PSEG Fossil

Reactive Power Capability

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Reactive Power Capability

2.1 What costs do synchronous generators incur to install and maintain Reactive Supply capability?

A. Installation costs: In order to supply reactive capability, a generator must be designed/sized larger than the desired megawatt output during installation. This includes the:

- Excitation system
- Transformers
- Generator bus
- Generator breakers
- Cooling systems, must be sized larger in order to provide the increased current requirements of supplying reactive power and cooling requirements to dissipate the heat produced in the generator, bus, and transformers when providing the reactive power.

Example:

- If reactive power is NOT to be supplied (PF=1.0), a 100 MW generator can be sized at 100MVA
- If reactive power is to be supplied (ex. PF=0.9, 100 MWs, 50 MVARs), the 100MW generator would need to be sized to 111.1 MVA.
- All electrical equipment from the generator to the point of interconnection must be sized to handle the increased current in supplying the reactive power.

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2.1 What costs do synchronous generators incur to install and maintain Reactive Supply capability? (continued)

B. Maintenance costs:

- To supply reactive capability, maintenance costs are the same as if not supplying reactive power as long as the equipment is sized and rated to adequately handle the reactive power.

- As equipment ages, degraded conditions can possibly occur within a generator that supplying reactive power can accelerate and cause damage to specific components within the generator. For example leading reactive power can accelerate any existing core iron insulation issues**,** and may result in a de-rate if the degraded condition is not repaired.

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2.2 Is the equipment required for synchronous generators to maintain Reactive Supply capability the same as that required to produce and deliver real power, or must additional costs be incurred to provide Reactive Supply capability?

- The equipment is the same, but it is required to be a larger size if it is intended to provide reactive capability

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2.3 Would synchronous generators be designed or operated differently were it not for the Reactive Supply capability requirements of their respective Interconnection Agreements or Reactive Supply reliability requirements?

- Design:
  - Without reactive supply capability requirements, the size/rating of the equipment (generator, bus, transformers, cooling equipment) could be reduced and a generator operated as close to unity power factor as possible.

- Operation:
  - Without reactive supply capability requirements, the unit would be operated at unity power factor

2.4 What costs do synchronous generators incur in real-time to provide Reactive Supply service?

- Aux power for Cooling:
  - Additional auxiliary power will be consumed to run the larger cooling systems required for cooling the generator, bus, and transformers.

- Aux power for Excitation:
  - **Lagging**: To provide lagging reactive power, the generator requires an increase in field current, resulting in an increase in auxiliary power used by the excitation system.
  - **Leading**: Conversely, to provide leading reactive power , the generator requires a reduction in field current, resulting in a decrease in auxiliary power used by the excitation system.
  - Increases heat losses.

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2.5 How are the costs required for synchronous generators to maintain Reactive Supply capability and to provide Reactive Supply service recovered?

- Most of PSEG Power's generating units are located in PJM and thus are paid under the *AEP* methodology.

- The *AEP* methodology calculates a cost-of-service rate for generating units providing reactive power services based on three components of production plant directly related to the production of VARs: (i) the generator and exciter; (ii) accessory electric equipment that supports operation of the generator and exciter; and (iii) remaining total production investment required to provide real power and operate the exciter. Recovery of the costs of incremental heating losses which are incurred in the production of reactive power are also allowed.

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2.5 How are the costs required for synchronous generators to maintain Reactive Supply capability and to provide Reactive Supply service recovered? (continued)

- The *AEP* methodology correctly recognizes that generating units required to be capable of providing reactive power incur capital and maintenance costs that they would not incur otherwise but may not adequately compensate units for these costs in some cases.

- The allowance for incremental heating losses under the *AEP* methodology may not adequately compensate for the additional auxiliary power consumed to run the larger cooling systems needed for cooling the appropriately-sized generator, bus, and transformers required to provide reactive power services.