UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Conference on Supply Margin Assessment) Docket No. PL02-8-000

Comments Of The California Independent System Operator Corporation Regarding the Supply Margin Assessment Screen And Related Mitigation Measures

Pursuant to the Federal Energy Regulatory Commission's ("Commission") "Notice Of Request For Written Comments On Supply Margin Assessment Screen" issued in the captioned docket on August 23, 2002, the California Independent System Operator Corporation ("CAISO") hereby submits its comments regarding the Supply Margin Assessment ("SMA") screen and related mitigation measures.

In support hereof, the CAISO respectfully states as follows:

I. INTRODUCTION

The SMA screen is a new, proposed methodology for assessing the market power of electricity suppliers in a given geographic region for purposes of determining whether the Commission should grant market-based rate authority. The Commission adopted the SMA methodology on an interim basis in a November 20, 2001 "Order on Triennial Market Power Updates and Announcing New, Interim Generation Market Power Screen And Mitigation Policy" issued in Docket No. ER96-2495-015, *et al. AEP Power Marketing, et al.*, 97 FERC ¶ 61,219 (2001) ("November 1 Order"). The Commission adopted the SMA as an alternative to the traditional hub-and-spoke methodology which the Commission previously had used to test for market power. The Commission has recommended applying the SMA test only to suppliers who are not part of a formal ISO/RTO. Suppliers who are part of an ISO would continue to possess market-based rate authority because it is assumed that the ISO will have sufficient market power mitigation measures already in place.

The proposed SMA test is similar to the residual supplier index ("RSI") analysis that the CAISO's Department of Market Analysis ("DMA") has used for the last four years to assess a supplier's potential ability to exercise market power[1]. Under such an analysis, if a supplier is pivotal during the annual peak hours, *i.e.*, without its supply the market demand cannot be met, the supplier will fail the SMA screen. In the November 1 Order, the Commission proposed that any supplier who failed the SMA screen for the peak hour would not be granted market-based rate authority and would be subject to mitigation in the spot market.

II. EXECUTIVE SUMMARY

The CAISO supports adoption of a new screen and mitigation for market-based rates. However, this should only serve as a first step in the process of addressing the serious flaws in the existing standard for granting market-based rate authority. While a new screen for granting market-based rate authority is critical, it is more important for the Commission to establish an explicit standard for just and reasonable rates on which to measure all market outcomes and

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[1] The Residual Supply Index was first presented to the Commission in the CAISO's first Annual Report on Market Issues and Performance, June 1999, Chapter 7, page 4.

prescribe prospective mitigation measures if market outcomes result in unjust and unreasonable costs to consumers.

In analyzing the Commission's proposed SMA screen and mitigation mechanism, the CAISO has identified the following deficiencies:

- The proposed screen and mitigation only applies to suppliers who are not part of a formal ISO/RTO. Suppliers who are part of an RTO/ISO would continue to possess market-based rate authority because it is assumed that the RTO/ISO has sufficient market power mitigation measures already in place. The results in the California market in 2000 and 2001 clearly illustrate that this is not always the case. Although all suppliers participating in the CAISO's markets passed the traditional market-based rate screen, the CAISO and the Commission found that tremendous market power plagued the California market from May 2000 to June 2001. The experience in California during that period demonstrates the need for a review of suppliers' market based rate authority and for effective market power mitigation inside an ISO/RTO/ITP.

- The SMA screen needs to be augmented to recognize the need for regulation service and operating reserve requirements for a control area, which typically constitute approximately 6-10% above the peak load. Due to the additional need for operating reserves, a large supplier can be pivotal for many hours of the year even if it passes the proposed SMA screen.

- The SMA does not consider the net position of a supplier (net of load and/or contractual obligations). Some large generation owners have native load obligations and therefore may be net buyers most of the time and not have an incentive to exercise market power. Long-term sales contracts to load will also reduce a supplier's incentive to exercise market power.

- The SMA screen also ignores the possibility of collusion. Generally there are several large suppliers in each market area. These suppliers can use oligopoly bidding strategies where they implicitly cooperate with each other to inflate market prices.

- The proposed mitigation for suppliers who fail the SMA test is inadequate and can be easily circumvented. It only works when there is available competitive supply in the market to exert pressure on the dominant suppliers, which is not true during periods of tight supply. Therefore, the mitigation will fail during the hours when it is most needed.

To ensure just and reasonable rates in a competitive wholesale electricity market, the Commission needs to utilize a more reliable test to determine whether it is appropriate to grant market-based rate authority to suppliers. The proposed SMA screen is a step in the right direction. However, due to the deficiencies noted above, the CAISO submits that the Commission should apply a refined version of the SMA – the RSI -- that considers the need for operating reserves, allows for occasional pivotal or near pivotal conditions for a large supplier as long as the supply is sufficient for competitive outcomes during a majority of the time within a year, and adjusts the pivotal supply analysis for sales of power under long term fixed price contracts and those committed to serve a supplier's native load. The RSI has proven to be an accurate indicator of suppliers' market power in California over the last four years. RSI also considers the strategic bidding of other large suppliers in the market. Therefore, it has many advantages over a simple SMA test.

In any event, any market power screen (RSI or SMA) and mitigation mechanism is incomplete absent the existence of a clear just and reasonable rate standard. Such a standard is critical to judge the effectiveness of the criteria and process for granting market based rates. Currently, there is no clear standard for defining just and reasonable rates. Without such a standard, there is no assurance that any proposed method for granting market-based rates will produce the just and reasonable rates required by Federal Power Act.

The CAISO has proposed a simple and practical test for defining just and reasonable market outcomes based on a 12-month rolling average price-cost mark-up index. The index measures the extent that the actual market price exceeds a competitive benchmark for a rolling 12-month period. The CAISO recommends this price-cost mark-up index should be below 10% or $5/MWh, on a 12 month-rolling basis, for the market outcome to be considered just and reasonable. The CAISO notes that in its July 17, 2002 "Order On The California Comprehensive Market Design Proposal" issued in Docket Nos. ER02-1656-000, *et al.*, the Commission directed the CAISO to file information produced by a 12-month market competitiveness index weekly with the Commission's Office of Market Oversight and Investigation. While this is an important first step that will allow the Commission to monitor the efficacy of such an index, the CAISO believes that the Commission needs to approve the use of such an index for the express purpose of testing for the justness and reasonableness of market prices.

It is important to understand that any screen such as the SMA or RSI will not be completely reliable or accurate in predicting a supplier's ability to exercise market power. The screens and processes the Commission has used in the past, including the HHI test and the 20% market share safe harbor, have proven to be inaccurate and ineffective measures of assessing suppliers' ability to exercise market power in California and other markets. Although the SMA or RSI are an improvement over the previous methods used by the Commission, they are not perfect indicators of a supplier's ability to exercise market power. The market-based rate authority that is granted based on these criteria cannot be absolute; it must be conditioned on actual market outcomes. One lesson learned from the California experience is that the Commission had unfounded reliance on the market based rate authority granted to large suppliers and failed to revoke market-based rate authority even after observing overwhelming evidence of the extraordinary adverse impact that such market power had on consumers (in the form of excessively high rates). Moreover, the Commission has to-date interpreted its refund authority as limited to prospective actions following the institution of a proceeding pursuant to Section 206 of the Federal Power Act. In order to improve confidence in the use of competitive wholesale markets, it is imperative that the Commission clearly define a measurable indicator of just and reasonable rates and use it to (1) govern suppliers' market based rate authority and (2) act expeditiously to revoke or modify the market based rate authority when actual outcomes require such action.

The CAISO's comments below contain the following: (1) a discussion of why a clear just and reasonable rate standard is needed and a proposal for a 12-month rolling price-cost markup index that would serve as a benchmark for this standard; (2) an outline of an alternative screen to be used for market-based rate authority; and (3) a discussion of some alternative mitigation mechanisms that should apply to suppliers who fail a market-based rate screen. Finally, the CAISO recommends that the Commission not grant suppliers in ITPs/RTOs/ISOs market based rate authority without proper screening and evaluation.

III. STANDARD OF JUST AND REASONABLE RATES; 12-MONTH ROLLING PRICE-COST MARKUP INDEX

Before discussing the specific provisions of the Commission's SMA proposal and mitigation mechanism, the CAISO must first emphasize the importance of establishing a clear just and reasonable rate standard. As stated above, a standard for just and reasonable rates is critical for assessing market performance, evaluating the effectiveness of the process of granting market-based rates and evaluating the success of any mitigation measures that may be in place. Currently, there is no clear standard on just and reasonable rates. Therefore, there is no assurance that any proposed method for granting market-based rates will produce just and reasonable rates as required by Federal Power Act.

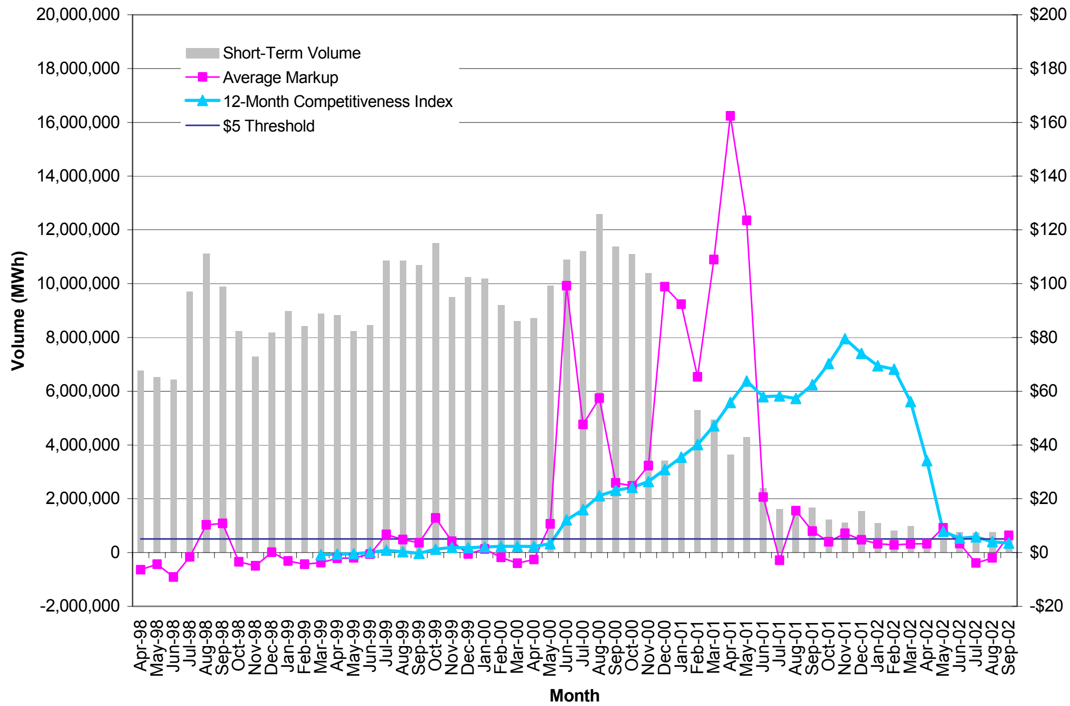
As indicated above, the CAISO has developed a practical test for measuring just and reasonable market outcomes. It is based on a 12-month rolling price-cost markup index that measures the extent that market prices remain above a competitive benchmark for a moving 12-month period. The standard for this index would be whether (based on a 12-month period) prices rise more than $5/MWh above the average competitive benchmark for the period. If prices do not exceed this threshold, market outcomes would be considered just and reasonable.

Under this index, the actual 12-month rolling total market cost is calculated as the hourly market price multiplied by hourly demand and accumulated into 12-month totals. The benchmark is determined as the market cost under competitive conditions and is estimated as the hourly system marginal cost multiplied by the hourly system demand and accumulated into a 12-month total. If the 12-month price/cost markup exceeds the $5/MWh mark-up, the Commission would have a clear signal of when to implement a prescribed set of mitigation measures. Such a clear standard for action would minimize concerns of consumers that the Commission might not intervene in a timely manner and would also signal when prices would be subject to refund on a prospective basis. Thus, under this proposal, market participants would receive consistent signals for action. This proposed methodology is ***prospective*** and easy to calculate. It is important to note that one important feature of this approach is that infrequent price spikes would not necessarily mandate action, but significant deviations on a sustained basis would. A focus on a 12-month rolling average allows the occasional price spikes but still sets specific thresholds to identify unjust and unreasonable rates.

The CAISO has tested this index to see if utilization of such an index could have averted much of the damage that occurred during the California power crisis in 2000 and 2001. The figure below shows that during the first two years of in the restructured California power markets, market costs were no more than seven percent above an effective competitive market outcome, even though there were occasional price spikes as high as $9,999/MWh. However, in May of 2000, after repeated price spikes, the rolling average cost of electricity surpassed the allowable $5/MWh mark-up above the average effective competitive market outcome. If the proposed standard had been in place, mitigation measures would have been implemented at that time. Without this explicit standard, however, California consumers endured monthly deviations of 40% or more between the 12-month rolling average cost of electricity and an effective competitive market outcome for approximately one year.

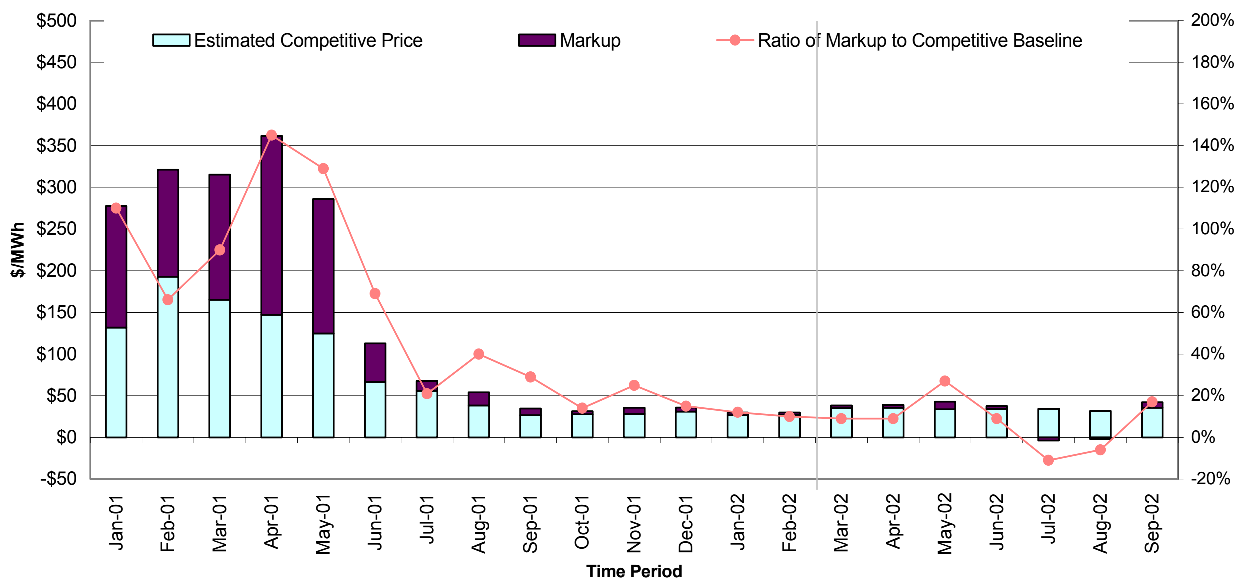
One of the key features of the 12-month index is that it provides certainty and confidence for all market participants. Consumers would know the level at which regulators would intervene to prevent market abuse. Power suppliers would be aware of when mitigation measures would be triggered and would have the opportunity to self-regulate their bidding practices in order to avoid regulatory intervention, and the Commission would have an objective standard to know when impose price mitigation measures. The following chart illustrates an example of the 12-month rolling index applied to the California market since start-up (April 1998 to September 2002). As shown, such a standard would have alerted all parties (consumers, suppliers, and regulators) that markets had become uncompetitive in May 2000. Once the market had been declared uncompetitive, *pre-authorized market power mitigation measures* such as the west-wide price mitigation measures adopted by the Commission in the June 19, 2001 order in Docket Nos. EL00-95, *et al.*, could have been implemented. This index also illustrates that the market began to stabilize after June 2001, when the monthly price-cost markup dropped to below the threshold. This stabilization was certain when volumes in real-time had dropped and monthly mark-ups were consistently below the threshold causing the 12-month index to fall below the threshold in May 2002.

California Market Performance Under a 12 Month Rolling Index Using a $5/MWh threshold



Monthly Price-Cost Markup in Short-Term Energy Transactions

(Day Ahead and Real-time)



The top chart shows volumes of transactions in bars; lines represent both the monthly price-cost markup index applied to the California market from April 1998 to September 2002 and the 12-month rolling price-cost markup index. The bottom chart shows, in dollar values, the monthly average competitive market benchmark compared to actual short-term energy prices from January 2001 to September 2002. The values for July – September 2002 are estimates pending final data on Day Ahead purchase prices from the California Energy Resource Scheduler ("CERS").

The discussion of the need for a measurable just and reasonable rate standard might not seem to be relevant to the discussion of the SMA screen and related mitigation. However, the CAISO submits that it is more important than the market based rate procedure because it represents the overarching goal of the market-based rate procedure, *i.e.*, competitive, just and reasonable rates, and is the ultimate measure of the effectiveness of the adopted test for assessing market power. Without a measurable standard for determining the justness and reasonableness of prices, no market based rate procedure can serve as a guarantee for just and reasonable rates. Often the procedure for granting market based rates is mistakenly confused as the standard itself. For example, many suppliers asserted during the California energy crisis that the market based rate authority given to them allowed them to price their products in the market as they deemed appropriate, and their prices did not reflect the exercise of market power. Unfortunately, for approximately one year, the Commission also apparently mistook the instrument for the standard, as well as implicit evidence that the market was competitive. Accordingly, the Commission did not take any action to mitigate the runaway market power.

Even though any SMA or RSI screen may improve upon the current test for assessing market power, such screens will not be perfect. They must be reviewed and evaluated in conjunction with actual market outcomes. The CAISO urges the Commission to state clearly that the just and reasonable rate standard governs the market based rate authority and develop a clear and measurable standard for just and reasonable rates as soon as possible.

IV. MARKET-BASED RATE PROCEDURE UTILIZING A RSI SCREEN

The CAISO submits that the Commission should utilize the RSI screen to assess market power because it offers more information than the Commission's proposed SMA screen and remedies some limitations of the SMA screen. The RSI screen considers ***all*** hours in which the supplier provides service and is eligible to earn revenues based on the market-based rate authority granted to it. The RSI screen also incorporates actual market outcomes and measures the ratio of the residual supply to the actual demand. The RSI is not a simple pass or no-pass statistic for one peak hour. The additional market information provided promotes a better understanding of whether market power can be exercised during any hour of the year. Finally, not only does the RSI screen consider whether a single large supplier is pivotal at any given time, it also considers the effects of implicit "cooperation" of other large suppliers in the market.

The RSI is discussed in detail below, and such discussion also describes how a screen based on the RSI can improve upon the Commission's proposed SMA screen.[2]

The RSI can be defined for the entire market or for any specific supplier.[3] It is calculated as the ratio of the residual supply (total supply minus the capacity of the supplier in question) to the system demand (which is load plus reserve, and equals to 1.1*load in CAISO).

RSI_s = Residual Supply (s) / (1.1*Load)

Both residual supply and load change from hour to hour. Load changes the most across month and hours of the day. Supply capacity is more constant, but can fluctuate hourly or daily due to full or partial outages. Capacity of an individual supplier is considered after subtracting contracted to serve load which can change from off peak to peak periods. As a result of all these factors, the RSI changes from hour to hour.

Using the above definition, the RSI screen can be applied as follows (specific numbers used here are examples for discussion purpose only): RSI should not be less than 110% for more than 5% of the hours in a year (438 hours) where the RSI is the measure of RSI for the individual supplier under review.

An RSI significantly above 100% indicates that there is sufficient competition in the market even if the supplier "S" withholds all of its capacity.

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2 For further detailed information, Appendix B contains a paper authored by Anjali Sheffrin and Jing Chen that provides a detailed discussion of the theory and empirical evidence of the RSI and its applications.

3 For the entire market, the RSI is defined as the RSI for the largest supplier.

When the RSI is less than or slightly above 100%, the largest supplier or suppliers would be able to exercise market power through physical or economic withholding. Based on three years of market data from the CAISO, when the RSI is about 110%, the average price-cost markup is approximately five percent. Therefore, the CAISO's recommended screen for market-based rate authority requires that the hours with high risk of market power problems account for no more than 5% of the hours in a year. Not all hours in a year have to be competitive, but the overall annual market performance is likely to be workably competitive.

In summary, the proposed RSI has the following advantages compared to the Commission's proposed SMA:

- The RSI considers only the net capacity of the supplier (after accounting for the supplier's obligation to serve load and sales contracts) in determining whether the supplier is pivotal and, therefore, becomes more selective in identifying the suppliers who have the incentive to exercise market power. The net capacity is the total capacity minus capacity committed to serve load under long-term fixed-price contracts. A supplier does not include capacity under fixed-price contracts when determining optimal bidding strategies. Another exception is that a supplier could be a net buyer, and therefore would not have the incentive to exercise market power. The net capacity should be used as the variable "Residual Supply" when calculating RSI. As a result, the RSI measure allows for consideration of these important factors.

- Operating reserve requirement: In the Commission's November 2001 order on SMA, the demand in a market area is considered to be its peak load. In actual operation, however, all control areas require some level of operating reserves. Typically, the reserve level is set at 5% to7% of actual load or the largest single contingency to ensure system reliability. Because these reserves are part of the required system resources, they should be included as part of the demand. The proposed inclusion of operating reserves makes the test more sensitive and more effective in identifying suppliers with potential market power. When considering operating reserve requirements, large suppliers become pivotal at lower load levels and therefore have the ability to exercise market power over more hours. The market-based rate measure should consider this factor to accurately identify all instances of potential market power.

- The RSI threshold applies to all hours and uses a standard where the RSI could not be below 110% for more than 5% of the time. Market power is not just the relationship between supply to the system peak because many more units may be operating at that time. During other times of the year, however, scheduled or unscheduled outages may create an imbalance between supply and demand. The 110% threshold provides more flexibility than the proposed SMA, which essentially uses 100% for only the peak hour. This broader threshold permits examination of all hours, and considers the potential for collusion.

- The RSI standard allows the threshold to be exceeded for a limited number of hours in a year, thereby leaving room for price fluctuations that reflect actual market demand and supply conditions. This enables price signals for demand response and new investment in generation. For a market to be considered competitive, it does not have to be competitive in every hour of the year. It simply requires that the market price be within a certain percentage of the competitive level on average over a period of time. For example, our proposed 12 month competitive index uses an annual average threshold of 10% or $5/MWh.

- The RSI framework can be used as a tool to forecast price markup outcomes for a market that is based on an empirically derived relationship between RSI and prices. This can be important in forecasting residual market power under a variety of circumstances such as upgrading transmission lines and the impact of new entry.

- The RSI screen can be fine-tuned based on actual market experience. The 5% of hours threshold can be increased or decreased, if the Commission determines that there is too much market power or too much mitigation. By simply adjusting the percent of hours that RSI can be below 110%, the screen can be adjusted for each market to best achieve competitive market outcomes.

As discussed above and presented in more detail in the attached paper (Appendix B), the RSI constitutes a new type of structural metrics of the electricity market that is closely correlated with the actual market performance in terms of how close the market outcome is to the competitive outcome. RSI therefore directly links the market structure to the standard of just and reasonable rates. All other metrics used by the Commission in the past, such as HHI and market concentration, have displayed minimum correlation with the market performance. Using RSI will correct for this serious disconnect between the instrument and goal.

Application of Proposed RSI Screen

The CAISO has tested the proposed criteria for large suppliers in the CAISO market. During 2000 (base year of our study), all suppliers failed the RSI screen. Their RSI was less than 110% for about 20% of the hours. This is significantly above the 5% threshold.

The CAISO also has examined a projected competitive market condition (which is approximated based on its recent report on reserve margin and workable competition). In that case, the CAISO assumed that an additional 5,050MW of new generation capacity owned by suppliers who have fully contracted their output to load. Under these projected market conditions, some of the large suppliers in the CAISO market would have a RSI below 110% for no more than 5% of the hours; the remaining suppliers are just slightly more than 5% of the hours. This provides evidence that a 5% threshold of low RSI hours provides a meaningful screen for a market-based rate standard. Table 1a below shows the number of hours when RSI is below 110% for the base year and the projected condition for the five largest non-utility suppliers in California. The second table, table 1b, shows the corresponding results of the RSI screening.

Table 1a. Number of Hours when RSI <= 110%

	Hours in Base Year 2000	% of Hours	Hours with 5,050 MW more capacity	% of Hours
S1	2044	23.3%	521	5.9%
S2	1712	19.5%	375	4.3%
S3	1922	21.9%	459	5.2%
S4	1980	22.6%	479	5.5%
S5	1825	20.8%	401	4.6%

Table 1b. RSI screening results

	Base Year 2000		With 5,050 MW new capacity fully contracted to load	
	% of Hours	RSI Screen	% of Hours	RSI Screen
S1	23.3%	Fail	5.9%	Fail
S2	19.5%	Fail	4.3%	Pass
S3	21.9%	Fail	5.2%	Fail
S4	22.6%	Fail	5.5%	Fail
S5	20.8%	Fail	4.6%	Pass

The CAISO also applied the SMA screen to the large suppliers in the CAISO market. Under year 2000 conditions, each of the suppliers failed the test. However, under projected competitive market conditions (with 5,050 MW of new capacity fully contracted to load), each supplier passed with a large margin.

If the CAISO were to use the Commission's SMA screen, the system only needed about 2000 to 3000 MW of new competitive capacity for the large suppliers to pass the SMA test. The primary reason for this implausible result is that the SMA does not consider the 10% reserve required on top of load. That makes the suppliers pivotal at a much lower load level. The last scenario, presented in Table 2 below, redefined the system supply margin to include the

10% operating reserve requirement. As a result, all suppliers failed the SMA screen by a significant margin. The SMA screen seems to be overly restrictive with this modification, because it requires a supplier to be non-pivotal for all hours. In comparison, the RSI screen passed some suppliers in the projected market while the remaining suppliers show a small deficiency.

Table 2. SMA screen under different market conditions and reserve requirement*

	Base year condition		With Additional Capacity (owned by competitive suppliers or contracted to load)		With Additional Capacity (owned by competitive suppliers or contracted to load) 10% op. reserves	
Annual Peak Load	45208		45208		45208	
Total Supply	46295.34		51345.34		51345	
System Supply Margin	1087.34		6137.34		1617	
Supplier's Capacity						
S1	3926		3926		3926	
S2	2824.8		2824.8		2824.8	
S3	3299.84		3299.84		3299.84	
S4	3507.5		3507.5		3507.5	
S5	2987.6		2987.6		2987.6	
Supply Margin – Supplier's Capacity, and SMA test results						
S1	-2838.66	Fail	2211.34	PASS	-2309	Fail
S2	-1737.46	Fail	3312.54	PASS	-1208	Fail
S3	-2212.5	Fail	2837.5	PASS	-1683	Fail
S4	-2420.16	Fail	2629.84	PASS	-1891	Fail
S5	-1900.26	Fail	3149.74	PASS	-1371	Fail

*Additional capacity (owned by competitive suppliers) is assumed to be 5,050 MW which is based on the study of the relationship between supply margin and market competitiveness.

Finally, the CAISO analyzed the correlation between the RSI and market performance during the summers of 2000, 2001 and 2002 which can be found in the attached Appendix A. As shown in Appendix A, the RSI provides a good structural metric about the competitiveness of the market and is also a good predictor of the market performance which makes the RSI a better index of market structure than the traditional indicator of HHI and concentration ratio.

V. MARKET POWER MITIGATION MEASURES

The focus of market power mitigation should be on establishing a market structure that includes:

- Setting a standard for just and reasonable rates and reviewing market outcomes for adherence to this standard,
- Providing strong incentives for development of price-responsive demand programs,
- Encouraging voluntary long-term contracts, and
- Ensuring adequate resource availability to serve the load, such as the Available Capacity Requirement proposed in Market Design 2002 by CAISO.

During periods when structural flaws continue or resurface, and the market outcome is not just and reasonable, mitigation may be needed. The CAISO has some serious concerns regarding the spot market mitigation proposed by the Commission, which has limitations making the mitigation mostly ineffective. The CAISO finds the proposed spot market mitigation can only be effective assuming the following conditions:

1. The decremental cost value must be closely tied to the incremental cost value. That is, if the large supplier inflates the incremental cost data, it must have comparable decremental cost data. This may not be true.

2. There must be excess capacity from competitive suppliers in the market. This is because the only threat to inflated decremental cost comes when other suppliers offer lower cost supply. There may not be lower cost supply available to the market.

3. Suppliers do not collude with each other with or without expressed communication. If suppliers can collude in some form, there may not be a supplier available to step forward to offer lower cost supply that may help keep the large supplier from inflating the incremental cost.

Since all these conditions do not always apply, the CAISO has concerns that the proposed spot market mitigation will not be effective unless the Commission mandates **accurate posting of incremental cost**. The Commission would have to demand complete and accurate reporting by the suppliers and conduct periodic audits of the posted marginal costs to ensure that they are justified by the underlying actual historic costs. For this purpose, the Commission needs to develop a method for estimating marginal cost of generation and require suppliers to use that method.

To address some of these limitations, the CAISO proposes the following alternative mitigation for a supplier who fails the market-based rate screen.

Measure 1. Use long-term contracts to cure highly pivotal suppliers (possessing RSIs less than 110% for more than 5% of the hours)

A supplier would be allowed to sign long-term fixed-price contracts with load to cover a sufficient portion of its available capacity to reduce its net capacity earning market-based rates and correct for excessive RSI. The long-term contracts should be subject to Commission review for just and reasonable rates. The Commission should reserve the power to set the rate based on cost of service if the contract rate is not deemed just and reasonable. If sufficient long-term contracts are signed with load and the supplier subsequently passes the RSI screen, the supplier would not be subject to further mitigation.

For example, a large supplier has 5,000MW of available capacity. The RSI for this supplier is less than 110% for 400 hours in a year. This supplier will fail the RSI screen and will have market power for too many hours. If the supplier signs a long term contract with load for 3,000MW of its available capacity, its RSI (now based on 2000MW of net capacity) will be lower than 110% for only 30 hours in a year (the figure in this example is hypothetical for illustration purpose only). Consequently, the supplier can pass the RSI screen with additional long-term contracts to load.

Measure 2. Spot market mitigation

If a supplier fails the RSI screen **and** fails to cure the excessive RSI with long-term contracts, then spot market mitigation will be applied to all bilateral trades in the spot markets. This is similar to the Commission's proposal. Due to the deficiencies mentioned earlier in this paper, the current Commission proposal should be modified to require a mitigated supplier to offer their available supply at marginal cost subject to verification and refund if they inflate marginal cost.

A mitigated supplier must post all its available capacity on its web page for sale, and the offer price must be justified by its actual cost of generation. The Commission's proposed method of posting decremental bids is not effective; a requirement of justifying offer price by cost will make the spot market mitigation meaningful.

VI. THE COMMISSION SHOULD NOT GIVE SUPPLIERS IN AN ITP/RTO/ISO MARKET-BASED RATE AUTHORITY WITHOUT PROPER SCREENING AND EVALUATION

The Commission cannot simply assume that ITP, RTO or ISO markets are safe harbors for competitive market outcomes. The experience in California and other ISO markets provides a painful lesson on this issue. FERC should not confuse a market based rate screen with a guarantee of competitive market outcomes.

It is generally agreed that competitive markets require key structural elements to contain market power. These include: (1) sufficient supply resources, (2) price responsive demand, (3) long term contract so load is sufficiently hedged against price volatility, and (4) effective market monitoring and mitigation.

A quick examination of these elements shows that there may not be sufficient improvement in some of these areas to guarantee competitive market outcomes. Supply and demand conditions are very dynamic and volatile. Unexpected load growth, sudden drought and the consequent reduction of hydro generation can skew the supply balance quickly. Billions of dollars of excess costs may occur before the supply balance is restored. Price responsive demand has been very slow to develop and may not provide sufficient mitigation effects for the next few years. Long-term contracts are more established, but only dampen market power impacts, not eliminate it. Finally, current market monitoring tools and mitigation measures given to RTOs /ISOs are very limited. Bid caps at high levels ($250 to $1000/MWh) can limit the impact of market power but still leave a significant amount of room for the exercise of market power. Even prices at $250/MWh can represent prices that are 100% to 300% above competitive levels and can result in huge cost impacts in a short period of time as demonstrated in California in August 2000 to December 2000. The AMP procedure (used in NYISO and to be used in California) is similarly limited due to overly generous thresholds for bid mitigation.

In summary, experience has shown that simply having certain market power mitigation measures in place in an RTO/ISO does not guarantee competitive market outcomes. The Commission's proposal to grant all suppliers in an ISO/RTO market based rate authority is not justified by any facts or analysis. The Commission must retain the authority to condition market based rate authority for all suppliers, even those in RTO markets, to foster competitive market outcomes consistent with a just and reasonable rate standard.

Respectfully submitted,

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Filed: October 24, 2002

APPENDIX A

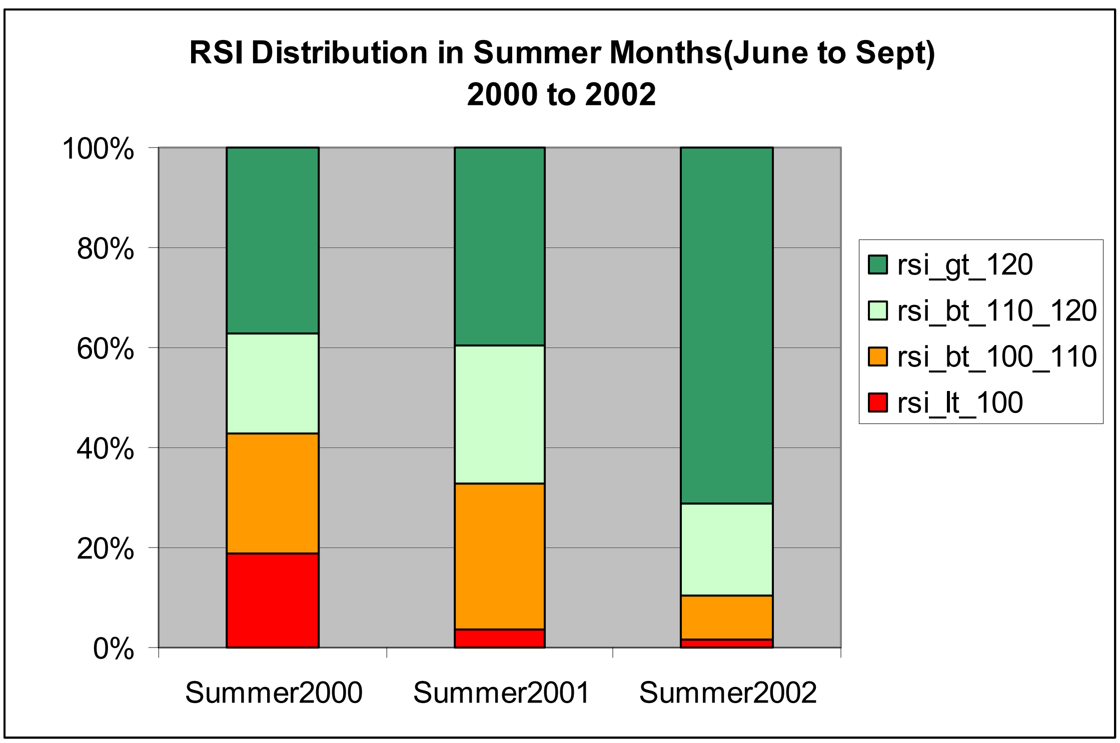
APPENDIX A

Demonstration of RSI to California Market Performance

As discussed in the filing, CAISO Department research into the Residual Supply Index ("RSI") indicates that it can serve as a good structural metric for the competitiveness of the market and can serve as a good predictor of the market performance. This makes RSI perform as a better index of market structure than the traditional indicator of HHI and concentration ratio. The CAISO demonstrates through empirical research as presented in Appendix B how the RSI has a strong stable relationship to the mark-up above costs in the California electricity market. In this appendix, the CAISO provides some simple statistics that were calculated using CAISO market data to illustrate our findings on the relationship between RSI and market performance.

The RSI has served as a stable indicator of market performance through great structural changes in the California electricity markets. The CAISO has tracked the changes in RSI in California from 1999 to the present. Figure 1 below shows the distribution of RSI for the summer months of 2000 to 2002. General observation shows that when RSI is greater than 120%, the market result is mostly competitive; when RSI is less than 120% but greater than 110%, the market result is marginally competitive; when RSI is less than 110% but greater than 100%, the market result is moderately uncompetitive; and when RSI is less than 100%, the market very uncompetitive.

FIGURE 1.



The distribution of hourly RSI shows that least competitive condition occurred in summer 2000, where 43% of the time the RSI was less than 110%. Market conditions in Summer 2001 improved somewhat with 33% of the hours with low RSI. Finally, Summer 2002 saw the most improvement with only about 10% of the hours with low RSI. There was also a significant reduction in the number of hours with very uncompetitive RSI values (RSI < 100%). Nineteen percent of the hours in Summer 2000 fell into the very uncompetitive category. However, this level was significantly reduced in Summer 2001 and 2002 at 3 and 2% respectively.

As the RSI calculations would indicate, market performance was least competitive in summer 2000. There was significant improvement in Summer 2001 and further improvement in Summer 2002. This can be seen with the price-cost markup index which shows the percentage of markup of actual market price over the estimated competitive market price. Figure 2 shows the average price-cost markup index in California ISO market in the summer months.

A comparison of Figures1 and 2, illustrates the close relationship between RSI and Price-cost markup. This relationship is further demonstrated in the regression analysis reported in the attached paper by Anjali Sheffrin and Jing Chen,.

FIGURE 2. Price-cost markup index for Summer 2000 to Summer 2002

	Average Market Cost ($/MWh)	Average Competitive MCP ($/MWh)	Average Markup ($/MWh)	Markup Index
Summer 2000	$ 142.74	$ 85.60	$ 57.14	66.8%
Summer 2001	$ 68.72	$ 60.17	$ 8.55	14.2%
Summer 2002	$ 35.29	$ 33.88	$ 1.41	4.2%

*Summer 2002 data are preliminary with estimated cost of CERS short term purchase.

The CAISO has conducted additional econometric research on the stability of relationship between RSI and Leaner Index. The preliminary results indicate the relationship is stable and significant and can have important predictive value in spite of tremendous changes in the underlying market rules. The CAISO will provide an update to the regression analysis reported in the attached paper (Appendix B) when this new research is complete.

APPENDIX B

APPENDIX B

Predicting Market Power in Wholesale Electricity Markets

Anjali Sheffrin and Jing Chen

May 3, 2002

1. Introduction

1.1. Overview

Experience in deregulated energy markets in general, and California's specific experience in 2000 and 2001, indicates that there were inadequate tools to measure the extent to which electricity generators could exercise market power. Costs in California's restructured wholesale energy markets soared from $7.7 billion in 1999 to $27 billion for the year 2000. This four-fold increase in costs caused many state government officials, businesses, and consumers to seek out the causes for these astronomical costs. While there were many factors contributing to the price increase, such as increased demand, reduced hydro generation and higher natural gas prices, they alone cannot totally explain the sustained high prices in California's market. Many analyses, including those done by CA ISO Department of Market Analysis, identified the exercise of market power as a primary cause of the extreme price run-up.[1]

Traditional indicators of market power have relied upon market concentration ratios of suppliers. As the main regulatory agency of wholesale power markets, the Federal Energy Regulatory Commission (FERC) has used a rule of suppliers having a 20 % market share and the Herfindahl-Hirshman Index (HHI a composite index of market share) as indicators of a supplier's potential market power. Based on these indicators, FERC concluded that no suppliers in the California energy market had sufficient market power and granted market based rate authority to all the suppliers. The events in 2000 and 2001 clearly demonstrated that these indicators failed to reveal the true level of market power possessed by suppliers in California wholesale electricity markets.

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[1] See Hildebrandt, E., "Further Analyses of the Exercise and Cost Impacts of Market Power In California's Wholesale Energy Market," filed as Attachment B to "Comments of the California ISO on Staff's Recommendation on Prospective Market Monitoring and Mitigation for the California Wholesale Electric Power Market; and Sheffrin, A., "*Empirical Evidence of Strategic Bidding in California Real-time Market", ,*" filed in FERC Docket No. EL00-95-012. Additional studies include Borenstein S., Bushnell J., Wolak, F., "Diagnosing Market Power in California's Deregulated Wholesale Electricity Market," *POWER Working Paper PWP-086,* University of California Energy Institute, revised December 2001; Paul L. Joskow and Edward Kahn, "A Quantitative Analysis of Pricing Behavior in California's Wholesale Electricity Market During Summer 2000," *National Bureau of Economic Research Working Paper #8157,* March 2001; Erin Mansour, "Pricing Behavior in the Initial Summer of the Restructured PJM Wholesale Electric Markets," *POWER Working Paper PWP-083*, University of California Energy Institute; and James Bushnell and Celeste Saravia, "An Empirical Assessment of the Competitiveness of the New England Electricity Market," February 2002, http://www.iso-ne.com/iso_news/,

To better gauge the potential market power in restructured wholesale electricity markets, we have developed an index called the Residual Supply Index (RSI) which measures how pivotal suppliers may be in setting prices. Empirical evidence indicates a close correlation between RSI and market power impacts in the CA ISO market. Econometric analysis demonstrates that a significant relationship exists between hourly RSI and the mark-up of prices above competitive level of costs as measured by the Lerner Index.[2] Based on this empirical relationship, the RSI can be used to make projections of market power impacts in future markets. The RSI can also be used as a refined market power screen to replace the traditional market concentration indices in predicting market power that suppliers possess.

This paper first defines the residual supply index and establishes the empirical relationship of RSI and the Lerner Index. Secondly, it describes three applications of this new index, namely, using RSI to conduct policy studies on reserve margin in California necessary to achieve a competitive market, estimating the benefits of increasing market competitiveness by upgrading Path 15, and predicting market power impacts of suppliers when granting market-based rate authority.

1.2. Development of the Residual Supply Index

After the start of CA ISO market in 1998, we quickly saw that the traditional market share index or the HHI were inadequate indicators of market power. In the California market for energy and ancillary services (regulation and operating reserves), suppliers had less than a 10% market share and the HHI was well below 2,000. According to prevailing conventional wisdom and regulatory guidelines, there should have been no concern about market power. However, prices were routinely above the competitive benchmarks estimated using system marginal cost for energy generation and the opportunity cost to provide ancillary services.

We also observed that the price level was closely related to how much the total supply bid into the market exceeded demand and whether any supplier was pivotal in a product market. Our monitoring experience indicated there were three key variables that affected market outcomes: demand, total available supply and a supplier’s available capacity. To distill these factors into one index, we examined each individual supplier’s capacity compared to the supply margin, the difference between total capacity and demand. For example, let’s assume the demand is 40,000MW and total supply is 44,000MW. A large supplier with 5,000MW of capacity becomes pivotal because the supplier’s 5,000MW of capacity is larger than the supply margin of 4,000MW (44,000- 40,000). It is pivotal because if the supplier were to withhold its entire capacity, there would be an absolute shortage in the market. Due to the lack of demand elasticity and lack of competition from other suppliers, the supplier would be able to charge an extremely high price without the fear of being priced out of market.

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[2] The Lener Index is defined as:
LI= (Market Price – Marginal cost of Highest Cost Unit Needed to Serve Demand)/ Market Price

Supply capacity is relatively constant in the market, changing only as a result of plant outages or level of imports. The demand in a power market fluctuates hourly, varying significantly during the day and across different days and seasons. With the same 44,000 MW capacity in the market, if the demand falls below 39,000MW, the supply margin will be greater than 5,000MW and the large supplier with 5,000MW capacity will no longer be pivotal. Based on this analysis, we devised a pivotal supply index that is a binary variable with a value of 1 if the supplier is pivotal and 0 otherwise. A pivotal supply index was actually used in our market monitoring work at the beginning of the market operation.

We later realized that refining this binary index was important because even when the pivotal supply index is zero the supplier could still possess some market power. This could be due to tacit collusion or that in repeated hourly markets it is easy to gauge what impact pricing decisions have on other suppliers reactions. This strategic bidding is extensively analyzed in the literature of oligopoly pricing strategy.[3] Under these conditions, a few large suppliers can withhold part of their supply and inflate the market prices above competitive levels. Our experience suggested that a continuous index of residual supply would be a better indicator of how much the price is above a competitive level. The Residual Supply Index could serve as such a metric.

The Residual Supply Index (RSI) is defined as the ratio of residual supply (the total available supply minus the capacity of a large supplier) over demand.

RSI_s = (Total Available Supply – Available Supply from Supplier S) / Demand

In the example above, when the demand is 40,000MW,

$RSI_s = (44{,}000 – 5{,}000) / 40{,}000 = .975$ (or 97.5%)

When demand is lower at 38,000 MW,

$RSI_s = (44{,}000 – 5{,}000) / 38{,}000 = 1.026$ (or 102.6%).

When a supplier is pivotal, the RSI < 1.0 and the potential for market power abuse is most serious. When the supplier is not pivotal, the RSI > 1.0, the supplier does not have absolute market power, but there may be oligopoly market power. Empirical observation in California shows that when RSI is below 1.2, there is still significant market power. Only when RSI is above 1.2, is there sufficient competition in the market place, and market power impact declines.[4]

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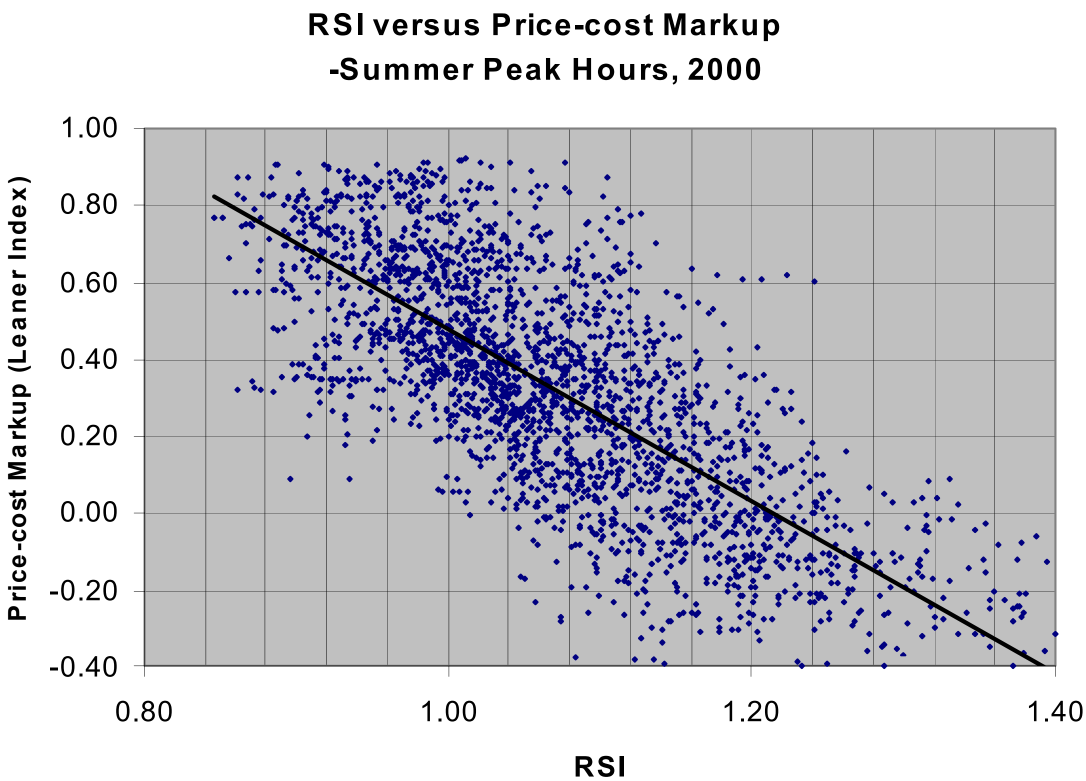
[3] See comments of Frank Wolak on the theoretical justification of RSI as a predictor of market power. Wolak, Frank, "The Residual Supply Index (RSI) Predictor of the Extent of Market Power in Wholesale Electricity Markets", March 2002.

[4] These estimates in California were highly dependent upon the level of price responsive demand, the extent to which suppliers are net sellers in the market (i.e. not pre-committed to sell to load at fixed prices), and the level of total load served in the spot market. Other electricity markets may have different estimates depending on these critical conditions.

So far we have defined RSI for a given supplier. We can further define a RSI for the whole market as the RSI for the largest supplier in the market.

RSI = (Total Available Supply – Available Supply of Largest Supplier) /Demand

Note this RSI does not have a subscript "S" but indicates whether the largest supplier is pivotal and how competitive the market will be. The following chart shows the relationship between price-cost markup (measured by Lerner index = (P – MC)/P) and the RSI using actual market data from the California wholesale electricity markets for the period November 1999 to October 2000.



This figure illustrates the relationship between RSI and Price-cost mark-up measured by the Lerner Index. It shows a clear negative correlation between the RSI and the Lerner Index. The higher the RSI, the lower the price-cost mark-up. When the RSI is about 1.2, the average price-cost mark-up is about zero. When RSI is 1.0, the average Lerner Index is about .5, or the price is 100% above the competitive level. There were many hours in Summer 2000 with a RSI less than 1.0 when the price mark-up was extremely high (above 100%). Note in Lerner Index, the denominator is price so the index is always less than 100%.

RSI measures the concentration of supply for the largest supplier in the market. Differing from the conventional static measure of market concentration, the RSI measures concentration relative to market demand for each operating hour. Therefore, the proposed relationship can relate the observed market power with the structural characteristics of the market place providing a dynamic market concentration index.

1.3. Theoretical Justification for RSI indices

This empirical relationship can be understood using different theoretical analyses of oligopoly pricing. One interpretation is based on the supply function equilibrium model proposed by Green and Newbery[5] to analyze the United Kingdom's electricity market. This study showed that in a market with demand of D(p) and supply from all suppliers other than firm i of S_r (also called residual supply), firm i with marginal cost of MC will bid the following supply curve into the market:

$$P_i - MC_i = q_i / (dS_r(p)/dp - dD(p)/dp)$$

where P is the bid price for q units of supply. The relationship implies that the bid price markup is proportional to the quantity supplied and inversely proportional to the sum of residual supply elasticity and absolute value of demand elasticity. Price markup will be higher if the residual supply elasticity is low or if the demand elasticity is low. In the CAISO real-time imbalance energy market, most of the time the demand elasticities are zero; therefore the equation is simplified to:

$$P_i - MC_i = q_i / (dS_r(p)/dp) = q_i \frac{dSr(q)}{dq}$$

The bid price markup is then mainly determined by the elasticity of residual supply by other firms in the market. Due to the huge amount of work required to construct MC_i and S_r for each large supplier in the market, an alternative was to examine the residual supply using a simplistic measure, the Residual Supply Index. The RSI captures the proportion of market that residual suppliers must meet. The lower the RSI, the lower the residual supply elasticity. When residual suppliers reach their capacity limits, the elasticity of residual supply is zero, and the Price-cost mark-up may approach infinity.

When residual supply is greater than 100 percent (i.e., suppliers other than the largest firm have enough capacity to meet the demand of the market), the largest firm has less influence on market clearing price. On the other hand, if residual supply is less than 100 percent of demand, the largest firm becomes the only source to fill the shortage and, thus, is the pivotal player in the market. It has complete control of the market clearing price and can set the price as high as the price cap allows.

As noted above the bid price markup is determined by the elasticity of residual supply, so the measure of the percent of residual supply (RSI) is only an approximation to the more accurate formula for residual supply elasticity.[6] When RSI is less than 100 percent, it can be used as the determining factor of MCP. When RSI is more than 100 percent, it is less

[5] Green, R. and D. Newbery, "Competition in the British Electricity Spot Market," Journal of Political Economy, 100(5), 929-953, 1992. For a more recent paper see *Linear Supply Function Equilibrium: Generalizations, Application, and Limitations*, Baldick, Grant, and Kahnor, POWER Working Paper, 2000.

[6] Individual bid price mark-up is the most important factor in determining market wide price cost mark-up. A study of individual bidding patterns in the California market is provided in Sheffrin, A., "Empirical Evidence of Strategic Bidding in California ISO Real-time Market", March 21, 2001. http://www.caiso.com/docs/2001/04/27/2001042710305919478.pdf

certain to predict the market outcome and a more detailed examination of the elasticity of residual supply is required. Nevertheless, the residual supply index is still informative, the higher the RSI the less capable the largest firm is of setting high prices.

Although RSI is defined as the market share measure of the largest supplier in the market, it can also be used as an indicator of the overall market power of all suppliers in the market. Our observation shows that even when RSI is greater than but close to 100 percent, there is significant markup over cost. Only when RSI is significantly above 100 percent will the price-cost markup drop down to zero. The explanation for this is that when RSI is greater than but still close to 100 percent the largest supplier is not pivotal, but a few of the large suppliers can still use certain bidding strategies to jointly influence market clearing prices. Extensive economic research on oligopoly (i.e., a market served by a few large firms) proposed various models showing that the large suppliers in a market can bid strategically in response to other large suppliers' bidding activities in order to inflate the price above the marginal cost. These bidding strategies do not need explicit price fixing or overt collusion and, therefore, are not illegal under antitrust regulation. The excessive price-cost markup, however, does require effective market power mitigation.

1.4. Regression Results

We used regression analysis to estimate the empirical relationship discussed above. The regression model used is the following:

$$LI = a + b*RSI + c*Load + e$$

where Load is the system load measured by GW and e is the random error term.

Given hourly load, imports, and operating reserve requirement data from November 1999 to October 2000, we first calculated the RSI and Lerner index for each hour for this period. The estimated hourly Lerner indexes were then regressed against estimated RSIs and actual system loads. To account for seasonal and time of day variations, the data was separated into four categories, Summer: May-October (Peak & Off-Peak Hours) and Winter: November-April (Peak & Off-Peak Hours) and separate regressions were done for each period (Table1). RSIs and actual system loads were assumed to vary linearly with respect to the Lerner Index. It is important to note that price-cost markups had a nonlinear relationship with RSIs and actual system loads and this captured the nonlinear relationship between price-cost markups and the Lerner Index.[7]

The regression equations were statistically significant for all periods with good R^2 values. All coefficients of RSI were highly significant and with large magnitude (negative), showing that RSI had a significant correlation with price-cost markup.

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[7] Price-cost Markup is defined as (Price – Cost)/Price, while Lerner Index is (Price – Cost) / Price. There is a nonlinear transformation between price cost markup and Lerner Index. Using Lerner Index captures the fact that as RSIs decline or actual system loads increase market prices increase at an increasing rate.

The inclusion of the load variable is very important to recognize the fact that price-cost markup might be very different under different load conditions even when the RSIs are the same. Actually, our regression equation indicated that load had a significant positive effect on price-cost markup almost under all scenarios of system conditions. It indicated that a higher load might lead to a higher price-cost markup, even when the RSI indexes were same. Although the numerical value of the regression coefficient for the load variable seemed to be very small, the effects of load on price-cost markup was large because the load variable had a very large numerical value. It was in the range of 20,000 to 45,000 MW. So the product of c*load was a significant number.

Separate regressions for different time periods (peak hour and off-peak seasons) and different hours (peak hours and off-peak hours) were conducted to account for the potential different relationships under different system conditions.

Table 1. Lerner index and RSI regression Results

Peak Season (May-Oct 2000)				
	Peak Hours		Off-Peak Hours	
Variables	Coefficient	t-stat	Coefficient	t-stat
Intercept	1.26	12.58	2.31	16.38
RSI	-1.54	-27.20	-2.24	-33.17
Actual Load	2.19E-05	15.85	2.01E-05	7.07
R-Squared	0.63		0.58	
Number of Observations	2,522		1,886	
Off-Peak Season (Nov-1999 - Apr 2000)				
	Peak Hours		Off-Peak Hours	
Variables	Coefficient	t-stat	Coefficient	t-stat
Intercept	1.48	10.96	1.59	4.25
RSI	-1.20	-21.74	-1.95	-12.77
Actual Load	1.93E-06	0.80	4.40E-05	6.03
R-Squared	0.42		0.34	
Number of Observations	2,494		1,840	

We also compared the regression results between summer 1999 and summer 2000. For the peak hours of summer 2000, the regression achieved a high R-square and highly significant estimates of the effects of RSI on the price-cost markup. For peak hours of summer 1999, the R-square was lower but the coefficients were still highly significant. Based on the regression results, in summer 2000, for a given system load level on peak hours in summer 2000, if there was a 10 percent reduction in RSI (say from 105 percent to 95 percent) there would be about a 15 percent increase in the price-cost markup. The increase would be about 12 percent in summer 1999 for the same reduction in RSI.

By comparing peak hours in peak and off peak season, we observed that, as expected, for a given RSI, the price-cost markup was always higher in the peak season than in the off-peak season. The large loads in the peak season led to a larger possibility for generators to exercise market power, and thus a higher price-cost markup. Also, as shown in the graph, the response was greater during the peak season than in the off-peak season. We should emphasize that here the relationship between RSI and price-cost markup was more relevant in *peak* hours, where system was more likely to be resource-strained. This was further confirmed by the relatively higher R-squared values (measuring the fitness of the regression equation) for regression using peak hours than those using off-peak hours as shown in our original regression summary tables.

2. Applications of RSI Indexes in Different Case Studies

Case Study 1: Reserve Margin Analysis

Experience in deregulated energy markets in general, and California's specific experience since the summer of 2000, indicates that a sufficient level of capacity reserve is a critical factor in reducing the possibility and the extent to which electricity generators can exercise market power. RSI analysis and simulation were used in assessing whether there was a sufficient level of reserve margin in California to ensure *workably competitive market outcomes*, i.e., to ensure that the price of energy is reasonably close to the price that would result in a *competitive market*.

A workably competitive market was defined as one where the average annual market price of power was less than 10% above a competitive market benchmark cost[8], i.e., the annual average price-cost mark-up is less than 10%. The estimated RSI analysis was used to analyze the impact on prices and then a simulation was conducted to demonstrate the effects of new capacity on prices in the market. As explained above, any new capacity from **competitive** suppliers will increase the RSI and lower price-cost mark-up, thus producing lower prices in the marketplace.

Based on the regression results that were shown in Table 1, we simulated the market power impacts or price-cost markup under different market supply and demand conditions, including the effect of new capacity additions. Specifically, given a particular level of new resource additions coming from competitive suppliers, we computed a new hourly RSI index. Intuitively, the assumed new, competitive resource capacity would increase RSI indexes. The increased hourly RSI index would, in turn, result in lower hourly price-cost markups. Then we computed the average annual price-cost markup

[8] At this time there is no established standard for a workably competitive market by any federal or state regulatory agencies. However, while there is not a formally established regulatory standard, economists generally agree that suppliers in a competitive market have an incentive to bid close their marginal cost. Thus, the ISO's Departments of Market Analysis believes that use of a 10% annual price-cost mark-up is a reasonable assumption.

based on the assumed level of new generation capacity. We adjusted the level of new capacity through simulations until we found a level of new capacity that resulted in a load-averaged annual price-cost markup of 10 percent.

Finally, we translated the results into the traditional measure of reserve margin as follows:

Reserve margin = (dependable supply[9] - peak demand)/(peak demand)

where dependable supply is the sum of historical net import, generation and demand side capacity actually participating in the market during the study period, and assumed level of new, competitive capacity.

Table 2. Load, Available Capacity and Reserve Margin at Summer Peak Hour (Hour 16, August 1, 2000)

	Base Year	With 5,050 MW new capacity	With 7,500 MW new capacity	Note
Peak Load	45,208 MW	45,208 MW	45,208 MW	
Available Capacity	40,680 MW	45,730 MW	48,180 MW	In-state resources only
Available Net Import	5,615 MW	5,615 MW	5,615 MW	
Reserve Margin	2%	14%	19%	(Available Capacity + Available Net Import – Peak Load) / Peak Load

We found the capacity reserve margin (based on "dependable" rather than "nameplate" capacity) should be 14% to 19% of the annual peak load to promote workably competitive market outcomes. We note this supply of reserves can come from a variety of sources including price-responsive demand under real-time meters, interruptible and curtailable loads, or new generation with the necessary transmission upgrades necessary to make them available to the larger market.

To illustrate this result, the capacity reserve margin for year 2000 was only 2%, and the corresponding annual price-cost markup was at an unacceptable level of 58%. To achieve and maintain the annual price-cost markup of below 10%, additional, dependable capacity of about 5,050 to 7,500 MW must be added to the base year dependable capacity

[9] We believe that it is highly misleading and inappropriate to use the nameplate generation capacity in computing the dependable supply and the reserve margin. For example, due to technical limitations and market incentives, total installed nameplate generation capacity of more than 50,000 MW could yield dependable supply of only 46,000 MW, providing opportunities for the exercise of market power and high price-cost markup, even when peak loads do not exceed 46,000 MW.

of 46,300 MW[10]. We assumed that the new resources would not be owned by the existing large or strategic suppliers, and the new resources would be obligated to offer their total capacity into the market through long-term contract or other mechanisms.[11]

Our findings were borne out by the California market experience of summer 2001, where predictions of dire shortages proved inaccurate. Due to the aggressive conservation efforts by California consumers totaling 3,000 – 5,000 MW, placing large amounts of existing generation under an obligation to supply under long-term contracts and new generation additions of approximately 2000 MW, and FERC implementing on June 19, 2001 west-wide price caps, spot market outcomes were considered fairly competitive during the summer of 2001.

Case Study 2: Economic Benefit of Upgrading Path 15 Transmission Line

Traditional analyses of the economic benefits of a transmission project is based on premise of a perfectly competitive electricity market where prices reflect marginal cost and no single supplier having the ability to manipulate prices. These economic analyses only look at net-cost savings to load or/and reduction in re-dispatch costs as a result of a transmission project. However, it has been shown in economic literature that transmission projects can have significant economic benefits in mitigating the potential for suppliers to exercise market power. [12] In evaluating the economic benefit from the Path 15 upgrading project, we went beyond the fundamental assumption of a perfectly competitive market and examined the extent to which suppliers may be able to exercise market power in northern California (NP15) in year 2005 under various scenarios of new generation investments and hydro conditions.

Again, RSI was used in this study to measure market power. First, we calculated hourly RSI values for Northern California (NP15) under 24 supply scenarios in 2005 with and without the proposed expansion of Path15 to capture how the potential added transmission capacity would mitigate market power.[13] Upgrading Path 15 essentially increased the total supply in the Northern California, or NP15 region, and introduced more competition in the area. The RSI indexes increased as a result of this project. Based on the regression results shown in Table 1, we then projected price-cost markup

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[10] In this report, we considered 5,600 MW of net imports were available and considered as a component of dependable capacity.

[11] It should be noted that the new reserve does not necessarily need to entirely come from competitive new generation. Demand side resources can be considered towards meeting the reserve requirements. Reserves could come all from price responsive demand with real-time metering, or a resource mix including conservation, demand-side reductions, long-term contracts, or new generation additions. This report does not offer insight into the appropriate mix of resources to meet the reserve requirement.

[12] Borenstein, Severin, Bushnell, James, and Steven Stoft. " The competitive effects of Transmission Capacity in a Deregulated Electricity Industry". *RAND Journal of Economics*, Vol. 31, No. 2, Summer 2000, pp. 294-325.

[13] This analysis is conducted for 24 different scenarios. The scenarios include 2-different hydro scenarios (dry, normal) 3-new generation scenarios for NP15 (low, medium, high), a with and without Existing Transmission Contracts (ETC) for Path 15 scenario, and a with and without Path 15 expansion scenario. In addition, because supply availability is highly variable and uncertain, we use Monte Carlo simulations for hydro availability, outage rates for existing thermal generation, and available ATC and TTC on Path15 and COI.

for the hourly RSI estimates in 2005. Finally, the computed price-cost markups were applied to the projected competitive market prices under each scenario and projected net-load to produce the costs due to exercising market power with and without the Path 15 expansion. The total cost benefits to NP15 load for year 2005 are the sum of the differences in these costs (with and without the Path 15 expansion) for all hours in 2005.

Table 3 provides a summary of the estimated cost savings to NP15 load from expanding Path 15. It includes the State's long-term power contracts in calculating the IOU's net-short position. Under a normal hydro year scenario, the annual benefits to NP15 load range from $52-$213 million when ETC is excluded from the available transmission capacity and range from $12 to $70 million when ETC is included. Under a dry hydro scenario, the annual benefits to NP15 load range from $96 million to $850 million in the "Excluding ETC" scenario and range from $25 to $196 million under the "Including ETC" scenario. Based on the most likely scenario, the economic benefit can range from about $400 million in four hydro normal years to about $600 million in three normal-hydro years and one dry-hydro year, while the projected cost of expanding Path 15's transmission capacity is estimated to be approximately $300 million.

Our analysis indicates that the Path15 upgrading project can have significant benefit in mitigating the market power, and is very beneficial to consumers, while other studies using either cost to load or change in re-dispatch costs only provide limited evidence supporting this project

Table 3: Summary Results of Estimated Cost Savings to NP15 Load from Path 15 Expansion (Including Long-term Contracts)

Case Study 3: Using RSI screen to access suppliers market power

Normal Hydro Year (Year 2000) $MM

		Exluding ETC			Including ETC		
Proposed New Generation Scenarios		Medium	Low	High	Medium	Low	High
Costs Due to Excercising Marketing Power	A: Path 15 Status Quo	$311.23	$589.12	$136.48	$79.89	$185.72	$26.23
	B: Path 15 Expansion	$206.33	$386.13	$85.15	$48.64	$118.99	$14.44
C: Cost Savings to NP15 Load from Reduced Market Power from Path 15 Expansion (A-B)		$104.90	$202.98	$51.33	$31.25	$66.73	$11.79
Benefit from Price reduction (C1)		$0.26	$19.18	($0.01)	$0.04	$3.14	$0.00
Benefit rom Reduction in Price-Cost Markup (C2)		$104.64	$183.81	$51.34	$31.21	$63.60	$11.79
D: Costs Savings due to Lower Competitive Prices form Path 15 Expansion		$1.05	$9.67	$0.37	$0.41	$3.61	$0.11
Total Cost Benefit to NP15 Load (C+D)		$105.95	$212.65	$51.70	$31.65	$70.34	$11.90
E: Cost Impact to SP15 Load		-$1.85	-$3.96	-$1.33	-$0.46	-$1.56	-$0.25
Net Cost Benefit to NP15 & SP15 Load (C+D+E)		$104.11	$208.70	$50.37	$31.19	$68.78	$11.65

Bad Hydro Year (64% of Year 2000 hydro volume) $MM

		Exluding ETC [a]			Including ETC		
Proposed New Generation Scenarios		Medium	Low	High	Medium	Low	High
Costs Due to Excercising Marketing Power	A: Path 15 Status Quo	$611.41	$1,454.07	$271.42	$163.13	$389.29	$57.24
	B: Path 15 Expansion	$406.90	$775.71	$175.53	$101.51	$235.03	$32.75
C: Cost Savings to NP15 Load from Reduced Market Power from Path 15 Expansion (A-B)		$204.52	$678.36	$95.89	$61.62	$154.25	$24.49
Benefit from Price reduction (C1)		$3.65	$308.30	$0.00	$0.79	$33.38	$0.00
Benefit rom Reduction in Price-Cost Markup (C2)		$200.86	$370.06	$95.89	$60.84	$120.87	$24.49
D: Costs Savings due to Lower Competitive Prices form Path 15 Expansion		$3.94	$171.85	$0.44	$1.49	$41.28	$0.20
Total Cost Benefit to NP15 Load (C+D)		$208.46	$850.21	$96.34	$63.12	$195.53	$24.68
E: Cost Impact to SP15 Load		-$3.09	-$8.50	-$1.46	-$1.37	-$6.22	-$0.48
Net Cost Benefit to NP15 & SP15 Load (C+D+E)		$205.37	$841.71	$94.87	$61.75	$189.31	$24.20

While FERC has historically used traditional indicators such as market share or HHI as tools to assess individual supplier's market power and determine market based rate authority, they have recently realized the limits of this approach. Recently FERC has proposed the Supply Margin Assessment (SMA) screen and suggested related mitigation mechanisms.[14]

SMA is similar to the Residual Supplier Index (RSI) that the DMA has used for the last two years. If a supplier is pivotal during the annual peak hours, i.e., without its supply the market demand cannot be met, the supplier will fail the SMA screen.

However, the SMA screen may not be sufficient since it does not consider operating reserve requirements for a control area, which are typically 10% above the peak load. Due to the additional need of resources, a large supplier can be pivotal for many hours of the year even if it passes the SMA screen. The SMA screen also ignores critical factors such as the possibility for collusion and the net buyer or seller position of a supplier.

The RSI index provides more information than the proposed SMA screen. It can be applied to all hours in which the supplier provides service and is eligible to earn revenues based on granted market-based rate authority. As discussed earlier, it also incorporates actual market outcomes and measures the ratio of the residual supply to the actual demand. It does not just calculate a simple pass or non-pass statistic. The additional market information provides a better understanding of whether market power is being exercised. We propose an RSI screen[15] [Numbers used here are examples for discussion purpose only]:

That RSI_s must not be less than 110% for more than 5% of the hours in a year

where RSI_s is the measure of RSI for the supplier under review. 5% of the hours in a year is about 438 hours.

The proposed screen requires that the hours with high risk of market power problem account for no more than 5% of the hours in a year. Using this screen, not all hours in a year have to be competitive, but the overall annual market performance is likely to be workably competitive. This proposal has the following advantages compared to FERC's proposed SMA:

- the RSI considers only net capacity of the supplier in determining whether it is pivotal and therefore becomes more selective in identifying the suppliers who have the incentive to exercise market power. The net capacity is the total capacity minus capacity committed under long term fixed price contracts. A supplier would not include capacity under fixed price contracts when determining optimal bidding

[14] "Order on Triennial Market Power Updates and Announcing New, Interim Generation Market Power Screen and Mitigation Policy", FERC, November 20th, 2001

[15] For the entire market, the RSI is defined as the RSI for the largest supplier.

strategy. Another exception is that a net buyer does not have incentive to exercise market power. The RSI measure can consider these situations;

- the RSI threshold would apply to all hours. It would use a standard where the RSI could fall below 110% no more than 5% of the time. This is a higher threshold than the SMA which uses 100% for the peak hour only. This wider threshold allows us to examine all hours, consider the potential for collusion and to include operating reserve requirements in the RSI calculation;

- the RSI standard also allows the threshold to be exceeded for a limited number of hours in a year to leave room for price fluctuation to reflect actual market demand and supply conditions. It would send signals for conservation and new investment in generation;

- the RSI framework can be used as a tool to forecast price markup outcomes for a market based on an empirically derived relationship between RSI and prices. This can be important in forecasting residual market power under a variety of circumstances such as upgrading transmission lines, impact of new entry, etc.

- the RSI screen can be adjusted based on actual market experience. The 5% of hours can be increased or decreased, if there is too much market power or too much mitigation. By simply adjusting the percent of hours that the RSI can exceed 110%, the regulator can fine tune the screen for each market and to best achieve the competitive market outcome.

We have tested the proposed criterion for large suppliers in CA ISO market. During 2000 (the base year of our study), all suppliers failed the RSI screen. Their RSIs were less than 110% for about 20% of the hours. That was significantly above the 5% threshold.

We also examined a projected competitive market condition (which is approximated based on our study on reserve margin and workable competition). In that case we assumed an additional 5,050MW of new generation capacity owned by smaller suppliers was likely to produce a workably competitive market outcome (annual price-cost mark-up less than 10%). In this projected market place, some of the large suppliers in CA ISO will have RSI below 110% for no more than 5% of the hours, the rest are just slightly more than 5% of the hours. This provided indirect evidence that a 5% threshold of low RSI hours is a meaningful screen for implementing a market based rate standard. Table 4a shows the number of hours when RSI is below 110% for the base year and the projected condition. Table 4b shows the corresponding results of RSI screening.

Table 4a. Number of Hours when RSI <= 110%

	Hours in Base Year 2000	% of Hours	Hours with 5,050 MW additonal capacity contracted to load	% of Hours
Supplier 1	1712	19.5%	375	4.3%
Supplier 2	1825	20.8%	401	4.6%
Supplier 3	1922	21.9%	459	5.2%
Supplier 4	1980	22.6%	479	5.5%
Supplier 5	2044	23.3%	521	5.9%

Table 4b. RSI screening results

	Base Year		With 5,050 MW additional capacity	
	% of Hours	RSI Screen	% of Hours	RSI Screen
Supplier 1	19.5%	Fail	4.3%	Pass
Supplier 2	20.8%	Fail	4.6%	Pass
Supplier 3	21.9%	Fail	5.2%	Fail
Supplier 4	22.6%	Fail	5.5%	Fail
Supplier 5	23.3%	Fail	5.9%	Fail

For comparison, we also applied the SMA screen to the large suppliers in CA ISO market. For the base year condition, they all failed the test. For the projected competitive market conditions (with 5050 MW of additional capacity), they all passed by a large margin. As the numerical value shows, the system only needed about 2000 to 3000 MW of new competitive capacity for the large suppliers to pass the SMA test. This is too optimistic. The main reason for this implausible result is that SMA does not consider the 10% reserve required on top of load. That makes the suppliers pivotal at a much lower load level. The last scenario presented in Table 5 redefined the system supply margin to include the 10% operating reserve requirement, which is much less then under the original definition. As a result, all suppliers fail the SMA screen with large deficiencies. The SMA screen seems to be overly restrictive with this modification, because it requires a supplier to be non-pivotal for all hours.

Table 5. SMA screen under different market conditions and reserve requirement

	Base year condition		With Additional Capacity (owned by competitive suppliers)		With Additional Capacity (owned by competitive suppliers) 10% op. reserves	
Annual Peak Load	45208		45208		45208	
Total Supply	46295.34		51345.34		50258	
System Supply Margin	**1087.34**		**6137.34**		**529.2**	
Supplier's Capacity						
WESC	3926		3926		3926	
ECI	2824.8		2824.8		2824.8	
DETM	3299.84		3299.84		3299.84	
RESI	3507.5		3507.5		3507.5	
SCEM	2987.6		2987.6		2987.6	
Supply Margin - Supplier's Capacity, and SMA test results						
WESC	-2838.66	Fail	2211.34	PASS	-3396.8	Fail
ECI	-1737.46	Fail	3312.54	PASS	-2295.6	Fail
DETM	-2212.5	Fail	2837.5	PASS	-2770.64	Fail
RESI	-2420.16	Fail	2629.84	PASS	-2978.3	Fail
SCEM	-1900.26	Fail	3149.74	PASS	-2458.4	Fail

In comparison, the RSI screen passed some suppliers in the projected market with the remaining suppliers showing a small deficiency. With an additional 2,000 MW all suppliers would have passed the RSI screen demonstrating that it strikes the proper balance in assessing market power of suppliers under a variety of circumstances.

3. Summary

This paper illustrates that the RSI index can be an effective and useful tool in analyzing the potential for suppliers to exercise market power. We find a strong relationship between RSI and price-cost markup in the California electricity market, and this relationship can help us to make a series of policy recommendations. However, the RSI index does have its own limitations. The RSI does not fully reflect the physical realities of the underlying system. For instance, within a particular zone where the RSI is computed, transmission constraints (intra-zonal congestions) might cause additional potential for suppliers to exercise market power. However, the RSI cannot measure this potential for additional market power. Also, the RSI does not account for the interactions among several largest suppliers in the markets. Finally, maybe most importantly, more investigation is necessary to explore how the relationship between the RSI indexes and price-cost markups changes with structural changes in the spot markets and forward markets. This is especially important in the current electricity market in California where a significant portion of load is now served under various forms of long-term contracts.

California Independent
System Operator

The Honorable Magalie Roman Salas
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

**Re: Conference on Supply Margin Assessment,
Docket No. PL02-8-000**

Dear Secretary Salas:

Pursuant to the "Notice of Request For Written Comments On Supply Margin Assessment Screen" issued by the Federal Energy Regulatory Commission ("Commission") on August 23, 2002 in the captioned proceeding, the California Independent System Operator Corporation (CAISO") hereby submits its Comments Regarding the Supply Margin Assessment Screen And Related Mitigation Measures" ("Comments"). The CAISO requests that the Commission grant leave and permit the CAISO to file such comments two days out-of-time. Good cause exists for permitting the CAISO to file its comments out-of-time. In that regard, the persons primarily responsible for preparing and reviewing the instant comments are the same persons that, in addition to their normal day-to-day responsibilities, have been actively involved in supporting numerous other significant CAISO efforts including, but not limited to, MD02 design and implementation, the California refund proceeding, numerous investigations into manipulation of the California markets and CAISO comments on the Commission's proposed standardized market design. Accordingly, the CAISO was unable to submit these comments on a timely basis.

The CAISO's Comments are being served on all parties in this proceeding in accordance with the Commission's Regulations.

Thank you for your assistance in this matter.

Respectfully submitted,

Anthony J. Ivancovich
Counsel for The California Independent
System Operator Corporation

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in the above-captioned dockets.

Dated at Folsom, CA, on this 24th day of October, 2002.

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Anthony Ivancovich