Index of Relevant Material Template

Submitter (Party Name)	California Parties
Index Exh. No.	CA-352
Privileged Info (Yes/No)	Yes
Document Title	Prepared Rebuttal Testimony of Robert J. Reynolds, Ph.D. On Behalf of the California Parties
Document Author	Robert J. Reynolds, Ph.D.
Doc. Date (mm/dd/yyyy)	03/20/2003
Specific finding made or proposed	California Generators withheld from the market. California Generators withheld by not bidding their output into the market even though the plant was fully operational. California Generators withheld generation from the market by bidding high, and in excess of their costs, so as to deliberately price themselves out of the market. Prices in the ISO and PX Spot Markets from October 2, 2000 through June 20, 2001 were unjust and unreasonable. Prices before October 2, 2000 were not consistent with Sellers' market-based rate tariffs and those of the ISO and PX. Market fundamentals do not explain the excessive prices charged by sellers in the ISO and PX markets during the period May 1, 2000 – June 20, 2001.
Time period at issue	a) before 10/2000; b) between 10/2000 and 6/2001
Docket No(s). and case(s) finding pertains to *	EL00-95 and EL00-98 (including all subdockets)
Indicate if Material is New or from the Existing Record (include references to record material)	New
Explanation of what the evidence purports	Harvey & Hogan do not raise any issues or provide any evidence in

the evidence purports to show	their March 3rd testimony that alters the conclusion that the California Generators engaged in significant levels of withholding from the CAISO real-time energy market over significant periods of time from January 1, 2000 through June 20, 2001. Harvey & Hogan's "extension" of Joskow & Kahn's withholding analysis does not provide a reliable basis for drawing conclusions about the extent of withholding by the California Generators. Specific examples of withholding by the California Generators drawn from the analysis described in Dr. Reynolds' direct testimony (Exhibit No. CA-5) provide strikingly clear evidence of withholding that cannot be "explained away" by the issues that Harvey & Hogan have raised in their March 3rd testimony. The significant level of withholding by the California Generators refutes the contention that high prices in the California electricity market can be explained solely by the "fundamentals" and not the exercise of market power by the California Generators.
Party/Parties performing any alleged manipulation	AES/Williams; Duke; Dynegy; Mirant; Reliant

*****This entry is not limited to the California and Northwest Docket Numbers.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

San Diego Gas & Electric Company,	)	
	)	
Complainant,	)	
	)	Docket No. EL00-95-000
v.	)	EL00-95-045
	)	EL00-95-075
Sellers of Energy and Ancillary Service Into	)	
Markets Operated by the California	)	
Independent System Operator Corporation	)	
and the California Power Exchange,	)	
	)	
Respondents.	)	
	)	
	)	
Investigation of Practices of the California	)	Docket No. EL00-98-000
Independent System Operator and the	)	EL00-98-042
California Power Exchange	)	EL00-98-063

PREPARED REBUTTAL TESTIMONY OF
ROBERT J. REYNOLDS, PH.D.
ON BEHALF OF THE CALIFORNIA PARTIES

INTRODUCTION AND SUMMARY

Q: Please state your name, occupation, and business address.

A: My name is Robert J. Reynolds. I am Chairman of Competition Economics, Inc., an economics research and consulting firm specializing in the analysis of competition, regulation, pricing, and financial performance, with extensive experience in many different industries. My business address is 4800 Montgomery Lane, Suite 900, Bethesda, MD 20814.

Q: Have you previously submitted testimony in this proceeding?

A: Yes. I submitted testimony on March 3, 2003 on behalf of the California Parties (Exhibits CA-5 and CA-6). That testimony focused on the extent to which the California Generators[1] withheld capacity from the California Independent System Operator (CAISO) real-time market over the period January 1, 2000 through June 20, 2001.[2] My analysis showed that, even using many conservative assumptions, there was significant withholding by the California Generators and that this was strong evidence that those firms had market power and exercised it.

Q: On whose behalf are you offering testimony at this time?

A: As with my previous testimony, I have been retained by the Attorney General of the State of California and am offering testimony on behalf of the California Parties.

Q: What is the purpose of your rebuttal testimony?

A: I am submitting this rebuttal testimony in response to certain aspects of the testimony submitted in this matter on March 3, 2003 by Scott Harvey and William Hogan on behalf of Mirant (Exhibit No. MIR-1). In particular, Messrs. Harvey and Hogan criticize

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[1] AES/Williams, Duke, Dynegy, Mirant, and Reliant, collectively.

[2] As I discussed in my March 3rd testimony, I define withholding as the failure to produce energy (or commit to produce energy via ancillary services) from capacity that was capable of economically providing energy at the prevailing market prices. Withholding can be divided into two categories: "physical withholding" and "economic withholding." Physical withholding refers to a situation in which capacity that is available and economic at the prevailing market price is not bid into the market. Economic withholding refers to a situation in which capacity that is available and economic at the prevailing market price is bid at a price that is higher than both its marginal cost and the market price, so that such capacity is not dispatched.

withholding studies that were performed by Paul Joskow and Edward Kahn, Anjali Sheffrin of the CAISO staff, and the California Public Utilities Commission (CPUC).[3]

Q: Has anything in Harvey & Hogan's March 3rd testimony caused you to change your conclusions?

A: No. Harvey & Hogan's testimony basically repeats the criticisms that they had previously put forth in a series of papers in response to papers by Joskow & Kahn and that Mirant had put forth in response to the CPUC report on withholding. As I discussed in detail in my March 3rd testimony, I either directly addressed these issues in my withholding analysis, which renders their criticism moot with respect to my analysis, or I found that the issue was not material or simply not relevant to my analysis at all. In fact, I found that, even using conservative assumptions in addressing a number of these issues, there was significant withholding by the California Generators.

Q: Have you run any additional sensitivity analyses since your March 3rd testimony?

A: Yes. As discussed in my March 3rd testimony, I relied on Richard McCann's assessment of the prices for RTCs for NOx emissions in the SCAQMD.[4] Harvey & Hogan have put forth RTC prices in their March 3rd testimony that are different from Dr. McCann's RTC prices.[5] I have run my withholding analysis using Harvey & Hogan's RTC prices and found that the results were not materially different from the base case results reported in my March 3rd testimony.

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[3] See Harvey & Hogan March 3rd testimony at 195-213 and 222-224.
[4] See my March 3rd testimony at 37.
[5] Harvey & Hogan March 3rd testimony at 194-195 and Figure 82.

Q: Besides criticizing withholding analyses that were done by others, do Harvey & Hogan present their own analysis of withholding?

A: Yes and no. Harvey & Hogan claim that they replicated Joskow & Kahn's withholding analysis and then "extended" it to account for some of the criticisms they raised regarding Joskow & Kahn's analysis. Harvey & Hogan claim that their "extension" of Joskow & Kahn's analysis shows an "output gap" that is "consistent with little or no withholding."[6] As I will explain, the analysis that Harvey & Hogan put forth is not reliable for assessing withholding for numerous reasons.

Q: Do you have any further evidence that the issues raised by Harvey & Hogan do not "explain away" withholding?

A: Yes. In my March 3rd testimony, I reported withholding by the California Generators in aggregate and by company for on-peak hours in each month that I analyzed. In this rebuttal testimony, I put forth some specific examples of withholding (i.e., specific units in specific hours) that underlie those aggregate results. These specific examples provide strikingly clear evidence of withholding that cannot be "explained away" by the issues that Harvey & Hogan have raised.

Q: How do you respond to arguments that "fundamentals" alone explain the high prices in the California electricity markets?

A: Harvey & Hogan and others have argued that the so-called "fundamentals" (i.e., factors that are exogenous to the sellers such as demand, hydro supply, fuel costs, etc.) and not

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[6] Harvey & Hogan March 3rd testimony at 200.

"manipulation" or the exercise of market power explain the high prices.[7] While I do not disagree that "fundamentals" affect market prices, "fundamentals" will affect market prices whether or not a market is competitive. For example, higher fuel prices will lead to higher electricity prices in a competitive market, but they will also lead to higher electricity prices in a market where firms exercise market power.[8] Therefore, simply showing a relationship between changes in "fundamentals" and market prices does not help distinguish the relative magnitude of the effect of "fundamentals" versus the effect of the exercise of market power. Moreover, my analysis identifies significant withholding by the California Generators that affects market prices. Withholding is not an exogenous "fundamental," but rather is behavior by the generators that represents the exercise of market power that is not consistent with a competitive market.[9]

Q: How is the remainder of your testimony organized?

A: It is organized into the following sections:

- First, I review issues raised by Harvey & Hogan in their March 3rd testimony and explain how I dealt with those issues in my March 3rd withholding analysis.
- Second, I explain why Harvey and Hogan's "extension" of the Joskow & Kahn withholding analysis is not reliable for assessing the significance of withholding.
- Third, I provide some specific examples of significant withholding from my March 3rd withholding analysis.

[7] See Harvey & Hogan March 3rd testimony at 6. See also March 3rd testimony of Charles J. Cicchetti (Exhibit No. MAR-1) at 46 and 58.

[8] While the effect of "fundamentals" on prices will likely be *directionally* the same whether or not the market is competitive, the *magnitude* of the effect may be different. In addition, the overall level of prices will be different in a competitive market than in a market in which firms exercise market power.

[9] As discussed in my March 3rd testimony, I have not been asked to quantify the effect of withholding on market prices. Nevertheless, the frequency and magnitude of the withholding that I identified strongly suggest that the effect was substantial given the very limited elasticity of demand, heterogeneity of supplier's marginal costs, and limited responsiveness of alternative sources of supply in the California electricity market.

RESPONSES TO ISSUES RAISED BY HARVEY & HOGAN

Q: What is the purpose of this section of your testimony?

A: In this section, I review issues raised by Harvey & Hogan in their March 3rd testimony regarding the Joskow & Kahn, Anjali Sheffrin, and CPUC analyses of withholding, and I explain how I addressed those issues in my March 3rd withholding analysis.

Q: Have you prepared a figure that summarizes issues raised by Harvey & Hogan and your responses to those issues?

A: Yes. Figure 1 summarizes issues raised by Harvey & Hogan, the study (or studies) they criticize on each issue, and how I addressed the issue in my withholding analysis. This figure also includes references to the pages in my March 3rd testimony where I addressed each issue.[10]

[10] I generally do not repeat the citations in the testimony that follows.

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Figure 1
Summary of Responses to
Issues Raised by Harvey & Hogan Regarding Withholding Analyses

Harvey & Hogan Issue	Study Criticized (a)	My Treatment (citation) (b)
Start-up times/costs and minimum load costs	J&K, AS	Directly addressed by not considering withholding during reserve shutdowns (pp. 52-59, 70, 104, 109-110)
CAISO dispatch instructions	J&K	Directly incorporated by crediting generators for decremental instructions (pp. 75-76, 106-107)
Ramping constraints	J&K	Directly incorporated, using ramp rates provided by the generators (pp. 32-33, 71-72, 105)
Maximum capacity	J&K, CPUC	Directly addressed by using lowest capacity specified by the generators (pp. 28-31, 105-106)
Environmental restrictions	J&K, AS	Directly incorporated relevant considerations (pp. 33-47)
Economic capacity and marginal costs	J&K, AS	Directly addressed using conservative assumptions and performed sensitivity analysis (pp. 47-51, 96-98, 110-111)
Intra-zonal congestion	J&K	Not relevant for withholding analysis and/or not material (pp. 61 and 103)
Transmission work	J&K	Directly addressed by not considering withholding during reserve shutdowns and/or not material (pp. 52-59, 70)
CEMS output data	J&K	Not relevant since I relied on CAISO data, not CEMS data (pp. 60-61)
Definition of withholding	AS	Not relevant to my definition of withholding (pp. 4-8)
Outages	AS, CPUC	Directly incorporated data from the generators, accepting all planned and forced outages reported as legitimate in base case (pp. 51-52)
Reporting hours impacted, not magnitude	AS	Not relevant, since I reported both hours and magnitude (pp. 9-16, 84-98)
Units subject to operating protocols worked out with CAISO	CPUC	Directly addressed by not considering withholding from such units (pp. 44-47)

(a) Study criticized is coded as follows: J&K = Joskow & Kahn; AS = Anjali Sheffrin; CPUC = California PUC.
(b) Citation to relevant pages in my March 3rd testimony is provided in parenthesis.

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Q: Let's go through the issues listed in Figure 1. First, please describe the issues raised by Harvey & Hogan regarding start-up times, start-up costs, and minimum load costs, and how you addressed those issues.

A: Harvey & Hogan assert that Joskow & Kahn's analysis makes no allowance for start-up and minimum load costs.[11] Harvey & Hogan also discuss the fact that the CAISO stated in its response to the CPUC report that unit start-up times can be as much as 72 hours after an outage.[12] Harvey & Hogan also assert that Sheffrin's study appears to characterize units taken off-line as physical withholding even if it would have been economically or physically infeasible for those units to serve real-time load when start-up times, costs, etc. were considered.[13] None of these criticisms are relevant to my withholding analysis because I have not considered withholding during hours that I identified, using a conservative approach, when units were in reserve shutdown.[14] Since I only consider hours when units were not in reserve shutdown, start-up times and costs are not relevant to the hours for which I consider withholding. For example, suppose that a unit had been off-line for an outage, the outage was resolved, and the unit was "warming up" to come back on-line. Since there would be no generation and no bids during this "warm up" period, I would identify this period as a reserve shutdown and would not consider it to be withholding.[15]

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[11] Harvey & Hogan March 3rd testimony at 197.

[12] Harvey & Hogan March 3rd testimony at 198.

[13] Harvey & Hogan March 3rd testimony at 212.

[14] As I discussed in my March 3rd testimony, I used the following rule to identify hours in which units were in reserve shutdown: if a unit had no generation, provided no ancillary services, and was not bid into the real-time market for four or more consecutive hours, then I considered the unit to be in reserve shutdown during those hours. This rule identified many more reserve shutdown hours than reported by the generators in their outage data. (See my March 3rd testimony at 53-55).

[15] As discussed in my March 3rd testimony, I also incorporated a one-hour lag between the end of an outage and the time I assumed that the capacity was available for the real-time market to account for the timing of the submission of real-time supplemental energy bids.

Q: Next, please describe the issue raised by Harvey & Hogan regarding CAISO dispatch instructions and how you addressed that issue.

A: Harvey & Hogan assert that because Joskow & Kahn measure their "output gap" based on the difference between capacity and generation, they do not account for the fact that units can be dispatched down by the CAISO and, as a result, Joskow & Kahn overstate withholding.[16] Such a criticism is not relevant to my withholding analysis since I explicitly give the generators credit for such "dispatch down" instructions (i.e., I do not consider energy that was not produced as a result of such an instruction to be withholding).

Q: Next, please describe the issue raised by Harvey & Hogan regarding ramping constraints and how you addressed that issue.

A: Harvey & Hogan claim that Joskow & Kahn's study makes no allowance for ramping constraints.[17] Such a criticism is not applicable to my withholding analysis since I explicitly incorporate ramping constraints in my analysis. Moreover, I base my ramp rates assumptions on the ramp rates submitted by the California Generators with their real-time supplemental energy bids.

Q: Next, please describe the issues raised by Harvey & Hogan regarding maximum capacity and how you addressed those issues.

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[16] Harvey & Hogan March 3rd testimony at 197, referencing their April 24, 2001 paper at 60-64.
[17] Harvey & Hogan March 3rd testimony at 197.

A: Harvey & Hogan criticize the Joskow & Kahn study on the grounds that Joskow & Kahn use the highest hourly output observed from each unit as their measure of capacity and assume that the unit could achieve this level in all hours.[18] Harvey & Hogan also assert that the CPUC report used overstated capacities for the Mirant units.[19] Such criticism is not relevant to my withholding analysis since I used the lowest capacity figure reported for each unit by the California Generators and I have not used the maximum observed output in developing my capacity assumptions. In fact, the capacity figures that I used for Mirant were the same as those reported by Mirant in its response to the CPUC report and shown by Harvey & Hogan in their March 3rd testimony.[20]

Q: Next, please describe the issues raised by Harvey & Hogan regarding environmental restrictions and how you addressed those issues.

A: Harvey & Hogan criticize the Joskow & Kahn study on the grounds that it makes no allowance for "environmental restrictions."[21] Similarly, Harvey & Hogan assert that Sheffrin did not account for "permit conditions" or "environmental rules" that limit a unit's operation.[22] Such criticism is not applicable to my withholding analysis since I incorporated the relevant environmental considerations into my analysis. As I discussed in my March 3rd testimony, I relied on Richard McCann's assessment of environmental considerations. In my March 3rd testimony, I discussed those considerations in detail. In

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[18] Harvey & Hogan March 3rd testimony at 197, referencing their April 24, 2001 paper at 64-65.

[19] Harvey & Hogan March 3rd testimony at 223.

[20] See Figure 7 of my March 3rd testimony, page 4 of the letter from Zack Starbird, Mirant Americas, Inc. to Cal. Sen. Joseph L. Dunn dated September 26, 2002, and Table 95 on page 229 of Harvey & Hogan's March 3rd testimony.

[21] Harvey & Hogan March 3rd testimony at 197.

[22] Harvey & Hogan March 3rd testimony at 223. Note that Harvey & Hogan do not explain what they mean by "permit conditions." Presumably they are referring to the annual run limits that they discussed with respect to Joskow & Kahn's analysis.

particular: I incorporated the appropriate NOx emissions costs into the marginal costs; I did not consider withholding from certain steam turbine units that were subject to NOx emissions limits; I incorporated the "Delta Dispatch" for cooling water discharge regulations at Mirant's Contra Costa and Pittsburg plants; and I did not consider withholding from the combustion turbine units, all of which had limits on the number of hours they could operate in 2000.

Q: Next, please describe the issues raised by Harvey & Hogan regarding economic capacity and marginal costs.

A: Harvey & Hogan criticize Joskow & Kahn's analysis on the grounds that they understate marginal costs and they use a price threshold, for determining the hours in which all units are economic, that is too low.[23] With respect to marginal costs, Harvey & Hogan assert that Joskow & Kahn understate NOx emission allowance prices and that Joskow & Kahn's assumption of zero variable O&M costs unambiguously understates such costs. Harvey & Hogan also criticize the natural gas price assumptions used by Sheffrin as being too low and assert that they cannot determine whether her study appropriately accounted for NOx and variable O&M costs.[24]

Q: How do you respond to these issues regarding economic capacity and marginal costs?

A: The criticisms raised by Harvey & Hogan are not relevant to my withholding analysis. First, Joskow & Kahn use a somewhat different approach than I have taken. They

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[23] Harvey & Hogan March 3rd testimony at 205-208.

[24] Harvey & Hogan March 3rd testimony at 212. Harvey & Hogan at p. 213 also criticize Sheffrin's study on the grounds that it does not "make any allowance for the potentially high cost of operating unit [sic] at very high rates," but Harvey & Hogan do not explain what they mean by "very high rates."

determine a price threshold that they claim exceeds the marginal cost of virtually all of the California Generators' units and then analyze withholding from all units only for those hours when the price exceeded their threshold. Harvey & Hogan argue that the threshold that Joskow & Kahn used was too low. In contrast to Joskow & Kahn, I examine every hour and assess whether the marginal cost of each unit exceeded the price in that hour. My approach to calculating marginal costs is consistent with the FERC's approach to calculating the MMCP, except that I make two adjustments that are favorable for the generators (i.e., lead to higher marginal costs): I incorporate NOx emissions costs and I use non-decreasing incremental heat rates. In particular, I used the gas prices that FERC used in calculating the MMCP, which were based on published indices that may overstate the generators' gas costs, as discussed in the March 3rd testimony of Michael Harris.[25]

Q: Let's discuss NOx costs, which is a component of your marginal costs. Do Harvey & Hogan put forth prices for RTC NOx emissions allowances?

A: Yes. Harvey & Hogan put forth what they characterize as "a rough estimate of NOx allowance costs" in the context of calculating marginal costs for "two stylized units located in SCAQMD."[26]

[25] In addition, I note that Harvey & Hogan use a variable O&M cost of $4 per MWh for their "stylized" steam turbine unit, which is less than the $6 per MWh that I used (in accordance with FERC's MMCP calculations). Although Harvey & Hogan use a higher figure for their "stylized" combustion turbine unit ($20 per MWh), that is not relevant to my analysis since I do not consider withholding from combustion turbines. (See Harvey & Hogan March 3rd testimony at 194-195.)

[26] Harvey & Hogan March 3rd testimony at 194-195 and Figure 82.

Q: Have you compared Harvey & Hogan's RTC prices with the prices you used in your withholding analysis?

A: Yes. As discussed in my March 3rd testimony, I relied on RTC prices prepared by Richard McCann. Figure 2 compares the two RTC price series. As seen in that figure, Dr. McCann's RTC prices were higher than Harvey & Hogan's in some periods and lower in others. The primary difference is the period from February through June 2001. During that period, Dr. McCann concluded that the relevant price was $7.50 per lb. whereas Harvey & Hogan's prices are higher.

Q: Have you tested the sensitivity of your results to the RTC price assumption?

A: Yes. I have run my withholding analysis using Harvey & Hogan's RTC prices under the assumption that all of the outages reported by the California Generators were legitimate. Figure 3 compares the results of the base case reported in my March 3rd testimony with this sensitivity case. As seen in that figure, the results are not materially different. From May through September 2000, the average hourly withholding during on-peak hours for the California Generators in aggregate was 1,025 MW in my March 3rd base cases vs. 999 MW using Harvey & Hogan's RTC prices. From February through June 2001 period, which is the period of the biggest difference in the two price series, average hourly withholding during on-peak hours was 323 MW in my March 3rd base case vs. 298 MW using Harvey & Hogan's RTC prices. Over the entire analysis period, the average hourly withholding during on-peak hours was 654 MW in my March 3rd base case vs. 649 MW using Harvey & Hogan's RTC prices, a difference of less than 1%.

Q: Does this sensitivity analysis lead you to change any of your conclusions?

A: No. These differences in the results using the alternative RTC prices are not material and do not lead me to change my conclusion that there was significant withholding by the California Generators during the period that I analyzed.

Figure 2
Comparison of McCann and Harvey & Hogan RTC Prices

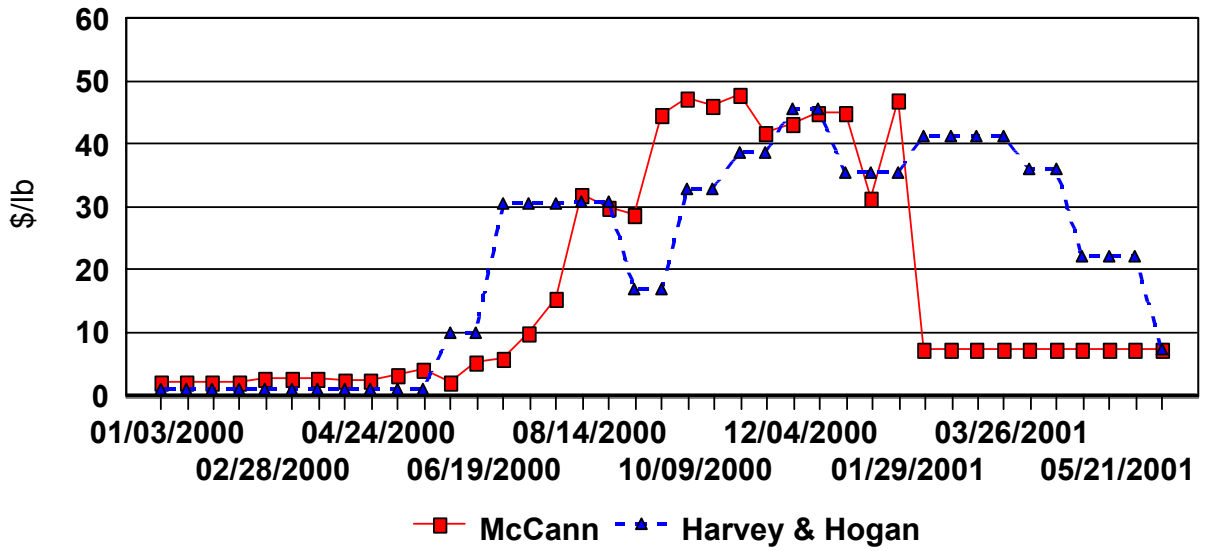

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Figure 3
Comparison of Average Hourly Withholding (MW)
During On-Peak Hours for California Generators in Aggregate
Under Alternative RTC Price Assumptions

Month	My March 3rd Base Case: McCann RTC Prices	Sensitivity Case: Harvey & Hogan RTC Prices	Difference
Jan-00	547	559	12
Feb-00	440	448	8
Mar-00	666	692	26
Apr-00	720	736	16
May-00	899	915	16
Jun-00	1,150	1,122	(28)
Jul-00	1,310	1,190	(120)
Aug-00	906	885	(21)
Sep-00	861	885	24
Oct-00	691	709	18
Nov-00	689	700	11
Dec-00	768	765	(3)
Jan-01	518	590	72
Feb-01	459	407	(52)
Mar-01	156	134	(22)
Apr-01	67	56	(11)
May-01	231	204	(27)
Jun-01	701	688	(13)
Averages:			
May-Sep 2000	1,025	999	(26)
Feb-Jun 2001	323	298	(25)
All Months	654	649	(5)

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Q: Do Harvey & Hogan make any other arguments with respect to thresholds and marginal costs?

A: Yes. In the context of criticizing the thresholds that Joskow & Kahn use in their withholding analysis, Harvey & Hogan assert that "If one is testing for economic or physical withholding, it is important to set a threshold sufficiently high that it is clearly above the actual running costs of any of the units to avoid confusing economic withholding with normal economic behavior (such as not operating a unit when the price is less than the unit's incremental cost)."[27]

Q: How do you respond to that argument?

A: As discussed in my March 3rd testimony, I ran sensitivity cases in which I increased the marginal costs of all units by 10% and 20% and I still found significant withholding in those cases. Thus, such an argument is not a valid criticism of my analysis.

Q: Next, please describe the issues raised by Harvey & Hogan regarding intra-zonal congestion and how you addressed those issues.

A: There are three aspects to this issue. First, Harvey & Hogan assert that the pay-as-bid system for intra-zonal congestion management used in California electricity markets "… will cause perfectly competitive firms to bid their assessment of the market-clearing price at their location, rather than their production costs."[28] While I do not dispute that the CAISO uses a pay-as-bid system for intra-zonal congestion management, this issue is not relevant to my withholding analysis. As I explained in my March 3rd testimony, this

[27] Harvey & Hogan March 3rd testimony at 205-206 (footnote omitted from quote).
[28] Harvey & Hogan March 3rd testimony at 123.

argument is not relevant to my withholding analysis because there is no incentive to bid above the locational market price (i.e., the capacity will still be dispatched and, thus, there will be no withholding in my calculation). Moreover, Harvey & Hogan admit that "… it does not appear that bidding incentives arising from the California intra-zonal congestion management system had a widespread impact during 2000 and 2001."[29]

Second, as I discussed in my March 3rd testimony, when capacity is dispatched out-of-sequence (OOS) due to intra-zonal congestion, that capacity does not set the market price. As a result, if a block of capacity is bid at its marginal cost, but bypassed in the BEEP stack when the CAISO selects a higher priced unit through an OOS call to relieve intra-zonal congestion, the market price will be below the marginal cost of that block and there will be no withholding in my calculation.

Third, Harvey & Hogan assert that the Joskow & Kahn study does not account for the fact that units may not be dispatched due to intra-zonal congestion.[30] This issue does not materially affect my withholding analysis. As a first point, this issue does not apply to cases where units were bid at prices above the market price or not bid at all. Furthermore, I analyzed the extent to which intra-zonal congestion may have affected dispatch during the periods in which I found the highest levels of withholding. That analysis showed that the potential effect was small relative to the amount of withholding that I found, particularly in light of the many conservative elements of my analysis, such as the rule that I used for identifying reserve shutdowns, which resulted in many more reserve shutdown hours than reported by the generators.[31]

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[29] Harvey & Hogan March 3rd testimony at 123.

[30] Harvey & Hogan March 3rd testimony at 198 and 201. I note that Harvey & Hogan do not provide any empirical evidence that the frequency and magnitude of such occurrences were material.

[31] See my March 3rd testimony at 17.

Q: Next, please describe the issue raised by Harvey & Hogan regarding transmission work and how you addressed that issue.

A: Harvey & Hogan assert that the Joskow & Kahn study does not account for "… actions taken by SCE and PG&E as transmission operators [fn omitted]," such as requiring generators to go off-line for transmission work.[32] I do not find this issue to be material to my analysis. First, any such "action" that results in a unit being reported on outage by the generator will not be considered withholding in my analysis. Second, any such "action" that results in a unit being off-line for four or more hours (without being reported on outage) will not be considered withholding in my analysis since this would be considered a reserve shutdown under the conservative rule that I used and I do not consider withholding during reserve shutdowns. Thus, this issue is not relevant for my withholding analysis for any lengthy actions. Moreover, Harvey & Hogan do not provide any evidence that this is a material consideration, let alone a material consideration when only short duration "actions" are considered. Finally, as noted above, the conservative rule that I have used for identifying reserve shutdowns provides an allowance in my withholding analysis for effects such as this transmission issue.

Q: Next, please describe the issue raised by Harvey & Hogan regarding the use of CEMS data and how you addressed that issue.

A: Joskow & Kahn rely on output data from the EPA's Continuous Emissions Monitoring System (CEMS), which is publicly available. Harvey & Hogan assert that this data is not consistent with output data reported to the U.S. Department of Energy's Energy

[32] Harvey & Hogan March 3rd testimony at 201.

Information Administration (EIA) and that the CEMS data may understate output.[33] This issue is not relevant to my withholding analysis since I relied on output data from the CAISO, not CEMS.

Q: Next, please describe the issues raised by Harvey & Hogan regarding outages and how you addressed those issues.

A: Harvey & Hogan assert that Sheffrin's analysis appeared to use an assumed 10% forced outage rate for each unit in each hour as opposed to actual unit outages.[34] Harvey & Hogan also assert that the CPUC study does not account for "recorded forced and maintenance outages."[35] These criticisms are not relevant to my withholding analysis since I directly utilized the outage data provided by the California Generators. As I discussed in my March 3rd testimony, I found significant withholding even in the case where I assumed all of the outages reported by the California Generators were legitimate.

Q: Next, please describe the issue raised by Harvey & Hogan regarding the definition of withholding used by Anjali Sheffrin and how you addressed that issue.

A: Harvey & Hogan argue that Ms. Sheffrin included as "withholding"capacity that was bid at "high prices," but was dispatched in real-time.[36] This criticism is not relevant to my withholding analysis since I defined withholding to only include situations in which output was not supplied. That is, I did not define "high bidding" in and of itself to be withholding. Rather, under my definition, "high bidding" is counted as withholding only

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[33] Harvey & Hogan March 3rd testimony at 201-202.
[34] Harvey & Hogan March 3rd testimony at 212 (footnote 200).
[35] Harvey & Hogan March 3rd testimony at 223.
[36] Harvey & Hogan March 3rd testimony at 211.

if it resulted in the capacity not being dispatched when it would have been dispatched if it had been bid at its marginal cost.

Q: Next, please describe the issue raised by Harvey & Hogan regarding reporting the number of hours "impacted," not the magnitude, and how you addressed that issue.

A: Harvey & Hogan assert that "… since the [Sheffrin] study reports only the number of hours impacted by the assumed physical or economic withholding, not the magnitude of the impact, it is not evident that the impact of any alleged withholding was material in a significant number of hours."[37] Such a criticism is not applicable to my March 3rd testimony since I reported both the magnitude and frequency of withholding. In particular, I reported the average level of withholding over all on-peak hours each month as well as the percentage of on-peak hours each month where withholding exceeded 1000 MW and 2000 MW.

Q: Next, please describe the issue raised by Harvey & Hogan regarding units subject to operating protocols worked out with CAISO and how you addressed that issue.

A: Harvey & Hogan assert that the CPUC report "… did not take account of the operating protocols that Mirant had worked out with the Cal ISO to enable the Potrero jets to be used most effectively …"[38] This issue is not relevant to my withholding analysis since I did not consider withholding from the Potrero jets or any of the other combustion turbine units.

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[37] Harvey & Hogan March 3rd testimony at 213.
[38] Harvey & Hogan March 3rd testimony at 223.

Q: Before we move on, can you summarize your responses to the issues raised by Harvey and Hogan that are listed in Figure 1?

A: Yes. As I have just explained, I have considered the various issues that Harvey & Hogan have raised as criticisms of withholding studies that were performed by Joskow & Kahn, Sheffrin, and the CPUC and I have addressed each of those issues in my withholding analysis, either by directly incorporating the issue in my analysis or by concluding that it was not material or relevant to my analysis. Thus, any such criticisms leveled by Harvey & Hogan against these other withholding analyses are not valid criticisms of my withholding analysis.

HARVEY AND HOGAN'S "EXTENSION" OF JOSKOW AND KAHN'S ANALYSIS

Q: What is the purpose of this section of your testimony?

A: In this section, I explain the limitations of Harvey and Hogan's "extension" of Joskow & Kahn's analysis of withholding and why it is not a reliable indicator of withholding.

Q: Can you briefly summarize Harvey & Hogan's analysis?

A: Yes. Harvey & Hogan claim that they replicated Joskow & Kahn's withholding analysis and then "extended" it to account for some of the criticisms they raised regarding Joskow & Kahn's analysis.[39] In particular, Harvey & Hogan: use a higher price threshold than Joskow & Kahn; exclude units that were off-line; and only look at "periods of sustained high prices." Moreover, Harvey & Hogan claim that they have only adjusted Joskow & Kahn's analysis for some of the shortcomings that they have identified.[40]

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[39] Harvey & Hogan March 3rd testimony at 200.
[40] Harvey & Hogan March 3rd testimony at 201.

Q: Do Harvey and Hogan claim that their analysis demonstrates that there was not significant withholding?

A: No. Harvey & Hogan claim that their "extension" of Joskow & Kahn's analysis shows an "output gap" that is "*consistent with* little or no withholding" [emphasis added].[41] Similarly, in their up-front summary section, Harvey and Hogan state the following:

> "… the withholding studies have been based on data and assumptions that cause them to identify capacity as economically withheld when it has not been. Correcting these studies for the more serious of these flaws leads to results *consistent with* the conclusion that market power has not been exercised." [emphasis added][42]

Q: Is "consistent with" the same as "demonstrates"?

A: No. Claiming that their results are "consistent with" no significant withholding is not the same as claiming that their results "demonstrate" no significant withholding. That is, unless Harvey & Hogan also claim that their "extension" of Joskow & Kahn's analysis is also *inconsistent* with significant withholding, their analysis provides no basis for making any conclusions regarding the extent of withholding. Harvey & Hogan do not make this latter claim. At best, Harvey & Hogan's analysis shows that Joskow & Kahn's analysis does not demonstrate significant withholding, but that does not mean that significant withholding did not occur. Rather it only means that, in Harvey & Hogan's view, Joskow and Kahn's analysis does not show it.

Q: Putting aside Harvey & Hogan's lack of such a claim, do you think that Harvey & Hogan's "extension" analysis demonstrates that there was not significant withholding?

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41 Harvey & Hogan March 3rd testimony at 200.

42 Harvey & Hogan March 3rd testimony at 13.

A: No. Harvey & Hogan's "extension" analysis suffers from a number of the limitations of the Joskow & Kahn analysis itself. These limitations arise, in part, from the fact that Joskow and Kahn had to rely on publicly available data for their analysis. In particular, Joskow & Kahn did not have access to the CAISO and generator data that I utilized in my analysis. As a result, Joskow & Kahn had to rely on certain data and to make certain assumptions that, as Harvey & Hogan themselves have pointed out in their March 3rd testimony and in their other writings, may not be accurate.[43] Harvey & Hogan's "extension" analysis continues to rely on the same publicly available data as Joskow & Kahn's analysis.

Q: Can you provide some specific examples of the limitations of Harvey & Hogan's "extension" analysis?

A: Yes. First, Harvey & Hogan's "extension" analysis relies on CEMS output data, which Harvey & Hogan themselves alleged may not be accurate, as I discussed earlier in this testimony. In fact, as Harvey & Hogan point out, CEMS reports *gross* output, not *net* output. However, gross output includes power generated for internal use (i.e., not supplied to the grid). As such, use of CEMS data may overstate supply and, thus, lead to an understatement of withholding. While Harvey & Hogan point to three examples where they assert that the CEMS output data for particular units in June of 2000 is higher than the EIA output data, which is net output, they do not show that the CEMS data systematically understates net output.

[43] See my March 3rd testimony at 103 (footnote 52), citing to Harvey & Hogan, "Identifying the Exercise of Market Power in California," December 28, 2001, at 78.

Q: Can you provide another example of the limitations of Harvey & Hogan's "extension" analysis?

A: Yes. Their analysis compares the "output gap" for the California Generators to an estimate of the total amount of undispatched ancillary services capacity procured by the CAISO in each hour. However, this approach is only reliable if all ancillary services procured by the CAISO are provided by the California Generators. To the extent that ancillary services were provided by other parties, Harvey & Hogan's "extension" analysis will understate withholding. In contrast, I use the CAISO data, which includes data on the provision of ancillary services by the California Generators.

Q: Can you provide another example of the limitations of Harvey & Hogan's "extension" analysis?

A: Yes. Their analysis is limited to certain hours in a single month (June 2000). Harvey & Hogan use the same price threshold approach as Joskow & Kahn, albeit with a higher threshold price. Moreover, Harvey & Hogan only consider "periods of sustained high prices."[44] In their December 28, 2001 paper, which has the same results as reported in their March 3rd testimony, they indicated that they excluded hours in which the price was above the threshold if the price in either the preceding or following hour was below the threshold.[45] In June 2000, only about 10% of the hours meet Harvey & Hogan's criteria for inclusion.

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[44] Harvey & Hogan March 3rd testimony at 200.

[45] See Harvey & Hogan, "Identifying the Exercise of Market Power in California, December 28, 2001, at 67.

Q: Are the hours considered by Harvey & Hogan the only hours in which withholding can occur?

A: No. The threshold was allegedly chosen such it was greater than the marginal cost of virtually all of the units. However, many units had costs significantly below the threshold. As such, withholding can occur in hours where the price was below the threshold. In fact, withholding did occur in such hours, as illustrated in the examples that I provide in the next section of this testimony.

Q: Do you limit the time period covered in your withholding analysis as Harvey & Hogan have done?

A: No. As discussed in my March 3rd testimony, my analysis considers all hours over the period January 2000 through June 20, 2001.

Q: Have you attempted to replicate Harvey & Hogan's "extension" analysis and further "extended" it to correct for the limitations in their analysis?

A: No. Such an exercise would simply lead me back to my own withholding analysis. There would be little point in going through that exercise.

SPECIFIC EXAMPLES OF WITHHOLDING

Q: What is the purpose of this section of your testimony?

A: In this section, for illustrative purposes, I elaborate on some specific examples of withholding drawn from the withholding analysis described in my March 3rd testimony.

Q: Have you changed your analysis of withholding since your March 3rd testimony?

A: No. These examples are all drawn from the analysis that I discussed in my March 3rd testimony. In that analysis, I calculated withholding for each unit in each hour, although I reported withholding for the California Generators in aggregate and by company for on-peak hours by month in my March 3rd testimony. Herein, I am simply providing some examples of the unit-specific hourly results underlying the aggregate results that I previously reported.

Q: Have you prepared a figure that lists the examples of withholding that you are presenting in this testimony?

A: Yes. Figure 4 lists the 10 examples that I will present. Figure 4 also lists the figure in the appendices to this testimony (Exhibit No. CA-353) that shows each example. As in my March 3rd testimony, I have focused herein on withholding during the on-peak hours. In the examples, I look at withholding during all on-peak hours of the day listed in Figure 2.[46]

[46] As discussed in my March 3rd testimony, the on-peak hours are the 7th through 22nd hour of each day.

Figure 4
Examples of Withholding Presented

Shown in Figure	Company	Unit	Date
RJR-1	Reliant	Ormond Beach Unit 1	July 23, 2000
RJR-2	Reliant	Ormond Beach Unit 2	July 13, 2000
RJR-3	Reliant	Coolwater Unit 3	September 13, 2000
RJR-4	AES/Williams	Alamitos Unit 4	June 11, 2000
RJR-5	AES/Williams	Redondo Beach Unit 7	June 11, 2000
RJR-6	AES/Williams	Huntington Beach Unit 2	July 9, 2000
RJR-7	Mirant	Potrero Unit 3	July 8, 2000
RJR-8	Mirant	Pittsburg Unit 6	August 31, 2000
RJR-9	Dynegy	El Segundo Unit 2	June 22, 2000
RJR-10	Dynegy	Long Beach 6_66Tot[47]	September 19, 2000

Q: Before discussing the individual examples, are there certain features that are common to all of the examples?

A: Yes. For simplicity of exposition, these examples have the following features:

- First, in each case the unit was not on reserve shutdown,[48] and did not have an outage (full or partial) at any time during the day considered. Even though I focus on withholding for on-peak hours only, in these examples there were no reserve shutdowns or outages during the entire day considered. Since the first six hours of the day are off-peak, this ensures that the first on-peak hour is at least six hours after the last reserve shutdown or outage.

[47] "Long Beach 6_66Tot" refers to CAISO unit identification "LBEACH_6_66TOT," which consists of units 1, 2, 3, 4, 8, and 9 at the Long Beach plant.

[48] As discussed in my March 3rd testimony at 54-55, I used a rule based on lack of activity to identify reserve shutdowns that is conservative.

- Second, in each case the unit had a positive forward schedule in all hours (on-peak and off-peak) of the day considered. As such, the unit was scheduled to be on-line prior to the submission of real-time bids for each hour of the day.

- Third, in each case the unit was not awarded any ancillary service capacity, had no decremental supplemental energy instructions, and had no OOM or OOS transactions in the on-peak hours of the day considered.

- Fourth, in each case, the real-time price was higher than the marginal cost of the unit in the vast majority, if not all, of the 16 on-peak hours.

Q: Do the equations that you used to assess withholding in your March 3rd testimony apply to these examples?

A: Yes, but in a simpler form. The general equations that I used for my withholding analysis accounted for certain potential complications. In these examples, many of those potential complications are not present and, thus, certain variables in those equations are zero. As a result, the equations for withholding that were explained in my March 3rd testimony simplify to the following:

$$WH = PEC - SO = PEC - MGEN$$

In words, withholding (WH) is equal to producible economic capacity (PEC) minus supplied output (SO). Supplied output (SO) is equal to metered generation (MGEN). In these examples, PEC can be below effective capacity (EFC) due to economic or ramping constraints. However, in most of the hours presented, producible economic capacity (PEC) is equal to effective capacity (EFC) since the real-time price is above the marginal cost and there are no ramping constraints.

Q: Let's look at your specific examples. How are you going to present those examples?

A: I have prepared a 1-page figure for each example that shows the relevant information. (see references in Figure 4 above). Each of the figures has the same format. I will walk through the figure for my first example in detail, explaining each column of the figure. For the remaining examples, I will provide a less detailed discussion.

Q: What is your first example?

A: My first example is Reliant's Ormond Beach Unit 1, a 725 MW steam turbine unit located in SP15, on July 23, 2000. Figure RJR-1 (Exhibit CA-353 at 1) shows the relevant information for this example.

Q: Please walk through Figure RJR-1 to explain this example.

A: In this figure, I provide one row for each of the on-peak hours in the day. The first set of columns shows the real-time price for the CAISO relevant zone (SP15 in this example), marginal cost of the unit, and margin in each hour. The margin is simply the difference between the real-time price and the marginal cost. In this figure, I use the highest marginal cost of any block of output for the unit above the forward schedule. This measure of marginal cost is conservative and, thus, the corresponding margin is also conservative. In this example, the real-time price is higher than the marginal cost in every on-peak hour and, on average, the real time price is more than 2.5 times the marginal cost ($132 per MWh vs. $49 per MWh).

Q: Now, please discuss the column labeled "Producible Economic Capacity."

A: As I discussed in this and the other examples, producible economic capacity (PEC) is equal to effective capacity in most of the hours if not all of the hours. There are no reserve shutdowns and no outages that limit producible economic capacity in any of the examples. In this case, economic capacity is not a constraint since the real-time price is above the maximum marginal cost in all hours. Moreover, although the calculation is not shown in this figure, ramping is not a constraint either.[49] So, in this case, producible economic capacity is equal to the effective capacity of 725 MW in all hours. In some of the other examples, producible economic capacity will be less than effective capacity in a few of the hours due to economic and/or ramping constraints.

Q: Please explain the next set of columns, which are labeled "Supplied Output."

A: The next set of columns shows supplied output (SO) in each hour. In this case, the unit had between 440 and 550 MW scheduled in advance of the real-time market in each hour. In some hours, the unit had supplemental energy dispatched and in others it did not. In some hours the unit had a positive uninstructed deviation and in other hours it was negative.[50] On average, the unit had a forward schedule of 494 MW, supplemental energy dispatched in real-time of 36 MW, and a positive uninstructed deviation of 18 MW, resulting in supplied output of 548 MW.

Q: Now, please discuss the column labeled "Withholding."

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[49] As discussed in my March 3rd testimony at 71-72, the ramping constraint depends on the operating level at the end of the prior hour (accounting for withholding) and the ramp rate. In this example, although the unit was not operating at full capacity in hour 6, the real-time prices were such that the unit would have been operating at full capacity at the end of hour 6 if it were not withholding. Thus, there is no ramping constraint in hour 7. Similarly, since the unit would have been operating at full capacity in hour 7 in the absence of withholding, there is no ramping constraint in hour 8. By the same logic, there is no ramping constraint in any of the on-peak hours.

[50] Uninstructed deviations are shown in the column labeled "Other" in Figure RJR-1.

A: As I have discussed, withholding (WH) is the difference between producible economic capacity and supplied output. In this case, withholding ranges form 78 MW to 267 MW, and averages 176 MW over the on-peak hours.

Q: Let's move on to the columns labeled "Incremental Supplemental Energy Bids." Please explain these columns.

A: These columns provide information about the real-time incremental supplemental energy bids for this unit in each hour.[51] In the real-time market, each unit can be bid up to 11 price-quantity pairs. Rather than show all of the bid pairs, I have shown only the lowest and highest. Since the supplemental energy bid prices in real-time must be non-decreasing, the lowest bid has both the lowest quantity and lowest price and the highest bid has both the highest quantity and highest price.

Q: Can you explain the supplemental energy bids in some specific hours in Figure RJR-1?

A: Yes. First, consider hour 7 in Figure RJR-1. In this hour, the bid pairs ranged from 10 MW at $97 per MWh to 100 MW at $149 per MWh. In this hour, the real-time price was $75 per MWh, which was below the lowest bid price, and there was no supplemental energy dispatched. On the other hand, consider hour 10. In this hour, the real-time price was $101 per MW, and the bid prices ranged from $94 to $135 per MWh. In this hour, 37 MW were dispatched on average over the hour.[52]

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[51] Note that this does not include decremental supplemental energy bids.

[52] As I discussed in my March 3rd testimony, the real-time price and unit dispatch can vary in 10-minute intervals and I am using average hourly real-time prices and dispatch. Hence, there will not necessarily be a perfect correspondence between the hourly real-time price, supplemental energy bids, and supplemental energy dispatched.

Q: How do these supplemental energy bids compare to the marginal cost of the unit?

A: They are significantly higher. As shown in Figure RJR-1, the bids ranged from $94 to $256 per MWh while the marginal cost of the unit was $49 per MWh. Thus, the bids were about 2 to 5 times the marginal cost.

Q: Let's move on to the last two columns, which are labeled "Un-Bid Producible Capacity." Please explain those columns.

A: These columns show the calculation of "un-bid producible capacity," as defined in my March 3rd testimony. Un-bid producible capacity is equal to the difference between producible economic capacity at the relevant price cap and maximum supply. In this and the other examples, producible economic capacity at the relevant price cap is equal to effective capacity in all hours considered. Maximum supply is equal to supplied output plus the difference between the maximum incremental supplemental energy bid quantity and the dispatched supplemental energy bid quantity. In this case, maximum supply averages 661 MW and un-bid producible capacity averages 63 MW.

Q: You stated that the average level of withholding in this example was 176 MW. Can you break this down between physical and economic withholding?

A: Yes. Since the marginal cost of the unit is below the real-time price in all hours, all of the un-bid producible capacity represented withholding in this example.[53] Thus, physical withholding averaged 63 MW. The remaining amount of 113 MW was economic withholding.

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[53] This is not true in general, since un-bid producible capacity may or may not represent withholding, as discussed in my March 3rd testimony.

Q: Can you summarize the Ormond Beach Unit 1 example that is detailed in Figure RJR-1?

A: Yes. On July 23, 2000, this unit was not on reserve shutdown, did not experience any outages, was not constrained by ramping limits during the on-peak hours, and its marginal cost was below the real-time price in all of the on-peak hours. Furthermore, the unit was scheduled at an average of about 70% of its effective capacity in advance of the real-time market. As such, the unit had an average of 213 MW of capacity that was available to be bid as supplemental energy in the real-time market during the on-peak hours.[54] If this capacity had been bid as supplemental energy in the real-time market *at its marginal cost*, it would have all been dispatched. In actuality, only 36 MW or 17% of the 213 MW was actually dispatched on average. The remaining amount – an average 176 MW (83%) during the on-peak hours – was withheld. This withholding was due to two factors: not bidding at all and bidding above the marginal cost of the unit and above the market clearing price ("high bidding"). Of the 176 MW of withholding, 63 MW was due to not bidding (physical withholding) and 113 MW was due to high bidding (economic withholding).

Q: Let's move on to the other examples that you have listed in Figure 4. Without going through each of the figures corresponding to these other examples in the same level of detail that you provided for Figure RJR-1, can you summarize each of these other examples?

[54] This figure is calculated as producible economic capacity (725 MW) less forward schedule (494 MW) less uninstructed deviations (18 MW).

A: Yes. The second example is Reliant's Ormond Beach Unit 2 on July 13, 2000, which is shown in Figure RJR-2 (Exhibit No. CA-353 at 2). This is a 750 MW steam turbine unit located in SP15. On the day analyzed, the marginal cost of this unit was below the real-time price in all on-peak hours except hour 20. While there were ramping constraints in a couple of hours that also limited output below effective capacity, producible economic capacity averaged 736 MW for the on-peak hours, which was close to its effective capacity. The unit actually supplied an average of 614 MW during the on-peak hours and, thus, withholding averaged 122 MW. This was primarily physical withholding. This unit had a forward schedule of about 600 MW on average over the on-peak hours and, thus, about 150 MW of capacity was available to bid into the real-time market. However, only 20 MW were bid as supplemental energy in each on-peak hour. Furthermore, the bids that were submitted ranged from $67 to $145 per MWh, which was well above the marginal cost of the unit ($55 per MWh).

Q: Next, please describe your third example.

A: The third example is Reliant's Coolwater Unit 3 on September 13, 2000, which is shown in Figure RJR-3 (Exhibit No. CA-353 at 3). This is a 241 MW combined cycle unit located in SP15. On the day analyzed, the marginal cost of this unit was below the real-time price in all on-peak hours and there were no ramping constraints. Thus, producible economic capacity was equal to effective capacity in all on-peak hours that day. The unit actually supplied an average of 183 MW during the on-peak hours and, thus, withholding

averaged 58 MW. This was essentially all physical withholding, as the unit did not have any incremental supplemental energy bids in hours 8 through 22.[55]

Q: Next, please describe your fourth example.

A: The fourth example is AES/Williams' Alamitos Unit 4 on June 11, 2000, which is shown in Figure RJR-4 (Exhibit No. CA-353 at 4). This is a 320 MW steam turbine unit located in SP15. On the day analyzed, the marginal cost of this unit was below the real-time price in all on-peak hours except hours 7 and 9 and there were ramping constraints in hours 8, 10, and 11. Producible economic capacity averaged 269 MW for the on-peak hours. However, only an average of 63 MW were supplied from this unit, resulting in withholding of 205 MW on average over the on-peak hours. This withholding was almost entirely economic, since the unit was generally bid into the real-time market up to its effective capacity.[56] This unit was bid at prices ranging from $70 to $305 per MWh, despite its marginal cost being only $49 per MWh.

Q: Next, please describe your fifth example.

A: The fifth example is AES/Williams' Redondo Beach Unit 7 on June 11, 2000, which is shown in Figure RJR-5 (Exhibit No. CA-353 at 5). This is a 480 MW steam turbine unit located in SP15. This example shows a very similar pattern to the previous example, which was for a different AES/Williams unit on the same day. Producible economic capacity averaged 415 MW and supplied output averaged 171 MW, resulting in withholding of 245 MW on average over the on-peak hours. As in the previous example,

[55] There was some economic withholding in hour 7, although this amounts to less than 1 MW on average over the on-peak hours.

[56] Although there was un-bid producible capacity of 271 MW in hour 9, the real-time price was below the marginal cost of the unit in that hour and, thus, such un-bid capacity was not withholding.

this was almost entirely economic withholding. This unit was bid at prices ranging from $60 to $191 per MWh, despite its marginal cost being only $46 per MWh.

Q: Next, please describe your sixth example.

A: The sixth example is AES/Williams' Huntington Beach Unit 2 on July 9, 2000, which is shown in Figure RJR-6 (Exhibit No. CA-353 at 6). This is a 215 MW steam turbine unit located in SP15. On the day analyzed, the marginal cost of this unit was below the real-time price in all on-peak hours except hour 7. While there were ramping constraints in hours 8 and 9 that limited its output below its effective capacity, producible economic capacity averaged 202 MW for the on-peak hours. The unit actually supplied an average of only 65 MW during the on-peak hours and withholding averaged 137 MW. This withholding was primarily economic, since the unit was generally bid into the real-time market up to its effective capacity (with the notable exception of hour 12). This unit was bid at prices ranging from $103 to $342 per MWh, despite its marginal cost being only $49 per MWh.

Q: Next, please describe your seventh example.

A: The seventh example is Mirant's Potrero Unit 3 on July 8, 2000, which is shown in Figure RJR-7 (Exhibit No. CA-353 at 7). This is a 206 MW steam turbine unit located in NP15. On the day analyzed, the marginal cost of this unit was below the real-time price in all on-peak hours and there were no ramping constraints. Thus, producible economic capacity was equal to the effective capacity of 206 MW in all on-peak hours. This unit was bid into the real-time market up to its full effective capacity in all hours and, thus,

there was no physical withholding in this example. However, the unit was bid at prices ranging from $70 to $200 per MWh, despite its marginal cost being only $44 per MWh. As a result, the unit was not dispatched to its full capacity in any hour and, on average, there was 86 MW of economic withholding.[57]

Q: Next, please describe your eighth example.

A: The eighth example is Mirant's Pittsburg Unit 6 on August 31, 2000, which is shown in Figure RJR-8 (Exhibit No. CA-353 at 8).[58] This is a 317 MW steam turbine unit located in NP15. On this day, the marginal cost of this unit was below the real-time price in all on-peak hours except two (hours 18 and 19), and there was a ramping constraint in only one hour (hour 20). Producible economic capacity averaged 307 MW, which was only slightly less than the effective capacity. However, supplied output only averaged 225 MW and, thus, there was 82 MW of withholding on average over the on-peak hours. In contrast to the previous example in which the unit was bid up to its full effective capacity in all of the on-peak hours, there were no incremental supplemental energy bids for this unit in hours 7 through 12, resulting in physical withholding of 40 MW on average for the on-peak hours. In hours 13 through 22, the unit was bid at prices ranging from $180 to $230 per MWh, despite its marginal cost being only $58 per MWh, resulting in 42 MW of economic withholding on average over the on-peak hours.

[57] Note that, in this example, there are substantial positive uninstructed deviations in hours 11 through 22. As discussed in my March 3rd testimony, I have conservatively given the generators credit for such energy since it may be due to legitimate factors. However, at least prior to September 2000, positive uninstructed deviations may represent "game playing" that effectively represents withholding, as discussed in my March 3rd testimony at 79.

[58] Note that the "Delta Dispatch" considerations only apply from May 1st through July 15th each year and, thus, do not affect this example.

Q: Next, please describe your ninth example.

A: The ninth example is Dynegy's El Segundo Unit 2 on June 22, 2000, which is shown in Figure RJR-9 (Exhibit No. CA-353 at 9). This is a 175 MW steam turbine unit located in SP15. On the day analyzed, the marginal cost of this unit was below the real-time market price in 14 of the 16 on-peak hours.[59] In addition, there were small ramping constraints in a couple of hours. As a result, producible economic capacity averaged 170 MW for the on-peak hours, which is only slightly below the effective capacity of 175 MW. However, the unit actually supplied an average of only 114 MW during the on-peak hours and withholding averaged 56 MW. This withholding was a combination of physical and economic: during hours 7 through 17, there were no supplemental energy bids submitted for this unit and during hours 18 through 22 the bids that were submitted for this unit ranged from $300 to $750 per MWh, which was well in excess of its marginal cost of $63 per MWh.

Q: Next, please describe your tenth and last example.

A: The tenth example is Dynegy's Long Beach 6_66TOT on September 19, 2000, which is shown in Figure RJR-10 (Exhibit No. CA-353 at 10). This is a 400 MW combined cycle unit located in SP15. On the day analyzed, the marginal cost of this unit was below the real-time market price in 12 of the 16 on-peak hours. In addition, there were ramping constraints in certain hours that limited the unit's output below its effective capacity. As a result, producible economic capacity averaged 351 MW for the on-peak hours. However, the unit actually supplied an average of only 315 MW during the on-peak

[59] As in the previous example, in the two hours in which the real-time price was below the marginal cost, it was only below the marginal cost for a portion of the capacity of the unit.

hours and withholding averaged 36 MW. Notably, during hours 14 through 20 the real-time price was at the cap of $250 per MWh, which was well above the marginal cost of the unit ($91 per MWh). During these seven hours, producible economic capacity was equal to effective capacity (400 MW) while supplied output averaged 345 MW, resulting in average withholding of 55 MW. There were no incremental supplemental energy bids submitted for this unit during the on-peak hours despite the fact that the unit was not fully scheduled in advance of the real-time market. Thus, all of the withholding was physical.

Q: Let's wrap up this section. First, can you summarize these 10 examples of withholding that you have presented?

A: Yes. These are all examples of withholding that are drawn from the thousands of instances of withholding identified in the analysis that I presented in my March 3rd testimony. In all cases, the unit was not on reserve shutdown and had no outage on the day examined. Moreover, the marginal cost of the unit was below the real-time price in all or almost all of the on-peak hours. The units also had some, but not all, of their capacity scheduled ahead of the real-time market during all on-peak hours. However, in each case, supplied output was below producible economic capacity, resulting in withholding. Analyzing the bid data for these examples clearly shows the source of the withholding: failing to bid (physical withholding), "high bidding" (economic withholding), or a combination.

Q: What do you conclude from these examples?

A: These examples illustrate the withholding that I discussed in my March 3rd testimony. As noted above, these examples are simply a subset of the withholding that I found. The competitive significance of withholding from the real-time market is most appropriately assessed by measuring withholding in aggregate for each firm and for all of the California Generators combined, as presented in my March 3rd testimony. Nevertheless, these examples "bring to life" the aggregate results and further respond to the criticisms of withholding analyses that Harvey & Hogan have put forth in their testimony.

Q: Does that conclude your testimony?

A: Yes.

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

San Diego Gas & Electric Company, Complainant	)	
v.	)	Docket Nos. EL00-95-069
Sellers of Energy and Ancillary Services Into Markets Operated by the California Independent System Operator Corporation and the California Power Exchange, Respondents.	)	
Investigation of Practices of the California Independent System Operator and the California Power Exchange.	)	Docket Nos. EL00-98-058

AFFIDAVIT OF ROBERT J. REYNOLDS

I declare under penalty of perjury that the foregoing is true and correct.

Executed on March 18, 2003.

Robert J. Reynolds