



Briefing on Contingency Modeling Enhancements

Technical Analysis Methodology and Results

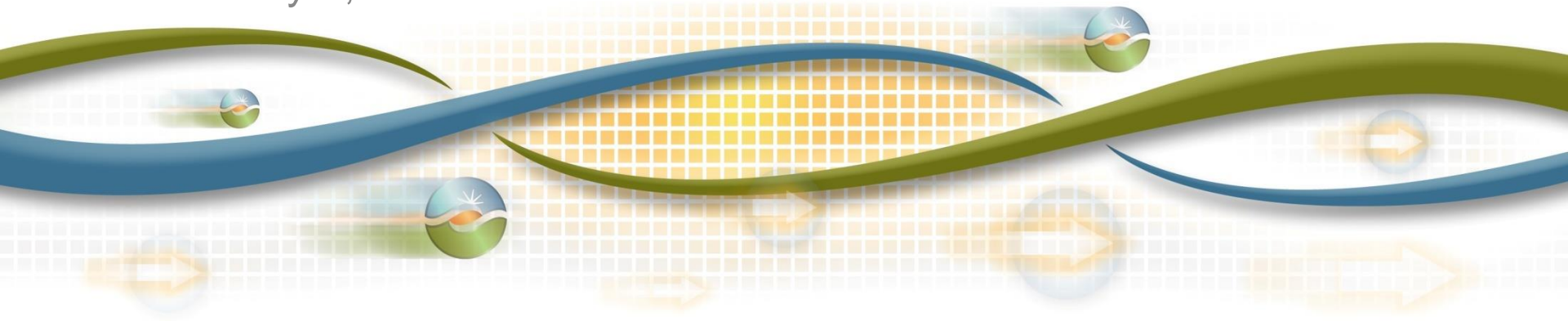
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General Session

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Purpose

- Validate how CME will work in production day-ahead market
 - Is sufficient corrective capacity procured?
 - Does it allow for reliable operations of the transmission system?
 - Are the price impacts as expected?

Technical analysis methodology

SCOPE AND SCENARIOS

Scope and scenarios

- Selected 12 scenarios to test
 - Choose six different network conditions
 - Major path outages
 - Test each network condition in two seasons
 - Spring
 - Summer

| Network condition | Season 1 | Season 2 |
|--------------------------|----------|----------|
| N0. All lines in service | N0S1 | N0S2 |
| N1. Path 26 outage | N1S1 | N1S2 |
| N2. Path 15 outage | N2S1 | N2S2 |
| N3. COI (PACI) outage | N3S1 | N3S2 |
| N4. SCIT outage | N4S1 | N4S2 |
| N5. SDGE IMP BG outage | N5S1 | N5S2 |

Scope and scenarios

- Build CME cases
 - Selected day-ahead production case matching the scenarios
 - Defined and enabled all CME contingencies in all scenarios
 - Used appropriate ratings for system condition and season
 - 20 minute corrective timeframe
 - Enable/Disable corrective capacity overlap with A/S based on contingency
 - Removed relevant MOCs
- Compare CME cases to same case but without CME enabled and without MOC enforced

Technical analysis results

ANALYSIS RESULTS

Analysis Results

Overview

- CME constraint binds in 1 of 12 scenarios
 - SDGE Import Limit (Summer)
- CME confirms enough unloaded 20-minute capacity in 11 of 12 scenarios
- CME confirms/allows reliable transmission system without using MOC in all 12 scenarios

Analysis Results

Non-binding scenarios

- CME confirms enough unloaded 20-minute capacity in 11 of 12 scenarios
- CME enforced in full day-ahead market, but for simplicity here, only showing peak hour results

| Scenario | Date:hour (GMT) | CME case | Path | Path Flow | Post-Contingency Rating | Capacity Required | Unloaded Capacity |
|----------|--|------------|-----------|-----------|-------------------------|-------------------|-------------------|
| N0S1 | 02FEB2015:02 | CME_PACI | PACI_MSL | 2523 | 1834 | 689 | 1282 |
| N0S2 | <i>Old case being replaced with newer case</i> | | | | | | |
| N1S1 | 31MAY2015:03 | CME_PATH26 | PATH26_BG | 1301 | 1000 | 301 | 714 |
| N1S2 | 04OCT2015:01 | CME_PATH26 | PATH26_BG | 3343 | 1000 | 2343 | 4481 |
| N2S1 | 02JUN2015:14 | CME_PATH15 | PATH15_BG | 2008 | 2650 | 0 | 1267 |
| N2S2 | 30MAR2015:07 | CME_PATH15 | PATH15_BG | 3079 | 2650 | 429 | 1404 |
| N3S1 | 05DEC2014:04 | CME_PACI | PACI_MSL | 2175 | 1633 | 542 | 2435 |
| N3S2 | <i>Old case being replaced with newer case</i> | | | | | | |
| N4S1 | <i>Old case being replaced with newer case</i> | | | | | | |
| N4S2 | 09OCT2015:23 | CME_SCIT | SCIT_BG | 13541 | 14920 | 0 | 392 |
| N5S2 | 06OCT2015:19 | CME_SDGE | CME_SDGE | 1943 | 1400 | 543 | 910 |

Analysis Results

Non-binding scenarios

- Price impact
 - Deminimis impact on LMPs between CME cases and non-CME/non-MOC cases.

Analysis Results

Binding scenario (SDGE Import Limit – Summer)

- CME binds in four hours
- CME procures enough corrective capacity in binding scenario
- CME de-commits El Cajon to award corrective capacity
- CME lowers pre-contingency flows

| Scenario | Date:hour (GMT) | CME case | Path | CME Flow | Post-Contingency Rating | Capacity Required | Corrective Capacity | Shadow Price | No CME Flow | No CME Available Capacity |
|----------|-----------------|----------|------------|----------|-------------------------|-------------------|---------------------|--------------|-------------|---------------------------|
| N5S1 | 23JUL2016:00 | SDGE | SDGEIMP_BG | 1919 | 1400 | 519 | 531 | 18.87 | 2264 | 275 |
| N5S1 | 23JUL2016:01 | SDGE | SDGEIMP_BG | 1921 | 1400 | 521 | 521 | 11.64 | 2183 | 273 |
| N5S1 | 23JUL2016:02 | SDGE | SDGEIMP_BG | 1906 | 1400 | 506 | 517 | 7.06 | 2066 | 273 |
| N5S1 | 23JUL2016:03 | SDGE | SDGEIMP_BG | 2065 | 1400 | 665 | 674 | 6.16 | 2170 | 363 |

Analysis Results

Binding scenario (SDGE Import Limit – Summer)

- Price impact
 - SDGE DLAP sees higher LMP than SCE
 - LMPs higher than non-CME/non-MOC cases by the cost of corrective capacity

| | PG&E | | | | SCE | | | | SDGE | | | | VEA | | | |
|--------------|------------|---------------|------------|---------------|------------|---------------|------------|---------------|------------|---------------|------------|---------------|------------|---------------|------------|---------------|
| | LMP | | Congestion | | LMP | | Congestion | | LMP | | Congestion | | LMP | | Congestion | |
| | <i>CME</i> | <i>No CME</i> | <i>CME</i> | <i>No CME</i> | <i>CME</i> | <i>No CME</i> | <i>CME</i> | <i>No CME</i> | <i>CME</i> | <i>No CME</i> | <i>CME</i> | <i>No CME</i> | <i>CME</i> | <i>No CME</i> | <i>CME</i> | <i>No CME</i> |
| 23JUL2016:00 | 51.32 | 50.48 | -7.28 | -7.51 | 63.03 | 65.77 | 1.69 | 4.85 | 84.19 | 68.2 | 20.35 | 4.56 | 60.57 | 62.88 | 1.06 | 3.98 |
| 23JUL2016:01 | 60.18 | 60.25 | -2.38 | -1.65 | 65.11 | 65.92 | -0.26 | 1.11 | 79.57 | 68.77 | 11.33 | 1.05 | 63.62 | 64.21 | -0.41 | 0.92 |
| 23JUL2016:02 | 59.98 | 60 | -2.09 | -1.26 | 65.28 | 65 | 0.32 | 0.81 | 75.16 | 67.95 | 7.31 | 1.03 | 63.76 | 61.78 | 0.15 | -0.94 |
| 23JUL2016:03 | 49.98 | 50 | -0.6 | -1.76 | 52.27 | 55 | -0.6 | 1.09 | 60.79 | 57.98 | 5.56 | 1.6 | 50.93 | 50.09 | -0.6 | -2.4 |

Analysis Results

Binding scenario (SDGE Import Limit – Summer)

- Ancillary services impact
 - Deminimis impact on A/S procurement between CME case and non-CME/non-MOC case.

| Scenario | Date:hour (GMT) | Commodity | Region | MW with CME | MW without CME | Price with CME | Price without CME |
|----------|-----------------|-----------|--------|-------------|----------------|----------------|-------------------|
| N5S1 | 23JUL2016:00 | En | SDGE | 4195 | 4364 | 84.19 | 68.20 |
| N5S1 | 23JUL2016:01 | En | SDGE | 4107 | 4276 | 79.57 | 68.77 |
| N5S1 | 23JUL2016:02 | En | SDGE | 4061 | 4145 | 75.16 | 67.95 |
| N5S1 | 23JUL2016:03 | En | SDGE | 4056 | 4090 | 60.79 | 57.98 |
| N5S1 | 23JUL2016:01 | Up AS | SP26 | 982 | 963 | 0 | 0 |
| N5S1 | 23JUL2016:02 | Up AS | SP26 | 1076 | 961 | 0 | 0 |
| N5S1 | 23JUL2016:03 | Up AS | SP26 | 928 | 818 | 0 | 0 |
| N5S1 | 23JUL2016:04 | Up As | SP26 | 655 | 578 | 0 | 0 |

QUESTIONS