



Aliso Canyon gas electric coordination phase 2 discussion

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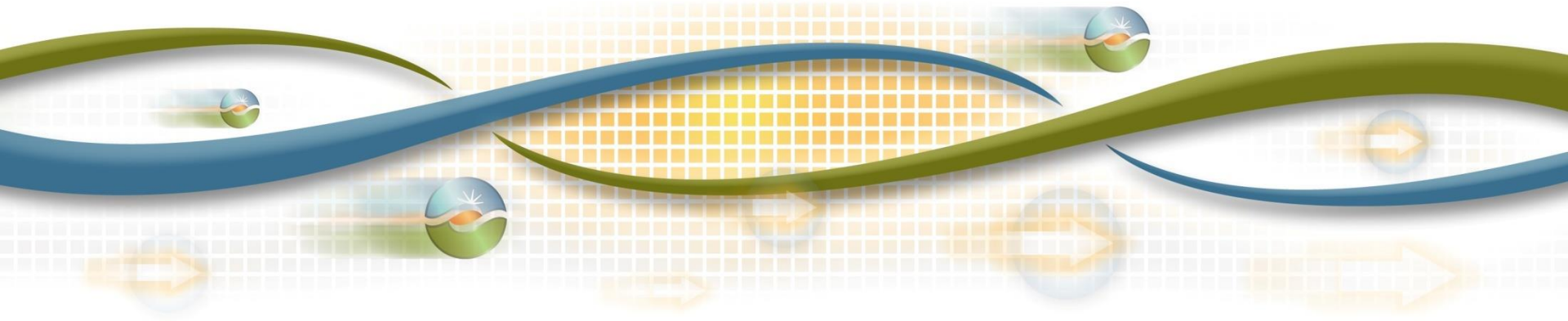
Senior Market Design and Policy Developer

Market & Infrastructure Policy

Market Surveillance Committee Meeting

General Session

September 19, 2016



Proposed Aliso Canyon phase 2 scope and focus

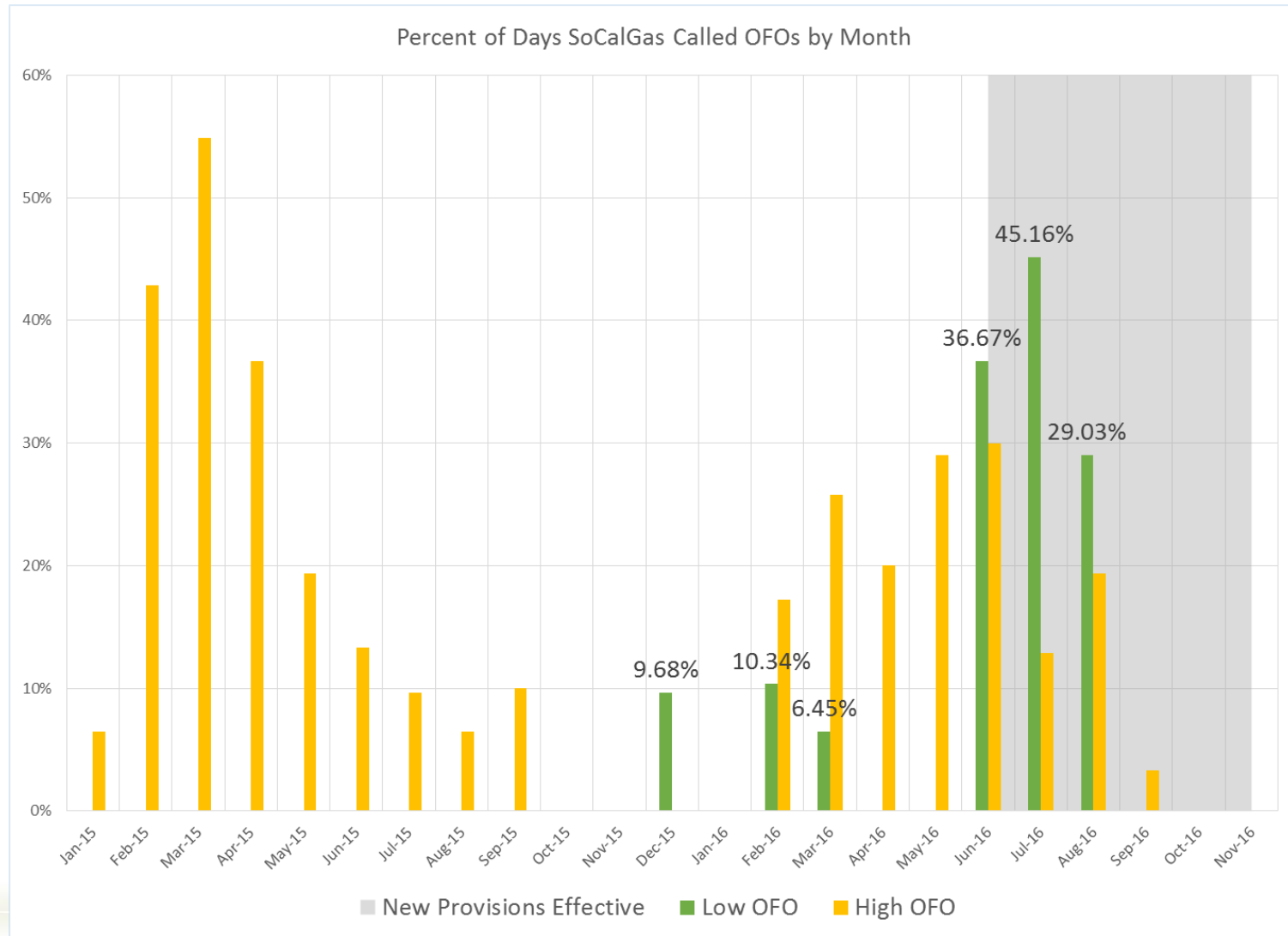
- Beginning summer 2016, ISO anticipates the limited operability of Aliso Canyon to affect electric operations.
- Since Phase 1 market design efforts contemplated the risk of **capacity limitations** (winter risk identified) no additional scope items are needed for Phase 2.
- Winter assessment did identify risks that support extending temporary provisions
- ISO proposes Phase 2 focus on:
 - Evaluate which temporary provisions are needed to continue successfully managing reliability
 - Evaluate what refinements are needed
 - Provide greater transparency still lacking, if possible

ISO STRAW PROPOSAL FOR TEMPORARY PROVISIONS PAST NOVEMBER 30TH

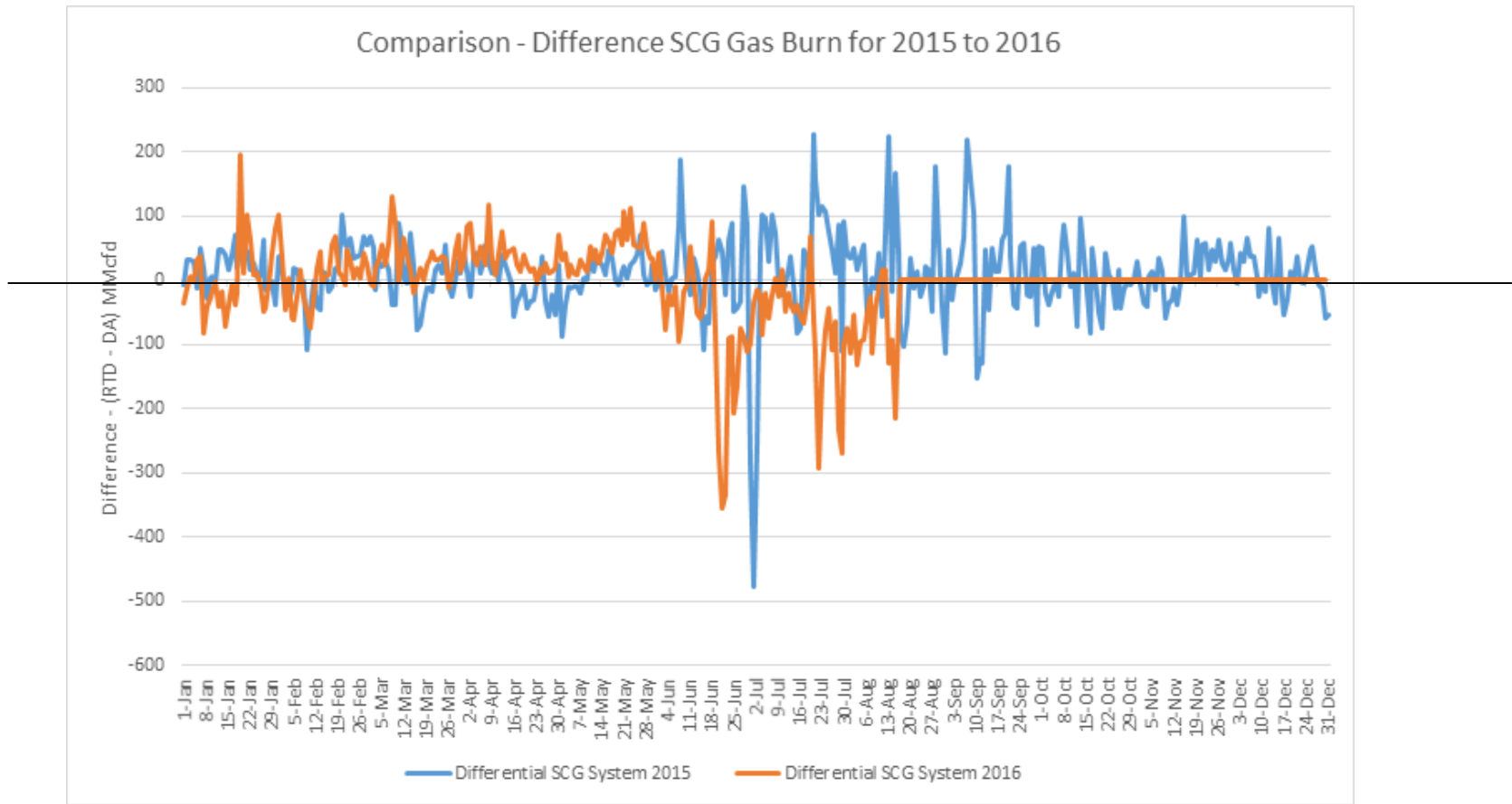
Review ISO summer operations

- Continued daily coordination between SoCalGas, ISO and SCs have allowed all parties to work together to successfully manage gas and electric operations during the past two heat waves, for example:
- SoCalGas' tighter balancing rules and SCs' gas scheduling practices have likely helped eliminate supply and demand mismatches, support gas operations, and fuel plants for power production
- Temporary provisions have not been needed yet due to
 - Communication between SoCalGas and ISO
 - Milder than expected summer, however summer is not over and SCA peaks in September

SoCalGas frequent use of OFOs and SCs responding efforts to sufficiently schedule gas helped mitigate risk



Good coordination, advanced electric planning, and more robust bidding flexibility helped mitigate risks



| Row Labels | Max Under scheduled 2015 | Max Under scheduled 2016 |
|------------|--------------------------|--------------------------|
| June | 188 | 93 |
| July | 226 | 69 |
| August | 225 | 18 |

ISO commits to continue to look for ongoing opportunities to enhance coordination

- ISO proposes to provide real-time gas burn information to gas companies. What real-time data is best?
 - Advisory gas burn information from STUC run
 - Binding real-time gas burn schedules from FMM/5MM
 - Including exceptional dispatch amounts
- ISO proposes to provide more than one day's worth of gas burn data at a time to encompass gas operating day

Question: Does the MSC have any suggestions for additional coordination efforts the ISO should consider?

ISO proposals for continuing to examine ongoing opportunities to enhance coordination

- ISO proposes to provide real-time gas burn information to gas companies. What real-time data is best?
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Proposal for temporary operational tools designed to improve ISO's ability to manage operations

Ability to reserve internal transfer capability into Southern California

Retire

- Mitigation measure – Can reduce CRR amounts in monthly auction

Ability to enforce gas constraints for either capacity or imbalance limitations

**Extend,
refine**

- Mitigation measure – Can override its assessment of competitive paths
- Mitigation measure – Can suspend virtual bidding for market inefficiencies

Proposal for temporary market changes to improve suppliers' ability to manage assets

Publish 2 day-ahead (TD-2) RUC schedules to Scheduling Coordinators

Extend

Improve DAM gas price index using an approximation of next day gas index

Extend

Adjust the RTM gas price index to include a scalar on the next day gas index

Extend

Include in after-the-fact cost recovery filing right opportunity to seek energy costs incurred above mitigated price

Extend

ISO filed its bidding rules enhancements board-approved provisions on Aug 19, 2016

Increased commitment cost real-time bidding flexibility

Filed, pending approval

Do not insert RTM bids for units not required to participate or scheduled in DA

Filed, pending approval

After-the-fact cost recovery filing right at FERC for commitment costs

Filed, pending approval

ISO will consider the best approach to pursue to ensure that these provisions will stay in effect as it waits for FERC approval for permanent tariff revisions.

SHOULD THERE BE ANY ADJUSTMENTS MADE TO THE GAS CONSTRAINT DESIGN?

Phase 1 included a total gas burn limit that is a **gas operating ceiling constraint** to reflect limited supply to affected generators (winter risk identified)

- Used to reflect identified physical capacity or deliverability limitation from:

- Outage to storage facilities
- Outage to pipeline
- Non-EFO Curtailments

Area's Power Output converted to gas burn \leq MMCFd capacity limit in area

$$\sum_{i \in S} \alpha_i (P_{i,t}) \leq RHS_t$$

Where limit is set as follows:

$$RHS_t = \gamma_t R_h$$

***Percentage factor shapes daily limit to hourly

$$\sum_1^N \gamma_t = 1$$

Phase 1 included incremental gas burn limits that mitigate risk of gas burn imbalances outside tolerance band in RTM (summer risk identified)

- Constraint would be enforced when risk of excessive imbalances could adversely impact gas and electric reliability such as:

- Anticipated load forecast error
- Insufficient nominations made relative to burn report sent to gas co.

Minimum imbalance limit in area \leq Area's Power Output converted to gas burn \leq Maximum imbalance limit in area

$$LHS_t \leq \sum_{i \in S} \alpha_i (G_{i,t} - \bar{G}_{i,t}) \leq RHS_t$$

Where limits are set as follows:

$$LHS_t = \beta_t R_l$$

$$RHS_t = \gamma_t R_h$$

$$\sum_1^N \beta_t = \sum_1^N \gamma_t = 1$$

***Percentage factor shapes daily limit to hourly

ISO proposes to extend gas constraints for either imbalance or capacity limitations. Should there be any adjustments made to the gas constraint design?

- ISO proposes to extend authority to enforce gas constraint with the adjustment that ISO does not intend to extend the use of the min gas burn limit
- Re-evaluate use and design of gas constraints including:
 - Re-evaluate shaping daily limits using hourly percentage share of load forecast (distribution factor)
 - Re-evaluate penalty factor when constraint is relaxed
 - What are the factors used in deciding to enforce?
 - Re-evaluate constraint limitation formulas using summers' lessons learned

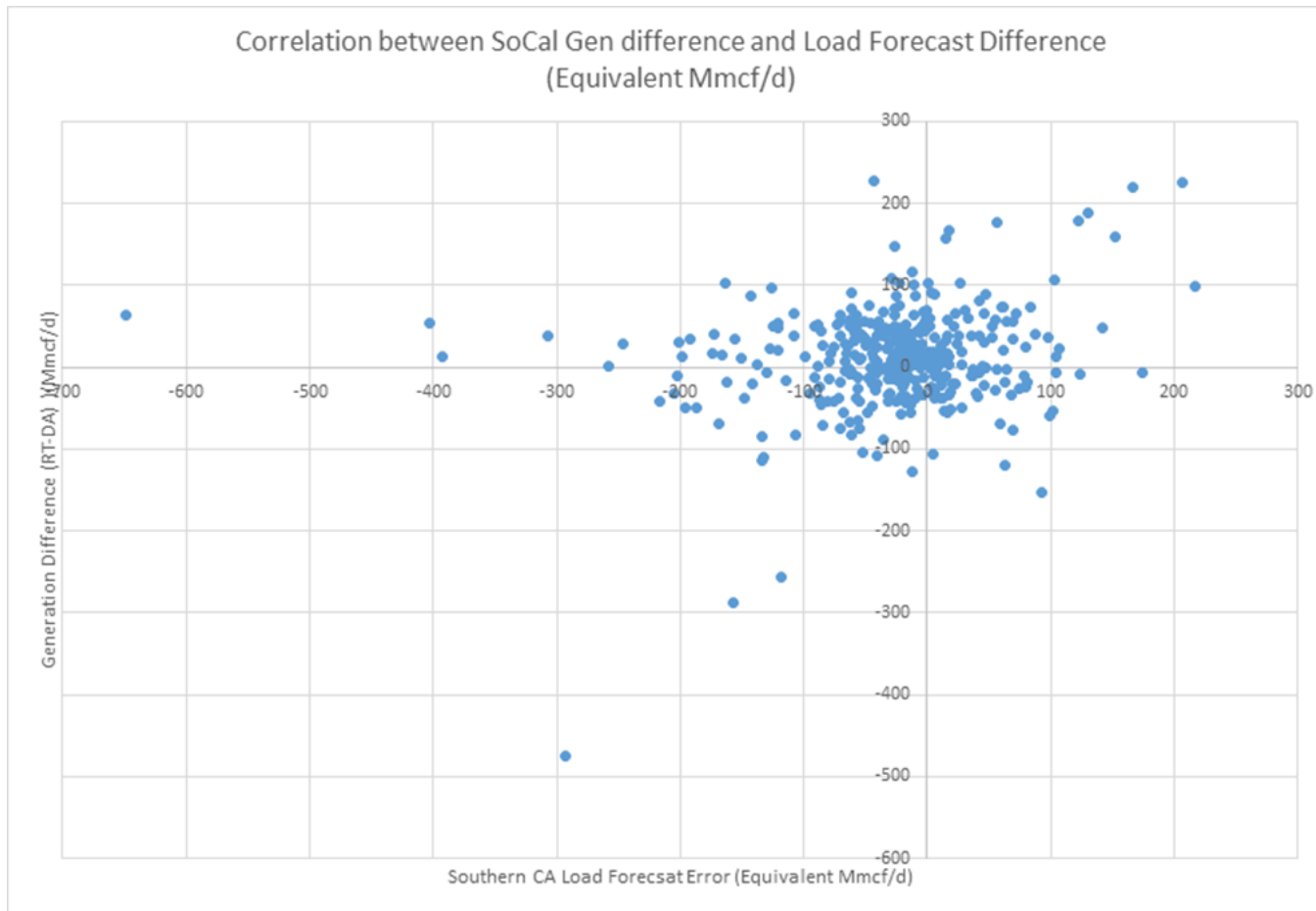
Should ISO refine the gas constraint design for shaping daily limits using hourly percentage share of load forecast

- Allocation method must ensure adequate flexibility needed by ISO to re-dispatch in real-time to serve load
- Current design distributes daily limitation in MMCF/d across electric day's hours based on hourly share of daily load forecast
 - Ratio of the load forecast of a given hour to the total daily load forecast
- Questions raised as to whether hourly share of daily load forecast is the best design for shaping a daily gas burn limitation to an hourly limit.

Analysis of Possible Factors to Gas Burn Differences

- At April MSC meeting, the ISO presented to the MSC analysis it would perform to analyze whether refinements to its daily limit shaping design should be pursued.
- Perform historical distribution analysis categorized by hour 1-24 of the difference between:
 - RTM load versus DAM load forecast
 - RTM net load and IFM cleared net load
 - RTM dispatch and IFM cleared generation
 - RTM and DAM (IFM&RUC) received start-up instructions
- For the largest observation, examine a sampling of hours (e.g. 5) to evaluate and isolate causes.

Analysis of 2015 load forecast error correlation to day-ahead and real-time gas burn difference patterns



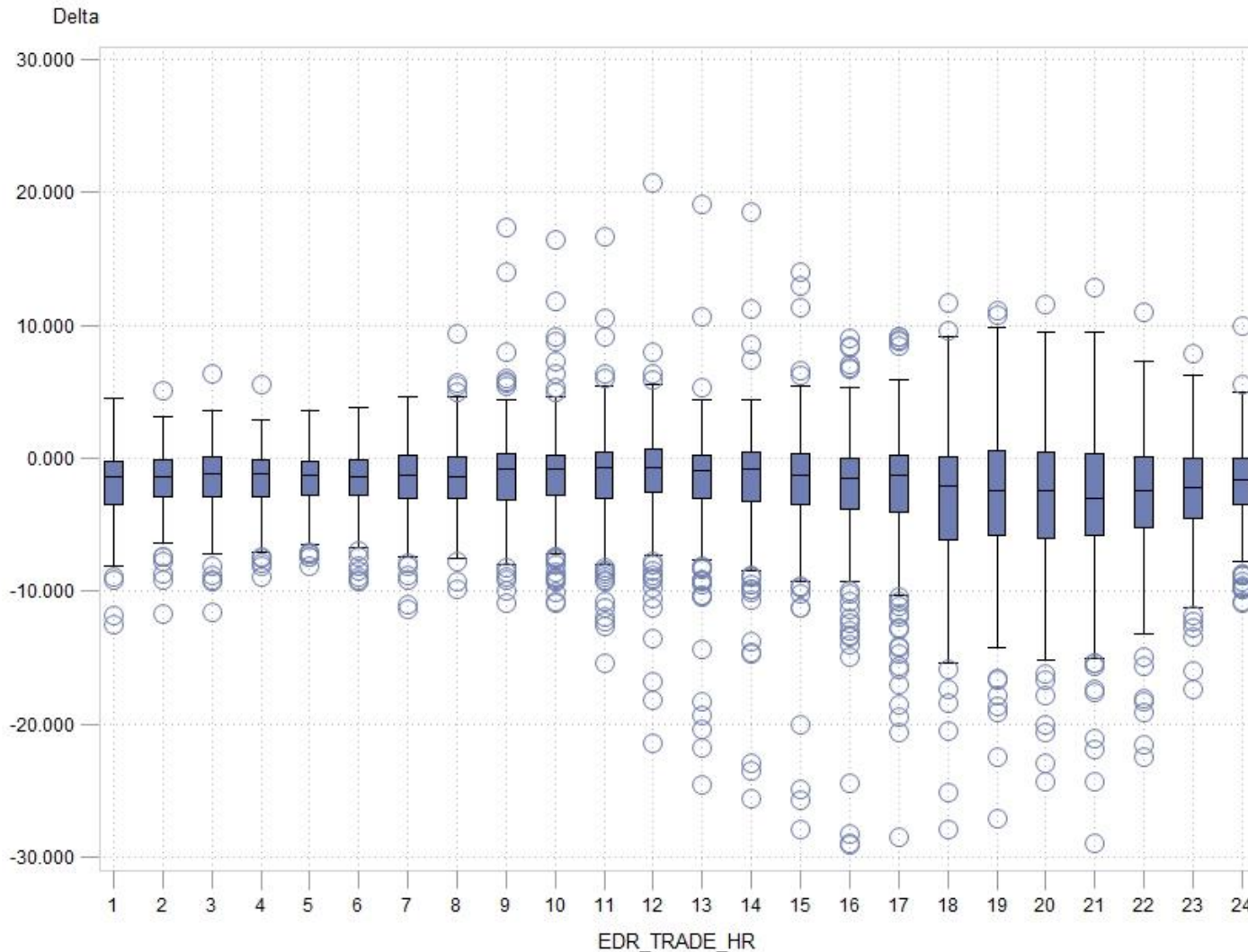
Sorted by Largest Gen Difference

| Row Labels | ISO Day-Ahead Daily Forecast Error-Southern California (in Equivalent Mmcf/d) | ISO Gas Resource Difference Between DA and RT |
|------------|---|---|
| 7/20/2015 | -44 | 226 |
| 8/13/2015 | 207 | 225 |
| 9/7/2015 | 166 | 220 |
| 6/8/2015 | 130 | 188 |
| 9/20/2015 | 122 | 178 |
| 8/28/2015 | 57 | 177 |
| 8/15/2015 | 18 | 166 |
| 9/8/2015 | 152 | 160 |
| 7/21/2015 | 15 | 156 |
| 6/28/2015 | -27 | 148 |
| 7/23/2015 | -13 | 116 |
| 7/24/2015 | -28 | 108 |
| 9/9/2015 | 103 | 106 |
| 2/20/2015 | 27 | 102 |
| 7/4/2015 | -163 | 102 |

Sorted by Largest Forecast Difference

| Row Labels | ISO Day-Ahead Daily Forecast Error-Southern California (in Equivalent Mmcf/d) | ISO Gas Resource Difference Between DA and RT |
|------------|---|---|
| 10/13/2015 | 217 | 98 |
| 8/13/2015 | 207 | 225 |
| 12/28/2015 | 174 | -6 |
| 9/7/2015 | 166 | 220 |
| 9/8/2015 | 152 | 160 |
| 9/13/2015 | 142 | 48 |
| 6/8/2015 | 130 | 188 |
| 10/10/2015 | 124 | -9 |
| 9/20/2015 | 122 | 178 |
| 3/15/2015 | 106 | 23 |
| 10/11/2015 | 104 | 12 |
| 8/24/2015 | 104 | -8 |
| 9/9/2015 | 103 | 106 |
| 4/29/2015 | 102 | -53 |
| 12/30/2015 | 99 | -59 |

Historical Analysis: Distribution of 5MM gas burn to D+1 RUC gas burn for each hour Jan-Aug 2016



Causal Analysis: Inconclusive findings

- Isolating a specific cause to a large burn imbalance proved very challenging
- Even if the ISO could have assumed which factors were primary driver, the drivers varied widely across the extreme observances
- ISO concludes that the causes of extreme observations should not be used as basis for market design, instead focused on historical, statistical analysis.

MSC Feedback

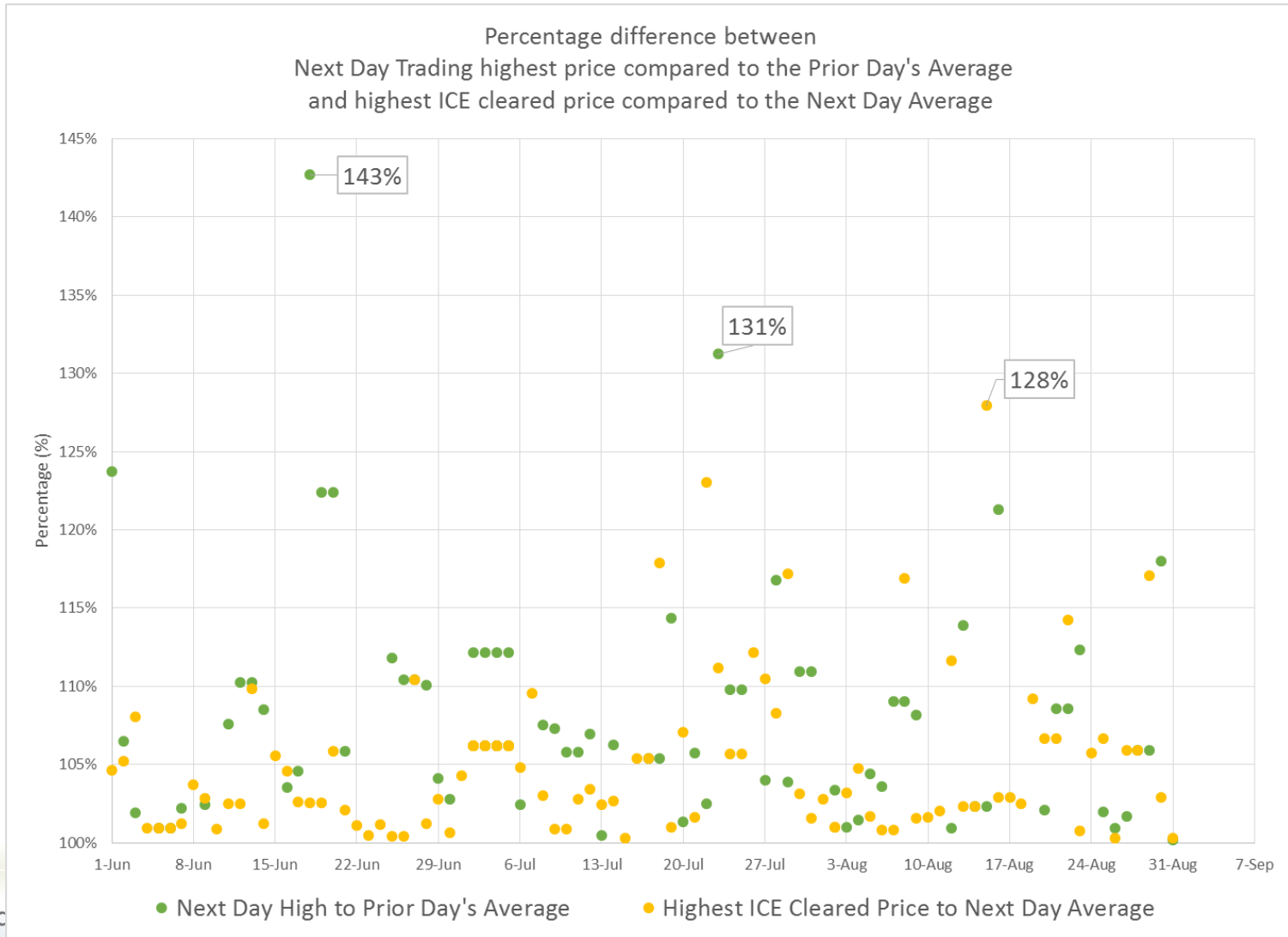
- ISO proposes to adjust the total max burn limit to be more reflective of electric system conditions
 - For example, winter assessment found min gen requirement to secure for N-1-1 event is ~96 MMCFd, limit could be imposed at ~300 MMCFd to reduce demand if conditions similar to 1-in-10 day conditions
 - ISO determines limit should be enforced (not constrained by gas company)
- ISO seeks feedback from MSC on appropriate factor for shaping from daily to hourly for enforcing hourly limits

SHOULD THERE BE ANY ADJUSTMENTS MADE TO THE GAS PRICE INDEX CHANGES?

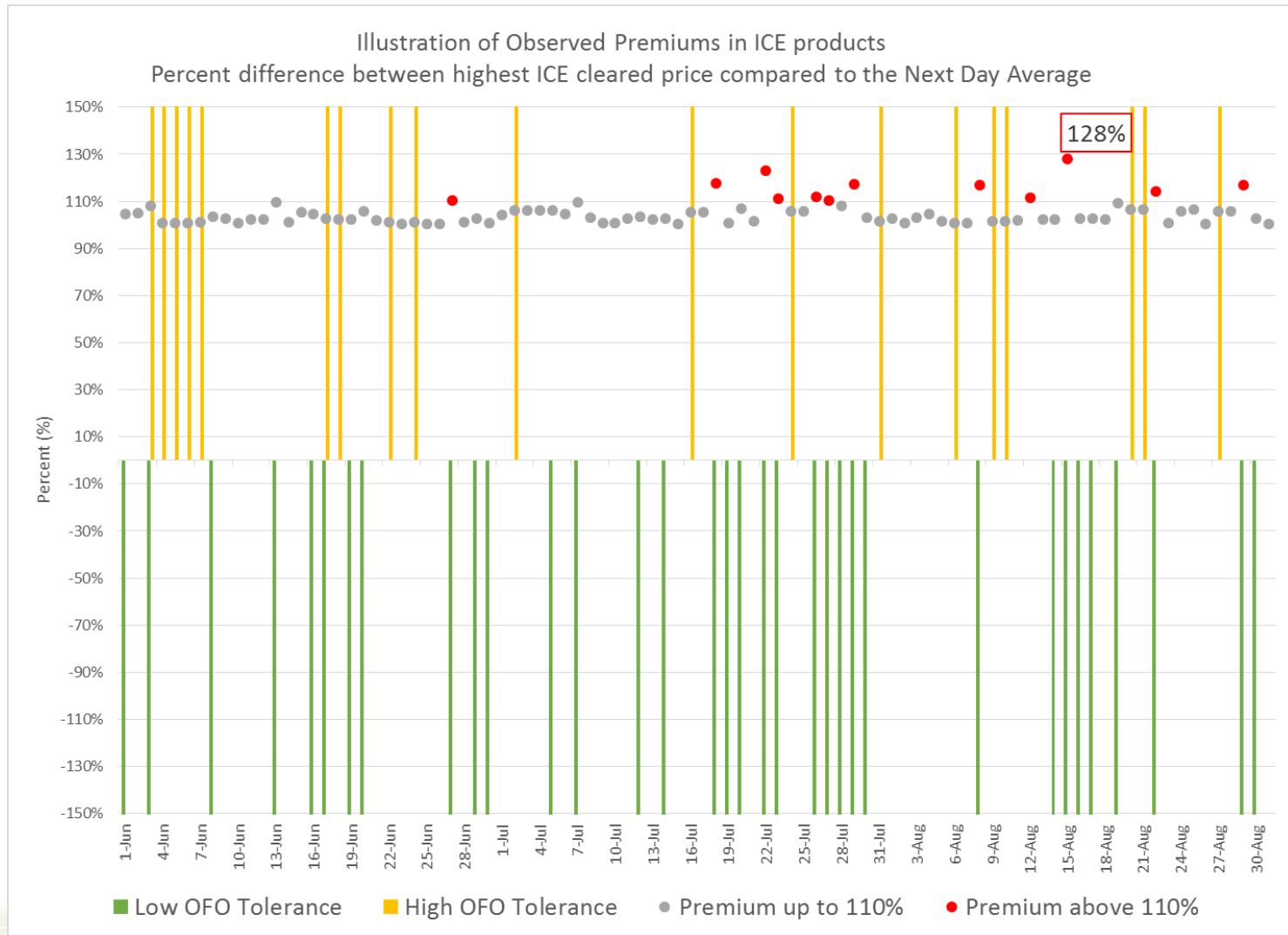
ISO proposes to extend all temporary market changes. Should there be any adjustments made to the temporary market changes?

- ISO re-evaluated scalars based on whether they do not:
 - Result in units dispatched to address system needs
 - Account for differences between DA & RT gas prices
 - Improve ability to manage usage within gas rules.
- DA GPI: ISO will continue to pursue using the Gas Day 2 index as it shows significant benefits.
- RT GPI_{Energy}: ISO found the 125% scalar generally sufficient to achieve the three listed goals

ISO benefits evaluation provided by improved DAM GPI and scaled RTM GPI shows improved DAM GPI is still needed and scalar levels used in RTM GPI are sufficient



When OFOs called, ISO observed highest price across ICE products less than 130% of ICE's next day index



MSC Feedback

- ISO proposes to maintain the temporary market changes as proposed under Phase 1 including the scalar levels
- ISO proposes to clarify the after-the-fact cost recovery is temporarily extended to any default energy bid type
- ISO seeks feedback from MSC as to whether the MSC would recommend any adjustments to these measures