Market Monitor Report

MC Webinar

IMM

6.20.2023

Monitoring Analytics

Demand Response

- **Review basic rules for demand response performance and payment.**

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Important Terms
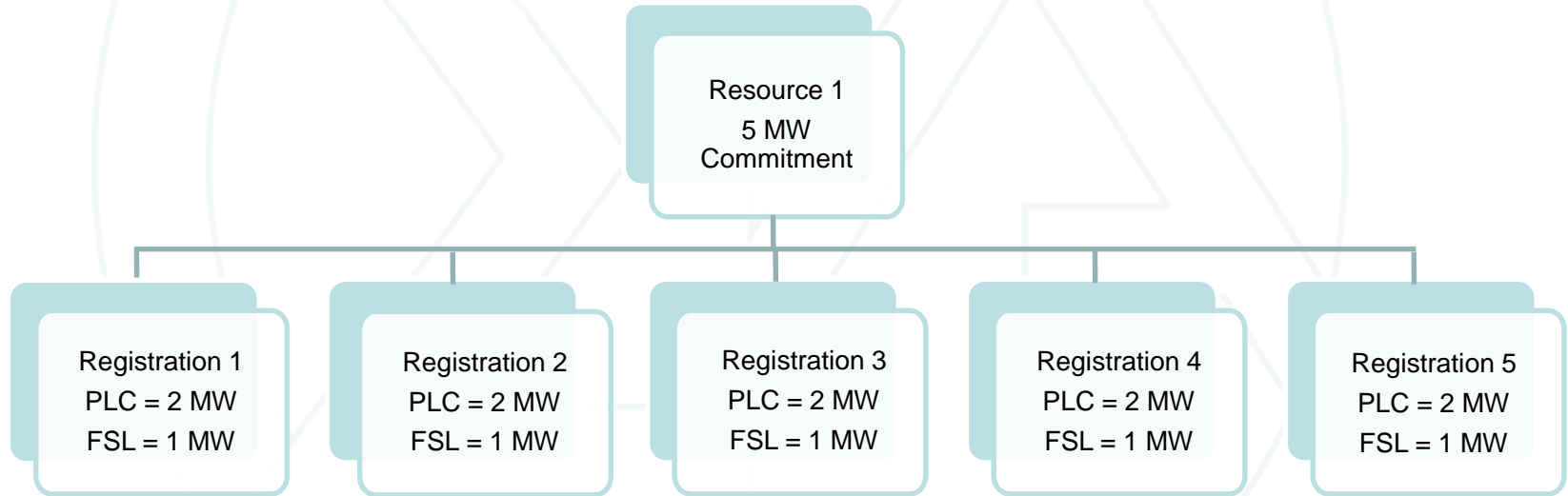
- <u>Location</u> – The physical location of an end use customer enrolled in Demand Response

- <u>Registration</u> – A grouping of one or more locations used to support a Demand Response resource

- <u>Resource</u> – A modeled Demand Response resource having an RPM commitment and backed by registrations

- <u>PLC</u> – Peak Load Contribution. The capacity value assigned by the EDC to an end use customer.

- <u>FSL</u> – Firm Service Level. The load level that a customer commits to reduce <u>to</u> during a PAI.

    Nominated ICAP MW quantity = (PLC-FSL)
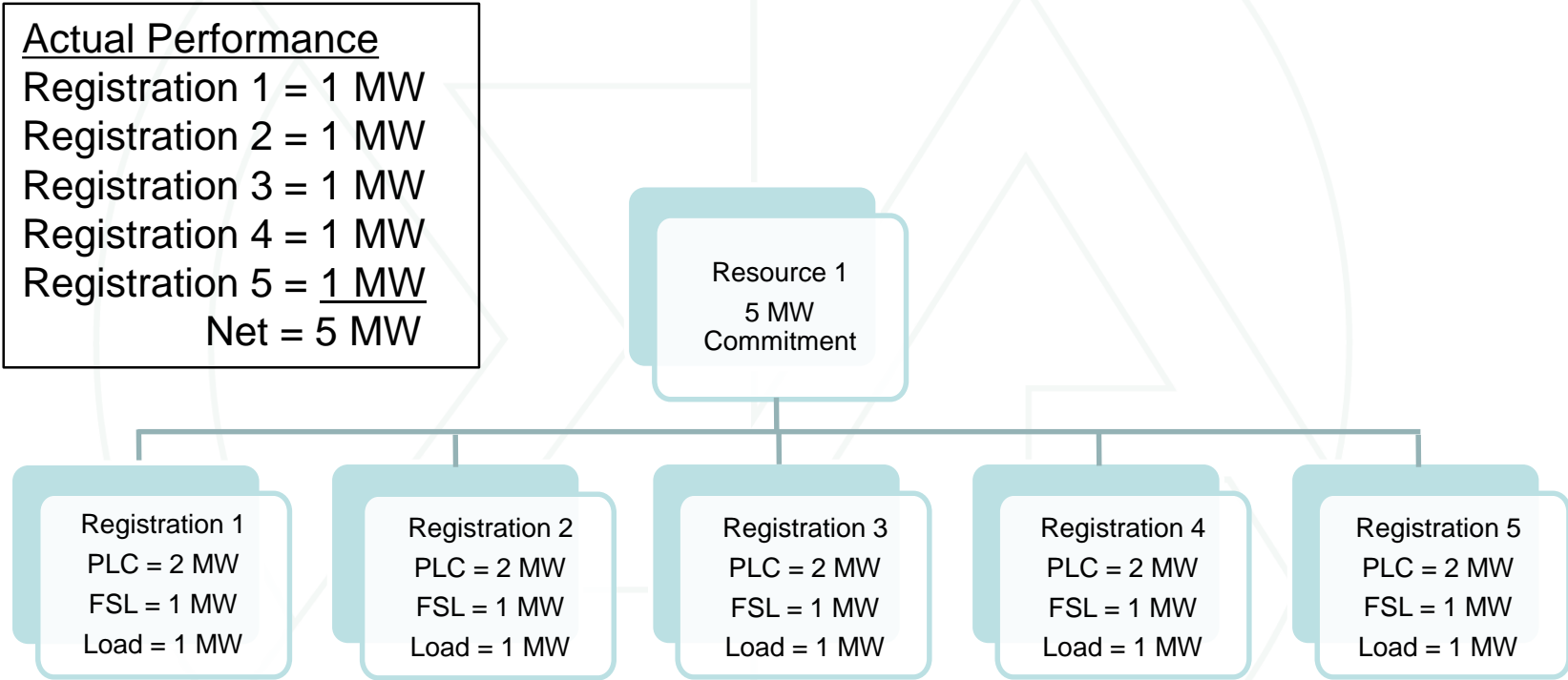
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Registrations Linked to Single RPM Resource

*Examples assume zero losses

Actual Performance = PLC – metered load

```
                          Resource 1
                          5 MW
                          Commitment


Registration 1    Registration 2    Registration 3    Registration 4    Registration 5
PLC = 2 MW        PLC = 2 MW        PLC = 2 MW        PLC = 2 MW        PLC = 2 MW
FSL = 1 MW        FSL = 1 MW        FSL = 1 MW        FSL = 1 MW        FSL = 1 MW
```

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Scenario 1: All Registrations Reduce to Their FSL

Actual Performance
Registration 1 = 1 MW
Registration 2 = 1 MW
Registration 3 = 1 MW
Registration 4 = 1 MW
Registration 5 = 1 MW
Net = 5 MW

Resource 1

5 MW
Commitment

Registration 1	Registration 2	Registration 3	Registration 4	Registration 5
PLC = 2 MW	PLC = 2 MW	PLC = 2 MW	PLC = 2 MW	PLC = 2 MW
FSL = 1 MW	FSL = 1 MW	FSL = 1 MW	FSL = 1 MW	FSL = 1 MW
Load = 1 MW	Load = 1 MW	Load = 1 MW	Load = 1 MW	Load = 1 MW

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Scenario 2: Some Registrations Increase in Load

Actual Performance
Registration 1 = 2 MW
Registration 2 = 2 MW
Registration 3 = 1 MW
Registration 4 = 0 MW
Registration 5 = 0 MW
Net = 5 MW

Actual performance treated as zero even though registrations increased load above PLC during event

Resource 1
5 MW Commitment

Registration 1	Registration 2	Registration 3	Registration 4	Registration 5
PLC = 2 MW	PLC = 2 MW	PLC = 2 MW	PLC = 2 MW	PLC = 2 MW
FSL = 1 MW	FSL = 1 MW	FSL = 1 MW	FSL = 1 MW	FSL = 1 MW
Load = 0 MW	Load = 0 MW	Load = 1 MW	Load = 3 MW	Load = 4 MW

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Scenario 2: Alternate Settlement Example

Actual Performance
Registration 1 = 2 MW
Registration 2 = 2 MW
Registration 3 = 1 MW
Registration 4 = -(1) MW
Registration 5 = -(2) MW
Net = 2 MW

Take into account the amount load increased above PLC

Resource 1

5 MW
Commitment

Registration 1	Registration 2	Registration 3	Registration 4	Registration 5
PLC = 2 MW	PLC = 2 MW	PLC = 2 MW	PLC = 2 MW	PLC = 2 MW
FSL = 1 MW	FSL = 1 MW	FSL = 1 MW	FSL = 1 MW	FSL = 1 MW
Load = 0 MW	Load = 0 MW	Load = 1 MW	Load = 3 MW	Load = 4 MW

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Netting of Resources During PAI

AEP	DOM	COMED	PEPCO	PSEG
Resource 1 PLC = 5 MW FSL = 4 MW	Resource 2 PLC = 5 MW FSL = 4 MW	Resource 3 PLC = 5 MW FSL = 4 MW	Resource 4 PLC = 5 MW FSL = 4 MW	Resource 5 PLC = 5 MW FSL = 4 MW
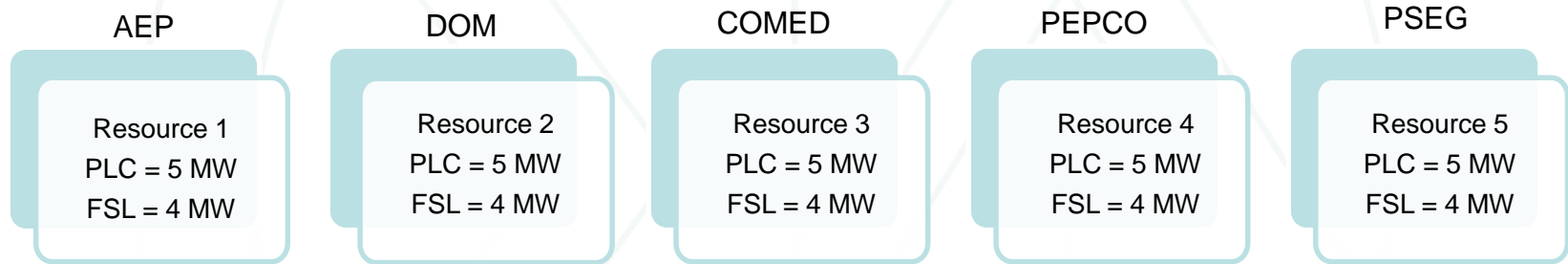
5 resources each with a 1 MW RPM commitment

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Scenario: RTO Wide PAI

Actual Performance
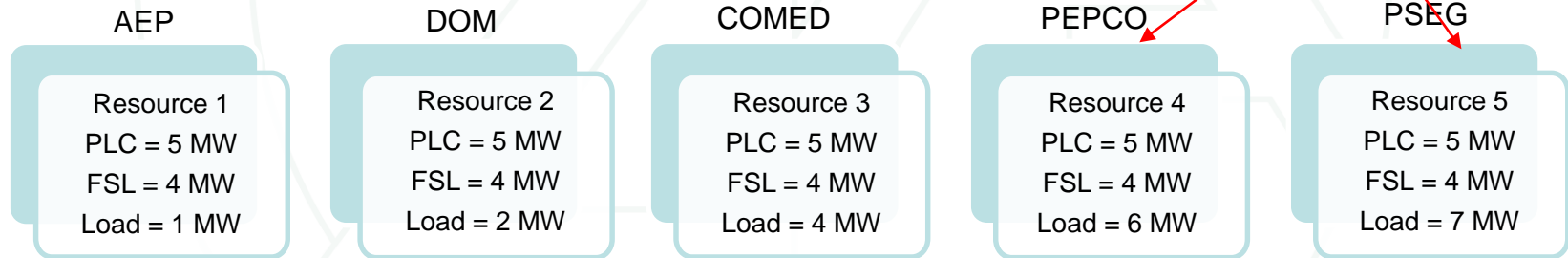Resource 1 = 4 MW; met commitment plus 3 MW bonus
Resource 2 = 3 MW; met commitment plus 2 MW bonus
Resource 3 = 1 MW; met commitment
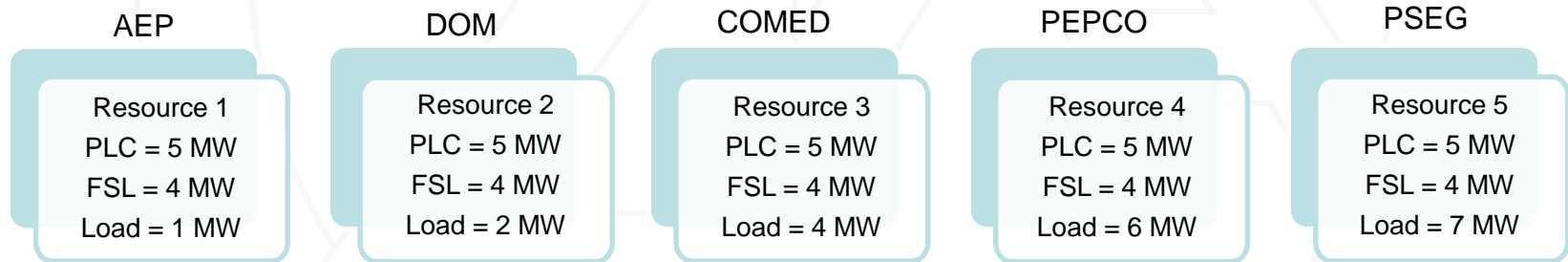Resource 4 = 0 MW; 1 MW deficient
Resource 5 = 0 MW; 1 MW deficient
Portfolio Net = 6 MW (1 MW Bonus)

Shortfall capped at 1 MW RPM commitment even though resources increased load above PLC during event

AEP	DOM	COMED	PEPCO	PSEG
Resource 1 PLC = 5 MW FSL = 4 MW Load = 1 MW	Resource 2 PLC = 5 MW FSL = 4 MW Load = 2 MW	Resource 3 PLC = 5 MW FSL = 4 MW Load = 4 MW	Resource 4 PLC = 5 MW FSL = 4 MW Load = 6 MW	Resource 5 PLC = 5 MW FSL = 4 MW Load = 7 MW

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Resource Netting During PAI

- Resources in same performance assessment area are netted by owner
- Overperformance of Resources 1 and 2 offset shortfall of Resources 4 and 5
- Total Expected Performance = 5 MW
- Net Portfolio Actual Performance = (4) + (3) + (1) - (1) - (1) = 6 MW
- 1 MW bonus split pro-rata between Resources 1 and 2. No nonperformance charges for Resources 4 or 5.

AEP

Resource 1
PLC = 5 MW
FSL = 4 MW
Load = 1 MW

DOM

Resource 2
PLC = 5 MW
FSL = 4 MW
Load = 2 MW

COMED

Resource 3
PLC = 5 MW
FSL = 4 MW
Load = 4 MW

PEPCO

Resource 4
PLC = 5 MW
FSL = 4 MW
Load = 6 MW

PSEG

Resource 5
PLC = 5 MW
FSL = 4 MW
Load = 7 MW

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Alternate Settlement Example

Actual Performance

Resource 1 = 4 MW; met commitment plus 3 MW bonus

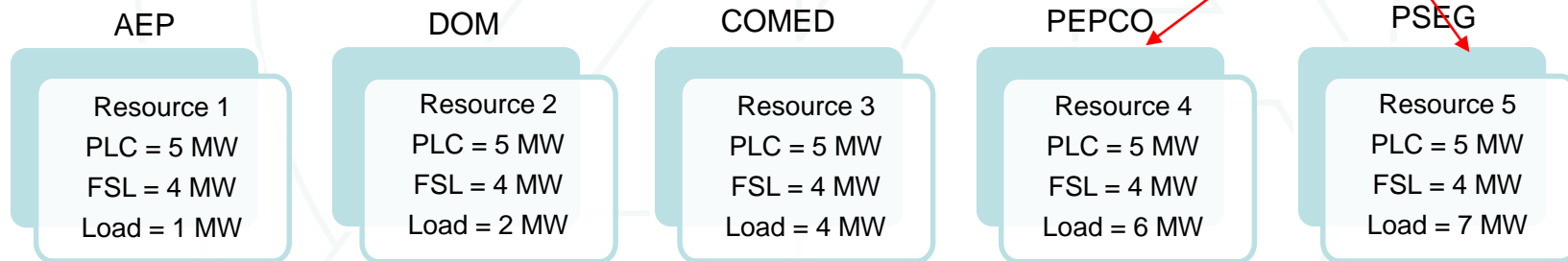Resource 2 = 3 MW; met commitment plus 2 MW bonus

Resource 3 = 1 MW; met commitment

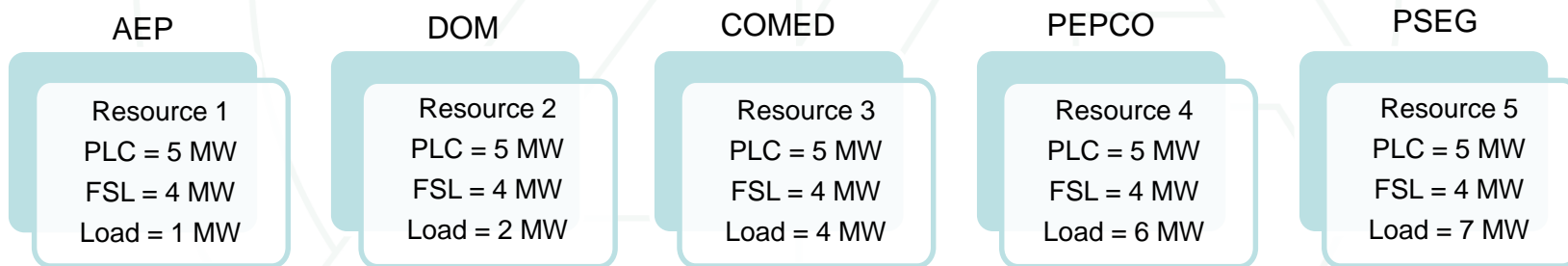Resource 4 = 0 MW; 2 MW deficient

Resource 5 = 0 MW; 3 MW deficient

Portfolio Net = 3 MW (2 MW Shortfall)

Determine shortfall as RPM deficiency plus MW increase above PLC

AEP

Resource 1

PLC = 5 MW

FSL = 4 MW

Load = 1 MW

DOM

Resource 2

PLC = 5 MW

FSL = 4 MW

Load = 2 MW

COMED

Resource 3

PLC = 5 MW

FSL = 4 MW

Load = 4 MW

PEPCO

Resource 4

PLC = 5 MW

FSL = 4 MW

Load = 6 MW

PSEG

Resource 5

PLC = 5 MW

FSL = 4 MW

Load = 7 MW

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Alternate Settlement Example

- Resources in same performance assessment area are netted by owner
- Overperformance of Resources 1 and 2 partially offset shortfall of Resources 4 and 5
- Total Expected Performance = 5 MW
- Net Portfolio Actual Performance = (4) + (3) + (1) - (2) - (3) = 3 MW
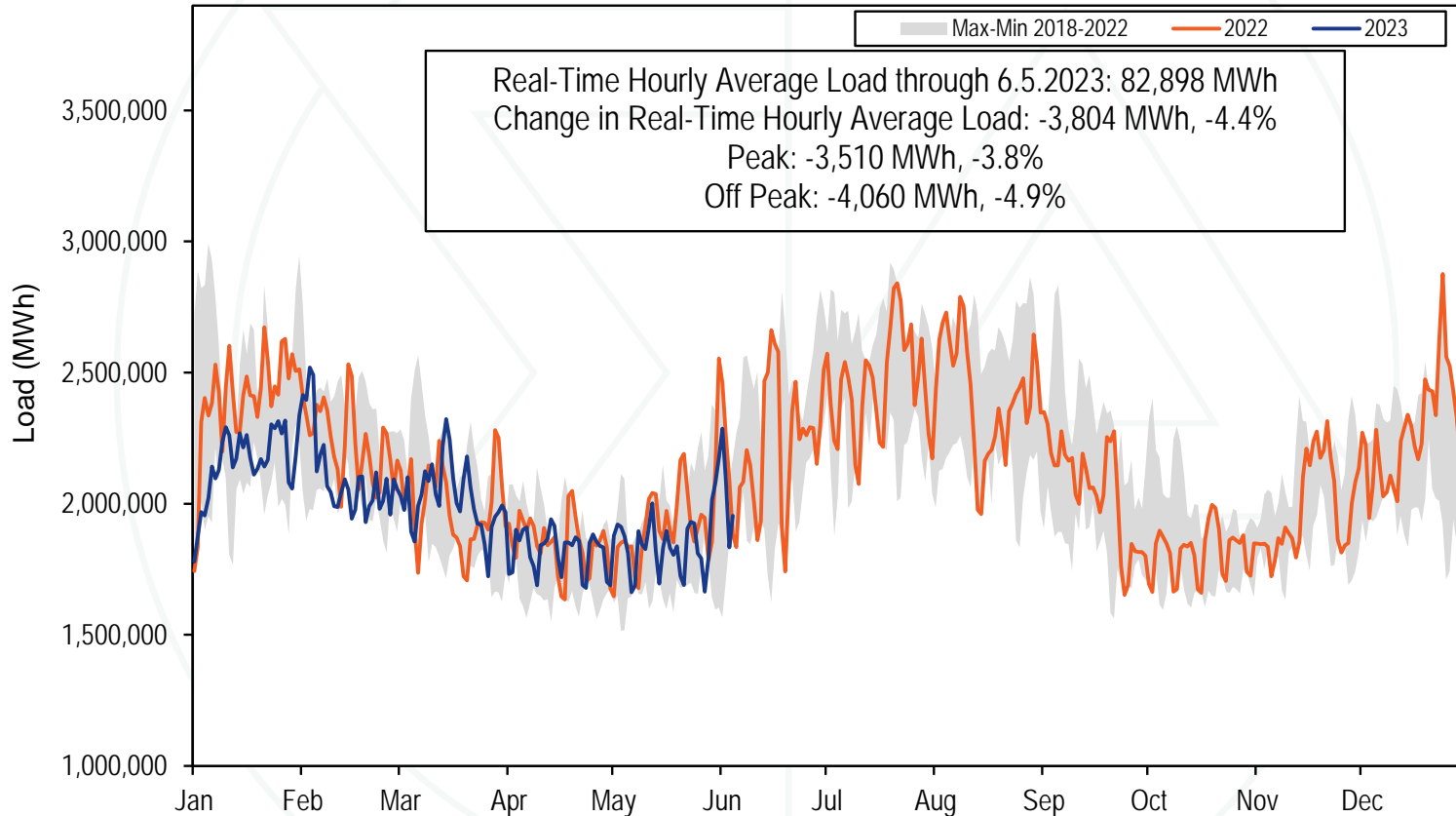- 2 MW shortfall split pro-rata between Resources 4 and 5. No Bonus awarded to Resources 1 and 2.

AEP

Resource 1
PLC = 5 MW
FSL = 4 MW
Load = 1 MW

DOM

Resource 2
PLC = 5 MW
FSL = 4 MW
Load = 2 MW

COMED

Resource 3
PLC = 5 MW
FSL = 4 MW
Load = 4 MW

PEPCO

Resource 4
PLC = 5 MW
FSL = 4 MW
Load = 6 MW

PSEG

Resource 5
PLC = 5 MW
FSL = 4 MW
Load = 7 MW

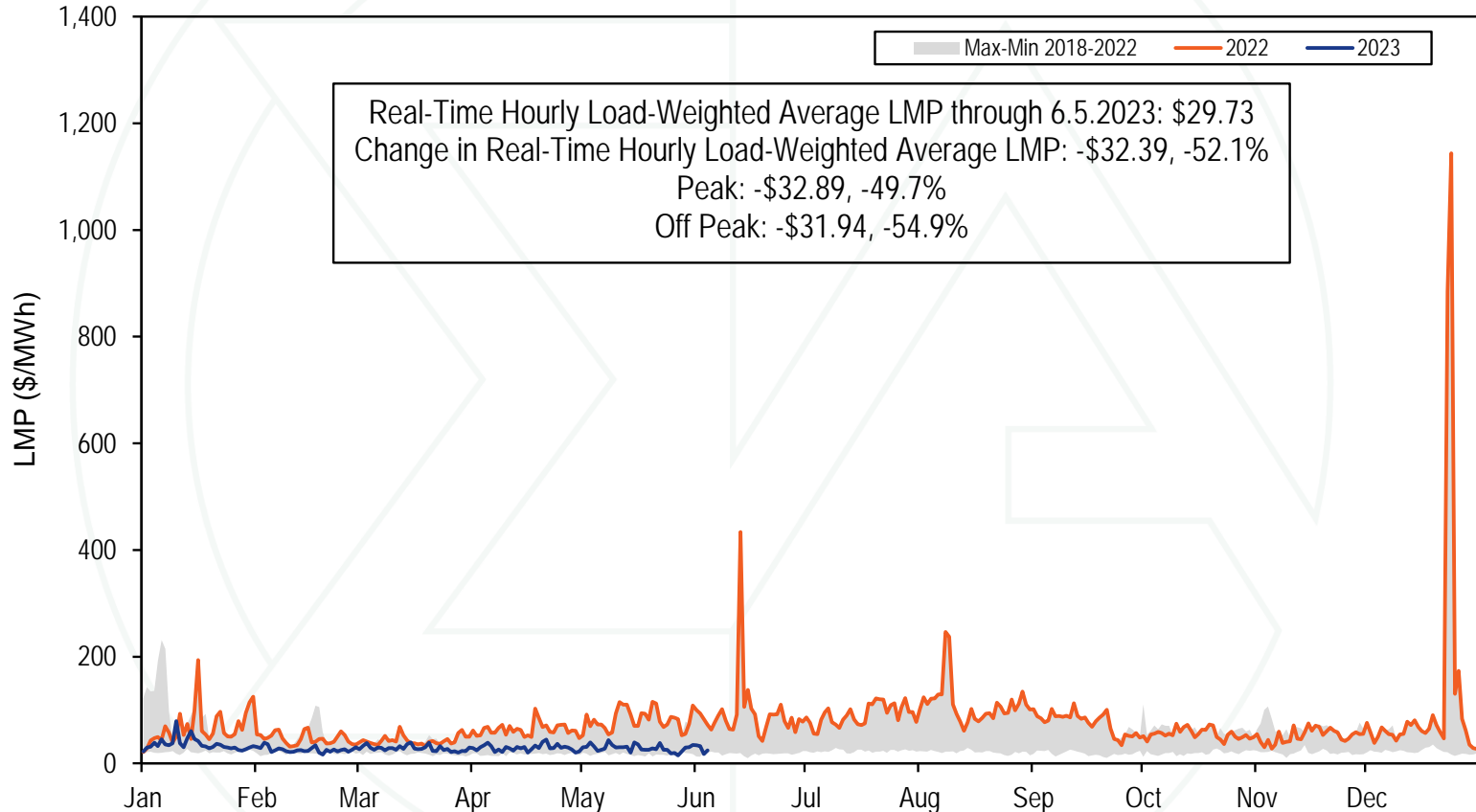Monitoring Analytics

Issues with Current DR Rules

- **Resource netting is asymmetrically applied to Demand Response**

- **Resource performance may be overstated**
  - **Registration nonperformance is capped at zero**
  - **Resource nonperformance is capped at RPM commitment quantity even when load has increased above PLC**

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Information on Load, DLMP and PLMP

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2023 YTD PJM Real-Time Daily Load

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2023 YTD PJM Real-Time Daily LMP

Legend: Max-Min 2018-2022 — 2022 — 2023

Real-Time Hourly Load-Weighted Average LMP through 6.5.2023: $29.73
Change in Real-Time Hourly Load-Weighted Average LMP: -$32.39, -52.1%
Peak: -$32.89, -49.7%
Off Peak: -$31.94, -54.9%

Monthly Average Load-Weighted DLMP and PLMP

		Day-Ahead Load-Weighted Average				Real-Time Load-Weighted Average			
Year	Month	DLMP	PLMP	Difference	Percent Difference	DLMP	PLMP	Difference	Percent Difference
2022	Jan	$64.57	$64.80	$0.22	0.3%	$66.43	$69.06	$2.64	4.0%
2022	Feb	$49.96	$50.35	$0.39	0.8%	$45.93	$46.76	$0.83	1.8%
2022	Mar	$45.25	$45.50	$0.25	0.6%	$41.83	$43.56	$1.73	4.1%
2022	Apr	$64.10	$64.18	$0.08	0.1%	$60.38	$63.91	$3.52	5.8%
2022	May	$83.17	$83.24	$0.06	0.1%	$79.04	$83.16	$4.12	5.2%
2022	Jun	$90.24	$90.54	$0.29	0.3%	$91.44	$97.89	$6.46	7.1%
2022	Jul	$96.07	$96.38	$0.32	0.3%	$84.03	$92.48	$8.45	10.1%
2022	Aug	$106.18	$106.07	($0.10)	(0.1%)	$105.68	$113.74	$8.06	7.6%
2022	Sep	$82.86	$82.80	($0.06)	(0.1%)	$74.08	$78.29	$4.22	5.7%
2022	Oct	$58.30	$58.37	$0.07	0.1%	$52.27	$55.90	$3.63	6.9%
2022	Nov	$56.29	$55.24	($1.05)	(1.9%)	$50.86	$52.93	$2.07	4.1%
2022	Dec	$93.02	$93.39	$0.37	0.4%	$143.65	$142.22	($1.42)	(1.0%)
2022	Jan - Dec	$75.35	$75.44	$0.08	0.1%	$76.34	$80.14	$3.80	5.0%
2023	Jan	$36.53	$36.58	$0.05	0.1%	$34.66	$35.75	$1.09	3.1%
2023	Feb	$31.16	$31.22	$0.06	0.2%	$25.47	$26.04	$0.57	2.2%
2023	Mar	$28.39	$28.41	$0.02	0.1%	$27.58	$28.42	$0.85	3.1%
2023	Apr	$29.81	$29.81	($0.00)	(0.0%)	$27.09	$29.32	$2.22	8.2%
2023	May	$28.86	$28.80	($0.05)	(0.2%)	$25.91	$28.44	$2.53	9.7%
2023	Jan - May	$31.08	$31.09	$0.02	0.1%	$28.34	$29.75	$1.42	5.0%

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Daily Average Real-Time DLMP and PLMP

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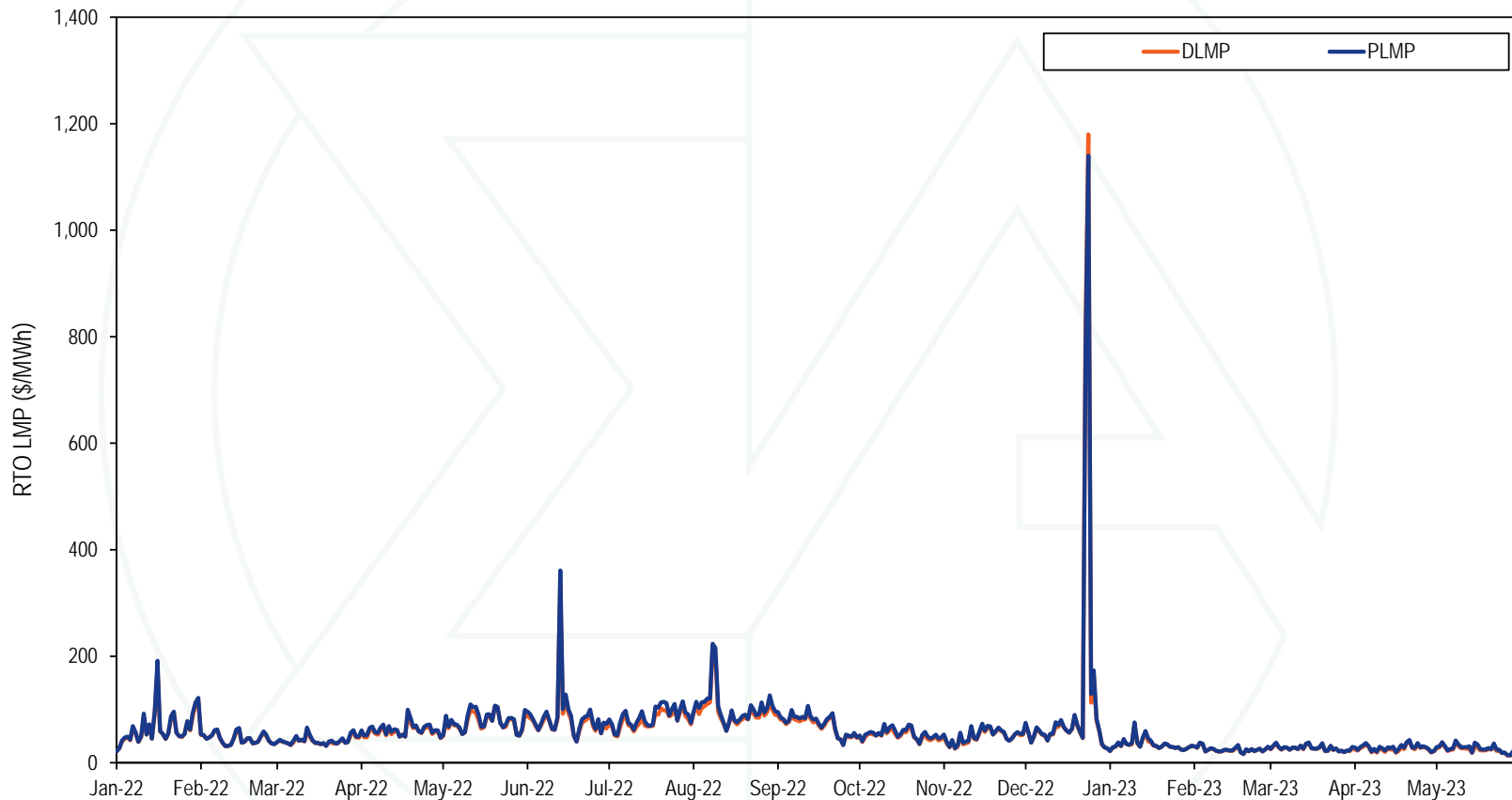
Hourly Difference: PLMP – DLMP

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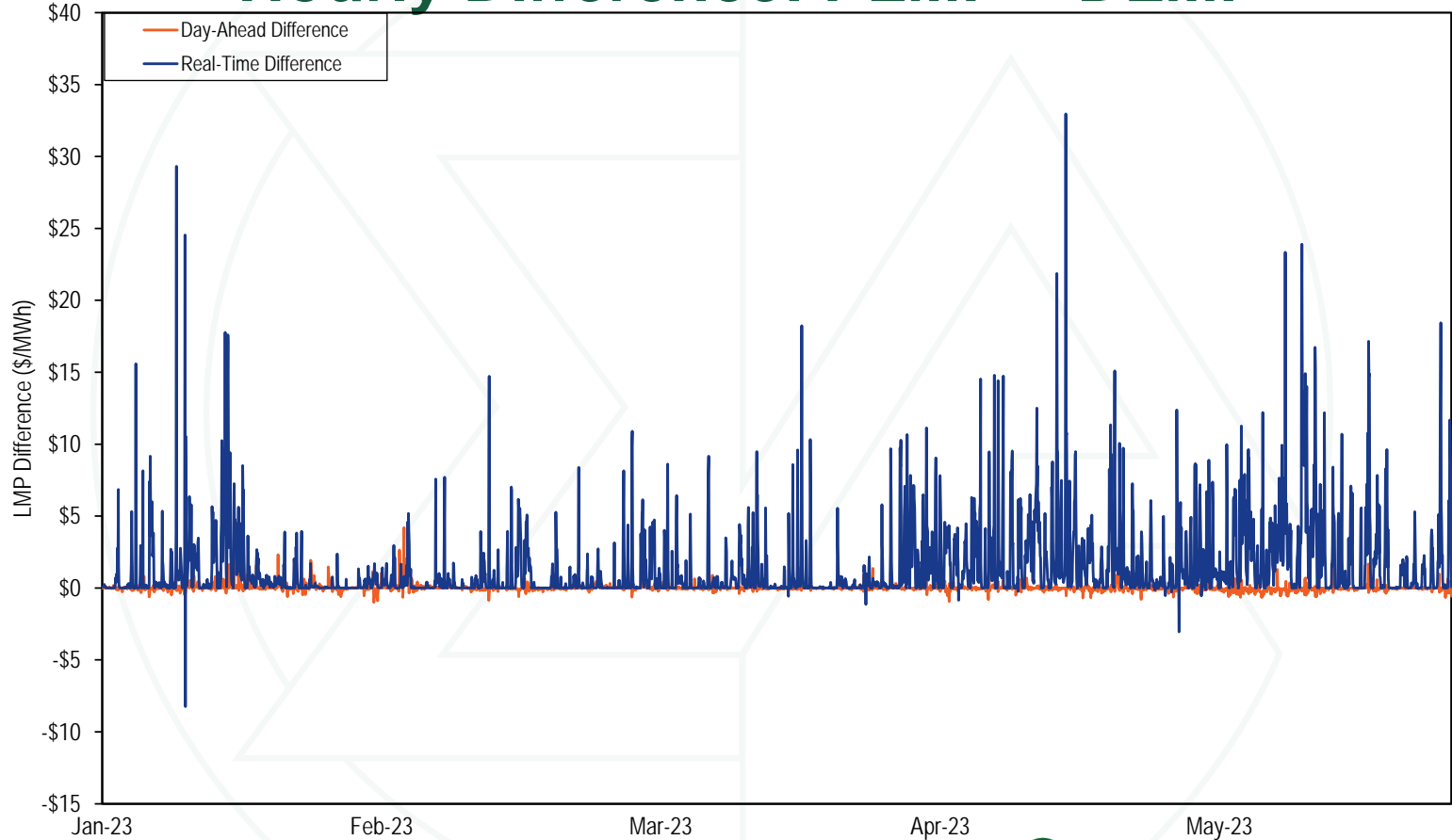
Fast Start Units as a Percent of Marginal Units

		Dispatch Run				Pricing Run			
Year	Month	CT	Diesel	Wind	All Fast Start Units	CT	Diesel	Wind	All Fast Start Units
2022	Jan	1.3%	0.3%	0.2%	1.8%	4.9%	0.9%	0.2%	6.2%
2022	Feb	0.6%	0.2%	0.3%	1.1%	3.2%	0.5%	0.3%	4.0%
2022	Mar	0.5%	0.2%	0.4%	1.1%	3.4%	0.5%	0.4%	4.4%
2022	Apr	0.8%	0.1%	0.1%	1.2%	4.4%	0.3%	0.1%	5.0%
2022	May	1.4%	0.7%	0.1%	2.4%	6.6%	1.2%	0.1%	8.1%
2022	Jun	2.3%	0.3%	0.1%	2.6%	9.3%	0.8%	0.1%	10.2%
2022	Jul	2.7%	0.6%	0.1%	3.3%	16.3%	1.4%	0.0%	17.7%
2022	Aug	2.0%	0.4%	0.0%	2.4%	12.0%	1.3%	0.0%	13.3%
2022	Sep	0.8%	0.3%	0.1%	1.2%	5.6%	1.0%	0.1%	6.7%
2022	Oct	2.2%	0.2%	0.3%	2.6%	6.6%	0.9%	0.2%	7.7%
2022	Nov	1.3%	0.2%	0.2%	1.7%	5.1%	0.9%	0.2%	6.1%
2022	Dec	1.3%	0.7%	0.2%	2.2%	6.3%	1.5%	0.2%	8.0%
2022	Jan - Dec	1.4%	0.3%	0.2%	2.0%	7.0%	0.9%	0.1%	8.1%
2023	Jan	1.6%	0.5%	0.1%	2.1%	6.2%	2.8%	0.0%	9.0%
2023	Feb	0.9%	0.2%	0.0%	1.1%	3.1%	0.6%	0.0%	3.7%
2023	Mar	0.8%	0.4%	0.1%	1.2%	3.0%	0.7%	0.1%	3.8%
2023	Apr	2.5%	0.4%	0.2%	3.2%	8.1%	0.8%	0.2%	9.1%
2023	May	1.0%	0.3%	0.1%	1.3%	4.8%	0.7%	0.1%	5.6%
2023	Jan - May	1.4%	0.4%	0.1%	1.8%	5.0%	1.1%	0.1%	6.2%

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Fast Start Impacts: Zonal Average Differences

	2023 Jan - May							
	Day-Ahead				Real-Time			
Zone	Average DLMP	Average PLMP	Difference	Percent Difference	Average DLMP	Average PLMP	Difference	Percent Difference
ACEC	$51.84	$51.96	$0.12	0.2%	$51.37	$53.52	$2.15	4.2%
AEP	$58.53	$58.64	$0.11	0.2%	$56.87	$59.60	$2.74	4.8%
APS	$59.50	$59.66	$0.16	0.3%	$57.52	$60.39	$2.86	5.0%
ATSI	$58.03	$58.16	$0.13	0.2%	$55.73	$58.43	$2.70	4.8%
BGE	$68.33	$68.46	$0.13	0.2%	$66.15	$69.55	$3.40	5.1%
COMED	$49.80	$49.90	$0.10	0.2%	$47.55	$49.99	$2.44	5.1%
DAY	$60.77	$60.88	$0.11	0.2%	$58.79	$61.64	$2.85	4.8%
DUKE	$59.64	$59.76	$0.11	0.2%	$57.56	$60.36	$2.80	4.9%
DOM	$69.83	$69.44	($0.40)	(0.6%)	$70.53	$73.53	$2.99	4.2%
DPL	$55.03	$55.17	$0.14	0.3%	$54.89	$57.81	$2.91	5.3%
DUQ	$57.04	$57.17	$0.13	0.2%	$55.04	$57.72	$2.68	4.9%
EKPC	$58.83	$58.93	$0.11	0.2%	$57.62	$60.37	$2.75	4.8%
JCPLC	$52.90	$53.02	$0.12	0.2%	$52.52	$54.81	$2.29	4.4%
MEC	$60.16	$60.27	$0.11	0.2%	$58.45	$61.14	$2.69	4.6%
OVEC	$57.44	$57.55	$0.11	0.2%	$55.64	$58.32	$2.68	4.8%
PECO	$50.71	$50.82	$0.11	0.2%	$50.25	$52.30	$2.05	4.1%
PE	$57.26	$57.38	$0.12	0.2%	$54.92	$57.49	$2.57	4.7%
PEPCO	$66.04	$66.17	$0.12	0.2%	$63.96	$67.18	$3.23	5.0%
PPL	$55.55	$55.67	$0.12	0.2%	$54.31	$56.73	$2.42	4.5%
PSEG	$53.57	$53.69	$0.12	0.2%	$53.22	$55.53	$2.31	4.3%
REC	$55.63	$55.75	$0.12	0.2%	$54.77	$57.20	$2.44	4.5%

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Fast Start Impacts: Hub Average Differences

Hub	Average DLMP	Day-Ahead Average PLMP	Difference	Percent Difference	Average DLMP	Real-Time Average PLMP	Difference	Percent Difference
				2023 Jan - May				
AEP GEN HUB	$56.89	$57.01	$0.12	0.2%	$54.84	$57.47	$2.62	4.8%
AEP-DAYTON HUB	$57.95	$58.06	$0.11	0.2%	$55.88	$58.58	$2.70	4.8%
ATSI GEN HUB	$56.86	$56.99	$0.13	0.2%	$54.40	$57.03	$2.63	4.8%
CHICAGO GEN HUB	$49.04	$49.14	$0.10	0.2%	$46.69	$49.10	$2.41	5.2%
CHICAGO HUB	$50.01	$50.11	$0.10	0.2%	$47.73	$50.19	$2.46	5.1%
DOMINION HUB	$63.84	$63.87	$0.02	0.0%	$62.62	$65.55	$2.93	4.7%
EASTERN HUB	$55.22	$55.36	$0.14	0.3%	$54.53	$57.37	$2.84	5.2%
N ILLINOIS HUB	$49.62	$49.72	$0.10	0.2%	$47.41	$49.84	$2.43	5.1%
NEW JERSEY HUB	$53.00	$53.12	$0.12	0.2%	$52.60	$54.87	$2.27	4.3%
OHIO HUB	$57.83	$57.94	$0.11	0.2%	$55.73	$58.43	$2.69	4.8%
WEST INT HUB	$59.48	$59.55	$0.07	0.1%	$57.42	$60.17	$2.75	4.8%
WESTERN HUB	$60.95	$61.07	$0.13	0.2%	$58.38	$61.23	$2.85	4.9%

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Zonal PLMP-DLMP Difference Frequency

Zone	< ($50)	($50) to ($10)	($10) to $0	$0	$0 to $10	$10 to $20	$20 to $50	$50 to $100	$100 to $200	>= $200
				2023 Jan - May						
PJM-RTO	0.0%	0.0%	0.4%	45.4%	51.5%	2.2%	0.4%	0.0%	0.0%	0.0%
ACEC	0.0%	0.0%	7.0%	46.0%	44.9%	1.7%	0.3%	0.0%	0.0%	0.0%
AEP	0.0%	0.0%	0.6%	45.8%	50.6%	2.4%	0.5%	0.0%	0.0%	0.0%
APS	0.0%	0.0%	0.5%	45.7%	50.7%	2.5%	0.5%	0.0%	0.0%	0.0%
ATSI	0.0%	0.0%	0.5%	45.6%	51.1%	2.4%	0.5%	0.0%	0.0%	0.0%
BGE	0.0%	0.0%	3.8%	45.3%	46.9%	2.8%	1.0%	0.1%	0.0%	0.0%
COMED	0.0%	0.0%	2.8%	46.5%	48.2%	2.0%	0.4%	0.0%	0.0%	0.0%
DAY	0.0%	0.0%	0.6%	45.7%	50.3%	2.6%	0.6%	0.0%	0.0%	0.0%
DUKE	0.0%	0.0%	0.7%	45.8%	50.3%	2.6%	0.6%	0.0%	0.0%	0.0%
DOM	0.0%	0.1%	2.2%	45.6%	48.4%	2.7%	0.8%	0.1%	0.0%	0.0%
DPL	0.0%	0.0%	11.7%	45.9%	40.0%	1.7%	0.4%	0.2%	0.1%	0.0%
DUQ	0.0%	0.0%	0.5%	45.6%	51.1%	2.3%	0.5%	0.0%	0.0%	0.0%
EKPC	0.0%	0.0%	0.8%	45.8%	50.4%	2.5%	0.5%	0.0%	0.0%	0.0%
JCPLC	0.0%	0.0%	3.1%	45.8%	49.1%	1.6%	0.3%	0.0%	0.0%	0.0%
MEC	0.0%	0.0%	2.2%	45.4%	49.6%	2.2%	0.5%	0.1%	0.0%	0.0%
OVEC	0.0%	0.0%	0.8%	45.9%	50.4%	2.4%	0.5%	0.0%	0.0%	0.0%
PECO	0.0%	0.0%	10.5%	46.0%	41.4%	1.7%	0.3%	0.0%	0.0%	0.0%
PE	0.0%	0.0%	0.4%	45.3%	51.7%	2.2%	0.4%	0.0%	0.0%	0.0%
PEPCO	0.0%	0.0%	2.6%	45.6%	48.2%	2.7%	0.8%	0.1%	0.0%	0.0%
PPL	0.0%	0.0%	2.8%	45.5%	49.6%	1.8%	0.4%	0.0%	0.0%	0.0%
PSEG	0.0%	0.0%	2.8%	45.8%	49.4%	1.6%	0.3%	0.0%	0.0%	0.0%
REC	0.0%	0.0%	2.0%	45.6%	50.4%	1.7%	0.3%	0.0%	0.0%	0.0%

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Hourly Average Load and LMP Difference: Jan through May 2023
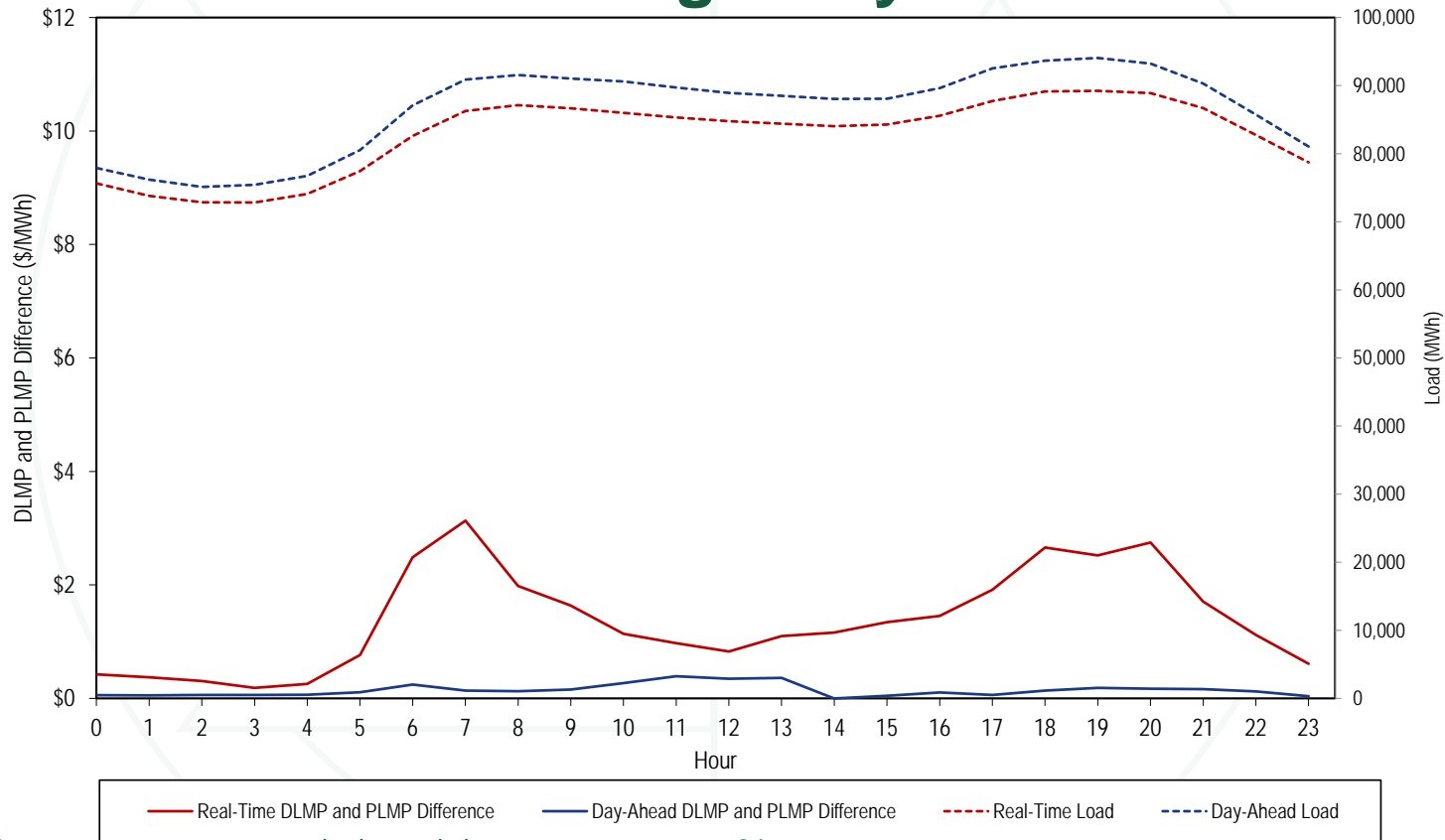
Real-Time Load-Weighted Average LMP

	2022				2023			
	Off Peak	On Peak	Difference	Percent Difference	Off Peak	On Peak	Difference	Percent Difference
Jan	$74.99	$62.54	($12.46)	(16.6%)	$33.20	$38.53	$5.32	16.0%
Feb	$45.70	$47.86	$2.16	4.7%	$23.45	$28.67	$5.22	22.3%
Mar	$41.58	$45.41	$3.83	9.2%	$26.96	$29.78	$2.82	10.5%
Apr	$55.93	$71.89	$15.96	28.5%	$24.08	$35.00	$10.92	45.4%
May	$66.12	$100.85	$34.73	52.5%	$22.65	$33.84	$11.19	49.4%
Jun	$61.63	$126.83	$65.20	105.8%				
Jul	$71.83	$114.14	$42.31	58.9%				
Aug	$85.89	$136.31	$50.42	58.7%				
Sep	$66.36	$89.76	$23.40	35.3%				
Oct	$47.61	$64.50	$16.90	35.5%				
Nov	$45.48	$60.50	$15.01	33.0%				
Dec	$153.54	$129.51	($24.03)	(15.7%)				

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