Energy Storage Participation in RPM

Options Matrix

Number	Design Components[1]	Priority (high/med/low)	Status Quo (Advanced Storage, Storage in PJM Today)	Status Quo (Resources in Capacity Market)	Solution Options[4]								
					A	B	C	D	E	F	G	H	I
1	Must offer requirement in day ahead market	low/medium	N/A (Batteries), Required (Storage)	All resources in Capacity market have a Must Offer Req in Day ahead	As other generation: must offer can be met through DA market, self schedule, or optional hydro optimizer	Self-scheduling	PJM optimization (e.g. pumped hydro)	Standard DA/RT, respecting max run time/max energy limits	same as conventional generation - with dynamic capability to determine cost	must offer req, market must match output req to be cap resource (10 hours)	All Generation resources with capacity commitment (including storage resources) Must offer in day ahead		
2	Minimum continuous electricity time capability	high	No Current Standard, Regulation ;market is hourly; cannot be out for XX mins, or else forfeit bid (Batteries), 10 hours (Storage)	10 Hours	N/A, 330kWh to provide 100kW of UCAP (Proposed as Minimum Energy Capacity)	keep current products - limited, extended summer consistent with shortest duration of current DR products	10 hours	15 mins/shorter than 1 hour	4 hours	6 hours	Sustained output for 10 hours continuous operation each day. Resource must produce its nominal capacity value for each hour of the 10 hour interval. Total storage capability of unit must support ability to provide its nominal capacity for 10 continuous hours. At full storage capability and probable time of PJM peak, resource must demonstrate empirically its ability to maintain the 10 hours capacity based on technical documentation. Value is capped at the CIR level		
3	Minimum continuous electricity production capability	low/medium	Continuous Capability for a certain period, 0.1 MW for existing resources (Batteries and Storage)	Continuous Capability for a certain period, 0.1 MW for existing resources	0.1 MW for existing resources	status quo							
3a	Power to energy ratio		no pre-defined req	no pre-defined req	storage resource must have min power to energy ratio	no requirement							
4	Test requirements	medium	- 1-2 hours based on resource type, Steam 2 hrs, Hydro 1 hr - Qualifying test - Seasonal test - Equivalent to duration		Option A to verify power rating. Once per year, full charge/discharge cycle at rated UCAP to verify MWh.	initial test - CIR, annual/seasonal test qualification test similar to regulation	Perform annual test each summer (consistent with existing rules): Show that you can produce your nominal capacity value for 1 hour						
4A	rating methodology				as other generation	min instantaneous output for duration of test	Based on min hourly output over 10 continuous hours. At full storage capability and probable time of PJM peak, resource must demonstrate empirically its ability to maintain the 10 hours capacity based on technical documentation						
5	Metering requirements	low/medium	As Defined by Regulation market rules; Energy Market in Load Response Manual, LM Outlines in M11(Batteries), As outlined in M14D (storage)	As outlined in M14D	Comply with rules in Manual 14D and 1	Comply with rules in Manual 14D and 1	Based on min hourly output over 10 continuous hours. At full storage capability and probable time of PJM peak, resource must demonstrate empirically its ability to maintain the 10 hours capacity based on technical documentation						
6	How does a PJM Resource make itself available/Method of Availability to PJM	medium	Enter through queue process, Register as part of Markets Database, make themselves available trough eMarket- Traditional generators - daily must offer - DR - have to register prior to delivery year - if EO - 20 mins notice, self schedule	Enter through queue process, Register as part of Markets Database, make themselves available trough eMarket- Traditional generators - daily must offer - DR - have to register prior to delivery year - if EO - 20 mins notice, self schedule	Must offer requirement applies to UCAP. Emergency procedures extend to full ICAP.	energy market must offer obligations	Alignment with the RPM current rules, available unless submitted an edart ticket						
7	Offer parameters	high	N/A (Batteries), See Cap Market (Storage)	mins/max, startup, emergency min/max, price/cost based, cost curve Optimized Pumped Storage units only: 1) Beginning and End of Day Storage levels in MW. (INITIAL MW, FINAL MW) 2) GenMin and PumpMin values, which will be the minimum hourly pumping and generating MW (MIN PUMP MW, MIN GEN MW) 3) Pumping efficiency (PUMP FACTOR). 4) Maximum or minimum storage level constraints (MAX MW, MIN MW) Other parameters for regular resources as well: Start up/ shutdown costs	status quo plus max run time and/or max energy and min charge time when using pumped hydro parameters, make obvious substitutions: pump/generate -> charge/discharge pumping efficiency -> cycle efficiency etc.	status quo plus max run time and/or max energy and min charge time when using pumped hydro parameters, make obvious substitutions: pump/generate -> charge/discharge pumping efficiency -> cycle efficiency etc.	status quo for existing generation						
8	Response and recovery	medium/high	Recovery=Min Down Time; Response=Notification time, max run time	Recovery=Min Down Time; Response=Notification time, max run time	Notification time for RT energy may vary with charge state. Scheduling method in (1) must respect recharge times.	Notification time for RT energy may vary with charge state. Scheduling method in (1) must respect recharge times.	status quo as for existing generation (default parameter to be determined)						

#	Design Component	Priority										
9	Capacity Value: How to determine UCAP	high	N/A (Batteries), See Cap Market (Storage)	- Discount ICAP based on outage rates, e.g., most gen - UCAP is fraction of ICAP, e.g., intermittent resources - Administratively determined, e.g., Energy Efficiency - Inferior product with limited clearing and price separation, e.g., sub-Annual DR.	UCAP is the lesser of energy capacity divided by 3.3 or maximum output power. eFORd applied as for other generation. Treated as generation in RPM auctions	Calculation based on load carrying capability at constant LOLE	ICAP derated by forced outages	actual output over series of peak hours (eg. Wind model)	average hourly output over req cont operation hourly req	ICAP determined by Design Component #2, UCAP calculated the same as all other units (some work required to collect Eford data for storage units, and to establish an advanced energy storage class average Eford)		
10	Applicability: what types of resources rules apply to	medium/high	N/A (Batteries), See Cap Market (Storage)	submit day ahead, schedule, blackstart level, never fully depleted	All interconnected storage devices not covered by current rules	These proposed rules will apply to all Energy Storage Resources						
11	Scheduling method	low/medium			Should be bundled with Design Component #1							
12	Cost Based Offer Cap (Energy)	high			Energy offer cap accounts for cost of purchased energy and cycle losses (e.g., net energy consumption)	Similar to current units, but will need to be determined						
12A	Cost Based Offer Cap (RPM)	high			Similar to current units, but will need to be determined by IMM							
13	Emergency Procedures Obligations	medium			During Min/MaxGen: 1. PJM may dispatch unit to charge/discharge at highest capable level, regardless of capacity obligation. 2. Unit not to discharge/charge except at PJM direction (following regulation signal counts as at PJM direction)	During Min/MaxGen: 1. PJM may dispatch unit to charge/discharge at highest capable level, regardless of capacity obligation. 2. Unit not to discharge/charge except at PJM direction (following regulation signal counts as at PJM direction)	Consistent with rules in M13 Section 6.4					
14	Performance Assessment	high	N/A (Batteries), See Cap Market (Storage)	- Seasonal verification test - EFORd and EFORp performance - DR compliance check - MMV for energy efficiency	EFOR(x) counting only hours when scheduled for energy. Outages forgiven in hours following emergency energy dispatch.	EFOR(x) counting only hours when scheduled for energy. Outages forgiven in hours following emergency energy dispatch.	Summer verification test; EFORd and EFORp performance					
15	Settlements/Penalties	high			As other generators, plus: 1. opportunity costs for transitions and "hold charge" hours included. 2. opportunity costs may be incurred during PJM directed charging as well as discharge. 3. make-whole payments if uneconomically dispatched by PJM (i.e., LMP while charging > efficiency * LMP while discharging)	As other generators, plus: 1. opportunity costs for transitions and "hold charge" hours included. 2. opportunity costs may be incurred during PJM directed charging as well as discharge. 3. make-whole payments if uneconomically dispatched by PJM (i.e., LMP while charging > efficiency * LMP while discharging)	Same as all other RPM Resources					
16	Immature resources/transition mechanisms for determining capacity value	medium/high		Class average values are blended with actual values on a monthly basis to produce EFORd values for future auctions	Class average EFORd determined by review of storage currently in service; may be technology dependent.	Status quo (how we test until class average is determined for any new technology type)						

Directions:

[1]Design Components - each is an "attribute" or "component" of any proposed solution. Consensus of the group should be sought on selection of a set of solution criteria.

[2]Solution Options - each is a solution alternative elicited from the stakeholder group that meet one of the specific solution criteria.

To complete the matrix:

1. Elicit from the stakeholder group a set of components (attributes) desired for any proposed solution. Enter a short label for each in the Design Components column.
2. If needed, enter a more detailed description of each criteria on the "Component Details" tab.
3. Using informal/non-binding voting, rate each component's priority in the final solution as "high/medium/low"
4. Elicit from the stakeholder group potential solution alternative(s) for each component. Enter a short label for each in the Solution Options columns.
5. If needed, enter a more detailed description of each potential solution option on the "Solution Details" tab.
6. Once the matrix is filled out, the group will attempt to select a single solution alternative (column) for each component (row) to form a solution "package".
   Example: cells 1B, 2C, 3A, 4B, 5D could make up a solution package.
7. If consensus is achieved on a single package (Tier 1 decision-making method), this will be documented in a Consensus Proposal Report to the parent committee.
8. If not, the group will identify up to 3 possible solution packages in a comparative Proposal Alternatives Report to the parent committee (Tier 2 decision-making method).