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# FERC 827 SUMMARY

## REACTIVE POWER REQUIREMENTS FOR NON-SYNCHRONOUS GENERATION

**FERC Order No. 827**, released on June 16, 2016, changes the language that goes into the standard Interconnection Agreement (IA) for generating facilities.



# FERC ORDER NO. 827<sup>1</sup>,

RELEASED ON JUNE 16, 2016, CHANGES THE LANGUAGE THAT GOES INTO THE STANDARD INTERCONNECTION AGREEMENT (IA) FOR GENERATING FACILITIES. THE REVISED STANDARD LANGUAGE IS BELOW:

## 9.6.1.2 NON-SYNCHRONOUS GENERATION

Interconnection Customer shall design the Large Generating Facility to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the Transmission Provider has established a different power factor range that applies to all non-synchronous generators in the Control Area on a comparable basis. This power factor range standard shall be dynamic and can be met using, for example, power electronics designed to supply this level of reactive capability (taking into account any limitations due to voltage level, real power output, etc.) or fixed and switched capacitors, or a combination of the two. This requirement shall only apply to newly interconnecting non-synchronous generators that have not yet executed a Facilities Study Agreement as of the effective date of the Final Rule establishing this requirement (Order No. 827).

**THIS LANGUAGE WILL BE STANDARD IN IAS FOR ALL PROJECTS THAT HAVE EXECUTED A FACILITIES STUDY AGREEMENT ON OR AFTER OCTOBER 14, 2016<sup>2</sup>.**

## THE THREE PRIMARY CHANGES THE NEW STANDARD CREATES ARE:

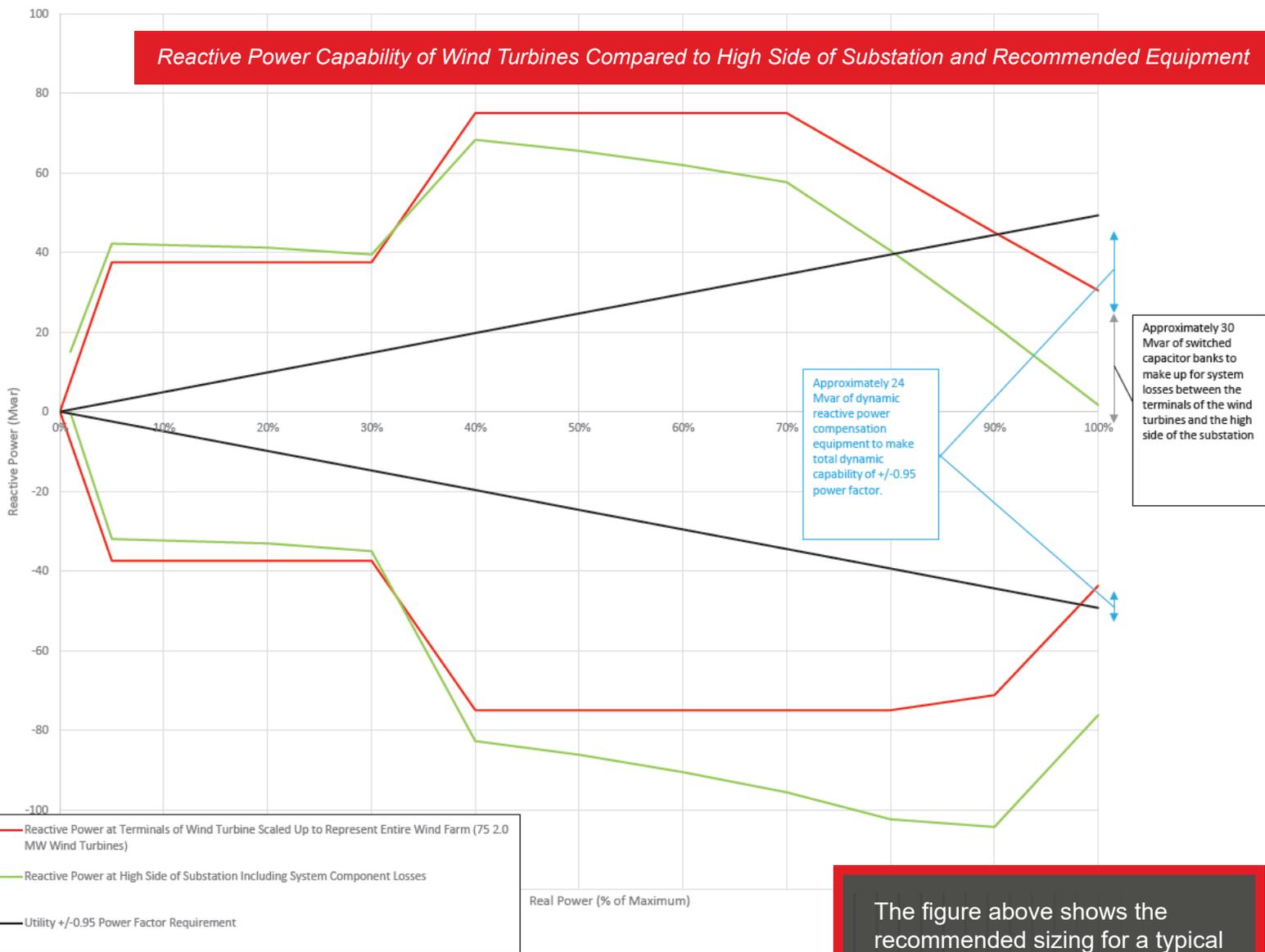
1. Projects are required to maintain reactive power capability at the high side of the project's collector substation. This is different from past projects which have had to maintain this reactive power capability of +/- 0.95 at the project's Point of Interconnection (POI).
2. Projects are required to have a dynamic power factor range of +/- 0.95. While the IA standard language is ambiguous, the full FERC 827 document includes discussion on the reasoning behind these new requirements. Ulteig's interpretation is that the dynamic capability must be met with the generators themselves and/or a dynamic reactive power device installed at the substation. Switched capacitor banks can only be used to offset system losses.
3. Projects are required to achieve a +/-0.95 power factor range for all output levels above 0 MW, as clarified in FERC Order No. 827 section III.C.

<sup>1</sup><http://www.ferc.gov/whats-new/comm-meet/2016/061616/E-1.pdf>

<sup>2</sup>[http://www.nerc.com/FilingsOrders/us/FERCOrdersRules/Notice\\_Ext\\_Dates\\_Orders\\_SGIA\\_20160808\\_RM16-8\\_RM16-1.pdf](http://www.nerc.com/FilingsOrders/us/FERCOrdersRules/Notice_Ext_Dates_Orders_SGIA_20160808_RM16-8_RM16-1.pdf)



## Reactive Power Capability of Wind Turbines Compared to High Side of Substation and Recommended Equipment



### EXPECTED IMPACTS OF FERC 827:

1. Typically, a smaller capacitor bank size due to the requirement being at the high side of the substation instead of the POI.
2. Dynamic reactive power compensation device installations (e.g. S&C PureWave® DSTATCOM, AMSC D-VAR®) on turbines that do not have a +/- 0.95 power factor capability at the terminals of the turbine. Even turbines that have a +/- 0.95 power factor capability may still need a small device if that full range doesn't transfer completely to the high side of the substation.
3. A reactor bank may still be necessary even if the local utility does not require the charging to be offset under no wind conditions because of the limited reactive power capability of the generator at low output.
4. New reactive power curves from wind turbine vendors that offer an extended reactive power range to satisfy FERC 827 without putting in a separate dynamic compensation device at the substation. However, the extended range will likely come with some other limitations that will need to be considered in the project design.
5. Greater potential impact of modifying original Facilities Studies. If the original Facilities Study Agreement was signed before October 14, 2016 but the study is updated to reflect a change such as an updated wind turbine model that may add FERC 827 requirements to the project not there originally.

The figure above shows the recommended sizing for a typical 150 MW project based on our interpretation of FERC 827. This is applied to a wind project rather than a solar project since the solar inverters we have worked with in the past all exceed the base rating of 0.95 leading / 0.95 lagging power factor range at the terminals, minimizing the impact of this change.

The wind turbines used in this analysis have a power factor range at the terminals of 0.98 leading through 0.96 lagging. As shown, dynamic reactive power compensation equipment is recommended to create a 0.95 leading / 0.95 lagging power factor range and switched capacitor banks are recommended to compensate for the reactive power losses over system components.



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## CONVERSATION STARTERS WITH PROJECT OWNER OR INTERCONNECTING UTILITY:

1. Did the project have an executed a Facilities Study Agreement signed on or after October 14, 2016? If so, the requirements in FERC 827 will apply to the project and the following questions should also be asked.
2. Is the project required to meet any reactive power, power factor, or voltage requirements beyond those identified in the FERC 827 language in the IA? FERC 827 gives the minimum requirement for projects to meet. The interconnecting utility could still require something above and beyond what FERC 827 requires. Ulteig recommends reviewing and challenging, as necessary, any ambiguous language on the requirements in the facility study or system impact study regarding the project requirements.
3. Are you considering static capacitor banks to meet the dynamic compensation requirement in FERC 827? There are different interpretations of what dynamic means beyond what Ulteig's interpretation is. Others in the industry are interpreting FERC 827 to mean that static capacitor banks can be considered dynamic.
4. What is the scheduled voltage range of the project at the high side of the substation? FERC 827 does not cover voltage levels the range is applied to, so to minimize the equipment sizing it is preferred to use the scheduled voltage range instead of an extended voltage range such as 0.95 pu through 1.05 pu.
5. Is the project required to offset system charging at 0% output? Reactor sizing for the no wind case is not covered in FERC 827, so projects may still have reactors required for that.



If you have questions,  
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