
Parabolic Trough Power for the California Competitive Market

Hank Price
NREL

Bob Cable
KJC OC

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Concentrating Solar Power

Sandia National Laboratories, Albuquerque, NM
National Renewable Energy Laboratory, Golden CO

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Restructuring of California Power Market

- March 31, 1998 – California Deregulates Power Market
- California Independent System Operator (CAISO)
- California Power Exchange Opens (CalPX)
- Investor Owned Utilities
 - IOUs Sell Generation Assets
 - Purchase & sell power through CalPX
 - Renewables (QFs) on must take contracts
- Consumer Retail Rates Frozen

California Market 1998 & 1999

- Good hydro resource
- Low cost natural gas
- Low cost electricity
- Utilities control most generation

⇒ **Electricity Prices 2-3¢/kWh**

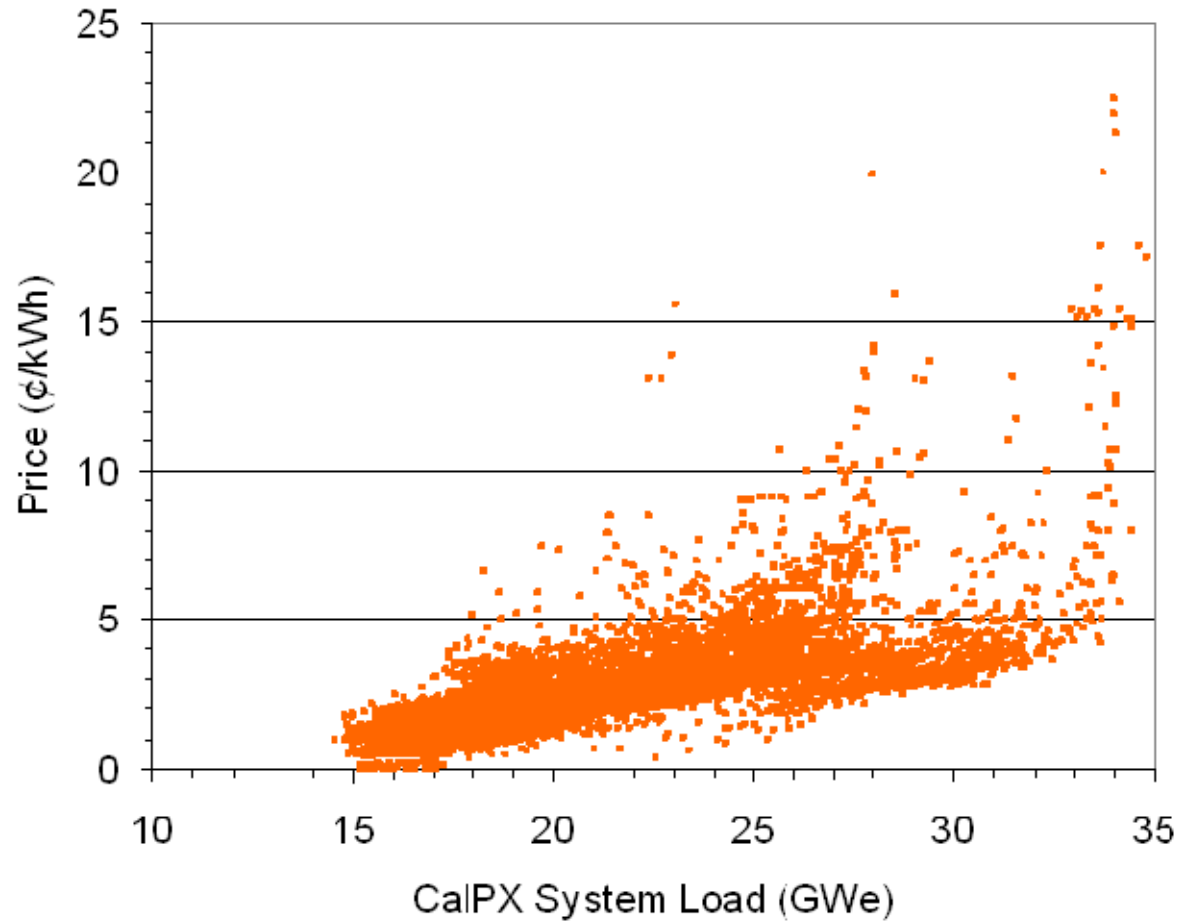


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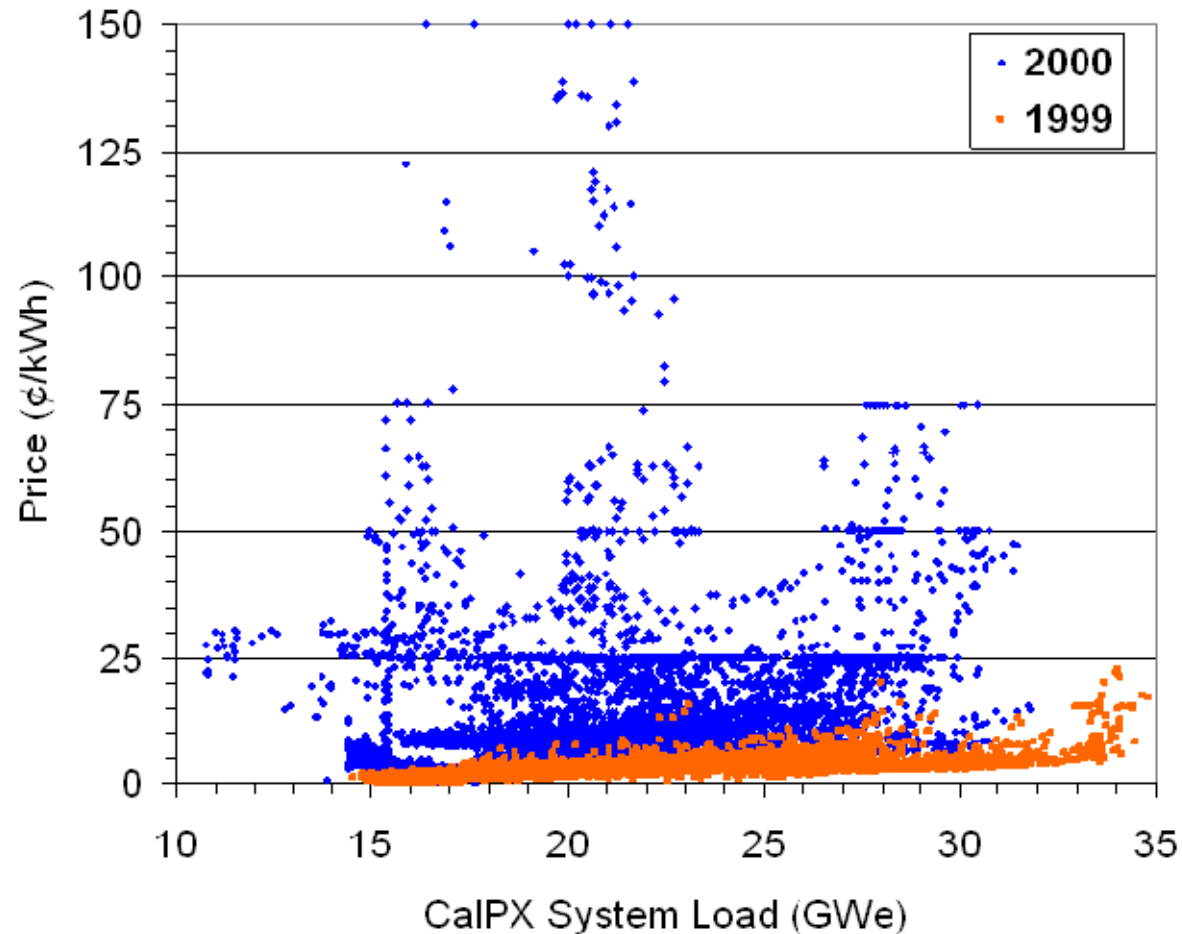
1999 Cal PX Day Ahead Pricing



California Market 2000

- Reduced hydro resource
- Utility generation sold to non-utility generators
- Natural gas supply limitations & increasing prices
- Caps on CalPX pricing

2000 Cal PX Day Ahead Pricing



Resulting Impacts

- Transfer of utility generation assets
 - Commercial decisions used to decide when and where to sell power
- Price Caps
 - Natural gas prices too high for generators to make profit in CalPX market
 - Generators sell power outside CA
 - Generators sell power to CAISO outside of CalPX
- Utilities
 - Utilities forced to pay more for electricity than they can charge
 - Utilities stop paying for QF and CalPX generation



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Re-Restructuring of California Power Market

- January 2001 – CalPX Closes
- California Department of Water Resource
 - Purchases power for CAISO
- CAISO Balances load with out of market purchases



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CalPX Market Clearing Prices

	1999 ¢/kWh	1999 % Inc	2000 ¢/kWh	2000 % Inc.
Average Price	2.83			
Price For Solar	3.32	17%		
Solar with Storage	3.78	33%		



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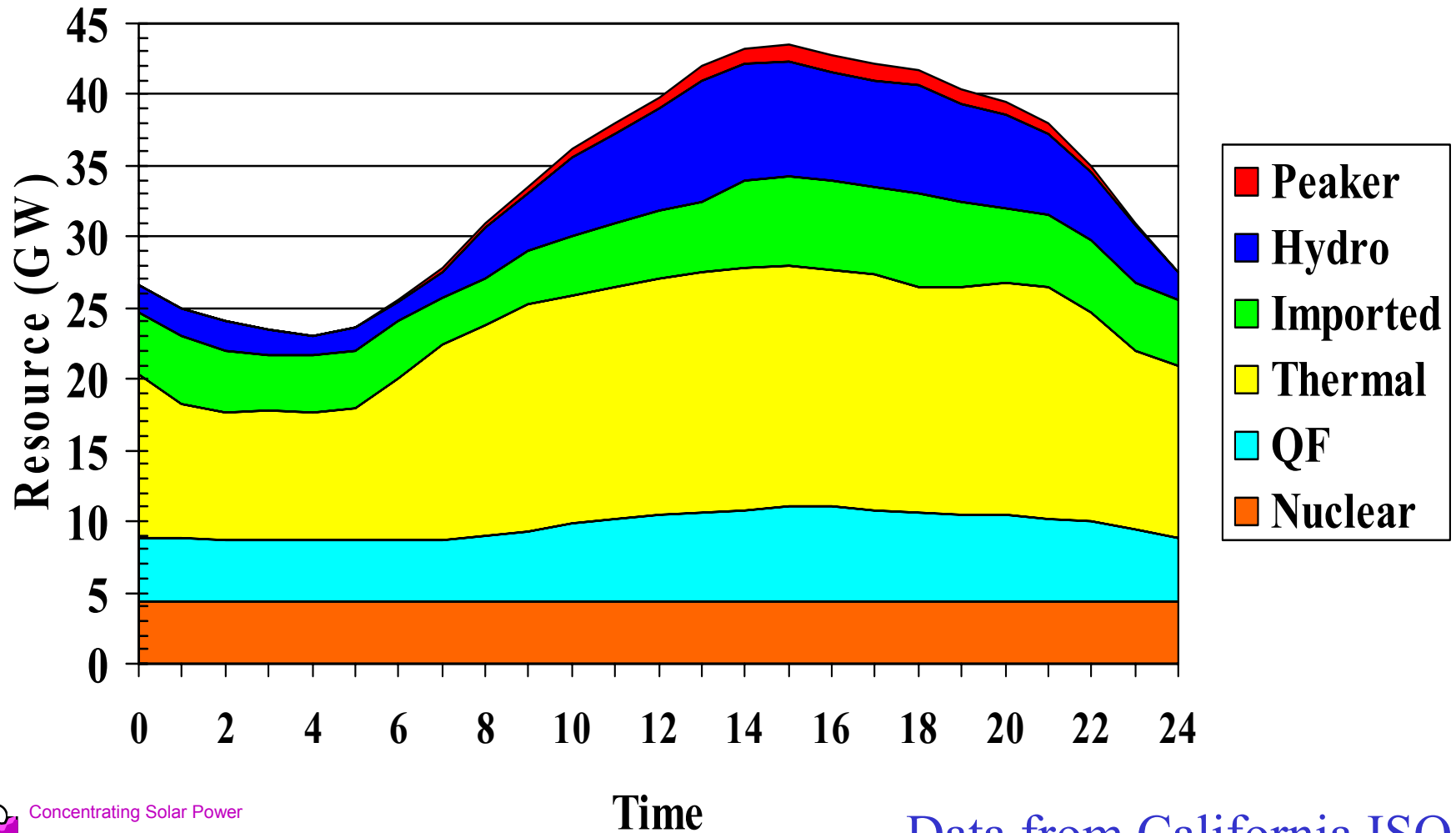
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CalPX Market Clearing Prices

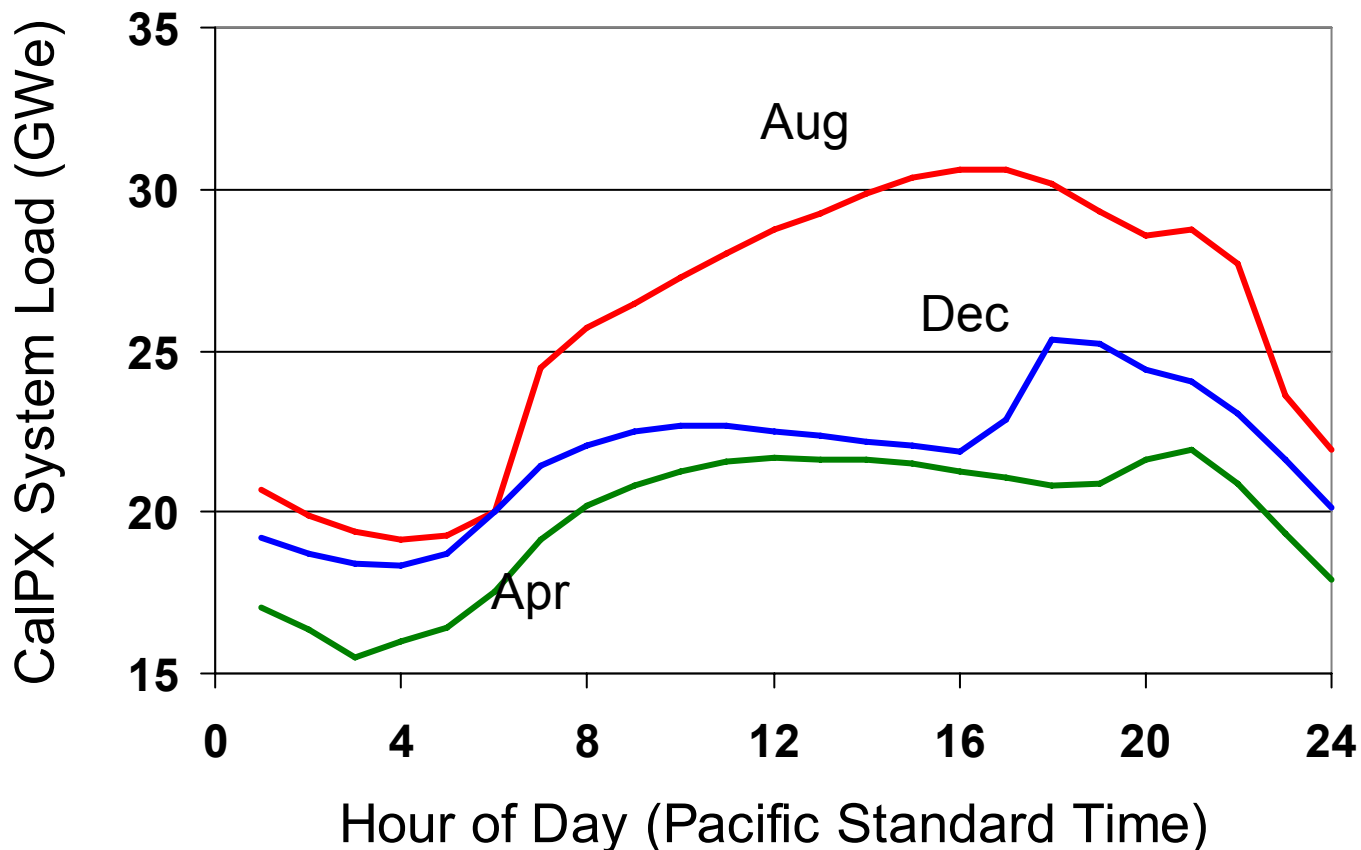
	1999 ¢/kWh	1999 % Inc	2000 ¢/kWh	2000 % Inc.
Average Price	2.83		11.11	
Price For Solar	3.32	17%	12.03	8%
Solar with Storage	3.78	33%	14.31	29%

California 2000 Peak Day Resource Summary

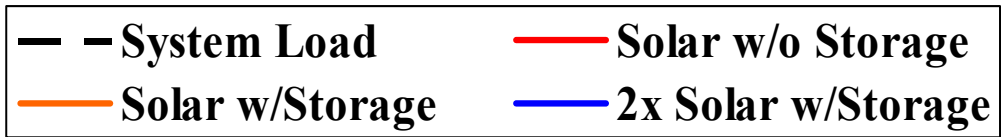
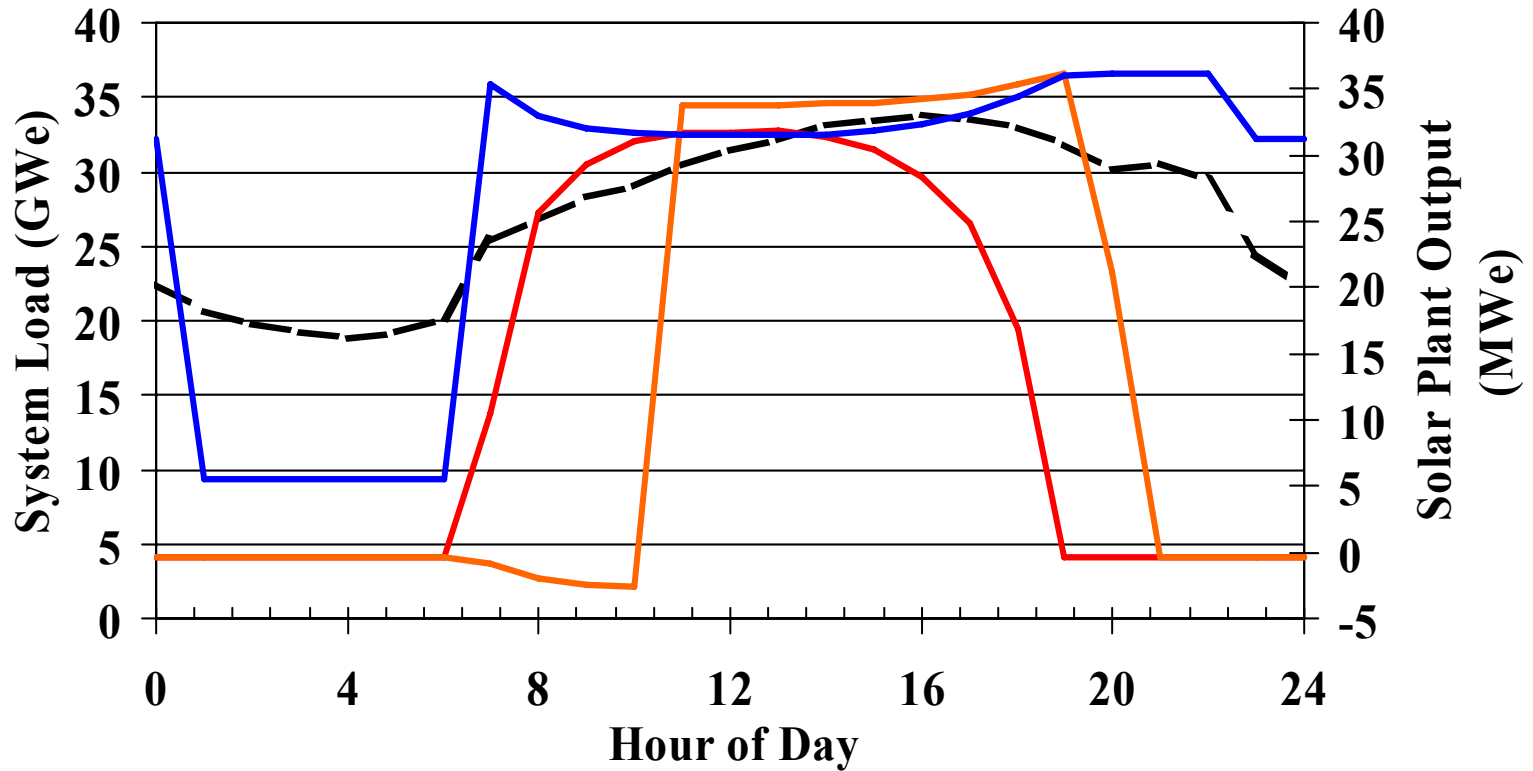
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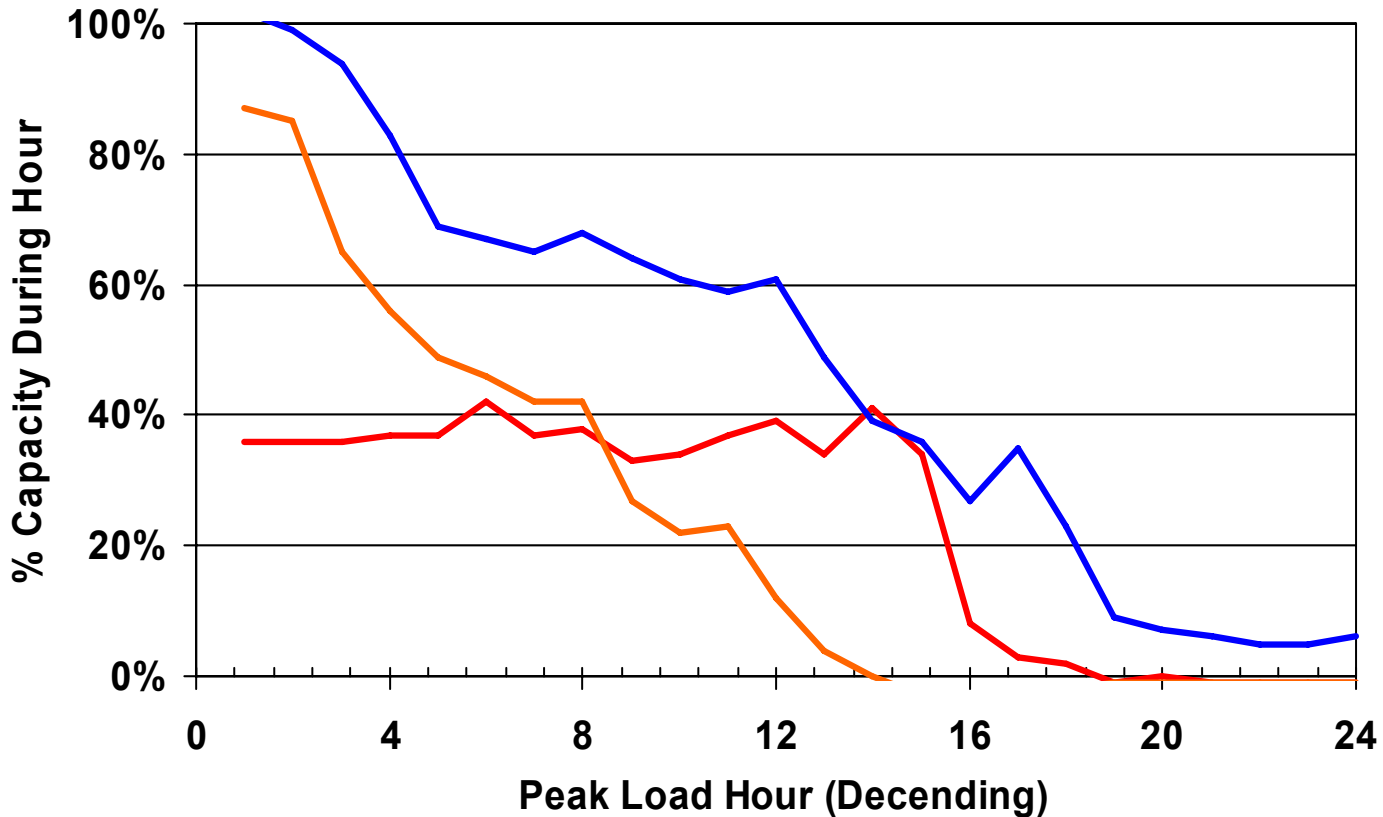
California 1999 Average Hourly System Load



Solar Output for 3 Solar Plant Configurations Compared to CalPX System Load (July 1, 1999)



Solar Output for 3 Solar Plant Configurations Compared to CalPX System Load (July 1, 1999)



— Solar w/o Storage — Solar w/Storage — 2x Solar w/Storage



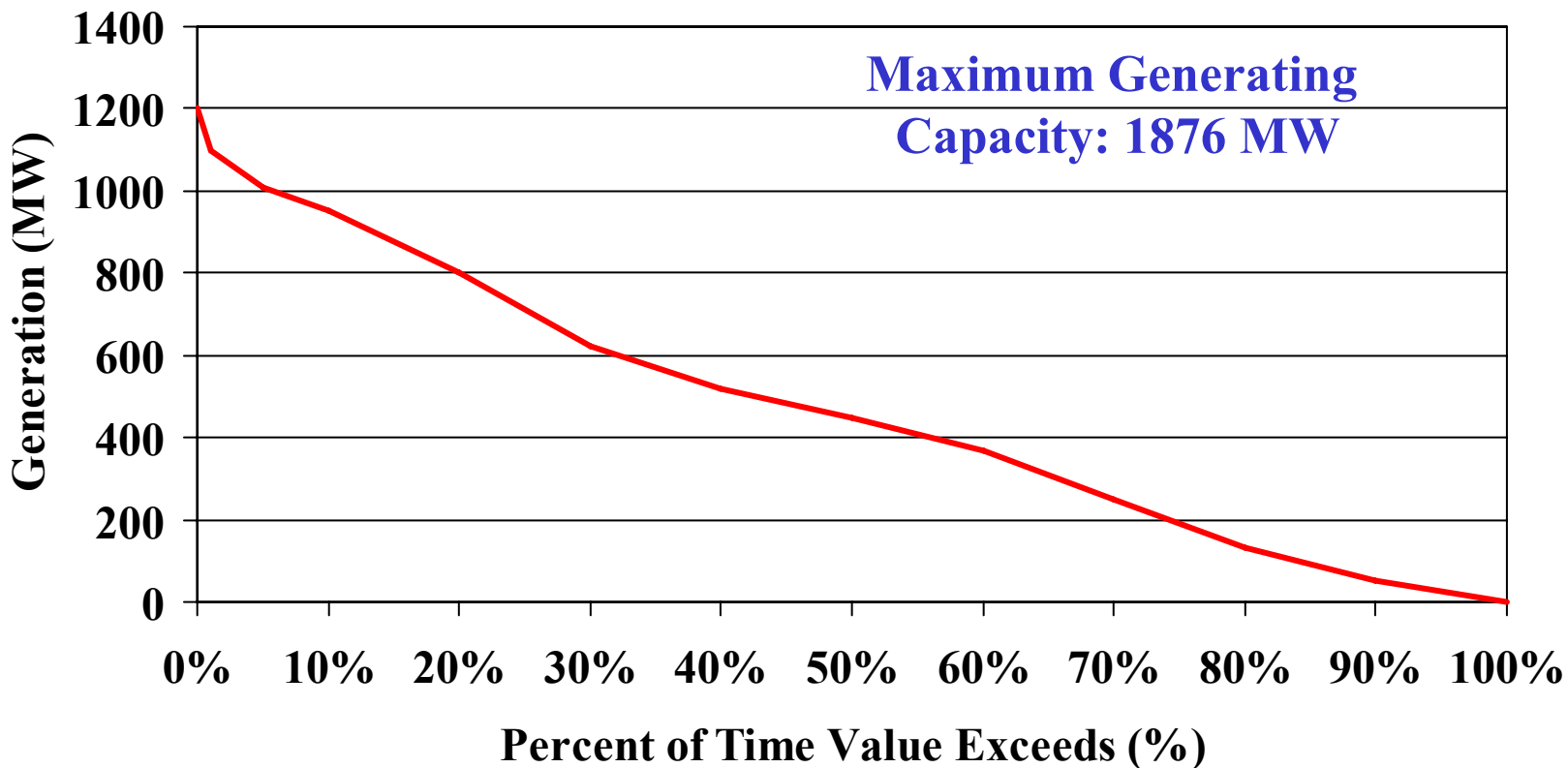
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Wind Generation Durration Curve for 2000

[Peak Hours Only]



Data from California ISO



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Meeting Peak Hour Demand

Peak Capacity Factor

Wind	25%
Solar w/o Storage	36%
Solar w/ Storage	87%
2x Solar w Storage	102%

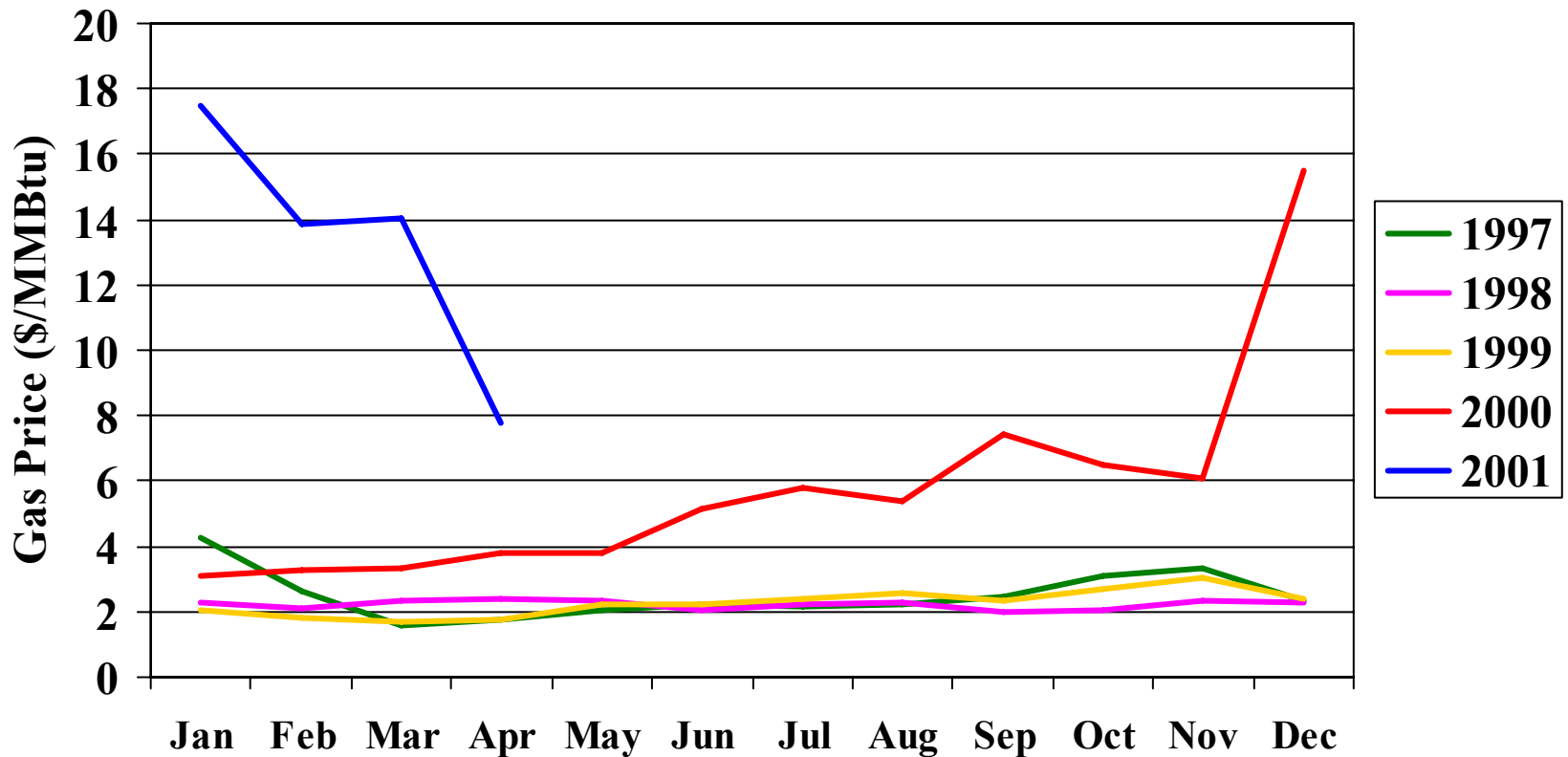


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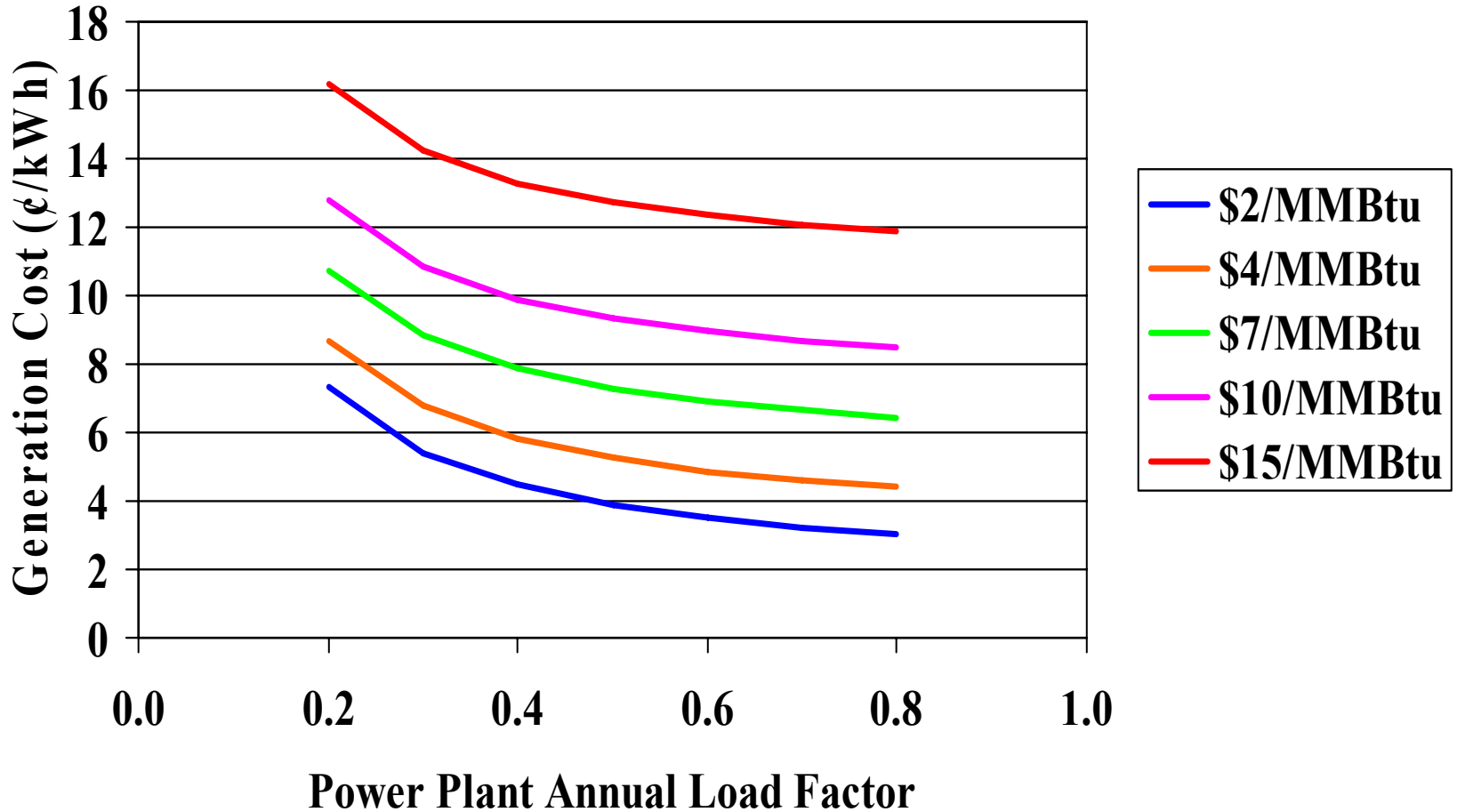
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Southern California Edison Short Run Avoided Cost - Gas Price



Wholesale Electric Price for Modern Combined Cycle Plant

CEC Assumptions: Heat rate = 6800 Btu/kWh, Cap = \$100/kW/yr, O&M = \$2.5/MWh



Wholesale Electric Price Combined Cycle Verses Trough Solar Plant

100 MWe Trough Plant, Solar Multiple 1.6, 4 Hours Thermal Storage

