

Table G-1 – IOS Technical Requirements and Bid Characteristics

IOS	Technical Requirement	Bid Characteristic
<p><b>C.1. Regulation and Frequency Response</b></p> <ul style="list-style-type: none"> <li>Regulation and Frequency Response Service is the provision of automatic generation control of a generator’s output that RTO West can use for balancing generation and demand in the RTO West Control Area.</li> <li>RTO West will determine location and adequacy in the DA market (Assume Scheduling Coordinator does not require transmission reservation since RTO West will set aside in running its SC Unit Commitment.)</li> <li>SC can self-track, self-provide, buy from RTO West</li> </ul>	<ul style="list-style-type: none"> <li>Resource capable of being controlled automatically by the RTO West EMS/AGC system via telecommunications link to meet second by second regulation of generation and demand to satisfy NERC CPS for RTO West</li> <li>Minimum Ramp Rates:               <ul style="list-style-type: none"> <li>for generator resource is xxMW/sec(min) for entire regulation range</li> <li>for demand resource is mmMW<sub>avg</sub>/sec(min) for entire regulation range</li> </ul> </li> <li>Minimum Regulation Range: greater of xxMW or yy% of generator rating. For demand resource: +mmMW<sub>avg</sub>; -nnMW<sub>avg</sub></li> <li>Metering requirement: MW, accuracy ±2.5%</li> <li>Indication and telemetry</li> </ul>	<ul style="list-style-type: none"> <li>Location - Bid at node (must be within RTO West control area unless dynamic scheduling is used and will also require transmission reservation)</li> <li>Capacity bid price</li> <li>Day Ahead and/or Hour Ahead for RT use</li> <li>Hours available</li> <li>Regulation range</li> <li>Ramp rates</li> <li>Should resources with unrestricted maneuverability to ramp up and down symmetrically over its entire regulation range be paid a premium? (should this be tied to CPS which are based on statistic averages?)</li> </ul>
<p><b>C.2. Load Following Up</b></p> <ul style="list-style-type: none"> <li>Load Following Up Service is the provision of generation, import or demand-side resources that RTO West can use on a minute-by-minute basis in real time in response to net increases in demand or decreases in generation in the RTO West Control Area.</li> <li>Service to be provided on zonal basis? If so, can you bid into another zone?</li> <li>SC can self-track, self-provide, buy from RTO West</li> </ul>	<ul style="list-style-type: none"> <li>Resource must be capable of following minute by minute dispatch instruction from RTO West</li> <li>Telecommunications link (control or voice)</li> <li>Generator minimum ramp up rate: xxMW/min from base line to specified maximum output until the next scheduling period commence</li> <li>Demand minimum ramp down rate: zzMW<sub>avg</sub>/min from base line to specified minimum demand until the next scheduling period commence (might be difficult to establish a load base line for a “long” period of time since most loads vary over time)</li> <li>Metering requirement: MW, MWHr, accuracy ±2.5%</li> </ul>	<ul style="list-style-type: none"> <li>Physical location</li> <li>Hours available</li> <li>Resource type (generator, demand, import)</li> <li>Capacity bid price</li> <li>Energy strike price</li> <li>EMS/AGC capable (bonus or gets penalized if not capable?)</li> <li>Bid location in zonal model (if different from physical location, Tx must be “reserved by paying diff. between LMP @ pt. of injection and LMP @ pt. of withdrawal or have CTR or FTO that would permit hedging of charges). Need to determine whether this service is provided through self-tracking or self-provision. Not applicable if IOS is provided to RTO West for communal use, then supplier and buyer gets paid/pay respectively at LMP prices.</li> </ul>

**NOTE: Although many of the technical requirements and bid characteristics are described in the context of generation, demand side resources are not precluded from participating if the technical requirements for the IOS are met.**

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<p><b>C.3. Load Following Down</b></p> <ul style="list-style-type: none"> <li>• Load Following Down Service is the provision of generation, export or demand-side resources that RTO West can use on a minute-by-minute basis in real time in response to net decreases in demand or increases in generation in the RTO West Control Area.</li> <li>• Service to be provided on zonal basis? If so, can you bid into another zone?</li> <li>• SC can self-track, self-provide, buy from RTO West</li> </ul>	<ul style="list-style-type: none"> <li>◆ Resource must be capable of following minute by minute dispatch instruction from RTO West</li> <li>◆ Telecommunications link (control or voice)</li> <li>◆ Generator minimum ramp down rate: xxMW/min from base line to specified maximum output until the next scheduling period commence</li> <li>◆ Demand minimum ramp up rate: zzMW<sub>avg</sub>/min from base line to specified minimum demand until the next scheduling period commence</li> <li>◆ Metering requirement: MW, MWhr, accuracy ±2.5%</li> </ul>	<ul style="list-style-type: none"> <li>◆ Physical location</li> <li>◆ Hours available</li> <li>◆ Resource type (generator, demand, export)</li> <li>◆ Capacity bid price</li> <li>◆ Energy strike price? Decremental bid – what will this look like?</li> <li>◆ Resource with symmetrical ramp up and ramp down capability over its load following range (bonus if able to do both load follow up and down?)</li> <li>◆ EMS/AGC capable (bonus or gets penalized if not capable?)</li> <li>◆ Bid location (if different from physical location, Tx must be “reserved by paying diff. between LMP @ pt. of injection and LMP @ pt. of withdrawal or have CTR or FTO that would permit hedging of charges). Need to determine whether this service is provided through self-tracking or self-provision. Not applicable if IOS is provided to RTO West for communal use, then supplier and buyer gets paid/pay respectively at LMP prices.</li> </ul>
<p><b>C.4. Spinning Reserve</b></p> <ul style="list-style-type: none"> <li>• Spinning Reserve Service is the provision of unloaded generation or import resource synchronized to the system that RTO West can use in real time in response to loss-of-resource contingencies in the RTO West Control Area.</li> <li>• RTO West will determine location and adequacy in the DA market</li> <li>• SC can self-provide, buy from RTO West</li> </ul>	<ul style="list-style-type: none"> <li>◆ Generator connected and synchronized to the Grid with xxMW unloaded capacity that can respond fully within 10 minutes to a resource loss contingency</li> <li>◆ Load Demand that can be reduced fully within 10 minutes to a resource loss contingency</li> <li>◆ Resource must be capable of maintaining its post contingency capability for the lesser of (i) the remainder of the operating hour, or (ii) the remainder of the hours available as specified in the bid</li> <li>◆ Must be able to follow RTO West dispatch</li> </ul>	<ul style="list-style-type: none"> <li>◆ Physical location – Bid at node/zone.</li> <li>◆ Hours available</li> <li>◆ Resource type (generator, demand, import)</li> <li>◆ Start up, no load, minimum runtime</li> <li>◆ Capacity bid</li> <li>◆ Energy strike price or price taker?</li> <li>◆ Surplus Regulation and Load Following Up capability may be used to satisfy RTO West Spinning Reserve requirement</li> <li>◆ Generator bidding spinning reserve with AGC capability will get a premium of xx% above MCP (xx% could be close to SSCD charges)</li> </ul>

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	<p>instruction immediately after a contingency</p> <ul style="list-style-type: none"> <li>◆ Regulation and Load Following Up may be used temporarily to satisfy Spinning Reserve</li> <li>◆ RTO West may impose location and minimum quantity requirement for Spinning Reserve</li> <li>◆ Metering req't: MW, MWhr, accuracy <math>\pm 2.5\%</math></li> <li>◆ How might reserve sharing work within RTO West? (are the reserve being shared by virtue of having a single stack of reserves?)</li> </ul>	<ul style="list-style-type: none"> <li>◆ Bid location (if different from physical location, Tx must be "reserved by paying diff. between LMP @ pt. of injection and LMP @ pt. of withdrawal )- probably not applicable if used for communal need and not for specific contingency</li> </ul>
<p><b>C.5. Non-Spinning Reserve</b></p> <ul style="list-style-type: none"> <li>• Non-Spinning Reserve Service is the provision of unloaded generation or import resources that may or may not be synchronized prior to dispatch, or a demand-side resource that RTO West can use in real time in response to loss-of-resource contingencies in the RTO West Control Area.</li> <li>• RTO West will determine location and adequacy in the DA market</li> <li>• SC can self-provide, buy from RTO West</li> </ul>	<ul style="list-style-type: none"> <li>◆ Generator must be able to be started, synchronized to the Grid and ramped up to its specified capacity within 10 minutes of a resource loss contingency and maintained at that level for the lesser of (i) the remainder of the operating hour, or (ii) the remainder of the hours available as specified in the bid</li> <li>◆ Load Demand providing this service must be immediately dispatchable by RTO West and load reduction fully implemented within 10 minutes and maintained for the lesser of (i) the remainder of the operating hour, or (ii) the remainder of the hours available as specified in the bid</li> <li>◆ Spinning reserve can also be used to satisfy non-spinning reserve requirement</li> <li>◆ RTO West may impose location and minimum quantity requirement for Spinning Reserve</li> <li>◆ Metering requirement: MW, MWhr, accuracy <math>\pm 2.5\%</math></li> <li>◆ Indication and telemetry</li> <li>◆ How might reserve sharing work within RTO West?</li> </ul>	<ul style="list-style-type: none"> <li>◆ Physical location – Bid at node/zone.</li> <li>◆ Hours available</li> <li>◆ Resource type (generator, demand, import)</li> <li>◆ Capacity bid</li> <li>◆ Energy strike price or price taker?</li> <li>◆ Surplus Spinning Reserve may be used to satisfy RTO West Non-Spinning Reserve requirement</li> <li>◆ Generator bidding spinning reserve with AGC capability will get a premium of xx% above MCP (xx% could be close to SSCD charges)</li> <li>◆ Bid location (if different from physical location, Tx must be "reserved by paying diff. between LMP @ pt. of injection and LMP @ pt. of withdrawal ) probably not applicable if used for communal need and not for specific contingency</li> </ul>

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<p><b>C.6. Replacement Reserve</b></p> <ul style="list-style-type: none"> <li>Replacement Reserve Service is the provision of an unloaded generation or import resource that may or may not be synchronized prior to dispatch or a demand-side resource that RTO West can use within a 60-minute period in order to maintain adequate reserves in the RTO West Control Area.</li> <li>RTO West will determine location and adequacy in the DA market (or HA market?)</li> </ul>	<ul style="list-style-type: none"> <li>Generator must be available and can be dispatched by RTO West within 60 minutes to satisfy reserve requirement</li> <li>Once ramped to its bid capacity, generator must be capable of sustaining output at the bid capacity level for the remainder of the hours available as specified in the bid</li> <li>Import (ex-RTO) must have transmission (or does not contribute to more congestion)</li> <li>Metering requirement: MW, MWhr, accuracy <math>\pm 2.5\%</math></li> </ul>	<ul style="list-style-type: none"> <li>Physical location</li> <li>Hours available</li> <li>Resource type (generator, import)</li> <li>Capacity bid may be priced as spin and non-spin?</li> <li>Energy strike price or price taker?</li> <li>Minimum startup and run time cost (especially for thermal generation)</li> <li>Bid location (if different from physical location, Tx must be “reserved by paying diff. between LMP @ pt. of injection and LMP @ pt. of withdrawal )</li> </ul>
<p><b>C.7. Congestion Redispatch</b></p> <ul style="list-style-type: none"> <li>Congestion Redispatch Service is the provision of generation, import/export or demand-side resources whose schedules can be readjusted by RTO West as a part of congestion management during the RTO West Day-Ahead Scheduling Process and the RTO West Schedule Adjustment Process in order to eliminate transmission congestion on the RTO West Transmission System prior to real time.</li> <li>Location Specific – How does this relate to the Reliability Commitment Process being developed by Market Operation?</li> </ul>	<ul style="list-style-type: none"> <li>Must be dispatchable by RTO West in RT. Curtailable load must be dispatchable by RTO West</li> <li>Metering requirement: MW, MWhr, accuracy <math>\pm 2.5\%</math></li> </ul>	<ul style="list-style-type: none"> <li>Location</li> <li>Hours available</li> <li>Resource type (generator, demand, import/export)</li> <li>Energy strike price? (Inc/Dec pricing from Generator and Load Demand?)</li> <li>RMR</li> </ul>

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<p><b>C.8. Supplemental Energy</b></p> <ul style="list-style-type: none"> <li>Supplemental Energy Service is the provision of dispatchable energy from generation, imports or demand-side resources that RTO West can use in conjunction with other Interconnected Operations Services to provide Balancing Energy Service or eliminate congestion on the RTO West Transmission System in real time.</li> <li>Day Ahead or Real Time?</li> </ul>	<ul style="list-style-type: none"> <li>Must be dispatchable in RT for the Balancing Energy market or to relief congestion. Is this passive (SC responds to LMP prices) or interactive (under RTO West direction) dispatch?</li> <li>No technical requirement except can respond to RTO West dispatch</li> <li>Metering requirement: MW, MWhr, accuracy <math>\pm 2.5\%</math></li> </ul>	<ul style="list-style-type: none"> <li>Location</li> <li>Hours available</li> <li>Resource type (generator, demand, import)</li> <li>Energy strike price.</li> <li>Minimum startup and run time cost (especially for thermal generation)</li> </ul>
<p><b>C.9. Balancing Energy</b></p>	<p><i>NOT an IOS according to RTO West</i></p>	
<p><b>C.10. Voltage Support</b></p> <ul style="list-style-type: none"> <li>Voltage Support Service is the provision of generation or other resources that are capable of delivering or absorbing reactive power that RTO West can use for the purpose of maintaining transmission system voltages within acceptable limits throughout the RTO West Transmission System.</li> <li>Location Specific</li> </ul>	<ul style="list-style-type: none"> <li>Generator providing this service must be capable of operating at 0.95 leading (under-excited) and 0.90 lagging (over-excited) power factor</li> <li>Synchronous condenser must be able to supply xx Mvar leading and zz Mvar lagging continuously</li> <li>Generator and S/C must also be able to respond dynamically within a specified range and time.</li> <li>AVR must be in service. (Note that there may be additional requirements for LDC or Joint Var Control if RTO West subscribe to these.)</li> <li>RTO West will require the ability to dispatch these generators outside the normal leading/lagging range in order to satisfy voltage stability criteria.</li> <li>Static Vars, SVC, LTC control (some of these may be included as part of Generation or Load or PTO facilities)</li> <li>Metering requirement: Voltage, Var, accuracy <math>\pm 2.5\%</math></li> </ul>	<ul style="list-style-type: none"> <li>Location (must be within RTO West area)</li> <li>Hours available</li> <li>Long term contract rather than market</li> <li>Substitution suitability</li> <li>Based on embedded cost??</li> <li>Generators directed to operate outside of normal range during system emergencies should get lost opportunity cost for following dispatch (part of NOPR on GIA)</li> <li>Resource with AVR out of service but still capable of providing static Vars will be penalized by yy%.</li> </ul>

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<p><b>C.11. Black Start</b></p> <ul style="list-style-type: none"> <li>• Black Start Service is the provision of generation resources that is capable of self-starting without support from the RTO West Transmission System for use by RTO West to restore the RTO West Transmission System to a secure operating state in the event of a widespread blackout.</li> <li>• Location Specific</li> </ul>	<ul style="list-style-type: none"> <li>◆ Generator must be able to be started without external supply</li> <li>◆ Generator must be capable of energizing transmission Line X and to pick up load L at location Y and is able to maintain minimum voltage and frequency within <math>\pm xx\%</math> and <math>zz\%</math> respectively.</li> <li>◆ The generator must be available at all times and if unattended, it must be able to be started remotely</li> <li>◆ Telecommunications link (control or voice)</li> </ul>	<ul style="list-style-type: none"> <li>◆ Location (must be within RTO West area)</li> <li>◆ Maximum time to energize up to specified location.</li> <li>◆ Time reduction to energize up to specified location will result in a performance bonus of \$-min.</li> <li>◆ Long term contract instead of market</li> <li>◆ Black start tests (payment for X tests per year?)</li> <li>◆ Staff training/certification cost</li> </ul>

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