

# **CAISO Contingency Modeling Proposal**

## *Views from SCE*

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**July 2, 2013**



# Introduction

- ◆ SCE agrees that the CAISO must run a reliable grid – but questions what dimensions of reliability should be incorporated as market products in the core market optimization
  
- ◆ SCE’s concerns with the CAISO proposal include:
  - Agreeing on NERC/WECC requirements
  - The complexity of the proposal coupled with the lack of research/testing, lack of any existing real-world application
    - Proposal introduces a new temporal dimension of constraint sets, not simply “new constraints”
  - The potential for broad and material impacts to existing market product prices and LMP price formation
  - Solution feasibility
  - Solution robustness/stability
    - What happens to market prices and “SOL-1 feasibility” when realized conditions drift from assumptions used in the problem formulation?
  - Solution approach
    - Why is a fully coupled, co-optimized deterministic representation a proper solution approach when in fact reality is highly stochastic?
    - If designed to address reliability issues, why are financial bids intermingled with physical bids? Why are RA units paid twice for capacity?
    - Highly unlikely events have the same price/market impacts as expected events
  - The proposal likely violates core preconditions for workably competitive market solutions



# Any Solutions Requires an Accurate Interpretation of NERC/WECC Requirements

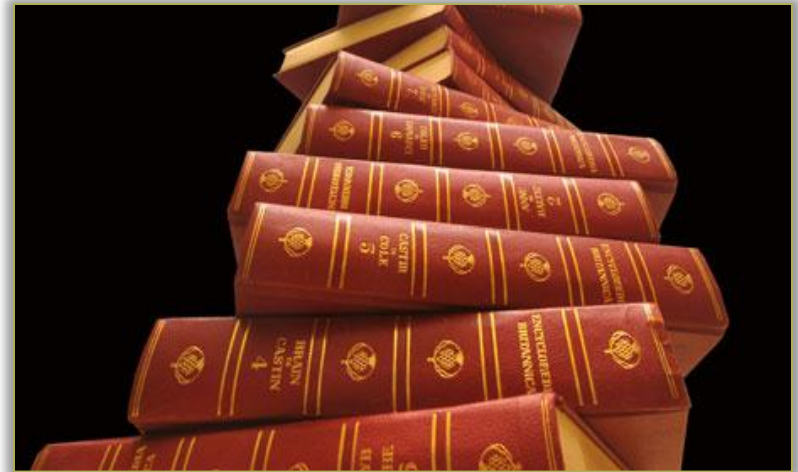
- ◆ CAISO rated paths return to SOL – 1 within 30 minutes
- ◆ SCE transmission operators are not convinced the CAISO's interpretation of NERC/WECC requirements is correct
- ◆ Key questions remain unanswered:
  - What are the limits pertaining to the NERC and WECC requirements? When are 4 hour or 1 hour emergency limits (rather than 30 minutes) applicable?
  - What are the definitions of the pre-contingency SOLs and the definitions of the post-contingency SOLs?
  - What operating actions are allowed, and what are not allowed, after an N-1 event within 30 minutes, to comply with the NERC and WECC requirements?
  - Under what conditions is load-shedding an allowed response? Does this vary depending on the SOL and the N-1 event?
  - What is the role of the Demand Response Programs?
  - What are the roles of RAS or other relief schemes in this process?
  - What are the roles of Ancillary Services, and other flexibility (e.g., Flexi-ramp) services procured by the CAISO?
- ◆ SCE recommends a summit between CAISO's and transmission operators (WECC/NERC as well?) to agree on requirements and allowable responses

- Don't create solutions until the problem is well defined
- Don't create solutions until all "tools" are identified and their allowable use is fully understood
- Don't use unnecessarily conservative assumptions



# Complexity “Creep”

- ◆ As of June 10, 2013:
  - CAISO has 4564 pages of Tariffs and BPMs – more than 4 volumes of Encyclopedia Britannica
  - 257 Operating Procedures
  - Complexity of modeling
    - Mandatory MSG, etc.
  - Complexity of BCR rules
    - Emergency filings on gaming
  - Complexity of settlements
    - 159 charge codes



## Excessive market complexity

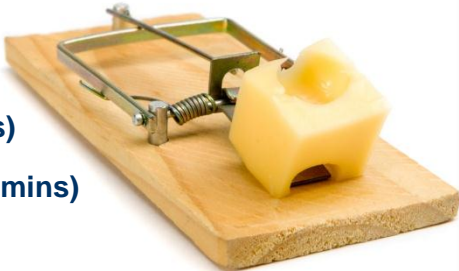
- Obscures economic meaning of prices signals
- Increases likelihood of unintended consequences
- Creates additional opportunities for market abuse
- Spawns the need for additional ad-hoc complexity in response to self-created problems



# More Products? Really?

- ◆ Products: At any given location, generation is already eligible to receive payments for –
  1. Energy/LMP (hourly, 5 mins, 15 mins\*)
  2. System RA capacity
  3. Local RA capacity
  4. Flexi-ramp Up constraint (FRP Up and Down hourly, 15, and 5 minutely\*)
  5. Regulation Up (hourly, 15 mins)
  6. Regulation Down(hourly, 15 mins)
  7. Mileage Up (hourly, 15 mins)
  8. Mileage Down (hourly, 15 mins)
  9. Spinning reserve (hourly, 15 mins)
  10. Non-spinning reserve (hourly, 15 mins)
  11. RUC
  12. CPM
  13. RMR
  14. \* EIM is a second network distinct from the DA network (DA CAISO modeling versus RT CAISO+EIM modeling)
  15. \* Flexibility attribute in RA capacity will now provide an extra dimension
  16. Virtual transactions on top of physical transactions at every node

Mouse trap vs. Mousetrap®



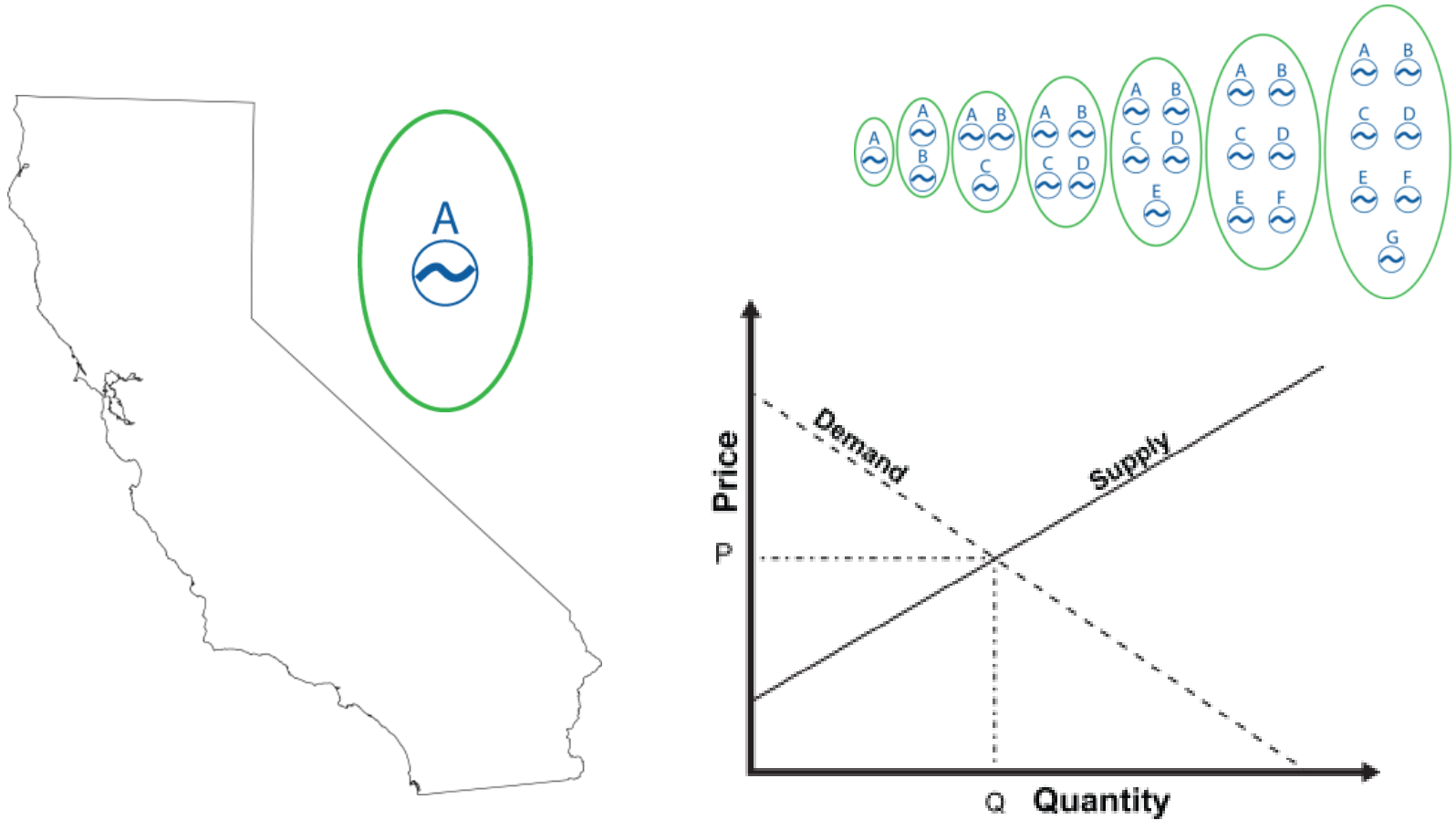
Durable designs drive towards “Irreducible complexity”

Key: \* = Proposed future product not currently in place



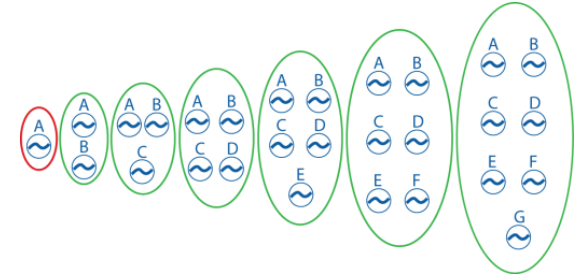
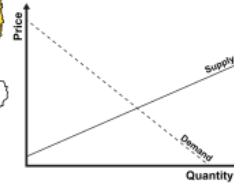
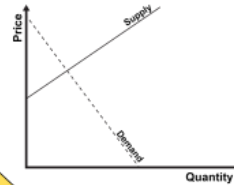
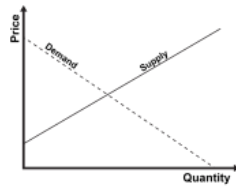
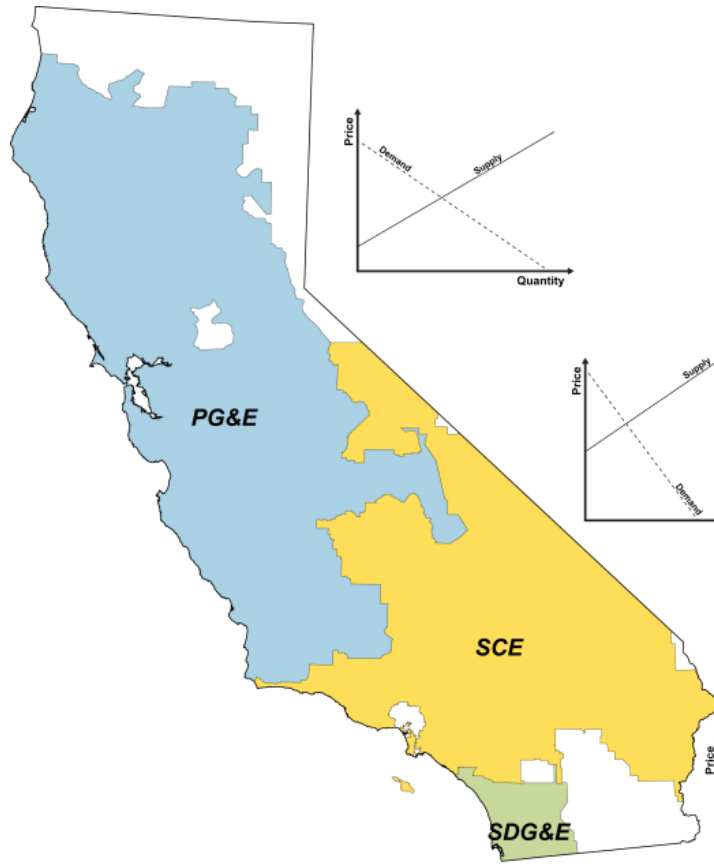
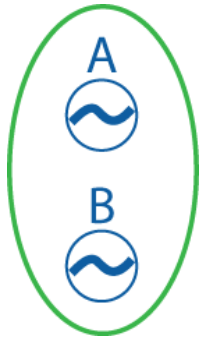
# How Far Can a Co-Optimized Market Bend Before it Breaks?

- ◆ Idea for deregulation 20 years ago
  - “Electricity is a commodity – hey let’s run a market!”



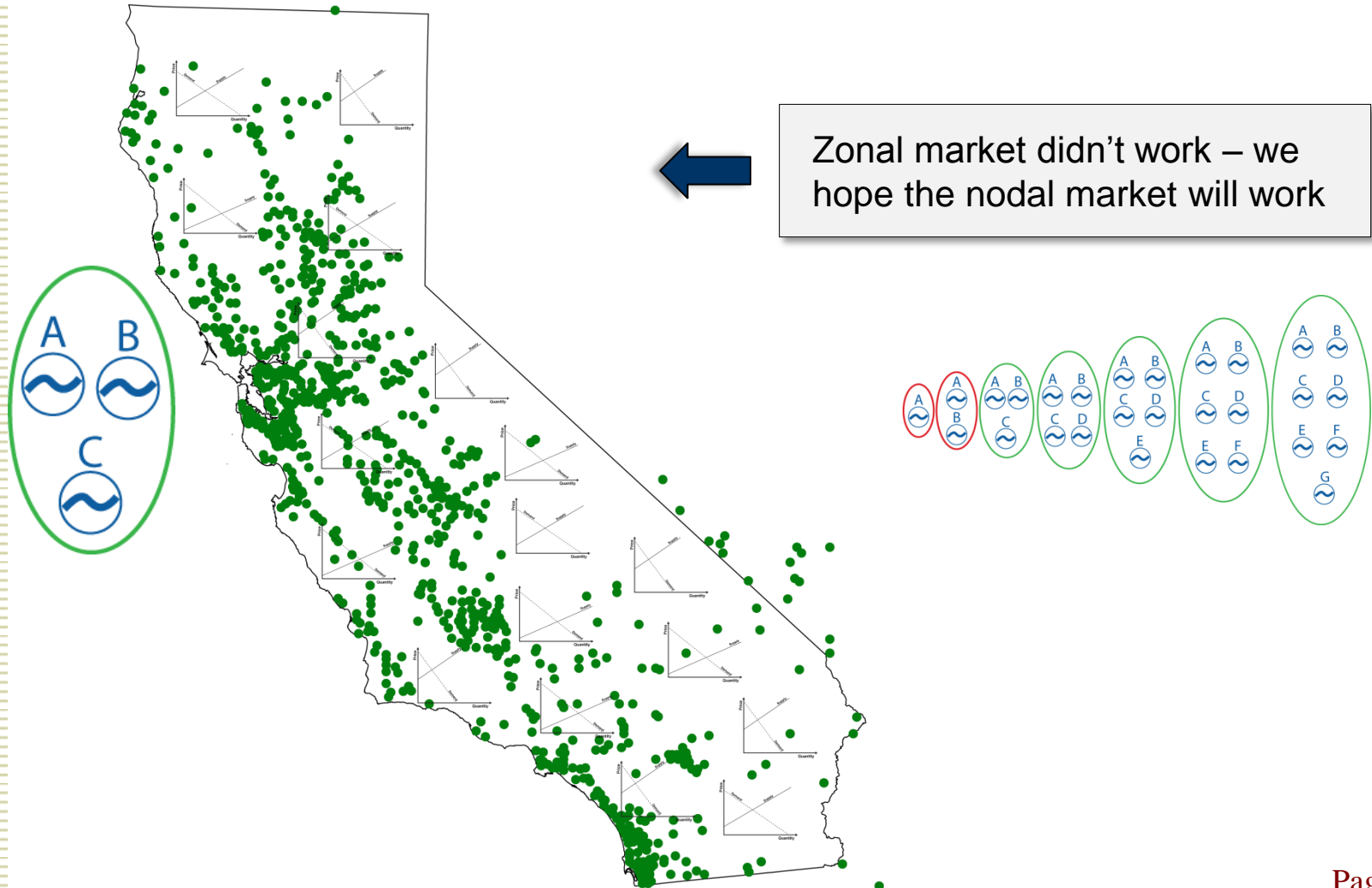
# “Well, we have some Transportation Constraints”

- ◆ Single market didn't work for electricity – so we went to a zonal market



# “Actually, we have a lot of Transportation Constraints”

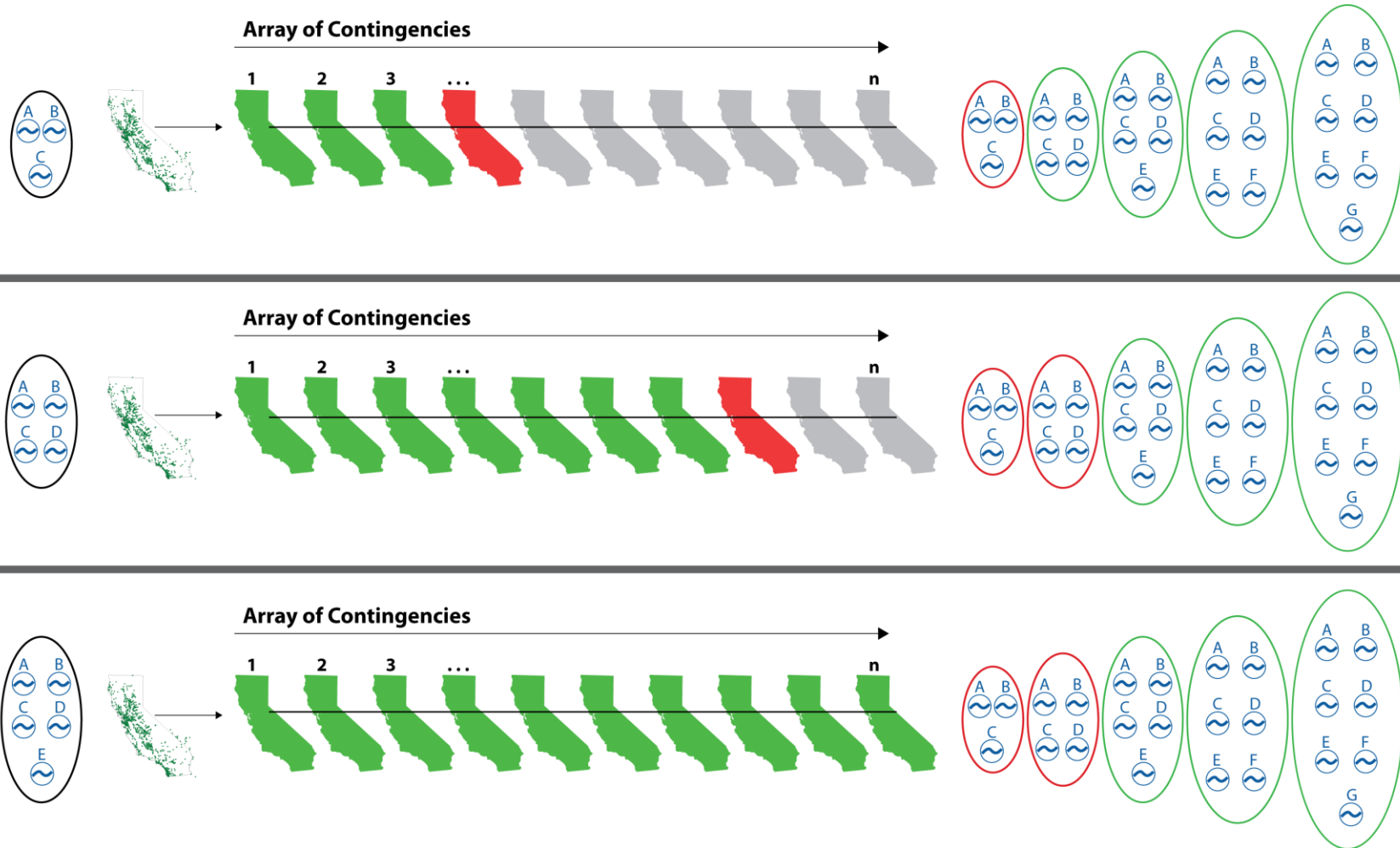
- ◆ However, we then needed a nodal market **due to gaming** concerns – each node has its own supply and demand modeled (total over 5000 nodes) – now we have over 5000 electricity markets



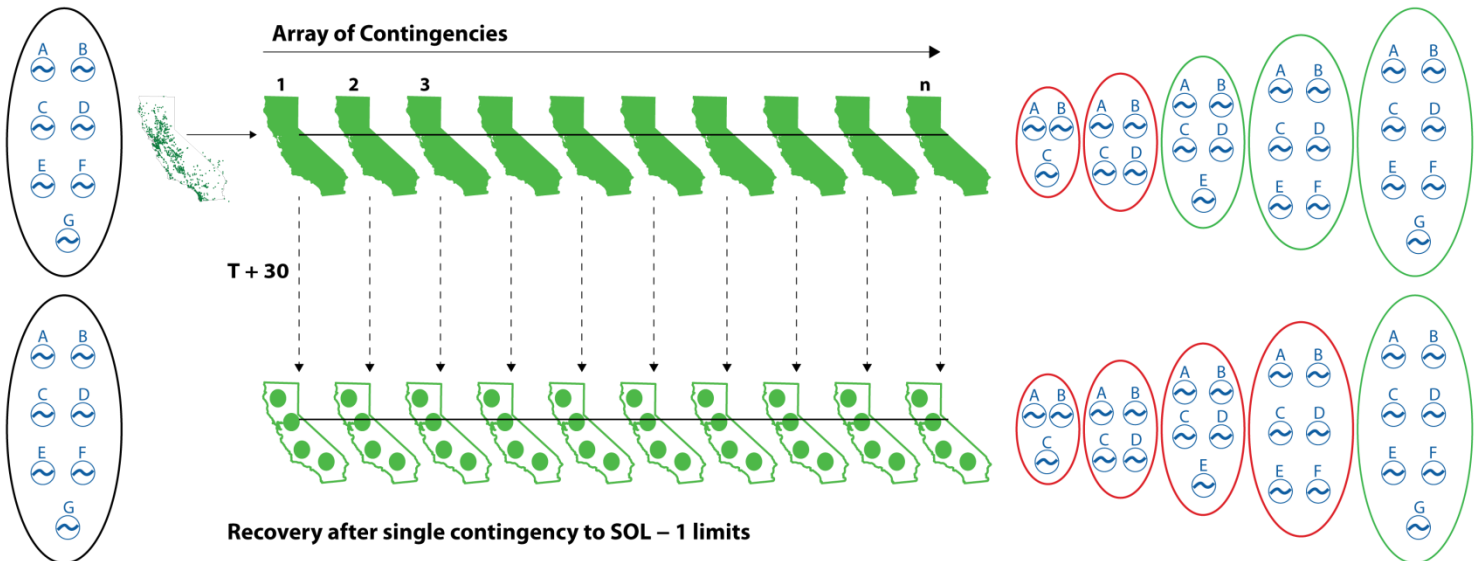
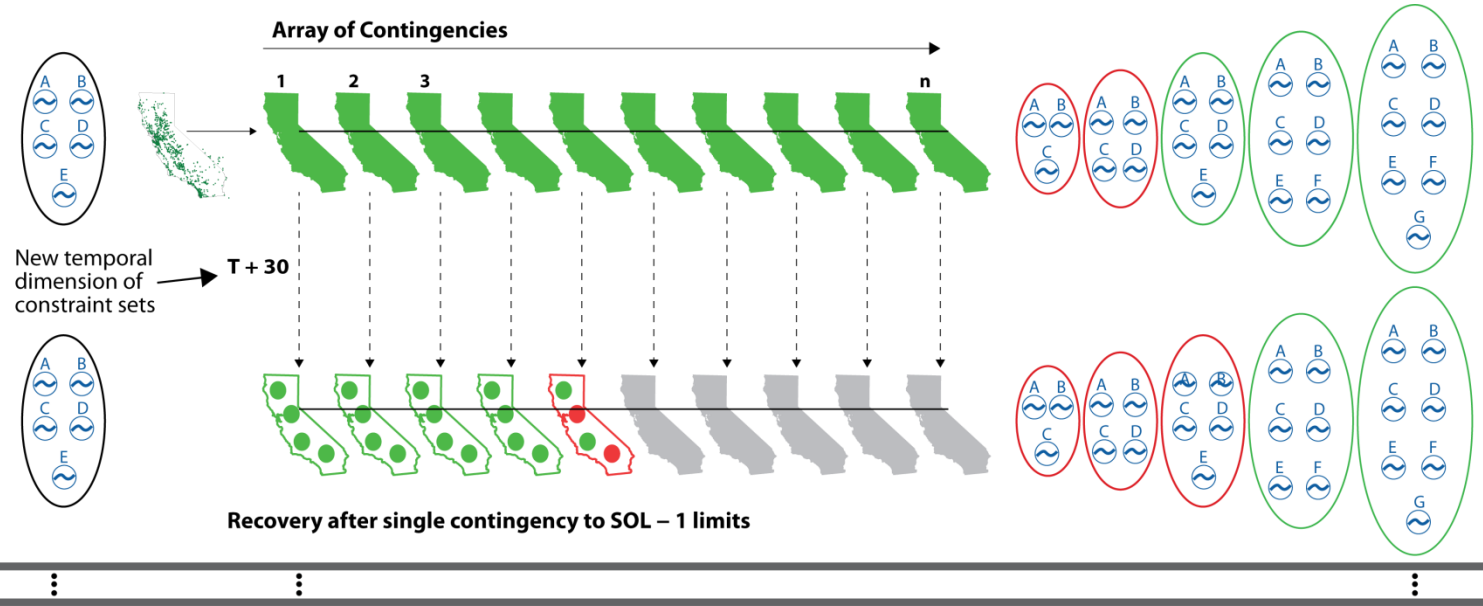


# “But what happens if..., and if..., and if...?”

- What happens when we don't have transmission under normal conditions? Its not good enough to deal with constraints of transmission (Zonal → Nodal), we now also have to imagine a system we don't have (outages, etc.) and run a market.

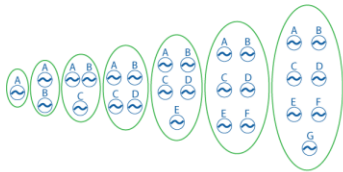


# CAISO Proposal: Add an Additional Dimension of Constraint Sets

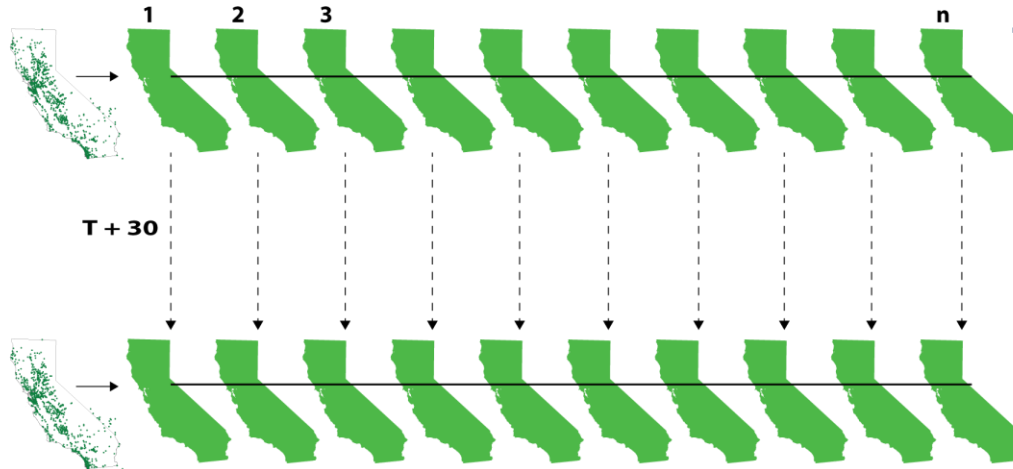


# “What happen? I thought electricity was a commodity?”

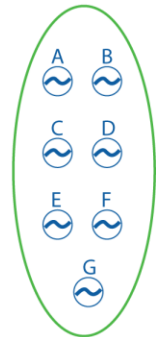
From this...



Array of Contingencies



...to this



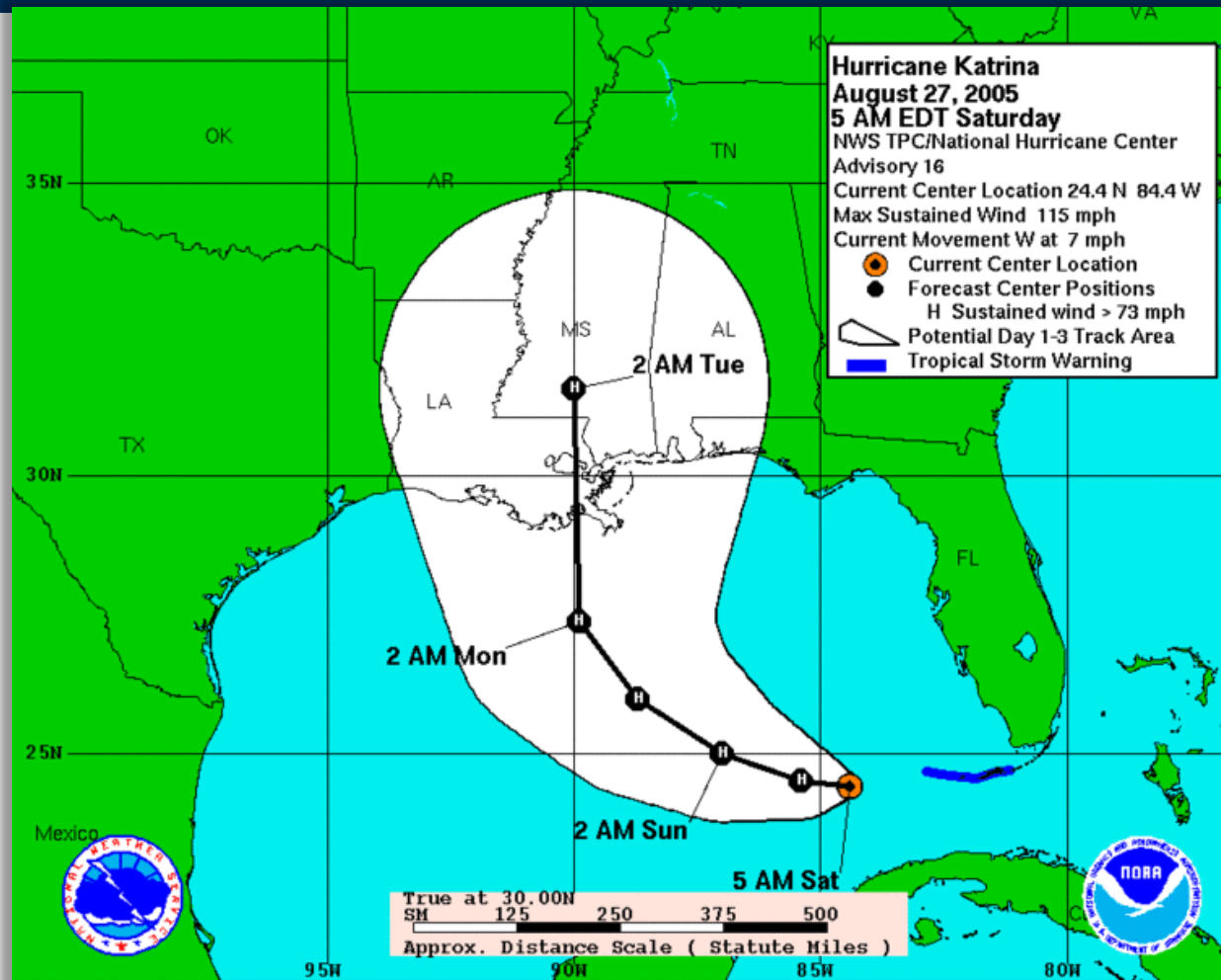
Recovery after single contingency to SOL - 1 limits

# Shouldn't we be Concerned with the Complexity and Untested Nature of the Proposal?

- ◆ Impact on LMP
  - “Temporal congestion” is the result of imaginations on top of imaginations on top of forecast error
- ◆ New nodal capacity product
- ◆ Likely will lead to nodal AS prices
  - Substitution of AS and SOL relief?
  - Pricing Hierarchy?
  - Prevents Flexible Ramping product/constraint from contributing to the solution
- ◆ Likely will lead to "derating" transmission as an option to maintaining SOL – 1 reserves
- ◆ Impact on all other co-optimized prices
  - Impact on all day-ahead prices based on deterministic inputs that WILL NOT materialize in real-time (the only horizon of need)
    - Why is a reliability process co-optimized with Virtual bids?
    - Impact on Virtual Bid settlements?
  - Impact on RT price spikes given limited real-time solutions and a deterministic approach to a stochastic problem
    - How are 15-minute inter-ties incorporated?
- ◆ Identifying market power
  - Understanding how it can be exercised (no current capacity mitigation)
    - E.g. “Under contingency 64, I have SOL-1 market power on path 42. As a result, I can impact the prices of all other market products as well as my SOL-1 capacity payment”
  - Identifying who has it, and figuring out how to mitigate it



# The Problem is Stochastic, Not Deterministic



- We don't know what conditions will ultimately develop
- But the proposal “optimizes” as if exact conditions, paths and timing are known



# Solution Robustness/Stability?

- ◆ The solution assumes everyone follows ISO dispatch perfectly
- ◆ The solution assumes CAISO forecasts the load perfectly at the beginning of the event, as well as the exact load 30 mins after the event.
  - We know all these assumptions will not be perfect – just how sensitive is the solution to input errors?
- ◆ Deterministic inputs to the “optimal” solution
  - Impact of stochastic on this solution
    - Load error
    - Dispatchable units not following instruction
    - Loop flow
    - 33% Renewable portfolio and Renewable and growing
  - Forecast of wind 24 hours in advance
- ◆ How robust is the solution if any initial condition assumptions are violated?
  - Real-time market issues since inception – should we expect this to improve performance?
  - If the solution approach is unstable, why is it reasonable to use it for economic signals and **PAYMENTS?**
  - The CAISO may get a solution but is it a market or administrative solution?



# Should we Expect this Market to Function Competitively?

- ◆ Why should we assume the CAISO proposal will produce competitive results?
- ◆ Should the CAISO's N-dimensional analysis of imagined outcomes on top of imagined contingencies be the basis for market pricing?
- ◆ In 2000, Wolak, Nordhaus, and Shapiro gave guidance on the preconditions necessary for a workably competitive market
  - Significant Quantity Bid but Not Called Upon
  - Bids at or Near Marginal Cost
  - Supply is Not Concentrated
  - Buyers are Flexible
  - No Unnecessary Institutional Barriers to Rivalry or to Demand Flexibility
  - Collusion is Difficult
  - Entry into the Market is Easy

**Source:** The Competitiveness of the California Energy and Ancillary Services Markets by *Market Surveillance Committee of the California Independent System Operator*, March 9, 2000.  
<http://www.caiso.com/Documents/AttachmentB15-Aug-00.pdf>

- What basis is there to conclude the proposal will result in Just and Reasonable outcomes?





# SCE's Recommendations

- ◆ Tradeoff between “optimal” and “reasonable”
  - Given the stochastic nature of this problem, the proposed “optimal” solution at best represents false precision
  - Rather we should find a “reasonable” approach for implementation, and continue research into more advanced solutions
    - Consider testing situational awareness tools in parallel with actual market operations

## Preferred initial approach

- ◆ Fully understand the NERC/WECC requirements
  - Make sure we are not unnecessarily conservative
- ◆ Develop and evaluate alternative approaches **using existing tools and market products**
  - Start with RUC enhancements
    - ◆ RUC is already a physical commitment for reliability requirements
    - ◆ Excludes Virtual bids
    - ◆ Existing product
    - ◆ Avoids “double payment” or RA capacity
    - ◆ Prevents impact of “temporal SOL-1 congestion” on core energy LMPs
    - ◆ Insulates/delinks core market from market power, lack of solution of SOL-1
  - Consider minor modifications to existing AS
    - ◆ Perhaps new AS regions with minimum purchase requirements determined via off-line studies
  - Make sure all tools (including Flexi Ramp) are considered when determining actions
- ◆ Use Offline studies – perhaps via the CAISO proposal- to determine reasonable commitment needs given the nature of the problem (e.g. stochastic inputs and low probability of events)
- ◆ *Thoroughly* simulate and study the impact of complex proposals before deciding if they are appropriate to implement in the market

