

January 8, 2010

BY COURIER (7 COPIES) AND EMAIL

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Dear Ms. Walli:

**Re: Pollution Probe – Responding Submissions for Interrogatory Motion
EB-2009-0139 – Toronto Hydro – 2010 Rates**

Pursuant to the Board's *Decision and Procedural Order No. 4*, please find enclosed Pollution Probe's responding submissions for Pollution Probe's motion regarding full and adequate interrogatory responses from Toronto Hydro.

Yours truly,



Basil Alexander

BA/ba

Encl.

cc: Applicant and Intervenors per Appendix "A" to *Procedural Order No. 1* by email

ONTARIO ENERGY BOARD

IN THE MATTER OF the *Ontario Energy Board Act, 1998*,
S.O. 1998, c.15, Schedule B;

AND IN THE MATTER OF an Application by Toronto Hydro-
Electric System Limited for an Order approving just and reasonable
rates and other charges for electricity distribution to be effective
May 1, 2010 (the "Toronto Hydro 2010 Rates Application").

RESPONDING SUBMISSIONS RECORD

**(Pollution Probe Motion for
Full and Adequate Interrogatory Responses**

January 8, 2010

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EB-2009-0139

ONTARIO ENERGY BOARD

IN THE MATTER OF the *Ontario Energy Board Act, 1998*,
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AND IN THE MATTER OF an Application by Toronto Hydro-
Electric System Limited for an Order approving just and reasonable
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RESPONDING SUBMISSIONS OF POLLUTION PROBE
(Pollution Probe Motion for Full and Adequate Interrogatory Responses)

A. Summary

1. Pollution Probe provides these responding submissions pursuant to the Board’s *Decision and Procedural Order No. 4*. As Toronto Hydro is the only party that provided submissions on Pollution Probe’s motion for full and adequate interrogatory responses, these submissions accordingly focus on responses to Toronto Hydro’s submissions.
2. In light of paragraph 18 of Toronto Hydro’s submissions, it appears that an order requiring a full and adequate response for Pollution Probe Interrogatory No. 6 is no longer necessary. However, Pollution Probe respectfully submits that Toronto Hydro has not provided valid reasons as to why it should not provide full and adequate interrogatory responses to Pollution Probe Interrogatory Nos. 2, 3, and 7, which all relate to issues legitimately raised by the studies filed by Toronto Hydro concerning potential barriers to

distributed generation in the Toronto service area. The Board should accordingly grant Pollution Probe's motion for full and adequate responses to these interrogatories.

3. With respect to Interrogatory No. 2, Pollution Probe is simply requesting that Toronto Hydro make reasonable inquiries of the Ontario Power Authority ("OPA") of other work or materials prepared by Navigant Consulting, Inc. ("Navigant") regarding distributed generation in the Toronto service area. This request is reasonable, not onerous, and appropriate given that the filed studies were prepared for both the OPA and Toronto Hydro and given that other information regarding potential barriers to distributed generation in the Toronto service area appears to be relevant.
4. With respect to Interrogatory No. 3, Pollution Probe is simply asking for recalculations and a corresponding new graph using only one change to the input assumptions. As Navigant completed the initial calculations and graph, it should have no difficulties making this one assumption change and doing the associated recalculations and regraphing. Such inquiries should be routinely answered, especially when they involve calculations in expert reports that are filed with the Board.
5. Finally, with respect to Interrogatory No. 7, Toronto Hydro appears to be confused about what its position actually is. First, Toronto Hydro makes numerous submissions to the effect that an amendment to the Distribution System Code is required as well as a generic hearing (which Pollution Probe strongly disagrees with). Yet, despite this implicit opposition, Toronto Hydro then apparently takes "no position" as to whether the Board should "apply the same or similar cost-sharing principles to new natural gas-fired CHP facilities." Pollution Probe submits that Toronto Hydro's position should be clarified, particularly in light of the apparent support of Toronto's sole shareholder for such an application of these principles.
6. Detailed submissions on these points are provided below.

B. Detailed Submissions

1. The Context

7. In light of the Board's decision to deal with this motion in writing, Pollution Probe submits that it is helpful to review the overall context for these interrogatories.

8. As the Board will recall, the Board made the following findings as part of Toronto Hydro's last rates case:

... [T]he Board considers that [Toronto Hydro] should facilitate connections for [distributed generation] and self-generation, where they can be implemented practically and economically, both from the perspective of the generator and of [Toronto Hydro] and its load customers.

EB-2007-0680, Decision, May 15, 2008 at pg. 62 [Motion Record, Tab 4, pg. 25]

9. Since the Board observed that Toronto Hydro's study of distributed generation had not been rigorous, the Board directed that Toronto Hydro conduct a study regarding incorporating a significant amount (up to 300 MW) of distributed generation into its system. This study was to be filed as part of this Toronto Hydro rates application.

EB-2007-0680, Decision, May 15, 2008 at pg. 62 [Motion Record, Tab 4, pg. 25]

10. The rationale for Pollution Probe's interest in this topic was summarized in both the Board's previous rates decision as well as the following excerpt from the study filed by Toronto Hydro:

... Central and Downtown Toronto faces a number of potential electricity system reliability challenges in the 2015 – 2017 timeframe including the need for additional area supply capacity, infrastructure renewal, and supply diversity *to mitigate against low probability but high impact events*.

Exhibit Q1, Tab 4, Schedule 1-1, pg. 2 [Responding Submissions Record, Tab 2, pg. 14]

See also EB-2007-0680, Decision, May 15, 2008 at pg. 61 [Motion Record, Tab 4, pg. 24]

11. As a result, there are at least 3 competing options to meet this system reliability challenge: (a) a third transmission line to downtown Toronto that is expected to cost more than \$500 million; (b) numerous small-scale, high-efficiency CHP projects in downtown and central Toronto with a total capacity of 300 MW; or (c) a large scale (300-400 MW) simple-cycle natural gas-fired peaker plant in downtown Toronto that is similar to the one being constructed for Northern York Region.

Exhibit Q1, Tab 4, Schedule 1-1, pgs. 2, 4-5 [Responding Submissions Record, Tab 2, pgs. 14-16]

See also EB-2007-0680, Decision, May 15, 2008 at pg. 61 [Motion Record, Tab 4, pg. 24]

12. Toronto Hydro accordingly filed the three Navigant reports as part of this rates application. Pollution Probe consequently raised two additional issues for this application as the next logical steps resulting from the studies: (1) “Are Toronto Hydro’s proposed programmes and budgets to reduce its distribution system constraints to the installation of distribution generation appropriate?”; and (2) “Should Toronto Hydro’s policies with respect to recovering its costs of adding CHP generation to its distribution grid be amended to encourage the development of CHP?” The Board ultimately determined that it was unnecessary to place these issues formally on the Issues List as these issues were already subsumed under Issue 1.1, and therefore questions and issues that legitimately arise from the studies could be raised in this proceeding.

Issues List Decision and Procedural Order No. 2, pgs. 3-4 [Motion Record, Tab 5, pgs. 28-29]

13. In light of the Board’s EB-2007-0680 *Decision* as well as the Board’s *Issues List Decision and Procedural Order No. 2* in this proceeding, Pollution Probe submitted interrogatories that it believes legitimately arise from the distributed generation studies filed by Toronto Hydro. Pollution Probe submits that the corresponding issues are thus subsumed as part of Issue 1.1 for this proceeding pursuant to the Board’s *Issues List Decision and Procedural Order No. 2*.
14. Pollution Probe submits that such questions are appropriate as intervenors, in order to be of genuine assistance to the Board, must be allowed significant latitude to evaluate the relative economics of the various supply-side and demand-side options discussed in the studies through appropriate questions, to illuminate which option (or options) can best meet Toronto’s ultimate need for reliable electricity supply. Further, intervenors must be given a meaningful chance to intelligently assist the Board in evaluating the advantages and disadvantages of related policy options for potentially increasing the reliability of Toronto Hydro’s system at a reasonable cost (e.g. potential changes to current Toronto Hydro policies regarding the costs of connecting CHP to Toronto Hydro’s grid). Such

questions are in accordance with the Board's statutory objectives of "protect[ing] the interests of consumers with respect to ... adequacy, reliability and quality of electricity service."

Ontario Energy Board Act, 1998, S.O. 1998, c. 15, Sched. B, s. 1(1) para. 1 [Responding Submissions Record, Tab 3, pg. 19]

15. However, Toronto Hydro did not provide full and adequate interrogatory responses to Pollution Probe's reasonable Interrogatory Nos. 2, 3, 6, and 7, although it no longer appears necessary to further deal with Interrogatory No. 6. This motion is accordingly pending for full and adequate responses for the remaining interrogatories.

2. Only Requesting Reasonable Inquiries of the OPA (Pollution Probe Interrogatory No. 2)

16. Pollution Probe submits that Toronto Hydro is respectfully overstating the nature of Pollution Probe's request in Interrogatory No. 2. For clarity, Pollution Probe is only asking in this motion that Toronto Hydro make reasonable inquiries of the OPA about other related work or materials that Navigant prepared regarding distributed generation for the Toronto service area. It is specifically because the OPA is a third party and not the Applicant that this request to Toronto Hydro is limited only to a certain degree of inquiries to the OPA and not more.
17. Pollution Probe also submits that this request is reasonable given the fact that Navigant was *jointly* retained by both the OPA and Toronto Hydro to prepare the studies that were filed in this proceeding. In other words, overlapping connections exist between Toronto Hydro and the OPA on the subject matter in question, and the request is relevant, not onerous, and can be completed with reasonable effort.

3. Only Requesting One Assumption Change to Expert Calculations and Graph (Pollution Probe Interrogatory No. 3)

18. With respect to Interrogatory No. 3, Pollution Probe respectfully submits that Toronto Hydro is misconstruing its obligations as a result of filing the Navigant expert reports.

Further, the interrogatory only requests one small change to Navigant's stated assumptions and the resulting calculations and corresponding graph.

19. By filing the expert reports in this proceeding pursuant to a Board requirement, the content of the expert reports obviously becomes a fair issue to be examined in this proceeding. Toronto Hydro (and Navigant as the retained expert) may have an obligation to redo expert calculations and graphs based upon different assumptions if such a recalculation relates to an issue that seems potentially significant for the Board's decision, and the recalculation is not overly onerous. Otherwise, the effect is that the expert reports are pre-emptively accepted at face value and not subject to reasonable probing and testing to ensure that the expert's conclusions are robust and reasonable. The fact that Toronto Hydro and its expert may disagree with the proposed assumption change is not a conclusive reason to avoid doing the recalculations.
20. Further, Pollution Probe is only requesting one small change to the expert's assumptions and resulting calculations. The request is simple and clear. It also promises to assist the Board by examining a basic common sense question. A key benefit of CHP arises from the fact that it uses the same molecules of gas to simultaneously provide two services, namely heat and electricity. That is, it extracts a double benefit from the use of gas. This "double use" increases the overall efficiency of the gas usage. However, Navigant appears to assume that this important "double use" of heat and power will occur only in colder seasons. In other words, in warmer seasons, gas will be used only for power, not for heat, and thus the efficiencies of "double use" will not occur in warm season. Navigant's economic calculations incorporate this assumption by including a sizable "boiler offset" for the winter seasons, but not for the summer seasons. As result, the economic calculations use a much lower "winter seasonal heat rate" that incorporates this "offset", while the "summer seasonal heat rate" is much higher as it does not incorporate this "offset" (e.g. 5,766 Btu/kWh and 9,100 Btu/kWh for large CHP).

Exhibit Q1, Tab 4, Schedule 1-3, pg. 181 [Responding Submissions Record, Tab 4, pg. 21]
Exhibit Q1, Tab 4, Schedule 1-3, pgs. 108-110 [Motion Record, Tab 3, pgs. 15-17]

21. However, Pollution Probe submits that there are CHP opportunities in Toronto that can obtain the “double use” efficiencies across all seasons, and Pollution Probe believes that these CHP opportunities are the most economically viable. For example, certain boilers operate year-round, not just in colder seasons, to provide hot water that is consumed or used for various purposes that exist throughout the year (e.g. hot water in a hospital/institution). In such situations of at least some “double use” in warmer seasons as well, the “boiler offset” in the economic calculations would apply across *both* colder and warmer seasons, and a uniform low heat rate would result instead of the differential seasonal heat rates used by Navigant. The interrogatory accordingly requests that the CHP “evaluated cost” calculations and graph be re-done with this assumption change.

Exhibit R1, Tab 8, Schedule 3, pg. 1 [Motion Record, Tab 2, pg. 11]

22. Pollution Probe submits that this assumption change has important consequences when Navigant does its economic comparisons in the reports. According to the relevant Navigant calculations and graph, it appears that a “simple-cycle” gas-fired plant has a lower “evaluated cost” per MW compared to CHP. In other words, according to Navigant’s calculations, such a plant (with its lower energy efficiency of 36%) would appear to meet Toronto’s security of supply issues at a lower cost than CHP despite CHP’s much higher energy efficiencies of 80-90%.

Exhibit Q1, Tab 4, Schedule 1-3, pg. 116 [Motion Record, Tab 3, pg. 18]

23. However, as discussed above, Pollution Probe believes that this apparent result arises because Navigant’s calculated “evaluated cost” for the various CHP options is higher than it should be because Navigant assumed that the CHP units will not in fact fully employ the “double use” efficiencies they are capable of. That is, they will not be appropriately sized to their minimum thermal loads, which is necessary to maximize their energy efficiency and minimize their annual cost per MWh of producing electricity. Pollution Probe’s interrogatory accordingly asks for a recalculation and corresponding new graph with this assumption change in light of the current reports’ contents.

24. Pollution Probe submits that this interrogatory is thus relevant as it tests the contents and conclusions of the reports on a plausible and potentially significant point, and is an issue that directly and legitimately arises from the studies. For example, it may well be that the recalculations and new graph may show that CHP has lower “evaluated costs” per MW than Navigant presently indicates, and CHP can in fact meet Toronto’s security of supply needs at a lower cost than a simple-cycle gas-fired plant. If so, this would also be another reason why Toronto Hydro’s policies regarding the costs of connecting CHP should be changed to encourage CHP. Such an interrogatory is also relevant given the context of the Board’s findings in its *Issues List Decision and Procedural Order No. 2*. These calculations and new graph can be conducted with reasonable (and likely little) effort since they involve only one change to the assumptions and calculations used by Navigant in its own reports.

4. Responding and Clarifying Toronto Hydro’s Position on Potential Barriers to Connecting CHP (Pollution Probe Interrogatories Nos. 6 and 7)

25. As noted above, it no longer appears necessary that a further Toronto Hydro response is required to Pollution Probe Interrogatory No. 6 in light of paragraph 18 of Toronto Hydro’s submission on this motion. However, Pollution Probe submits that clarifications are still required in order for Toronto Hydro to provide a full and adequate response to Pollution Probe Interrogatory No. 7 related to potential barriers to connecting CHP to Toronto Hydro’s grid.
26. As a preliminary matter, Pollution Probe respectfully submits that Toronto Hydro is mistaken with respect to its general comments about both of these interrogatories.
27. Toronto Hydro asserts that these interrogatories do not relate to any approved issue, which it says is tacitly acknowledged by Pollution Probe as there is no reference to the evidence. Pollution Probe respectfully submits in response that Board ruled in its *Issues List Decision and Procedural Order No. 2* that issues identified in the reports that pertain to distributed generation barriers are subsumed as part of Issue 1.1. Further, barriers to

distributed generation are explicitly discussed as part of the Navigant reports. These discussed barrier issues include payback periods, working with stakeholders to lower distributed generation barriers (including incentives as appropriate), and that supportive rules and regulations will provide a necessary framework (including treatment of distribution system costs).

Issues List Decision and Procedural Order No. 2, pgs. 3-4 [Motion Record, Tab 5, pgs. 28-29]
 Exhibit Q1, Tab 4, Schedule 1-1, pgs. 5-6 [Motion Record, Tab 7, pgs. 34-35]
 Exhibit Q1, Tab 4, Schedule 1-1, pg. 7 [Responding Submission Record, Tab 2, pg. 18]
 Exhibit Q1, Tab 4, Schedule 1-2, pgs. 2-3 [Motion Record, Tab 8, pgs. 37-38]
 Exhibit Q1, Tab 4, Schedule 1-3, pgs. 149 & 151 [Motion Record, Tab 3, pgs. 19-20]

28. Pollution Probe thus submits that these interrogatories are clearly appropriate since they seek to both “clarify evidence filed by a party” and “permit a full and satisfactory understanding of the matters to be considered.”

Rule 28.01(a) and (c) [Motion Record, Tab 11, pg. 53]

29. Toronto Hydro also continues to assert that it has no discretion regarding the costs of connecting distributed generation to its grid, and that this issue is possibly appropriate for consideration in a generic proceeding but does not pertain to Toronto Hydro individually. Toronto Hydro accordingly says it takes no position regarding whether the Board should apply the cost-sharing principles associated with renewable generating facilities to new natural gas-fired CHP facilities in the Toronto service area as a potential response to Interrogatory No. 7.
30. Pollution Probe continues to strongly dispute Toronto Hydro’s assertions on these points. Pollution Probe submits that Toronto Hydro has discretion regarding these costs because the Board’s *Distribution System Code* only states that such costs “may” (i.e. not “shall”) be recovered from customers. Further, Toronto Hydro continues to not account for the recently added section 78(3.0.5) of the *Ontario Energy Board Act, 1998*, which explicitly provides the Board with statutory authority in its rate making function for individual distributors to allow for incentives and the recovery of costs related to connections to a distributor’s grid.

Distribution System Code, pgs. 28, 29, 30, 32 [Motion Record, Tab 10, pgs. 45-48]
Ontario Energy Board Act, 1998, S.O. 1998, c. 15, Sched. B, s. 78(3.0.5) [Motion Record, Tab 9, pg. 39]

31. Pollution Probe also submits that Toronto Hydro's security of supply issues are unique and real for the Toronto service area (i.e. they pertain to Toronto Hydro individually), and they must be addressed in some manner. It is accordingly appropriate to examine Toronto Hydro's policies regarding the costs of connecting CHP to its grid to see if they are a barrier to facilitating the solution of distributed generation that should be removed. This issue is also not a new issue as it was discussed in the previous Toronto Hydro rates case as well as the Navigant reports filed here.
32. Finally, Pollution Probe submits that while Toronto Hydro provided an answer to Interrogatory No. 6, it has not yet clearly answered Interrogatory No. 7. This interrogatory specifically asked whether "Toronto Hydro would be *opposed* to a directive from the Board to apply the same or similar cost-sharing principles [associated with renewable generating facilities] to new natural gas-fired CHP facilities in its service territory?" However, at paragraph 18 of Toronto Hydro's response for this motion, it stated that it "takes no position in this proceeding on whether the Board should 'apply the same or similar cost-sharing principles to new natural gas-fired CHP facilities.'" In other words, Toronto Hydro did not clearly state whether it would be *opposed* to such a directive (i.e. does it have any *objections* to such a directive).
33. Pollution Probe submits that it is important to have clarity on this issue, since the position of the City of Toronto, Toronto Hydro's sole and ultimate shareholder, is that the cost-sharing principles associated with renewable generating facilities should also be applied to natural gas-fired CHP facilities. In other words, the position of Toronto Hydro's ultimate shareholder appears to support such a directive from the Board, and it is important to know if Toronto Hydro has any differences of opinion or objections regarding such a Board directive. Pollution Probe also submits that the issue is relevant as it legitimately arises from the Navigant reports and "permit[s] a full and satisfactory

understanding of the matters to be considered.” Toronto Hydro accordingly should be required to provide a full and adequate response to this interrogatory to provide clarity.


EB-2009-0077, City of Toronto Submissions dated June 22, 2009, pg. 1 [Motion Record, Tab 6, pg. 30]

Rule 28.01(a) and (c) [Motion Record, Tab 11, pg. 53]

THE FOLLOWING ADDITIONAL DOCUMENTARY EVIDENCE will be used at the hearing of the motion:

1. Additional marked excerpt from *Executive Summary: Distributed Generation in Central and Downtown Toronto* (Exhibit Q1, Tab 4, Schedule 1-1) [Responding Submissions Record, Tab 2];
2. *Ontario Energy Board Act, 1998*, S.O. 1998, c. 15, Sched. B, s. 1(1) [Responding Submissions Record, Tab 3];
3. Additional marked excerpt from *Central and Downtown Toronto Distributed Generation – Final Report* (Exhibit Q1, Tab 4, Schedule 1-3) [Responding Submissions Record, Tab 4]; and
4. Such further materials as Pollution Probe may submit.

All of which is respectfully submitted this 8th day of January, 2010.


per: Murray Klippenstein


Basil Alexander

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Counsel for Pollution Probe

TO: TORONTO HYDRO-ELECTRIC SYSTEM LIMITED
per *Procedural Order No. 1*, Appendix A

AND TO: INTERVENORS
per *Procedural Order No. 1*, Appendix A

**EXECUTIVE SUMMARY:
DISTRIBUTED GENERATION IN CENTRAL AND
DOWNTOWN TORONTO**

Presented to



JULY 28, 2009

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Background

With a peak demand of some 2,000 MW (representing about 40% of the roughly 5,000 MW peak demand for Toronto Hydro's entire service territory), Central and Downtown Toronto faces a number of potential electricity system reliability challenges in the 2015 – 2017 timeframe including the need for additional area supply capacity, infrastructure renewal, and supply diversity to mitigate against low probability but high impact events.

Toronto Hydro and the Ontario Power Authority (OPA) retained Navigant Consulting to evaluate the potential for distributed generation (DG) to address some or all of these needs. This study responds directly to a request to Toronto Hydro by the Ontario Energy Board to investigate the potential for DG in its service territory and to a directive from the Minister of Energy and Infrastructure to the OPA to revisit the renewable generation, DG and conservation and demand management (CDM) targets in its Integrated Power System Plan (IPSP). During the course of the study, the Ontario government passed the Green Energy Act, which further enhances Ontario's focus on renewable generation, DG, and CDM.

Local Electrical System Characteristics

Three key transmission and supply sources serve Central and Downtown Toronto:

- Leaside Transformer Station (TS), serving approximately 1300 MW (pre-PEC operation)
- Portlands Energy Centre (PEC) at Hearn TS, with a rated capacity of 550 MW
- Manby (East and West) TS, serving approximately 700 MW

Leaside TS requires a major refurbishment sometime in the next three to five years for asset end-of-life replacement. Limited short circuit or fault current capacity at Leaside TS (and Manby TS) is currently a constraint on certain types of DG in Central and Downtown Toronto. The planned refurbishment provides an opportunity to upgrade the short circuit capacity at Leaside TS, which would enable higher levels of DG.

However, the transmission and supply sources will have limited capacity to serve load if a loss of a significant portion of Leaside TS capability were to occur. The IPSP indicates that a deficit of approximately 300 MW would occur if such a low probability, high impact event were to occur.

In addition to the Leaside TS refurbishment, the IPSP indicates that a major transmission upgrade is being assessed as one of the options to serve the Central and Downtown Toronto area (DG is another option being assessed). The upgrade would increase transmission capacity into Central and Downtown Toronto by up to 700 MW and is expected to cost more than \$500 million. The most likely timing for any such upgrade would be in the 2016 – 2018 timeframe.

Table 1: Technical Potential for Customer-based Distributed Generation in Central & Downtown Toronto

Generation Type	Technical Potential*	Comments
Natural Gas Engines	180 MW	Sized to meet 20% of building electrical peak demand. Could be "up-sized" to > 20% which would increase total MW
Diesel Backup Generation	180 MW	Based on upgrading existing generators to meet new environmental requirements for non-emergency operation.
Non-Residential CHP	640 MW	Sized at 15% of peak thermal demand.
Multi-Residential CHP	210 MW	Sized at 15% of peak thermal demand; year-round thermal demand improves economics.
Residential micro-CHP	210 MW	Based on 1.8 kW _(electric) / 3.6 kW _(thermal) unit
Non-Residential PV	1,000 MW	Adjusted for "available" roof area and shading
Residential PV	300 MW	Adjusted for "available" roof area and shading

* Potential does not reflect system and physical constraints, and does not consider the costs of various generation types.

Economic Analysis

Navigant Consulting's economic analysis was based on the "evaluated cost" of each DG technology. The evaluated cost approach is used by the OPA to determine the estimated net costs for new generation projects and allows proposals to its various generation procurements to be compared on an "apples-to-apples" basis. Some generation procurements undertaken by the OPA are necessary to encourage generation where it provides the highest overall value to the system and rate payers, by accounting for factors such as local transmission reliability, operational requirements, deferral of other more expensive transmission system upgrades and / or improving system losses. Since one of the OPA's primary objectives for many generation procurements is capacity, the evaluated cost model expresses the net costs over the contract term on a present value \$ / MW basis.

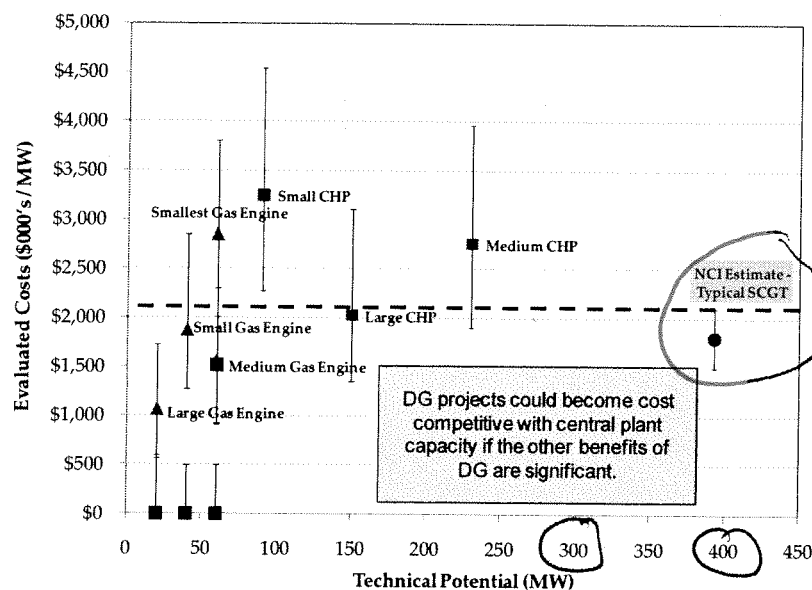
The estimated evaluated costs for the various DG technologies range from \$1.5 - \$24 million / MW with costs for small-scale residential PV expectedly at the high end of this range. As reference, Navigant Consulting estimates the evaluated for a typical peaking plant (such as being constructed in Northern York Region) would fall in the range of \$1.8 - \$2 million / MW.

Widespread installation of DG in Central and Downtown Toronto could defer the need for a major transmission upgrade and other upgrades that would otherwise be necessary to meet peak demand. On the other hand, Hydro One and Toronto Hydro are likely to incur costs to enable significant levels of DG in Central and Downtown Toronto. These other potential benefits would help to narrow the cost "gap" between DG and central plant peaking capacity and increase the relative economic attractiveness of DG.

Figure 1 on the following page indicates that, if these other benefits of DG are significant, many DG technologies would be economically attractive relative to a large peaking plant. Further analysis is required to determine the magnitude of these other additional benefits.

Figure 1 illustrates the potential impact these other benefits could have on the cost-effectiveness of DG based on the most favourable assumptions regarding these other benefits. The figure shows the combination of evaluated costs and technical potential for the most cost-effective of the DG technologies explored. Many of the DG technologies are further broken out by size category. See for example the green dot labeled "Medium CHP" in the middle of the figure. This "dot" indicates that the medium CHP size category (1 to 5 MW per generator) has a technical potential of approximately 230 MW (shown on the horizontal axis) and an evaluated cost (with the most favourable assumptions regarding the other potential benefits of DG) of just under \$3 million / MW (shown on the vertical axis). The vertical bar through this dot illustrates the range of evaluated cost for this DG technology given uncertainty with respect to capital cost and operating performance.

Figure 1: Relative Evaluated Cost of DG (High Value of Other Benefits)



Net of the other benefits described above and based on the most favourable assumptions regarding these other benefits, the evaluated cost are more than \$13 million / MW for non-residential PV and more than \$20 million / MW for residential PV. Hence, these technologies are not shown in Figure 1.

Potential Market Penetration for Distributed Generation in Central & Downtown Toronto

Navigant Consulting estimated the market penetration for various DG technologies based on expected customer willingness to install DG at various "price" points. In essence, customers'

willingness to develop a DG project will increase as the payback period for their investment decreases. The payback acceptance curves utilized by Navigant Consulting have proven to be accurate forecasting tools in many previous industry studies.

The expected market penetration ranges from 140 MW in the medium term to more than 550 MW in the long-term. Table 2 provides specific details on the expected market penetration of each DG technology in the medium term (~5 years) represented by the lower number in the expected range and the long term (~10 years) represented by the higher number in the expected range. Note that the penetration rate for non-residential and residential PV given in Table 2 is based on the feed-in-tariffs as proposed by the government. These proposed tariffs provide a payback on the initial investment of ten years or more. As a result, the expected penetration of the PV technologies as a percentage of the technical potential is very low. Conversely, the penetration rates for the non-PV technologies shown in Table 2 reflect a payment structure to customers that yields a very short (eg, 2 to 4 year) payback period so the expected penetration as a percentage of the technical potential is much higher than for the PV technologies.

Table 2: Expected Range of DG Penetration in Central & Downtown Toronto

Project Size	Technical Potential (MW)							
	Diesel Backup w/ SCR	Gas Engine	CHP	Fuel Cell CHP	Multi-Residential CHP	Micro-CHP	Non-Residential PV	Residential PV
100-500 kW	60	60	170	-	84	210	1,000	300
0.5 - 1 MW	40	40	90	-	-			
1-5 MW	60	60	230	150	-			
5-10 MW	20	20	150		-			
Total	180	180	640	150	84	210	1,000	300
Expected Range on Market Penetration (MW)	36-90	12-70	31-224	4-35	5-19	3-84	2-27	1-3

If the assumed payments underlying the non-PV penetration rates shown in Table 2 were to continue over a twenty year contract period, the evaluated costs for these DG technologies would be much higher than shown previously in Figure 1. Alternative contract and payment structures with lower evaluated costs may still satisfy customer desire for short payback periods. One option would be to offer higher initial payments to enable a short payback period on the initial investment, and then revert to lower payments over the remaining contract term.

Next Steps

The results of this study suggest that DG may be able serve some of the future electricity supply for Central and Downtown Toronto. However, this study is only a first step and further analysis is required by Toronto Hydro and the OPA to more fully understand how DG could serve the needs of Central and Downtown Toronto and how it could serve the

provincial government's policy objectives. These next steps for Toronto Hydro and/or the OPA include:

1. Information gathering with respect to the options and costs for upgrading the short-circuit capabilities of the distribution and transmission system in this area, the effects of Toronto Hydro's and the City of Toronto's aggressive CDM efforts, and an evaluation of the End of Life Asset Replacement plan for the transmission system serving this area.
2. Further analysis to identify the preferred Local Area Integrated Electrical Service solution that would serve as a long term plan for the local subsystem that meets the unique issues facing Central and Downtown Toronto. This analysis would assess local system impacts and examine the short-term, mid-term and long-term benefits and costs for each option.
3. Develop an implementation plan for the preferred solution that could include development of additional CDM programs, working with stakeholders to lower barriers to DG (including incentives as appropriate), reinforcing distribution and transmission system facilities as necessary (leveraging Smart Grid initiatives where possible) and phasing of system upgrades to manage short circuit levels.

Board objectives, electricity

1. (1) The Board, in carrying out its responsibilities under this or any other Act in relation to electricity, shall be guided by the following objectives:

1. To protect the interests of consumers with respect to prices and the adequacy, reliability and quality of electricity service.
2. To promote economic efficiency and cost effectiveness in the generation, transmission, distribution, sale and demand management of electricity and to facilitate the maintenance of a financially viable electricity industry.
3. To promote electricity conservation and demand management in a manner consistent with the policies of the Government of Ontario, including having regard to the consumer's economic circumstances.
4. To facilitate the implementation of a smart grid in Ontario.
5. To promote the use and generation of electricity from renewable energy sources in a manner consistent with the policies of the Government of Ontario, including the timely expansion or reinforcement of transmission systems and distribution systems to accommodate the connection of renewable energy generation facilities. 2004, c. 23, Sched. B, s. 1; 2009, c. 12, Sched. D, s. 1.

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Toronto Hydro-Electric System Limited
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Exhibit Q1, Tab 4, Schedule 1-3
ORIGINAL
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Central and Downtown Toronto Distributed Generation

Final Report

Prepared for:



toronto hydro
electric system

OPPA
Ontario Power Authority

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Seasonal Gas Engine CHP Heat Rate Calculation

- The operating characteristics of the gas engine utilized in this illustrative calculation are shown below.
- Given a project heat rate of 9,100 and boiler efficiency of 95%, 3,400 Btus of heat can be offset by the CHP unit.

Electric Efficiency	41%
Exhaust Heat Captured	59%
Boiler Efficiency	95%

