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March 21, 2016

Ontario Energy Board
2300 Yonge Street, 27th Floor
Toronto, ON M4P 1E4

Attention: Ms.Kirsten Walli, Board Secretary

Re: Natural Gas Expansion – Generic Hearing
OEB File No.: EB-2016-0004

Dear Ms. Walli:

We act for EPCOR Utilities Inc. in this matter.

Please find enclosed the evidence of Adonis Yatchew of Charles River Associates and the University of Toronto.

_____

Gordon E. Kaiser

Counsel for EPCOR Utilities Inc.

Copy: Charles Keizer, Torys

Chris Ripley, Union

CRA Charles River Associates

EB-2016-004

Ontario Energy Board

Generic Proceeding on Natural Gas Expansion in Communities That Are Not Served

Expert Evidence

Adonis Yatchew

Charles River Associates Inc.

On behalf of

EPCOR Utilities Inc.

March 21, 2016

Contents

A. Natural Gas – Economics, Policy and the Environment

A.1 Benefits of Access to Natural Gas

1. Expansion of natural gas networks has important economic benefits; it lowers energy costs for households, farms, and commercial and industrial establishments; access to low cost energy can also spur growth in the expansion area; and, there are potentially environmental benefits as natural gas has the lowest carbon footprint in the hydrocarbon family.

2. Expansion can also lead to higher capacity utilization rates of existing transmission, distribution and storage infrastructure which may lead to broader sharing of costs. Security of supply may also be enhanced if infrastructure is strengthened.

3. In addition to these benefits, the Province has recognized the increasing divergence of energy costs between areas that enjoy natural gas service and those that do not, the latter usually being in rural areas where incomes are often lower. For these reasons, the Government is promoting natural gas expansion, and supporting it with new loan and grant programs.

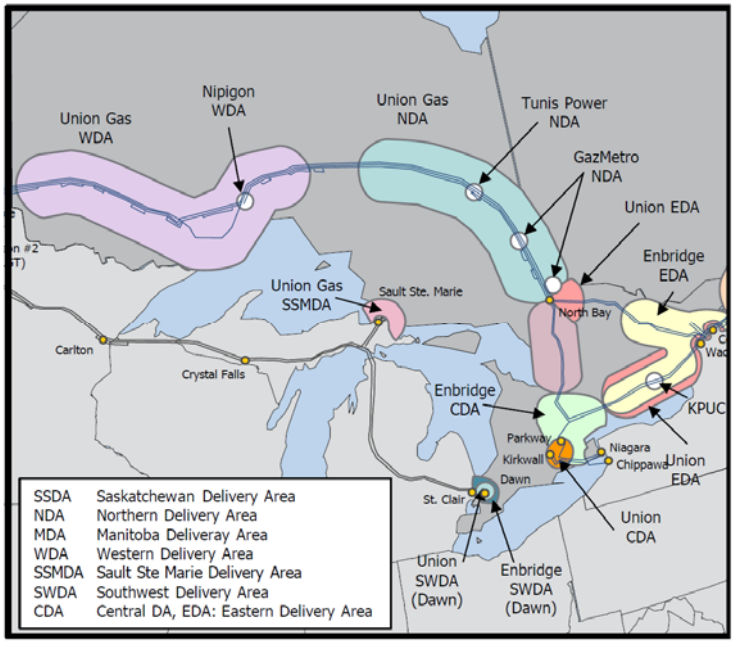
4. Most of the capital expenditures to supply a new franchise area would likely occur in the first few years. Conversion by customers to natural gas should therefore take place as quickly as possible. Both the regulator and the Province may want to take this into consideration when determining rate design, patterns of cost recovery and support levels.

A.2 Natural Gas Markets

5. The shale revolution has led to profound changes in North American natural gas

markets.[1] Prices are likely to remain low for the foreseeable future. Flows of natural gas across North American pipeline networks have been fundamentally altered as well, with significant consequences for pipeline owners and users. At the same time, electricity prices have increased dramatically in Ontario, as well as in other jurisdictions, further propelling the migration to natural gas.[2]

Figure 1[3]



[1] Natural gas markets are continental because of the cost of shipping overseas. During the financial crisis beginning in 2008, gas prices dropped dramatically in many parts of the world. However, in the ensuing years North American prices remained low while prices elsewhere recovered. This divergence signaled the fundamental shift stemming from the shale revolution. See e.g., BP Statistical Review of World Energy June 2015, page 27, http://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2015/bp-statistical-review-of-world-energy-2015-full-report.pdf.

[2] The shale revolution also underlies the tectonic shift in oil markets, the magnitude of which we have not seen since OPEC first exercised its market power in 1973. Extraction of unconventional oil has upturned oil markets not just because it provides a new source of supply, but more importantly because it is *scaleable*. The cost of a shale well is a few million dollars (in comparison to billions for undersea fields). Saudi Arabia, the leading member of OPEC has changed its strategy from supporting market price, to maintaining market share. See, e.g., A. Yatchew (2016), "Discerning Trends in Commodity Prices", forthcoming *Macroeconomic Dynamics.*

[3] Source: Ontario Natural Gas Background Report, Prepared for Ontario Energy Board by HSB Solomon Associates Canada Ltd. March 2014.

6. Most of the areas receiving gas service in Ontario are near the TransCanada Mainline System (see Figure 1). Presently there are two major natural gas distribution companies in Ontario, Union and Enbridge, and a few local distributors. Union serves northern, western and some southern parts of the Province, Enbridge service areas are primarily in the south and east. The two rarely compete against each other for new franchise areas.

A.3 Government Policy Favours Expansion

7. The Ministry of Energy's 2013 Long-term Energy Plan (LTEP) signaled the Ontario Government's intentions to ensure that additional communities would gain access to natural gas in order to benefit from the changing North American market and low prices. The LTEP stated that "[T]he government will work with gas distributors and municipalities to pursue options to expand natural gas infrastructure to service more communities in rural and northern Ontario."[4]

8. In February 2015, the Minister of Energy wrote to the Chair of the Ontario Energy Board ("Board") stating that "In addition to our LTEP commitment, the government is working to develop a Natural Gas Access Loan and a Natural Gas Economic Development Grant." The Minister encouraged "the Board to continue to move forward on a timely basis on its plans to examine opportunities to facilitate access to natural gas services to more communities".[5]

9. In response to the Minister's letter, the Board issued a letter to prospective applicants for expansion of natural gas distribution. The letter invited parties to identify options for expanding natural gas services in communities for which the

[4] Ontario Ministry of Energy "Achieving Balance, Ontario's Long Term Energy Plan", page 7, http://www.energy.gov.on.ca/en/ltep/achieving-balance-ontarios-long-term-energy-plan/.

[5] Letter from the Minister of Energy, Bob Chiarelli, to Ontario Energy Board Chair, Rosemarie Leclair, February 17 2015, http://www.ontarioenergyboard.ca/oeb/_Documents/EB-2014-0227/Letter_Minister_to_OEB_OESP_20150217.pdf.

economics of the proposed projects may not be strictly accommodated within the current regulatory construct.[6] The Board indicated that applicants should seek to minimize impacts on existing natural gas ratepayers.

10. In April 2015, the Ministry of Economic Development, Employment and Infrastructure officially introduced the $200 million Natural Gas Access Loan and $30 million Natural Gas Economic Development Grant program stating that the program "will attract new industry, make commercial transportation and agriculture more affordable, help to create jobs, provide more energy choices and will lower electricity prices for businesses and consumers across Ontario." [7]

A.4 Environmental Context

11. The Government is instituting a carbon pricing approach in the form of cap-and-trade to deal with the environmental externalities of hydrocarbon use. This represents an important shift from previous efforts to decarbonize the Ontario economy. Unlike programs such as feed-in-tariffs, which require the Government to select technologies and determine prices, cap-and-trade addresses the adverse externality directly, and permits individuals, firms and markets to determine the most cost effective ways to reduce their dependence on fossil fuels.[8] This in turn promotes equalization of carbon abatement costs across the various uses and users of hydrocarbons in the economy.

[6] "E.B.O. 188. IN THE MATTER OF the Ontario Energy Board Act, R.S.O. 1990, c. O.13; AND IN THE MATTER OF a hearing to inquire into, hear and determine certain matters relating to natural gas system expansion for The Consumers' Gas Company Ltd., Union Gas Limited and Centra Gas Ontario Inc.", Final Report of the Board, January 30, 1998. Henceforth "EBO 188".

[7] Government of Ontario, News Release, April 24 2015, https://news.ontario.ca/medt/en/2015/04/ontario-expanding-natural-gas-service-to-more-communities.html

[8] For a theoretical analysis of tools for decarbonization see R. Green and A. Yatchew (2012) "Support Schemes for Renewable Energy: An Economic Analysis", *Economics of Energy & Environmental Policy*, 1, 83-98. For a recent evaluation of renewable electricity programs in Ontario, see B. Rivard and A. Yatchew (2016), "Integration of Renewables into the Ontario Electricity System", forthcoming, *The Energy Journal*.

12. From an environmental perspective, natural gas (methane) has both advantages and disadvantages. It is a hydrocarbon, so its combustion produces greenhouse gases. On the other hand, methane has the lowest combustion carbon footprint in the hydrocarbon family -- about half that of coal, two thirds that of oil and about 80% that of propane.[9] Furthermore, piped natural gas produces less CO_2 than propane (or oil) delivered by truck because of lower transportation related emissions. Households that switch from oil or even propane heating are therefore expected to be reducing their greenhouse gas emissions.

13. Electric heating is expensive, and propane and oil heating costs were not much lower prior to the shift in oil markets. The precipitous drop in oil prices is likely to lead to sustained lower oil and propane heating costs, slowing a price induced switch from these heating fuels. However, at the same time that price attractiveness of natural gas can lead to fuel switching and an increase in demand, decarbonization measures may dampen demand growth and even reduce it.

14. For purposes of the present discussion, the important point is that Government policies which price carbon provide an effective mechanism for capping *total carbon generation* in the Province and ensuring that hydrocarbons, mainly oil and natural gas, are dedicated to their best and most needed uses. Carbon pricing does not preclude, and indeed may promote increased use of natural gas in some sectors at the same time that hydrocarbon use in other sectors declines.

15. To summarize, expansion of gas services has important economic benefits, it puts rural customers (residential, farm, commercial and industrial) on an energy footing that is closer to that enjoyed by customers in served areas, and it has the

[9] See U.S. Energy Information Administration, "How much carbon dioxide is produced when different fuels are burned?" https://www.eia.gov/tools/faqs/faq.cfm?id=73&t=11. Some have argued that natural gas is the 'bridge fuel' that will help bring us out of the hydrocarbon age as humans strive to decarbonize their energy production. See e.g., MIT Energy Initiative, "The Future of Natural Gas", http://mitei.mit.edu/publications/reports-studies/future-natural-gas.

clear support of the Government. There are also potential environmental benefits.

B. Franchise Competitiveness

B.1 Benefits of Competitiveness

16. In many industries, the presence of multiple suppliers is sufficient to ensure that there is workable or even vigorous *competition in the market;* customers have alternatives, and failure to provide goods or services at reasonable prices leads to losses in sales and profits. In industries with natural monopoly characteristics, such as electricity and gas distribution, competition in the market is not possible, but there is substantial potential for promoting the public interest through *competition for the market.* Franchise bidding is a mechanism that can achieve this objective.[10]

17. Competitiveness for franchise areas brings significant benefits.

    a. Competitive forces are more likely to ensure that new customers are served at lowest cost. They strengthen a potential distributor's incentives to find ways to reduce the capital costs of expansion where possible, with the benefits of these savings being realized by customers through lower rates.

[10] The idea that even in natural monopoly industries, competition in the form of franchise bidding, i.e., for the right to serve as a regulated monopoly supplier, can bring significant consumer benefits was noted by Harold Demsetz, "Why Regulate Utilities?" Journal of Law and Economics, 11(1): 55–65, 1968. For a more recent review of the literature, see, e.g., Mark Armstrong and David Sappington, "Regulation, Competition, and Liberalization," Journal of Economic Literature Vol. XLIV (June 2006), pp. 325–366.

b. Expansion time-frames will likely be accelerated, particularly if agreements incorporate exit clauses in the event the proponent fails to build facilities in a timely fashion.[11]

c. With multiple firms vying for customers, there are likely to be innovative offerings to secure a deal, such as conversion financing options and alternative approaches to risk sharing.[12]

d. New entrants may bring alternative business models which take advantage of, for example, economies of scope, by providing multiple services. These can bring savings to customers through the sharing of billing service costs and common overheads.[13] There is considerable statistical evidence that multi-utilities can produce significant cost savings.[14] The provision of multiple services by a single entity can also lead to added convenience for customers.

e. One of the most important benefits of competition is that it promotes dynamic efficiency. Open competition will drive innovation and more efficient ways of producing energy services, for example through combined heat and power facilities. [15]

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[11] In Alaska, a new entrant offered a much more aggressive expansion plan than the incumbent, projecting to connect more than six times the number of customers. See discussion below.

[12] As the Maine Public Utilities Commission noted in its approval of Summit Natural Gas's rate plan "SNG will offer a lower cost alternative compared to other fuels, … and will provide up-front financial incentives to customers to help defray the cost to convert to natural gas." See discussion below.

[13] The cities of Kingston and Kitchener offer multiple utility services within single corporate entities, as does EPCOR in Edmonton and other locations.

[14]EPCOR is a good example. The company provides both water and electricity services in a number of markets. Operating gas distribution services in those markets may bring additional economies that could further increase the benefits. In Ontario, earlier work found significant saving at electricity distribution companies that provided water/sewage services. See A. Yatchew 2000, Scale Economies in Electricity Distribution, *Journal of Applied Econometrics*, Vol. 15, 187-210.

[15] The California Public Service Commission has recently authorized the Distributed Energy Resource Service tariff. The utility is permitted to own and operate a combined heat and power (CHP) facility on or near the customer's

B.2 Experience in Other Jurisdictions

18. There is strong evidence that competition for franchise areas is feasible when encouraged and not impeded by regulatory or other artificial barriers. The KPMG report that was prepared for the Board in EB-2015-0156, highlights examples of competition for franchises in Alaska and in Maine.[16] The recently signed franchise agreements between two municipalities and a township in Bruce County, and EPCOR provides a clear indication of the feasibility of competition in Ontario.

19. In 2013, following the Alaska government's introduction of the Interior Energy Plan, two gas distribution companies applied to the Regulatory Commission of Alaska for authorization to supply natural gas service in a newly created service territory in Fairbanks. Fairbanks Natural Gas ("FNG") was the incumbent distributor in the area and Interior Alaska Natural Gas Utility ("IGU") was a newly created public corporation, wholly owned by the local municipality. The Regulatory Commission ultimately denied FNG's application and granted IGU the new franchise as IGU "committed to a more aggressive expansion program" [17] The Interior Energy Plan offered financial assistance for local distribution expansion and other investments to reduce the cost of natural gas supply in Alaska.

20. The Maine Public Utilities Commission ("MPUC") has a "longstanding policy in favor of gas utility competition." [18] It does not grant exclusive gas franchise

premises and to provide the output to the customer at a regulated rate. In the northern parts of Ontario where distribution of natural gas is a challenge because of population sparsity, the ability of a gas utility to provide CHP services to municipal institutions such as hospitals and community centers as well as large farms could provide an important revenue stream to the utility and significant cost savings to customers.

[16] "Jurisdictional Review of Natural Gas Distribution System Expansion," KPMG Report prepared for the Ontario Energy Board, March 31, 2015.

[17] KPMG Report, page 3.

[18] KPMG Report, page 12.

territories and is even willing to authorize a second utility to serve an area already serviced by a local distribution company. The MPUC has also shown flexibility in the types of rates or pricing models that it is willing to approve. For example, it has approved higher rates in some areas noting that in new expansion areas "the utility is seeking customers who are in no sense 'captives' of the utility – since virtually all can satisfy their energy needs using other fuels but will reduce their energy costs by adding natural gas as a resource – it makes little sense to apply all the traditional metrics for establishing that rates are 'just and reasonable'." [19]

21. The MPUC has been willing to authorize new entrants to supply natural gas to unserved areas if they can demonstrate (i) a public need for the service, (ii) the technical ability to provide the service; (iii) adequate financial resources to complete the proposed project; and (iv) the ability to provide the service at just and reasonable rates.[20] The initial threshold requirement is a finding that "the entity proposing to become a public utility has a reasonable chance of bringing its project to fruition, but not that it is certain to do so."[21]

22. This regulatory approach has attracted new distributors to Maine. The MPUC recently approved the entry and eventual expansion of Summit Natural Gas of Maine ("SNG") into previously unserved areas. SNG's business strategy has been to seek opportunities to serve new areas. It has offered innovative approaches to pricing including accepting a rate of return that is below industry standards for the initial years of the tariff plan, offering pricing structures that include up-front financial incentives to help defray the costs of converting to natural gas and offering 'on-bill' loans to help bridge the gap between upfront

[19] KPMG Report , page 14.

[20] KPMG Report, page 14.

[21] KPMG Report, page 14.

costs of conversion and eventual savings from switching to a cheaper fuel source. SNG also won a competitive bidding process held by local communities, outbidding two of Maine's incumbent utilities.

23. In early 2015, the Municipalities of Kincardine and Arran-Elderslie and the township of Huron-Kinlos officially commenced a competitive Request for Information ("RFI") process to attract a natural gas distributor. The RFI identified multiple potential developers to construct, own and operate a new natural gas distribution utility in the area. In February 2016, the franchises were awarded to EPCOR, subject to the approval to the Board.

B.3 The Board's Support for Competitiveness

24. The Board has previously demonstrated a preference for processes that incorporate competitiveness to select a provider for a natural monopoly service. In 2010, the Board published its Framework for Transmission Project Development Plans which set out its policy for new transmission investment in Ontario.[22] In developing this policy, the Board was guided by the objectives of protecting the interests of consumers with respect to price, quality and reliability of electricity supply and facilitating economic efficiency. The Board stated that "The Board believes that economic efficiency will be best pursued by introducing competition in transmission service to the extent possible" and that introducing competition will "lead to better outcomes for the consumer."[23]

25. The Minister of Energy concurred with the Board's approach when he wrote to the Board Chair in March 2011, requesting that the Board undertake a process to

[22] EB-2010-0059 Board Policy: Framework for Transmission Development Plans, April 26, 2010.

[23] EB-2010-0059 Board Policy: Framework for Transmission Development Plans, April 26, 2010.

seek the most qualified and cost-effective transmission company to develop the East-West Tie. The Minister's letter stated:

> "The Board's Policy Framework for Transmission Project Development Plans is well suited to apply to the East-West Tie project. Such an approach would allow transmitters to move ahead on development work in a timely manner, encourage new entrants to transmission in Ontario and bring additional resources for project development. It will also support competition in transmission in Ontario to drive economic efficiency for the benefit of ratepayers."[24]

26. The *benefits* of competitiveness in a regulatory process became evident in the Ontario Energy Board decision of August 7, 2013 regarding the East West Transmission Tie Line project. The line involved a 445 km double circuit 230 kV transmission line in Northern Ontario. In response to the competitive bid process the Board received six applications for designation. In the end the Board selected the Nextbridge partnership, an innovative combination of two major utilities, NextEra Energy (a major Florida utility) and Enbridge. The third partner was Borealis Infrastructure, an investment arm of the OMERS pension plan.[25] [26]
27. Importantly, the Board process demonstrated the unique range of capital that can be attracted through such a process.

28. Competitive processes are widely recognized as good public policy as they generate alternatives and inject market discipline. In settings such as this one,

[24] See http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/322660/view/.

[25] NextEra operates Florida Light and Power, one of the largest rate regulated utilities in the United States with close to five million customers. OMERS is one of Canada's largest pension funds with net assets exceeding $70 billion.

[26] Competitive processes for transmission projects have also been adopted in Alberta and for renewable electricity generation in Ontario.

where competition ‘in the market’ is not possible, competition ‘for the market’ provides a meaningful alternative.

C. Framework for Implementation

C.1 Expansion Reserve

29. To achieve the significant benefits of expansion and following the policy direction from the Government, the Board should establish and administer an Expansion Reserve which would be funded by a small volumetric levy on Province-wide sales of natural gas to current customers. System expansion brings direct and indirect benefits throughout the Province.

30. The maximum potential support from the Expansion Reserve could be based on expected annual sales, averaged over a suitable period. For example, if Project A is expected to generate 10 times the sales volume of Project B, then its maximum support in aid of construction would be 10 times the maximum potentially available for Project B.

31. This ‘per-unit’ ceiling would be established in advance by the Board and publicly available. A volumetric based transfer has the appeal that a customer seeking service would be eligible for the same level of support, per unit volume, wherever she or he is located. Unspent or excess funds in the reserve could be returned to customers, based on their contributions, or retained for use in future years.

32. At the time of approval of the franchise agreement, the Board, which would be ultimately responsible for the distribution of funds, should determine whether the applicant would be eligible for support from the Expansion Reserve. An indication from the Province of the likely magnitude of its financial support would further expedite the development process.

33. To determine the level of support, the proponent would need to put forth a business plan which includes projections of capital and operating costs, estimates of conversion rates, expected sales volumes, and possible sources of funds.

34. Existing guidelines and principles (in particular EBO 188) assert that current customers should not be subsidizing new customers. The Expansion Reserve would seemingly contravene these rules.

35. However, it should be noted that even current arrangements implicitly contain cross-subsidies of one form or another. For example, under the portfolio approach, customers in areas where the profitability index is above one are presumably cross-subsidizing those with a value less than one.

36. Furthermore, cost allocations in networks (and more generally whenever there are common costs) do not have unique and unequivocal solutions based purely on principles of cost causality. Some would argue that alternative allocations of costs would be reasonable or even fairer. Indeed, existing customers have likely received a benefit from payments by past customers for infrastructure, for example, in instances where excess capacity was constructed to allow for future growth.

37. In addition, even existing customers may arguably gain in the longer term from the increase in system customers, capacity usage and sales volumes if this in turn reduces their unit transmission, distribution, storage or commodity costs.

38. To summarize, a modest surcharge on current customers, even in the absence of Governmental policy direction, would be within the bounds of equity.

C.2 Viability of a Project

39. The profitability index[27] of individual projects should continue to provide a useful benchmark as it reflects the costs of an expansion, relative to a measure of revenues. However, a simple specific threshold value, below which projects would not be approved, may not be the best approach, at least not without modification.

40. There may be communities with industrial or commercial customers who are willing to contribute to expansion costs in order to secure gas supply. In some communities, residential or agricultural customers may be prepared to pay more on the expectation of longer term benefits.

41. The objective should be for proponents and communities to bring forth a plan which they believe is viable and which incorporates the various sources of funding (including moneys that might be available from the proponent, the Expansion Reserve, the Province, the Municipality, up-front contributions by future customers, and time-limited surcharges within the new franchise).

42. The Board would need to determine whether the plan incorporates reasonable assumptions, is potentially viable, and the mechanism by which any shortfalls would be covered (i.e., how risk is shared).

43. Such an approach may very well lead to varying rates across new and existing franchise areas. (I note that there is considerable variation in electricity distribution costs and rates across the Province.)

[27] Under the existing framework, a portfolio of projects may be considered, so long as the overall profitability index meets a specified threshold. As one moves to a competitive environment, the Board may need to consider proposals on an individual project basis.

C.3 Sharing the Costs of Expansion and Regulatory Treatment

44. It is reasonable that all interested parties make contributions to ensure viability of a project as each will gain from the enterprise:

    a. Provincial funds could be earmarked to support conversions; such programs should have broad appeal throughout the Province. In rural or suburban communities, lower customer density increases 'conversion costs' as service lines traverse longer distances. For some projects, distance from the source of supply comprises the major share of expansion costs.[28] Connecting these communities may be seen by the Province as an infrastructure project, not dissimilar to road development, which promotes economic development.[29] To the extent that customers convert from oil or propane heating, there may be beneficial environmental impacts.

    b. Municipalities could contribute to capital costs associated with connecting the community to existing transmission facilities and building out a distribution network. Municipalities stand to benefit from availability of natural gas in government buildings, schools and hospitals. There is also the potential for favourable economic development impacts as lower energy costs may attract industrial and commercial enterprises. The taxes that Ontario gas utilities are required to pay to municipalities can be substantial; they can include both property and pipeline taxes. To attract service it will often be necessary for municipalities to waive those taxes for a period of time.

[28] For example, the Kincardine, Tiverton, Paisley, Chesley communities are 87 kilometers from existing facilities. Union Application, Updated Evidence, Filed: 2015-12-14, EB-2015-0179, Exhibit A, Tab 1, Appendix D, page 1.

[29] In the electricity system, costs of incremental transmission facilities are distributed over a wide population of users, not just those that might be directly served by the project.

c. Given the high and divergent costs of available energy sources in comparison to natural gas prices, customers in new franchise areas stand to benefit. They could contribute via time-limited surcharges but these may create a free-rider problem as some may delay conversion until surcharges expire. Regulated rates that differ from those elsewhere, and are higher on a sustained basis because of the greater delivery costs, are an alternative option. The latter approach allows one to distribute costs over a longer period of time, and thereby reduce the shorter term hurdles to conversion.

d. The distributor serving the new franchise area would incur the dominant portion of capital costs, and would likely be allocated the main portion of risk in the event of revenue shortfalls, or cost overruns. At the same time, the company would benefit through the acquisition of new subscribers and energy sales in a regulated environment.

45. Given the 'lumpiness' of capital expenditures to supply the franchise, rapid conversion is a highly desirable objective. This in turn may inform rate design (as well as Board and Provincial decisions regarding the levels of support). For example, the Board might consider rates that are lower in earlier years to allow new customers to absorb the costs of conversion.[30]

46. Contributions from the Expansion Reserve towards capital costs should not enter into rate base, but instead be treated as a Contribution in Aid of Construction.

47. For new entrants, the regulatory cycle would commence once assets are in place and are being used. The regime would likely be some form of incentive regulation. For existing distributors that are in the midst of an IR cycle, expansion costs and revenues would need to be treated separately from ongoing operations

[30] In other industries, companies seeking to attract customers may offer 'introductory' rates which encourage switching.

until the completion of the cycle, at which time they could be merged for the subsequent period. This approach will ensure that new entrants and incumbents receive comparable regulatory treatment, and that the latter are not inappropriately burdened with additional unplanned expenses in mid-cycle.

C.4 Facilitating Competitiveness

48. In order to minimize barriers to entry, potential entrants should be given unimpeded opportunity to compete for franchise areas against incumbent distributors.

49. An opaque environment, where information is difficult to obtain and its reliability uncertain, creates an additional barrier to entry. Keeping in mind that many expansion opportunities are small in size, external candidates are less likely to explore business ventures unless information is readily available. The Board should therefore consider instituting a series of changes to facilitate a competitive process.

50. A registry of interested proponents and a comprehensive database of franchise agreements should be made available. (The Board can determine the information that must be provided publicly while ensuring protection of commercially sensitive data.) Board approvals should be conditional on the municipality or other governing authority having conducted a process of due diligence. This may be, but does not necessarily need to be a comprehensive 'RFP' process. Rather, it could be within a range of processes such as a request for information, request for expressions of interest, request for qualifications, and so forth.[31]

51. The franchise approval stage also provides an opportunity for applicants to seek authorization for innovative new services that may be necessary to make service

[31] In some instances, it could be that the due diligence process leads to the conclusion that an extensive competitive process is not feasible, for example due to the size of the proposed expansion.

in the expansion territory viable. During this early stage, it would be appropriate for the Board to determine whether the proponent is eligible for support from the Expansion Reserve. Provincial expressions of the magnitude of its contributions would also be most desirable as such support may be necessary to assure the viability of the project.

52. Subject to negotiation, milestones should be included in the Franchise Agreement, but not specifically prescribed by the Board. Flexibility is an essential feature of commercial transactions, particularly as circumstances and opportunities can differ materially from one location to another. Information on the approaching termination of existing agreements should be publicly available.

53. In the event that a new provider is successful in its application, clear rules should be put in place to ensure that connections and modifications to existing infrastructure are completed in a timely fashion. New entrants will be dependent on the two main incumbents for the foreseeable future for gas supply; they should not be subject to unreasonable costs (such as advance reinforcement costs) or the exercise of market power. The Board may want to consider an expedited process to resolve disputes.[32]

D. The Union Proposal

D.1 Features of the Union Proposal

54. In July 2015, Union presented the Board with its Community Expansion proposal. The proposal was a response to the Board's initiative to address the Government's desire to expand natural gas distribution systems to currently

[32] In some industries, e.g. telecom, new entrants have at times been given preference by the regulator to promote competition and expansion of services. In the electricity sector, solar and wind have been given priority connection and dispatch for environmental reasons.

unserved communities.

55. Union has indicated that its proposal is guided by a set of principles intended to balance the impacts on all affected parties: [33]

- Those that directly benefit from a project should contribute to the financial viability of the project;
- Expansion customer contributions to project feasibility should be commensurate with the savings achieved by switching to natural gas;
- Moderate cross subsidization from existing customers is acceptable, provided they are reasonable over the long-term;
- Natural gas distributors should not be exposed to financial risk related to the incremental new community capital investments.[34]

56. We are in broad agreement with the first three principles: our proposal contemplates that potential new customers, municipalities and existing customers contribute to system expansion costs. Competition for the franchise would reveal the willingness of all parties to contribute to the viability of the enterprise.

57. However, for reasons indicated above, we believe that the proponent should also be willing to contribute to project costs. Furthermore, in our view, natural gas distributors should not be shielded from all financial risks associated with the projects. The distribution of risk should be an outcome of the negotiation process and embedded in the franchise agreement.

58. Union has indicated that its proposal is designed to maximize the number of communities to receive natural gas services *without* the use of provincial funding

[33] Union Application, Updated Evidence, Filed: 2015-12-14, EB-2015-0179, page 6.

[34] Union Application, page 6.

support.[35] It is unclear why support should not be used if available, given the desirability of expanding to currently unserved areas and the likelihood of wider benefits. In our view Provincial support should be accepted.

59. As per the Board request, the Union proposal puts forth options that would require relaxing certain restrictions of EB0 188, in particular the limitation on cross-subsidization. The impacts are to be limited to a maximum of $2 per month. These 'cross-subsidization' amounts are to be collected and administered by Union.

60. Our model contemplates a Province-wide Expansion Reserve that is administered by the Board or its designate, not by one or another distributor. Reserve funds would be available to incumbents and to entrants seeking to expand service to new areas, and would therefore help to level the playing field.

61. The purpose of the Reserve that we have proposed is to defray capital costs. As such the amounts are treated in much the same way as Capital in Aid of Construction, thus reducing the capital amounts that enter into rate base. Nor should the funds be used as insurance to ensure that the utility earns its rate of return.

D.2 The Union Proposal Would Impede Franchise Competition

62. Approval of the approach put forth in the Union proposal would likely establish the regulatory approach for the future, and would have the effect of erecting a barrier to new gas distributors in their efforts to offer competing alternatives to those being proposed by incumbents. The Union proposal contemplates that higher rates paid by its customers be used only to support Union expansions. As discussed above, competition amongst gas distributors to serve new communities can bring considerable societal benefits and should be encouraged.

[35] Union Application, page 3.

63. A regulatory model that allows incumbent providers to recover part of their capital expansion costs through higher rates charged to their existing customers, without having these funds available to competing entities, would seriously disadvantage potential entrants. This underscores the essentiality of creating a segregated fund, administered by the Board or its designate.

E. Concluding Comments

64. It is in the public interest to create a vigorously competitive environment for system expansion, one that fosters alternative business models, promotes dynamic efficiency and allows communities and municipalities to have broader options for energy supply. Divergence in energy prices has exacerbated energy cost differentials between areas supplied by natural gas, and those presently unserved.

65. In Ontario, electricity prices are rising, which creates additional pressure for lower cost energy alternatives, particularly in rural areas. In these markets, expansion of natural gas systems can assist and promote the competitiveness of industry and agriculture.

66. The allocation of costs in networks does not generally admit unique assignments based on cost causality. A range of outcomes can satisfy principles of equity. Furthermore, current Board-approved principles implicitly recognize a degree of cross-subsidization between customers.

67. The Union proposal supports a moderate degree of cross-subsidization by existing customers to support expansion. We agree. However, to promote competitiveness, such funds should be available to any company seeking to provide distribution to unserved areas. The Board should therefore establish and

administer an Expansion Reserve funded by a small volumetric levy on Province-wide sales of natural gas.

68. Expansion to new areas can be expensive and all parties – the Province, the municipality or other local governing body, customers and the proponent – have a role in contributing to project viability and should be given flexibility, for example, in their responses to competitive processes for the awarding of franchises and the commercial arrangements they ultimately negotiate.

69. Finally, accelerated rates of conversion should be a key objective as once supply infrastructure is put in place, underutilization would represent an economic loss.

Appendix A: Responses to Board "Draft Issues List"[36]

1. What is considered a community in the context of this proceeding?

   For purposes of this proceeding a narrow definition of "community", based for example on a numerical threshold, may be not be helpful. It would also appear that the Province has not provided a specific definition of a community, though the term is used in its letters and documents. If competitive forces are to be promoted, entrants and incumbents should be in a position to compete for the opportunity to provide service to new customers. In most cases, this will require franchise agreements with local governing authorities that represent the interests of the target community. [See Section A.3 Government Policy Favours Expansion.]

2. Does the OEB have the legal authority to establish a framework whereby the customers of one utility subsidize the expansion undertaken by another distributor into communities that do not have natural gas service?

   EPCOR will respond to this in its legal argument.

3. Based on a premise that the OEB has the legal authority described in Issue #1, what are the merits of this approach? How should these contributions be treated for ratemaking purposes?

   Following the policy direction from the Government, and in order to support expansion, the Board should establish and administer an Expansion Reserve which would be funded by a small volumetric levy on Province-wide sales of natural gas to current customers. The

[36] Ontario Energy Board, Decision and Procedural Order No. 2, EB-2016-004, Generic Proceeding on Natural Gas Expansion in Communities That Are Not Served, March 9, 2016.

requirement that current customers make a small contribution to system expansion is within the bounds of equity. Many current customers may have benefitted from contributions made by previous customers. Cost allocations in networks (and more generally whenever there are common costs) do not have unique and unequivocal solutions based purely on principles of cost causality. [See Section C.1 Expansion Reserve.]

Furthermore, higher utilization rates of common transmission, distribution and storage infrastructure would lead to broader sharing of costs. There are also economic benefits if access to low cost energy spurs growth in the expansion area; and, there are potentially environmental benefits. [See Sections A.1 Benefits of Access to Natural Gas, A.2 Natural Gas Markets, A.3 Government Policy Favours Expansion and A.4 Environmental Context.]

Contributions from the Expansion Reserve should not enter into the rate base, but instead be treated as a Contribution in Aid of Construction. [See Section C.3 Sharing the Costs of Expansion and Regulatory Treatment.]

4. Should the OEB consider exemptions or changes to the EBO 188 guidelines for rural, remote and First Nation community expansion projects?

    a) Should the OEB consider projects that have a portfolio profitability index (PI) less than 1.0 and individual projects within a portfolio that have a PI lower than 0.8?

b) What costs should be included in the economic assessment for providing natural gas service to communities and how are they to be determined and calculated.

c) What, if any, amendments to the EBO 188 and EBO 134 guidelines would be required as a result of the inclusion of any costs identified above?

d) What would be the criteria for the projects/communities that would be eligible for such exemptions? What, if any, other public interest factors should be included as part of this criteria? How are they to be determined?

e) Should there be exemptions to certain costs being included in the economic assessment for providing natural gas service to communities that are not served? If so, what are those exemptions and how should the OEB consider them in assessing to approve specific community expansion projects?

f) Should the economic, environmental and public interest components in not expanding natural gas service to a specific community be considered? If so how?

In an increasingly competitive environment, it makes sense to move away from a portfolio approach, and from predetermined profitability index thresholds. Instead, parties should assemble a proposal which combines Provincial support, potential transfers from the Expansion Reserve, as well as contributions from the proponent, municipalities and customers as they see fit in the circumstances. The costs of expansion into unserved areas are influenced to a large degree by the distance from existing sources of supply, capacity at the source, and

the density of the customer base. These locational and density factors may rationally lead to higher service rates. The viability of a project would depend in part on the willingness of customers to pay potentially higher rates, the willingness of applicants to serve and absorb some of the costs, and the willingness of the Province and municipality or other local government to contribute. In determining its level of financial support, the Province may choose to consider other factors, such as the potential for economic development and other public interest considerations. From the perspective of the Board, it would appear that the Province has communicated its desire for expansion. The Board will need to develop mechanisms that promote vigorous competition and determine appropriate contribution levels from existing customers. [See Sections A.3 Government Policy Favours Expansion, C.2 Viability of a Project and C.3 Sharing the Costs of Expansion and Regulatory Treatment.]

5. Should the OEB allow existing natural gas distributors to establish surcharges from customers of new communities to improve the feasibility of potential community expansion projects? If so, what approaches are appropriate and over what period of time?

Time limited surcharges constitute one option, but they may create a free-rider problem as some potential customers might delay conversion until surcharges expire. Regulated rates that differ from those elsewhere, and are higher on a sustained basis because of the greater delivery costs, are an alternative option. The latter approach would allow one to distribute costs over a longer period of time, and thereby reduce the hurdles to conversion. [See Section C.3 Sharing the Costs of Expansion and Regulatory Treatment.]

6. Are there other ratemaking or rate recovery approaches that the OEB should consider?

Given the 'lumpiness' of capital expenditures to supply the franchise, rapid conversion is a highly desirable objective. This in turn may inform rate design (as well as Board and Provincial decisions regarding the levels of support). For example, the Board might consider rates that are lower in earlier years, by allowing a capital cost deferral account, to allow new customers to absorb the costs of conversion. [See Section C.3 Sharing the Costs of Expansion and Regulatory Treatment.]

7. Should the OEB allow for the recovery of the revenue requirement associated with community expansion costs in rates that are outside the OEB approved incentive ratemaking framework prior to the end of any incentive regulation plan term once the assets are used and useful?

For new entrants, the regulatory cycle would commence once assets are in place and are being used. The regime would likely be some form of incentive regulation. For existing distributors that are in the midst of an IR cycle, expansion costs and revenues would need to be treated separately from ongoing cost recovery until the completion of the cycle, at which time they could be merged for the subsequent period. This approach will ensure that new entrants and incumbents receive comparable regulatory treatment, and that the latter are not inappropriately burdened with additional unplanned expenses in mid-cycle. [See Section C.3 Sharing the Costs of Expansion and Regulatory Treatment.]

8. Should the OEB consider imposing conditions or making other changes to Municipal Franchise Agreements and Certificates of Public Convenience and Necessity to reduce barriers to natural gas expansion?

Subject to negotiation, milestones should be included in the Franchise Agreement, but not specifically prescribed by the Board. Flexibility is

an essential feature of commercial transactions, particularly as circumstances and opportunities can differ materially from one location to another. Information on the approaching termination of existing agreements should be publicly available. [See Section C.4 Facilitating Competitiveness.]

9. What types of processes could be implemented to facilitate the introduction of new entrants to provide service to communities that do not have access to natural gas. What are the merits of these processes and what are the existing barriers to implementation? (e.g. Issuance of Request for Proposals to enter into franchise agreements)

The Board should maintain a registry of interested proponents and a comprehensive database of franchise agreements should be made available. (The Board can determine the information that must be publicly available while ensuring protection of commercially sensitive data.) Board approvals should be conditional on the municipality or other governing authority having conducted a process of due diligence. This may be, but does not necessarily need to be an 'RFP' process. The franchise approval process could also be used by applicants to seek approval for innovative new services that may be necessary to make service in the expansion territory viable. During this early stage, it would be appropriate for the Board to determine whether the proponent is eligible for support from the Expansion Reserve. [See Section C.4 Facilitating Competitiveness.]

10. How will the Ontario Government's proposed cap and trade program impact an alternative framework that the OEB may establish to facilitate the provision of natural gas services in communities that do not currently have access?

A clear distinction should be maintained between cap and trade, and efficient use of energy resources. Government policies which price carbon provide an effective mechanism for capping total carbon generation in the Province and ensuring that hydrocarbons, mainly oil and natural gas, are dedicated to their best and most needed uses. Carbon pricing does not preclude, and indeed may promote increased use of natural gas in some sectors at the same time that hydrocarbon use in other sectors declines. [See Section A.4 Environmental Context.]

11. What is the impact of the Ontario Government's proposed cap and trade program on the estimated savings to switch from other alternative fuels to natural gas and the resulting impact on conversion rates?

The impact on estimated savings and impacts on conversion rates will depend on the relative price changes of competing fuels. While a price on carbon can be expected to increase the commodity price of hydrocarbons, natural gas has the lowest carbon footprint and should therefore merit a lower carbon price on a BTU basis relative to other carbon fuels. The differential between natural gas prices and electricity prices, is likely to remain large. Furthermore, the production price of natural gas is expected to remain at low levels for the foreseeable future. [See Sections A.2 Natural Gas Markets, and A.4 Environmental Context.]

12. How should the OEB incorporate the Ontario Government's recently announced loan and grant programs into the economic feasibility analysis?

It will be up to the Government to determine the timing, criteria and levels of support. Ideally, the Government should provide a clear indication in a timely fashion so that competing entities would be in a position to incorporate specific numbers into their submissions to the

Board for its evaluation and approval. [See Section C.1 Expansion Reserve and C.4 Facilitating Competitiveness.]

Appendix B: Curriculum Vitae

ADONIS YATCHEW

Professor of Economics, University of Toronto
Editor-in-Chief, The Energy Journal
Senior Consultant, Charles River Associates

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Ph.D. Economics 1980
Harvard University

M.A. Economics 1975
University of Toronto

B.A. Mathematics and
Economics 1974
University of Toronto

Adonis Yatchew's research focuses on econometrics, energy and regulatory economics. Since completing his Ph.D. at Harvard University in 1980, he has taught at the University of Toronto. He has also held visiting appointments at Trinity College, Cambridge University and the University of Chicago. He has written a graduate level text on semiparametric regression techniques published by Cambridge University Press. He has served in various editorial capacities at The Energy Journal since 1995. He has advised public and private sector companies on electricity, regulatory and other matters for over 25 years and has provided testimony in numerous regulatory and litigation procedures. While studying mathematics and economics as an undergraduate at the University of Toronto, he completed practical exams for an A.R.C.T. in performance (piano) at the Royal Conservatory of Music. Adonis Yatchew currently teaches undergraduate and graduate courses in energy economics, graduate courses in econometrics and 'Big Ideas' courses on Energy with colleagues in physics and classics.

ACADEMIC EXPERIENCE

Current Position	Professor of Economics, University of Toronto
2008	Visiting academic, Department of Mathematics and Statistics, University of Melbourne
2008	Visiting academic, School of Economics and Finance, Queensland University of Technology
2008	Visitor, National Center for Econometric Research, Queensland University of Technology
2005	Visiting Fellow, ARC Center of Excellence for Mathematics and Statistics of Complex Systems, Mathematical Sciences Institute, Australian National University
2001	Visiting Fellow, School of Mathematical Sciences, Australian National University
1986 to 2004	Associate Professor, Economics, University of Toronto

1989, 1990, 1991	Visiting Research Associate, Harvard University
1986	Visiting Fellow Commoner, Trinity College, Cambridge U.K.
1980 to 1986	Assistant Professor, Economics, University of Toronto
1984	Visiting Research Associate, National Bureau of Economic Research, Cambridge, Massachusetts
1982 to 1984	Visiting Assistant Professor, University of Chicago
1976	Lecturer, University of Toronto, Scarborough College

EDITORIAL AND PROFESSIONAL ACTIVITIES

Current

Editor-in-Chief, The Energy Journal (2006-present) http://www.iaee.org/en/publications/journal.aspx
Member, Board of Editors, Economics of Energy and Environmental Policy
Member, Editorial Board, Foundations and Trends in Econometrics
Member, Council, International Association for Energy Economics
Member, National Center for Econometric Research, Econometrics of Energy and the Environment, Australia

Past

Editor, The Energy Journal, (2006)
Joint Editor, The Energy Journal (1995-2005)
Associate Chair for Graduate Studies, University of Toronto, 2006-2009
Joint Editor 1997, Distributed Generation, special issue of the Energy Journal
Advisory Editor, Economics Letters (1985-1997)
Member, Advisory Board, *Eurasia Foundation*, 1995-2007

AWARDS AND DISTINCTIONS

USAEE Senior Fellow Award, June 2014

SELECTED PRESENTATIONS

June 2015, Milan: "Discerning Trends in Commodity Prices", Invited presentation, Fondazione Eni Enrico Mattei, International Workshop on Recent Evolutions of Oil and Commodity prices.

September 2014, Beijing: Keynote address entitled "The Economics of Energy, Big Ideas for the Non-Economist", Chinese Academy of Sciences, International Association for Energy Economics 4th IAEE Asian Conference.

June 2014, Hong Kong: Invited presentation entitled "Renewable Energy", Hong Kong's Electricity Future: Balancing Reliability, Environment and Cost, Hong Kong Baptist University.

July 2012, Hong Kong: Invited Speaker on "Climate Change and Electricity Generation", Hong Kong Baptist University.

December 2010, Hong Kong: Invited paper on renewable energy, Fourth Asian Energy Conference.

October 2010, Berlin: Invited paper on quantile regression, Workshop on Quantile Regression Methods, Humboldt University.

October 2008, Gold Coast, Queensland: Keynote speaker, Australian Conference of Economists. Title of presentation: "Economics, Econometrics and Regulation".

August 2007, Lisbon: Keynote speaker, Cemapre Conference on Advances in Semiparametric Methods and Applications. Title of presentation: "Data on Derivatives, Nonparametric Regression and the Curse of Dimensionality".

BOOK

Yatchew, A., 2003, Semiparametric Regression for the Applied Econometrician, 213 pages, Themes in Modern Econometrics, Cambridge University Press.

REFEREED PUBLICATIONS

Rivard, B. and A. Yatchew 2016, "Integration of Renewables into the Ontario Electricity System", forthcoming, The Energy Journal.

Dimitropoulos, D. and A. Yatchew 2016, "Discerning Long-Term Trends in Commodity Prices", forthcoming, Macroeconomic Dynamics.

Yatchew, A. 2014: "Energy, Markets and Their Failures", Bulletin of the Chinese Academy of Sciences, vol. 28, no. 4, pp. 304-305.

Yatchew, A. 2014: "Economics of Energy: Big Ideas for the Non-Economist", Energy Research and Social Science, 1(1), 74-82.

Green, R. and A. Yatchew 2012: "Support Schemes for Renewable Energy: An Economic Analysis", Economics of Energy & Environmental Policy, 1, 83-98.

Yatchew, A. and A. Baziliauskas 2011: "Ontario Feed-In Tariff Programs", Energy Policy, 39, 3885-3893.

Hall, Peter and A. Yatchew 2010: "Nonparametric Least Squares in Derivative Families", Journal of Econometrics, 157, 362-374.

Yatchew, A. 2008: "Perspectives on Nonparametric and Semiparametric Modeling", The Energy Journal, Special Issue to Acknowledge the Contribution of G. Campbell Watkins to Energy Economics, 17-30.

Hall, Peter and A. Yatchew 2007: "Nonparametric Estimation When Data on Derivatives are Available", Annals of Statistics, 35:1, 300-323.

McCaig, B. and A. Yatchew 2007: "International Welfare Comparisons and Nonparametric Testing of Multivariate Stochastic Dominance", Journal of Applied Econometrics, 22:5, 951-969.

Ricciuto, L., V. Tarasuk and A. Yatchew 2006: "Socio-demographic Influences on Food Purchasing Among Canadian Households", European Journal of Clinical Nutrition, 60:6, 778-790.

Yatchew, A. and W. Haerdle 2006: "Nonparametric State Price Density Estimation Using Constrained Least Squares and the Bootstrap", Journal of Econometrics, 133:2, 579-599.

Hall, Peter and A. Yatchew, 2005: "Unified Approach to Testing Functional Hypotheses in Semiparametric Contexts", Journal of Econometrics, 127, 225-252.

Yatchew, A.,Y. Sun and C. Deri, 2003: " Efficient Estimation of Semi-parametric Equivalence Scales With Evidence From South Africa", Journal of Business and Economic Statistics, 21, 247-257.

Yatchew, A. and J.A. No, 2001: "Household Gasoline Demand in Canada", Econometrica, 1697-1710.

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Waverman, L. and A. Yatchew (1994), "The Regulation of Electricity in Canada", in International Comparisons of Electricity Regulation, R. Gilbert and E. Kahn, editors, Cambridge University Press, 366-405.

Yatchew, A., 1992, "Nonparametric Regression Tests Based on Least Squares", Econometric Theory, Vol. 8, 435-451.

Yatchew, A., 1988, "Some Tests of Nonparametric Regression Models", in Dynamic Econometric Modelling, Proceedings of the Third International Symposium on Economic Theory, W. Barnett, E. Berndt, H.White (eds.), Cambridge University Press, 121-135.

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Epstein, L., and A. Yatchew, 1985, "Nonparametric Hypothesis Testing Procedures and Application to Demand Analysis", Journal of Econometrics, Vol. 30, 149-169.

Epstein, L., and A. Yatchew, 1985, "The Empirical Determination of Technology and Expectations: A Simplified Procedure:, Journal of Econometrics, Vol. 27, 235-258.

Bird, R., M. Bucovetsky and A. Yatchew, 1985, "Tax Incentives for Film Production: The Canadian Experience", Public Finance Quarterly, Vol. 13, 396-421.

Yatchew, A. 1984, “Generalizing the Composite Commodity Theorem”, Economics Letters, 16, 15-21.

Yatchew, A. 1984, “Applied Welfare Analysis With Discrete Choice Models”, Economics Letters, 18, 13-16.

Yatchew, A., 1981, "Further Evidence on 'Estimation of a Disequilibrium Aggregate Labor Market'", Review of Economics and Statistics, 142-144.

Griliches, Z. and A. Yatchew, 1981, “Sample Selection Bias and Endogeneity in the Estimation of the Wage Equation: An Alternative Specification, Annales de l’Insee, 43, 35-46.

Pesando, J., and Yatchew, A., 1977, "Real vs. Nominal Interest Rates and the Demand for Consumer Durables in Canada", Journal of Money, Credit, and Banking, 28-436.

OTHER PAPERS / STUDIES

Littlechild, S. and A. Yatchew, 2002: "Hydro One Transmission and Distribution: Should They Remain Combined or be Separated", www.chass.utoronto.ca/~yatchew .

Yatchew, A. 2001: "Incentive Regulation of Distributing Utilities Using Yardstick Competition", Electricity Journal, Jan/Feb, 56-60.

Yatchew, A., 1999, "Differencing Methods in Nonparametric Regression: Simple Techniques for the Applied Econometrician", 86 manuscript pages.

Yatchew, A. 1995, "The Distribution of Electricity on Ontario: Restructuring Issues, Costs and Regulation", Ontario Hydro at the Millenium, University of Toronto Press, 327-342,353-354.

Yatchew, A. 1995, "Comments on The Regulation of Trade in Electricity: A Canadian Perspective", Ontario Hydro at the Millenium, University of Toronto Press, 165-7.

CURRENT RESEARCH

Dimitropoulos, D. and A. Yatchew, "Joint Estimation of Production and Cost Models, With an Application to Electricity Distribution", manuscript, May 2015.

Dimitropoulos, D. and A. Yatchew, "Is Productivity Growth in Electricity Distribution Negative? An Empirical Analysis Using Ontario Data", manuscript, May 2015. (Under submission)

RECENT RESEARCH GRANTS

2011-2016 SSHRC grant "Nonparametric regression when data on derivatives are available".

2007-2011 SSHRC grant "Nonparametric and semiparametric estimation when data on derivatives are available".

2004-2007 SSHRC grant "Semiparametric demand modeling and testing".

CURRENT AND RECENT SUPERVISIONS

Ph.D.

Dimitrios Dimitropoulos (2015): Three Essays in Energy Economics and Industrial Organization, Thesis Supervisor.

Adam Found (2014): Essays in Municipal Finance, Thesis Supervisor.

M.A.

Nathan Warkentin (2015-2016): Masters of Science in Sustainability Management. “Integration of Renewable Wind Energy Sources in Ontario”

Sean Lemon (2013): M.Sc.Pl., Planning Program, Geography. “An Evaluation of Ontario’s Global Adjustment Mechanism (GAM).” Thesis Committee.

Undergraduate

Wilbur Li, (2012) Engineering Science. Undergraduate thesis: “Ontario’s Feed-In-Tariff Program. Analysis of PV Solar Feed-In-Tariff Rates”. Thesis Supervisor.

SELECTED PROFESSIONAL EXPERIENCE:

(2015) Coauthored report on integration of renewable generation for the Alberta Market Surveillance Administrator

(2015) Conducted analyses of utility benchmarking for a large electricity distributor as part of a regulatory proceeding.

(2014) Conducted econometrics analyses of spot and forward prices in electricity markets for a major electricity market participant.

(2013) Prepared expert evidence on behalf of the Electricity Distributors Association of the 4th Generation Incentive Regulation Mechanism before the Ontario Energy Board.

(2012) Prepared expert damages testimony in *Oracle America Inc. v. Micron Technology, Inc.*, U.S. District Court, Northern District of California, Oakland Division.

(2011) Coauthored study for the *Alberta Market Surveillance Administrator* on electricity market transparency and bidding.

(2011) Prepared Ontario electricity sector review for the Electricity Distributors Association.

(2011) Appointed sole representative of a major Canadian utility in infrastructure pricing negotiations with an incumbent telecom carrier.

(2011) Prepared testimony on behalf of Toronto Hydro on the pricing of attachment space for wireless facilities on joint-use-poles.

(2010) Prepared testimony on behalf of Noranda Aluminum, Inc. Filed before the *Public Service Commission of the State of Missouri*.

(2009) Prepared study for major generating company on sufficient competition tests for boundary entities in the Ontario electricity market.

(2009) Prepared testimony on worldwide paraxylene markets *Interquisa Canada L.P. and Parachem Chemicals L.P.*, International Court of Arbitration of the International Chamber of Commerce.

(2008) Prepared analysis of incentive regulation of capital and operating costs and productivity growth for electricity distributors. Filed before the *Ontario Energy Board*.

(2007) Prepared analysis of distributor benchmarking of capital and operating costs on behalf of the Electricity Distributors Association. Filed before the *Ontario Energy Board*.

(2007) Prepared evidence on market power in electricity markets.

(2005-2007) Prepared analyses of pricing of investor communications services.

(2007) Prepared testimony on behalf of the Electricity Distributors Association on utility benchmarking of capital and operating costs. Filed before the *Ontario Energy Board*.

(2004-2007) Prepared various analyses in a class action and settlement proceeding involving billing of natural gas. Participated in settlement proceedings.

(2004, 2005, 2006) Prepared odds of winning prizes in promotions by a leading U.S.-based international fast-food chain.

(2006) Prepared testimony on incentive regulation. Filed before the *Ontario Energy Board*.

(2006) Prepared testimony on cost-sharing of capital and operating costs of joint-use power poles. Filed before the *New Brunswick Board of Commissioners of Public Utilities.*

(2005) Prepared testimony on cost-sharing of power poles by cable companies on behalf of Thunder Bay Hydro.

(2004) Prepared testimony on cost-sharing of capital costs of power poles by cable companies. Filed before the *Ontario Energy Board*.

(2003) Prepared testimony on behalf of large Ontario electricity distributors on distributor service area amendments. Filed before the *Ontario Energy Board*.

(2003) Prepared testimony on behalf of J.D. Irving Ltd. on rates of return, performance based regulation and benchmarking. Filed before the *New Brunswick Board of Commissioners of Public Utilities*.