UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

California Independent System Operator Corporation	**)** **)**	**Docket Nos. ER09-1048-___** **ER06-615-___** **ER06-615-___**

MOTION FOR CLARIFICATION OR, IN THE ALTERNATIVE, REQUEST FOR REHEARING, OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

Pursuant to Section 313(a) of the Federal Power Act[1] and Rules 212 and 713 of the Commission's Rules of Practice and Procedure, the California Independent System Operator Corporation ("ISO") respectfully submits this motion for clarification, or, in the alternative, request for rehearing of the Commission's November 19, 2009 order in this proceeding.[2] Specifically, the ISO requests clarification that it can comply with the directive that the ISO allow demand response resources providing ancillary services "the ability to specify the maximum number of times that they may be dispatched to a different output level during a day"[3] by providing demand response resources with the ability to specify the maximum number of dispatch periods for those resources during a day. To the extent that the November 19 Order was intended to require the ISO to allow demand response resources to specify a maximum number of times during the day that the ISO can issue dispatch instructions to change the megawatt ("MW") levels of those resources, the ISO requests rehearing of this directive as this

---

1 16 U.S.C. § 825l(a) (2009)
2 *Cal. Indep. Sys. Operator Corp.*, 129 FERC ¶ 61,157 (2009) ("November 19 Order").
3 *Id.* at P 37

directive would require the ISO to expend substantial resources on an operational constraint that would actually limit the ability of demand response resources to participate in the ISO's ancillary service markets.

I. Background

In Order No. 719 and Order No. 719-A,[4] the Commission established reforms to improve the operation of organized wholesale electric power markets administered by the ISO and other independent system operators ("ISOs") and regional transmission organizations ("RTOs"). The Commission established requirements in four areas: (1) demand response; (2) long-term power contracting; (3) market-monitoring policies; and (4) the responsiveness of RTOs and ISOs to customers and other stakeholders.

In the area of demand response, Order No. 719 established a number of requirements for RTOs and ISOs, with the express goal of eliminating barriers to demand response participation in organized energy markets by treating demand response resources comparably to other resources.[5] Among other requirements, Order No. 719 provided that:

> All RTOs and ISOs must incorporate new parameters into their ancillary services bidding rules that allow demand response resources to specify a maximum duration in hours that the demand response resource may be dispatched, a maximum number of times that the demand response resource may be dispatched during a day, and a maximum amount of electric energy reduction that the demand response resource may be required to provide either daily or weekly.[6]

---

[4] *Wholesale Competition in Regions with Organized Electric Markets*, Order No. 719, 73 Fed. Reg. 61,400 (Oct. 28, 2008), FERC Stats. & Regs. ¶ 31,281 (2008) ("Order No. 719"), *order on reh'g*, Order No. 719-A, 74 Fed. Reg. 37,776 (July 29, 2009), 128 FERC ¶ 61,059 (2009).

[5] Order No. 719 at P 15.

[6] Order No. 719 at P 81.

The Commission noted that these limits would be comparable to the limits that generators may specify on price, quantity, startup and no-load costs, and minimum downtime between starts.[7]

In its comments on the Order 719 rulemaking, the ISO explained that it expected that it would comply with this bidding parameter requirement upon implementation of enhancements to its Participating Load program that would be implemented in a market enhancement release after the initial implementation of the new ISO markets, previously known as the Market Redesign and Technology Upgrade.[8] The Commission acknowledged this statement in Order No. 719, and deferred its determination of whether the ISO satisfied the requirement until the ISO submitted its Order No. 719 compliance filing.[9] The ISO submitted the applicable filing in this proceeding on April 28, 2009 ("April 28 Compliance Filing").

The April 28 Compliance Filing explained how the ISO through its Participating Load Program ("PLP"), which allows demand response resources to participate in ISO markets, satisfied the demand response requirements of Order No. 719.[10] In its compliance filing, the ISO acknowledged that Order No. 719 directed ISOs to allow demand response resources to identify the maximum number of times that they could be "dispatched" during a day.[11] The ISO also noted the Commission's stated intention to allow demand response resources to specify limits comparable to generators. As the ISO explained, the ISO tariff

---

7 *Id.*

8 Calif. Indep. Sys. Operator Corp. Comments, Docket Nos. RM07-19-000 and AD07-7-000 (September 14, 2007), at 2.

9 Order No. 719 at P 87.

10 April 28 Compliance Filing at 34.

11 *Id.*

does not allow generators to limit the number of instances of dispatch between output levels. It only allows generators to limit the number of startups during the day. Similarly, the ISO's PLP will allow a Participating Load (*i.e.*, a demand response resource) to specify the maximum number of times that it may be started up during a day, but neither the existing PLP nor the enhancements to that program under development will allow Participating Loads to designate a maximum number of times that the ISO can dispatch the resource to different MW levels between their minimum and maximum curtailment levels. Thus, to treat demand response comparably with generators, the ISO proposed to satisfy the "dispatch" parameter limits by giving Participating Loads the ability to limit the number of times that a resource would be "dispatched" from 0 MW.[12]

The November 19 Order largely accepted the ISO's compliance filing, but it rejected the ISO's initial explanation of how it will comply with the new bidding parameter requirements of Order No. 719.[13] The November 19 Order stated that "[t]he 'comparable' treatment of demand resources, in this case, dictates recognition of the inherent characteristics of demand response resources in determining bidding parameter rules, not necessarily identical treatment as afforded to generation."[14] The Commission stated that "we will require the CAISO to allow demand response resources the ability to specify the maximum number of times that they may be dispatched to a different output level during a day."[15]

---

12 *Id.*
13 November 19 Order at PP 35-37.
14 *Id.* at P 37
15 *Id.*

II. Specification of Errors

The ISO respectfully submits that the November 19 Order erred insofar as the order was intended to require the ISO to allow demand response resources to specify a maximum number of times during a day that the ISO can issue dispatch instructions to change the MW levels of those resources between their minimum and maximum curtailment levels, as this directive would require the ISO to expend substantial resources on an operational constraint that would actually limit the ability of demand response resources to participate in the ISO's ancillary service markets.

III. Statement of Issues for Rehearing Request

Whether the Commission properly concluded that the ISO must allow demand response resources to specify a maximum number of times during the day that the ISO can issue dispatch instructions to change the MW levels of those resources.

IV. Motion for Clarification

A. Providing Participating Loads with the Ability To Specify a Maximum Number of Dispatch Periods During the Day Will Comply with the Order No. 719 Directives in a Manner Consistent with the Objectives of Eliminating Barriers to Demand Response Participation in Ancillary Service Markets

The ISO believes that the original directive in Order No. 719 that ISOs must allow demand response resources to specify "a maximum number of times that the demand response resource may be dispatched during the day" was

ambiguous. While the ISO appreciates the additional discussion on this requirement in the November 19 Order, the ISO believes there are still a number of possible interpretations of this directive. One interpretation would be that the ISO must allow demand response resources (*i.e.,* Participating Loads) to specify a maximum number of times during the day that the ISO can issue dispatch instructions to change the MW levels of those resources. For the reasons explained in Section V of this filing, not only would this interpretation create technical issues for the ISO, but it would also, by necessity, substantially limit the ancillary services that Participating Loads designating such limits could provide.

The ISO believes an alternative interpretation of the Commission's directive is more consistent with the objectives of enhancing demand response participation in ISO markets. Specifically, the ISO requests clarification that it can comply with this directive by providing Participating Loads with the ability to specify the maximum number of dispatch periods (*i.e.*, periods in which the ISO may dispatch the demand response resources below their base load to at least their minimum curtailment levels) for those resources during a day.

This functionality will be included in the Participating Load Program enhancements currently under development by the ISO. As explained in the April 28 Compliance Filing,[16] today Participating Loads can only provide non-spinning reserves and bid into the markets through which the ISO addresses energy imbalance. The additional functionality under development as part of the ISO's Participating Load Program enhancements will allow Participating Loads, subject to the resolution of any remaining regulatory or reliability standards

[16] April 28 Compliance Filing at 34.

issues, to provide higher-quality ancillary services such as regulation and spinning operating reserves. These enhancements will also allow Participating Loads to specify the maximum number of dispatch periods for those resources during a day.

B. The ISO's Participating Load Program Enhancements Will Provide Participating Loads with Greater Flexibility than Generation Resources

The ISO recognizes that a significant element of the clarification provided in the November 19 Order is that the bidding parameters available to demand response resources need to provide abilities to participate in wholesale electricity markets comparable to those provided generators, but that these parameters should not necessarily be identical to the parameters available to generators. As explained in the attached declaration of Dr. Khaled Abdul-Rahman, Principal, Power Systems Technology Architecture & Development for the ISO, the functionality available to Participating Loads under the ISO's PLP enhancements will provide these resources with bidding parameters and flexibility that exceeds, in some respects, the flexibility provided to generators in the ISO markets. Specifically, Dr. Abdul-Rahman explains that Participating Loads that seek to provide ancillary services in the ISO markets will have the ability to designate a large number of operational constraints, which are expected to include the following:

- A minimum load reduction time, which will allow a Participating Load to impose a minimum demand response period;

- A maximum load reduction time, which will limit the demand response duration, after which a Participating Load will be returned to its base load;
- A minimum base load time, which will allow a Participating Load to designate the minimum amount of time during which the resource must remain at base load (after returning to it) before the resource can again provide demand response;
- A maximum number of daily load reductions, which will allow a Participating Load to limit demand response periods in a Trading Day; and
- A load reduction initiation time, which will allow a Participating Load to designate a prior notification time before the resource can enter a demand response period (where the resource schedule is reduced below the resource's base load).

These enhancements have been developed with substantial stakeholder input and represent the functionality needed to facilitate improved participation of demand response resources in the ISO markets. The Commission should clarify that these enhancements collectively allow the ISO to comply with the bidding parameter requirements of Order No. 719.

C. The ISO's Proposed Approach to Complying with the Bid Parameter Requirements of Order No. 719 Is Consistent with Approaches the Commission Has Accepted for Other Independent System Operators

The Commission has accepted explanations by other independent system operators that the ability of demand response resources to designate a number of operational constraints when bidding into applicable markets satisfies the

requirement that demand response resources have the ability to specify a maximum number of times the resource will be dispatched during a day. In its Order No. 719 compliance filing, the New York Independent System Operator, Inc. ("NYISO") addressed its compliance with the bidding parameter requirements by explaining that Demand Side Resources in the NYISO markets must "specify their 'Maximum Number of Startups per Day' and their 'Minimum Run Time' and 'Minimum Down Time,' which together effectively determine the maximum number of times that they may be dispatched during a day."[17] The Commission acknowledged this explanation and accepted the NYISO's filing as compliant with the demand response provisions of Order No. 719, subject to certain unrelated conditions.[18] The Participating Load Program enhancements discussed above and in the declaration of Dr. Abdul-Rahman provide demand response resources in California with the same functionality described by the NYISO in its compliance filing. As such, the Commission should also find the California ISO in compliance with the bidding parameter requirements of Order No. 719.

V. Request for Rehearing

If the Commission intended in the November 19 Order to require the ISO to develop new parameters that would allow Participating Loads to specify a maximum number of times during the day when the ISO can issue dispatch instructions to change the MW levels of those resources, the Commission should

[17] May 15, 2009, NYISO compliance filing in Docket No. ER09-1142 at p. 7.

[18] *New York Independent System Operator, Inc.,* 129 FERC ¶ 61,164 at PP 22, 33-34 (2009)

grant rehearing and modify that directive as inconsistent with the Order No. 719's objective of eliminating barriers to demand response participation in organized energy markets. If so interpreted, the Commission's directive would actually create barriers to Participating Loads providing high-quality ancillary services in the ISO markets.

As explained in the attached declaration of Dr. Abdul-Rahman, under the ISO's new market design, which uses state-of-the-art optimization technology for solving the unit commitment and dispatch processes, the ISO's real-time market software operates in two time frames that are relevant. Dispatches of resources to different MW levels occur every five minutes, as part of the real-time dispatch process, while unit commitment decisions and the procurement of ancillary services occur every 15 minutes.[19] These different time frames are due, in part, to software processing limitations. The ISO software processes that address unit commitment decisions cannot solve every five minutes.

If the ISO were required to allow Participating Loads providing ancillary services to specify the maximum number of times during the day that the ISO can issue dispatch instructions to change the MW levels of those resources, then, in order to satisfy that requirement, the ISO would have to develop a new integer variable constraint and add that constraint into the software it uses to run the ISO markets processes. Such an integer variable constraint would have to consider the limitation of the number of changes in the MW level as a start-up or as a commitment decision. This constraint would create complications for the overall market design and performance.

[19] *See* ISO tariff, Sections 27, 8.3.1.

Introducing this new integer variable constraint into the market software would increase, to significantly longer than five minutes, the amount of time needed to obtain a real-time market solution for Participating Loads providing ancillary services. Adding this constraint to real-time dispatch would be inconsistent with the five-minute dispatch interval of the ISO's real-time market. As a result, it would be impossible for Participating Loads designating a maximum number of times during the day when the ISO can issue dispatch instructions to change the MW levels of those resources to be dispatched pursuant to the five-minute real-time dispatch. This would prevent Participating Loads that designate a maximum number of times during the day when the ISO can issue dispatch instructions to change the MW levels of those resources from meeting the criteria for providing Regulation, the highest-quality ancillary service, which requires an instantaneous response to dispatch instructions. This would also introduce additional complexity to the market design, as it would be necessary to bring the Participating Load resource back to its base load value if either (a) its regulation award were called upon by Automatic Generation Control to provide energy curtailment within the five- minute intervals, or (b) its operating reserves were dispatched below its minimum curtailable level in excess of maximum number of dispatches. Assuming that a Participating Load would eventually want the ISO to return its load to its base level after the need for the ancillary service reserves concluded, the ISO market design would need either to allow an additional dispatch above the specified daily limit, or to forbid the final set of dispatches that bring the Participating Load below its base level, even

though those dispatches are within the daily limit. As explained by Dr. Abdul-Rahman, in theory the ISO could attempt to include a new integer variable constraint to implement a maximum number of MW level dispatches for Participating Loads in the 15-minute real-time unit commitment time horizon. But this could create software performance issues that could hinder the ISO's ability to meet the market time-line within even that 15-minute time frame. If this functionality could not be reliably included in the 15-minute real-time unit commitment time horizon, the ISO would need to develop an approximation that processes such a constraint every 30 minutes or 60 minutes. If this were necessary, Participating Loads designating a maximum number of daily dispatches could only provide ancillary services for capacity that can be dispatched every 30 minutes or every 60 minutes. This would limit these Participating Loads to providing only non-spinning operating reserves, the lowest-quality ancillary service procured in the ISO markets, which have to be able to provide energy from their reserves in 10 minutes.

Although it is possible that the ISO could resolve some of the software performance issues associated with the second possible interpretation of the Commission's directive, doing so would require a significant commitment of time and resources by the ISO. It would also substantially limit the ability of Participating Loads utilizing the maximum dispatch functionality to provide ancillary services. The ISO urges the Commission not to adopt this interpretation of its directives in Order No. 719 and the November 19 Order because such an

interpretation would be inconsistent with the objective of eliminating barriers to demand response participation in organized energy markets.

VI. Conclusion

The ISO respectfully requests that the Commission grant clarification or, in the alternative, rehearing of the November 19 Order consistent with the discussion above.

Respectfully submitted,

/s/ Sean A. Atkins

Nancy Saracino,
General Counsel
Daniel J. Shonkwiler
Assistant General Counsel – Corporate
The California Independent System
Operator Corporation
151 Blue Ravine Road
Folsom, CA 95630
Tel: (916) 351-4400
Fax: (916) 351-4436

Sean A. Atkins
Michael E. Ward
Bradley Miliauskas
Alston & Bird LLP
The Atlantic Building
950 F Street, N.W.
Washington, DC 20004-1404
Tel: (202) 756-3300
Fax: (202) 756-3333

Counsel for the California Independent System Operator Corporation

Dated: December 22, 2009

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

California Independent System Operator Corporation	)	**Docket Nos. ER09-1048-___**
	)	**ER06-615-___**
	)	**and ER06-615-___**

DECLARATION OF KHALED ABDUL-RAHMAN

I, Khaled Abdul-Rahman, hereby provide my declaration in support of the request by the California Independent System Operator Corporation ("ISO") for clarification or, in the alternative, rehearing of the Commission's November 19, 2009 order in this proceeding, 129 FERC ¶ 61,157 ("November 19 Order").

1. I am employed as Principal, Power Systems Technology Architecture & Development for the ISO.

2. I have worked in the electric power system industry for over a decade, focusing primarily on management and software design. Between March 2006 and July 2009, I was employed as the Independent Principal Consultant for Electricity Markets at Siemens Transmission & Distribution, where my responsibilities included supporting Energy Market Management software areas and putting the Security Constrained Unit Commitment and Constrained Dispatch software used in the new ISO market into action. Since July, I have worked for the ISO as the Principal for Power Systems Technology Architecture and Development. I am currently designated as the ISO's Initiative Owner responsible for the successful implementation and deployment of the technical requirements of all Market and Performance projects including among others

the Participating Load Refinements project. My *curriculum vitae* is provided in Appendix 1 to my declaration.

3. I am familiar with the operation of the software that implements the ISO's new market design, which went into effect on March 31, 2009 for the April 1, 2009 Trading Day. I am also actively involved in the development, testing, and integration of the software modifications to implement a number of ISO market enhancements, including enhancements to the ability of Participating Loads to participate in the ISO's new markets.

4. Once the enhancements to the Participating Load program are implemented, Participating Loads that seek to provide ancillary services in the ISO markets will have the ability to designate a large number of operational constraints, which will provide them additional flexibility to participate in the ISO markets. These enhancements will provide Participating Loads with greater flexibility in some respects than a generating resource. These operational constraints are expected to include:

- A minimum load reduction time, which will allow a Participating Load to impose a minimum demand response period;
- A maximum load reduction time, which will limit the demand response duration, after which a Participating Load will be returned to its base load;
- A minimum base load time, which will allow a Participating Load to designate a minimum amount of time when the resource must remain at base load (after returning to it) before the resource can again provide demand response ;

- A maximum number of daily load reductions, which will allow a Participating Load to limit demand response periods in a Trading Day; and
- A load reduction initiation time, which will allow a Participating Load to designate a prior notification time before the resource can enter a demand response period (where the resource schedule is reduced below the resource's base load).

5. In the November 19 Order, the Commission rejected the ISO's initial explanation as to how the ISO will comply with certain provisions of the Commission's Order No. 719 relating to allowing demand response resources to provide ancillary services. The Commission stated that it would require the ISO to give demand response resources providing ancillary services "the ability to specify the maximum number of times that they may be dispatched to a different output level during a day." November 19 Order at P 37.

6. In determining how to apply this statement to the ISO's Participating Load program, I believe there are two possible interpretations of this directive. The first interpretation, which I believe is the interpretation which is most consistent with the Commission's objective of enhancing the ability of demand response resources to participate in ISO markets, is that the ISO is required to allow demand response resources (*i.e.,* Participating Loads) the ability to specify the maximum number of dispatch periods (*i.e.*, periods in which the ISO may dispatch the demand response resources below their base load to at least their minimum curtailment levels) for those resources during a day. If this interpretation is correct, then the ISO's Participating

Load program enhancements will implement additional constraint in its unit commitment function to satisfy the maximum number of dispatch periods for Participating Loads, consistent with the requirements of Order 719 as clarified by the November 19 Order.

7. The second possible interpretation of the explanation in the November 19 Order, which is the interpretation I believe is inconsistent with the Commission's objective of enhancing the ability of demand response resources to participate in ISO markets, is that the ISO is required to allow demand response resources to specify a maximum number of times during the day when the ISO can issue dispatch instructions to change the megawatt (MW) levels of those resources between their minimum and maximum curtailment levels. If this interpretation were to be adopted, it would have extremely problematic consequences both for demand response resources providing ancillary services and for the ISO, for the reasons I will describe.

8. Under the ISO's new market design, the ISO's real-time market software operates in two time frames that are relevant here. Dispatches of resources to different MW levels occur every five minutes, as part of the real-time dispatch ("RTD") process, while unit commitment decisions and the procurement of ancillary services occur every 15 minutes. These different time frames are due, in part, to current state-of-the-art software processing limitations. The ISO software processes that address unit commitment decisions cannot solve every five minutes.

9. If the ISO were to be required to allow Participating Loads providing ancillary services to specify the maximum number of times during the day when the ISO can issue dispatch instructions to change the MW levels of those resources, then, in order to satisfy that requirement, the ISO would have to create a new integer variable constraint and introduce that constraint into the software it uses to run the ISO markets processes. The integer variable constraint would have to consider each change in MW as a start-up or as a commitment decision. This constraint would create complications for the overall market design and performance.

10. Introducing this new integer variable constraint into the market software would increase, to significantly longer than five minutes, the amount of time needed to obtain a real-time market solution for Participating Loads providing ancillary services. Therefore, due to the introduction of the constraint, it would be impossible for such Participating Loads to be dispatched pursuant to the five-minute RTD. This would prevent Participating Loads that designate a maximum number of times during the day when the ISO can issue dispatch instructions to change the MW levels of those resources from meeting the criteria for providing Regulation, the highest-quality ancillary service, which requires an instantaneous response to dispatch instructions. This would also introduce complexity to the market design to bring the Participating Load resource back to its base load value if either (a) its regulation award were called upon by Automatic Generation Control to provide energy curtailment within the five- minute intervals, or (b) its operating reserves were dispatched below its minimum curtailable level in excess of maximum number of dispatches. Assuming that a Participating Load would eventually

want the ISO to return its load to its base level after the need for the ancillary service reserves concluded, the ISO market design would need either to allow an additional dispatch above the specified daily limit, or to forbid the final set of dispatches that bring the Participating Load below its base level, even though those dispatches are within the daily limit.

11. Further, attempting to include a new integer variable constraint to implement a maximum number of MW level dispatches for Participating Loads in the 15-minute real-time unit commitment time horizon could create software performance issues that could potentially hinder the ISO's ability to meet the market time-line within the 15-minute time frame. If this functionality could not be reliably included in the 15-minute real-time unit commitment time horizon, the ISO would need to develop an approximation that processes such a constraint every 30 minutes or 60 minutes. If this were necessary, Participating Loads designating a maximum number of daily dispatches could only provide ancillary services for capacity that can be dispatched every 30 minutes or every 60 minutes. This would limit these Participating Loads to providing only non-spinning operating reserves, the lowest-quality ancillary service procured in the ISO markets.

12. Thus although it is possible that the ISO could resolve some of the software performance issues associated with the second possible interpretation of the Commission's directive, doing so would not only require a significant commitment of time and resources by the ISO but it would also substantially limit the ability of demand

response resources utilizing the maximum dispatch functionality to provide ancillary services.

13. For all these reasons, the Commission should confirm that the ISO will comply with the requirements of Order 719 as clarified by the November 19 Order by providing Participating Loads with the ability to specify the maximum number of dispatch periods (*i.e.*, periods in which the ISO may dispatch the demand response resources below their base load to at least their minimum curtailment levels) for those resources.

I affirm under penalty of perjury that the foregoing statements are true and correct to the best of my knowledge, information, and belief.

K. H. Abdul Rahman

Khaled Abdul-Rahman

Executed this 22d day of December, 2009.

Appendix 1

Dr. KHALED H. ABDUL-RAHMAN
Principal, California ISO
Power Systems Technology Architecture & Development
Tel: 916.802.0026 | Fax: 916.351.2487 | E-mail: *kabdul@caiso.com*
151 Blue Ravine Rd., Folsom, CA 95630

Summary
Dr. Khaled Abdul-Rahman offers high caliber consulting services developed over 15 years experience in a variety of applications related to Electricity Markets Design, software implementation, Testing, and on-line deployment. Dr. Abdul-Rahman's deep knowledge of the electrical power industry restructuring coupled with his advanced technical and analytical skills, information technology experience, and his management and personal skills make him a perfect fit to assume key roles in projects related to various aspects of the electric power system industry.

Dr. Abdul-Rahman has been closely involved with various different types of entities in this industry including academic institutions, vertical electric utilities, independent system operators, power systems software vendors, Database vendor, and consulting firms. Specifically, Dr. Abdul-Rahman career involves working on projects at:

- California Independent System Operator (CAISO): Non-profit Transmission Grid Operator and Electricity Markets Facilitator
- Siemens Energy: Major EMS and Electricity Market Systems vendor for ISOs and electric Utilities in the area of energy management and automation.
- Energy Consulting Company, International: A recognized International Consulting firm in the area of Power Systems and Electricity Markets design, operations, and market performance evaluations.
- Alliance Regional Transmission Operator (ARTO): For-Profit Transmission Grid Operator
- Illinois Power Company: Electric Utility
- Florida Power and Light: Electric Utility
- Siemens, ABB, and ESCA: Recognized major vendors for Energy Management Systems, and integrated Electricity Markets software in the US and abroad.
- Open Access Technology International: Major vendor for Tagging & Scheduling, OASIS, Portfolio management software
- Oracle Corporation: Major vendor for Database and Information Managment software
- Sargent & Lundy Engineers: A recognized International Consulting Firm in the area of nuclear and coal power plant stations design.
- Illinois Institute of Technology (IIT): A recognized International Academic and Research Institution.

PROFESSIONAL EXPERIENCE

Leadership Experience and Major Achievements:

California Independent System Operator (CAISO) (July 2009 – Present)- **Principal**, **Power Systems Technology Architecture & Development**

Responsibility includes working closely with various Internal CAISO groups including Project Management Office, Market Infrastructure & Development, Market Operations, Grid Operations, and Legal and Tariff groups, as well as external entities such as Market Participants and software vendors. Current Responsibilities include:

- Develop business requirements, detailed software design, software implementation, testing, and deployment plans for the following projects:
    - **Virtual Convergence Bidding in Day-Ahead Market**: bid volume limits, AC power flow issues, market power mitigation, reliability must-run issues, software testing, and market simulations plans.
    - **Scarcity Pricing**: Ancillary Services Marginal Price under AS scarcity situations.
- **Strategy Framework Project**: Core Team member to develop a detailed strategy plan and roadmap for CAISO for the next 5 to 10 years to cope with industry changes related to increased integration of renewable resources, advances in smart grid technologies, and other environmental and policy drivers.
- **CAISO Training Academy**: Instructor for power system analysis and market optimization training classes for CAISO employees.

Siemens Transmission & Distribution – Energy Management & Automation Division, (March 2006 – July 2009)**, Independent Principal Consultant – Electricity Markets**

Responsibilities include: Provide Functional Definition and Business Requirement support in the Energy Market Management software areas; Accomplish design and implementation tasks within the Security Constrained Unit Commitment and Constrained Dispatch software; Provide application support and functional expertise on Siemens' customer sites; Assist Siemens's customers with application testing activities; Provide Analysis of complex analytical scenarios based on implemented market design rules; Provide Business knowledge and recommendation for the integration of market system with other customer's legacy systems; Provide on-site support for cutover, and Go-Live activities.

Energy Consulting Company International (ECCO), (Mar 2001 – Feb 2006), **Independent Electricity Markets & Power Systems Managing Principal Consultant**

California ISO (July 2002 – Jan 2006)- *Subcontractor for ECCO:*

Assisting California ISO in its effort in re-designing all market applications including Full Network Modeling of the CAISO system, Integrated Forward Market, and Real-Time Nodal LMP market. This Market Re-design Technology Upgrade (MRTU) project involves switching from zonal pricing to a full network model, and Locational-Marginal Pricing (LMP) on the nodal level. This effort involves:

- CAISO Test Team Lead for managing the daily Testing of ***Siemens*** Forward and Real-Time Markets software including the following functions: Market Power Mitigation (MPM), Integrated Day-ahead forward Market, Reliability Unit Commitment (RUC), Integrated

Hour-Ahead Process, Real-time Pre-Dispatch, Interval Dispatch, Contingency Dispatch, Manual Dispatch, and Very-Short-Term-Load-Prediction (VSTLP). The software involves state-of-the-art modeling for complicated features such as dynamic ramp rates as a function of resources' MW, prohibited regions, network constraints with AC power flow, nomograms, co-optimization of energy and A/S services, as well as the use of the Common Information Model (CIM) and additional extensions for network and market data representations. The Siemens' software is based on the ILOG-CPLEX optimization library to solve the mixed integer programs of the different markets.

- Assist in the requirements definition, software design, and managed the daily software testing of the Integrated Forward Market and the Real-Time markets including the co-optimization of energy and ancillary services, Market Power Mitigation (MPM), and Reliability Unit Commitment (RUC) applications.
- Member of the Congestion Revenue Rights (CRR) implementation Team.
- Assist in resolving modeling issues related to the use of full AC network model inside California ISO control area.
- Assist in identifying criteria, and resolving issues related to CAISO State Estimator (SE) which is used as a feed to the RTN market.
- Assist in writing functional requirements for the forward markets Request For Proposal (RFP).
- Assist in the screening, evaluation, and selection process of the market software vendor.
- Member of the forward markets Content Team to assess the technical capabilities/shortcomings of the different candidate vendors.
- Assist in the unit commitment data collection and results analysis of the CAISO Forward Market Proof-of-Concept (POC) project using ***Siemens***'s Security Constrained Unit commitment (SCUC) software package.
- Member of the CAISO Real-Time market application validation and Testing Team to perform Factory Acceptance Test for the ***ABB***'s Real-Time software package. This effort involved testing SCED optimization engine, testing SCUC optimization engine, testing out-of-market sequence (OOS).
- Member of a CAISO team for utilizing ***ABB***'s transmission constrained unit commitment software to assist Grid Operators issue the waiver denial instructions for must-offer resources.

Cap Gemini Ernst & Young (CGEY) (Mar 2001 – Dec 2001),)- *Subcontractor for ECCO*
Member of the Cap Gemini Ernst & Young Project Management Office for the Alliance Regional Transmission Organization (RTO) in the area of Market Operation Applications to coordinate between the different software vendors.

- Lead software Tester for the **Alliance RTO** Imbalance Energy Market software including testing and verifying the market user interface for portfolio definitions and bids submission, interfaces to load forecast, tagging &scheduling, loss calculator, real time data, security coordinator, NERC IDC, optimal market dispatch of bids, and imbalance charge calculations under both pay-as-bid and pay-as-MCP pricing mechanism.
- Training of the Alliance RTO Imbalance Energy Market Coordinator personal to review and confirm imbalance bids from generation suppliers, watch for abnormalities in quantity or

pricing curves, analyze changing internal load trends taking into consideration season, time of day and weather changes.
- Technical lead for the Alliance RTO data conversion activities including Service Points, Paths, Flowgates, and OASIS Users information.
- Technical lead for the conversion of the metadata describing Alliance RTO real-time data points from the Inter-regional Security Network (ISN) format to *Siemens* Inter-Control-Center-Protocol (ICCP) XML format
- Developed Technical Training material about the Alliance RTO in the areas of OASIS, Tagging & Scheduling, Imbalance Engine, Security Coordinator, and general overview if the electric energy deregulation and the different industry models.
- Member of the Alliance RTO Technical Team. Participated in the definition requirement, design and business processes of the real time Imbalance Energy Market based on Locational Marginal Pricing (LMP) with provisions to settle as pay-as-bid or pay-as-market-clearing-price.

ECCO International, (Mar 2001 – Present), **Independent Electricity Markets & Power Systems Managing Principal Consultant**
- Provide consulting services in areas related to the de-regulated electricity market including generating reports summarizing the strengths and drawbacks of PJM electricity market and a comparison of *PJM, New York ISO, ISO New England* and *ERCOT* electricity markets. (*Direct Time & Material Contract*)
- Assist in writing an *EPRI* Research Report on "Integrated Engineering and Economic Operation of Power Systems" (*Direct Time & Material Contract*)

Illinois Power Company (subsidiary of Dynegy), (Jan 2002 – July 2002), **Independent Power Systems Principal Consultant**
- Technical Project Lead for developing Illinois Power (IP)'s real time Network Model to run network topology, state estimator, power flow and contingency ranking & analysis using PTI's PSS/O API calls to an Oracle Database Implementation of the power system Common Information Model (CIM). The developed tool assists IP's control center operators study their power system behavior, evaluate switching conditions, check any system configuration for operating problems, and help operate the system in an economical and secure manner. (*Direct Time & Material Contract*)

Open Access Technology International (OATI), Inc., (Feb 2002 – June 2002), **Independent Power Systems Principal Consultant**
Project Manager and software Lead Developer for OATI's Automated Decision Support tool for Bidding (ADSB) software. The project involves database integration, User interface development and algorithm enhancements to the ADSB software. The ADSB software identifies optimal bidding strategies for energy, spinning and non-spinning reserves markets. ADSB uses market information together with information on the generating units, fuel costs, O&M, bilateral agreements, and other positions to help generate optimal bidding strategies for energy, spinning, and non-spinning reserves markets. (*Direct Fixed Cost Contract*)

Oracle Corporation, Oracle Consulting for Electric Utilities, (Nov 1998 – Feb 2001), **Managing Principal Consultant**

- Technical Lead for a discovery phase team to put together a technical architecture plan and proposal for the migration of AT&T Global Operation accounting legacy system to Oracle Technology.
- Technical lead for proposing Oracle On-line Marketing package to *SBC* (Ameritech).
- Functional Team Lead for the utility billing requirements for *ORCOM* (Denver, CO - Scottsbluff, NE - Bend, OR). This is part of a discovery phase for the implementation of a complete Oracle solution for Customer Information System (CIS), Customer Relationship Management (CRM), ERP and Data Warehouse portal. ORCOM is an Application Service Provider (ASP) for CIS and CRM applications to customers ranging from energy service providers (ESP) to utility distribution companies (UDC).
- Provided functional expertise to *BC Hydro Grid Operation Group*, Vancouver, Canada, in the area of Transmission and Energy Scheduling under a joint effort with *ALSTOM ESCA*. This effort included definition of functional requirement and process flows for curtailment, buy-at-market, alternate POR/POD, firm, non-firm and secondary transmission reservations and ATC calculations and updates to OASIS among other things.
- Provided preliminary technical architecture design and functional requirements for the ISO/PXs CIO Council in North America. The Council consists of all Independent System Operators and Power Exchanges in North America.
- Technical Lead for the assessment of the *California ISO* internal Data Warehouse development Project, Sacramento, CA, including gathering information about the processes and data flows between the various market functions and operational systems.
- Project Lead for the *Nevada Power Services* (NPS) Project, Las Vegas, NV, for the integration of NPS 3rd party systems (Lodestar, Banner, Proform and Energy Trading applications) and design of data storage and user interface requirements
- Project Manager and Functional Lead for the Electric Power Research Institute (EPRI) Project, Palo Alto, CA to integrate its Topology Processor application to Oracle-based Common Information Model (CIM) database via Control Center Application Program Interface (CCAPI)
- Representing the US power industry in an Oracle Global Energy Team to identify future software requirements and products needed for Energy Trading. This effort involved studying the needs of different energy markets in US, and Europe. Meetings were conducted in the US, Canada, England, France, and Sweden with various vendors in this area.
- Representing Oracle in the Control Center Application Interface (CCAPI) Committee of the Electric Power Research Institute (*EPRI*) Common Data Access Task Force in 1999.

Siemens Power Systems Control, (Nov 1994 – Mar 1998), **Software Applications Lead Engineer**

- Technical Team lead for the development of Resource Scheduling and Bid Evaluation software for *Siemens*; a major Energy Management Systems (EMS) vendor in the power systems industry.
- Technical lead for the design phase of the PJM Unit Commitment program and its interface with the Generation Database (GDB).

- Responsible for Identifying new models and solution algorithms for linear and nonlinear optimization problems with various constraints such as fuel, emission, transmission network and comprehensive transactions models.
- Technical lead for the Oracle-based Florida Power and Light (FPL) Unit Commitment project. This effort involved data migration from the Cyber system to Oracle DB on Unix, and migration of displays and interfaces from FPL legacy systems.
- Technical Lead in the area of Unit Commitment for Al-Salvador and Israel Energy Management Systems.

Energy Management Systems (EMS) Software Development Experience:

Siemens Power Systems Control, (Nov 1994 – Mar 1998)

- Developed a prototype for a Price Based Unit Commitment with generation and demands bids.
- Developed and integrated a Security Constrained Unit Commitment base product for Siemens Power Systems Control. The software is based on the augmented Lagrange relaxation optimization technique and considers physical unit constraints as well as system operating constraints such as demand, reserve and network transmission constraints. The software used Oracle as its relational database and ORACLE Forms as the user input/output interface. This software product is operational at many national and international Energy Management Control Centers.
- Implemented the first distributed computing approach for unit commitment using parallel virtual machines (PVM) software.
- Developed a very specialized approach and solution technique for Short/Mid-Term Unit Commitment incorporating fuel allocation, transmission line flow limits, and area generation protection constraints for a major power utility.
- Coded and tested Interface software between SCADA and EMS functions for Siemens Power Systems Control.
- Developed active and reactive power optimization packages for power systems operation.

Power Systems Analytical Studies:

Sargent & Lundy Engineers, Sr. Electrical Analytical Engineer, (April 1998 – Oct 1998)

- Performed transmission system interconnection and impact studies due to planned capacity addition and/or re-powering of generation plants
- Performed Transient analysis and Short circuit fault current calculations for a nuclear power station in Wisconsin, USA.
- Developed and tested a Mathcad calculation shell program for the Ampacity of wrapped cable trays for a nuclear power station in mid-Illinois, USA.

Illinois Institute of Technology (IIT), Lecturer and Sr. Researcher, (Jan. 1994 – Oct.1994)

- Developed an artificial intelligence approach utilizing fuzzy set theory, neural networks and expert system to solve the reactive power optimization problem.

- Co-Principal investigator for studying the effects of regional power transfers and open transmission access on real-time power system control (the first US Department of Energy sponsored project in this area).

Marketing and Sales Technical Support Experience:

- I have the sole responsibility for marketing and selling my consulting services as an independent Consultant to various electric utilities, RTOs/ISOs, power systems software vendors, and other energy consulting companies (2001-Present).
- Technical Lead for a Discovery Phase Team to put together a technical architecture plan and proposal for the migration of AT&T Global Operation accounting legacy system to Oracle Technology (2000).
- Technical lead for proposing Oracle On-line Marketing package to SBC (2001).
- Prepared various proposals for Electric Utilities, Energy Trading companies, Independent System Operators (ISO), and the Electric Power Research Institute (EPRI) (1998 –2001).
- Helping Oracle Sales Force understand the electric industry business and practices and support them to gain customers' trust in Oracle's understanding of the electric business requirements (1999-2001).
- Providing technical support for Oracle Marketing and Sale in the area of data warehousing and Oracle decision support tools (Reports, Discoverer, Express) for the electric power industry (1999-2001).
- Contributed to various proposals for many investors and electric utilities in different areas of power systems transmission and generation (1999-2000).
- Prepared and presented thermal Unit Commitment demos to various potential customers and responded to their technical questions and concerns in the area of short-term scheduling (1994-1998).
- Conducted training sessions on thermal Unit Commitment (1996-1997).

TECHNICAL PROFICIENCIES

Power System Industry:

- **Deregulation**: Integrated Forward markets, and Real time electricity markets for ISOs, Bidding Evaluation for Gencos, future market clearing price, location evaluation for new generators and their impact on the inter-regional power transfers, Power Trading and Marketing, Energy Risk Management, ISO and Power Exchange operations, Transmission Reservation and OASIS application, NERC E-Tagging system, Transaction Scheduling system, Imbalance Energy application, Transmission Congestion Management and Pricing.
- **Base Power Applications**: AGC, economic dispatch, reserve monitoring
- **Transmission Network Applications**: power flow, optimal power flow, reactive power optimization, transmission impact studies for new generation and re-powering, real-time network modeling, state estimator, contingency analysis

- **Generation Scheduling Applications**: Unit Commitment, Load Forecast, Hydro-Thermal Coordination, Transmission Security Constrained and Co-optimization of energy and AS services.
- **System Analysis**: transient Analysis, short circuit current calculations

Technology

- **Software, Tools & Languages**: Oracle Developer 2000+ including Oracle Forms, Reports and Graphics; Oracle Discoverer, Oracle Express, Oracle Designer, Data warehouse AppsBuilder, Matlab, Mathcad, Fortran 90, Pro*Fortran, C, Pro*C, C++, PL/SQL, JAVA, Oracle Jdeveloper, DHTML
- **Database Experience:** Oracle Database Administration for Oracle 7.x, Oracle 8i, Develop Database Applications with JAVA, MS SQL 2000.
- **Operating Systems**: VAX/VMS, UNIX, Windows NT, 2000, XP.
- **Oracle Application Server**: Develop Database applications with JAVA, Develop Web-based Applications with JAVA
- **System Architecture Design:** Client/Server, Network Computing, Message Oriented Middleware (MOM) Technology and Oracle Advanced Queuing

ACADEMIC ACHIEVEMENTS

Ph.D. in Electrical Engineering, Illinois Institute of Technology, Chicago, Illinois, December 1993
Thesis: ***Application of Fuzzy Sets to Power Systems Operation and Planning***

M.Sc. in Electrical Engineering, Kuwait University, Kuwait, June 1990
Thesis: ***Abnormal Transients in Power Transformers***

B.Sc. in Electrical and Computer Engineering, Kuwait University, Kuwait, June 1986
Project: ***Series Compensation of Overhead Transmission Lines***.

Adjunct Professor, (Jan 1999 – June 2002)
Electrical and Computer Engineering Department at Illinois Institute of Technology (**IIT**), Chicago, IL:

- Teaching courses on electric utility restructuring and the challenges of power systems operation and planning in the new deregulation marketplace.

Teaching Experience:
Taught the following courses at Illinois Institute of Technology (**IIT**), Chicago, IL:

- Electric Machinery (ECE Undergraduate course at IIT, 1994,1999)
- Advanced Methods in Power Systems (ECE Graduate & Undergraduate course at IIT, 1999)
- Deregulation of the Electric Utility Industry (ECE Graduate course at IIT, 2000)
- Power Systems Planning in Regulated and Deregulated Environment (ECE Graduate course at IIT, 2001)

PUBLICATIONS

Refereed Journals:

- "A Fuzzy-Based Optimal Reactive Power Control," ***IEEE Transactions on Power Systems***, Vol. 8, No. 2, pp. 662-670, May 1993 (*principal author*)
- "Reactive Power Optimization Using Fuzzy Load Representation," ***IEEE Transactions on Power Systems***, Vol. 9, No. 2, pp. 898-905, May 1994 (*principal author*)
- "Application of Fuzzy Sets to Optimal Reactive Power Planning with Security Constraints," in **Proceedings of the IEEE 1993 Power Industry Computer Application** (**PICA**) Conference, pp. 124-130, Scottsdale, AZ, May 1993, Also in the ***IEEE Transactions on Power Systems***, Vol. 9, No. 2, pp. 589-597, May 1994 (*principal author*)
- "Static Security in Power System Operation with Fuzzy Real Load Conditions," ***IEEE Transactions on Power Systems***, Vol. 10, No, 1, pp. 77-87, Feb. 1995 (*principal author*)
- "AI Approach to Optimal Var Control with Fuzzy Reactive Loads," ***IEEE Transactions on Power Systems***, Vol. 10, No. 1, pp. 88-97, Feb. 1995 (*principal author*)
- "Effect of EMF on Minimum Cost Power Transmission," in Proceedings of the IEEE Transmission & Distribution (**T&D**) Conference, pp. 627-633, Chicago, IL, April 1994, Also in the ***IEEE Transactions on Power Systems***, Vol. 10, No. 1, pp. 347-355, Feb. 1995 (*principal author*)
- "A Practical Resource Scheduling with OPF Constraints," in **Proceedings of the IEEE 1995 Power Industry Computer Applications** (**PICA**) Conference, pp. 92-97, Salt Lake City, Utah, May 1995, Also in the ***IEEE Transactions on Power Systems,*** Vol. 11, No. 1, pp. 254-259, Feb. 1996 (*principal author*)
- "Spot Pricing of Capacities for Generation and Transmission of Reserve in an Extended Poolco Model," Accepted for Publications in the ***IEEE Transactions on Power Systems,*** 1997 Winter Meeting (co-author)
- "Short Term Generation Scheduling in Photovoltaic-Utility Grid with Battery Storage", in **Proceedings of the IEEE 1997 Power Industry Computer Applications** (**PICA**) Conference, Columbus, OH, Also to appear in the ***IEEE Transactions on Power Systems*** (co-author)
- "Use of Simulators in Testing New Electricity Markets", in **IEEE PES 2009 Proceedings**, Calgary, Alberta, Canada (co-author)

Proceedings of Refereed Conferences:

- "Optimal Reactive Power Dispatch with Fuzzy Variables," in Proceedings of the **IEEE 1993 International Symposium on Circuits and Systems** (**ISCS**), pp. 2188-2191, Chicago, IL, May 1993 (*principal author*)
- "Application of Artificial Intelligence to Optimal Var Control in Electric Power Systems," in **Proceedings of Expert System Applications for the Electric Power Industry Conference**, Phoenix, AZ, December 1993 (*principal author)*
- "On the Exact Computation of Some Typical Transient and Dynamic Phenomena in Power Networks Including Steel-Core Transformers," in **Proceedings of the IEEE Industrial & Commercial Power Systems Conference** (**ICPS**), pp. 61-69, Irvine, CA, May 1994 (*principal author*)

- "Application of Distributed Computing for Resource Scheduling," in **Proceedings of the 1996 American Power Conference** (**APC**), pp. 1284-1289, Chicago, IL., April 1996 (*principal author*)

Others:

- "An Augmented Short Term Generation Scheduling in a Constrained Power Network", Presented in response to invitation from the **Advanced Operation Methods Subcommittee of the Power System Committee,** IEEE PES 1997 Winter Meeting, New York, NY, Feb. 1997 (*principal author*)

Research Projects Completed:

- Develop Energy and Ancillary Services Bidding Strategies for GENCOs in Deregulated Power Markets
- Data Warehouse and Decision Support Tools Requirement for the Operation of Independent System Operators (ISOs).
- Business Requirements for Transmission Providers in the Area of Transmission and Energy Scheduling
- API Development for the Integration of the Electric Power Research Institute (EPRI) Topology Processing Application to the Common Information Model (CIM) based Oracle Database.
- Detailed Functional Requirements for Energy Trading in USA and EMEA.
- Price Based Unit Commitment with generation and demand bids
- Effect of Generation and Transmission of Reserve on Spot Prices
- Unit commitment in a Distributed Environment
- Incorporation of the Network Constraints in Unit Commitment
- Unit Commitment Study With Ramping Constraints for Common Wealth Edison Company (ComEd)
- Optimal Power Flow With Electro-Magnetic Fields Constraints
- Application of Fuzzy Sets to Power Systems Operation and Planning
- Applications of Neural Networks and Expert Systems to Optimal VAR Control with Fuzzy Reactive Loads
- Abnormal Transients in Power Transformers

Seminars Attended:

- IEEE 1993 International Symposium on Circuits and Systems (ISCS), Chicago, IL, May 1993
- IEEE/PES Winter Meeting, New York, New York, Jan/Feb 1994
- IEEE Transmission & Distribution (T&D) Conference, Chicago, IL, April, 1994
- American Power Conference (APC), Chicago, IL, April 1996
- IEEE Advanced Operation Methods Subcommittee Meeting**,** IEEE/PES 1997 Winter Meeting, New York, NY, Feb. 1997
- IEEE 1997 PICA Conference, Columbus, OH, 1997
- IEEE 1999 PICA Conference, Santa Clara, CA, May 1999
- NERC TagMart Conference, Dallas, TX, Feb 1999
- EPRI CCAPI Workshop, Las Vegas, NV, Mar 1999

- EPRI CCAPI Workshop, San Francisco, CA, June 1999
- NERC Common Power System Modeling III Meeting, Chicago, IL., Oct 1999
- Power Marketing 2000 Conference, Arlington, VA, Nov 1999
- Johnson Control Company Meeting, Milwaukee, WI, Dec 1999
- ISO's CIO Council Meeting, Indianapolis, IN, May 2000
- Congestion Forecasting & Pricing Conference, Chicago, IL, Jun 2000

Participation in Thesis Committees:

- Ph.D. Thesis Committee, "Transmission and Generation Maintenance Scheduling with Different Time Scales in Power Systems" by M.K.C. Marwali, Illinois Institute of Technology, Chicago, IL 1998.
- Ph.D. Thesis Committee, "Decomposition Approach to Unit Commitment with Reactive Power Constraints" by H. Ma, Illinois Institute of Technology, Chicago, IL 1999.

CERTIFICATE OF SERVICE

I hereby certify that I have served the foregoing document upon the parties listed on the official service lists in the captioned proceedings, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated at Washington, D.C. this 22d day of December, 2009.

/s/ Sean A. Atkins

Sean A. Atkins
Alston & Bird LLP