

Initial Comments to
Ontario Society of Professional Engineers

provided via

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Regarding
“Draft for Comment”

“Wind and the Electrical Grid”

Dated December 13, 2011

Comments by

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Background:

On December 13, 2011, the Ontario Society of Professional Engineers issued a “Draft for Comment” titled, “Wind and the Electrical Grid.” It was sent to OSPE Members, and posted on the OSPE Website on December 19, 2011, inviting comment by January 13, 2012. This document provides initial comments on that draft, and invites members of the report drafting group to contact me for further clarification. The comments provided here cannot be a final comprehensive review simply because the draft as presented has a significant number of issues of concern, and other issues faced over the Christmas season have prevented allocating time to rebut all of the points of concern. Hence, the comments provided will be at a fairly high level, identifying areas of concern, rather than commenting on specific page and paragraph, as comments would normally be provided.

To provide a brief resume of my interest and background related to provision of comments on the OSPE Draft, I provide a brief paragraph of related experience:

William Palmer is Ontario Licensed Professional Engineer. He has applied his professional experience in the energy industry (Noranda Mines and over 30 years in the operations of Ontario nuclear reactors), as well as education in engineering and risk assessment to a study of the safety of wind turbines. He has published a number of papers dealing with the subject of wind turbine noise, has presented to international conferences, and has been a witness before tribunals, regulators, and legislators regarding wind turbines in Ontario. He has professional concern with the approach taken and regulations used to site wind turbines in Ontario. He has made submissions regarding the economics of electricity generation choices and the impact on the Ontario Electrical System to the Ontario Power Authority, the Ontario Ministry of Energy, and the Ontario Energy Board.

Significant Issues of Concern with the Draft:

Engineers in Ontario are bound by a code of ethics that demands making “reasonable provision for the safeguarding of life, health or property of a person who may be affected by the work for which the practitioner is responsible” and yet the work of the report as drafted fails to recognize that the inappropriate placement of wind turbines has not only an impact on the electrical grid, but also on human health and safety.

The cover photo chosen for the report, for which credit is given to the industry wind turbine advocacy group, might well be replaced by one which shows any of a number of Ontario homes from which citizens have been forced to walk away due to wind turbines nearby. To have the OSPE casually dismiss the concern by the line, “*There is strong public support for solar and wind (with the notable exception of industrial wind farms in rural areas and near residences)*” is inadequate to “recognize the concern for safeguarding of life, health, or property of a person who may be affected by the work for which the practitioner is responsible.” The “strong public support” is not present in many areas where the wind power developments are being erected, in many cases with direct

opposition by elected municipal councils or the elected MPP. The Ministry of the Environment have not dealt with identified concerns, and permitted installations in direct violation of their own guidelines. The Chief Medical Officer of Health failed to address identified errors in the report issued by that office, and failed to even interview citizens reporting concerns. It is an extremely troubling situation, professionally, socially, and morally. The OSPE draft report trivializes an important justice issue.

The OSPE report sidesteps addressing the issuance of “Ministerial Directives” as the major planning input for the Ontario Electricity system. Professional submissions made to the Ontario Power Authority were not dispositioned other than in oral responses that the OPA are bound to comply with Ministerial Directives, and the Professional Engineers in the OPA or IESO were unwilling to identify errors in the Ministerial Directives. From the old story, someone needs to tell the emperor that he is not wearing any clothes! The OSPE report needs to be honest, and complete. It is not.

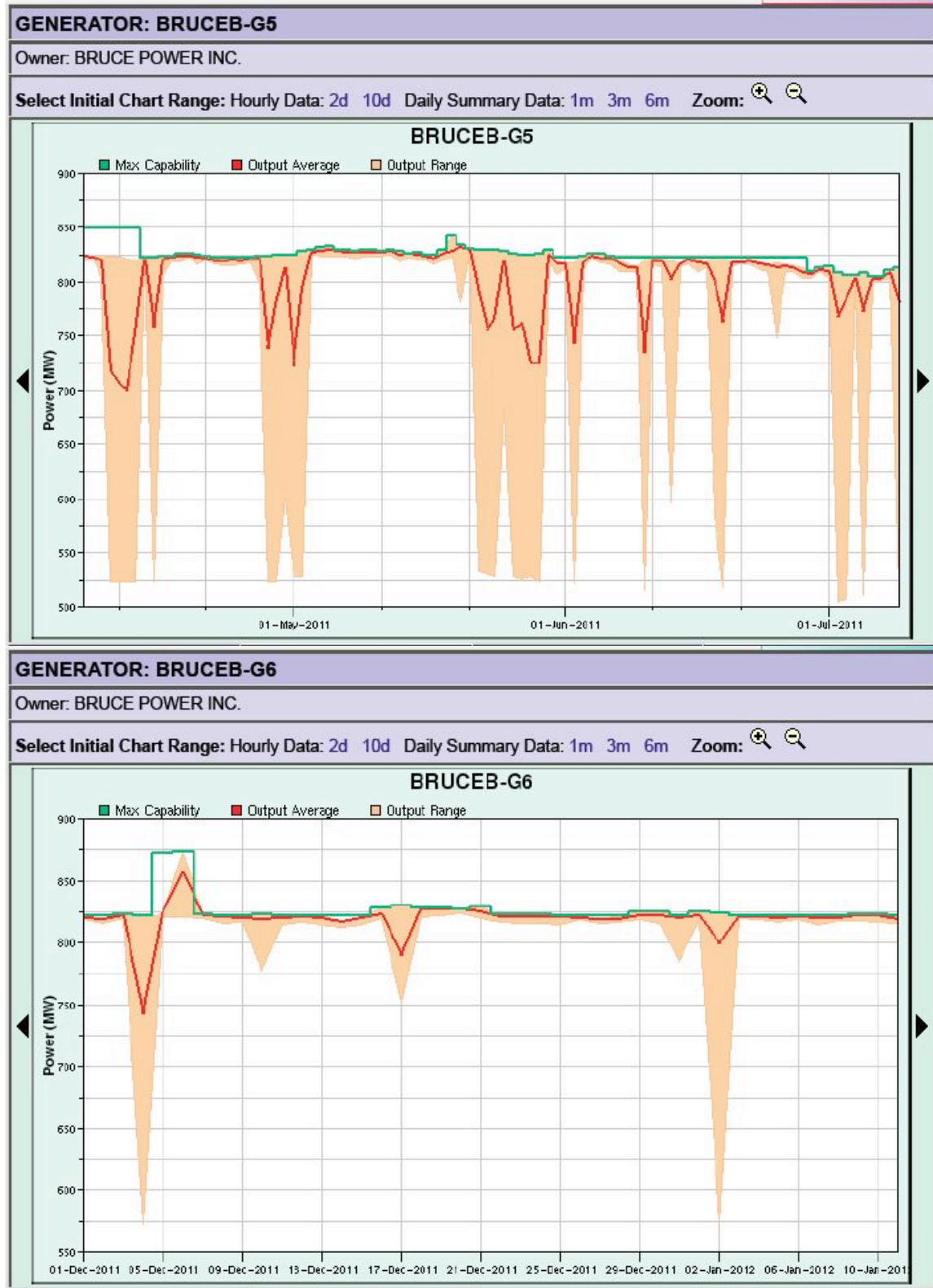
As an example, the IESO publicly issued calendar for 2012 identifies proudly on the “April 2012” page, *“In addition to Ontario’s hydroelectric power, Ontario forecasts 10,700 MW of renewable energy from wind, solar, and bioenergy by 2018. ... The IESO is integrating these new generation facilities into the electricity system, ensuring the reliable and efficient operation of a more sustainable supply mix.”* The OSPE report needs to be forceful in stating that it is not technically feasible to integrate this level of intermittent and non-dispatchable generation into the Ontario grid within 6 years while still maintaining *“reliable and efficient operation.”*

Consider the reality of the Ontario grid. As the OSPE report does identify, the typical Ontario demand is 12,000 MW minimum to 16,000 to 24,000 MW maximum (excepting odd days such as holiday weekends and extreme heat waves.) In round numbers, the Ontario supply includes:

- 10,500 MW nuclear, increasing to about 12,000 in 2012
- 7,000 MW hydro, of which about 2,000 MW is continuously operating run of river with little storage, and 5,000 MW can be varied with some storage capability
- 7,000 MW of Natural Gas, headed to about 10,000 MW, of which at least 1,000 MW is base load generation as combined with another user, such as a commercial heat load, or a compressor station. Additionally, as the OSPE report identifies, much of the additional gas load is combined cycle plants, which need to run above about 50% output to be able to vary their load. They are not nearly as variable as believed to be, as the OSPE report suggests.
- Coal – which was ~ 6600 MW, but is being reduced to 0 due to the refurbishment of nuclear generators and the provision of natural gas generators – which can be reduced to 0 MW.
- Wind – headed to about 8,000 MW, and which is poor during peak, and best during off peak, but is often below 5% output for the entire province for periods of up to 36 hours at a time.

What this means is that potentially the baseload generation available at night might be 12,000 MW nuclear + 2000 MW Hydro + 1,000 MW Natural Gas + 8,000 MW wind =

23,000 MW – potentially 9,000 MW of excess. As the OSPE report identifies, there is some maneuverability of the Bruce B reactors, where the backing off output from 800 MW to 550 MW occurs with considerable regularity. See the curves below.

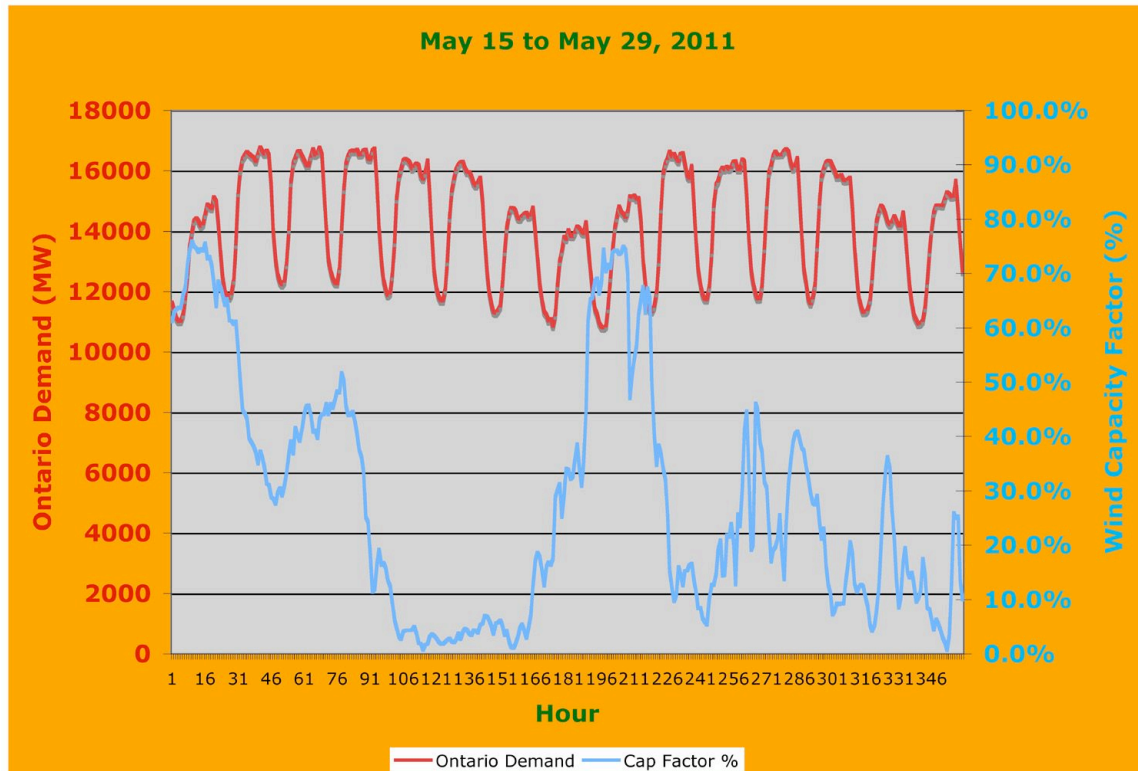


Additionally, the OSPE report identifies that *“In the near future (likely by the spring of 2013) the shutdown of some of these base load generating facilities will be necessary to maintain electrical grid stability ...”* The OSPE draft is well behind time – the shutdown of Bruce Nuclear units has occurred already in the summer of 2010 and 2011 due to underutilized base load generation, at times when the wind generators were barely over 1000 MW.

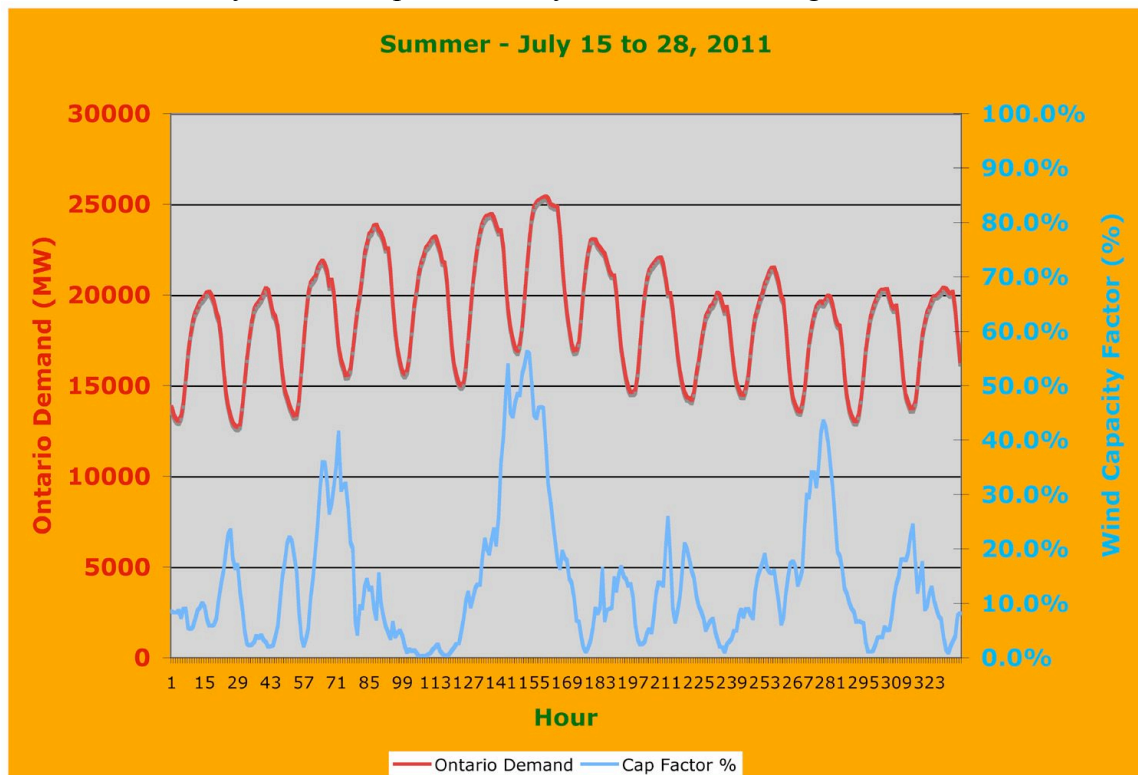
Additionally, as a Professional Engineer who has operating experience as an authorized nuclear shift supervisor at Bruce nuclear units, and who was partly responsible for preparation of the risk assessment for the restart of Bruce nuclear units I am prepared to state that operation of nuclear units on condenser steam discharge mode on a repetitive basis as has been forced already (see the curves on the previous page) is one heck (mildly put) of a way to operate a unit designed for base load operation. Yes, the plant design permits operation in “poison prevent” mode dumping steam, but as one who has stood beside the discharge valves as they strained against their anchors dumping hundreds of kilograms of steam at 4000 kPa (250 degrees celsius) into the condenser this inspires great respect with the energy. To do this day after day because of a Ministerial Directive that encourages buying wind power at 135 \$ a MWh (plus a \$10 federal Eco Action grant) while nuclear power is dumped at \$45 a MWh, and we often then have to pay up to \$120 a MWh to dump the power to our neighbours is not good nor conservative engineering. As a result, the consumer pays $135 + 10 + 45 + 120$ for every MW, and the nuclear plant incurs unnecessary risk – all because no one has the courage to tell the Minister that the Directive that drives the operation is bad. For the OSPE report to casually suggest such ongoing operation is ethically unacceptable.

The OSPE report sidesteps around the concern that integration of wind generation into the grid really is not ideal as wind does not match the system load profile. However, what is needed in the OSPE report is not sidestepping this issue but putting it clearly on the table. This is not a unique situation in Ontario, it occurs routinely elsewhere in the world wherever wind energy is “integrated” into the electrical system.

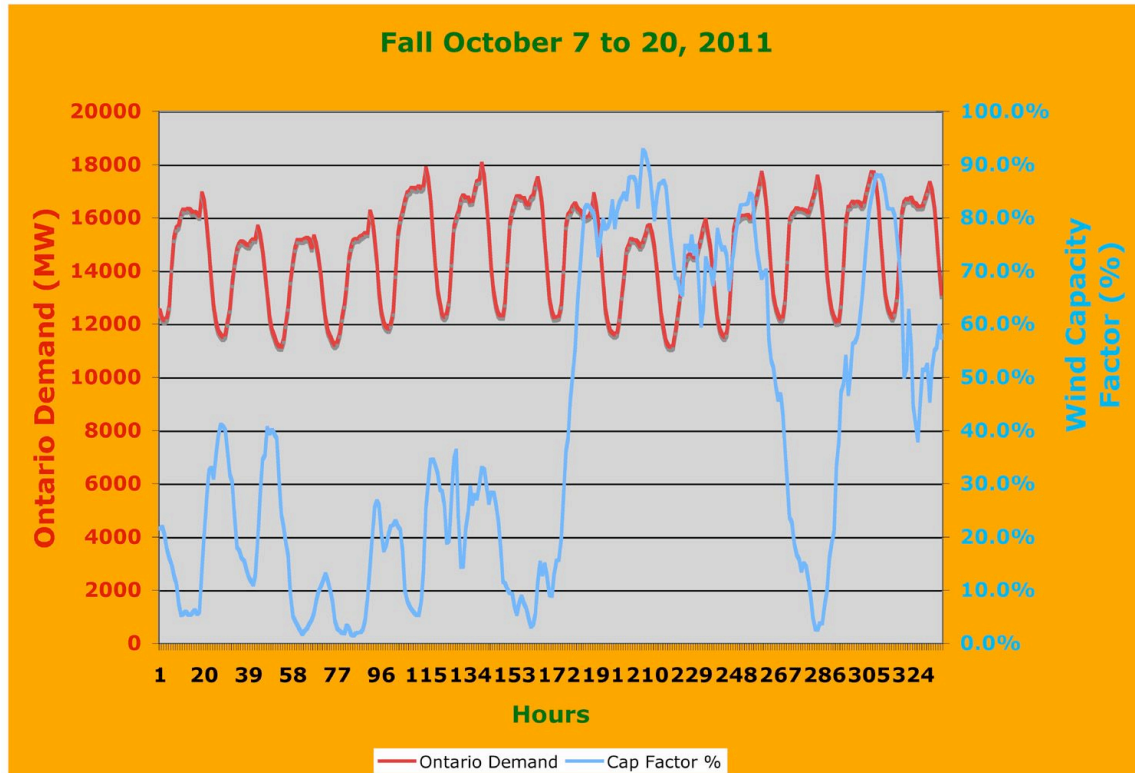
The next three pages identify typical two week periods from Ontario from 2011, in the spring, summer, fall, and winter plus a similar situation in Texas which make it clear that wind not only does not match the system demand, but only a small bit of imagination shows that if Ontario had the 8000 MW of wind that the IESO was “Directed” to achieve in 6 years by 2018, then system operation will be unnecessarily difficult. Wind might be 7500 MW at night, which along with 2000 MW of hydro and 1000 MW of gas that stay on line, would be able to carry nearly the entire system – leaving no room for nuclear at all, requiring nuclear unit shutdown, not simply a back off of 300 MW per unit. Then when the wind falls to perhaps 500 MW just as the system load increases from 12,000 MW at night to 16,000 or 18,000 MW in the daytime, the system operator will need to find perhaps 15,000 MW of generation within hours ... from an available pool of perhaps 8,000 MW more Gas, plus 5,000 MW more hydro, plus ... well perhaps coal.



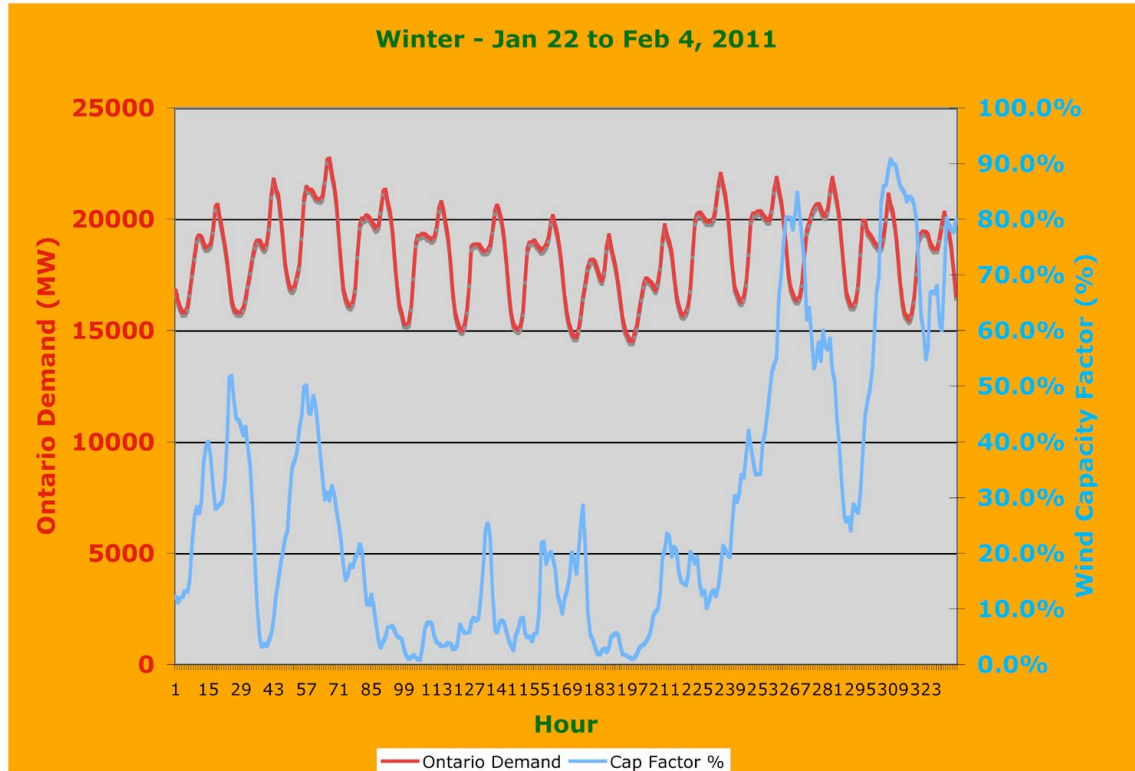
Spring 2011 - days with wind of nothing, followed by a wind peak to 80% as system load is low, followed by a wind drop to low as system load rises. A good match?



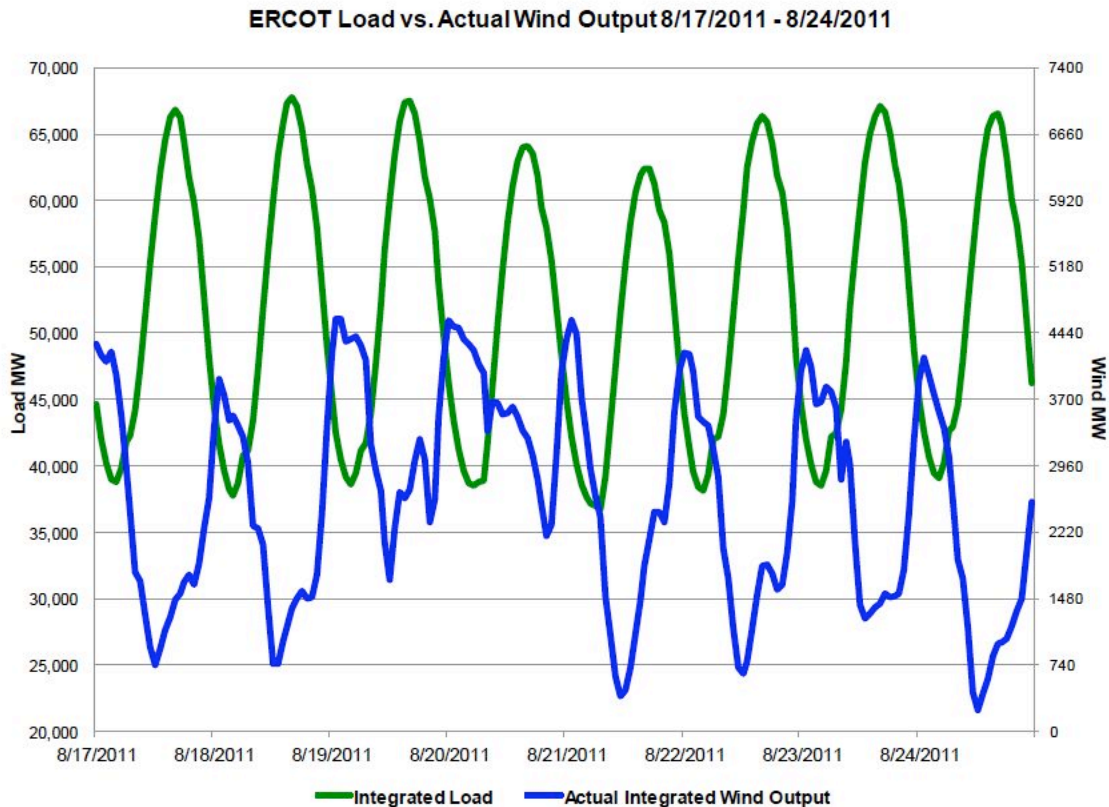
Summer 2011 – days of low wind, followed by short duration wind peak in mid week as system load drops, followed by wind drop to zero as system peaks for the 2 week period.



Fall 2011 – low wind output, followed by several days of high wind output, then drop to zero before recovering. Good match?



Winter 2011 – even when the days are cold, do not count on wind.



This is a comparable figure from the ERCOT (Texas grid operator) for a week in 2011. Note the almost perfect **mismatch** – every day, wind peaks at night when system demand is low, and then wind falls to near zero as the system peaks in the daytime. Good Match?

Similar data is available from Denmark, Germany, and Great Britain. Yet, the IESO and OPA are blindly following a Ministerial Directive to increase wind and other renewables to 10,700 MW by 2018. Are Engineers who have studied reality not obliged to point out the mismatch?

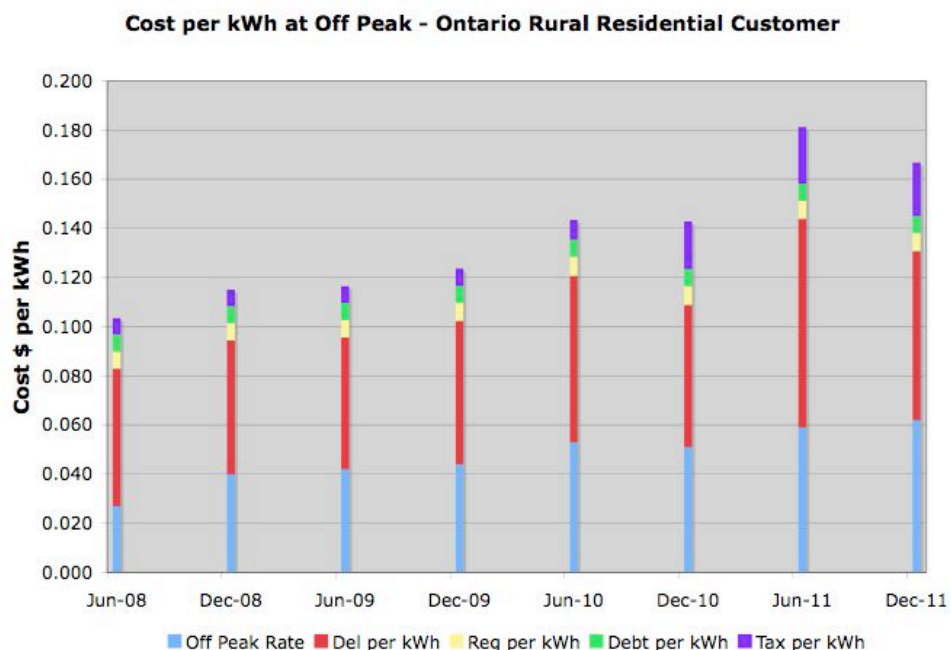
Another aspect that is not properly discussed in the OSPE report is the economic consequences of the decision to integrate wind into the grid. The OSPE report skates around the subject with statements such as:

- Wind generation is intermittent and can't be shutdown too frequently or it becomes uneconomic. *(So it is uneconomic – call a spade a spade.)*
- To provide more room for wind generation there is a need to either phase out low cost non-maneuverable nuclear ... *(and the impact of phasing out low cost generation to replace it with high cost generation, that will by doing so emit more green house gases due to the backup up with gas, or coal, or burning wood?)*
- or you need to make nuclear electric output maneuverable and have nuclear generation provide the backup. *(redesigning the existing nuclear fleet within 6 years is unrealistic – and why, so we can still pay it to back off and pay wind, when it is available? For goodness sakes, why not just run the lower cost non-green house emitting nuclear, if you are going to build it anyhow, and have it?)*

The OSPE report talks around the subject of storage, as if it were a simple possibility. Perhaps a more responsible approach would be to recognize that while storage is possible, it will be VERY expensive. Jan Carr PhD P. Eng., former Chair of the OPA put it quite clearly in a CBC interview on Fifth Estate a few year back – Quoting Dr. Carr from the Fifth Estate Transcript of Nov. 12, 2008. “... *when you need electricity the wind’s not necessarily blowing and so on. So there’s two issues here. There’s the fact that it’s not continuous and the fact it’s not available on command. Now, electricity is ... is ... is a product. It’s a manmade product, it doesn’t occur in nature. And it is a product which ... which is very, very expensive to store. Virtually impossible to store. In large quantities – very expensive to store. Which means that the most economic way of having an electricity system is to make it on demand which therefore puts a premium on peak demand.*”

The OSPE report does no justice to public accountability to discuss storage casually, in the section on “A.4.2” where storage options are discussed such as “charging electric plug-in vehicle batteries.” We may have all seen the Ontario Government advertisements on television for the use of plug in cars to store wind energy at night. A tiny bit of research, showed just to see how many currently available electric cars would be needed to store the excess energy from an 8000 MW wind generation component if it was not required at night. Looking up the storage capability of the currently available electric car, the Toyota Prius, it was interesting to quickly and roughly determine that some 24 million Toyota Prius batteries would be needed – all batteries fully depleted when plugged in, in a province with a population of about 12 million people. Could there be a tiny flaw in the argument? The OSPE needs to at least do the rudimentary calculations to see if what the report offers as alternatives are actually feasible, and what the economic cost would be. Even if we look at larger battery pack capabilities, do we really think that it would be economically responsible to suggest replacing the entire Ontario vehicle fleet in 6 years to be ready for 2018? And who pays?

The “and who pays” question is another one that needs attention. Page 11 states, “*Wind generation is environmentally friendly ... and has very low operating costs.*” The OSPE report does not discuss the environmental impacts on the locations where people live near the turbines, nor the fact that non-dispatchable wind is paid a premium price even if the operating costs are low. The consumer is paying, while the developers gain. The curve below shows the increase in the electricity cost for an Ontario consumer over three years from 2008 to 2011. The off peak rate has nearly trebled, and the distribution charge is up over 50% in the same period. There has been an 80% increase in the cost per kWh. This is before we put in service major new transmission corridors that have been required for the transmission of wind generation. Those costs will hit the bills once the transmission corridors are in service. The OSPE should be taking advantage of this report to identify that the projected electricity price increase predicted by the Ontario Long Term Energy Plan (2010) that predicts an electricity price increase of 46% over 5 years and doubling in 20 years is perhaps just a tad under estimated – it has already gone up 80% in the last 3 years, even before most of the costs come on stream! See the next page.



Conclusions:

To properly review the OSPE report point by point would take considerably more time than is available before the required submission deadline.

I have attempted from a high level to identify that there are significant concerns with the OSPE draft, that call for a re-working of it before submission to the Ministry of Energy. The integration of wind turbines into the electrical grid and the impact of such decisions on:

- public safety and health, and environmental effects
- economic impacts on the Ontario economy
- the integrity of the Ontario electricity system

have not been fully addressed by the OSPE draft as it exists.

I would be pleased to provide further assistance to the report authors who have already made a good start at developing a report, but the recommendations provided in the draft fail to address the concerns. The recommendations in the report do not address the real problem of a Ministerial Directive that drives an option that does not meet Ontario's needs and causes other even more serious problems than just integration into the grid.

With respect,
William K.G. Palmer P. Eng. January 13, 2012