

Emerging Issue #RAS-2: *Accommodating Variable Resources in System Operations*

Emerging Issue	Item	Specifics
Horizon	Number of years	Current and On-Going
Status	Emerging or Standing	Standing
	Technical Group	Integration of Variable Generation Task Force (IVGTF)
Background	Description	<p>The expected significant increase in variable generation additions to the bulk power system will increase the amount of uncertainty that a system operator must factor into operating decisions. To manage this increased uncertainty, the system operator must have access to advanced variable generation forecasting techniques and have access to sufficient flexible resources to mitigate the added variability and uncertainty associated with the large scale integration of variable generation. In this respect, operating criteria, forecasting, commitment, scheduling, dispatch and balancing practices, procedures and tools must be enhanced to assist operators in maintaining bulk power system reliability.</p> <p>This emerging issue will include the on-going work of the Integration of Variable Generation Task Force, as well as recent reports on bulk power system operations.</p> <ul style="list-style-type: none"> • <u>Operating Practices, Procedures, and Tools</u> • <u>Ancillary Service and Balancing Authority Area Solutions to Integrate Variable Generation</u> • <u>Variable Generation Power Forecasting for Operations</u>
	What changes during the 10-year horizon?	<ul style="list-style-type: none"> • Operational procedures • Operating reserve requirements • Dispatching methods • Forecasting • Flexibility needs
	What is the impact to regional reliability?	Improved operating practices, procedures and tools are critical to integrate variable generation into the power system, as well as improve the control performance and reliability characteristics of the power system. System resources supporting reliability, such as flexible generation and responsive load, are finite. Operating practices, procedures, and tools that maximize the effective use of limited responsive resources improve reliability and facilitate variable generation integration.
Assessment Factors	Resource Adequacy Considerations [Yes/No]?	Yes. Impacts to operating reserve margins and ancillary service requirements may affect short-term operational planning. Considerations for start-up times of fossil fueled resources will have to be included in operational planning for the variable resources. Impacts to long-term planning may be affected as well.

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	<p>Transmission Adequacy Considerations [Yes/No]?</p>	<p>Yes. Within a balancing area, as the level of variable generation increases, the variability individually or when coupled with extreme events, such as system-wide high-rate ramping (up or down), may not be manageable with the existing conventional generation resources within the balancing area alone. If there is sufficient bulk power transmission, this situation may be managed by obtaining ancillary services and flexible resources from a larger generation base, such as through participation in wider-area balancing management or balancing area consolidation. Transmission planning and operations techniques, including economic inter-area planning methods, should be used for inter-area transmission development to provide access to and sharing of flexible resources.</p> <p>Therefore, the composite capacity value of variable generation resources significantly improves when inter-area transmission additions enable variable generators across much wider geographic areas to interact with one another, hence improving overall system operational reliability.</p>
	<p>Resource Siting Impacts [Yes/No]?</p>	<p>Yes. Even if equivalent capacity of the new resources is placed in the same location on the system, there are still potential impacts due to the change in performance characteristics.</p>
	<p>Operations Impacts [Yes/No]?</p>	<p>Yes. An increase in variable generation resources may require changes to the dispatch as well as the types and amounts of operating reserves to compensate for the variability and uncertainty of the new resources. Additional sophistication is needed in EMS tools to incorporate weather and wind forecasts as well as locational dispatch for system stability to compensate for the different performance characteristics of the new resources. As more variable resources are added to the system before necessary changes can be made, challenges for system operators can be created.</p> <p>There are significant differences in the actual scope and implementation of individual operator tools, which can be mainly attributed to the differences in the systems and associated markets for which the tools were developed. Some of the tools are intended to provide comprehensive information about existing system operating conditions and expected short-term changes, so that the operator can decide the most appropriate control action (operator training). These operator tools include additional visualization displays and calculation of system performance metrics for determining what measures should be undertaken to mitigate possible adverse effects.</p>
	<p>Remaining Uncertainties</p>	<ul style="list-style-type: none"> • Availability of appropriate ancillary services to accommodate steep ramps from variable generation • Real-time flexibility is unknown