



CALIFORNIA ISO

California Independent
System Operator

The Future is Now Power Industry Challenges In California

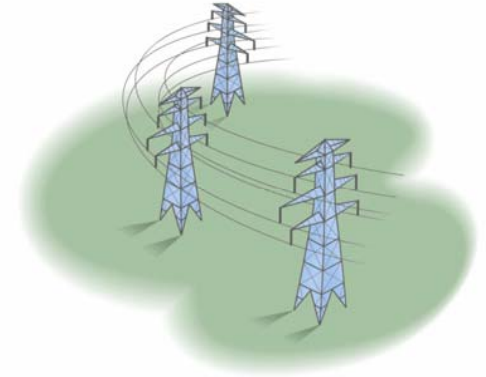
*October 4, 2005
IEEE San Francisco
Annual Banquet*

Yakout Mansour
President & Chief Executive Officer



The California Independent System Operator

- A not-for-profit public benefit corporation
- Controls the flow of electricity on the transmission grid
- Ensures reliable operation of the grid and “keeps the lights on”.
- Created by California state law
 - Board of Governors appointed by governor, confirmed by State Senate
 - Works closely with state government agencies
- Regulated by FERC

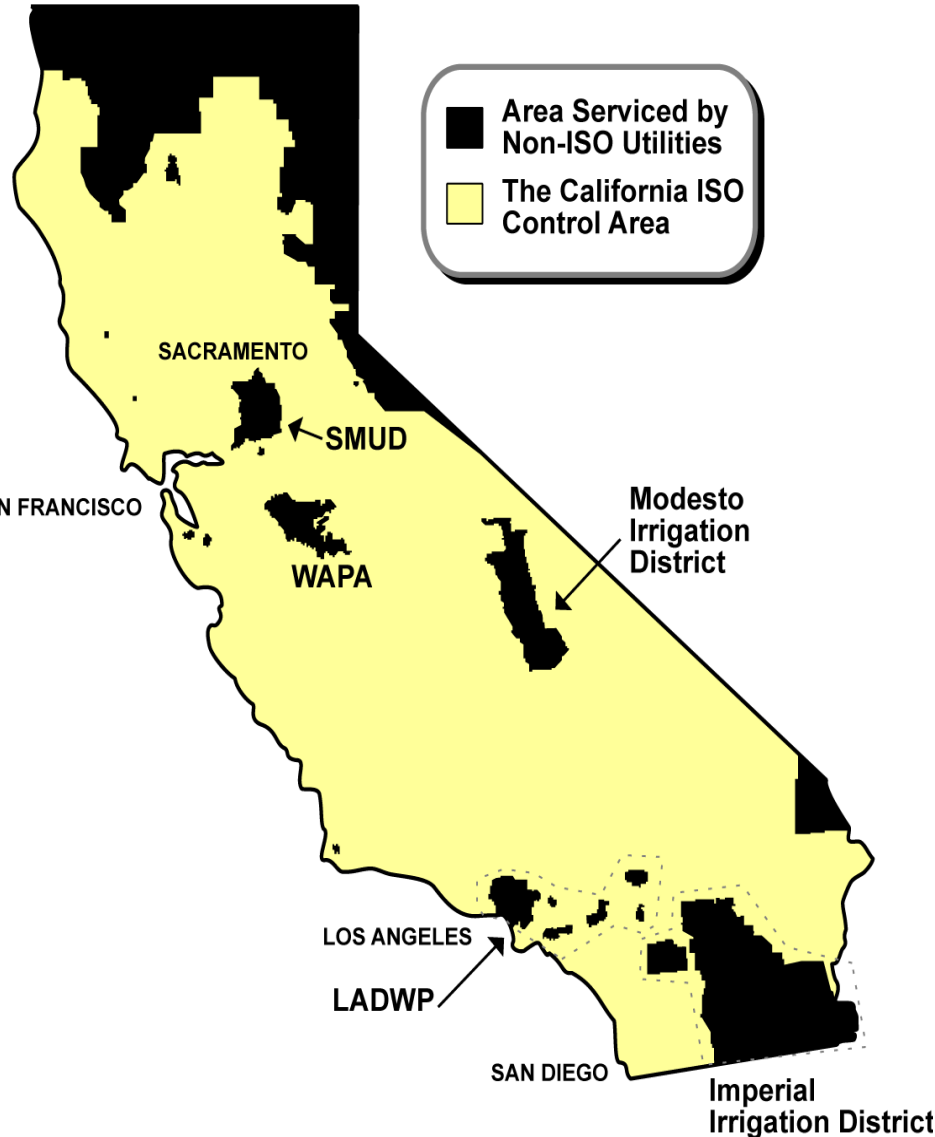




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PacifiCorp



THE NUMBERS:

55,183 megawatts
of power plant capacity

15,000 market
transactions
per hour

25,526 circuit-miles of
transmission lines

30 million people served

\$2.7 billion annual billings

230 billion kilowatt-hours
of power delivered
annually



CALIFORNIA ISO Key Roles

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- **Scheduling of Power Transfers**
- **Congestion Management**
- **Grid Planning**
- **Real-Time Dispatch**
- **Financial Settlements**
- **Control Area Operations**
- **Ancillary Services Management**
- **Outage scheduling - Trans. & Generation**





California Power Industry Challenges

1. How can we design a robust energy market ?
2. How do we insure enough generation is built to meet future load growth and generator retirements?
3. What are the sources of fuels and diversity of supply?
4. How can we do a better job of transmission planning and insure the timely construction of new transmission facilities?



California Power Industry Challenges

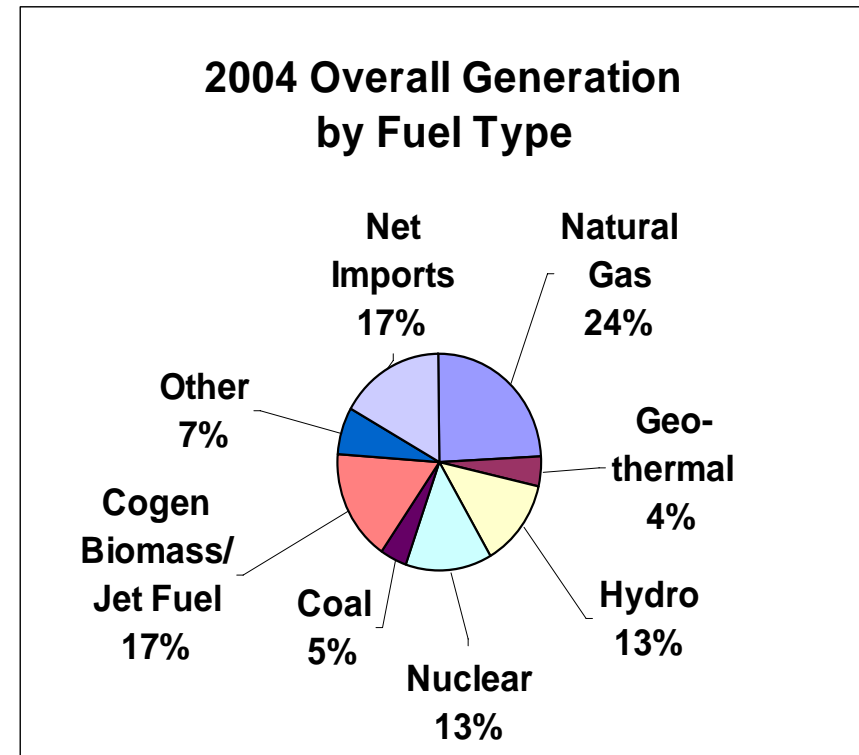
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5. How can we do a better job of integrating wind generation and other renewable resources?
6. What should be the role of energy storage systems and how can we improve the economics of energy storage devices?
7. Where will we find the future engineers and technical talent that is so vital to this industry?
8. How can we maintain reliable operation in such a highly dynamic operating environment?



Generation Resources Picture

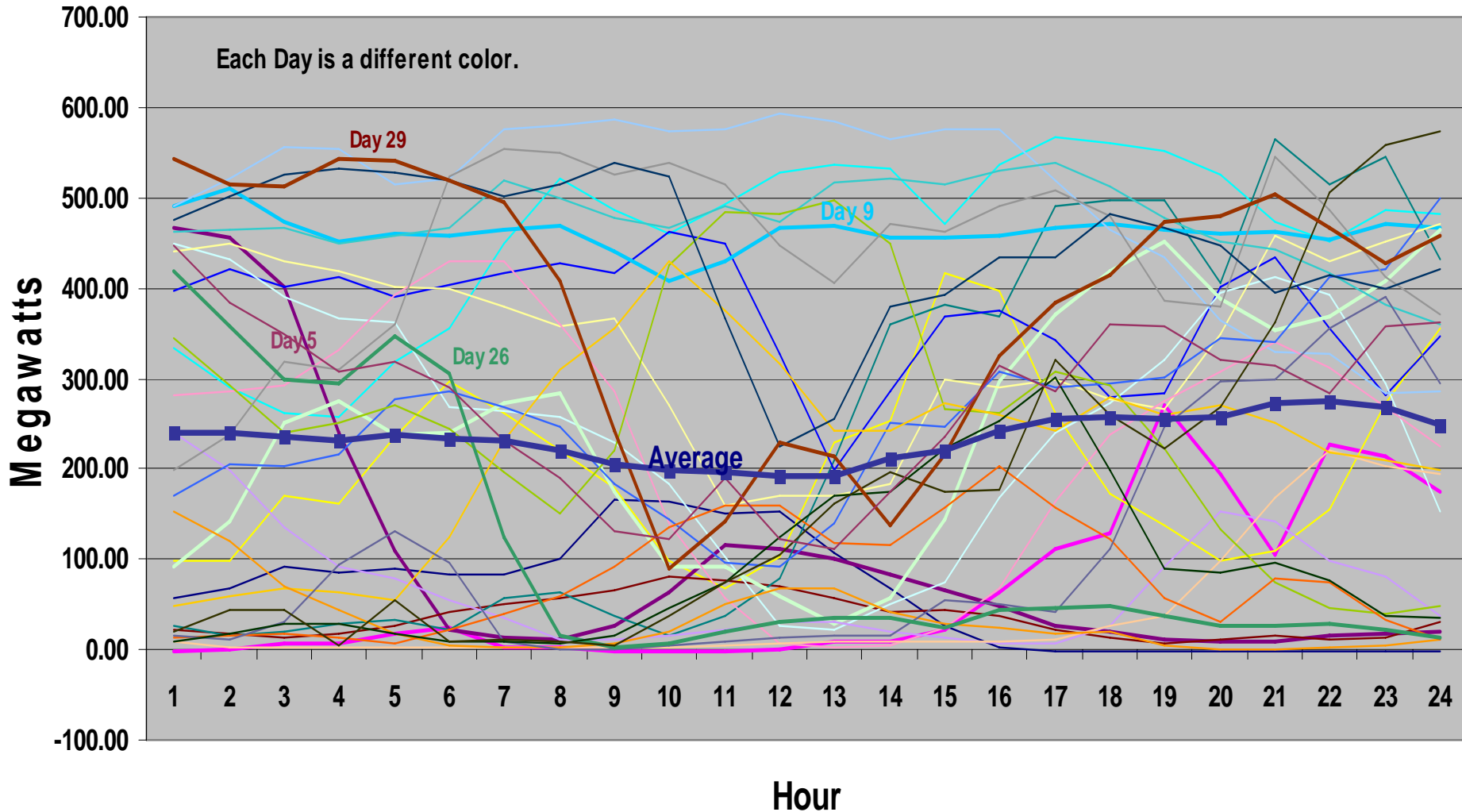
- Energy Imports are a critical resource for California
- 2005 was a great hydro year in California
- Thermal generation is predominately gas fired Combined Cycle Combustion Turbines
 - excellent as base load units with low operating cost but limited flexibility for quick start up & shut down,
- Renewable resources are increasing – especially wind generation





The Wind Challenge

Could you predict the energy production for this wind park either day-ahead or 5 hours in advance?





Integration of Wind Generation

- Need for accurate day-ahead forecasts for procurement of A/S (Regulation Services) and accurate RMR Dispatch notices
- Need for 5 hour ahead forecasts for accurate dispatch notices to quick start generators
- Need better transmission planning tools that model the both hourly wind energy production and the use of storage technology. What is the transmission capacity utilization? How can we accommodate 10,000+ MWs of Wind Generation in the future?

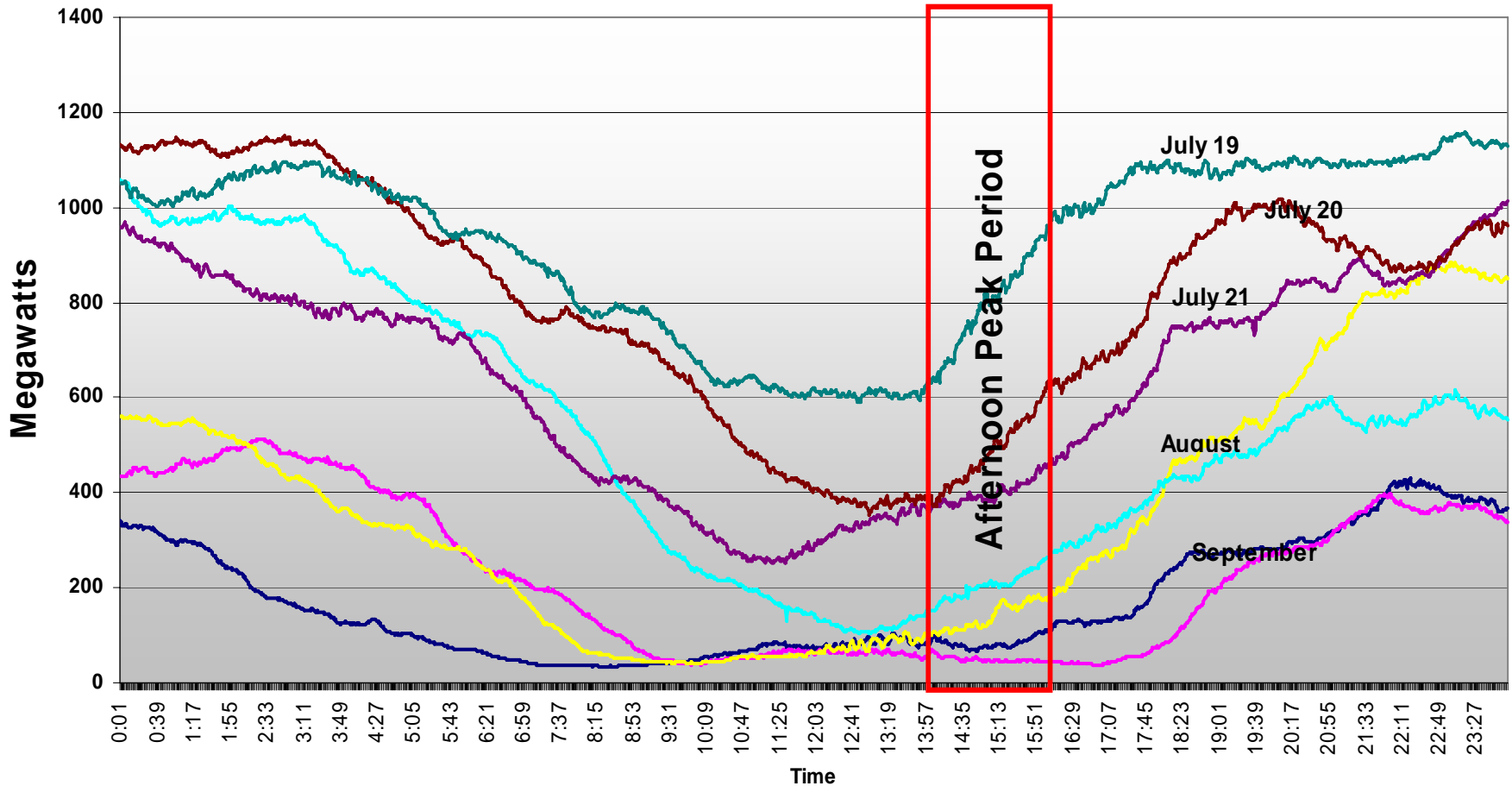


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Capacity Value of wind to meet peak summer loads remains an issue

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Wind Energy Production on Peak Days in 2004





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Meeting the Challenge

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Market Redesign and Technology Upgrade

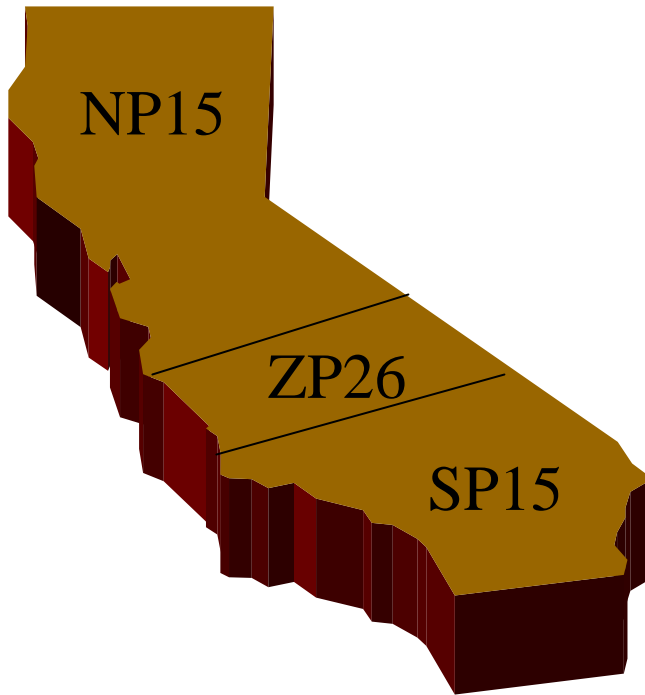
Designed to:

- Fix flaws in original market structure
- Ensure feasible forward scheduling
- Upgrade aging computer systems
- Replace “missing market”
(California Power Exchange)
- Decrease reliance on spot market
- Ultimately—reduce costs





The Original Market Design

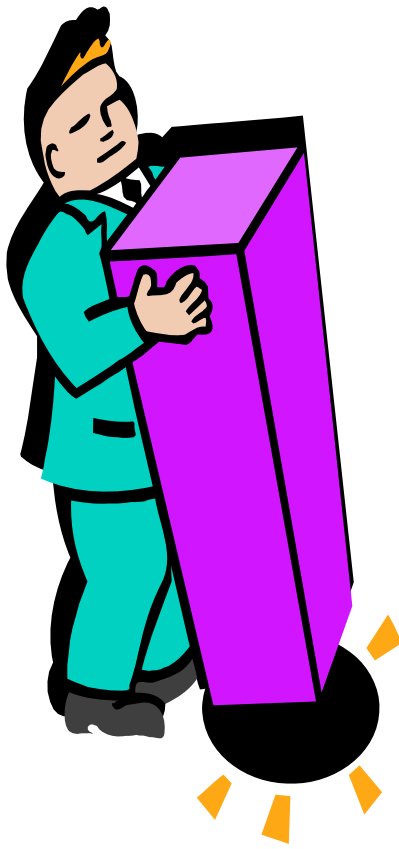


Three “zones” in California

- Three zones for congestion management
- Unable to “see” crowded power lines within the same zone until real-time
- Allowed infeasible day-ahead schedules
- Mitigating “intra-zonal congestion” in real-time is costly and jeopardizes grid reliability



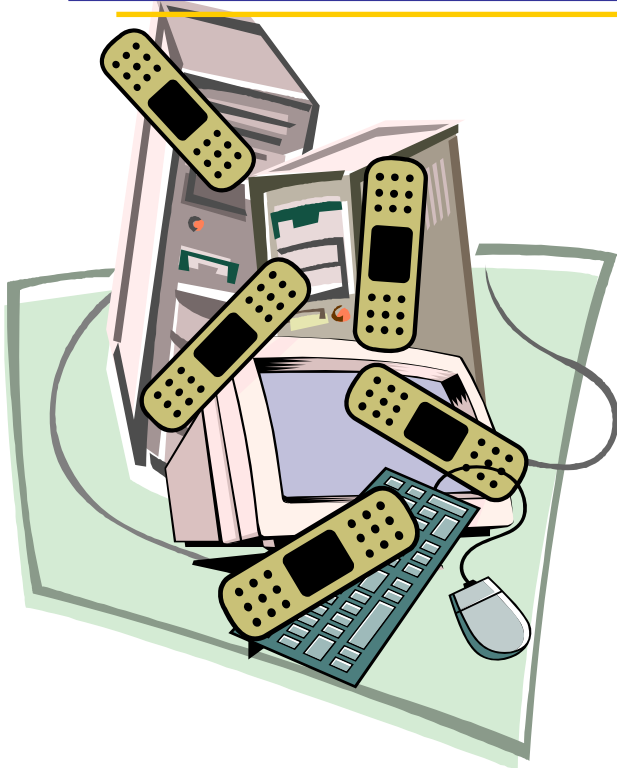
Flaws caused/exposed by the energy crisis



- The California Power Exchange went bankrupt leaving no day-ahead market for energy
- “Enron type” games and market manipulation
- Insufficient energy commitments or obligations to California
- Allowed/forced too much reliance on ISO real-time markets
- Square Peg—Round Hole



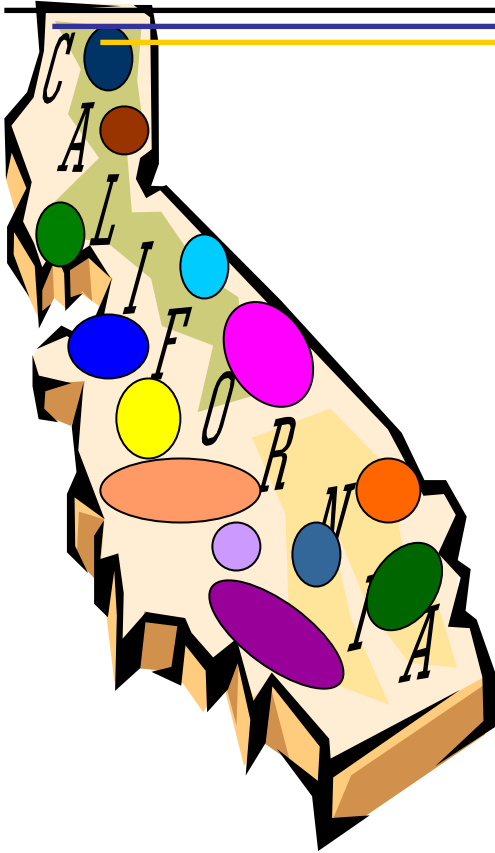
Aging Computer Systems



- ISO original systems installed in 1997
- Systems “patched” hundreds of times requiring costly manual input
- Systems no longer meet today’s needs let alone future growth
- Need to be replaced with or without a market redesign



New Rules and Tools



- Replaces “zonal” congestion management with “nodal” system
- Provides exact electronic replica of the grid that can “see” and mitigate all bottlenecks from day-ahead schedules
- Institutes an Integrated Forward Market
- Requires feasible scheduling
- Locational Marginal Pricing offers clear view of the true wholesale cost
- Carries new rules/authority to stop gaming and manipulation
- Replaces aging computer systems with flexible, scalable systems



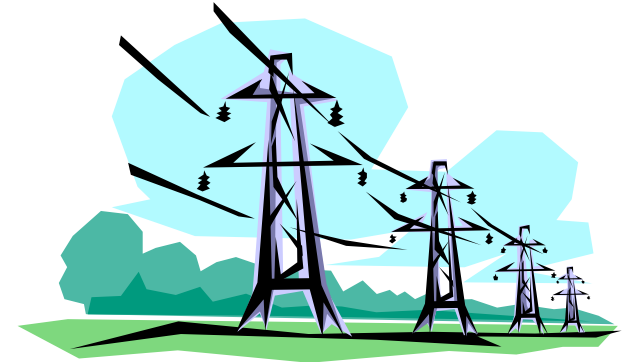
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Meeting the Challenge

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Grid Planning

- Currently reactive – proactive beginning 2006
- Signal to serious locational alternatives
- The non-wire transmission cost
- The missing child of the 80's – Integrated Planning





Meeting the Challenge

Grid Operations

- Complexity of the highly stressed swiss cheese
- Operator training – the future operator
- Advanced applications – what is on the desk, not on paper
- Capacity products, or pricing reliability.





Conclusion

- The future is challenging and bright.
- The ISO, market participants, and the regulatory agencies are collaborating.
- It is an old industry – new market.....be patient.
- The Power Engineering skills will continue to be a hot commodity.