

Energy Storage Participation in RPM

Options Matrix

						Options Matrix				
					Solution Options ²					
		Status Quo (Advanced								
	Design	Storage, Storage in PJM								
									_	
Number	Components ¹	Today)	Status Quo (Resources in Capacity Market)	A	В	C	D	E	F	G H
							Standard	same as	must offer req,	
									**	
							DA/RT,	conventional	market must	
	Must offer						respecting	generation -	match output	
	requirement in			As other generation: must offer can be			max run	with dynamic	req to be cap	
	day ahead	N/A (Batteries), Required	All resources in Capacity market have a Must Offer	met through DA market, self schedule, or		PJM optimization (e.g.	time/max	capability to	resource (10	
1	market	(Storage)			Self-scheduling	pumped hydro)		determine cost	,	
!	market	(Storage)	Ned in Day anead	optional hydro optimizer	Jen-scriedding	,	energy infine	determine cost	riours)	
						keep current products -				
		No Current Standard,				limited, extended				
	Minimum	Regulation ;market is hourly;				summer				
	continuous	cannot be out for XX mins,				consistent with shortest		15		
		or else forfeit bid (Batteries),		N/A, 330kWh to provide 100kW of UCAP		duration of current DR		mins/shorter		
2	The state of the s		10 Hours		14 hours		10 hours		4 hours	6 hours
	capability	10 hours (Storage)	10 Hours	(Proposed as Minimum Energy Capacity)	1 hour	products	10 hours	than 1 hour	4 hours	6 hours
	Minimum									
	continuous	Continuous Capability for a								
	electricity	certain period, 0.1 MW for								
			Continuous Capability for a certain period, 0.1 MW for							
3		and Storage)		100kW	atatua aua					
3	сараршцу	and Storage)		TOURVV	status quo					
			- 1-2 hours based on resource type, Steam 2 hrs,							
			Hydro 1 hr							
			- Qualifying test	Option A to verify power rating.						
	Test		- Seasonal test	Once per year, full charge/discharge cycle	initial test - CIR annual/seasonal test					
1	requirements		- Equivalent to duration		qualification test similar to regulation					
4			- Equivalent to duration	at fated OCAF to verify www.	qualification test similar to regulation					
	rating									
4A	methodology			as other generation	min instantaneous output for duration of test					
		As Defined by Regulation								
		market rules; Energy Market								
		in Load Response Manual,								
		LM Outlines in								
		M11(Batteries), As outlined								
5	requirements	in M14D (storage)	As outlined in M14D	Comply with rules in Manual 14D and 1	Comply with rules in Manual 14D and 1					
		Enter through queue								
		process, Register as part of								
		Markets Database, make								
		themselves available trough								
	How does a PJM	eMarket- Traditional								
			Enter through queue process, Register as part of							
			Markets Database, make themselves available trough							
	available/Method			Must offer requirement applies to UCAP.						
	of Availability to			Emergency procedures extend to full						
	6 PJM	schedule			energy market must offer obligations					
			1		, , , , , , , , , , , , , , , , , , ,					

			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	status quo plus max run time and/or max	status quo plus max run time and/or max energy and min				
				energy and min charge time	charge time				
			3) Pumping efficiency (PUMP FACTOR).	l chargy and min onargo time	onargo umo				
			4) Maximum or minimum storage level constraints	when using pumped hydro parameters,	when using pumped hydro parameters, make obvious				
			(MAX MW, MIN MW)	make obvious substitutions:	substitutions:				
			(IVIAA IVIVV, IVIIIN IVIVV)						
			0(1	pump/generate -> charge/discharge	pump/generate -> charge/discharge				
		NI/A (Batta day) Octobria	Other parameters for regular resources as well:	pumping efficiency -> cycle efficiency	pumping efficiency -> cycle efficiency				
		N/A (Batteries), See Cap	Start up/ shutdown costs	etc.	etc.				
7	Offer parameters								
	_	Recovery=Min Down Time;		Notification time for RT energy may vary					
	Response and	Response=Notification time,		with charge state. Scheduling method in	Notification time for RT energy may vary with charge state.				
	8 recovery	max run time	time, max run time	(1) must respect recharge times.	Scheduling method in (1) must respect recharge times.				
			- Discount ICAP based on outage rates, e.g., most						
			gen				actual		
			- UCAP is fraction of ICAP, e.g., intermittent				output over	average hourly	
			resources	UCAP is the lesser of energy capacity			series of	output over	
	Capacity Value:			divided by 3.3 or maximum output power.			peak hours	req cont	
		N/A (Batteries), See Cap	- Inferior product with limited clearing and price	eFORd applied as for other generation.		ICAP derated by forced		operation .	
9	UCAP	Market (Storage)	separation, e.g., sub-Annual DR.	Treated as generation in RPM auctions	Calculation based on load carrying capability at constant LOLE		model)	hourly req	
	Applicability: what				, , ,	- v	,	, ,	
	types of		submit day ahead, schedule, blackstart level, never						
	resources rules	N/A (Batteries), See Cap	fully depleted		All interconnected storage devices not covered by current				
	10 apply to	Market (Storage)		Option A	rules				
	Scheduling	mainter (Grenage)			1.4.00				
11	method			Option A	As specified in (1)				
				Energy offer cap accounts for cost of					
	Cost Based Offer			purchased energy and cycle losses (e.g.,					
	12 Cap (Energy)			net energy consumption)					
	Cost Based Offer			l					
12A	Cap (RPM)								
127	Cap (iti iii)			During Min/MaxGen:					
					During Min/MaxGen:				
	Emergency								
	Procedure								
13	Procedures Obligations		- Seasonal verification test	,	(Tollowing regulation signal counts as at Folyl direction)				
13	Obligations		I OCOSOLICI VELITICATOTI TEST		FFOD(x) counting only because when coheduled for energy				
13				scheduled for energy Outages forgiven in					
13	Obligations	N/A (Ratteriae), See Con	- EFORd and EFORp performance	scheduled for energy. Outages forgiven in	EFOR(x) counting only hours when scheduled for energy.				
13	Obligations Performance	N/A (Batteries), See Cap	- EFORd and EFORp performance - DR compliance check	hours following emergency energy	Outages forgiven in hours following emergency energy				
13	Obligations	N/A (Batteries), See Cap Market (Storage)	- EFORd and EFORp performance	hours following emergency energy dispatch.					
13	Obligations Performance		- EFORd and EFORp performance - DR compliance check	hours following emergency energy dispatch. As other generators, plus:	Outages forgiven in hours following emergency energy				
13	Obligations Performance		- EFORd and EFORp performance - DR compliance check	hours following emergency energy dispatch. As other generators, plus: 1. opportunity costs for transitions and	Outages forgiven in hours following emergency energy				
13	Obligations Performance		- EFORd and EFORp performance - DR compliance check	hours following emergency energy dispatch. As other generators, plus: 1. opportunity costs for transitions and "hold charge" hours included.	Outages forgiven in hours following emergency energy dispatch.				
13	Obligations Performance		- EFORd and EFORp performance - DR compliance check - MMV for energy efficiency	hours following emergency energy dispatch. As other generators, plus: 1. opportunity costs for transitions and "hold charge" hours included. 2. opportunity costs may be incurred	Outages forgiven in hours following emergency energy dispatch. As other generators, plus:				
13	Obligations Performance		- EFORd and EFORp performance - DR compliance check - MMV for energy efficiency	hours following emergency energy dispatch. 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	Outages forgiven in hours following emergency energy dispatch. As other generators, plus: 1. opportunity costs for transitions and "hold charge" hours				
13	Obligations Performance		- EFORd and EFORp performance - DR compliance check - MMV for energy efficiency	hours following emergency energy dispatch. 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.	Outages forgiven in hours following emergency energy dispatch. As other generators, plus: 1. opportunity costs for transitions and "hold charge" hours included.				
13	Obligations Performance		- EFORd and EFORp performance - DR compliance check - MMV for energy efficiency	hours following emergency energy dispatch. 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	Outages forgiven in hours following emergency energy dispatch. As other generators, plus: 1. opportunity costs for transitions and "hold charge" hours included. 2. opportunity costs may be incurred during PJM directed				
13	Obligations Performance 14 Assessment		- EFORd and EFORp performance - DR compliance check - MMV for energy efficiency	hours following emergency energy dispatch. 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.,	Outages forgiven in hours following emergency energy dispatch. 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.				
13	Obligations Performance		- EFORd and EFORp performance - DR compliance check - MMV for energy efficiency	hours following emergency energy dispatch. 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	Outages forgiven in hours following emergency energy dispatch. As other generators, plus: 1. opportunity costs for transitions and "hold charge" hours included. 2. opportunity costs may be incurred during PJM directed				
	Emergency			PJM may dispatch unit to charge/discharge at highest capable level, regardless of capacity obligation. Unit not to discharge/charge except at PJM direction (following regulation signal counts as at PJM direction) EFOR(x) counting only hours when	PJM may dispatch unit to charge/discharge at highest capable level, regardless of capacity obligation. Unit not to discharge/charge except at PJM direction (following regulation signal counts as at PJM direction)				

Immature		
resources/transiti		
on mechanisms	Class average values are blended with actual values	Class average EFORd determined by
for determining	on a monthly basis to produce EFORd values for	review of storage currently in service; may
16 capacity value	future auctions	be technology dependent.

Directions:

¹Design 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.

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).

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