



Education for Capacity Compliance DR and PRD

DRS

Pete Langbein

9/2/22



DR/PRD Compliance construct for Weather Sensitive Load

- Focus: Explore alternative FSL capacity compliance M&V for weather sensitive load for DR/PRD
 - [Problem Statement](#)
 - [Issue Charge](#)
- Out of Scope: Use of PLC to determine amount of DR nominations and associated load reductions

Committee	Activity	Notes	Sep-2022	Oct-2022	Nov-2022	Dec-2022	Jan-2023	Feb-2023	Mar-2023	Apr-2023	May-2023	Jun-2023	Jul-2023	Aug-2023	Sep-2023	Oct-2023	Nov-2023
DRS	Education		■														
	Interest, matrix and solutions				■	■	■	■									
MIC	First Read							■									
	Endorsement								■								
MRC	First Read (tariff/manual language)									■							
	Endorsement										■						
MC	Endorsement											■					
FERC Filing														■			
FERC Order																■	



- **Prior related stakeholder efforts**
- Terms and concepts
- Capacity Nomination
- Compliance & Add back calculations

- LMTF>MIC>MRC>MC (2009 to ~2012)
 - Fix double counting problem – “You can only sell what you own”.
 - PLC reflects amount of capacity allocated to customer and therefore it is used as reference point for nominations (capacity accreditation/ICAP), load reductions and addbacks.
 - Customer can reduce PLC (“peak shave”) to reduce retail capacity cost or commit to DR in the wholesale market
 - You can’t do both for the same MW
 - Participation and associated addbacks should not result in capacity allocation higher than if they did not participate.
 - Customer receives energy revenue based on real time energy load reduction (PLC is not used in this process)
 - Energy load reduction is measured differently than capacity load reduction
 - Extensive stakeholder effort and FERC filings
 - Contentious issue where FERC order approved PJM endorsed changes

- MIC (~2016)
 - Problem Statement by CSP to use PRD adjusted MESL (aka FSL) for DR
 - PRD adjusted MESL effectively increased the FSL value when weather is hotter than the weather normalized (50/50) load forecast. Said another way, load does not need to get to FSL value on really hot days, just need to get to higher FSL value.
 - PJM indicated this would lead to reliability issues (resource adequacy issue) and is also inconsistent with prior FERC order
 - Problem Statement withdrawn

- service level adjustment factor = higher of 1.0 or $(\text{actual zonal load} - \text{actual total PRD load in zone}) / (\text{Final Zonal Peak Load Forecast-final total Zonal Expected Peak Load Value of PRD in Zone meeting the price conditions specified for compliance})$, where:
 - Actual zonal load is equal to the actual zonal hourly metered load during an emergency event.
 - Actual total PRD load in zone is the hourly integrated metered load during an emergency event for all end-use customers' registered to meet a PRD commitment for RPM or FRR Alternative and subject to compliance.

- DRS>MIC>MRC>MC (2015 to ~ 2020)
 - Make load reductions for DR/PRD required on an annual basis because of Capacity Performance requirement.
 - PLC is only based on summer values so does not reflect load reductions in the winter
 - Use Winter Peak Load (WPL) to determine winter load reductions
 - FERC approved DR changes but rejected PRD change because of WPL requirement to measure winter load reductions
 - Change PRD to be consistent with DR during the summer (effective for 22/23 DY)
 - Eliminated adjusted MESL and use FSL approach
 - FERC approved



- Prior related stakeholder efforts
- **Terms and concepts**
- Capacity Nomination
- Compliance & Add back calculations

- DR (summer months) and PRD capacity compliance are done the same.
- Capacity Nomination = Ucap value (capacity accreditation) for a customer for the DY. Summer is based on PLC and Winter is based on WPL
 - PLC – (FSL*loss factor).
 - If customer peak shaves PLC to 0 then they cannot nominate any capacity in the summer since the customer is not responsible for any capacity
- Firm Service Level – FSL, load needs to be at or below this value during an event or test.
- Nomination method = Load Reduction method = Add back method. This ensure nomination through addback are aligned and fixes prior issues
- Load Reduction (Capacity) – PLC – (load*loss factor)
- Load Reduction (Energy) – (Forecast Energy (CBL) – load) * loss factor

- Add Back = load reduction used to measure compliance. Load reductions are added back to the load data to develop the unrestricted peak load forecast.
- Load Forecast – 50/50 load forecast
- Unrestricted peak load forecast – RTO/zonal forecasted load assuming no future DR/PRD. This is used to determine the reliability requirement for RPM auction or FRR plan.
- FPR – forecast pool requirement – $(1+IRM)*(1- \text{PJM avg EFORd})$. This is effectively UCAP adjusted reserve requirement converted to a factor that can be applied to the load forecast. IRM is in ICAP, FPR is in UCAP.
- IRM – installed reserve margin – amount of reserves required to cover load increase from weather or generator forced outages. This is derived from 1 n 10 resource adequacy standard.

- PJM market rules explicitly limit amount of capacity that each customer may provide to market based on amount of capacity that was purchased for them.
 - This is based on “You can only sell what you own” principle.
- Capacity compliance issue only - Customer may reduce load and therefore avoid purchase of capacity AND use same load reduction to allow CSP to offset resources that do not perform when PJM needs for reliability (during an emergency).
 - Some DR customer loads have been significantly higher than capacity procured for such customers.
- All real time energy reductions are paid for full real time energy load reductions under emergency compensation provisions
 - Higher of strike price plus shutdown costs or LMP



- Prior related stakeholder efforts
- Terms and concepts
- **Capacity Nomination**
- Compliance & Add back calculations



CP nomination process - based on lower of Summer and Winter Nominated Quantities, as measured at the RPM Resource Level

- CSP determines Summer and Winter nominated capacity MWs with summer vs winter FSL
 - Annual nomination for the RPM Resource is the lessor of:
 - Sum of Summer nominated capacity of each registration with same RPM Resource
 - $\text{Registration summer nominated capacity} = \text{PLC} - [\text{FSL}(\text{summer}) * \text{line loss factor}]$
 - Sum of Winter nominated capacity of each registration with same RPM Resource
 - $\text{Registration winter nominated capacity} = \{\text{Winter Peak Load} * \text{Winter Weather Adjustment Factor} - \text{FSL}(\text{winter})\} * \text{line loss factor}$
 - Summer-Period nomination for the RPM Resource is Sum of Summer nominated capacity of each registration with same RPM Resource
 - Capacity nomination for aggregate registration is based on sum of location PLC and sum of WPL
- CSP must request and receive PLC (Peak Load Contribution) from EDC to register each location
 - EDC typically requires Letter of Authorization (“LOA”) from customer to allow EDC to distribute PLC information to the CSP

CSP should not estimate or calculate the PLC. The PLC is determined by the EDC

- Customer Winter Peak Load
 - PJM publishes winter 5 CP days (Dec/Jan/Feb)
 - CSP uploads meter data for the 5 CP days for Delivery Year - 2
 - DR Hub calculates Customer Winter Peak Load = customer's average peak demand on PJM Winter 5 CP days from 6am through 9pm (CP availability window)
 - Up to 2 days can be excluded for low usage to ensure WPL reflects typical Winter Peak Load
- Winter Weather Adjustment Factor (zonal WWAF)
 - Zonal Weather Normalized Winter Peak / Zonal Average of 5 CP Loads in Winter
 - PJM calculates and applies during capacity nomination on the registration

[Winter 5CPs and WWAF by zone: https://pjm.com/-/media/markets-ops/demand-response/2018-2019-winter-peaks-and-5cps.ashx?la=en](https://pjm.com/-/media/markets-ops/demand-response/2018-2019-winter-peaks-and-5cps.ashx?la=en)



CP DR Example (nomination)

DR Resource with Customer Registrations shown below

Assume this case where only 1 registration (below) is linked to RPM resource

RPM resource may have up to 17 CP annual and additional 5 MW Summer Period DR commitment without penalty.

		1	2	(3) = (1) - (2)	(4)	(5)	(6) = (4) * (5)	7	8 = (4) - (7)	9 = Min (3 & 8)
Location #	Customer Load Profile	Summer PLC (MW)	Summer FSL (MW)	Summer Nominated DR Value (MW)	Winter Peak Load (MW)	Winter Weather Adjustment Factor	Weather Adjusted Winter Peak Load (MW)	Winter FSL (MW)	Winter Nominated DR Value (MW)	Annual Nominated DR Value (MW)
1	Winter load lower than summer load	10	5	5	8	1.05	8.4	5	3.4	
2	Winter load higher than summer load	10	5	5	12	1.05	12.6	5	7.6	
3	Winter load equal to summer load	10	5	5	10	1.05	10.5	5.5	5	
4	Summer only DR (A/C Cycling)	10	4	6	6	1.05	6.3	6.3	0	
5	Winter only DR (Ski Load)	1	0	1	12	1.05	12.6	11.6	1	
Registration		41	19	22			50.4	33.4	17	17
Column										
1	Summer PLC based on the current process									
4	Winter Peak Load = customer peak on 5 winter CP days from HE7 through HE21 (Capacity Performance DR availability requirement) for Dec/Jan/Feb									
5	Winter Weather Adjustment Factor published and applied by PJM = Weather Normalized Winter Peak/Actual Winter Peak									
9	Annual Nominated DR Value based on registered nominated amount									

Additional Notes

Capacity Reduction will be used for Add Back in Summer and Non-summer periods
Winter Peak Load is adjusted up for transmission and distribution line loss factor
Winter load reductions may not exceed Winter Peak Load.
Load has already been grossed up for losses



Calculating Load Management Revenue - Example

Type	A PLC (MW)	B WPL*WWAF (MW)	C Summer Managed Load (MW)	D Winter Managed Load (MW)	E Capacity Loss Factor	F Nominated ICAP (MW)	G FPR	H Nominated UCAP (MW)
FSL (CP)	30	20	10	3	1.0634	18.078	1.0809	19.540
						CP: $F = \min(A - (C * E), (B - D) * E)$		$H = F * G$
GLD (CP)	30	20	20	10	1.0634	10.634	1.0809	11.494
						CP: $F = \min(\min(A, C * E), \min(B * E, D * E))$		$H = F * G$

Type	Total Nominated UCAP (MW)	Resource Clearing Price (\$/MW-day)	Days/year	Annual Revenue
CP	31.035	\$ 125.00	365	\$ 1,415,952.92

See PJM Web for appropriate Planning Year Parameter

Market Price for DR is the clearing price from the auction in which the DR cleared



- Prior related stakeholder efforts
- Terms and concepts
- Capacity Nomination
- **Compliance & Add back calculations**



Measurement of Actual Load Reduction for Registration

PAI occurs during:	Actual Load Reduction (MW) = Add Back =	
	FSL Customer	GLD Customer
June-October & May of DY	$PLC - [\text{hourly metered load} * \text{loss factor}]$	Lessor of (a) $[\text{Comparison load} - \text{hourly metered load}] * \text{loss factor}$ or (b) $PLC - [\text{hourly metered load} * \text{loss factor}]$ <i>Summer load reduction only recognized if $[\text{hourly metered load} * \text{loss factor}] < PLC$</i>
November – April of DY	$[\text{Winter Peak Load} * \text{Zonal Winter Weather Adjustment Factor} * \text{loss factor}] - [\text{hourly metered load} * \text{loss factor}]$	Lessor of (a) $[\text{Comparison load} - \text{hourly metered load}] * \text{loss factor}$ or (b) $[\text{Winter Peak Load} * \text{Zonal Winter Weather Adjustment Factor} * \text{loss factor}] - [\text{hourly metered load} * \text{loss factor}]$ <i>Non-summer load reduction only recognized if $[\text{hourly metered load} * \text{loss factor}] < \text{Winter Peak Load} * \text{Zonal Winter Weather Adjustment Factor} * \text{loss factor}$</i>

Note: 24 hours of load data must be provided for event and test day. If 5 minute load data is available, it will be used for calculations

- Multiple options are available - the method used should result in the best possible estimate of what load would have occurred in the absence of an emergency or test event
- The CSP will be responsible for supplying all necessary load data to PJM in order to calculate the load reduction for each registered end use customer. The amount of load data required will depend on the GLD method selected where the minimum amount shall be 24 hours for one full calendar day

- Comparable Day (GLD-Compare Day): The customer's actual hourly loads on one of the prior 10 calendar days before the test or emergency event day selected by the CSP which best represents what the load level would have been absent the emergency or test event. The CSP may request use of an alternative day for extenuating circumstances with supporting documentation that clarifies why the alternative day should be utilized. PJM must approve the use of any alternative day. CSP must provide usage data for all 10 days such that PJM may validate an appropriate day was selected
- Same Day- Before/After Event (GLD-SameDay): The customer's average hourly integrated consumption for two full hours prior to notification of an emergency event or prior to one full hour before a test and for two full hours after skipping first full hour after the event or test. This option is appropriate for high load factor customers with no weather sensitivity

- Customer Baseline (GLD-Similar Day): The Customer's estimated baseline used to calculate load drops for PJM economic demand resources as defined on the applicable PJM economic registration
- Regression Analysis (GLD-Regression): The customer's estimated hourly loads from a regression analysis of the customer's actual loads versus weather. This option is appropriate for customers with significant weather sensitivity. The CSP will perform the regression analysis and provide results including supporting information to PJM. The information should include all load and weather data and associated regression statistics used to estimate the load impact on the event or test day
- Generation (GLD-Generation): The hourly integrated output from a generator used to provide Guaranteed Load Drop. This method may only be utilized if the generation would not have otherwise been deployed on the emergency event or test day and must comply with the provisions contained in the PJM Manuals

Add Back – Definition and Administrative Process

- For the months of June, July, August and September PJM calculates account specific load reductions for Load Management Events, Load Management Test Events and economic dispatches made by locations in the Load Management program. EDCs can use the customer-specific reduction data in their PLC (Peak Load Contribution) determination processes for the next Delivery Year by “adding back” the reduction value to the meter data
- Process
 - Emergency Event/Test Event/Economic Events
 - CSP submits customer specific load data by the respective due dates
 - PJM calculates add backs
 - PJM posts customer specific add backs for 5 CP hours in DRHub for downloading by the CSP, EDC and LSE (mid-November)
 - EDC downloads add backs for customer specific PLC determination which is due by 1/1

- Load Drop used to determine capacity compliance; also determines add back
- Firm Service Level:
 - $PLC - (Load * LF)$
- Guaranteed Load Drop or Economic Load Reduction (where applicable):
 - Lessor of $\{(CBL - Load) * LF, PLC - (Load * LF)\}$
- Small Generator (customer $PLC < 0.5MW$) where load interval metering is not installed
 - Generation output

Presenter:
[Pete Langbein,
peter.langbein@pjm.com]

**[Proposal to Consolidate DRS and DIRS
into one Subcommittee]**



Member Hotline

(610) 666 – 8980

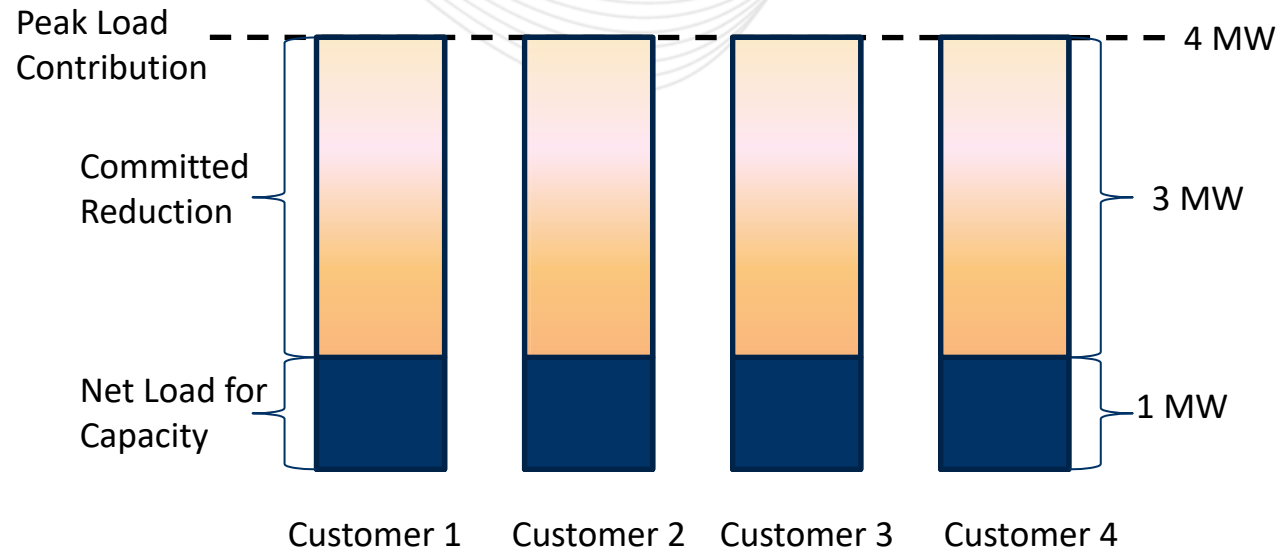
(866) 400 – 8980

custsvc@pjm.com

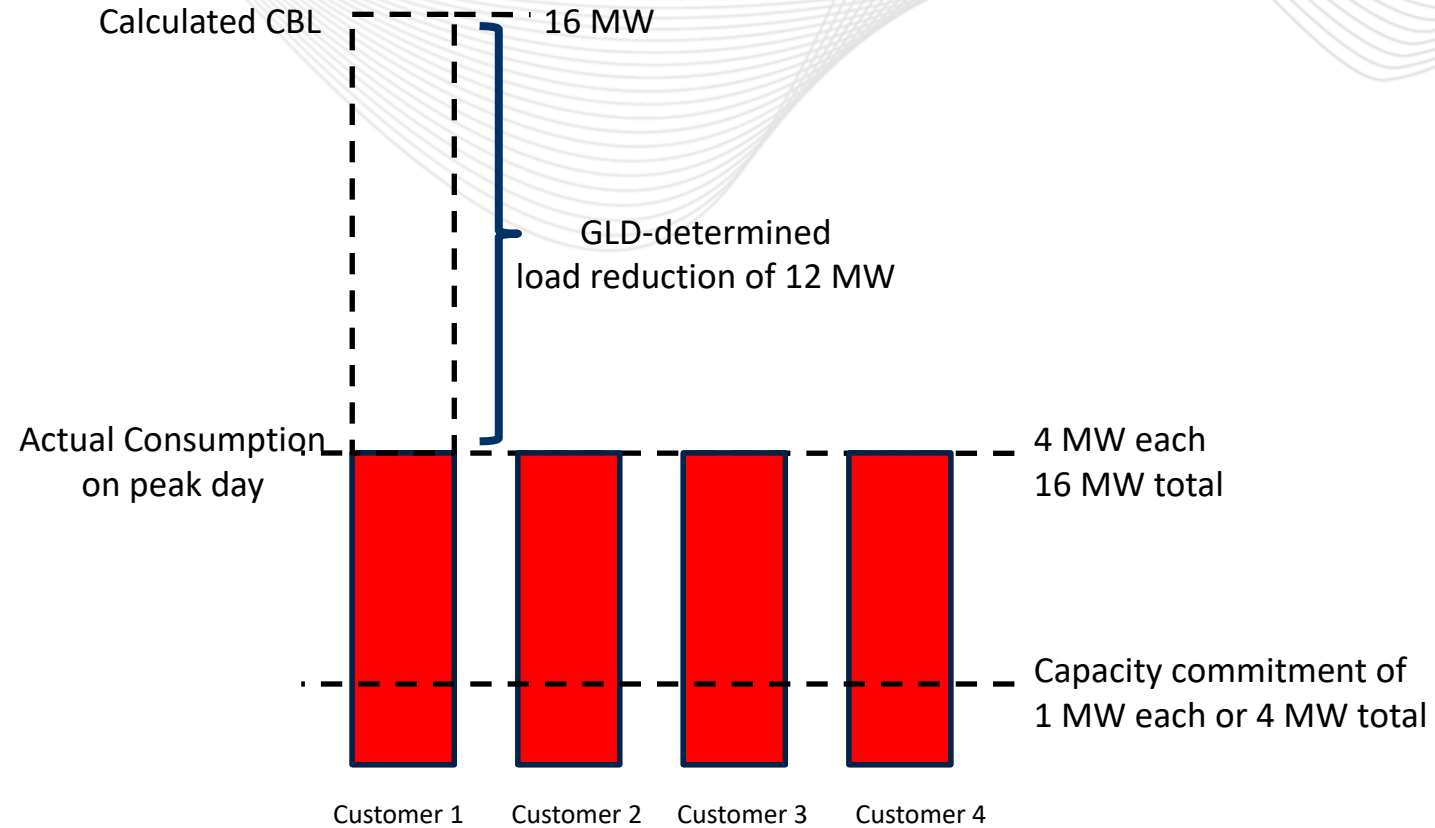
- Double Counting examples from prior stakeholder discussion

- PJM market rules explicitly limit amount of capacity that each customer may provide to market based on amount of capacity that was purchased for them to ensure reliability.
 - This allow each customer to potentially hedge their specific capacity requirements.
- Capacity compliance issue only - Customer may reduce load and therefore avoid purchase of capacity AND use same load reduction to allow CSP to offset resources that do not perform when PJM needs for reliability (during an emergency).
 - Some DR customer loads have been significantly higher than capacity procured for such customers during emergency and test conditions.
- All real time energy reductions are paid for full real time energy load reductions under emergency compensation provisions
 - Higher of strike price plus shutdown costs or LMP

Simple Example of issue

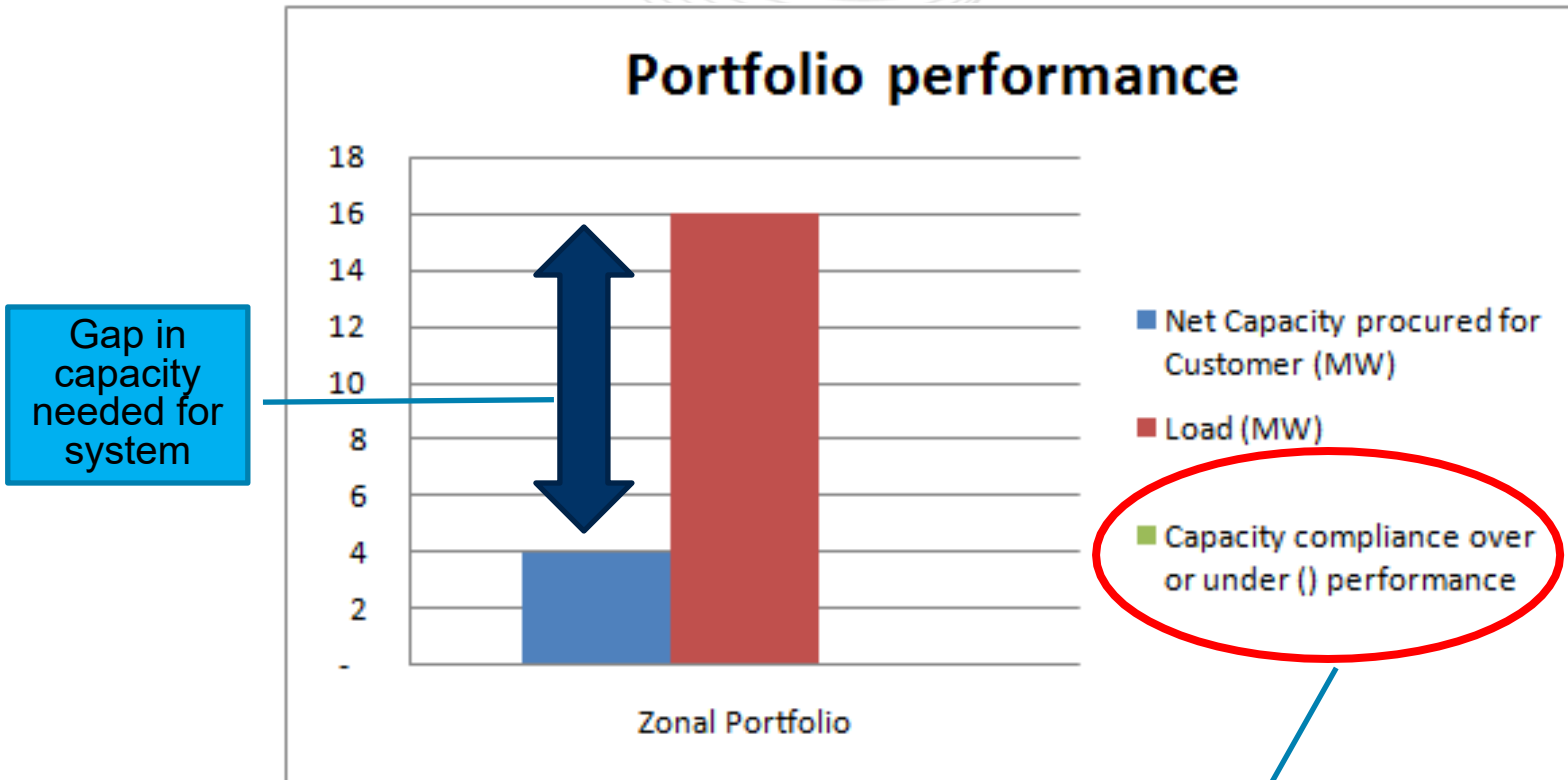


- PJM buys capacity for 4 MW based on the net capacity commitment of these four customers
- All four customers consume 4 MW on the peak day. PJM therefore must serve 16 MW of load instead of the 4 MW for which capacity was purchased



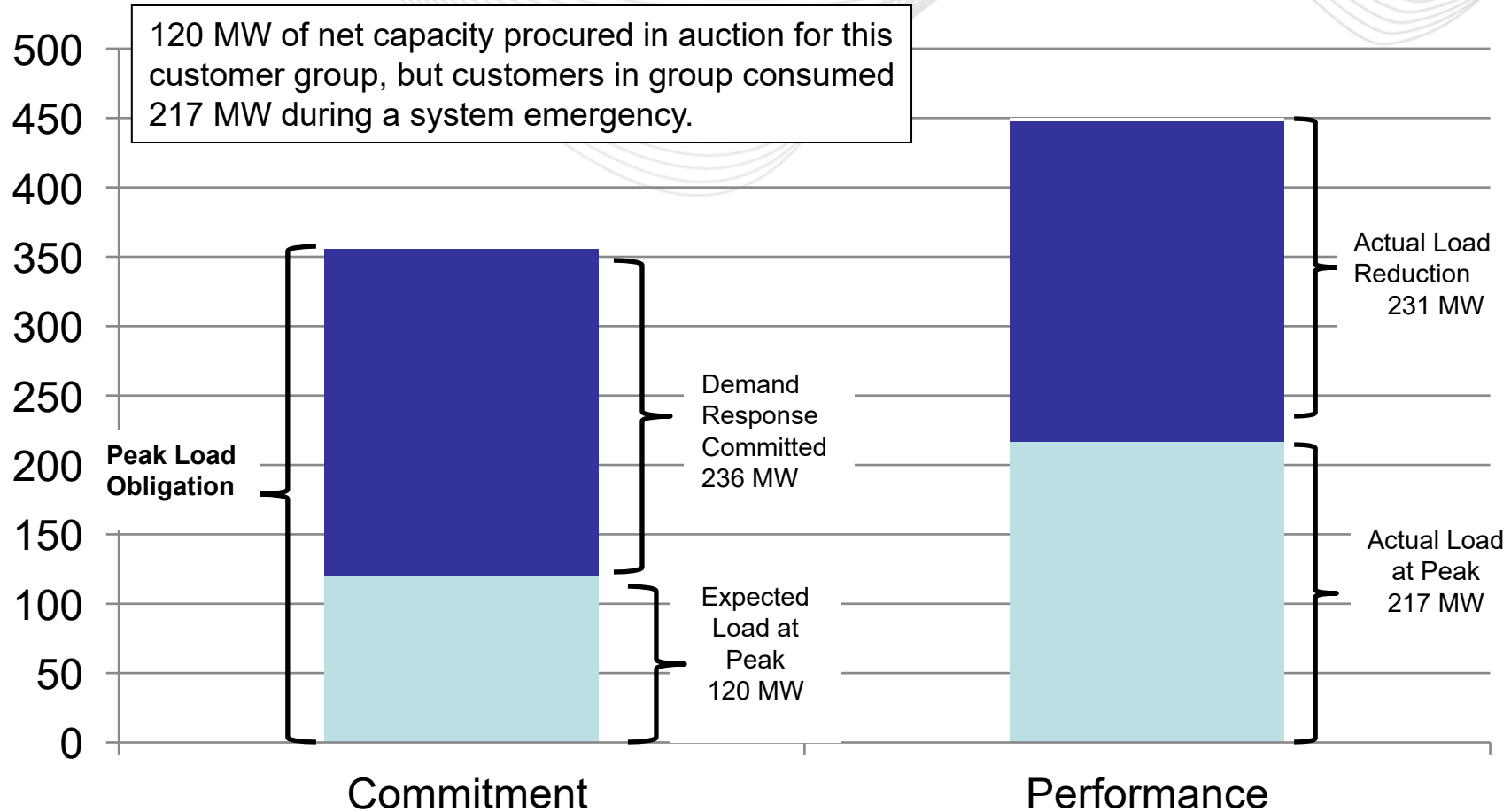
- Customer 1 submits a reduction quantity of 12 MW based on a calculated CBL of 16 MW and its actual load of 4 MW. Customer 2, 3 and 4 did not reduce load.
- As a result of this “double counting” all four customers appear compliant because the “over-response” of Customer 1 is applied to the shortfall for Customer 2 – 4.

Load higher than capacity procured during system emergency



- Example - Customer has load of 50 MW and is capable of dropping load to 5 MW
 - Customer performed peak shaving of 40 MW
 - Therefore capacity obligation or Peak Load Contribution is 10 MW
 - PJM rules limit DR registration to 10 MW PLC value
- Assume capacity price is \$100,
 - Through peak shaving, customer already avoided capacity payment of $40\text{MW} \times 100 \times 365 = \mathbf{\$1,460,000}$
 - If no underperformers exist in their portfolio customer DR value = $10\text{MW} \times 100 \times 365 = \mathbf{\$365,000}$
 - If portfolio has underperformance, customer DR value can be as high as $45\text{MW} \times 100 \times 365 = \mathbf{\$1,642,500}$
- **Perverse Incentive** is created because the additional value can only be created if the CSP registers a substantial volume of underperforming demand response.

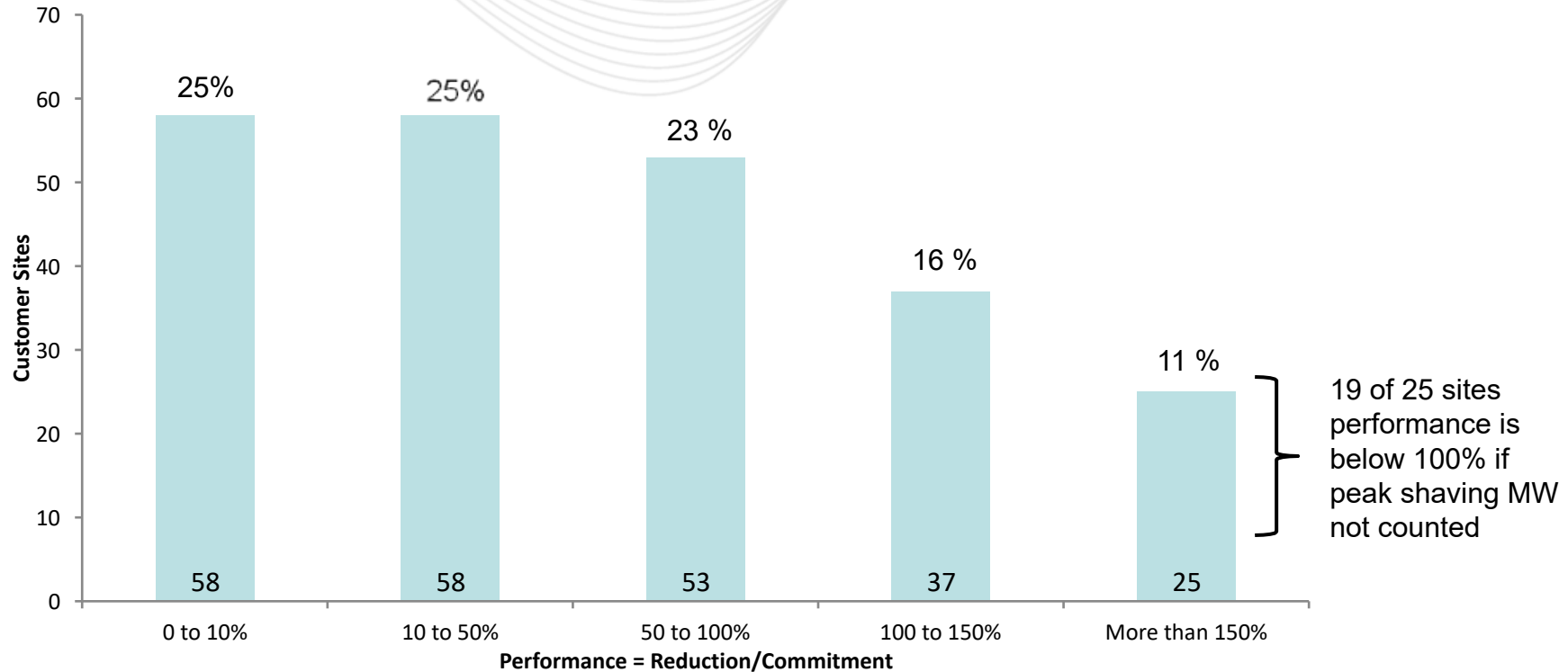
Zonal portfolio performance for CSP A



Result .. customer group was paid for 236 MW of DR based capacity from RPM and was also paid energy price for load reductions **but customers consumed 97 MW MORE during system emergency** than net capacity procured for them .

If all customers did thisPJM would be short capacity during emergency and would resort to rolling blackouts to maintain system reliability during emergency

CSP A BGE Zone - Performance



50% of registered sites performed at less than 50% of committed level. The claimed “over” performers are reporting MW already counted for peak shaving activity which is not achieving expected reduction.