

# LOW POWER FACTOR AT WINGHAM TS ASSESSMENT

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This Local Planning Report was prepared for the purpose of developing wires options and recommending a preferred solution(s) to address the local needs identified in the [Needs Assessment \(NA\) report](#) for the Greater Bruce/Huron Region that do not require further coordinated regional planning. The preferred solution(s) that have been identified through this Local Planning Report may be reevaluated based on the findings of further analysis. The load forecast and results reported in this Local Planning Report are based on the information and assumptions provided by study team participants.

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## **Background**

As part of the Ontario Energy Board's (OEB) Regional Planning process, a Needs Assessment was performed for the Greater Bruce / Huron Region. There were four (4) needs identified in the 2016 Needs Assessment for this Region, one of them being the poor power factor and voltage deficiency at Wingham TS.

This assessment addresses the low power factor and voltage deficiency issues at the Wingham TS identified in the Needs Assessment report.

## **Introduction**

Wingham TS is a 230/44kV transformer station supplying Hydro One Distribution and Westario Power loads. The station is supplied via 230kV circuits B22D and B23D and has four (4) 44kV distribution feeders with an approximate loading of 60MW. There is also a significant amount of distributed generation (DG) connected at Wingham TS.

As per IESO Market Rules, customers are required to maintain a power factor of 0.9 or better at the point of connection. The power factor at Wingham TS has fallen below 0.5 on some occasions. A graph of the power factor performance at Wingham TS from June 2015 to June 2016 is shown in Figure 1 of Appendix A.

## **Findings**

Upon further assessment, Hydro One Transmission, Hydro One Distribution and Westario Power determined that the low power factor was directly related to DGs connected on Hydro One's M4 feeder. The generation operates at a fixed power factor and is set to an appropriate value to help maintain the desired feeder voltage. DGs typically impact the load characteristic as seen from the transformer station. The DG will typically displace the loads real power (MW) absorbed from the transmission system while the reactive power (MVAR) of the load will typically remain unchanged.

To determine the root cause for low power factor, Hydro One Distribution and Westario Power investigated whether there were any loads that had undergone any facility modifications that could have caused this concern, however this was not the case. It was observed that, prior to the connection of an 18MW wind farm to a Wingham TS feeder, the power factor at the transformer station was consistently above 0.9, however the power factor started oscillating sporadically once the wind farm was placed in service. A graph showing the power factor performance before and after the incorporation of the wind farm is shown in Figure 2 of Appendix A.

To further confirm that it is the wind farm that is causing the poor power factor performance, the Wingham TS load power factor was isolated to determine if it would be acceptable without the effect of the 18MW wind farm. The wind farm's power output (MW and MVAR) was added to the Wingham TS load, and, the resulting load power factor was around 0.9. A graph showing the Wingham TS load power factor is shown in Figure 3 of Appendix A.

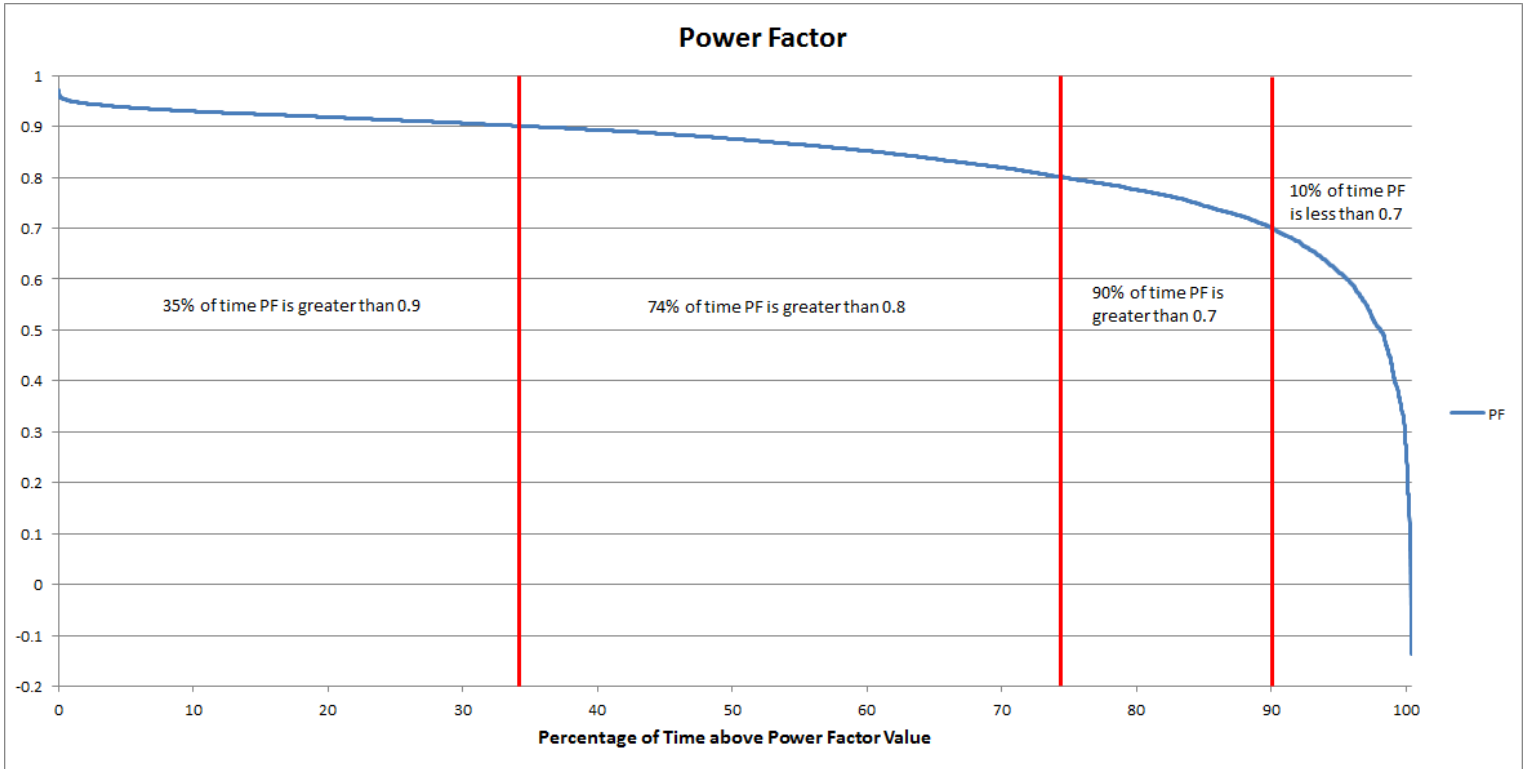
To ensure that the power factor performance was not negatively impacting the Wingham TS load customers, Hydro One Distribution and Westario Power looked into 1) customers' complaints about power quality (specifically voltage) and service, and 2) summer loading at Distribution Stations to confirm load power factors are acceptable. Neither Hydro One Distribution nor Westario Power received any customer complaints, and load power factors were found to be acceptable.

At this time, the Wingham TS load is well below the station's capacity, and therefore the higher MVA flow (caused by the absorption of VAR by the wind farm) will not result in equipment overload or cause equipment damage. It was also confirmed that both the 230kV and the 44kV bus voltage stayed within criteria during periods of low power factor. A graph of the Wingham TS MVA loading from May 2013 to May 2016 is shown in Figure 4 of Appendix A.

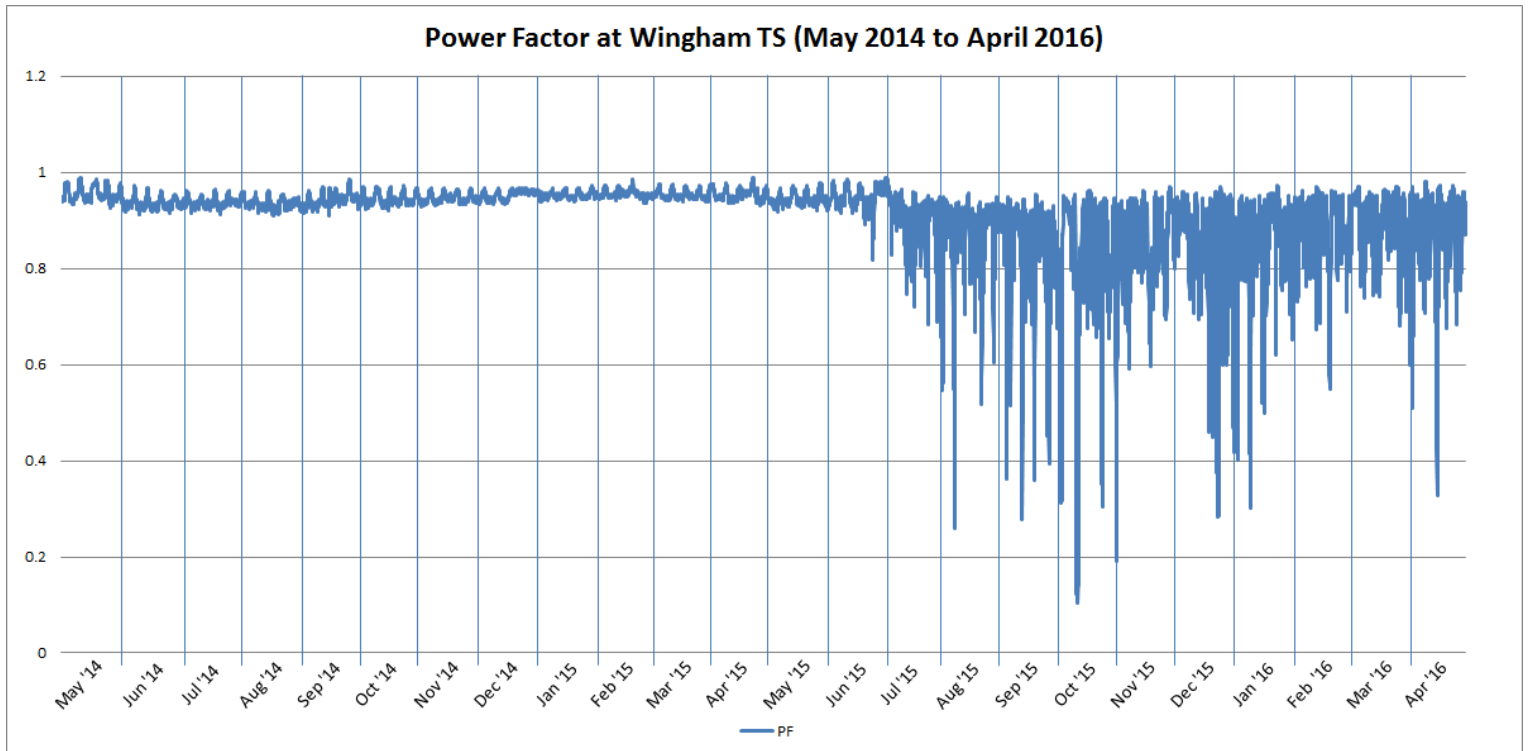
## **Conclusion**

The power factor of loads at Wingham TS is within planning criteria, and the DGs connected at Wingham TS are the cause of the power factor deviating from Market Rules. Since there are no voltage issues at Wingham TS, and there is no lack of reactive power support in the local area, Hydro One Transmission, Hydro One Distribution and Westario Power propose that no action is required at this time and the occasional low power factor observed at Wingham TS is not a need that requires mitigation. Hydro One proposes to discuss, with the IESO, possible changes to the Market Rules that would take into account the effects DGs have on station power factor, and will continue to monitor the situation and act accordingly if the low power factor becomes an issue in the future.

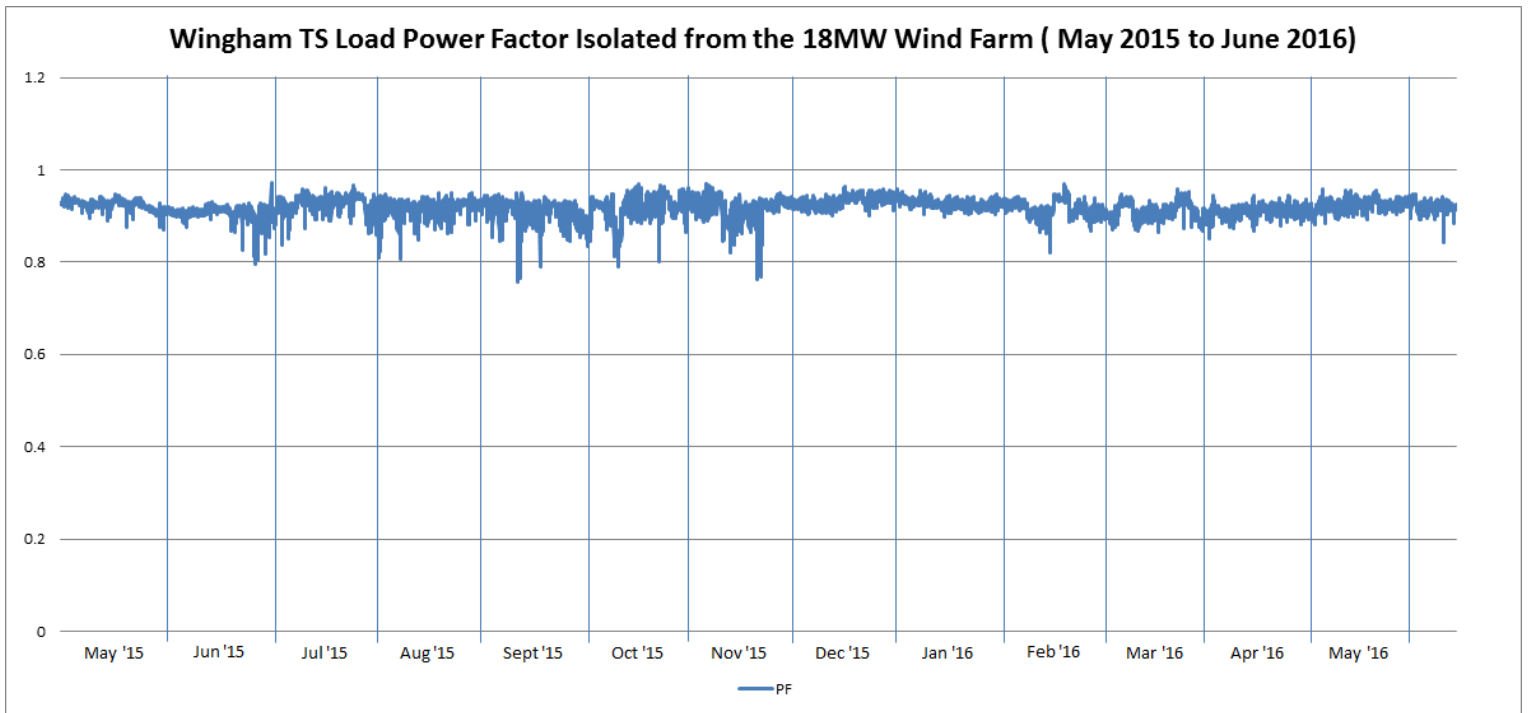
# APPENDIX A



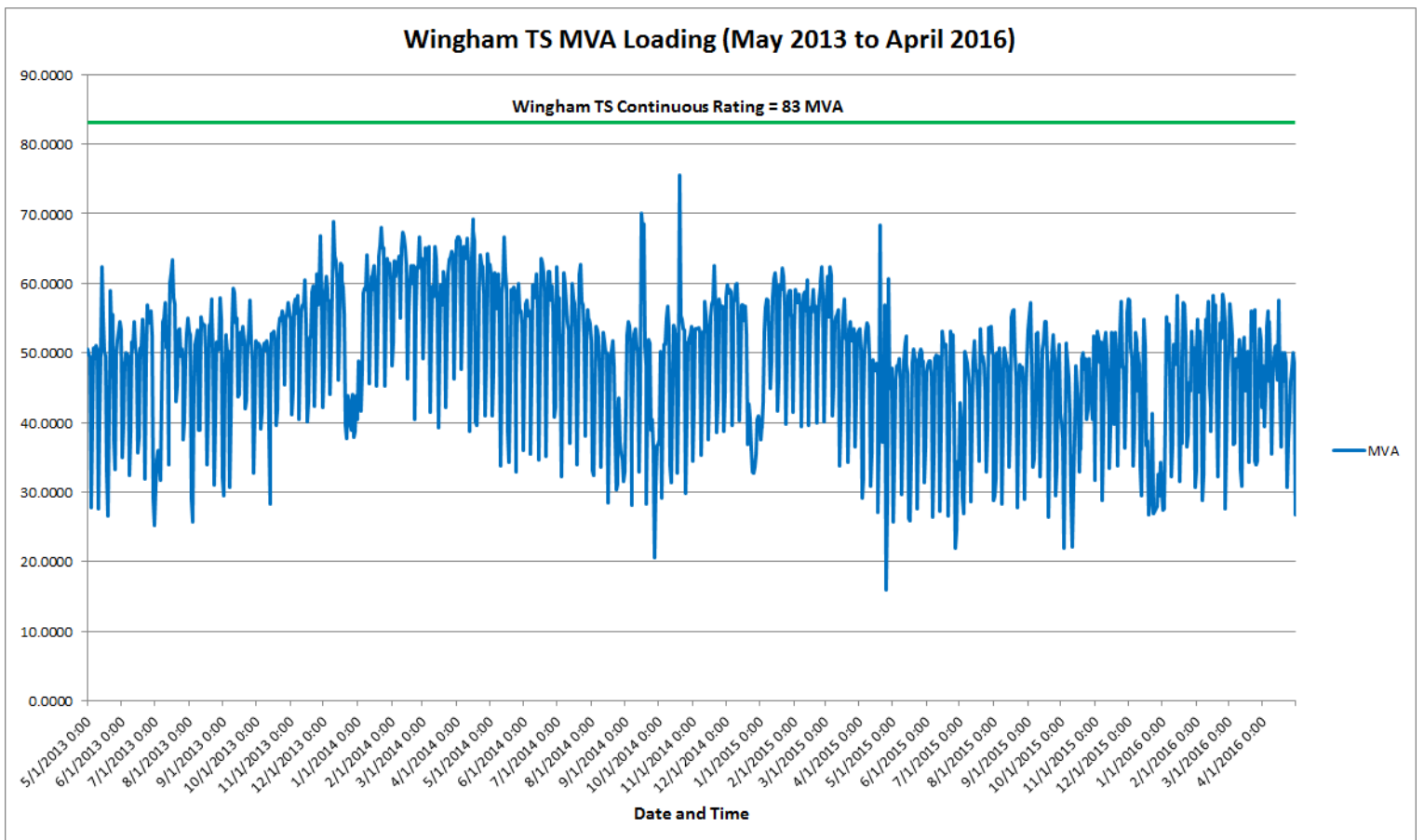
**Figure 1:** Graph showing the power factor performance of Wingham TS between June 2015 and June 2016



**Figure 2:** Graph showing Wingham TS power factor before and after wind farm was place in service.



**Figure 3:** Graph showing Wingham TS load power factor since the connection of wind farm.



**Figure 4:** Graph showing MVA loading at Wingham TS over the last 3 years