Distributed Generation in Toronto:

A Stakeholder Survey of Barriers and Benefits

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Executive Summary

1. This study looks at stakeholder views on Distributed Generation (DG) in Toronto. It is based upon 41 in-depth interviews and a literature review. The principal objective is to identify key barriers and opportunities for DG in Toronto.

2. Escalating interest in DG over the past 10-15 years has been driven by various factors: technological innovations; increasing system-capacity needs; changing economic and regulatory environments; and, shifting environmental and social priorities. The International Energy Agency (IEA) (2002) specifies five major factors contributing to this evolution: developments in DG technologies; constraints on the construction of new transmission lines; increased customer demand for highly reliable electricity; the liberalization of electricity markets; and, concerns about climate change[1].

3. DG is growing quickly: as of 2005, 25% of new electricity generation installed globally came from distributed resources, compared with only 13% in 2002.[2] In Europe, decentralized energy systems and distributed generation are growing in demand, as they are seen to meet the twin challenges of energy security and climate change. Countries like Denmark, Finland and the Netherlands demonstrate that it is possible to make much greater use of DG and district energy opportunities. In Denmark, approximately 57% of electrical capacity comes from CHP and 31% from renewables – achieved primarily through the introduction of a feed-in tariff to promote renewables and CHP[3], and heat planning legislation to promote CHP and district heating.

4. In contrast to the traditional, centralized system, DG is "a system in which electricity is produced by small to medium-sized generators connected to distribution systems."[4] This study will define DG as electricity production that is on-site or close to a load center, either interconnected to the utility distribution system or, less commonly, stand-alone. These generators can range from a few kW to approximately 20MW. Widespread uptake of DG will require a paradigm shift from the centralized power generation model Ontario was built on. This definition includes such technologies as photovoltaics; small wind; small biomass; small combined heat and power (CHP) or small cogeneration; small combined cooling, heat and power (CCHP); small non-CHP systems; and gas fired CHeP systems.

1 International Energy Agency (2002). Distributed Generation in Liberalized Markets. Accessed at **http://www.iea.org/textbase/nppdf/free/2000/distributed2002.pdf**
2 WADE, World Survey of Decentralized Energy 2006. Accessed at: **www.localpower.org**.
3 UK DTI Ofgem Study on Decentralized Generation. 2007
4 Ontario Electricity Market Primer, Revised August 2007, Electricity Distributors Association. Accessed October 2008 at **http://www.eda-on.ca/eda/edaweb.nsf/0/3B81CCABE37213958525734D00460E37**.

5. While larger cogeneration does not technically fit this definition, it is included in the scope of this survey. Cogeneration is defined as electricity and heat production that is on-site or close to the load center that could be interconnected at distribution, sub-transmission, or transmission system voltages, combining heat and power and recycling heat and gases. These systems can range from several kWs to hundreds of MWs in size.

6. Downtown Toronto faces significant medium and long-term reliability and capacity challenges. A new supply source is being actively explored and development work is being initialized. Until development and uprating work can be done through to 2011, implementation of DG in downtown Toronto will totally constrained, with the exception of micro-solar installation.

7. However, these constraints do not explain the lack of progress in addressing the myriad other barriers that DG projects face across the board. Nor does it explain why DG penetration remains low in other areas of Ontario that could benefit from it, and which do not face the same issues as the Downtown Toronto grid.

8. DG penetration in Toronto and Ontario remains exceedingly low. Currently[5], Toronto Hydro identifies the amount of embedded generation within their service territory to be 88 MW of installed capacity spread out over 77 projects. Much of this embedded generation is used for purely back up purposes and is not used for grid generation purposes. Of the 88 MW, only roughly 0.1 MW or 100 kW is contracted through the Renewable Energy Standard Offer Program (RESOP). Currently, the RESOP program has 6.7 MW in-service through 50 existing contracts in the Toronto Zone. Of that 6.7MW, there is a single contract for 5.6 MW.

9. The City of Toronto, meanwhile, has taken significant measures to address barriers and incentives within its jurisdiction, with an aim to accelerate DG uptake in Toronto as a means of meeting its climate and air quality targets through renewable energy.

The Survey

10. The majority of respondents – 69% – expressed personal support for DG and the need to increase and facilitate implementation to in order to reap the benefits and assist in alleviating current energy challenges in Toronto.

11. The benefits of DG are widely acknowledged by respondents and in the literature. A number of jurisdictions have well-established DG systems and policies, while others are moving aggressively to accelerate the implementation of DG through policy and incentive measures. Challenges still remain in quantifying DG's benefits and in factoring these into overall costs and rewards. Ontario is pursuing this quantification work, though it lags behind other leading jurisdictions.[6]

12. Benefits as identified by respondents, fell into four main categories: system benefits; environmental benefits; social benefits; and economic benefits. The system benefits of DG – as a category – were the most often identified and recognized by respondents, followed by environmental benefits, then social and finally economic benefits.

5 Provided by the Ontario Power Authority in response to an email request, dated January 13, 2009.
6 EES Consulting for the Ontario Energy Board (2007). Discussion Paper on Distributed Generation (DG) and Rate Treatment of DG. Page 10.

13. The top 5 single benefits cited by respondents (unprompted to an open-ended question) are:
    a. Reduction in line losses and efficiency gains, cited by 67% of respondents;
    b. Reduction in carbon footprint / GHG emissions, cited by 52% of respondents;
    c. Delayed or avoided infrastructure investments, cited by 52 % of respondents;
    d. Reliability, security, stability of supply, cited by 48% of respondents; and,
    e. Increase in clean energy, cited by 45% of respondents.

14. The benefits of DG are well understood and appreciated amongst stakeholders, evidenced also by the strong personal support expressed by the majority of respondents at the top of and throughout the interviews. The wide range of benefits to be derived from DG have not, in themselves, been sufficient to catalyze any large or widespread implementation of DG, as evidenced by the very low penetration of DG in Toronto or Ontario.

15. In Toronto and Ontario, widespread implementation of DG will be critical to "turbo-charging" green energy deployment, as envisioned in the Green Energy Act. "The implications for DG development for renewable energy may well be the most significant environmental benefit conferred by DG."[7] The system change facilitated by a greater move to DG favours greater clean energy deployment, eradicating some of the system bias and comparative costs over time. This will build momentum for DG as barriers come down.

16. These benefits also align closely with many of the Province's goals in respect of climate change, energy, sustainability and community development. At present, these values are not reflected in either the pricing or incentives for DG and cogeneration projects. The playing field is skewed toward central generation and discriminates against smaller, local generation.

Barriers

17. The lack of adequate financial incentive, or a functioning Clean Energy Standard Offer Program (CESOP), was the top barrier identified by 25 of the 42 respondents as impeding the uptake of DG. Notwithstanding the establishment of a mechanism, being the CESOP or the newly-announced feed-in-tariffs, the actual price will be a critical determinant of the uptake of DG, particularly for much-needed CHP projects.

18. Barriers were grouped into four categories: system barriers; financial barriers; technical barriers; and social barriers. System barriers were the most frequently cited category or type of barrier, a total of 115 times. These barriers tend to be systemic and reflect the system's design to serve the needs of large central generators and extensive transmission and distribution infrastructure.

19. After system barriers, financial barriers were the category of barrier most frequently cited by respondents. Financial barriers include the lack of financial incentive, such as the CESOP – or "C-STOP" as one respondent referred to it. CESOP and RESOP were repeatedly characterized as being inadequate, or not working as intended (in the case of RESOP).

7 Canadian Renewable Energy Alliance (2006). Alex Doukas.
Distributed Generation in Canada – Maximizing the benefits of renewable resources.

20. Almost half of respondents identified a lack of vision and mandate – 19 out of 42 or 45% – as a real impediment to more concerted implementation of DG. The same percentage identified a lack of coordination and strategy across the system as a major barrier to individual projects. Respondents felt that DG was being approached across the system in a piecemeal fashion, with little coordination between the parts of the system, resulting in a lack of harmony between stated goals and actual implementation. There is no target, much less a path, for DG in either Ontario or Toronto – nothwithstanding recent information from the OPA that they will be looking for up to 400MW of DG in Downtown Toronto beginning in 2011.

21. The barriers to DG are consistently – and significantly – outweighing the benefits. Ultimately, regulators and policymakers must set appropriate principles, policy goals and regulations so that implemented DG results in more benefits than costs to project developers. In other words, we must level the playing field for DG, and eradicate the system bias that is preventing its uptake, as so many other jurisdictions have done or are in the process of doing.

22. Ontario needs a Roadmap for DG, starting with Downtown Toronto. A Roadmap is proposed in Chapter 9. As the details of the Green Energy Act are worked through and regulations established, such a Roadmap can set Toronto and Ontario on the path to more decentralized energy and increased community energy planning and control. Key elements of the proposed Roadmap are:
    a. A Vision for meeting 30% of Toronto's total peak demand with DG and cogeneration by 2020;
    b. A five-point strategy for achieving the 2020 Vision;
    c. The most important measures to undertake through the strategy, based on this survey;
    d. The most immediate opportunities to be seized in the short-term for increasing DG and cogeneration in Toronto.

Conclusion: DG and Cogeneration Roadmap for Toronto

DG and cogeneration are seen by many working in Ontario's energy sector as attractive energy resource solutions for Toronto, in the near and particularly the medium and long-term when critical supply and capacity issues must be addressed. They can provide added capacity to meet peak demand, provide additional energy supply, and reduce congestion. Stakeholders identify the top benefits of DG and cogeneration as: increased efficiency and reduced line losses; reduced greenhouse gas emissions; reduced transmission and distribution infrastructure spending (about 30% of the total cost of delivered electricity); enhanced stability and security; and greater modularity and flexibility. Additionally, greater distribution of energy resources will help to catalyze greater integration of green energy, as envisioned in the Province's *Green Energy and Green Economy Act*.

Defining DG and Cogeneration

DG and cogeneration represent a paradigm shift in the way we procure, generate and deliver energy in Ontario, away from the centralized model the Province was built on. DG is defined here as electricity production that is on-site or close to a load center, either interconnected to the utility distribution system or stand-alone. These generators can range from a few kWs to approximately 20MW. This definition includes such technologies as photovoltaics; small wind; small biomass; small combined small cogeneration (or combined heat and power, known as CHP); small combined cooling, heat and power (CCHP); small non-CHP systems; and gas fired CHeP systems.

Cogeneration is defined as electricity and heat production that is on-site or close to the load center that could be interconnected at distribution, sub-transmission, or transmission system voltages, combining heat and power and recycling heat and gases. These systems can range from several kWs to hundreds of MWs in size. Systems over 20MW in size are defined as large cogeneration projects.

A Roadmap

This DG and Cogeneration Roadmap proposes a long-term blueprint for advancing DG and cogeneration in Toronto. This is a critical first step, given the numerous barriers DG and cogeneration face, and the lack of overall leadership in catalyzing any meaningful uptake of DG in Toronto or Ontario to date. The Roadmap is modeled on the *Distributed Generation and Cogeneration Policy Roadmap for California*. It includes a 2020 DG and Cogeneration Vision and a Pathway outlining general milestones for addressing barriers and implementing measures and policies to advance DG in Toronto.

The 2020 DG and Cogeneration Vision will require some new policy initiatives. The seeds of some of these measures are contained in the present version of Ontario's *Green Energy and Green Economy Act* (April 2009), but will require amendment and elaboration in regulations to be effective. The Roadmap policy proposals are general, based on input from stakeholders, and by no means exhaustive or detailed – that will require a second phase of detailed mapping, hopefully by a group of stakeholders. The Roadmap also proposes general timelines, or phases, for achieving the Vision, and an overarching strategy. Other, non-policy measures are also included in the Roadmap, stemming from the recommendations of stakeholders.

Where we are: Status of DG and Cogeneration in Toronto

Currently, there are approximately 88 MW of installed DG capacity spread out over 77 projects in Toronto. Much of this embedded generation is used for purely back up purposes and is not used for grid generation purposes. Of the 88 MW, only roughly 0.1 MW or 100 kW is contracted through RESOP. Currently, the RESOP program has 6.7 MW in-service through 50 existing contracts in the Toronto Zone (which represents roughly the GTA). Of that 6.7MW, there is a single contract for 5.6 MW.

Across Ontario, total pre-filed generation of existing generators less than 20 MW amounts to 541 MW, according to the IPSP filing. A further breakdown shows that 52 MWs come from early RESOP contracts and the remaining 489 MW from non-RESOP generators.

The current regulatory framework and rate structure in Ontario discriminate against DG and cogeneration. There are limited subsidies, incentives and recognition of DG and cogeneration in procurement and planning processes. Rates are currently established through the lens of ratepayer protection; though an important principle, other principles and values must be brought to bear in pricing, and in planning. "Lack of a price signal that will change customer behaviour undervalues the environmental, temporal and locational aspects of many resources, including DG and cogeneration."[8] Steps need to be taken in the short and medium-term to level the playing term for long-term growth in DG and cogeneration.

The DG and cogeneration industries are still nascent in Ontario, and they will need support in the short-term to build the presence, expertise and employment necessary to deliver longer-term goals.

Guiding Principles for the Development of DG and Cogeneration

Measures to assist the development of DG and cogeneration should:

- Be a clear target and objective in the Integrated Power Supply Plan and process, with clear leadership assigned within the system for delivery of increased DG and cogeneration;
- Catalyze low-CO2, low-waste and efficient forms of DG and cogeneration;
- Provide a means of enabling DG projects to realize a reasonable rate of return;
- Reduce the complexity involved in setting up DG and cogeneration projects; and,
- Ensure requirements on these smaller generators are proportionate to their size and the use they make of the wider public network.

8 California Energy Commission (2007). Distributed Generation and Cogeneration Policy Roadmap for California. Page 2.

A Vision for DG and Cogeneration

Toronto 2020 DG and Cogeneration Vision Statement
DG and cogeneration are significant components of Toronto's electricity system, meeting over 30% of the total peak demand • DG and cogeneration are integral to procurement, transmission and distribution planning and operations, and to IPSP planning and targets. • After conservation, renewable DG is a designated preferred option for new load generation in Toronto. • Successful and widespread DG and cogeneration projects have resulted in a robust local industry fulfilling consumer and utility needs for clean affordable DG, and Toronto is seen as a leading jurisdiction in the development and implementation of DG technologies. • Customers have multiple options, including DG and cogeneration, to consider as part of their energy sourcing strategy. • Large cogeneration has increased its position as an important resource to Toronto and the GTA. • Transparent, dynamic rates and market structures are in place that account for environmental attributes and incorporate locational and temporal power system needs. • The Feed-in Tariffs, CHP procurements and other financial incentives (CESOP) have fulfilled their mandates. • All other barriers to DG have been removed and all DG permitting is efficient and environmentally responsible, and meets the social and environmental priorities of the City and the Province.

Table 5: Toronto DG and Cogeneration Vision Statement

Most Important Measures to Catalyze DG and Cogeneration Development

Stakeholders view the following as the most important measures (policy and non-policy) to facilitate and encourage DG and Cogeneration in Toronto:

- Establish a clear Vision for DG and Cogeneration, including a mandate, a strategy or plan and clear targets;
- Address and resolve the capacity issues in Toronto and broader grid access issues in Toronto and Ontario as a priority;
- Financial incentives including the Feed-in Tariffs, procurement and incentives for Cogeneration and other incentives (CESOP);
- Incentivize LDCs to pursue and implement DG and cogeneration (utility-owned as now envisioned in the Green Energy Act, and customer-owned) and develop LDC expertise and service for DG;
- Resolve and standardize interconnection issues, as in California's Rule 21 (see Appendix F);
- Streamline (other, non-interconnection related) municipal and provincial regulations to facilitate and encourage DG and Cogeneration; and
- Build public education, awareness and acceptance of DG and cogeneration as Green Energy, and important sources of local community power and pollution abatement.

A Strategy to Achieve the 2020 Vision

To achieve the vision, the Roadmap contains a five-part strategy:

1. *Develop and support adequate incentives and Rate Mechanisms for DG and Cogeneration* – Over the next 10 years, Ontario must provide incentives for DG and cogeneration.

2. *Break out and identify specific overall and regional DG targets in the IPSP* – The Province and the OPA must target DG and cogeneration, and establish a clear mandate within the system for achieving the targets, in order to overcome existing inertia.

3. *Reduce Remaining Institutional Barriers* – Ontario and Toronto need to make the elimination of the most pervasive barriers to DG a priority. In the case of barriers to DG in Toronto, this work can be undertaken immediately, while necessary development and uprating work is being undertaken. This will allow rapid deployment of DG in Toronto starting in 2011.

4. *Total of 70 MWs in Pilot projects in Toronto 2009-2011* – While development and uprating work is taking place, pilot projects could be deployed up to 70 MW in Downtown and Central Toronto, incorporating a variety of technologies and locations. This would help to work out and reduce barriers through practical experience. These projects should receive special one-time supports, as priority pilots.

5. *Particular strategy for Cogeneration* – Cogeneration is vital to the greening of the grid, and special attention must be paid to developing a strategy and clear, aggressive targets for cogeneration in Toronto.

Most Immediate Opportunities

- **CHP or cogeneration projects:** Specific targets need to be established for cogeneration, in order to harness and re-use waste heat and gases. CHP is ideal for a number of facilities, including industrial/manufacturing sites, hospitals, municipal buildings, schools, etc. and will be critical to "greening the grid" in Ontario.
- **Provincial buildings/Building Code:** The Province must demonstrate leadership, and could, like Exhibition Place, use its own facilities and buildings to demonstrate the variety and potential of DG to become much more efficient and/or "grid-neutral." There is enormous potential in Toronto. Also the Province should address DG and cogeneration in new buildings through amendments to the building code.
- **Hospitals:** Hospitals offer great potential in Toronto for cogeneration. Sunnybrook as an ideal first location. The broader MASH sector also offers great potential, particularly for new-build and newer communities.
- **District energy planning:** Community district energy systems offer a great opportunity for increasing DG and clean energy in Toronto, and should be integrated in local and provincial planning.
- **Loading preference:** This has been successful in California, where new load priority is given to conservation first and renewables second. DG and cogeneration could be specified in a Toronto-specific loading order.