Overview -- Making Markets Work

or… "Is Summer Over Yet?"

Learnings from California….

What I'm Going to Discuss

- What's really happening in California?
  - How the PX markets work
  - How the ISO markets work
  - What is working and what is not
- What the PX offers other markets
  - A liquid and transparent forward spot market
  - A platform of additional trading tools
    - Ancillary services and green markets
  - Risk mitigation through centralized clearing pool
  - Learnings and experience in operating markets

Our History / Background

- **Mission: Provide efficient, open (transparent) energy market**
  - **Trading: daily, hourly, monthly, quarterly, yearly energy and ancillary services contracts**
  - **Scheduling Coordination: energy, ancillary services, congestion adjustments, balancing energy**
  - **Clearinghouse, credit management and settlements--all markets**
- **Experience / track record**
  - **Operate a $14+ billion market**
  - **80 customers, all of top national marketers**
  - **The marker price for western U.S.**
  - **Linking physical and financial markets**

A Brief History of the PX– Growth and Adaptation

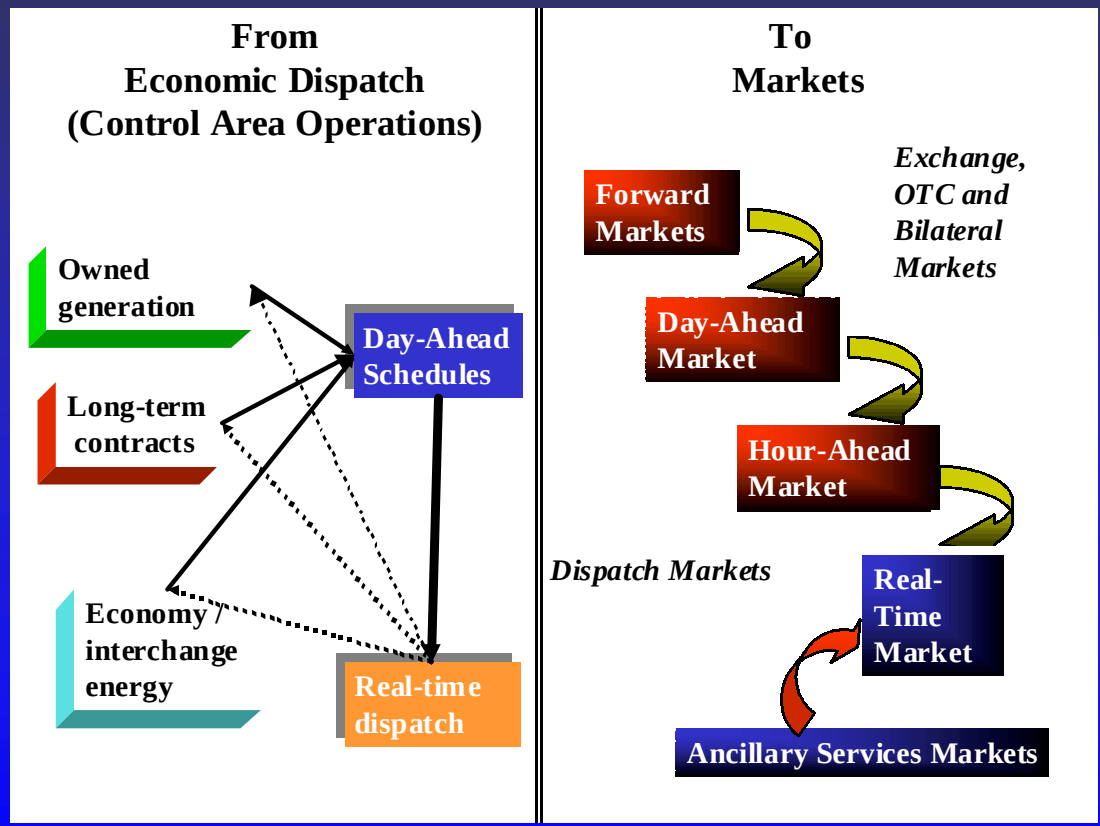
- September 1996-- California Legislation passed
- May 1997-- First employee hired
- March 31, 1998-- Day-ahead market opened (39 participants)
- July 30, 1998--Hour-ahead market opened
- January 1999 --Day-of market replaces hour-ahead
- July 1999--Opened Block Forwards Market and Launched Post - Close Quantity Match trading
- October 1999--Extended Block Forwards Market and offered quarterly contracts
- Today-- 80 participants, the “reference market” for the western US, multiple delivery points, multiple forward markets

Learnings From California--Restructuring Is a "Process" Not An Event

- What happened?
  - Tight supplies made it a seller's market
  - San Diego customers exposed to volatile spot market prices with no "choices" (no rate freeze)
  - SCE and PG&E face huge losses due to rate freeze
- Solutions
  - Fix the retail / wholesale interface (define default service)
  - Provide choices
    - Price risk management tools (exchange products)
    - Price responsive consumption options
- "…current price caps are not capable of protecting …purchasers …their efficacy is likely to diminish…as sellers find more effective ways of evading them." *Conclusions of the CAISO Market Surveillance Committee 9-21-00*

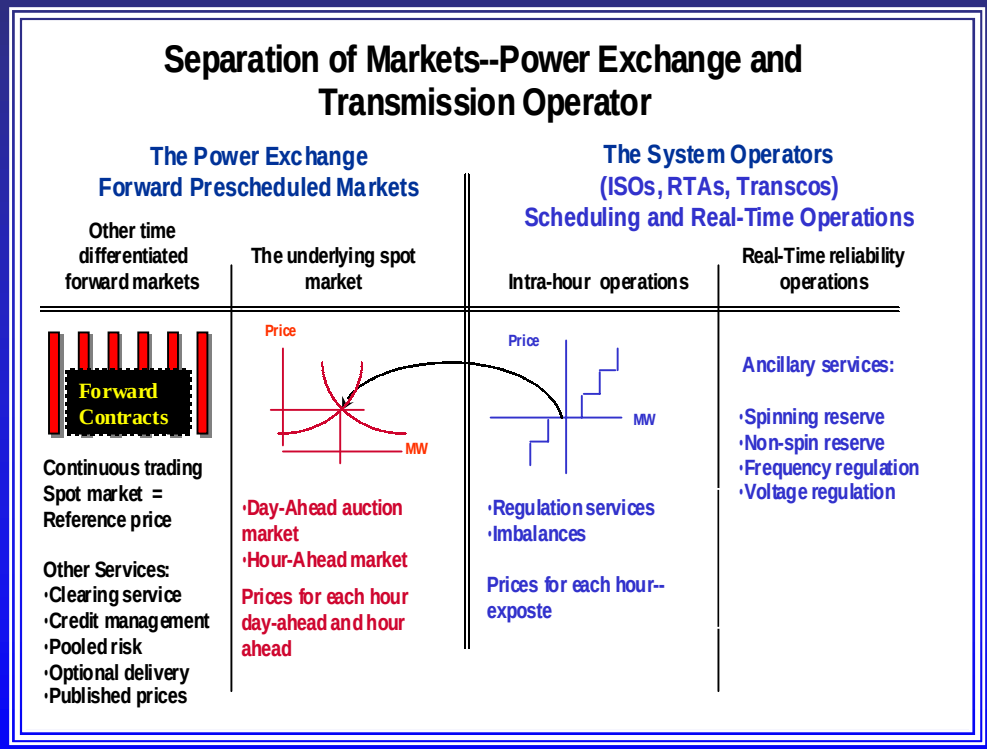
The New Paradigm for Electricity Markets

- New wholesale electricity "markets"
  - Dispatch (real-time) markets
    - centralized market operations (ISO, RTO, IMO)
  - Day-Ahead hourly reference (cash) market
    - transparent exchange-based market
  - Forward markets
    - bilateral contracts
    - exchange and OTC forwards, futures
  - Other derivatives



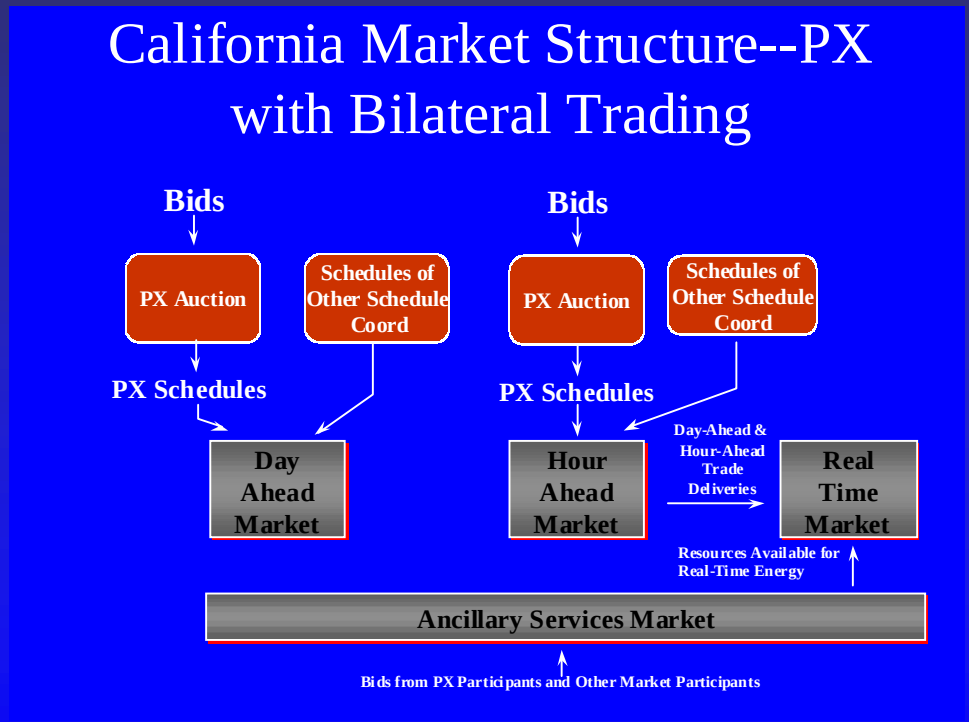
Why a Separate Power Exchange in California

- Exchange functions Vs. ISO functions
  - Exchanges create markets (buyers and sellers determine price)
  - ISOs facilitate reliable delivery
- These are distinctly different functions
  - Exchanges create market reliability
  - ISOs provide system reliability



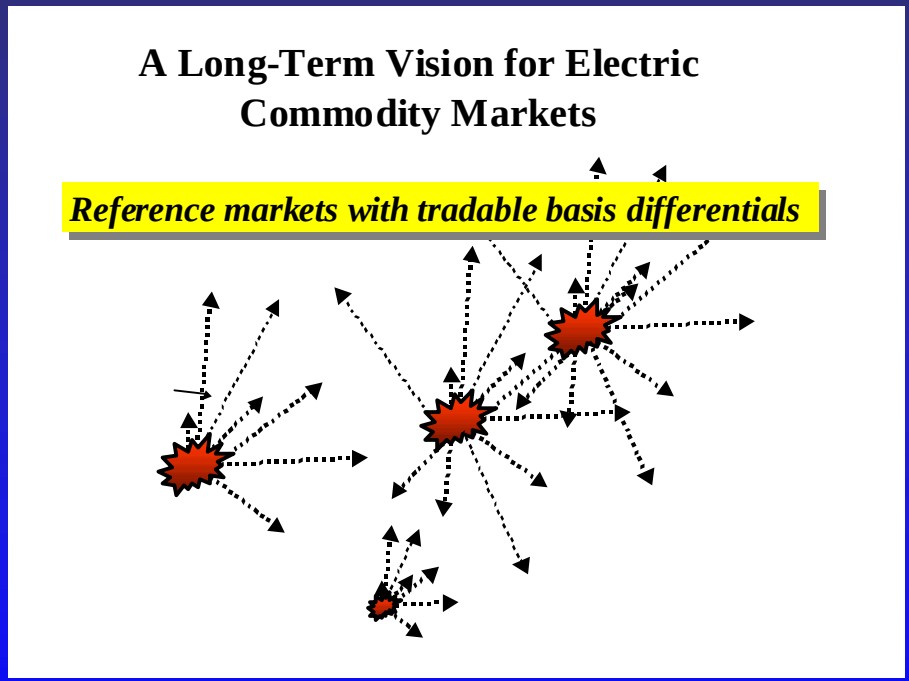
The CAISO Facilitates Reliable Delivery of Schedules Submitted

- Schedule coordinators submit balanced schedules to the ISO
- ISO accepts forward schedules, determines reserves required and clears constrained paths
  - *"bid based real-time market subject to security constraints"*
- ISO provides "market of last resort"
  - Real-time balancing
  - Ancillary services
- ISO monitors markets



The CalPX Facilitates Markets

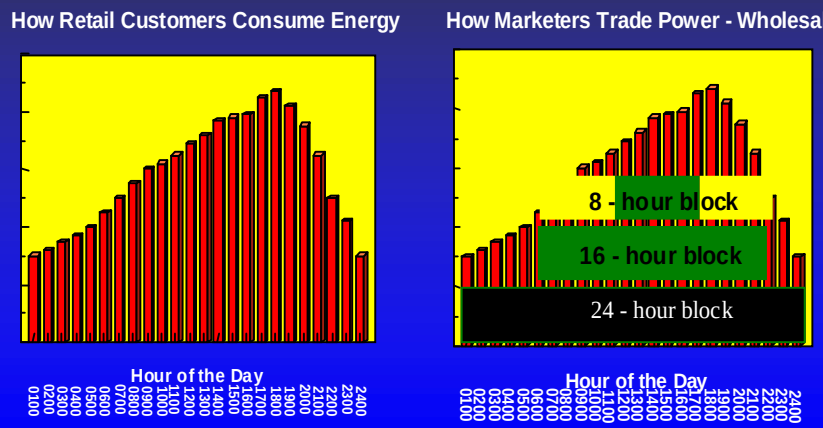
- A neutral forum for trading standardized forward contracts
- A solid reference market
  - Linking physical to financial
  - Linking retail to wholesale
  - Linking markets to each other
- Centralized clearing and settlement services
- A non-discriminatory market for new entry
- Market stability



The Day-Ahead Hourly Market--Linking Retail to Wholesale

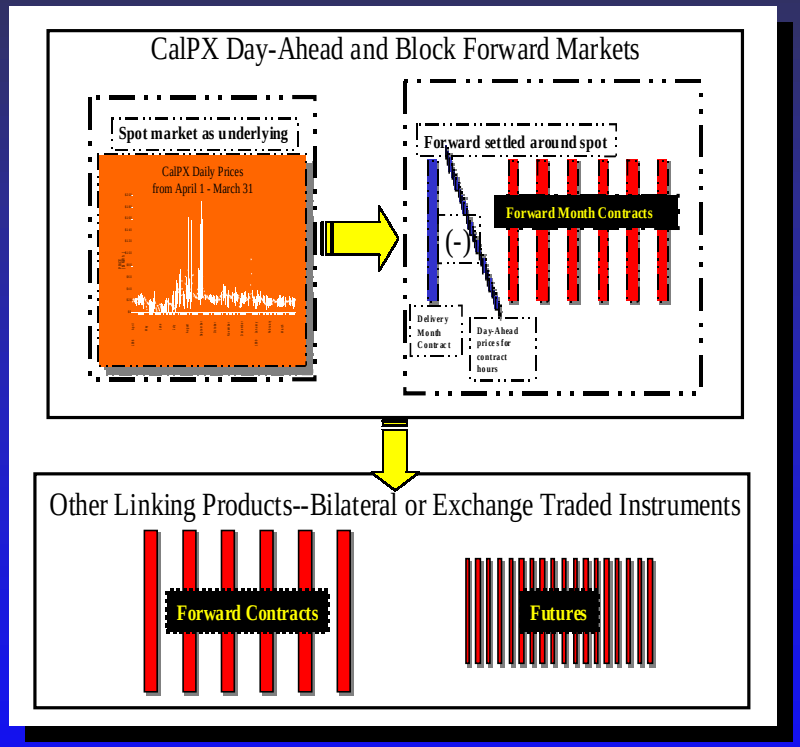
- Providing a reference ("cash") market
  - Consumers / regulators
  - Financing new generation
  - Futures and other derivative markets
- Hourly market prices
  - demand-side programs
  - efficient market for load shape
- Separation of retail procurement and production functions

A Liquid Hourly Market to Meet Retail Requirements



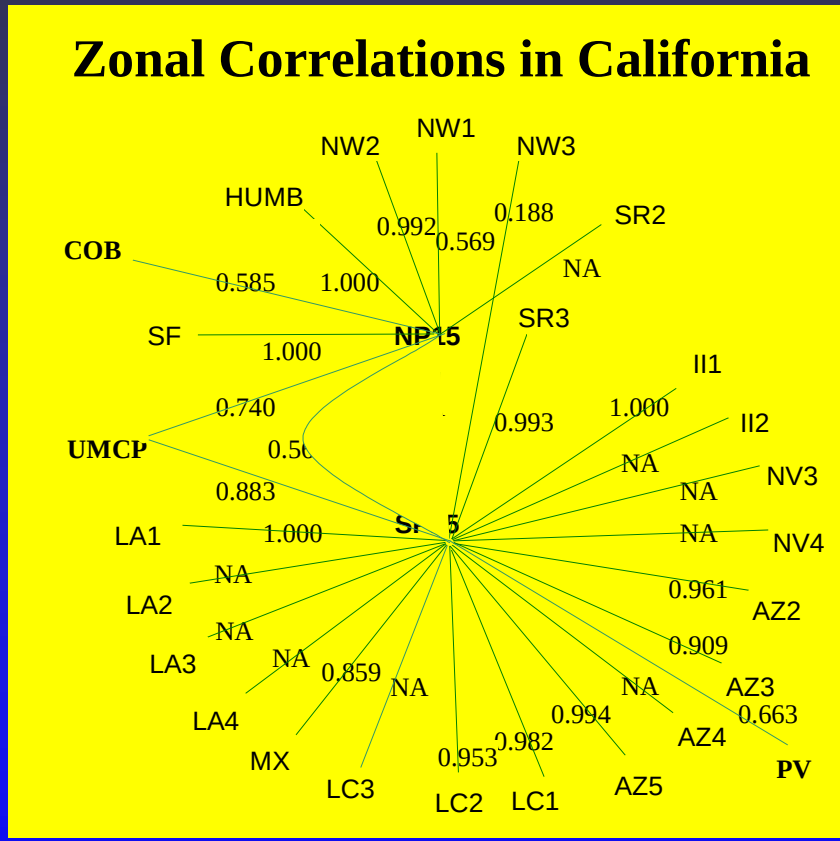
Linking Physical to Financial--Serial Forward Markets Work

- Price volatility (uncertainty) increases as markets get closer to delivery
  - Forward markets allow buyers and sellers to hedge price uncertainty
- Serial forward markets allow buyers and sellers to improve their financial position as more information is available closer to delivery
  - Generators have incentive to bid opportunity costs in real-time once financial position secured in forward markets
  - Serial forward markets create structural elasticity for buyers



Linking Markets to Each Other

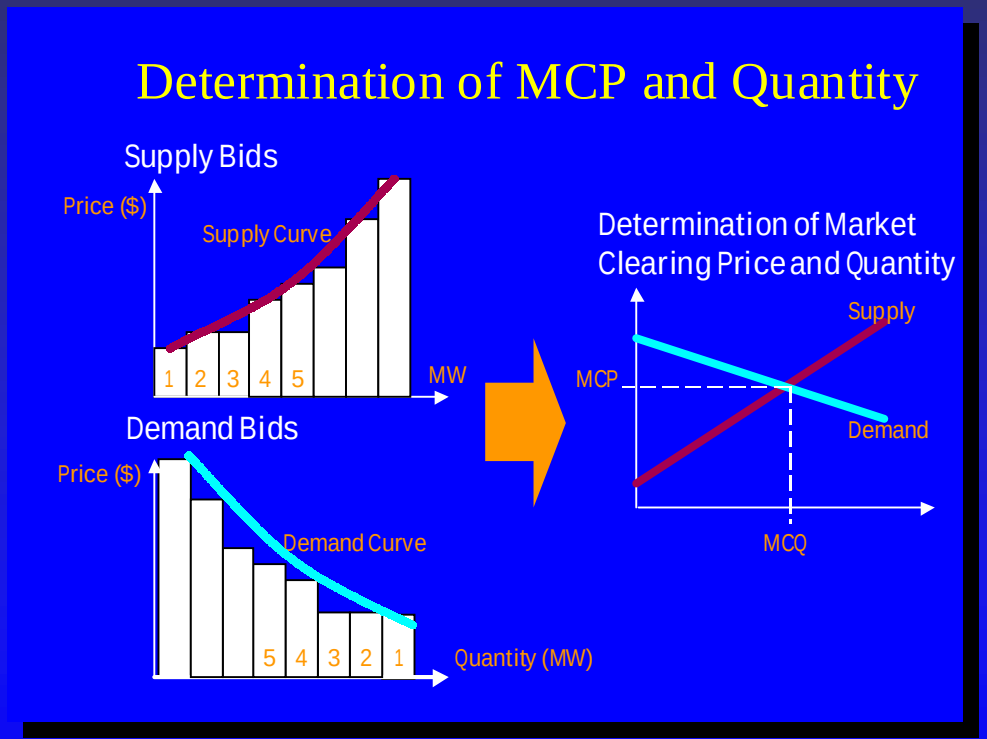
- Goal: Seamless regional markets
- A standardized day-ahead platform can link markets to each other
  - Create “hubs” to maximize liquidity while minimizing real-time delivery differentials
- Transmission markets provide hedges between hubs and nodes or zones



26 zones in California demonstrate 2 liquid “hubs” (80% or better correlation)

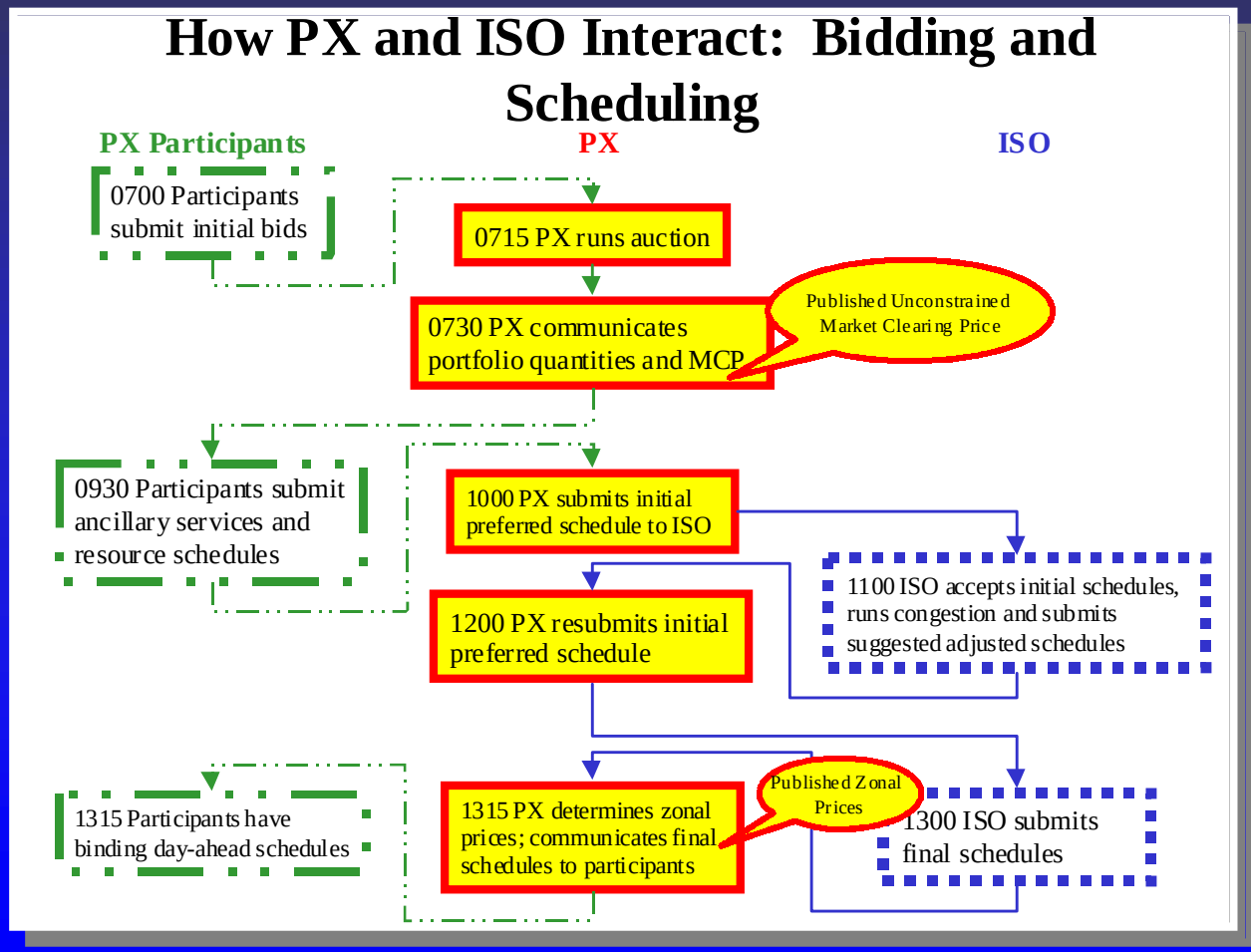
The Day-Ahead Auction --Determining the Market Clearing Price

- Demand and supply bids accepted - 24 settlement periods
- Bids aggregated to form demand and supply curves
- MCP is intersection of supply and demand bids
- May be adjusted for congestion



The California Model--Linking PX and ISO Processes

- PX day-ahead market is transparent and separate from ISO markets
- Links to ISO for congestion management, ancillary services and real-time markets

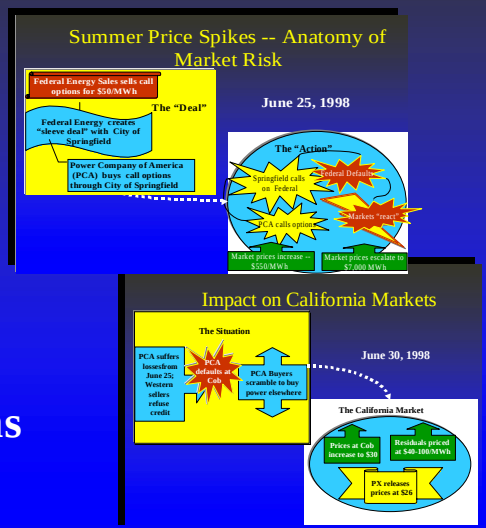


New Risks in New Markets--How An Exchange Can Reduce Risk

- Serial, time differentiated markets provide fundamental risk management tools and lend stability to markets
- Credit and clearing function reduces default risk, collateral requirements and back-office costs
- Credible market reduces regulatory uncertainty

For the Past 150 Years --Exchanges Operate to Manage Risks in Commodity Markets

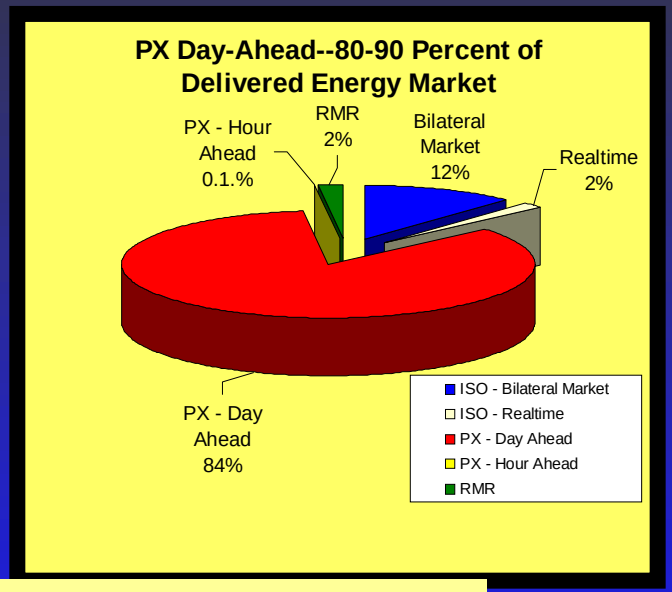
- ***New Risks in Electricity Markets***
  - **Price volatility**
  - **Default**
  - **Chain reactions**

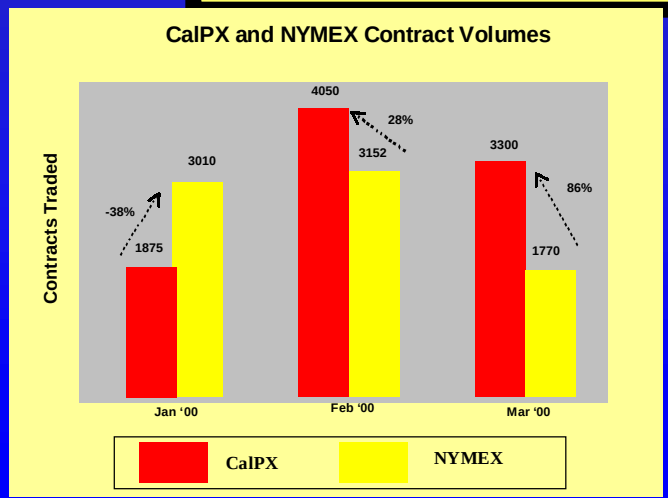


Creating the Reference Market

CalPX produces the reference markets for the Western U.S.

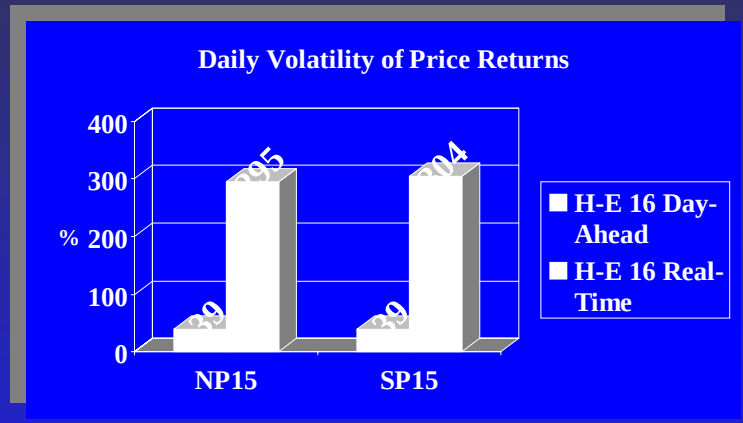
- Day-ahead hourly market is the "index" or "cash" market
  - 200 TWh annually--25 % of WSCC volume
  - Over $30 billion settled since inception
- Forwards markets
  - BFM volume surpasses NYMEX at COB & PV

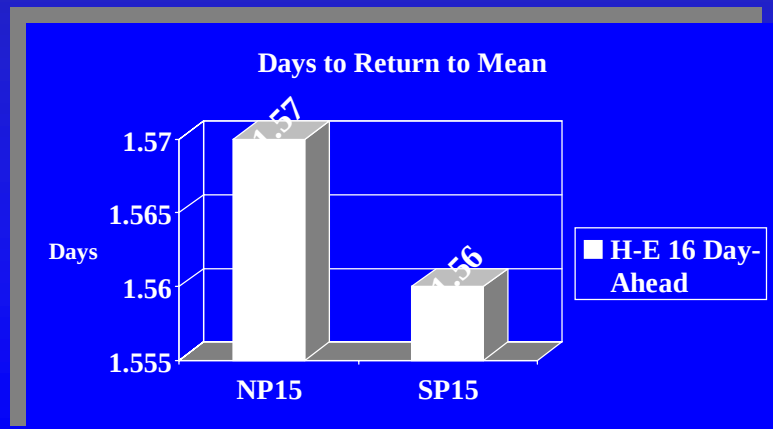




Day-Ahead Market Hedges Real-Time Price Volatility

- Statistical analysis shows PX day-ahead market is credible and effectively hedges real-time risk
  - Market prices are event driven and revert to expected price quickly (less than 2 days)
  - Volatility of day-ahead market is a fraction of the ISO real-time market

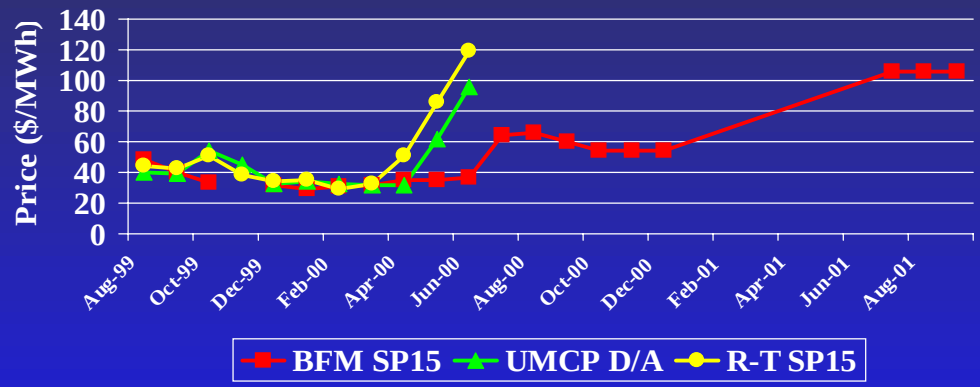




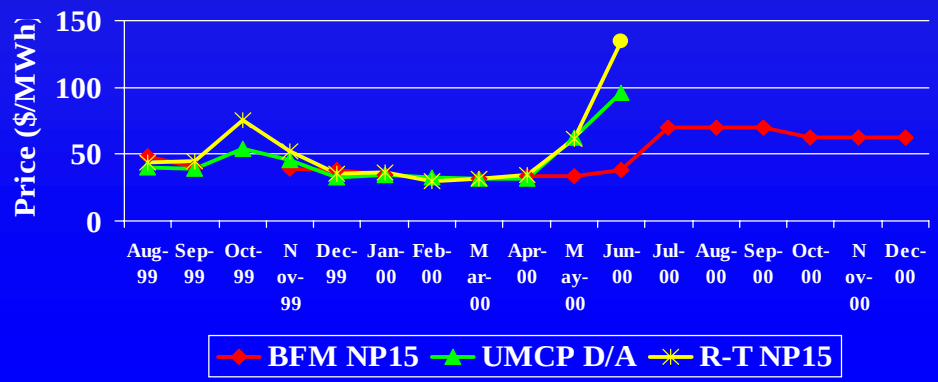
Enhancing Market Efficiency Through Serial Forward Markets

- PX day-ahead market hedges the ISO real-time market
- PX block forward market hedges the day-ahead market up to one year in advance
  - Continuously traded dailies, monthlies, ancillary services
  - Multiple hubs (PV, COB, NP15, SP15, Mead….)
- The day-ahead market is a deep and liquid cash market

Serial Time Differentiated Markets in California SP15

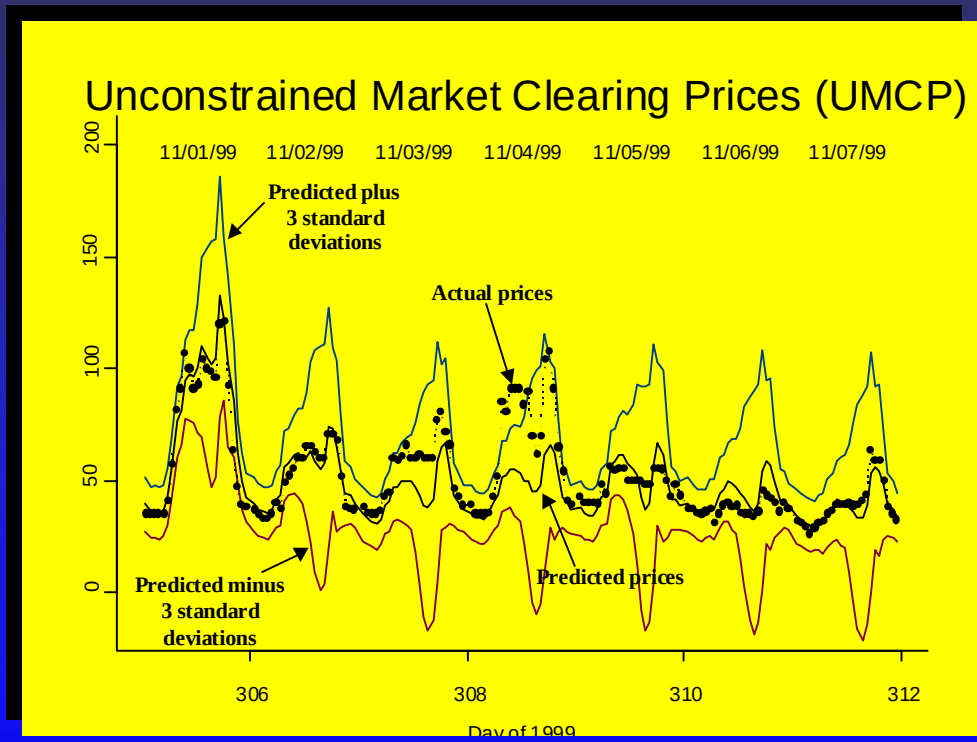


Serial Time Differentiated Markets in California NP15



Market Monitoring -- Applying Fundamental Analysis

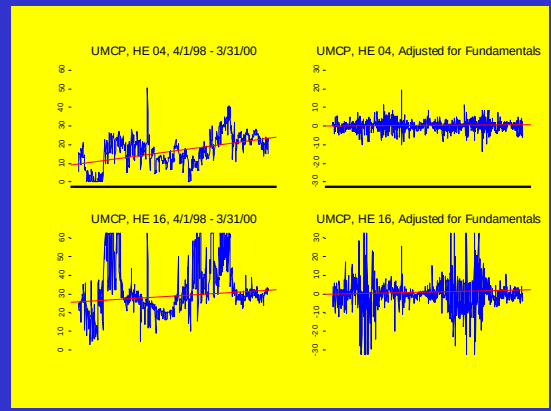
- Market monitoring screens for anomalies
  - Comparing raw prices to adjusted prices
  - Defining range of “normal” events
  - Events outside range are low probability
  - Events selected for examination are usually explained in some other way



Evaluating the California Markets (Pre-Summer 2000)

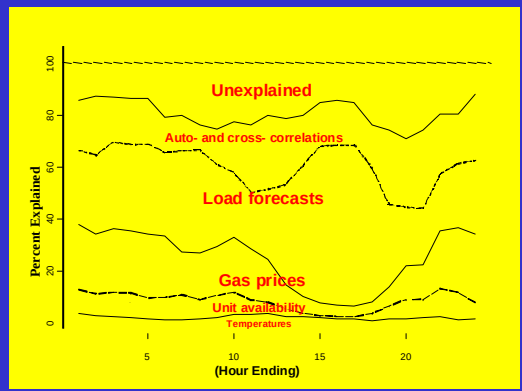
- **Fundamental modeling used to monitor markets, predict prices and determine anomalies**
- **Trends in day-ahead prices are largely (80%) explained by fundamentals**
  - **Temperatures**
  - **Unit availability**
  - **Gas prices**
  - **Load forecasts**
  - **Auto- and cross-correlation**
- **Conclusion: the California market was working and enhancing market efficiency**
  - **Effective hedging through serial time differentiated markets**
  - **Markets are operating within fundamentals and are self correcting**

There are trends in raw prices….



...but none in adjusted prices.

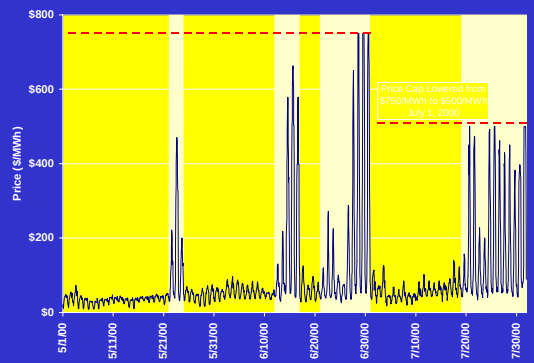
Variability in Unconstrained Market Clearing Price (UMCP)



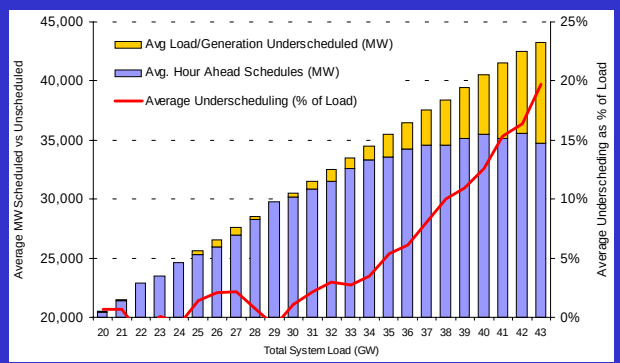
What Happened During Summer 2000

- June prices hit $750/ MWh price cap
- ISO board reduces price caps to $500 and ultimately $250
- Volumes move from day-ahead to other markets
- ISO reports increased supply costs have outweighed impact of lower price caps

Price Caps and Response--Summer 2000



Underscheduling in the Forward Market



Source: CAISO

Impacts of $250 Price Caps--Summer 2000

- Reduced transparency
  - Supplier volumes move “out-of-market”
- Less “balance” going into real-time
  - More potential for “out-of-market”
- “Dulled signals”
  - Demand side programs stifled
  - New capacity potentially diverted
  - Exacerbation of supply/demand differential

What's Not Working

The Push and Pull of Transition

'Camden felt so strongly about me weighing in that she quit…if you think that "political pressure is wrong," then you people don't understand your job.'

Comments made by Senator Steve Peace at a CAISO Board meeting resulting in $250 price caps after two previous attempts.

"Is deregulation really at fault? No. It is similarly inaccurate to blame the recent rise in electric bills…on deregulation when the real culprit is the old state and federal regulatory regime that has left electricity in short supply."

Excerpts from GeoInvestor.com "Short Circuit Executive Summary: California's Self-Imposed Power Crisis" by William P. Kucewicz.b

- **The Solutions***
  - **forward contracting**
    - **regulatory authority**
    - **more tools**
  - **price-responsive demand programs**
  - **expedited transmission and generation construction**
- **What's needed from "markets" *(Per CalPX)***
  - **Day-ahead hourly markets for demand side programs (currently offered)**
  - **Serial forwards (currently offered)**
  - **Ancillary services markets (currently offered)**
  - **Options to provide collars for utilities and risk management to retail customers (next)**

Per CAISO Market Surveillance Committee report

What the PX Can Offer to New Markets

- A proven financially binding day ahead market
- A trading platform that allows other markets to be added quickly and inexpensively
  - Day-of / hour-ahead markets
  - Existing forwards (up to 5 years)
  - Ancillary services and green markets
  - Transmission / “spread” markets
- Largest clearing market in North America
  - Reduced risk(s)
  - Reduced collateral costs
  - Reduced back-office costs
- Transparent, neutral and independent energy market operations by an experienced market operator
  - Exchange based commercial practices
  - Methods to provide liquidity in forward markets around locational pricing
  - An existing customer base of all top traders in North America
  - Leading edge market monitoring practices
- A link to other markets