August 27, 2007

BY EMAIL & BY COURIER

Ms. Kirsten Walli
Board Secretary
Ontario Energy Board
2300 Yonge St, Suite 2701
Toronto ON M4P 1E4

Dear Ms. Walli:

Board File No. EB-2007-0630
Distributed Generation: Rates and Connection
Submission of Energy Probe

Attached please find three hard copies of the Submission of Energy Probe Research Foundation (Energy Probe) in respect of the Board's consultation on Distributed Generation: Rates and Connection. An electronic copy of this communication in PDF format is being forwarded to your attention.

Should you have any questions or require additional information, please do not hesitate to contact me.

Yours truly,

David S. MacIntosh
Case Manager

cc.   Tom Adams, Energy Probe Research Foundation, (By email)

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EB-2007-0630

Ontario Energy Board

Distribution Generation:

Rates and Connection

SUBMISSIONS OF
ENERGY PROBE RESEARCH FOUNDATION
(“ENERGY PROBE”)

August 27, 2007

Distribution Generation: Rates and Connection

EB-2007-0630

Energy Probe Research Foundation Submission

Background

On July 13, 2007, the Ontario Energy Board announced that the issues of rates and connection in relation to distributed generation would be the focus of a consultation process, with the expectation that comments from interested parties would assist in the development of a rates and connection policy framework.

As part of the announcement the Board released a report by EES Consulting (EESC), retained to conduct a review of distributed generation in selected jurisdictions around the world and make recommendations on rate design and other issues related to distributed generation. In addition, the Board released a Staff Discussion Paper on rates and connection in relation to distributed generation.

The report prepared by EESC, entitled *Discussion Paper on Distributed Generation (DG) and Rate Treatment of DG* (the EESC Paper) and the Staff Discussion Paper have been released for comment by interested parties.

Comments of Energy Probe

Overview

The Ontario Energy Board is developing policies with respect to standby rates for customers with load displacement generation, rate classification, and the recovery through distribution rates or charges of connection costs for distributed generation in Ontario.

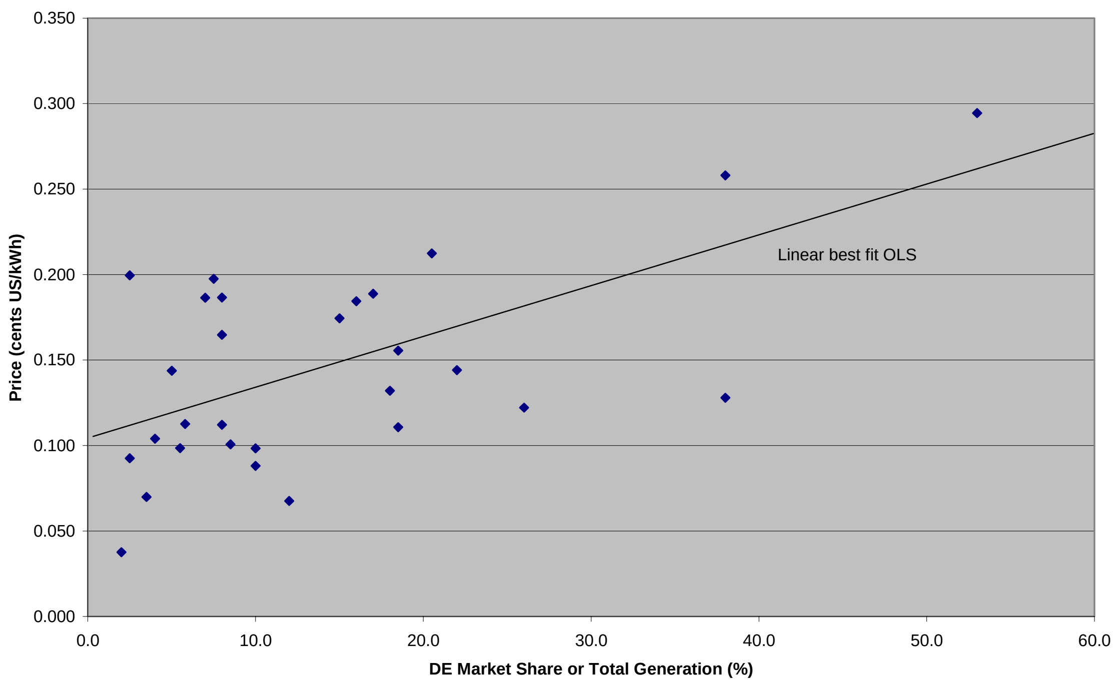
Energy Probe Research Foundation (Energy Probe) believes that all policy-related barriers to economically efficient distributed generation should be eliminated. In resolving any policy-related barriers to economically efficient distributed generation, Energy Probe is concerned that distributed energy be developed in a fashion that maximizes benefits consumers, even if that benefit is merely to reduce the extent to which rates would otherwise rise.

Many arguments alleging policy barriers to distributed generation rely on allocating sunk cost. Debate around net metering, stranded cost recovery, and standby charges often focus on allocating sunk cost. As important as the recovery of historic cost is, Energy Probe urges the Board to concentrate on minimizing incremental cost in its design of measures to promote economic distributed generation.

The track record of the international distributed generation development experience suggests that care is required in implementing distributed generation to meet consumer energy needs.

Energy Probe has analyzed the statistical relationship between the contribution of distributed energy and power prices paid by residential consumers. The relationship is presented in the following graph:

Graph #1: Distributed Energy vs. Residential Power Price



The methodology for this analysis is to compare the most recent power price reported by the US Energy Information Administration with the decentralized energy ratio reported by the World Association of Distributed Energy. A total of 29 countries were identified as being reported in both sets of analysis. No instances were deleted where both price and distributed energy share were available. The R Square statistic for the linear regression is 34%. The data set, more detailed references, and Energy Probe's analysis is presented in Appendix A.

In interpreting Graph #1, it is important to consider that price is also correlated with energy taxation, which is not addressed in this analysis.

The demonstrated tendency identified in Energy Probe's international analysis whereby higher distributed generation accompanies higher power rates suggests that the international experience may be of limited utility in developing methods to encourage economic distributed generation beneficial to consumers in Ontario.

Principles

The Board Staff Discussion Paper contains several important points applicable to the appropriate principles to apply in developing policies to promote economically efficient distribution energy development. Energy Probe draws particular attention to the statement of the Board in its March 21, 2006 Decision with Reasons in the Generic 2006 EDR Proceeding, "The Board believes that efficient localized generation including load displacement generation can and will provide benefits to the provincial electricity system and to ratepayers."

Energy Probe wishes to draw attention to two principles we believe are also applicable.

First, the onus for demonstrating overall consumer benefits should rest with those proposing energy developments. This is the Board's tried and true practice with respect to leave-to-construct applications, and the same principle appears applicable to resolving policy matters which allegedly represent barriers to otherwise economic distributed generation.

Second, Energy Probe suggestions that general regulatory principles, well accepted by the Board, of unbundling and cost internalization have application to the development of policies to promote economic distributed generation. To the extent possible, costs to the power system caused by a particular generator (or load) should be paid for by that generator (or load). Any benefits that a particular generator provides to the power system should be paid for by the customers most directly

enjoying the gain. Our submission addresses in greater detail how these principles should be applied.

Revenue Loss Due to Load Displacement Generation

Energy Probe believes that the questions of revenue loss due to distributed generation must be considered in the context of the ongoing secular and beneficial trend of declining usage.

Overall electricity sales in Ontario in 2006 were lower than any time since 2001.

Ontario Electricity Sales

Year	Total (TWh)	Increase Over Previous Year
2006	151	-3.8%
2005	157	2.3%
2004	153	1.1%
2003	152	-0.7%
2002	153	4.1%
2001	147	0%
2000	147	2.1%
1999	144	2.9%
1998	140	1.4%
1997	138	

Particular when considering Ontario's modest but steady economic advancement in recent years, it is clear that conservation is making important progress.

With exception to some limited number of suburban jurisdictions, distribution utilities in Ontario are experiencing static or declining loads. Where load is rising, utilities would potentially be facing incremental capacity cost. Where distributed generation can reliably be operated in a way that mitigates the requirement to

expand the local distribution system, the distributed generator should be fully compensated for the cost savings associate with this benefit. The Safety Power concept developed by the Ontario Electrical Safety Authority appears to offer substantial benefits in this regard.

However, in cases where load is static or declining, the likely economic impact of a Distribute Generation unit on a Local Electricity Distribution Company (LDC), even if operated in a way that reliably mitigates LDC costs, would in many cases be limited to line loss mitigation.

Distributed Generation Cost Recovery

Generator interests claiming that generation options represent an opportunity to mitigate transmission or distribution maintenance requirements should bear the onus to demonstrate the basis of any such claim.

As discussed above, Energy Probe believes that if benefits result from the output of a particular generator, those benefits should be paid for by the customers most directly enjoying the gain. Any reductions in distribution costs attributable to a DG operation should be paid by the distribution utility. However, system-wide benefits attributable to DG should be compensated by all consumers, not only customers of the local LDC.

The Board Staff paper recognizes that distributed generators should be compensated for benefits they provide to the power system, however, the Staff paper does not discuss from whom recovery of these costs should be made. Energy Probe recommends that benefits enjoyed by the local distributor should be paid by the distribution customer. These benefits might include distribution line loss reductions or capital project deferral. Similarly, Energy Probe recommends that benefits to the transmission system should be paid by transmission customers. Benefits to the overall system might include overall generation security or adequacy and should be paid through energy charges on all customers.

Local distribution utilities should not be required to recover from their customers, costs associated by benefits that flow to customers beyond the LDC.

Distribution-Connected Merchant Generation

The existing rules reflected in the Distribution System Code provide that a distributed generator is responsible for paying the direct costs of connecting their facilities to the distribution network, and the costs, if any, associated with system reinforcement beyond the connection point. Energy Probe strongly supports this rule but suggests that the scope of reinforcement beyond the connection point needs to be fully considered before the intent of the rule can be properly applied.

Energy Probe understands that in excess of 80% of the distribution connected merchant generation coming onto Ontario's power system are wind generators under standard offer contracts from Ontario Power Authority. These generators are almost all expected to be connected to Hydro One's distribution system.

Energy Probe recommends that the special nature of wind generation be examined as a potential driver of overall distribution cost.

The Ontario government has committed to facilitating the development of renewable energy opportunities within the province and has set targets to increase renewable energy production by 2700 MW by 2010, sufficient to supply approximate 10% of Ontario's forecasted needs. Further, Ontario government has decided that Ontario is to have 15700 MW of installed renewable energy capacity by 2025, up from 7855 MW in 2005 most of which is historic hydro-electric. By far the largest incremental source to meet these mandates is anticipated to be wind power.

Ontario currently has 395 MW of wind power capacity in large farms. All the commercial wind farms in Ontario with capacity over 20 MW are transmission

connected, even though they may use dedicated 44kV or 27.6kV feeds to connect to the Hydro One grid. In general, these connections are not routed directly through any local distribution system, as the output is too large for a distribution system to accept this load.

Energy Probe is advised that core design differences between transmission and distribution systems in Ontario have important implications for distribution connection policies and procedures. Ontario's network transmission systems are designed so that power can move every which way, both being injected by generators and consumed by loads. Distribution systems are designed to operate in a waterfall fashion, with the power going in one direction. Protection systems and voltage control are not designed to handle substantial injections of power except from the transmission grid. Without implementing significant design changes, distribution utilities will need to identify specific constraints on how much generation any particular feeder can handle, likely expressed as a percentage of the minimum feeder loading. Even generation capacity connected to 44kV systems or 27.6kV sub-transmission systems, may need to be constrained, although lower voltage systems will present more restrictive constraints.

Energy Probe's analysis of wind power, discussed below, indicates that it is a technology prone to highly volatile generation. Significant incremental wind capacity could cause a distribution feeder to experience unacceptable supply voltage changes or compromise over-current protection.

Hydro One technical experts have expressed related concerns at the Independent Electricity System Operator's (IESO's) Wind Power Integration Working Group. Ontario Energy Board staff do not regularly attend meetings of the IESO's Wind Power Integration Working Group. The minutes of the group can be found at <http://www.ieso.ca/imoweb/consult/consult_se29.asp>.

While Ontario has only three main transmission system voltages, Ontario has many,

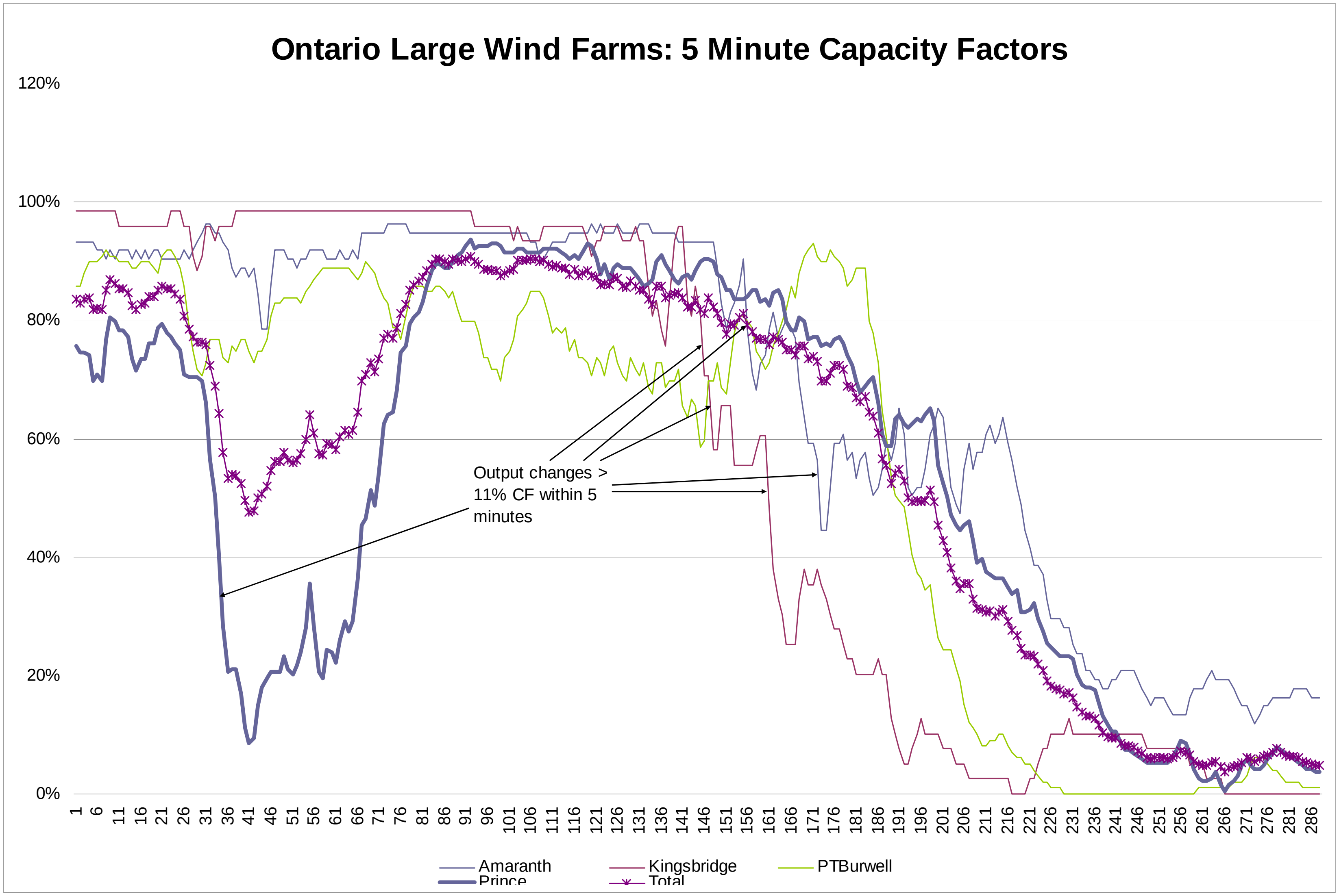
many different distribution system configurations. This means that beyond a few high level generalizations, virtually every significant generation resource connected to the distribution system will require a custom engineered solution.

Wind Power Analysis

To better understand wind power's implications for Ontario consumers, Energy Probe is analyzing 17 months of hourly production data from Ontario's large wind farms. The data we are examining reflect the outputs of all large farms since they were declared in service and is provided by the IESO. The basic unit of analysis is Capacity Factor (CF), the ratio of actual power produced vs. theoretically perfect production. In the context of a wider analysis but of specific relevance to distributed generation rates and connection, we have considered performance variability.

In one aspect of our study of variability, the 17 month data set was screened to select the days that offer pronounced examples of prominent patterns in the overall production experience. One issue of interest was days with high absolute variability as measured by the one hour CF change. We then obtained 5 minute wind production data.

On the following page is a graphic showing the five minute data from March 22, 2007.


Ontario Large Wind Farms: 5 Minute Capacity Factors
120%
100%
80%
60%
40%
20%
0%
Output changes > 11% CF within 5 minutes
1 6 11 16 21 26 31 36 41 46 51 56 61 66 71 76 81 86 91 96 101 106 111 116 121 126 131 136 141 146 151 156 161 166 171 176 181 186 191 196 201 206 211 216 221 226 231 236 241 246 251 256 261 266 271 276 281 286
Amaranth
Kingsbridge
PTBurwell
Prince
Total

The graphic indicates clearly that individual farms show much more variability of output than the fleet total.

The smallest wind farm in our sample is 40 MW. The sizes of wind farms connected to a distribution feeder would be smaller and therefore more volatile than the farms Energy Probe has analyzed.

Individual distributed generators might be able to reduce wires capacity requirements if they are able to reliably supply at peak times. Energy Probe's analysis suggests that the contribution of wind generators to mitigate wires systems peak requirements is likely to be negligible.

Ontario's wind farms demonstrate some diversity benefits to the overall power system attributable to the prevailing isobar distance between wind farms. The output of proximate wind farms is highly correlated. For example, the output correlation coefficient between Kingsbridge and Amaranth in the 5 minute graph above is 91%. The distance between farms necessary to realize diversity benefits is so great as to make diversity benefits effectively unavailable for wires planning purposes. Rather the opposite is more likely true, that being that diversity benefits from a growing wind capacity in Ontario can only be achieved with wires capability more advanced than is in-service today.

The reliability of wind power's contribution on peak is influenced by a variety of factors including diurnal production patterns, winter temperature production patterns, and summer seasonal patterns.

The diurnal correlation coefficient between average wind output and average load in Energy Probe's data set is -23% for the full 24 daily time period. This is an unfavourable correlation (wind output tending to be high when load is low) but the correlation is in fact substantially worse in some key periods. Wind power's average output peaks from 2-6pm and from 8pm-2am. It hits the lowest from 7am-11am.

Ontario demand peaks and remains relatively stable from 8am-10pm. It hits lowest from 1am-5am. From 5am-9am and 8pm-12am there is a strong negative correlation between wind output and Ontario demand. The rest of the time there is a weak positive correlation. Overall, on a daily basis average wind output has a medium strength negative correlation with ON demand (i.e. extra ramping requirement for other generation).

Although winter is the best season for wind power production, the wind output tends to do best on warmer winter days. During the winter season from December 2006 through March 2007 the temperature vs. production correlation coefficient of daily average total wind output and average daily temperature measured at Pearson Airport was +16%. The implication here is that on the warmer days when load tends to be lower, wind output tends to be stronger whereas on the colder days when load tends to be higher wind output tends to weaker.

A substantial literature from across Canada and across Western Europe suggests that summer in the Northern Hemisphere is generally a period of low wind speed. Ontario is no different. During the July and August of 2006, weekly average capacity factors for Ontario's total large wind fleet were often below 15%. The probability of wind power being able to make any meaningful and reliable contribution to summer peak demands with such a poor overall average output seems very low indeed.

In Closing

Production variability on local feeders should be considered in detail as a potentially significant issue. Energy Probe's analysis of data on wind production variability, supports Hydro One's concerns expressed at the IESO Wind Power Integration Working Group that distribution impacts be carefully considered and addressed. Consistent with the Board's intentions as expressed in the Distribution System Code, if any re-engineering of distribution system driven by distributed generators to increase distribution capacity and/or to convert them from one-way to two-way systems should be borne by generators, not customers.

Respectfully submitted at Toronto, Ontario this 27th day of August, 2007.

Tom Adams

Executive Director
Energy Probe Research Foundation

Appendix - Distributed Energy vs Price

Country	Residential Power Price in $US/kWh (1)			Most Recent Price	DE share of total generation (2)
	2004	**2005**	**2006**		
Argentina	0.038	NA	NA	0.038	2.0
Australia	0.099	NA	NA	0.099	5.5
Austria	0.177	0.174	0.174	0.174	15.0
Brazil	0.093	NA	NA	0.093	2.5
Canada	0.068	NA	NA	0.068	12.0
Chile	0.088	NA	NA	0.088	10.0
Czech Republic	0.097	0.106	0.122	0.122	26.0
Denmark	0.283	0.295	NA	0.295	53.0
Finland	0.123	0.121	0.128	0.128	38.0
France	0.142	0.142	0.144	0.144	5.0
Germany	0.198	0.212	NA	0.212	20.5
Greece	0.107	0.112	NA	0.112	8.0
Hungary	0.134	0.146	0.144	0.144	22.0
Ireland	0.173	0.199	0.200	0.200	2.5
Italy	0.191	0.198	NA	0.198	7.5
Japan	0.196	0.189	NA	0.189	17.0
Korea, South	0.079	0.089	0.098	0.098	10.0
Luxembourg	0.147	0.187	NA	0.187	8.0
Mexico	0.090	0.097	0.101	0.101	8.5
Netherlands	0.221	0.236	0.258	0.258	38.0
Poland	0.103	0.121	0.132	0.132	18.0
Portugal	0.175	0.180	0.184	0.184	16.0
Slovak Republic (Slovakia)	0.134	0.141	0.156	0.156	18.5
Spain	0.152	0.154	0.165	0.165	8.0
Thailand	0.070	NA	NA	0.070	3.5
Turkey	0.111	0.118	0.111	0.111	18.5
United Kingdom	0.138	0.149	0.186	0.186	7.0
United States [3]	0.090	0.095	0.104	0.104	4.0
Uruguay	0.113	NA	NA	0.113	5.8

Notes
1. Source: http://www.eia.doe.gov/emeu/international/elecprih.html
2. Source: http://www.localpower.org/deb_where.html (read from graph)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.58387
R Square	0.340904
Adjusted R Square	0.316493
Standard Error	0.048162
Observations	29

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.032394	0.032394	13.96520529	0.000883688
Residual	27	0.062629	0.00232		
Total	28	0.095022			

	Coefficients	*tandard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Ipper 95.0%*
Intercept	0.103866	0.013903	7.470729	4.89895E-08	0.075339119	0.132392	0.075339	0.132392
X Variable 1	0.002812	0.000752	3.737005	0.000883688	0.001267864	0.004355	0.001268	0.004355