UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

California Independent System Operator ) Docket No. ER06-___-000
Corporation )

PREPARED DIRECT TESTIMONY
OF
BRIAN RAHMAN
Q Please state your name, position, and business address.

A My name is Brian Rahman. I am the Program Manager for the Market Redesign and Technology Upgrade (“MRTU”) project at the California Independent System Operator Corporation (“CAISO”). My business address is 151 Blue Ravine Road, Folsom, California 95630.

Q Please describe your professional background.

A I have over fourteen years experience in evaluating, planning, coordinating, and managing electric systems, projects and markets. I have been with the CAISO since before it began operations, and my responsibilities throughout that time have included software design and development. I have worked on MRTU since 2002 and assumed my present position in July 2005. My resume is attached as Appendix 1.

Q What is the purpose of your testimony?

A I am testifying regarding the status of the development of the software required to implement the policy decisions incorporated in “Release 1” of MRTU and the impact on the implementation date of MRTU that could occur if any significant policy decisions are modified. I will also testify regarding the plans and schedule for the development of Business Practice Manuals that are intended to provide implementation detail and additional information consistent with the MRTU tariff.
Q Please summarize your conclusions.

A After undertaking a review to determine whether any discrepancies exist between the MRTU tariff language and policy decisions, on the one hand, and the status of software development, on the other hand, the CAISO has concluded that certain adjustments in software development must occur to reflect policy decisions that are fundamental to Release 1 of MRTU. The changes in software to be consistent with policy, together with an earlier reevaluation of the MRTU schedule, have caused the CAISO to revise the implementation date for MRTU Release 1 to November 2007. It is critical for the Commission and stakeholders to understand that the delay in implementation of Release 1 of MRTU does not create any opportunity to expand the scope of Release 1. Moreover, the November 2007 date is only achievable if there are no other significant changes to the components included in Release 1.

Q For background purposes, please describe the software development process for projects such as MRTU.

A The software development and implementation process comprises seven major steps that begin with the preparation of the package for the vendor. It involves development of the software, testing, and integration. The seven steps are (1) the documentation of software requirements; (2) vendor design and coding of software; (3) factory acceptance test; (4) site acceptance test; (5) integration testing; (6) market test; (7) production release. It is important to recognize that these steps only commence after the project sponsor has made the necessary
policy decisions and determined the nature of the necessary software. In the case of MRTU, of course, that process has involved years of effort.

Part of that process has included dividing MRTU into Release 1 and Release 2. In some cases, as I will discuss later, components were included in Release 2 for schedule reasons. For the most part, however, Release 1 reflects those components of MRTU that need to be put in place and tested in the real world markets to ensure that they are working properly and efficiently before the refinements of Release 2 are added.

**Q** What is the importance of this software development and implementation process to projects such as MRTU?

**A** In an ideal world, one would finalize all policy decisions before beginning software development. In projects such as MRTU, however, in order to minimize the overall project schedule, policy decisions and software development often must proceed on parallel tracks. As should be apparent from the length of time involved, software development is usually, if not always, on the critical path for market modifications, and particularly so for a major market redesign such as MRTU. The impact on the overall project schedule of new policy decisions is thus largely driven by the impact of these changes on the software development and implementation process. A change to even one component of the MRTU market design may have a very significant impact on the overall project schedule.
Q What is the current status of the development of MRTU software?

A Two of the three original vendor software packages (the Market and Bidding System-Siemens and the Congestion Revenue Rights) are in the Site Acceptance Test step of program implementation. The internally developed systems are all in the final stages prior to system integration. As I will describe below, however, the need to accommodate the reconciliation of inconsistencies between the software and policy decisions into these packages will delay the progress of the software development through the final steps of development.

Q You mentioned that policy decisions and software development proceed on parallel tracks. Could you describe the recent policy work on MRTU?

A On May 13, 2005, the CAISO made a conceptual filing with the Commission on MRTU, addressing a number of issues and incorporating the work of the CAISO’s consultants, the Law and Economic Consulting Group. The CAISO conducted a two-day stakeholder meeting the following week, and a three-day stakeholder meeting in June. The Commission issued a guidance order regarding the CAISO’s filing on July 1, 2005, which affected a number of policy issues.

The CAISO held eight additional days of stakeholder meetings in July and August to resolve outstanding MRTU issues and respond to comments regarding proposed MRTU tariff language. On September 19, 2005, the Commission issued an order on rehearing regarding the CAISO’s May 13 filing, providing additional guidance. Two additional days of stakeholder meetings occurred in the beginning of October.
At its October meeting, the CAISO Board of Governors approved a number of management proposals regarding MRTU policy that had been developed based on stakeholder input and Commission guidance.

In October, November and December, the CAISO held fifteen days of meetings to review the proposed MRTU tariff language with stakeholders.

Q How did this policy work affect the software development and implementation process?

A After the CAISO’s internal reorganization, during which I assumed my current position, we initiated a complete status review of MRTU, reevaluating the logical scheduling progression and determining the critical path. It became apparent at that time that the then-projected February 2007 implementation date was not achievable. Eliminating all contingencies, we thought that implementation in late Spring 2007 remained a responsible goal.

Next, following the public review of the MRTU tariff language, and as a result of this continued refinement of MRTU, the CAISO undertook a review to reconcile the status of software development with tariff and policy decisions, including the additional policy decisions that had already been implemented in response to the Commission and stakeholders. The purpose of the review was first to identify discrepancies between the software development and the then-existing tariff and policy decisions; it did not evaluate the addition of new components to Release 1. Except with regard to minor discrepancies that could be addressed by tariff adjustments, the review then served to identify those capabilities that needed to be included in Release 1 despite the need to modify the
software to include these capabilities – the “must have” requirements – and those
to all critical components of Release 1, but to those capabilities that were not
consistent with the status of software development and which the CAISO
concluded could not be delayed until Release 2.

What criteria did the CAISO use to identify “must have” requirements?

A requirement was considered “must have” if (1) its functionality was necessary
to resolve a critical defect in MRTU’s mechanisms for ensuring reliability; (2) its
functionality was necessary to resolve a critical defect in the markets established
in MRTU; or (3) Market Participants had insisted on the inclusion of the
component and the CAISO agreed to include the component.

What “must have” requirements did the CAISO identify?
The CAISO identified eleven areas in which the software needed to be modified
in Release 1:

(1) Revisions necessary to eliminate the potential for improper mitigation of
resources used to resolve non-competitive constraints;

(2) Applications to support the use of a conduct test for all resources in a
Designated Constraint area in case the CAISO needs to modify the mitigation
approach from a PJM-style mitigation to a NYISO-style mitigation;

(3) Incorporation of capability to model adjacent and embedded Control
Areas properly in order to prevent infeasible Integrated Forward Market (“IFM”)
solutions because of inaccurate modeling;
(4) Software to fulfill the CAISO’s commitment to stakeholders to support partial Resource Adequacy resources;
(5) Additional validation rules for Existing Contract and Transmission Owner Rights schedules to ensure consistency with Existing Contracts and Transmission Ownership Rights;
(6) Rules to eliminate problems with the IFM when supply resources submit infeasible schedules;
(7) Functionality to implement settlement on “sellers choice” bilateral Energy contracts;
(8) Software to implement the policy regarding the calculation of Trading Hub Prices in the IMF and Real-Time Market that was adopted by the CAISO Board;
(9) Additional rules for the Scheduling Infrastructure Business Rules to ensure the feasibility of the optimization solution;
(10) Modifications to implement Metered Subsystem Requirements, such as Load-following; and
(11) Verification that the Pumped Storage Data Model will perform as required.

Q **How has the inclusion of the “must have” requirements affected the software development?**

A The vendors will have to resume development at the factory and integrate the new software with the software that has been developed. The changes will require additional testing, integration work, and training across the program. It bears
repeating that these changes were necessary to bring software closer to policy
because we discovered that the lower level detail implementation of software was
not consistent with the overall policy.

Q Have you estimated the impact on the schedule?
A Yes. The CAISO has concluded that, because of the necessary software
development, late Spring 2007 is no longer a reasonable goal for implementing
MRTU. The CAISO has thus revised the implementation date of MRTU to
November 2007.

Q How would major steps of software development apply to substantive
additions or modifications to the planned scope of the MRTU Release 1
project?
A The duration of each of the steps depends on the magnitude of the software
package. At this stage of Release 1, our concern is the impact of additions or
modifications to the original packages. In describing the seven steps, therefore, I
will discuss the time involved for additions or modifications to the software
packages.

As I noted, Step 1 of the software development process involves the
documentation by the project sponsor of the requirements for the software. This
process, which generally takes six to eight weeks, is necessary for dealing with
the vendor and for addressing program impacts.
In Step 2, the vendor designs and codes the software at its development location. Although the duration will vary according to the magnitude of the changes to existing software, this phase usually lasts 16 to 24 weeks.

Step 3 is the Factory Acceptance Test, in which the vendor tests the software at its development location. This includes full impact regression testing (which requires repeating a significant number of tests) to insure software integrity, that is, the ability of the various components of the software to work together without interference. These tests consume another 16 to 24 weeks.

The software is then tested onsite in Step 4, the Site Acceptance Test, to ensure the integrity of the software and the customer environment. Such testing lasts six to ten weeks.

The last three steps involve system integration, combining the various software packages that will be implemented together. Step 5, which lasts 10 to 16 weeks, is Integration Testing, in which the packages are assembled into the final product, in this case for the MRTU Release.

In Step 6, the software undergoes an eight to twelve week Market Trial. The software is made available for trial use by market participants. Market output is generated and mock billing statements are generated.

Finally, the software is deployed to trained personnel and Market Participants over a four to eight week period in Step 7, Production Release. At the end of this step, the software may be put into operation.
Q Inasmuch as you are stating that implementation must be delayed anyway, can you now include additional components in Release 1?

A Not without even further delay. All schedule contingencies had been consumed prior to the addition of the “must have” requirements, and the November 2007 date includes no additional time for contingencies. For example, as discussed below, implementation of virtual bids could require an additional 12-months on top of the revised implementation date of November 2007.

Q Could you provide examples of how a market design change could affect the overall project schedule?

A Yes. The estimated delay, for example, of the development of the software for the bid submission and settlement system that would be caused by a decision to implement submission of virtual bids in Release 1 could be an additional 12 months on top of the revised implementation date of November 2007. Such a change would modify all downstream data stores as well as the integration of all major systems. It would require significant testing, market trials, and training to insure proper implementation. Significant training for Market Participants would be required as well.

Q Can you provide an additional example?

A Yes. The CAISO originally proposed to base the Day-Ahead market power mitigation run on forecasted Load as opposed to bid-in Load. In its July 1, 2005 Market Design Order, the Commission approved the CAISO’s market power mitigation proposal, which included this approach. However, in response to a
rehearing request, the Commission reversed course and directed the CAISO to
base the Day-Ahead LMPM procedures on bid-in Load. The CAISO requested
rehearing of this issue.

As discussed in the CAISO’s rehearing request, the CAISO cannot
incorporate this change into MRTU Release 1 without substantially delaying
MRTU implementation. This change affects the foundational database of the
MRTU market systems and alters the objective function of the Market Power
Mitigation and Reliability Resource Determination runs of the market prior to the
IFM. The CAISO has begun considering possible software changes to implement
this market design change and has discussed the matter with its software vendor,
but has not discussed these options with stakeholders. One potential solution
would be to move Reliability Resource Determination pre-Dispatch identification
out of the pre-IFM market power mitigation and reliability determination process
and into the Residual Unit Commitment process, thereby allowing the mitigation
and reliability determination to be based on bid-in Load. This option would
require multiple changes to the existing market software as well as development
of an additional pass in the Residual Unit Commitment process whereby
competitive transmission constraints would first be applied in the Residual Unit
Commitment, followed by all transmission constraints, in order to identify which
Residual Unit Commitment “dispatches” were required for local reliability.
Implementation of this change would require changes in all parts of the software
development cycle. This change would require additional time and resources to
be allocated for testing, training and market trials. Vendor estimates of the impact
of this change on the overall MRTU project schedule are between 10 and 14 months.

Q Besides significant policy changes, are there other factors that could affect the critical path?

A Yes. The timing of the Commission’s order on the MRTU filing could also affect implementation. As I have discussed, any significant policy changes would likely prevent implementation of Release 1 by November 2007. Moreover, changes which may appear minor from a policy perspective could be substantial from a software development and implementation perspective. Nonetheless, it may be possible to incorporate some truly minor changes to the MRTU proposal and still implement Release 1 by November 2007. In order to incorporate such changes into the software and still meet that implementation date, however, the CAISO would need a Commission order by early June 2006.

Q Are there additional reasons why a Commission order by June 2006 would be helpful?

A Yes. This timing would also be important for Market Participants, who have informed the CAISO that they will need substantial time – in some cases more than a year – to make the commitments necessary to develop appropriate business practices to accommodate MRTU.
Q Why does the CAISO believe further delays to Release 1 of MRTU should be avoided?

A As explained in the testimony of Lorenzo Kristov (Exhibit No. ISO–1 ), the existing CAISO market design has a number of flaws which expose customers to risks associated with the exercise of market power, and the new CAISO market design should be put into place as soon as it can be reasonably implemented, taking into account the need to develop and test the new market software. In addition, the CAISO’s existing market software systems have not been substantially updated for many years. This is the reason for the “Technology Upgrade” portion of MRTU. This upgrade should not be delayed any longer than necessary.

Q You also mentioned Business Practice Manuals. What is the purpose of Business Practice Manuals?

A The Business Practice Manuals (“BPMs”) will document the manner in which the CAISO conducts its operations consistent with the MRTU Tariff. They will both serve as guides for internal operations and inform Market Participants regarding the CAISO’s practices. The BPMs will thus provide consistency and transparency in the implementation of MRTU. The CAISO has attempted to include in the MRTU tariff provisions a level of detail similar to that in the tariffs of other independent system operators, like PJM and MISO. Like the manuals and procedures adopted by such other independent system operators, these BPMs will include more detail, including examples and timelines, than will be found in the MRTU tariff provisions.
Q What subjects does the CAISO currently plan to cover in the BPMs?

A The CAISO will develop BPMs in all areas of the CAISO’s business. The MRTU-specific BPMs that I anticipate will be of greatest interest to parties to this proceeding include the following subject areas:

- Settlements
- Bid Submission Process
- Mitigation
- Integrated Forward Market
- Residual Unit Commitment
- Hour-Ahead Scheduling Process
- Real-Time Market
- Congestion Revenue Rights
- Billing
- Resource Adequacy
- Load Forecasting

Q How does the CAISO plan to develop the BPMs?

A The CAISO plans to develop the BPMs from its business units with the assistance of an outside vendor. At each stage of the development, the CAISO expects to provide the opportunity for, and to respond to, stakeholder input.

Q Please describe the planned schedule and process for the development of the BPMs.

A In April 2006, the CAISO would release Initial Drafts of the information to be incorporated into the BPMs, which would comprise raw draft materials regarding the business rules and would explain the processes involved.

In July 2006, the CAISO would release Initial Versions of the BPMs. At that point, all releases would be identified by version and subject to change control, but would not be operational.
The CAISO would provide revised versions of the BPMs for a Market Simulation Release by November 2006. Those versions would be sufficiently close to final to allow market simulation testing.

The Market Launch Release would occur in May 2007. These would constitute the first operationally effective versions of the BPMs. New versions would be issued, subject to stakeholder input and change control, as necessary.

Q  Thank you. I have no further questions.
I, Brian Rahman, declare under penalty of perjury, that the foregoing questions and answers labeled as my testimony were prepared by me, with the assistance of others working under my direction and supervision; and that the facts contained in my answers are true and correct to the best of my knowledge, information and belief.

Executed on: 2-6-06
Date
Brian Rahman
EDUCATION / REGISTRATION

• Bachelor of Science in Electrical Engineering, August 1991 from Washington State University
• Registered Professional Engineer in the State of California. Registration No. E 014914

PROFESSIONAL EXPERIENCE

MRTU Program Manager and Manager of Program Office, California ISO 7/00 - Present

Responsibilities include overall management of the Market Redesign and Technology Upgrade program. This program includes the wholesale replacement of all Market Systems, Settlement systems and modifications to approximately 15 supporting applications. Additionally, the program includes the deployment of an open architecture (SOA) technology to support future flexibility and corporate needs. This is a $140 M program with contract and staff headcount of 160 people.

Manager, Market Operations, California ISO 7/00 – July 05

During this period I held several Manager position within the Market Operations Department as described below. Additional responsibilities include Department Capital and O&M Budget development, department and corporate representative for market design and technical implementation expert.

• Manager of Market Redesign and Technology Update, Special Projects (9/03 – present) – Technical lead for the specification, design, procurement, and testing of the Forward, Real-time, and Residual Unit Commitment Markets. Responsible for the management of a team of 15 staff and contractors dedicated to the implementation of the CAISO’s future market applications. Additionally, I am the overall program technical lead with primary responsibilities to insure all corporate business unit needs are meet from a “bid to bill” perspective. This effort encompasses resolution of program level policy and technical issues and the overall coordination of 5 main systems and 12 supporting applications.

• Manager of Market Engineering (7/01 – 9/03) – Manage staff of 10 to 15 design engineers and 5 to 6 contract staff responsible for design, implementation, testing, and support of market software applications. Primary responsibilities: Provide management, leadership, and coordinate for multiple project groups engaged in the design and implantation of market applications and supporting systems. Responsible for project requests, budgets, staffing, design documents, and contract negotiations. Responsible to insure Tariff and FERC order requirements are represented in market applications and operating procedures.

• Manager of Markets (7/00 – 7/01) - Oversee the Day-Ahead, Hour-Ahead, and Real-Time energy, transmission, and ancillary service markets. Primary responsibilities: Manage staff of 18 shift and 3 senior operators, insure close coordination with grid operations concerning system load forecast, energy and reserve procurements, insure accuracy of all published prices and settlement quality data.

Senior Market Design Engineer, Market Operations, California ISO 9/97– 7/00

• Market Software Design, Testing, and Project Management – Responsibilities include development of detailed design documents for vendor and internally developed software, coordination of software testing and deployment with Market Participants. Project Management responsibilities consist of overall project development including budget, design, staffing, inter-departmental and vendor coordination, testing, and deployment

• Technical Support for Real-Time Operations – Duties included 24 x 7 support for real-time personnel operating market applications and software. Requires detailed understanding of grid operations and the impacts of “The Markets” on these operations as well as precise knowledge of the integrated computer systems, which support “The Markets”.
• Real-Time Market Operations – Responsible for processing the Day Ahead, Hour Ahead, and Real-Time Markets. Operated markets in real-time, environment ensuring enforcement of market rules and procedures. Responsible for Real-Time Market functions as part of 12 person operations shift working 12 hour rotating shifts in a 24 x 7 control room environment.

• Start-Up Team – Duties included market software acceptance testing, operational dry run and market simulation operations. Provided training for market participants in the use of scheduling applications and functionality of Real-Time energy market.

**Lead Electrical Engineer, Hydro Generation, Pacific Gas & Electric Co. 5/97-9/97**

• Project Engineering – Prepared job proposals that included cost estimates, engineering calculations, studies, and design. Developed equipment and consulting specifications, procurement documents, and evaluated proposals for electrical equipment and system revisions and upgrades. Provided engineering guidance and technical support to engineering designers and drafters. Planned, designed and developed routine work plans needed to maintain and improve PG&E hydro facilities.

**Distribution Engineer, North Bay Division, Pacific Gas & Electric Co. 4/96-5/97**

• Provided electric planning and operations support for 12kV distribution network. Performed load growth studies and developed capacity increase projects as needed for future growth. Provided protection settings for distribution breakers and line equipment to insure coordination of protective devices. Investigated and resolved power quality and voltage complaints. Served as on-call supervisor during off-hour emergencies.

**Electrical Engineer, Hydro Generation, Pacific Gas & Electric Co. 1/94-4/96**

During this period I worked out of PG&E's Corporate Headquarters for only 12 months with the rest of my time actually located in the field as various hydro facility field locations. Primarily responsible for the facilities located on the Mokelumne and Stanislaus watersheds consisting of 9 powerhouses and a variety of extensive water conveyance systems.

• Provided construction, maintenance, and operations engineering support for PG&E hydro facilities. Identified equipment problems and developed scope, cost, design, and procurement documents. Provided technical support for maintenance activities, operational constraints, and construction projects.

• Provided budget input including project alternatives, economic evaluations, and justification. Served as project manager, providing project estimating, justification, schedule and cost tracking. Provided construction coordination and on site engineering. Served as on-call supervisor.

• Applied Reliability Center Maintenance practices to PG&E hydro facilities. Responsibilities included: Comprehensive review of hydro generation equipment maintenance practices and detailed reviews with maintenance staff, documentation of existing time based practices, and recommended condition based analysis used to trigger maintenance.

• Project Coordination - Prepared job proposals that included cost estimates, engineering calculations, studies, and design. Developed equipment/consulting specifications, procurement documents, and evaluated proposals for electrical equipment/system revisions and upgrades. Provided engineering guidance and technical support to engineering designers and drafters. Planned, designed, and developed routine hydro work needed to maintain and improve PG&E hydro facilities.

• Engineering Consulting - Solved electrical engineering problems, evaluated and recommended alternative solutions, evaluated equipment and engineering service bids and assisted in the project scope, evaluation and justification.

**Power System Engineer, Pacific Gas & Electric Co., San Francisco, CA 8/91-12/93**

• Performed contingency studies, analyzed system disturbances and coordinated switching and clearances for transmission and relay protection maintenance. Monitored system performance and developed Dispatch Operating Instructions.
• Reviewed transmission and generation planning projects for operational capability, relay coordination and determined impact to generation resources.

**INTERNSHIPS**

**Pacific Gas & Electric Co.** 5/90-8/90 and 5/89-12/89

• Performed transformer evaluation studies for use in transformer bank re-rating project and station capability report for planning studies.

• Developed qualifying facility database and PG&E winter electric system base-case. Worked on procedure for Diablo Canyon Power Plant black-start.

**TRAINING**

• Extensive 1 year training in power systems, encompassing Transmission and Distribution Operations, Power Plant Operations (Thermal and Hydro), Protection, Planning, Forecasting and System Dispatching.

• Rotation - Transmission Planning (5 months), focusing on electric planning and system modeling.

• Seminars & Classes:  
  • Stationery Battery Maintenance and Testing (Alber Co.)  
  • Protective Relay Coordination (GE)  
  • Power Systems Fault Analysis (Power Systems Analysis)  
  • Generator Control and Protection (Basler)

*add management classes from iso*

**AWARDS**

• 1992 Power Control Department's Performance Recognition Award for dedication, innovation, and teamwork

• 1994 Hydro Generation Department's Performance Recognition Award for Philadelphia Fish-Screen Project

*need to add the ISO recognition awards look for certificates in office*

**ACTIVITIES**

• IEEE Member

• Power Engineering Society (San Francisco Chapter) - Membership Chairman 1992-93

• Power Engineering Society (San Francisco Chapter) - Student Activities Co-Chair 1994-95