economic Opportunities", it is far from it. The Rate Impact Measures (RIM) test is used to define an upper limit to the DSM measures that are admitted to their program, thus ensuring that the approved program does not even approach "all economic opportunities", even as underestimated by their own consultants.

Rather than pursuing demand side management in a true "resource acquisition mode", Manitoba assigns it a secondary and remedial role in system planning. The phrase "building power plants is what we do; investing in DSM is something we help our customers do" characterizes the lopsided approach to the energy service market taken by Manitoba Hydro, an approach in which DSM resources are underestimated, undervalued, and undercapitalized.

This approach leads to a business plan and an investment strategy that pursues supply options that are demonstrably more expensive than available demand side resources; hence the Wuskwatim Advancement proposal. This type of strategy can be sustained for some time by an organization that has a monopolistic presence in the energy marketplace, but it leads to the accumulation of pent-up, unrealized and clearly economic "alternatives to" supply side expansion; hence the large gap between "economic" and "achievable" DSM potential.

This gap eventually becomes so large that, even if Manitoba Hydro chooses to develop only a small and extremely profitable portion of it, and in spite of all the ways in which Manitoba Hydro can and does "tilt the playing field" in favour of supply over demand, other investors (perhaps even other public investors) will find ways to tap the pent-up DSM resource. Because of the "pent-up" nature of the underdeveloped DSM resource, this can happen quickly relative to the time it takes the utility to plan and build a large (or even a medium-sized) central power plant. When it does, the "accuracy" of the utility load forecast plummets, with the well known consequences to utility supply side investment programs.

16. What are the characteristics of current "best practice" in the field of DSM and energy efficiency programs?

Reviews of the most successful DSM programs in North America in recent years reveal a diversity of resource acquisition and market transformation programs, technology-focused and

sector-wide approaches. Kushler[15] has identified a number of traits that characterize exemplary programs:

- Comprehensive
- Customized services and customer-oriented
- Marketing of cobenefits
- Some exemplary programs are technology-specific, but still promoted with comprehensive and integrated marketing strategies
- Priority on program marketing and support services
- Financial Incentives and Direct Investment
- Non-utility programs increasing (Efficiency Manitoba?)
- Partnerships and collaborations
- Supporting programs and services (training, financing, training
- Energy Star now widely recognized as brand for energy efficiency

17. How does Manitoba Hydro's approach to DSM compare with more advanced approaches to DSM investment?

Manitoba Hydro's Power Smart program is a reasonably good example of second generation DSM programs as practiced in the late 1980's and early 1990's but has fallen behind current best practice.

With regard to the need for and alternatives to Wuskwatim Advancement, the failure of Manitoba Hydro to commit to investment in the full economic potential for DSM, or even to "see" DSM and DG as serious alternatives, represents a critical flaw in the case they have put forward for Wuskwatim Advancement. Notwithstanding a certain amount of rhetoric to the contrary, Manitoba Hydro's actual practices, business plans and case before this Commission reflect a utility that still regards DSM as perturbation on the underlying demand for its primary product – electricity, rather than as a fully legitimate and even preferable strategy for meeting its customers' end use service needs.

[15] Dan York and Martin Kushler, "America's Best: Profiles of America's Leading Energy Efficiency Programs", Report U032, American Council for an Energy Efficiency Economy, Washington, March 2003. http://aceee.org. Also, Martin Kushler, "Demand Side Management and Demand Response in the Ontario Energy Sectors", written comments to the Ontario Energy Board, October 2003.

18. Would you also comment on the role of electricity prices in stimulating the more efficient use of electricity and in the success of DSM programs?

The price of electricity, the rate and direction of change of the price of electricity, and the structure of the electricity rate schedule are all contributing factors in determining the level of electricity demand and the intensity of electricity efficiency improvements and technological innovation. DSM programs will be more effective when delivered against a backdrop of rising electricity prices. TREE/RCM have tabled a separate brief on this topic.

19. Given your assessment of the portion of the economic potential for DSM that could be achieved with a more advanced approach to DSM in Manitoba, do you have an estimate of the "achievable" potential for DSM in Manitoba?

If Manitoba Hydro were to take an aggressive approach to the acquisition of economic DSM and distributed generation resources, the resulting impacts would be several times the current Power Smart objectives. We have developed a scenario of the demand for central power plant electricity in Manitoba in 2018 that would result from such an aggressive approach, and further documentation of this estimate could be provided on request.

20. How does the analysis you have done of electricity demand in Manitoba lead to what could be called a DSM/DG "alternative to" Wuskwatim Advancement?

I think that it demonstrates that there is a scenario of electricity demand in Manitoba over the period between now and 2020, based largely on exploitation of the demand side resource and distributed generation, that captures opportunities for electricity export revenue while delivering most if not all the other perceived benefits of Wuskwatim Advancement, and then some. The Wuskwatim Advancement option is not a very quick or very cheap way to accomplish the basic objective of the undertaking – to maximize revenues from opportunities to export electricity. It will now be at least 2010 before the billion dollar project will produce a single kilowatt-hour. Investments in DSM and distributed generation (primarily wind), on the other hand, begin yielding benefits almost immediately, thus making more effective use of capital while also

providing immediate protection against short term constraints such as the current drought. We have sketched a scenario based on DSM and DG that represents an "alternative to" Wuskwatim Advancement, an alternative that is both plausible and we think preferable in many ways to the slower, more expensive and ultimately unsustainable approach put forward by Manitoba Hydro.

21. What benefits does this alternative scenario offers that are not also offered by Wuskwatim Advancement?

The alternative scenario offers environmental, economic, social, employment, and financial benefits over Wuskwatim Advancement. There is no disagreement that the DSM/DG (wind) option represents the lowest environmental impact strategy for meeting end use service needs; Manitoba Hydro acknowledges this point. It is also well known that dollar-for-dollar, DSM investment produces several times more jobs than power plant investment, especially when the multiplier effects of the recirculated savings from lower power bills are included in the calculation. Northern and First Nation employment levels achieved by Wuskwatim Advancement could be surpassed in a DSM/DG scenario, and lead to versatile skills that could form the basis of sustainable economic activities in Northern communities. The DSM/DG technologies are also "sunrise" technologies – there is a fast growing global demand for environmentally sustainable solutions for providing energy services, and those economies and societies that excel in this field will enjoy a significant competitive advantage.