

Measurement and Verification for Variable DR Economic Resources

DRS

7/12/2013

- Ensure load can be forecast on a reasonably accurate basis before participation
- If load can be forecast on a accurate basis then load reductions can be quantified
- Variable Customers = Hourly load that can not be forecast on an accurate basis
 - Based on existing CBL methods.
- RRMSE test is objective way to determine accuracy of CBL to forecast load.

- There are a significant number of resources that are:
 - Variable but just miss the CBL accuracy threshold
 - Use MBL approach for CBL
 - developed to ensure load reductions are not attributed to normal load fluctuations

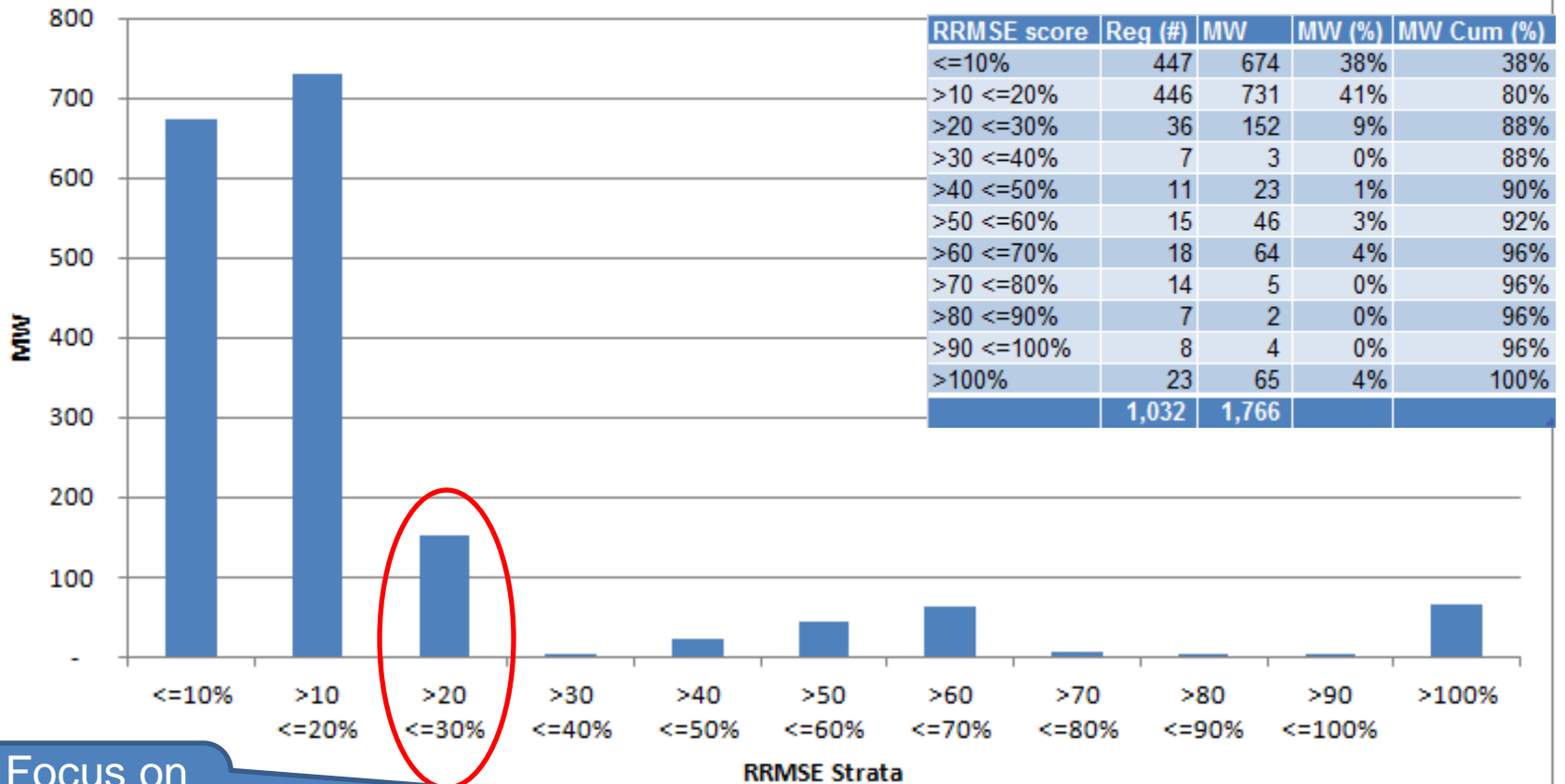
PJM did develop new Alternative CBL (Same Day 3+2) for 2012 Summer to use on temporary basis

CBL breakdown for all Economic DR registrations

CBL	MW	MW (%)	Registration (Count)	Registration (%)
3 Day Types with SAA (high 4 of 5)	1,122	47%	748	71%
Non-hourly metered sites DLC	768	32%	79	8%
MBL(Max Base Load)	270	11%	170	16%
Manual	140	6%	28	3%
3 Day Types (high 4 of 5)	107	4%	23	2%
7 Day Types with SAA (3 day average)	4	0%	3	0%
7 Day Types (3 day average)	0.1	0%	1	0%
3 Day Types with WSA (high 4 of 5)	-	0%	0	0%
Metered Generation	-	0%	0	0%
	2,411	100%	1,052	100%

“Manual” CBL represents Same Day 3+2 method used last summer which was calculated and upload by CSP

MW registered by RRMSE score strata



Focus on these customers

- 20 CBLs
 - Standard CBL: High 4/5 – 2/3 like days
 - 3 day type: Mean, Mean + SAA (Standard CBL)
 - 25% usage threshold
 - Past 5/5 – 3/3 like days
 - 3 day type: Mean, Median, Mean + SAA, Median + SAA
 - 5 day type: Mean, Median, Mean + SAA, Median + SAA
 - 7 day type: Mean, Median, Mean + SAA, Median + SAA
 - All hours mixed – Mean, Median
 - 3+2
 - ARIMA
 - MBL: Mean, Median
- 115 Registrations
 - RRMSE 20-40% using existing methods

Comprehensive graphical review of all MBL and 3+2 registration with economic events during 2012 summer

- No market rule changes necessary – CSPs should:
 - Check load data to ensure it is accurate and properly loaded in eLRS
 - Run all available CBL options, an alternative may be available that is more accurate.
 - Analyze RRMSE report to determine if anomaly has significantly increased RRMSE score
 - For example – RRMSE test conducted for School during Spring break when Customer will NOT provide load reduction to market.

Pros

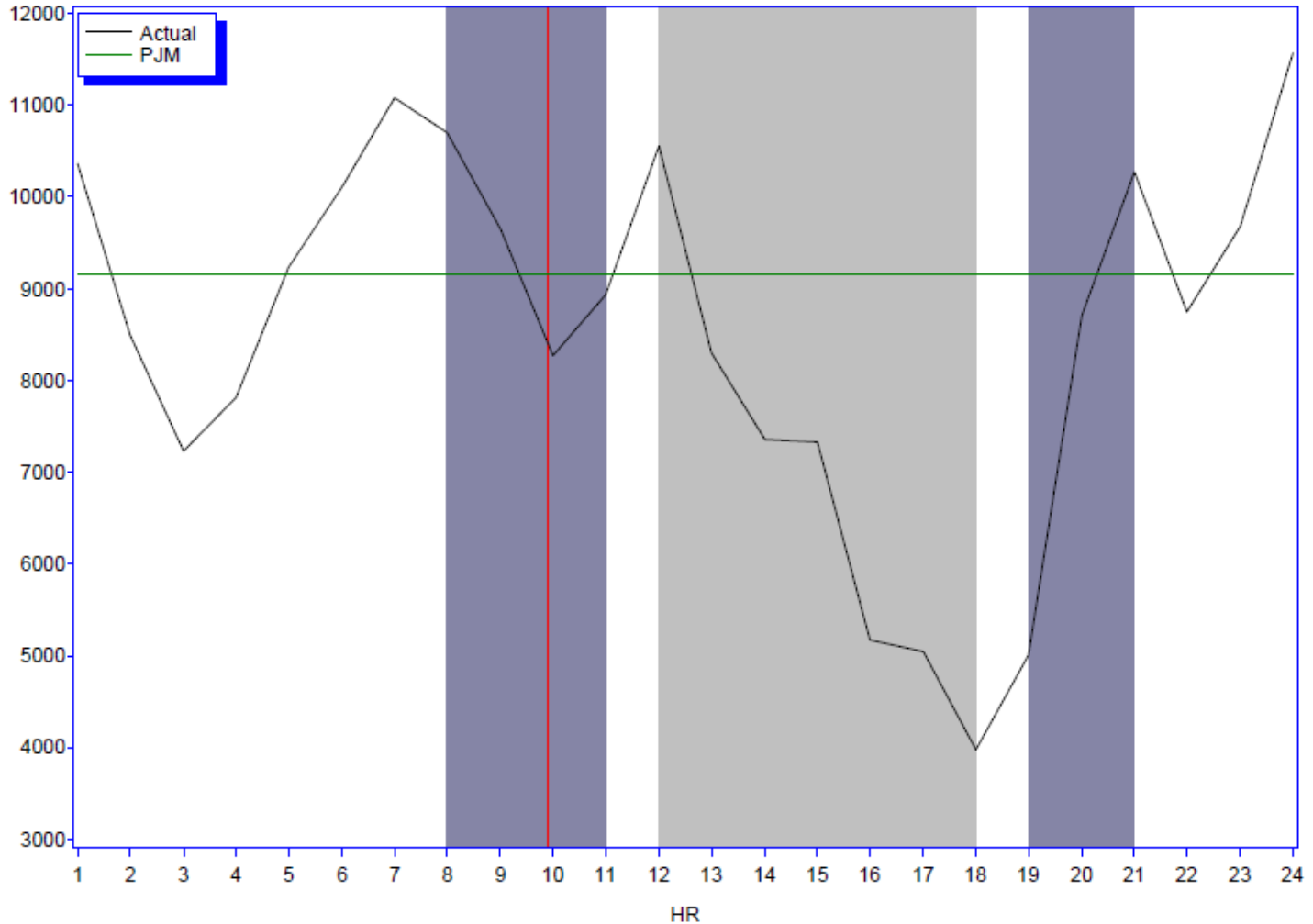
- Improves accuracy to < 20% for some registrations

Cons

- If significant amount of load shifts to 3+2 hours, it will inflate CBL
- Significant positive bias when RRMS > 20%

Baseline Comparison:

RECORDKEY=Sample ID:_10_Type is:_RT_Notify Time (Red line) is:_9:54:23



- **CBL 1 = Same Day (3 + 2)**
 - Average of 3 hours before event (after skipping one hour) and 2 hours after event (after skipping one hour)
 - CSP may use only if no significant pre or post change in operations that will impact CBL calculation
 - Thermal load (pre-cooling or snapback)
 - Change in typical operations (including on-site generation schedule)
 - No events during HE1, 2, 3, 23, 24 (to ensure hours are available to calculate CBL)

Designed for customer with daily usage that is fairly consistent (intra-day hourly volatility)

- CBL 2 = Match Day (3 day average)
 - Pick 3 non-event days from prior 45 calendar days that have the most similar usage to non-event hours on event day.
 - Compute the difference between the event day and day within the CBL Basis Day Limit. For each day:
 - Take the difference between each comparison hour from the event day and the same hour in each day in the CBL Basis Day Limit to determine the hourly difference for each comparison hour for each day.
 - Square all the hourly differences for each day and then sum the squared differences to determine the daily differences.
 - Select the 3 days from the CBL Basis Day Limit with the smallest daily differences to determine the CBL Days.
 - Average each of the event hours across the three CBL Days to determine the CBL
 - First event hour to last event hour in operating day will comprise no more than 10 elapsed hours. This will ensure there are at least 12 non-event hours in the operating day to determine the selection of CBL days

Designed for customer daily usage pattern that vary and are not based on type of day (based more on production cycle for day)

	RRMSE range	Min. across existing CBL	Match 3 day avg	3 + 2	Min. across variable options
		Percent of Registrations	<20%	0%	35%
	20%-30%	63%	39%	22%	39%
	>30%	37%	25%	64%	18%
Percent of MW	<20%	0%	8%	32%	37%
	20%-30%	26%	39%	12%	19%
	>30%	74%	53%	56%	44%



Expect to move 42% (48) of registrations with RRMSE score >20% and <40% (115) to new alternative CBL with RRMSE <20%

- Existing CBL options in Manual 11

Parameter/CBLs	3 DayTypes		3 Day Types with SAA (Tariff Default)		3 Day Types with WSA	
	Weekdays	Sat, Sun/Hol	Weekdays	Sat, Sun/Hol	Weekdays	Sat, Sun/Hol
DayType	Weekdays	Sat, Sun/Hol	Weekdays	Sat, Sun/Hol	Weekdays	Sat, Sun/Hol
Calculation ¹	Average	Average	Average	Average	Average	Average
CBL Basis Window ²	5	3	5	3	5	3
CBL Basis Window Limit ³	45	45	45	45	45	45
Start Selection From Days Prior to Event ⁴	1	1	1	1	1	1
Exclude Previous Curtailment Days ⁵	Y	Y	Y	Y	Y	Y
Exclude Long/Short DST Days ⁶	N/A	Y	N/A	Y	N/A	Y
Exclude Avg. Event Period Usage Less than Threshold ⁷	25%	25%	25%	25%	25%	25%
Exclude # of Low Usage Days ⁸	1	1	1	1	1	1
Use Previous Curtailment if CBL Basis Window incomplete ⁹	Yes	Yes	Yes	Yes	Yes	Yes
Use Highest or Recent Previous Curtailment Day ¹⁰	Highest	Highest	Highest	Highest	Highest	Highest
Adjustments ¹¹	None	None	Symmetric Additive	Symmetric Additive	Weather Sensitive	Weather Sensitive
Allow Negative Adjustments ¹²	N/A	N/A	Yes	Yes	Yes	Yes
Adjustments Start (HE0-x) ¹³	N/A	N/A	4	4	0	0
Adjustment Basis Hours ¹⁴	N/A	N/A	3	3	Event Hours	Event Hours

Parameter/CBLs	7 DayTypes	7 Day Types with SAA	MBL(Max Base Load) ^A		Metered Generation ^B
	Mon,Tue,Wed,Thu,Fri,Sat,Sun/Hol	Mon,Tue,Wed,Thu,Fri,Sat,Sun/Hol	Weekdays	Sat,Sun/Hol	
DayType					N/A
Calculation ¹	Average	Average	Average	Average	N/A
CBL Basis Window ²	3	3	5	3	N/A
CBL Basis Window Limit ³	60	60	45	45	N/A
Start Selection From Days Prior to Event ⁴	1	1	1	1	N/A
Exclude Previous Curtailment Days ⁵	Y	Y	Y	Y	N/A
Exclude Long/Short DST Days ⁶	Y	Y	N/A	Y	N/A
Exclude Avg. Event Period Usage Less than Threshold ⁷	25%	25%	25%	25%	N/A
Exclude # of Low Usage Days ⁸	0	0	0	0	N/A
Use Previous Curtailment if CBL Basis Window incomplete ⁹	Yes	Yes	Yes	Yes	N/A
Use Highest or Recent Previous Curtailment Day ¹⁰	Highest	Highest	Recent	Recent	N/A
Adjustments ¹¹	None	Symmetric Additive	None	None	N/A
Allow Negative Adjustments ¹²	N/A	Yes	N/A	N/A	N/A
Adjustments Start (HE0-x) ¹³	N/A	4	N/A	N/A	N/A
Adjustment Basis Hours ¹⁴	N/A	3	N/A	N/A	N/A