Aliso Canyon Gas Electric Coordination

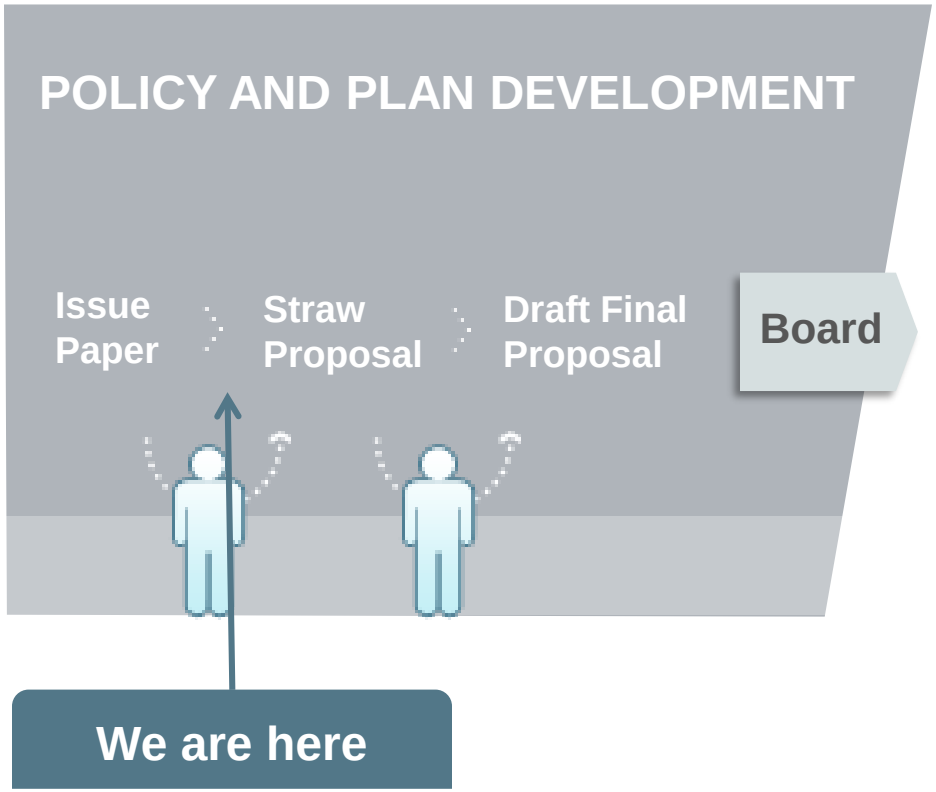
Cathleen Colbert
Senior Market Design and Policy Developer
Market & Infrastructure Policy

Working Group Meeting
April 6, 2016

Agenda

Time	Topic	Presenter
10:00 – 10:30	Introduction and background	Kim Perez
10:30 – 11:50	CAISO Gas-Electric Coordination	Brad Bouillon
1:00 – 2:50	Discussion of Issues & alternatives	Cathleen Colbert
2:50 – 3:00	Next Steps	Kim Perez

ISO Policy Initiative Stakeholder Process



Plan for stakeholder engagement

Milestone	Date
Issue Paper Posted	3/17/16
Stakeholder Call	3/23/2016
Stakeholder Written Comments Due	3/30/2016
Working Group Stakeholder Meeting	4/06/2016
Straw Proposal Posted	4/11/2016
Stakeholder Call	4/13/2016
Stakeholder Written Comments Due	4/18/2016
Market Surveillance Meeting discussion item	4/19/2016
Draft Final Proposal and Draft Tariff Language Posted	4/21/2016
Stakeholder Call	4/26/2016
Stakeholder Written Comments Due	4/29/2016

Aliso Canyon Gas Electric Coordination - Overview

- Beginning Summer 2016, ISO anticipates the limited operability of Aliso Canyon to affect electric operations.
  - ISO participating in inter-agency task force to asses reliability risks associated with limited operations
  - ISO initiating expedited stakeholder process to explore mechanisms or other tools to address risks
- Under stakeholder process, ISO seeks to:
  1. Evaluate reliability risks due to limited operations,
  2. Evaluate how daily gas balancing requirements proposed affect resources' ability to manage generation assets,
  3. Identify and develop market mechanisms or tools necessary to support reliability and ensure markets are not adversely impacted.

Aliso Supports ~9,800 MW: 40% LADWP/ 60% in CAISO; Critical for Peak Day and Contingency Reserve Situations

Capacity of Pipe and Other Storage Indicates General Risk

Supply/Demand	System Design (Bcf/day)	Actual Experience (Bcf/day)
Pipeline Capacity Supply	3.8	3.0
Other Storage Supply (without Aliso)	1.7	1.0
TOTAL SUPPLY	5.5	4.0
Peak Winter Gas Demand	-5.0	-5.0
RESERVE MARGIN	0.5	(1.0)

- Typical outages can reduce capacity 0.5-1.0 Bcf/day
- Electric generation typically requires 1.0-2.0 Bcf/day

Analysis Verified Risks to Reliability

1. Scheduled flowing gas can fail to meet actual demand

2. Planned and unplanned outages on gas system often limit pipeline and other storage availability

3. Rapid ramping of electric generation can exceed dynamic capability of gas system
   - i.e. contingency recovery, renewable generation following

4. Cold weather to east can reduce gas supplies for California

Analysis Assessed Actual Operations on 4 Key Days

DATE	CONDITION	TOTAL DEMAND (Bcf per Day)
9/16/14	LADWP Peak Day	3.5
7/30/15	Large Electric Generation Ramp	3.2
9/9/15	CAISO – Large Difference between Day Ahead and Real Time actual + LADWP 2015 Peak	3.2
12/15/15	Winter Day and High Electric Generation	3.3

Key Findings:

- Gas system unable to tolerate mismatches between scheduled gas and actual flows if Aliso gas is not used
- Situation is worse if planned or unplanned outages occur

Confirmed: Serious Risk to Gas/Electric Reliability this Summer

- If Aliso is not used, the LA Basin can expect 16 summer days of gas curtailment in 2016
  - electric generators are first to be curtailed

- Up to 14 summer days may require electric service interruption, potentially to millions of customers

	Scenario	Gas Quantity Curtailed (8 peak hours HE14-HE21)	Days of Gas Curtailment Risk for Electric Generators (Summer)	Gas Curtailment Interrupts Electricity Service (Summer)
A.	150 MMcf mismatch between scheduled gas and actual demand	84 Mmcf	2	Not Likely
B.	Mismatch plus outage at other storage field	224 Mmcf	2	Likely
C.	Mismatch plus pipeline outage	280 Mmcf	9	Yes
D.	Mismatch plus outage both on other storage and pipeline	513 Mmcf	3	Yes

CAISO GAS-ELECTRIC COORDINATION

Brad Bouillon

Director, Regional Operations Initiatives

Current Practices

- Outage Planning
  - *Share outage planning with NDA signed Gas Transmission Providers*
- Communications
  - *Every two weeks phone calls with gas maintenance planners*
  - *Daily calls during peak demand periods*
- What some of the issues are
  - *Conflicting Peak Operating/Maintenance Seasons*
  - *Traditional rules in a new Renewable World*

Real-Time Planning

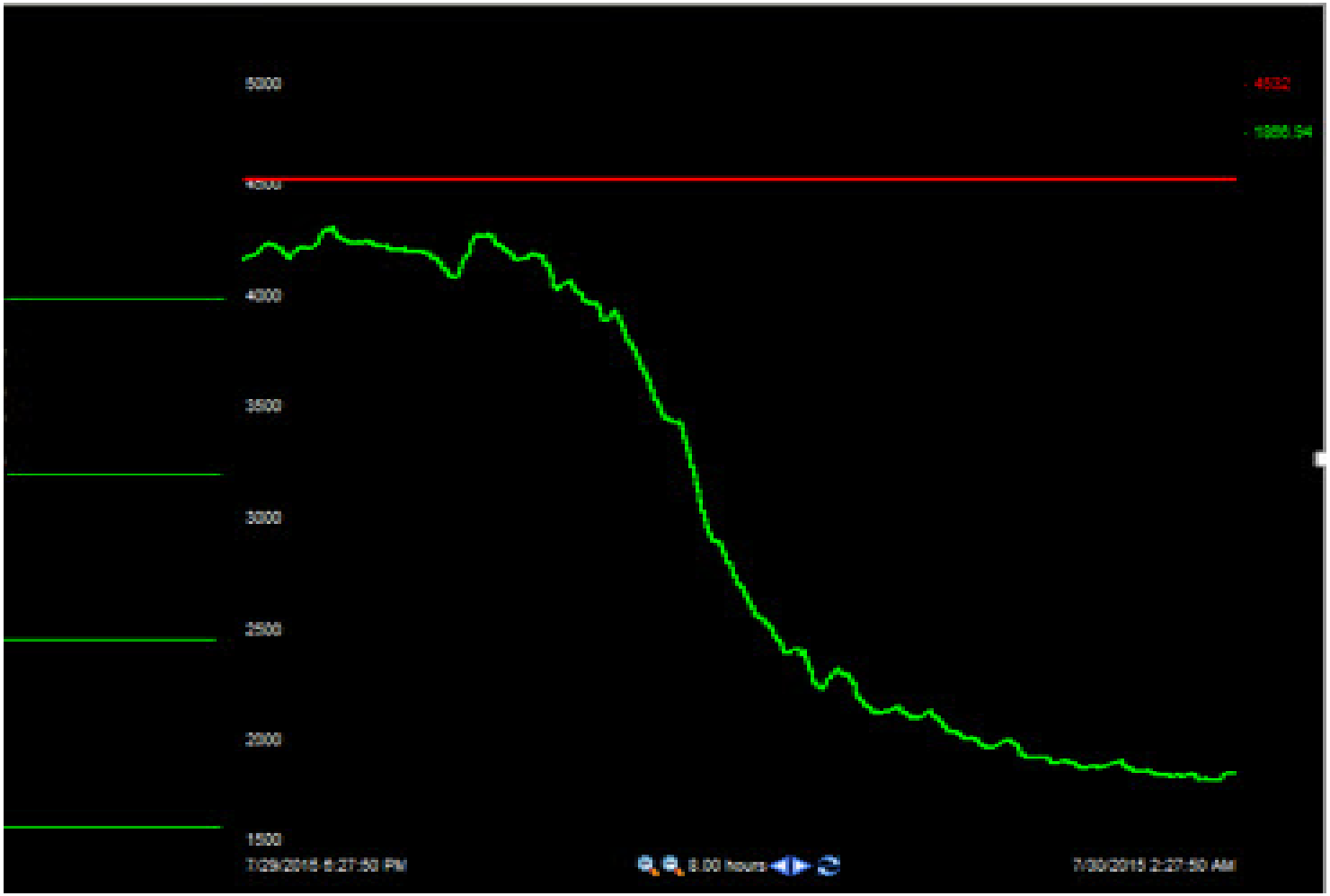
- What we are currently doing
  - *Providing gas burn forecasts for Day Ahead and Day Ahead+1 EG*
  - *Real-time notification if ISO dispatches resources significantly above existing schedule.*
- Real Time Incidents
  - *Coordinate with gas transmission providers to re-dispatch as needed to mitigate real-time gas supply issues.*
- What are some of the issues
  - *Short notice gas system maintenance that curtails a resource*
  - *February 2014*
    - *West wide natural gas availability issue*

Improved Gas-Electric Coordination

- By adapting current technology
  - *Visibility*
  - *Gas Electric Operational Zones*
  - *Improved Communication*

- EIM Changes

Real-Time Visibility



Visibility with Both Gas System and Generation Information

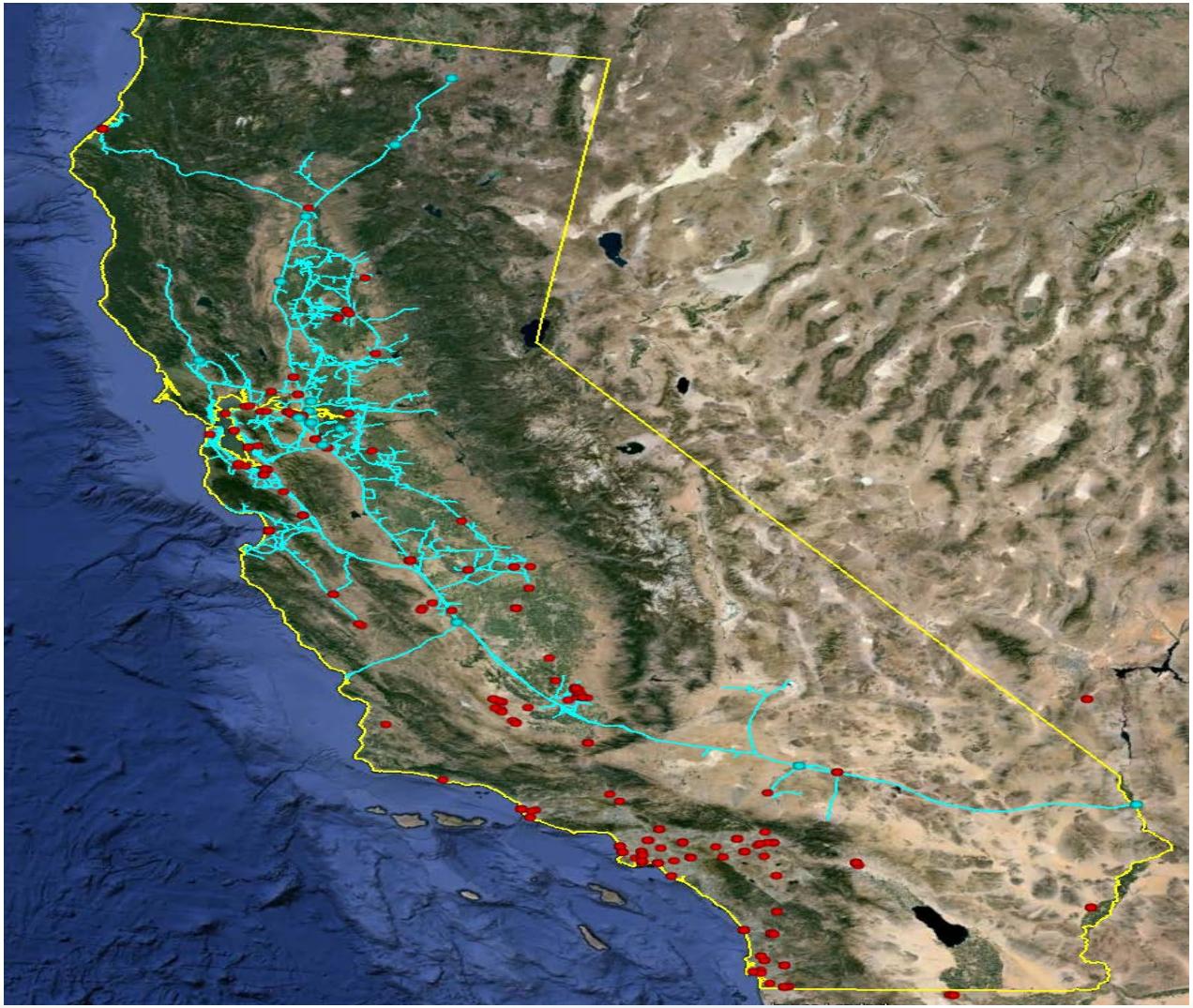


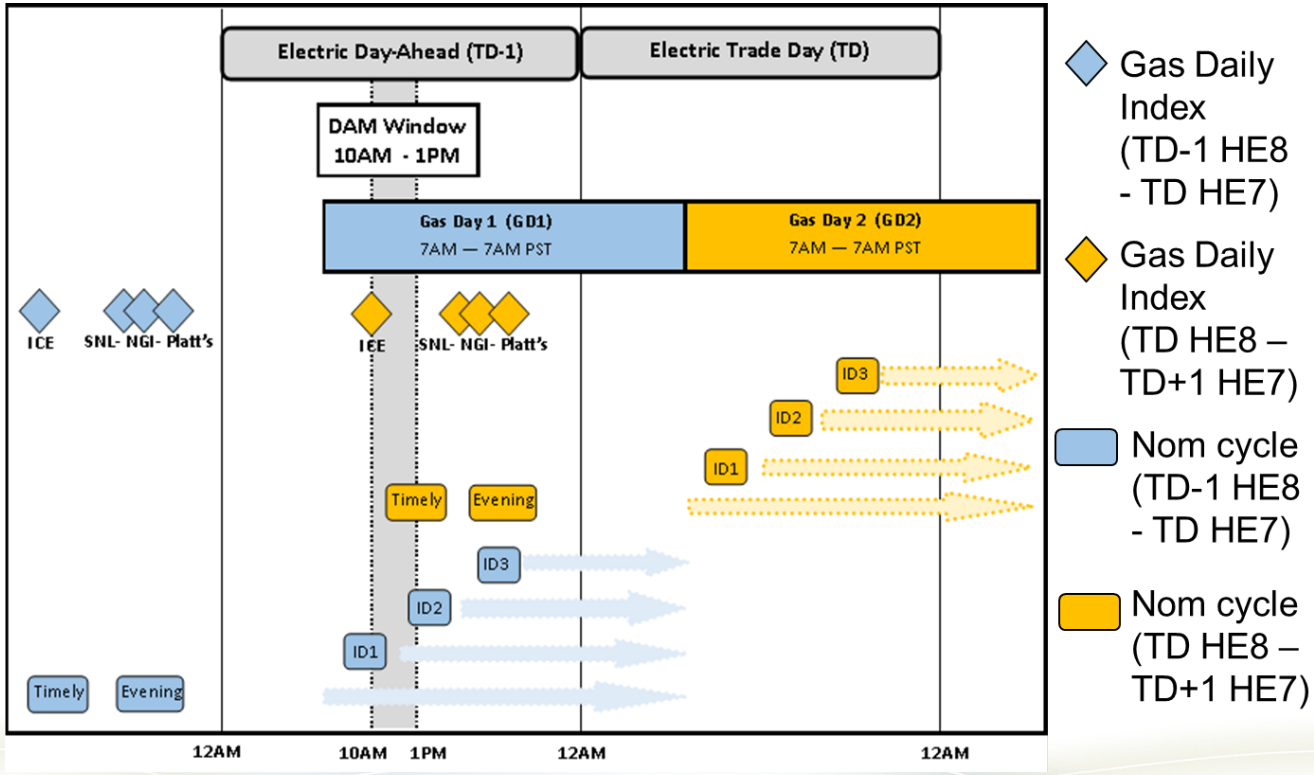
Illustration of gas-electric coordination process

- Draft visualization of gas-electric coordination process beginning in day-ahead time frame available at: Draft Visualization – Gas Electric Coordination Process.
- Discussion points:
  - Is there any portion of this process unclear or inaccurate?
  - Are there any gaps that can be identified that any of these parties should be considering and addressing during a real-time event?
  - How, if at all, could this process by improved or made more transparent?

DISCUSSION OF ISSUES & ALTERNATIVES

Issues - timing DAM results relative to ID3 nominations for HE1-HE7 or evening nominations for HE8 - HE24

- ISO understands that the balancing rules are evaluated for compliance midnight to midnight consistent with its operating day allowing for any deviations during early hours to be managed when procuring and scheduling for GD2.



Issues - timing DAM results relative to ID3 nominations for HE1-HE7 or evening nominations for HE8 - HE24

- ISO identified potential risk from current publication time which might increase risk of mismatch of nominated gas flow and actual gas demand.

  ISO understanding from discussion and comments is risk is driven by uncertainty of incremental changes to DAM schedules in RTM which would not be alleviated by moving the DAM window.

- ISO identified potential risk from current publication time which might increase price risk if not procured in advance since procurement occurs during more illiquid periods and likely higher than index.

  ISO understanding from discussion and comments is that by procurement occurring after DAM publication following majority of timely trading, price risk would be alleviated by moving the DAM window.

Issues – RTM commitments & dispatch might need to be constrained to reflect gas balancing limitations

- Changes to ISO unit commitments or dispatch targets through its RTM re-optimization process exacerbates risk RTM could result in commitments and dispatches that could cause difference between nominated flows and gas burn.

ISO understands from the discussion and comments this risk is most severe for Scheduling Coordinators managing generators largely dispatched and relied on as peaker units to respond to ISO's flexibility needs or mitigated resources that cannot manage gas limitations effectively through incremental energy offers.

Issues - commitment cost bid cap & mitigated energy bids may not reflect intraday gas prices

- Under strained gas conditions, intraday gas costs will likely increase and experience higher levels of intraday volatility.
- ISO's cost estimates do not currently include information from the intra-day gas markets which may be more volatile due to limited operability of Aliso Canyon
- Costs of generating power to serve load may not fully reflected in commitment cost bids or DEBs resulting in:
  - Markets suppress incentives to resources introduced by noncompliance charges to influence behavior
  - Less efficient commitments and dispatch
- ISO understands stakeholders largely agree this is an existing market design gap.

Brainstorm alternatives and discuss advantages and disadvantages

- Draft template for evaluating pros and cons associated with various alternatives:
  Alternatives Template

- Discussion points:
  - Are there any alternatives missing?
  - What are the advantages and disadvantages for these alternatives?

NEXT STEPS

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Stakeholder Call	4/25/2016
Stakeholder Written Comments Due	4/27/2016

REFERENCE MATERIALS – ISSUE PAPER BACKGROUND

Background – Aliso Canyon Impact

Oct. 2015, discovered Aliso Canyon leak

Jan. 2016, Gov. Brown issued proclamation of state of emergency

- Continue prohibition on injecting gas into the storage facility
- Direct CPUC, CEC an ISO to coordinate to ensure continued reliability

Jan. 2016, multi-agency technical working group looking at short-term reliability risks associated with summer and peak winter operations due to limited operations of Aliso Canyon facility

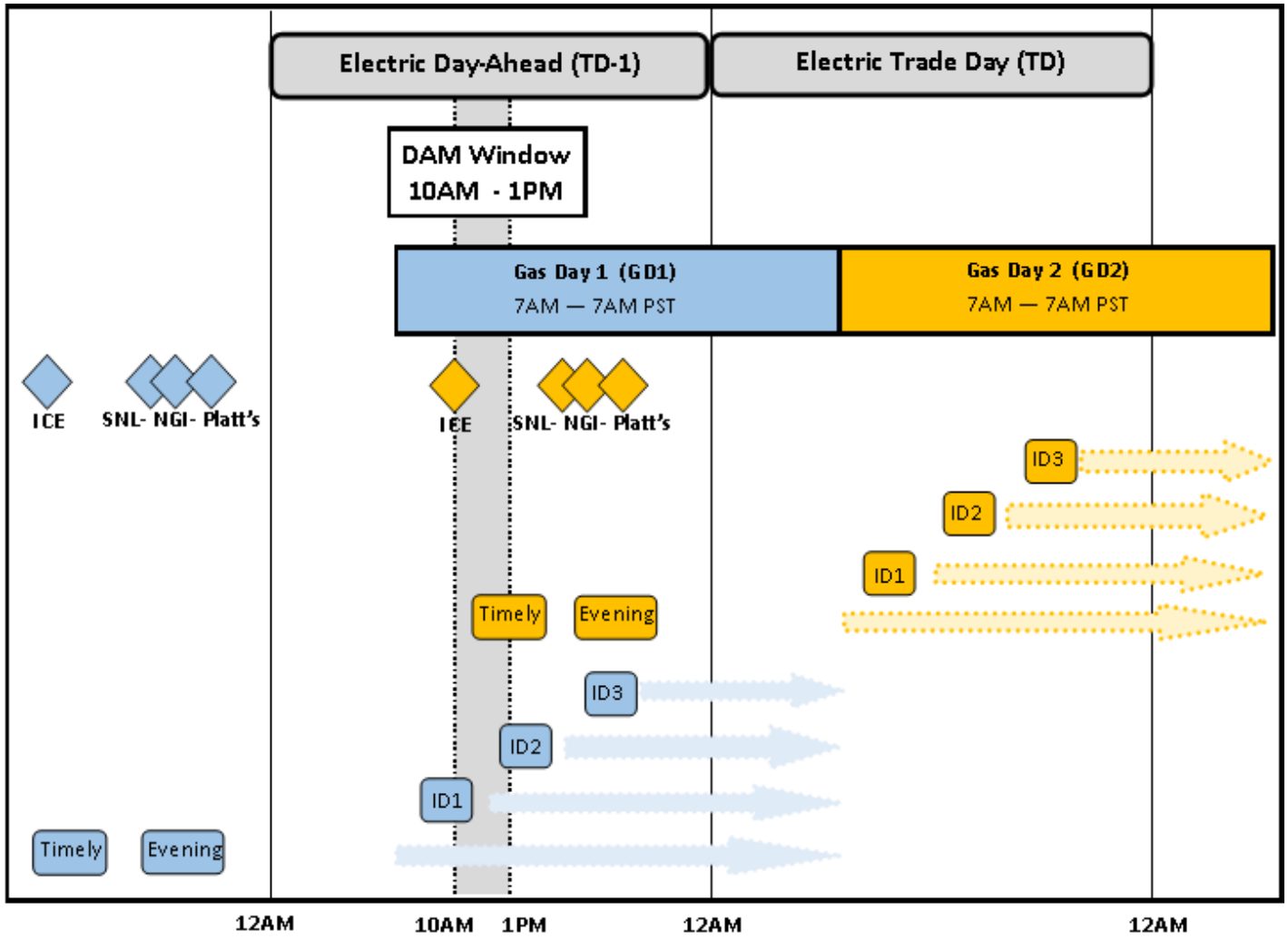
Feb. 2016, State regulators confirmed gas leak sealed but continued moratorium on new injections until Division of Oil, Gas, and Geothermal Resources complete inspections

Mar. 2016, SoCalGas and SDG&E filed motion to establish interim daily balancing requirements effective May 1, 2016 (5% tolerance band / 150% of gas daily penalty)

Background – FERC Order 809

Nomination Cycle	Nomination Deadline (PST)	Notification of Nominate (PST)	Nomination Effective (PST)	Bumping of interruptible transportation
Timely	9:30 a.m. 11:00 a.m.	2:30 p.m. 3:00 p.m.	7:00 a.m. Next Day	N/A
Evening	4:00 p.m.	8:00 p.m. 7:00 p.m.	7:00 a.m. Next Day	Yes Yes
Intra-day 1	8:00 a.m.	12:00 p.m. 11:00 a.m.	3:00 p.m. Current Day 12:00 p.m. effective	Yes Yes
Intra-day 2	3:00 p.m. 12:30 p.m.	7:00 p.m. 3:30 p.m.	7:00 p.m. Current Day 4:00 p.m. effective	No Yes
Intra-day 3	5:00 p.m.	8:00 p.m.	8:00 p.m. effective	No

Background - Alignment natural gas & electric markets



Gas Daily Index (TD-1 HE8 - TD HE7)

Gas Daily Index (TD HE8 – TD+1 HE7)

Nom cycle (TD-1 HE8 - TD HE7)

Nom cycle (TD HE8 – TD+1 HE7)