Energy Reserve Simulations Update

EPSTF

Sep 26, 2018

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Agenda

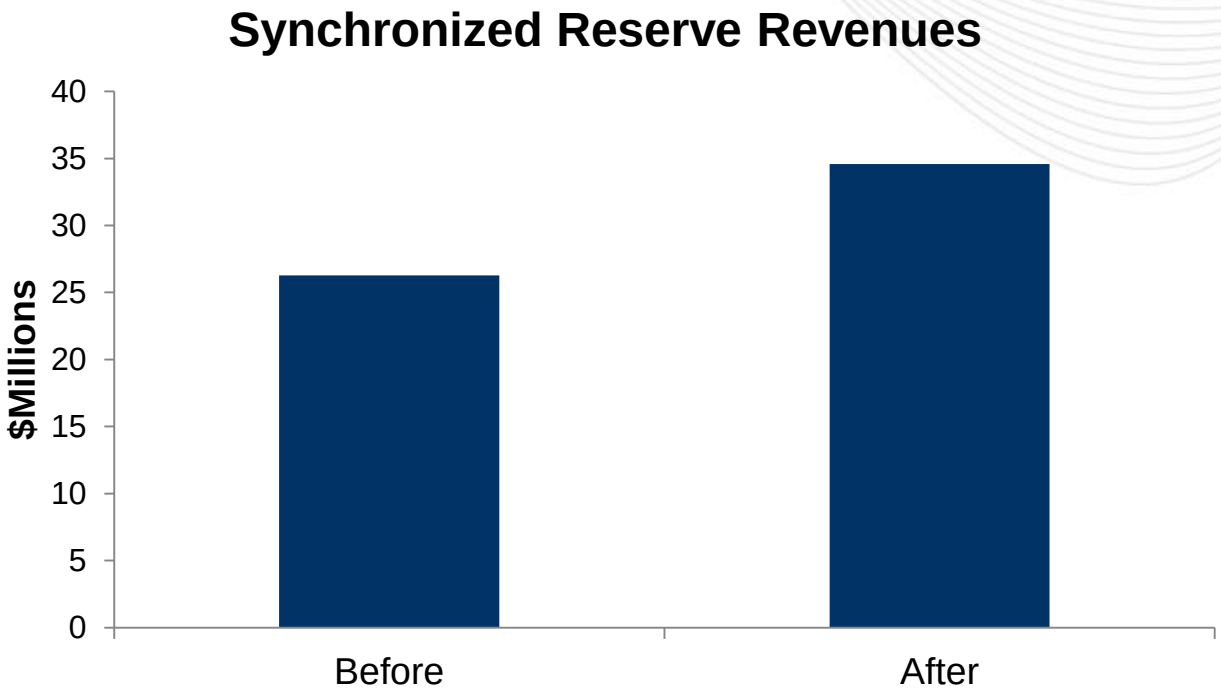
Tier 1 and Tier 2 Consolidation

Downward Sloping Operating Reserve Demand Curve (ORDC)

Tier 1 & Tier 2 Consolidation – Overview

Item	Description
Objective	Calculate the reserve market revenue impacts of consolidating the Tier 1 and Tier 2 products
Method	- For 6/1/2017 thru 5/31/2018, simulate Synchronized Reserve (SR) revenue when Tier 1 and Tier 2 products are consolidated - Compare simulated results with actual observed data
Assumption	- Market Participant submitted Tier 2 offers were used in the simulation; no further adjustments were introduced to the reserve market offers - No Tier 1 biasing included in the simulations - Plenty of transfers from non MAD to MAD; therefore only simulating RTO (from SOM: in 2017, price divergence between RTO and MAD in 2.3% of hours)

Tier 1 & Tier 2 Consolidation Results: June 1, 2017 – May 31, 2018



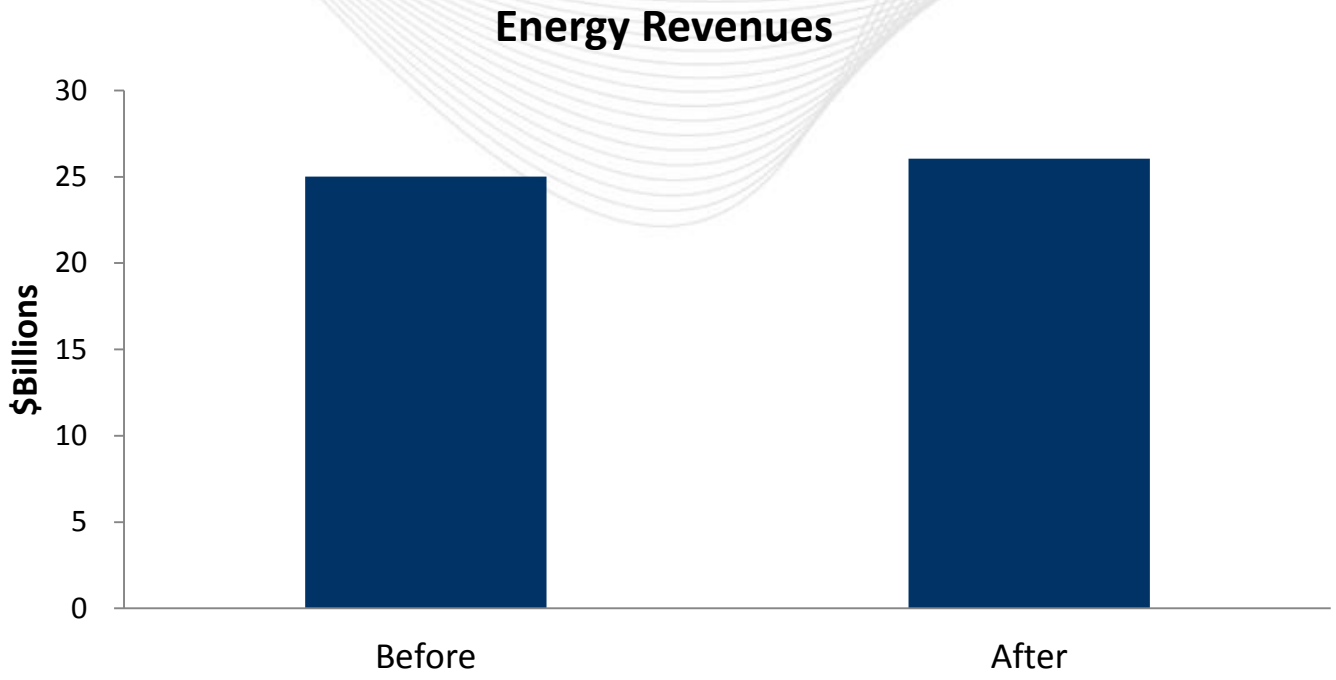
	Synchronized Reserve Revenues
Before (actual)	$26,282,638
After (simulation)	$34,571,497
Increase	$8,288,859

Actual Tier 2 uplift was $24.8 million. Due to the removal of the Tier 1 product, it is expected that Tier 2 (SR) uplift will decrease.

Downward-Sloping ORDC - Overview

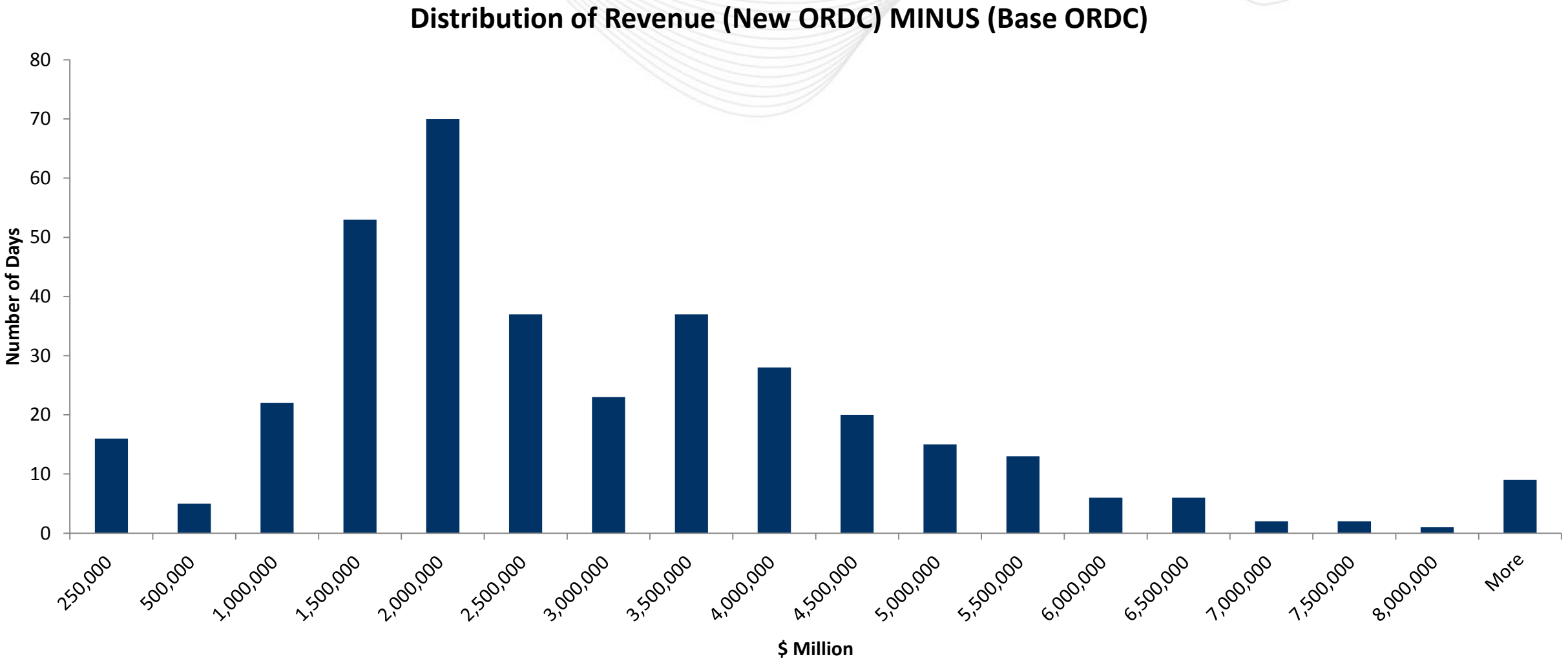
Item	Description
Objective	Calculate the reserve market revenue and uplift impacts based on downward-sloping ORDCs
Method	- For 6/1/2017 thru 5/31/2018, simulate SR revenue and uplift using current RTO step ORDC and proposed RTO downward-sloping ORDCs - Enable PROBE Perfect Dispatch to commit and de-commit CTs
Assumption	- Market Participant submitted Tier 2 offers were used in the simulations; no further adjustments were introduced to the reserve market offers - No Tier 1 Biasing included - Plenty of transfers from non MAD to MAD; therefore only simulating RTO (from SOM: in 2017, price divergence between RTO and MAD in 2.3% of hours)

Downward-Sloping ORDC - Energy Revenues



	Energy Revenues
Before	$25,019,576,620
After	$26,042,869,516
Increase	$1,023,292,896
% Increase	4.1%

Downward-Sloping ORDC Energy Revenue Delta Distribution



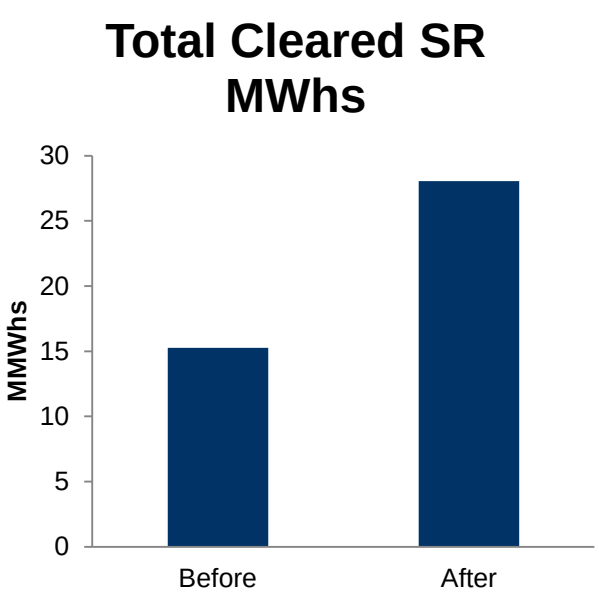
Downward-Sloping ORDC Energy Revenue Delta Distribution

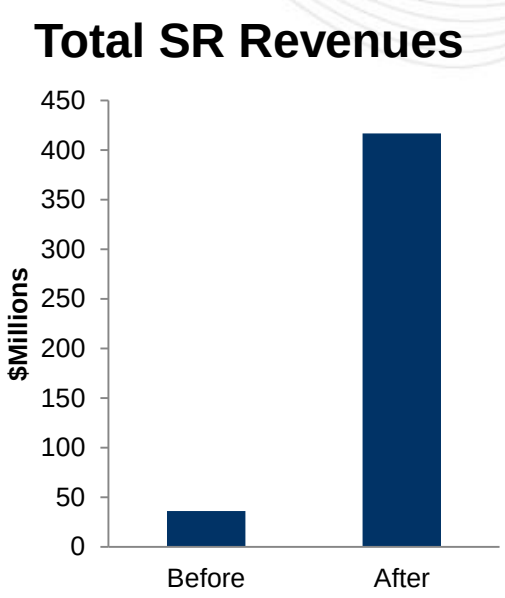
Top Ten Days Revenue Distribution

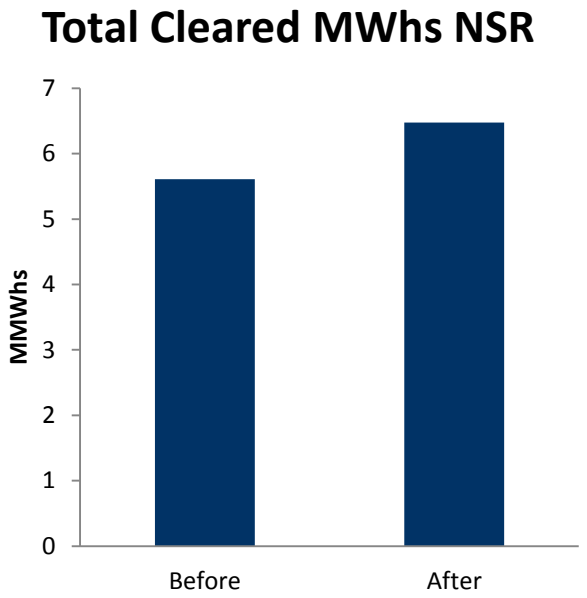
DATE	Revenue$ DIFF	% Increase From Base to New ORDC
1/5/2018	$ 20,855,339	5.2%
1/4/2018	$ 15,886,238	4.5%
1/17/2018	$ 15,669,673	7.1%
1/3/2018	$ 14,643,568	4.6%
7/19/2017*	$ 14,215,576	10.9%
1/16/2018	$ 12,968,671	8.3%
1/6/2018	$ 12,690,429	3.3%
1/14/2018	$ 10,159,928	6.1%
1/13/2018	$ 9,756,786	8.8%
12/30/2017	$ 7,943,504	5.7%

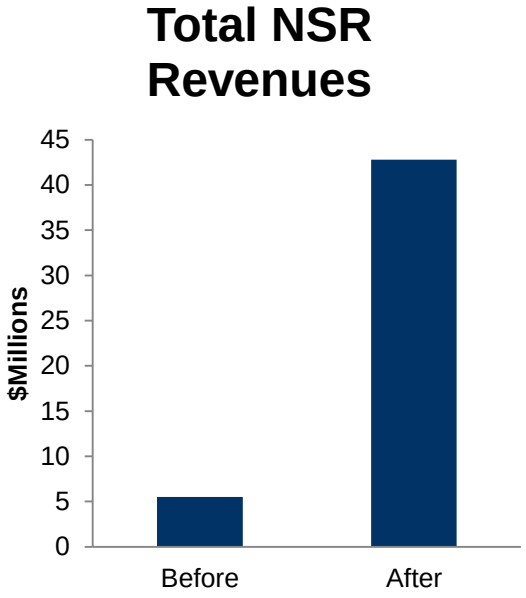
*Summer Peak Load Day

Downward-Sloping ORDC – SR and NSR





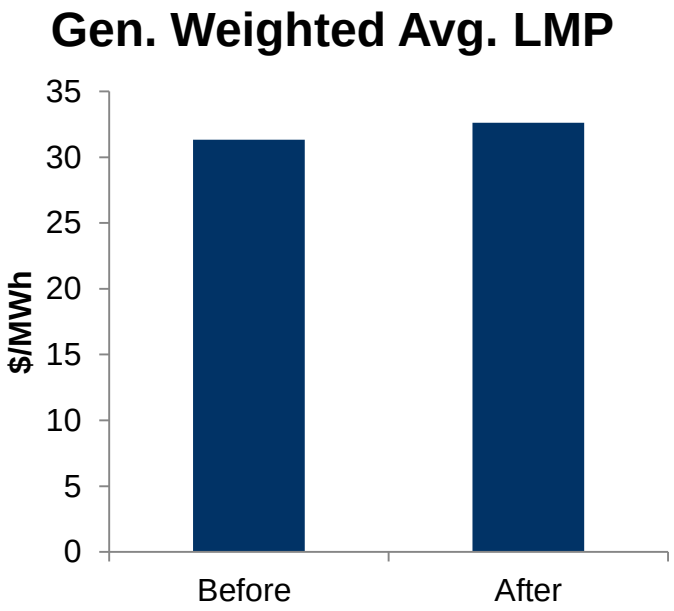


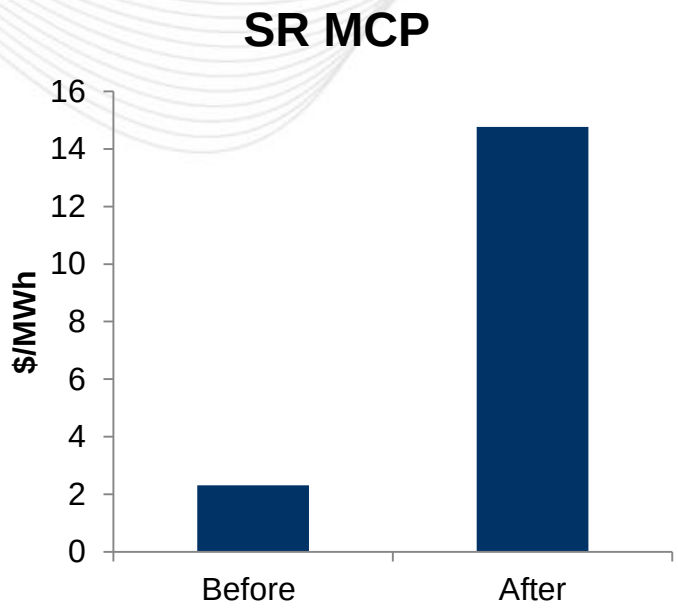


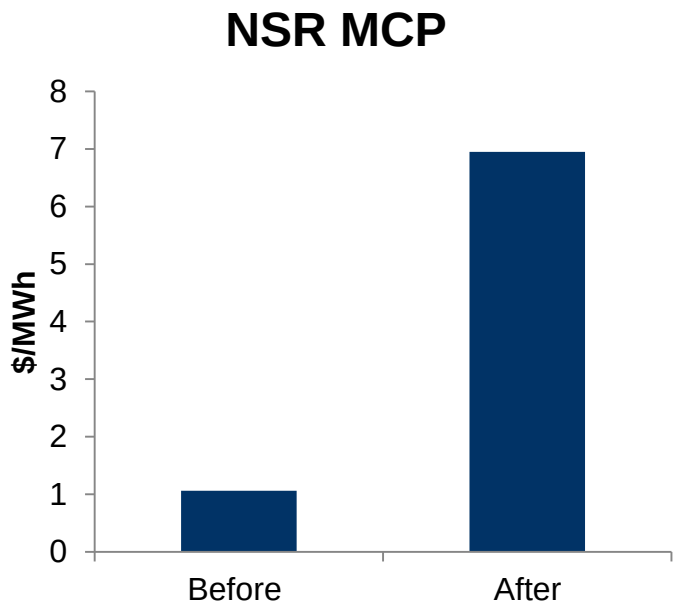
	SR MWhs	SR Revenues
Before	15,267,907	$36,032,619
After	28,060,989	$416,670,420
Increase	12,793,082	$380,637,800

	NSR MWhs	NSR Revenues
Before	5,608,465	$5,521,643
After	6,476,598	$42,807,802
Increase	868,133	$37,286,158

Energy LMPs and SR and NSR MCPs



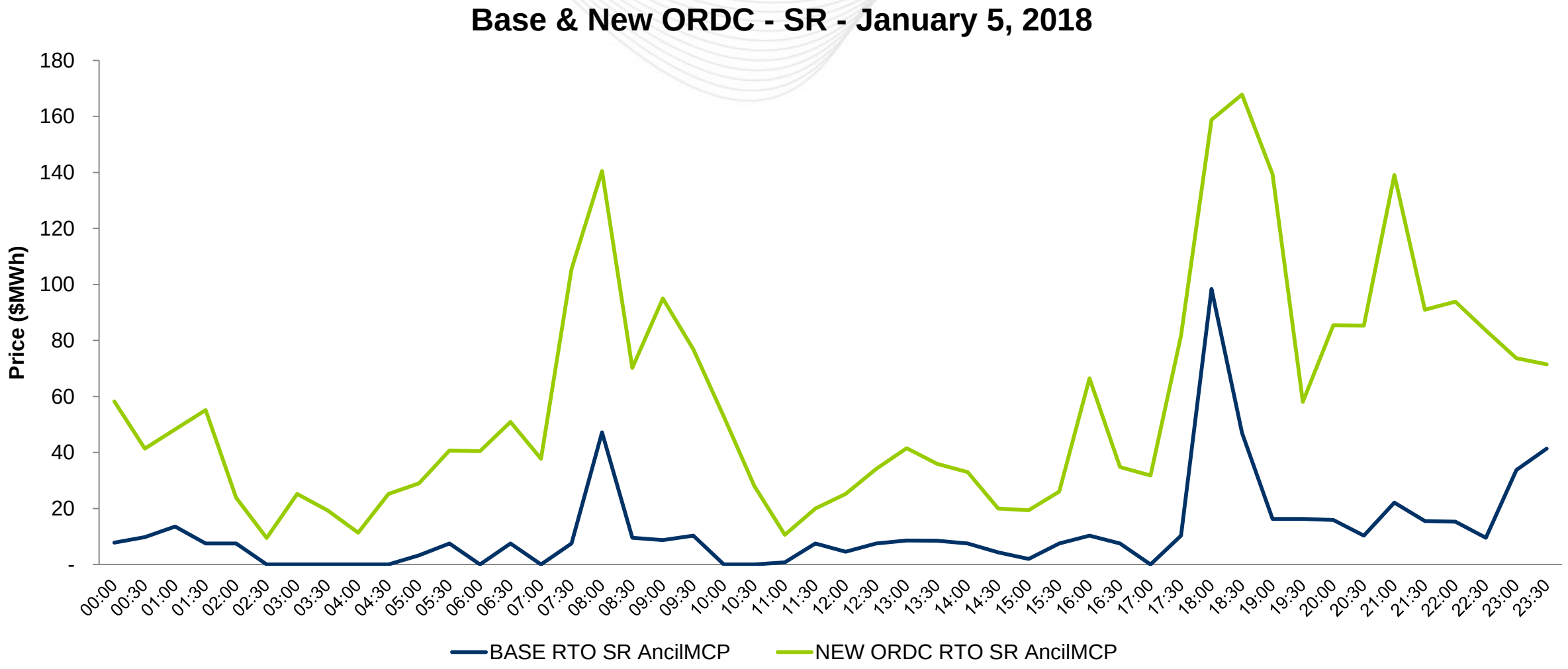




	Gen. Weighted Avg. LMP ($/MWh)
Before	31.33
After	32.61
Increase	1.28

	SR MCP ($/MWh)	NSR MCP ($/MWh)
Before	2.31	1.06
After	14.77	6.95
Increase	12.46	5.89

High Load Scenario Winter: January 5, 2018



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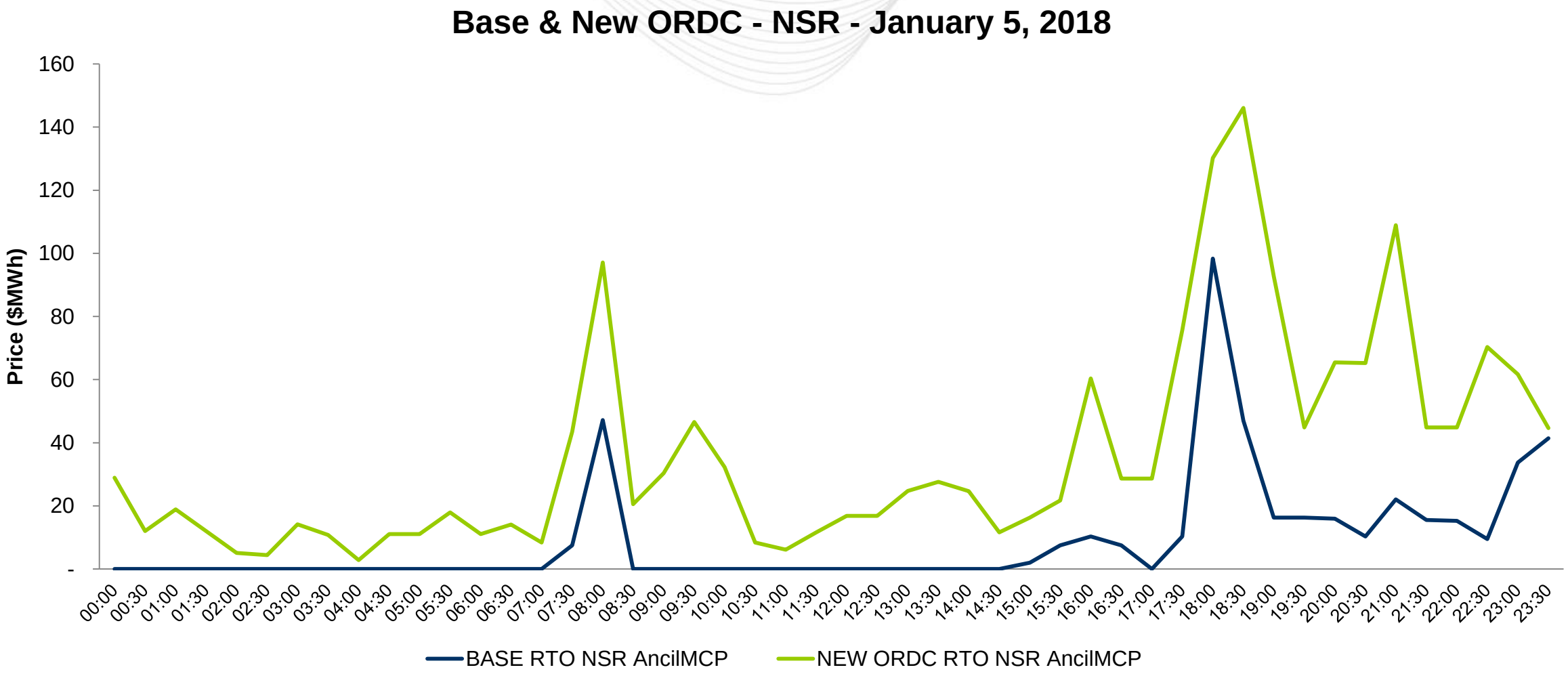

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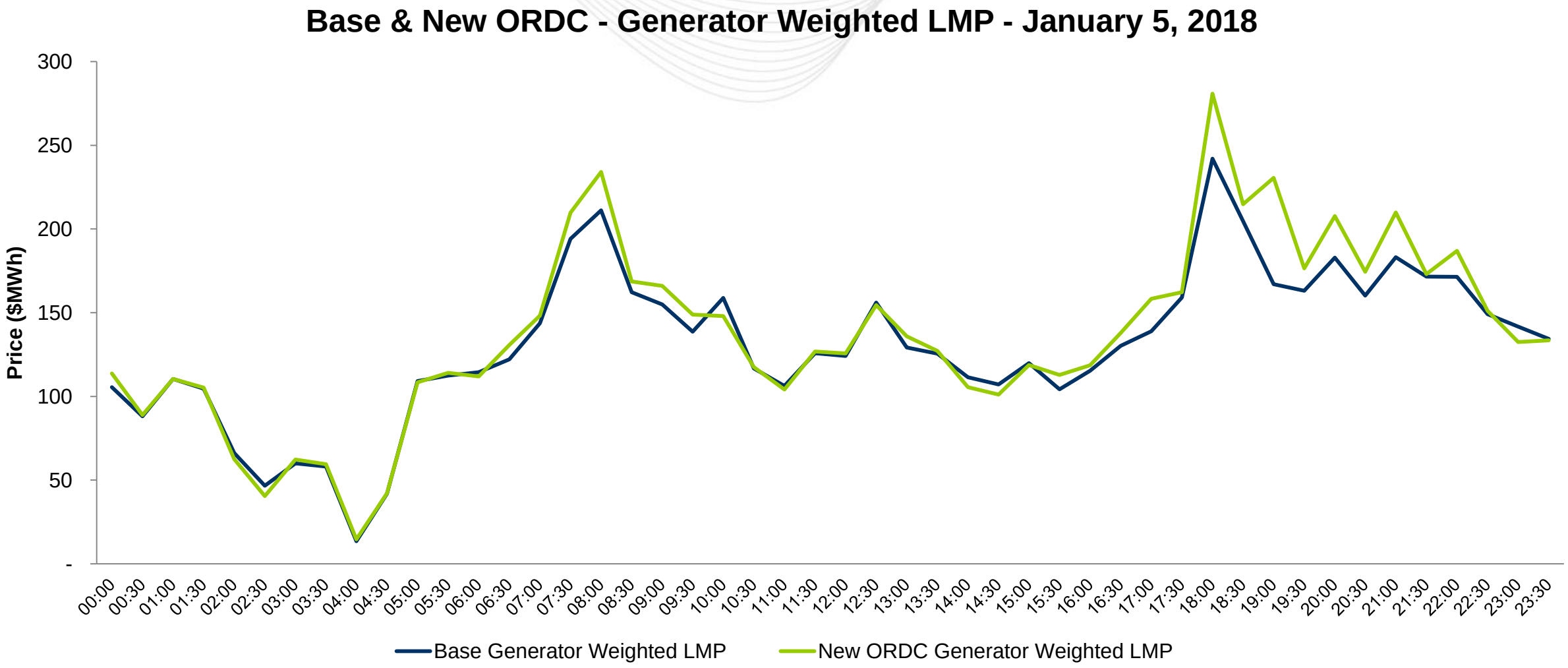
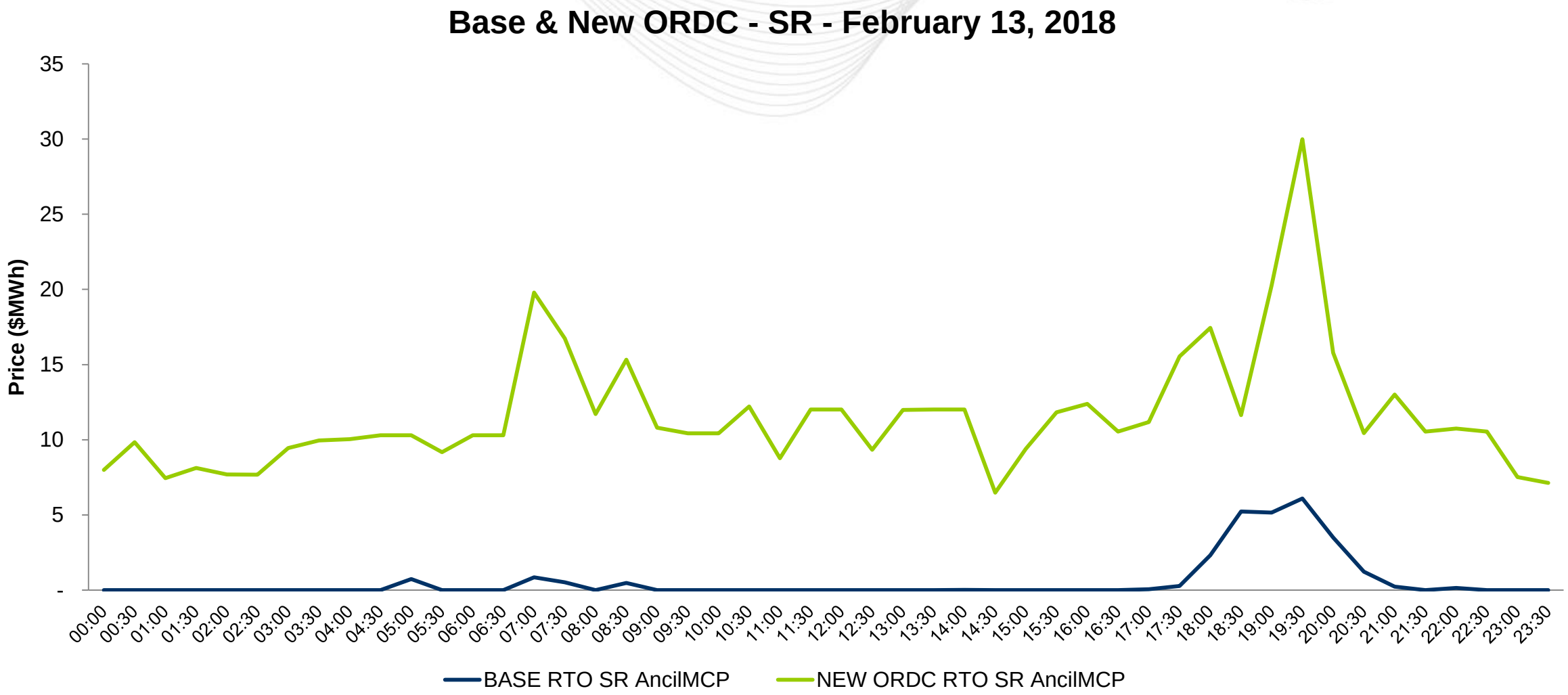


Typical Winter Day: February 13, 2018



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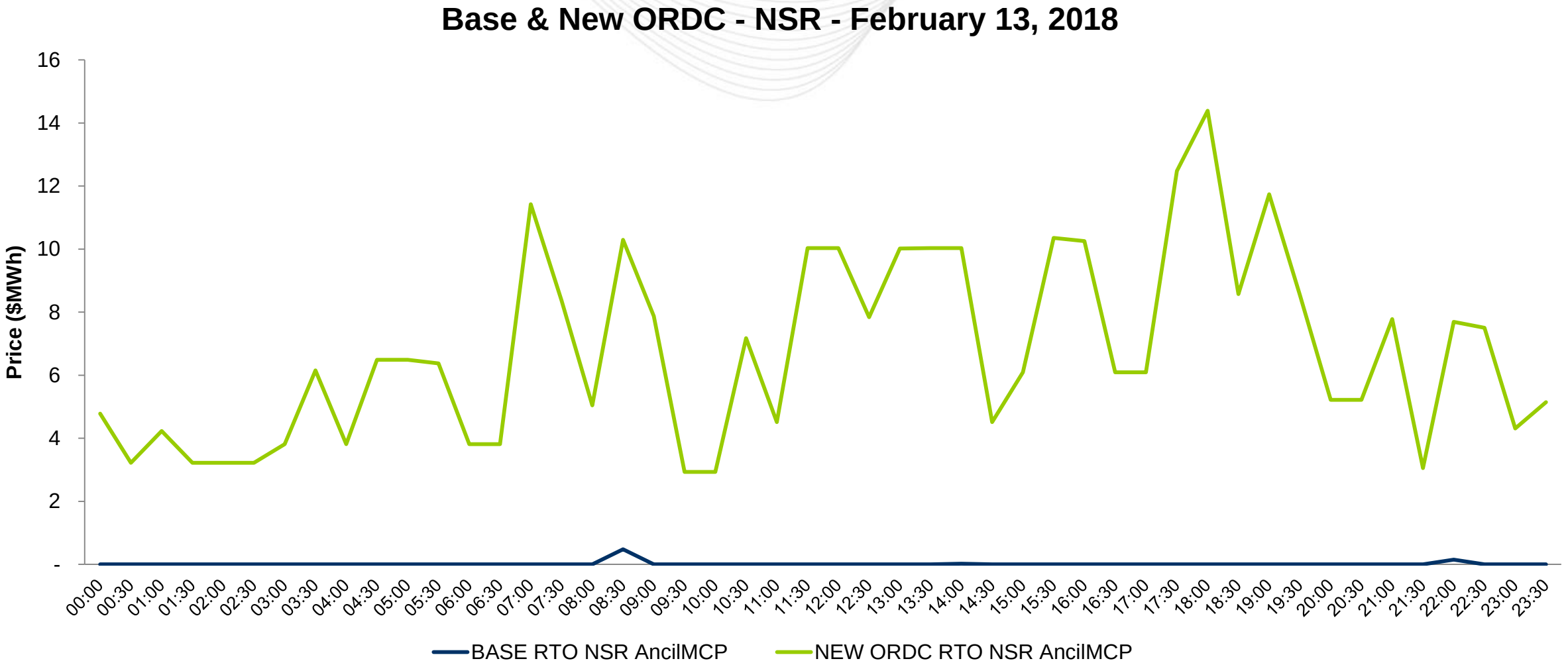

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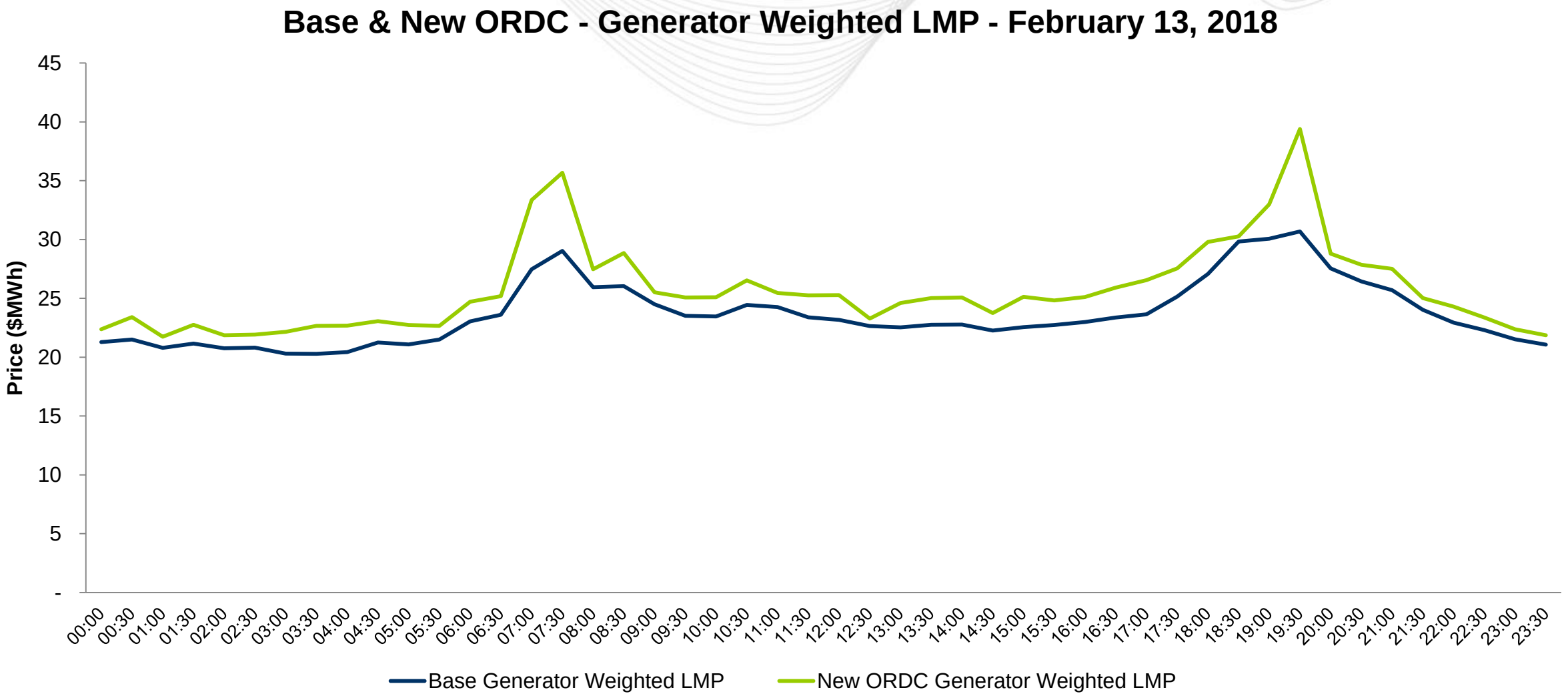
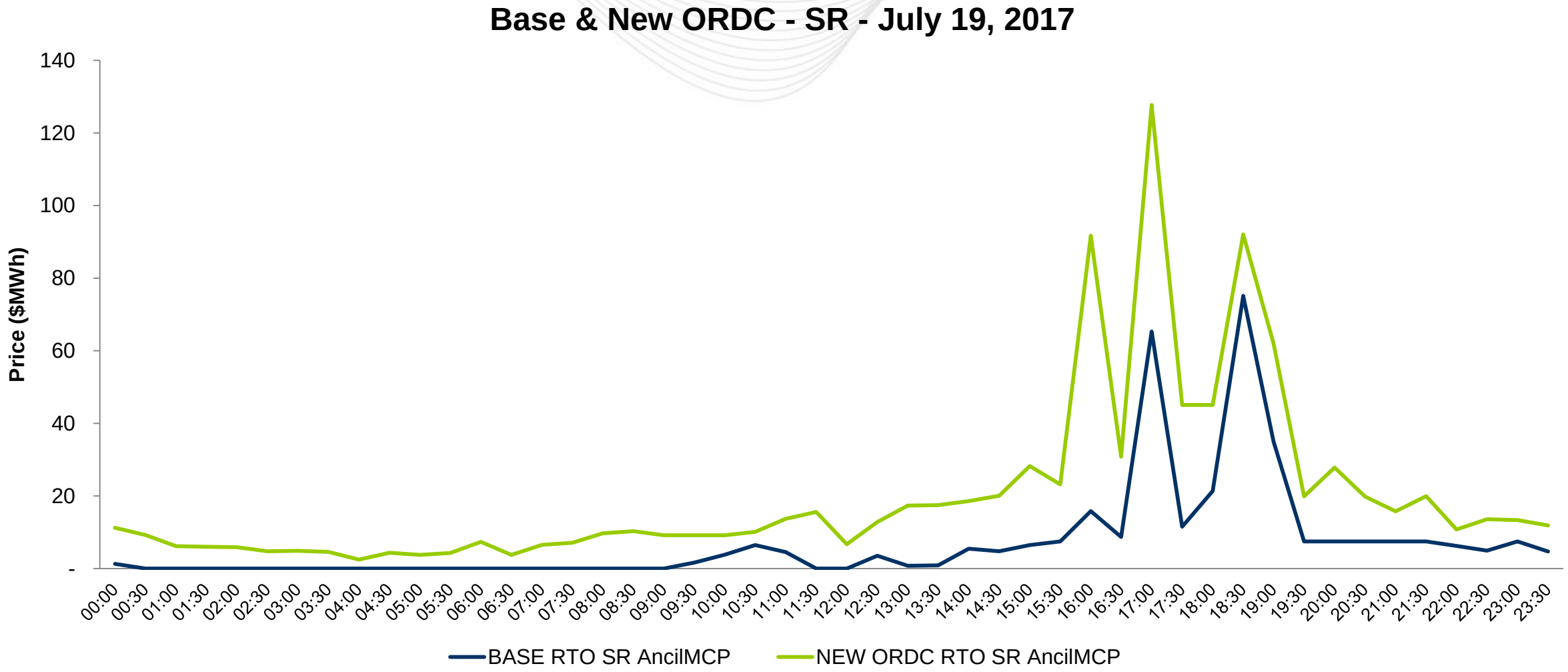
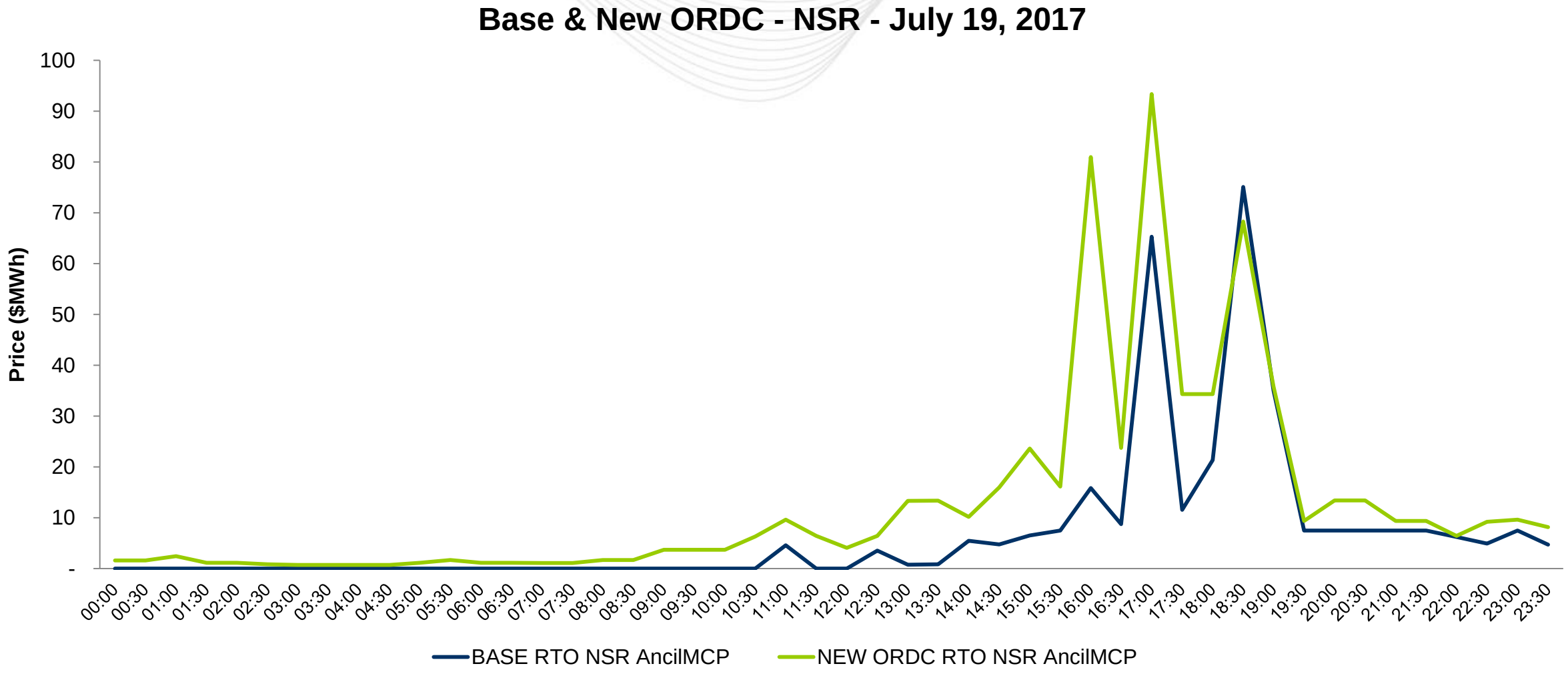


High Load Scenario Summer: July 19, 2017



High Load Scenario Summer: July 19, 2017



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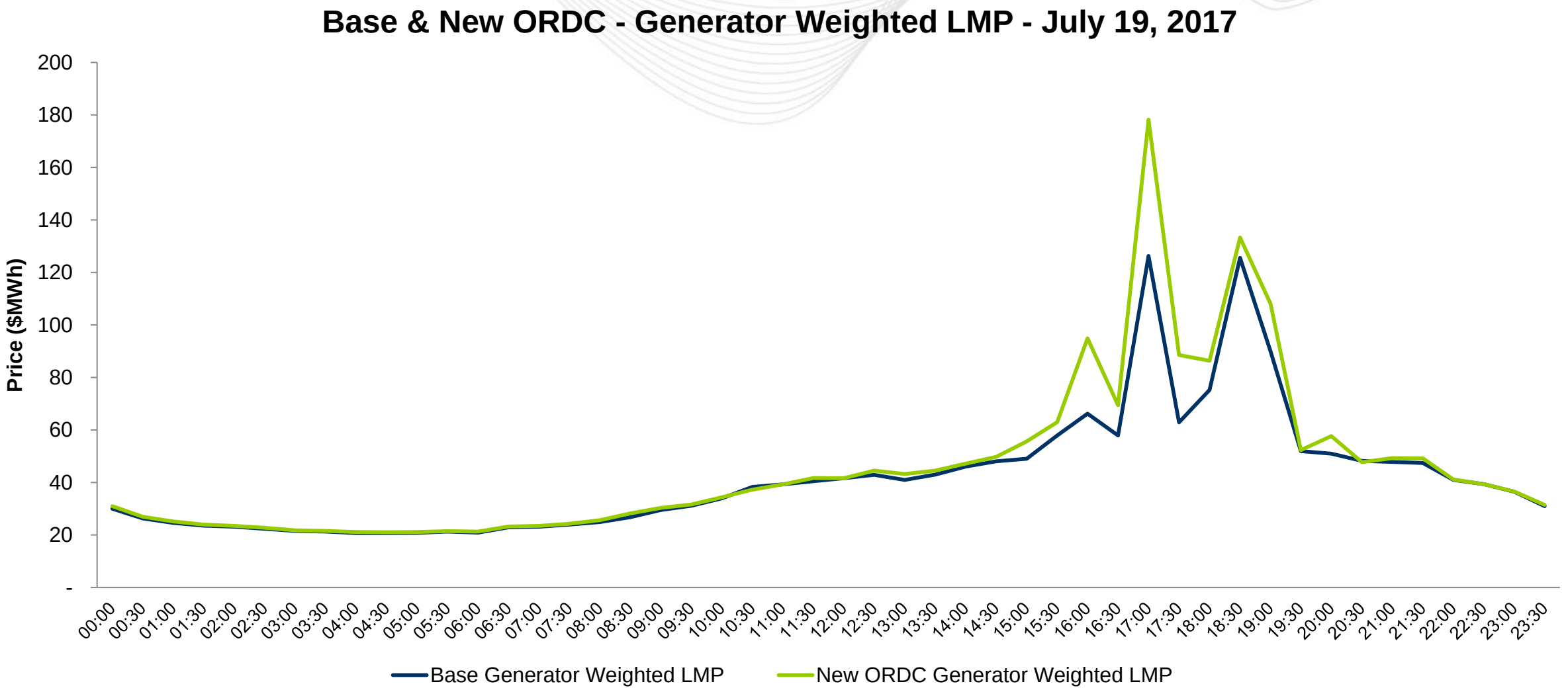
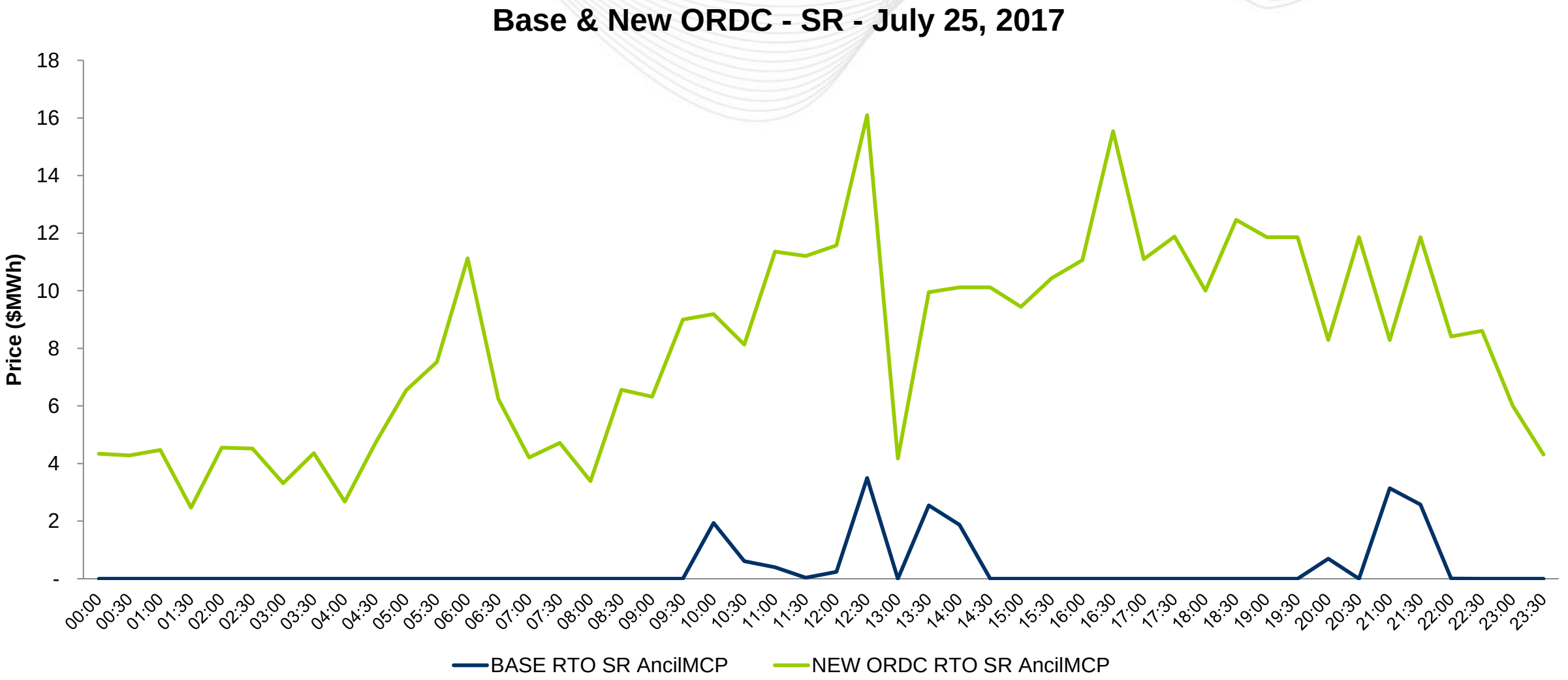


Typical Summer Day: July 25, 2017



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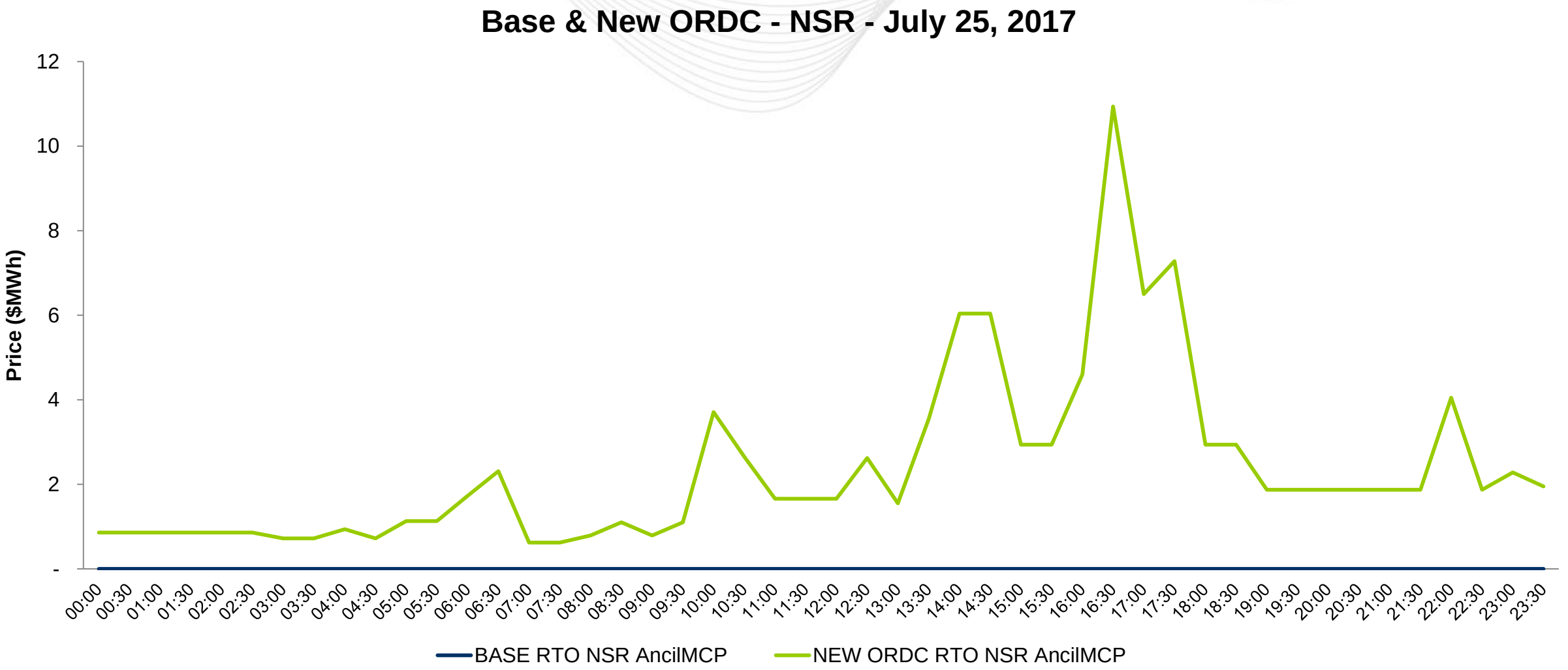

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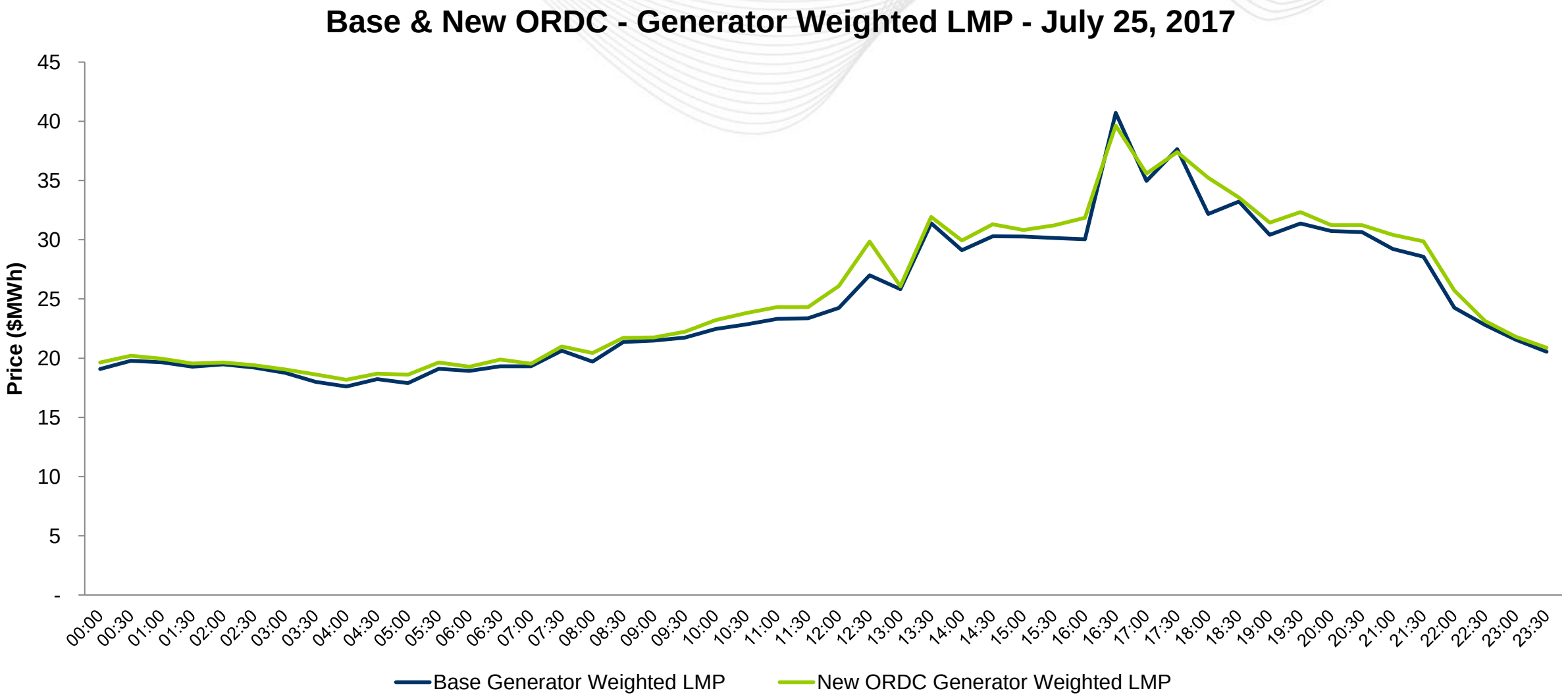
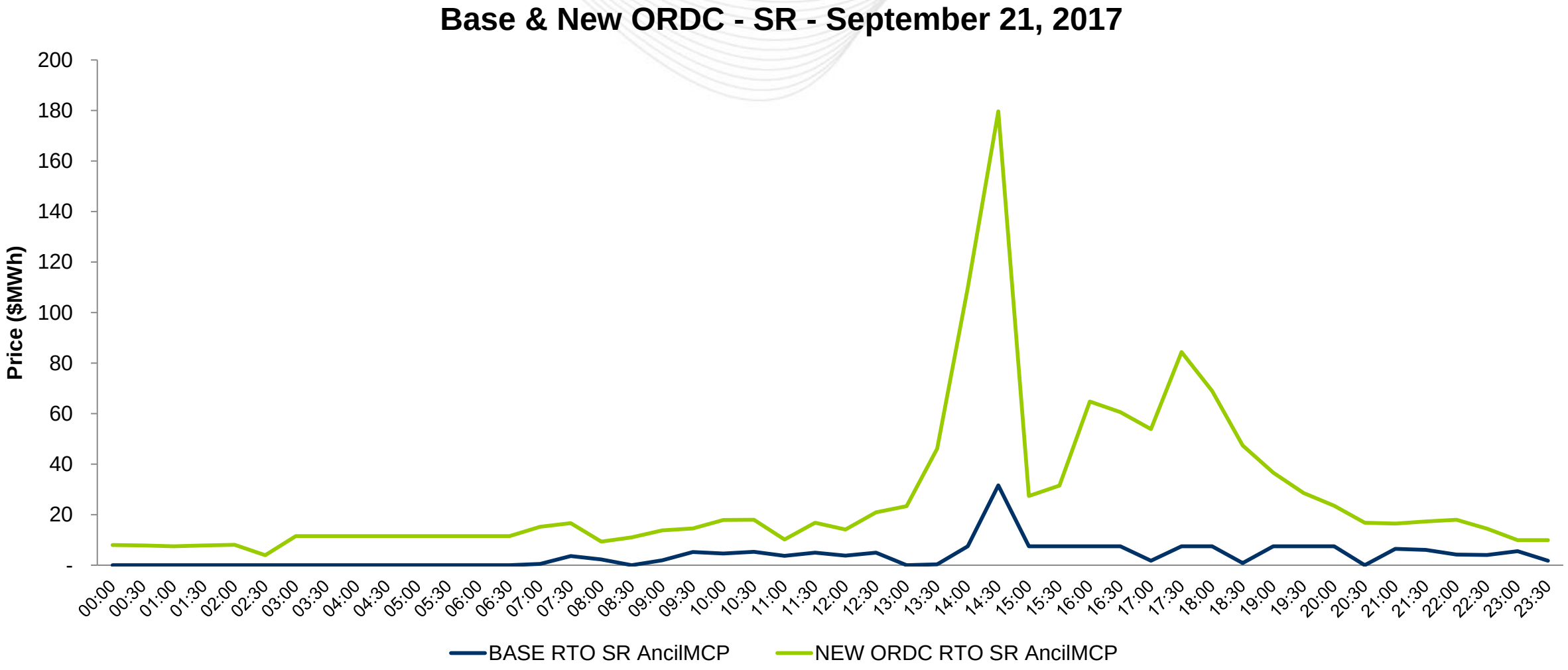


Shortage* Pricing Day: September 21, 2017

*Note: PROBE PD is committing and decommitting CTs and has perfect foresight.



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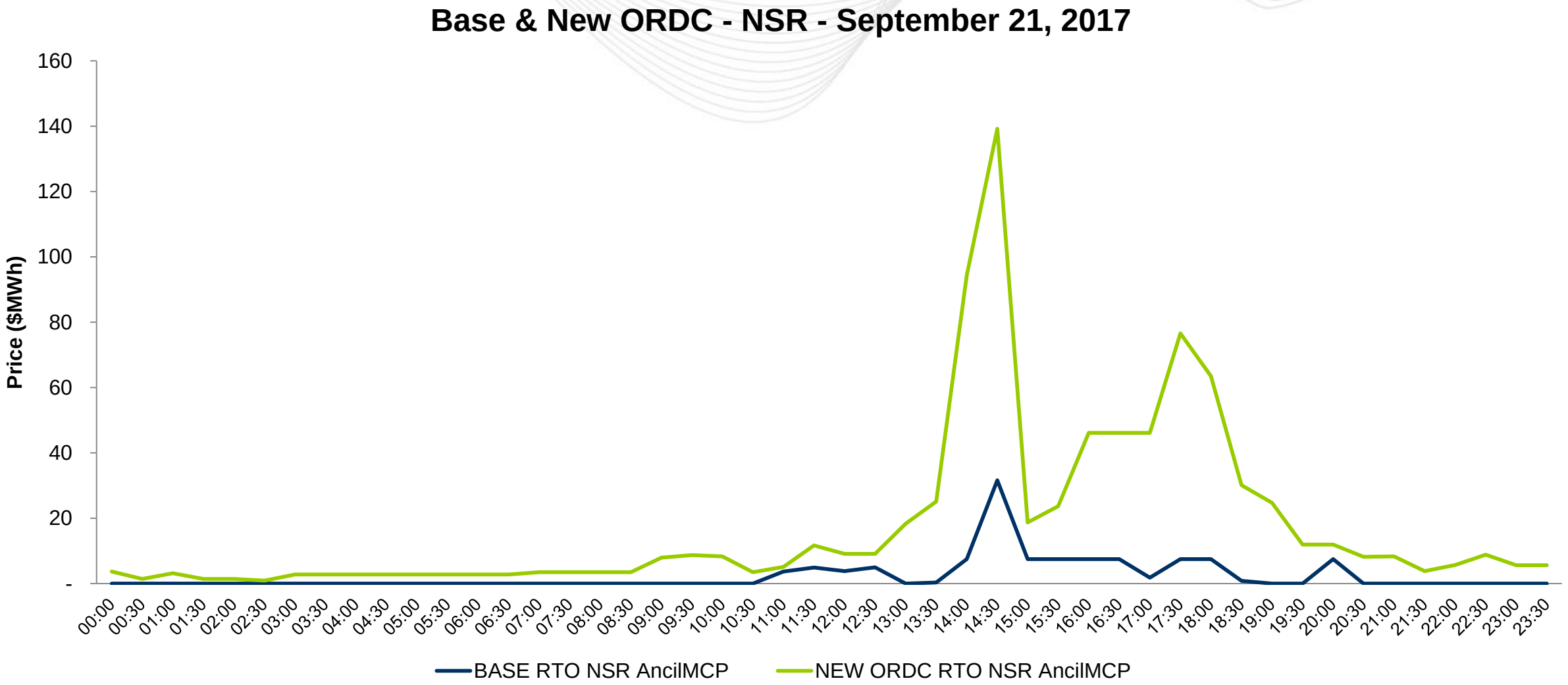

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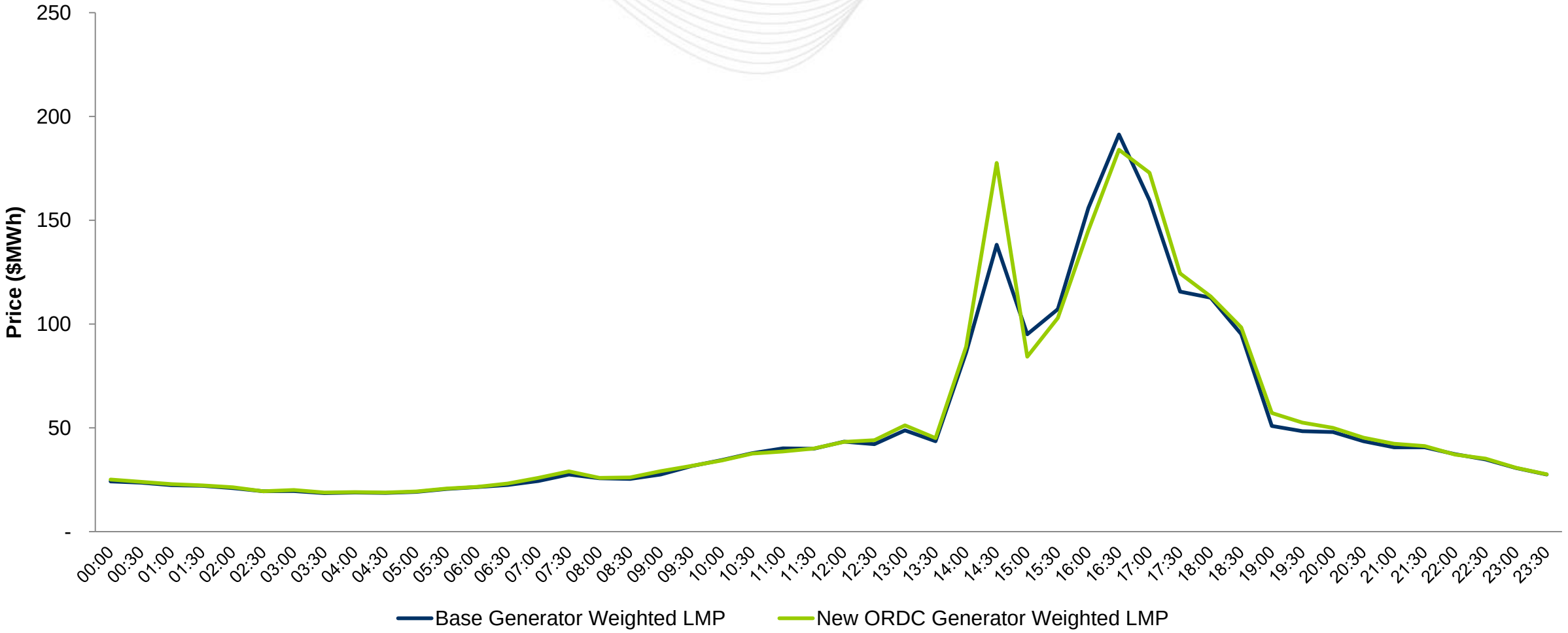
Base & New ORDC - Generator Weighted LMP - September 21, 2017



Current ORDC vs. Proposed ORDC $ Impact

Item	$ Impact (Million)
Tier 1 & Tier 2 Consolidation	$8.3 minus SR uplift reduction
Energy Revenue	$1,023.3
Reserve Revenue	$417.9
% Decrease in Energy and SR Uplift*	14.1%
Net Energy and Reserve Market Impact	$1,449.5 minus Energy and SR uplift reduction
% Energy and Reserve Market Impact compared to Base energy market billing at $25.1 Billion	5.8% (does not include Energy and SR uplift reduction)
Capacity Market Costs**	($650 - $1,200)
Net Impact***	$250 - $800 (1-3.2% increase)

*PROBE PD uplift calculation is a simplification of actual PJM Settlement rules and is provided for informational purposes only

**Extrapolating results from previous analysis, additional analysis forthcoming

***Under steady-state conditions once the capacity market has incorporated ORDC changes in the energy market