BEFORE THE
UNITED STATE OF AMERICA
ENERGY REGULATORY COMMISSION

Reactive Supply Compensation	**)**	
in Markets Operated by	**)**	**Docket No. AD16-17**
Regional Transmission Organizations	**)**	
and Independent System Operators	**)**	

PRESENTER: OMAR MARTINO
DIRECTOR, TRANSMISSION
EDF RENEWABLE ENERGY, INC.

TOPIC: INTRODUCTORY REMARKS
PANEL 3 ADDRESSING "COSTS INCURRED BY NON-SYNCHRONOUS GENERATORS FOR REACTIVE SUPPLY"

DATE: JUNE 30, 2016

Good afternoon. My name is Omar Martino. I am the Director of Transmission Strategy within the Valuation and Transaction Group at EDF Renewable Energy, Inc.

EDF Renewable is a subsidiary of Électricité de France, S.A., a French electric utility company. In North America, EDF Renewable has developed over 6 gigawatts ("GW") of generation since 2012. EDF Renewable currently owns 3.1 GW of generation, has another 1.1 GW currently under construction and provides operations and maintenance service for another 10.5 GW of generation.

I want to thank the Commission for inviting me to speak today.

EDF Renewable has significant experience operating wind resources in the United States and around the world, and we can provide significant insight into the cost and ability to provide Reactive Supply and proper compensation means.

We are grateful for the Commission diving into this issue. The compensation for Reactive Supply from wind resources in RTO markets is either non-existent or insufficient to cover costs. Thus, it is vital that the Commission install mechanisms that ensure compensation and at adequate levels. From our perspective, this needs to be done though the *AEP* methodology in all RTOs and cannot be done through a centralized market.

So, to address the Commission's specific questions:

Non-synchronous generators face much the same costs to install and maintain Reactive Supply capability as synchronous generators.

The difference between non-synchronous and synchronous generators is in the rotor windings.

In the synchronous generator, the rotor winding is typically a DC winding energized by a separate DC machine, called an exciter, or other DC source. The rotor is then turned in the stator by the prime mover at the synchronous speed to create the rotating field that generates both the real power and the reactive power produced by the synchronous generator.

In the non-synchronous generator, the rotor contains an AC winding that is energized by the same source as the stator winding. However, since the prime mover does not turn the rotor at the synchronous speed, the rotor current is modulated through an AC-DC-AC converter to control the frequency and optimize the torque from the prime mover to generate both the real power and the reactive power.

The rotor energization source along with the AC-DC-AC converter and associated controller are the equivalent of the exciter and excitation control system in the synchronous generator. All of this equipment is required for the non-synchronous generator to supply both real and reactive power capability.

Non-synchronous and conventional synchronous generators have other differences. Much of the accessory electric equipment and support systems found in a conventional synchronous generating facility, such as a steam turbine generator or a combustion turbine generator burning fossil fuels, is not present in a non-synchronous generation facility using renewable resources such as wind and solar energy. However, a wind turbine facility is spread out over a large geographic area which requires a much more extensive collection system to gather the output of each generator and convey it to the point of interconnection to the transmission system. While the generator bus from a synchronous generator to the GSU may be only a few hundred feet or less, the collection system at a wind turbine facility will traverse several miles from the wind turbine generators to the GSU. This much more extensive accessory electric equipment comes at not only higher capital costs, but also incurs higher O&M costs for real power losses and equipment maintenance.

Most of the equipment that is required to maintain Reactive Supply capability is the same for non-synchronous and synchronous generation.

Equipment must have a higher rating and be capable of increased currents and greater heat dissipation to provide Reactive Supply. This is true for synchronous and non-synchronous generators. These increased capabilities require higher costs.

However, non-synchronous generators bring a higher level of reliability to provide Reactive Supply. A typical non-synchronous facility is composed of many more turbine generators than a typical synchronous generator facility of comparable size. Therefore, an outage or failure of one generator in a non-synchronous facility results in the loss of a much smaller portion of the real and Reactive Power Supply capability.

Another unique benefit is that modern non-synchronous wind generators can purchase turbines with a “Wind Free” option that allows the wind generator to produce and deliver Reactive Power to the transmission system even when the generator is not producing any real power. This

"Wind Free" capability comes with additional costs, but greatly increases the value of the generator to the reliable operation of the transmission system. Synchronous generators do not have this capability unless the prime mover is decoupled from the generator and the generator is then operated as a synchronous motor, which typically cannot be done in a quick or convenient manner. The "Wind Free" capability of a wind turbine facility, however, provides an instantaneous response to the Reactive Power needs of the transmission system.

Non-synchronous and synchronous generators face different costs in real-time to provide Reactive Supply.

Conventional synchronous generators burn fossil fuel or convert some other energy source to drive the prime mover. Non-synchronous generators use natural, renewable energy sources like wind and solar energy to drive their prime movers. Therefore, for the non-synchronous generator, the incremental cost to produce Reactive Power is its lost opportunity costs to provide the real power that would not be lost but for the requirement to provide Reactive Supply. It is important for the Commission to understand that most wind generation projects operate under "take or pay" PPAs that incentivize the sale of real power. PPAs also have minimum real power delivery requirements that, if not met, have financial penalties. Thus, non-synchronous generators face real opportunity costs to provide Reactive Supply. These need to be taken into account when the Commission fashions its order addressing compensation.

Up to this point, non-synchronous generators have not been able to recover their costs required to maintain Reactive Supply capability or to provide Reactive Supply service.

Synchronous generators are allowed to recover their costs through Schedule 2 of the *pro forma* Open Access Transmission Tariff. Non-synchronous generators have been required to recover all of their costs through the price to their real power production, which puts them at a competitive disadvantage to synchronous generators in the same market.

Non-synchronous generators have the same types of costs as a synchronous generator for equipment that is used to produce both real power and Reactive Power. Both have rotating electric machines, or generators, with stator and rotor windings, an excitation system which provides the power and control to generate both the real and reactive power, auxiliary electric equipment that supports the generator and excitation system, a generator step up transformer that interconnects the generators to the transmission system, and a balance of plant that is necessary for the real power production. These are the components that are used in the *AEP* methodology used to compensate synchronous generators. They are as equally applicable to non-synchronous generators. The cost of components of the non-synchronous generators that are used to produce both real and Reactive Power can be allocated into their respective real power and reactive power categories using the Reactive Power Allocation Factor developed in *AEP*, just as they are for synchronous generators. In order to provide comparable treatment for non-synchronous and synchronous generators, equal treatment in the recovery of costs for Reactive Supply capability and Reactive Supply service must be afforded to both classes of generators.

Unfortunately, the RTOs currently use a wide variety of compensation methods. On one extreme is CAISO which only compensates for lost opportunity costs if a generator must lower its real power output to provide additional Reactive Power at the request of the ISO. SPP compensates for actual Reactive Power production on a $/MVARh basis, but only for Reactive Power produced outside of a dead-band of 0.95 lagging to 0.95 leading power factor. For most generators this means that no compensation is paid for reactive power capability. ISO-NE and NYISO compensate on a capacity basis for Reactive Supply capability at a $/MVAR rate using a generator's qualified Reactive capability. All generators receive the same compensation rate, regardless of their costs. MISO and PJM compensate generators using their FERC approved cost-based revenue requirement which is developed using the *AEP* methodology.

A further problem is that most of these compensation methods are not commensurate with the costs to provide Reactive capability and Reactive supply. Again, CAISO is on one extreme where there is no compensation paid to generators for Reactive Supply service. In SPP, the capital costs are not recognized by the $/MVARh rate paid for actual VAR production outside the dead-band and zero compensation inside the dead-band. ISO-NE and NYISO do properly recognize the capacity or demand aspect of Reactive Supply service, however, the capacity charge is below most new generation's capital cost for providing the service. Only MISO and PJM, which utilize a FERC approved revenue requirement based on the *AEP* methodology, are compensating generators commensurate with their costs for providing the service.

To put some numbers on this, assume a wind plant providing about 200 MVAR of Reactive Power capability (100 MVAR lagging and 100 MVAR leading) from a 200 MW plant with 0.9 pf rated generators. In CAISO, the wind generator would receive no compensation. In SPP, the new generator would receive essentially no compensation for Reactive Power because no supply likely will occur outside the dead-band. ISO-NE would compensate the generator about $225,000/year using its formula, and NYISO would compensate about $525,000/year. However, using the *AEP* methodology in either MISO or PJM, the generator would receive approximately

$1,900,000/year in revenue. Using a standard reactive compensation rate for all generators as in ISO-NE and NYISO fails to recognize that different technologies of generation and therefore, Reactive Supply service providers, have different costs. Reactive Supply compensation needs to reflect the costs associated with the provision of the service.

EDF Renewable believes it is important, and just and reasonable, that *all* RTOs compensate non-synchronous and all generators using the *AEP* methodology. Until this is done, generators will not be compensated for the value they provide. This switch is all the more needed now given the Commission's recent order requiring that all generators provide Reactive Supply.

The Commission should also understand that it is important *all* RTOs use the *AEP* methodology. The compensation method for Reactive Supply should not influence where new generation is invested and developed. If compensation is not via the *AEP* methodology, this will deter new investment because costs are recovered and this is coupled with a loss of revenue for foregone real power sales. Given the critical need for Reactive Supply, and now the requirement to provide Reactive Supply, RTOs need a compensation methodology that draws investment, rather than deters it. Only the *AEP* methodology does that.

Testing and monitoring is a vital component.

However, testing for non-synchronous generators, and in particular wind generation, should not be a deterrent to allowing for immediate compensation. In our experience, it can take months for conditions to allow for certification. Wind generators cannot arbitrarily increase their output to satisfy a testing requirement or condition. For this reason, wind generators should be allowed to use design criteria to satisfy their initial capability verification. Then over a certain period of time, such as six months, operational data can be used to verify the design criteria. Testing requirements should be standardized across the various RTOs and ISOs. Currently, generation owners with resources in multiple RTOs and ISOs must navigate different, and in some cases, non-existent, testing requirements and procedures.

Finally, EDF Renewable does not believe the RTOs can and should develop centralized markets for reactive power compensation.

Reactive Power is not as easily transportable as real power. Generally, a generator's ability to deliver Reactive Power is limited to an electrically smaller geographic area. This characteristic undermines the ability to develop a centralized market. At most, a centralized market might be able to be developed in smaller physical sub-regions where the Reactive Power would be consumed, but that would be very limited. In general, in areas where limited Reactive resources are present, a competitive market mechanism would not yield appropriate costs for Reactive Power.

Thank you, again, for inviting me to speak to you. We very much appreciate the Commission providing a platform to ensure proper compensation is provided to non-synchronous generation. I look forward to your questions.

*   *   *