Q. **Reference: Pre-filed Testimony of Mr. P. Bowman and Mr. Hamid Najmidinov. Section 5.0, footnote 65, page 30**

With regard to the classification of wind generation to 100% energy, P. Bowman and H. Najmidinov state in footnote 65 that "...properly analyzed wind does provide some capacity benefit in terms of LOLH".

Please explain this statement more fully and provide any applicable citations.

A.

The concept of an LOLH probabilistic planning criteria is that there is a non-zero probability of lost load in any hour of the year. The LOLH is a sum of all of the probabilities. Many hours will contribute only a trivial amount (such as low load shoulder season periods) but a large number of hours will make up the sum of the annual LOLH measure, and this sum is not to exceed the target level. The more generation that is available in those hours, the lower the likelihood of a loss of load event and the higher the peak load that can be carried under the same LOLH criterion.

Contrary to other deterministic type criteria, the probabilistic approach is not based on a single or small number of peak hours. As a result, it is largely irrelevant that wind cannot be made to blow at a single defined peak hour.

Similar to the load variability input to the probabilistic model (higher loads in winter, and in peak hours, lower load other times), there is also a generation probability distribution built into the model. These are shown in RFI PR-PUB-NLH-136 from the Prudence Review. For example, in 2006, Hydro used 0.9% as the hydraulic unit Forced Outage Rate (FOR) for Hydro's hydraulic generating units (99.1% likelihood of being available at any given hour). If this value were varied, the measured peak load carrying capability at the 2.8 hours/year LOLH would also change (more unavailability means less load carrying capability).

The premise behind a wind contribution to LOLH is that wind being excluded from the model is like imposing a 100% Forced Outage Rate on wind in every hour. This is not correct. In each hour of the year there is a non-zero probability that wind will be contributing to the grid supply, at times up to its full rated capacity. Much like the

hydraulic unit FOR, if the wind FOR was adjusted to reflect an appropriate probability of availability, the peak load carrying capability of the system at the 2.8 hours/year LOLH standard would rise (more MW of load could be reliably carried). In short, this would be an indication that the wind does contribute reliable firm capacity to the system.

As an example of the literature on the subject, the following link is to a 2004 paper summarizing the effects of adding wind generation to the Saskatchewan grid. In the simple single-site example shown in Table IV of the article, a wind generator under a Mean Wind Speed of 29.28 km/hour (1.5 times the average wind speed at Regina) could install 20 MW of wind to replace 10 MW of thermal generation (a 2.0 ratio).

http://ecreee.wikischolars.columbia.edu/file/view/Billington+2004+-+Generating+Capacity+Adequacy+Associated+with+Wind+Energy.pdf