Issue Paper

Dynamic Transfer Issue Paper

Provided in Support of 2009-2010 Stakeholder Process to Consider Expansion of Dynamic Transfer Services in ISO Tariff

November 30, 2009

Dynamic Transfers

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1.

Executive Summary

The objective of this issue paper is to review the range of dynamic transfer-based services presently offered in the ISO tariff and to explore the issues central to the potential expansion of ISO dynamic transfer scheduling policy. Areas of potential future expansion of ISO dynamic transfer services include:

Incorporation of pseudo tie service in the ISO tariff, predicated upon the successful culmination of the two present conventional resource Pseudo Tie pilots.

1. Extension of pseudo tie service to include intermittent resources.
2. Expanded use of dynamic import service for conventional resources to include dynamic transfer of intermittent or "renewable" energy resources into the ISO from other Balancing Authority Areas (BAAs).
3. Expansion of present dynamic scheduling functionality to include dynamic export service in the ISO tariff, including renewable energy and/or ancillary services from the ISO to other BAAs.
4. Currently, the ISO offers a limited set of dynamic transfer services. The present tariff supports dynamic *import* service, considered on a case-by-case basis subject to assessment of the grid reliability implications associated with each specific request. However, the ISO tariff does not specifically offer dynamic import service for intermittent resources, pseudo ties or dynamic *export* services.

A fundamental present day issue is the import of intermittent/renewable energy on the interties (ie, between BAAs). Neither the North American Electric Reliability Corporation (NERC) nor Western Electricity Coordinating Council (WECC) policies directly address the implementation of dynamic transfers associated with renewable or "intermittent" resources. Accordingly, various efforts are underway within the WECC to consider how to implement, operate and account for the coordinated interchange of intermittent energy from source to sink BAAs. Additionally, the use of dynamic transfer functionality to establish pseudo ties in a market construct is a relatively new and currently rarely used concept in the West.

With the advent of the 20 and 33 percent Renewable Portfolio Standards (RPS) standards for California load, the frequency of requests to the ISO for dynamic scheduling based import services has increased dramatically. Over the past year, the ISO has been repeatedly approached by independent power project (IPP) developers of external conventional and intermittent generation resources, inquiring about participation in various ISO markets and renewable energy programs, including the Participating Intermittent Resource Program (PIRP).

These developers, representing both conventional and renewable energy projects, seek operating and scheduling services not presently offered in the ISO Tariff. Their ISO service requests include the ability to dynamically schedule renewable energy imports into the ISO, dynamic imports from "single generator" BAAs, and the implementation of additional pseudo ties for both conventional and renewable external resources. A related issue is the use of dynamic scheduling functionality to support dynamic *export* services.

To date, the ISO has not extended dynamic import service to external intermittent (renewable) resources due to concern for the potential grid reliability impacts and increased regulation and energy balancing burden. Of particular concern is the ability of an external intermittent resource to be immediately responsive to interchange schedule (e-Tag) curtailment and decremental dispatch instructions in the event of real time intertie derate or contingency event. Further, the ISO does not presently offer pseudo tie service nor dynamic export services under its tariff.

This paper will explore the expansion of dynamic transfer tariff service to incorporate these additional uses of dynamic transfer functionality. Potential benefits as well as grid reliability and market considerations will be addressed through the stakeholder process. This paper begins to identify some of the operational and market design issues to be resolved in expanding dynamic transfer services.

2. Background

Interchange scheduling is fundamental to the implementation of dynamic transfers across inter-ties. In this section, we describe how interchange scheduling is accomplished, and the various types of schedules used including static hourly schedules, dynamic schedules and pseudo-ties.

2.1. Basic explanation of Interchange Scheduling

The Western Electricity Coordinating Council (WECC) and its 37 Balancing authorities manage the interchange of energy schedules between their respective BAAs. Specifically, the NERC national e-Tag system ("e-Tag Specification 1.8") is used to process Requests for Interchange (RFI) and to approve, implement and manage intertie schedules between BAAs in real-time. WECC serves as the Interchange Authority (IA) for the California ISO and for the Western Interconnection. As the IA, the WECC uses its WECC Interchange Tool (WIT) as the single e-Tag authority for the WECC Interconnection. The WIT validates submitted interchange requests via a WECC Registry. All POR/PODs ("points of receipt/point of delivery"--the physical path naming convention used on e-tags) and the associated transmission line adjacencies are registered in the WIT. E-Tags passing WIT validation and approval by the various Transmission Providers (TP) and BAAs receive a composite "Implemented" status and thus contribute to "net scheduled interchange" between the respective BAAs along the physical path. Thus, WIT serves as the definitive validation tool for both Net Scheduled Interchange (NSI) and Net Actual Interchange (NAI) between BAs as well as inadvertent energy for the West. BAs confirm this "Arranged Interchange" with each other (through "NSI and NAI checkout processes") and with the WIT. E-Tags are thus the primary reliability management tool for scheduled Interchange on the ties.

The Control Area Scheduler (CAS) is the ISO's Interchange Transaction System (ITS) used to approve and manage interchange scheduling between adjacent BAAs and the WECC WIT for grid reliability purposes. NERC e-Tag interchange schedules are received from the e-Tag authority into the ISO operating systems, via CAS. The CAS application compares Market transmission awards/schedules, submitted by ISO market participants into the ISO's market system with interchange schedules (e-Tags) submitted by the market participant's Purchasing Selling Entity (PSE), to assure that each interchange schedule has a corresponding, valid ISO transmission market reservation.

Under the NERC National Tagging Standard 1.8, interchange energy schedules may be "static" or "dynamic." Static tags represent a fixed amount of energy scheduled to flow across an intertie between adjacent BAAs for the hour. A dynamic interchange schedule may fluctuate in MW magnitude throughout the operating hour, every 4–seconds (4 second periodicity). Dynamic scheduling functionality is typically used for specific purposes such as load following, the scheduling of interchange associated with a jointly owned generator with split unit percentage shares, and the provision of operating reserves or regulation services across ties.

2.1.1. Static Interchange Scheduling and Mid-Hour Changes

Static hourly schedules are predominately used to schedule the transfer of energy (interchange) between Balancing Authority Areas (BAAs). Static or “Normal” Interchange (e-Tag) schedules are fixed for the operating hour. The sending or “host” BAA is responsible to provide all real-time balancing energy needs for the source generator (including regulation) through its Energy Management System (EMS) and its Automated Generation Control (AGC) system to maintain the pre-arranged static or fixed MW interchange schedule, with the sink BAA. Ancillary services (capacity tags) on the ties may also be scheduled using static interchange schedules (e-Tags); however, the use of static capacity tags is generally limited to ancillary services (AS) capacity in the form of contingency reserves, which are only converted to energy in the event of a contingency that requires the dispatch of AS energy to respond to a sink BAA contingency event.

An exception to static hourly interchange schedules is a manual process for intra-hour schedule changes across balancing authorities (every 10 minutes, 15 minutes, or 30 minutes). These are done on an exception basis because they require a multitude of manual changes. The regular use of this mechanism is a future option to be further explored in that it would allow a sharing of the regulation and operational burden beyond simply shifting the entire burden to the sending or receiving balancing authorities.

Thus, a benefit of dynamic schedules is the ability to “automate” intra-hour dispatch and RT interchange adjustments. Dynamic schedules can facilitate the provision of AS and energy to the ISO on the ties, no longer restricting these services to pre-dispatch, on an hourly basis. However, it does fully shift the burden for regulation to the receiving balancing authority.

2.1.2. Dynamic Scheduling

Dynamic transfer is a type of interchange scheduling that transfers all, or a portion of, the actual, real-time MW output of a specific or aggregation of generators located in one BAA (source), to another BAA(sink) in real-time. The dynamic schedule is adjusted every 4-seconds between the respective source and sink BAAs. Dynamic scheduling and pseudo tie arrangements are two uses to achieve dynamic transfer functionality. Each use provides slightly different benefits as described in this section.

Dynamic schedules facilitate changes in NSI between two BAAs, within the operating hour by “automating” intra-hour dispatch and RT interchange NSI adjustments. They also facilitate the provision of ancillary services and energy to the ISO on the ties, no longer restricting these services to “pre-dispatch” on an hourly basis. In the case of a dynamic import schedule for a conventional resource, the receiving BAA acquires responsibility for provision of balancing energy services and the associated Regulation burden.

Presently, imports scheduled dynamically into the ISO BAA are governed by Section 4.5.4.3 of the ISO tariff. This Section allows dynamic schedule imports of energy and AS provided that: (a) the dynamic schedule is “technically feasible” and consistent with NERC and WECC reliability standards, (b) all requirements of the ISO’s Dynamic Scheduling Protocols (ISO tariff, Appendix X) are satisfied, (c) the Scheduling Coordinator for the resource executes a Dynamic Scheduling Agreement, and (d) the sending or Host BAA executes an Interconnected Balancing Authority Area Operating Agreement, a Dynamic Scheduling Host Balancing Authority Operating Agreement, or other special agreement related to dynamic scheduling functionality.

Through the Dynamic Scheduling Protocols, Section 5, the ISO reserves the right to limit imports from dynamic schedules. Such limits may be established based on any one, or a combination, of the following considerations: a specific import limit (or a percentage thereof) applicable to total ISO BAA requirements; a specific import limit (or percentage thereof) applicable to a particular scheduling point or transmission interface; a specific import limit (or percentage thereof) applicable to total requirements in a specific ancillary service region; or operating factors which may include, but are not limited to, operating nomograms, remedial action schemes, protection schemes, scheduling and curtailment procedures, or any potential single point of failure associated with the actual delivery process.

The ISO needs to determine the operational, reliability, and market design impacts of dynamic schedules of intermittent resources. The stakeholder process will be used to determine the terms and conditions which are necessary to provide this type of service. In addition, the tariff terms required to provide for dynamic *exports* of energy or ancillary services to external BAAs will be considered.

2.1.3. Pseudo Ties

Pseudo-ties are employed to dynamically transfer resources (generating resources or loads) from the BAA to which they are physically interconnected (native BAA) into another BAA that assumes operational control of the resource (attaining BAA). Thus, pseudo-ties provide for transfer of BAA jurisdiction from the native to the attaining BAA and at the same time establish the attaining BAA as provider of BAA services on behalf of the remote resource (including balancing energy, regulation and the energy to supply a generating resource's auxiliary load needs). The native BAA, while no longer being responsible for provision of BAA services, continues to receive transmission revenues for power delivered by the pseudo-tie generator to the physical intertie with the attaining BAA, and any local "VAR" support.

A pseudo-tie generator (PTG) external to the ISO BAA is treated as any other internal generating resource and may fully participate in the ISO's markets, as a Participating Generator. The external generating resource procures BAA services from the ISO and provides energy and ancillary services to the ISO BAA. A pseudo-tie participating generator must adhere to the applicable provisions, protocols and agreements in accordance with the ISO tariff. Additionally, pro forma Pseudo Participating Generator Agreement (PPGA) and the pro forma Meter Service Agreement for ISO Metered Entities (MSA-CAISOME) agreements between the ISO and the generating resource's operator are required. Operating agreements between the ISO and the generating resource's native BAA and any intermediary balancing authorities that are interconnected to the ISO are also required.

Implementation of the ISO pseudo-tie model is consistent with all policies and guidelines of the NERC and the WECC. Although the Federal Energy Regulatory Commission (FERC) allows generators to seek BAA services from non-host BAAs (i.e., from BAAs other than those to which such generators are directly interconnected). There is no FERC requirement for BAAs to offer such services to external (non-host) generating resources.

Embassy Analogy

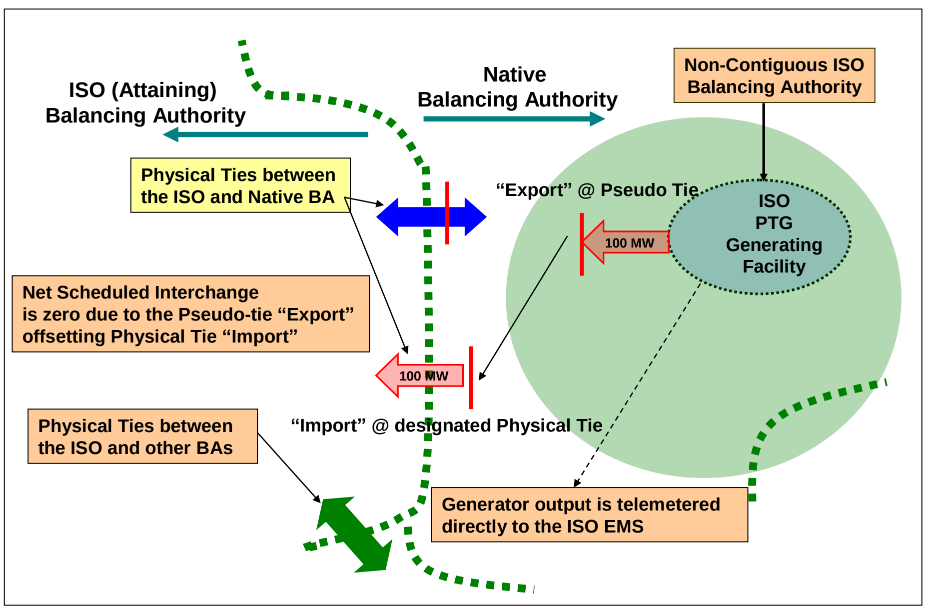
Conceptually, a pseudo-tie is somewhat analogous to the embassy (i.e., generating resource) of one country (i.e., the attaining balancing authority) physically located or "interconnected" within another country (i.e., the host balancing authority). The embassy property "belongs to" and is "sovereign ground" to the attaining balancing authority despite being physically located, as if an island, within the host BAA.

The pseudo-tie generator's actual output is measured by revenue metering at the perimeter of the island; i.e., at its interconnection point with the host BAA, the "pseudo–tie." This metering serves two purposes. First, the generating resource's metering serves as the "pseudo-tie interconnection point", not a physical intertie point, between the host and attaining BAAs.

However, the pseudo tie metering point within the host BA is treated as a new point of interchange, a "pseudo tie". This pseudo tie metering is added into the net actual interchange (NAI) equation and ACE calculation by the two BAAs. Second, this pseudo-tie metering is also used to settle the output of the pseudo-tie generator, as if it were a conventional generating resource interconnected directly within the attaining BAA.

The pseudo tie generator's energy is dynamically scheduled between this pseudo-tie and one of the shared physical inter-ties between the host and attaining BAAs. NERC requires that pseudo-tie energy (a form of dynamic interchange schedule) be scheduled as interchange, as an export/import from the attaining BAAs pseudo-tie and as an import/export at the physical intertie, dependent upon whether the pseudo-tie generator is generating or taking station power via the dynamic schedule. Thus, the power flows from the pseudo-tie generator net out of the area control error (ACE) equation for both BAAs. The pseudo-tie generator is also scheduled as a physical generating resource located within the attaining BAA. The BAA provides all BAA services to its "embassy".

SCHEMATIC ILLUSTRATION OF PSEUDO-TIE ARRANGEMENT BETWEEN NATIVE (HOST) AND ATTAINING BALANCING AUTHORITY AREAS



2.2. Comparison of Dynamic Scheduling and Pseudo-Tie Services

Both dynamic imports and pseudo ties offer benefits. In the case of dynamic transfer imports, dynamics facilitate mid-hour dispatch of ancillary services and energy bid into the ISO real-time markets on the interties. Typically, adjacent balancing authorities preclude dispatch during mid-hour of static scheduled reserves as energy, as they view ancillary services solely as "contingency reserves" to be dispatched only in system emergencies. Mid-hour dispatch of these services requires manual scheduling work, in real time, between the respective balancing authority real-time schedulers, and adjustments to static balancing authority area interchange schedules. Dynamics “automate” this mid-hour dispatch and interchange adjustment process. Thus, dynamics facilitate the provision of ancillary services and energy to the ISO on the interties, no longer restricting these services to pre-dispatch, on an hourly basis.

A pseudo tie takes the use of conventional dynamic scheduling functionality several steps further, with additional benefits to both balancing authorities. A pseudo tie effectively brings the external generating resource into the ISO balancing authority area, electrically. The ISO executes a pro forma Pseudo Participating Generator Agreement with the owner of the resource.

Dynamic imports and pseudo ties offer benefits to both the native and attaining BA’s. In the case of dynamic transfer of imports, dynamic schedules facilitate mid-hour dispatch of ancillary services and energy by the ISO real-time market on the inter-ties. This is in contrast to typically operation between adjacent BAAs, which precludes dispatch of static scheduled reserves as energy during mid hour, because they view ancillary services soley as “contingency reserves” which should only be dispatched as energy in system emergencies. In addition, mid-hour dispatch between adjacent BAs typically requires manual scheduling work in real-time, between the respective BAA’s real-time schedulers, and involves adjustments to static interchange schedules. The dynamically scheduled imports automates this mid-hour dispatch and interchange adjustment process. Thus, the dynamic schedules facilitate the provision of ancillary services and energy to the ISO on the inter ties, no longer restricting these services to pre-dispatch on an hourly basis..

A pseudo-tie takes the use of conventional dynamic scheduling functionality several steps further, with additional benefits to both balancing authorities. A pseudo-tie effectively brings the external generating resource into the ISO BAA, electrically. The native BAA benefits most from the voltage support provided by the resource, locally, and is released from any regulation burden for the pseudo-tie generator.

The key differences between a pseudo-tie and the more conventional dynamic import can be contrasted by considering their operating, technical and business or market attributes. A comparison of the two types of service are provided in Table 2 below.

Table 2: Comparison of Key Attributes of Dynamic Schedules and Pseudo Tie Generators

	Attribute	***Dynamic Schedule***	***Pseudo Tie***
1	Area Control Error Equation	The Dynamic Transfer Signal is incorporated in the Net Scheduled Interchange side of the ACE equation.	The Dynamic Transfer Signal is incorporated in the Actual Interchange side of the ACE equation.
2	Transmission	Firm transmission must be reserved for the dynamic transfers across the entire transmission path external to the ISO BA to the ISO delivery point.	Same
3	Layoffs	The ISO will not supply Operating Reserves for any “layoff” energy sales outside the ISO BA.	Layoffs would be treated as a firm export from the ISO. All applicable related GMC (except wheeling charges) and market charges apply.

4	Ancillary Services (A/S)	Participate in all A/S Markets • Currently the ISO imposes the 50% of requirements from ties. • In a split market we procure A/S on a zonal basis. • In a split condition, if single largest contingency is greater than 5% & 7%, then it becomes the requirement to procure A/S. Interchange template is utilized for scheduling A/S.	Same
5	Unit Dispatch	The ISO will have real-time dispatch control over the dynamically scheduled portion of the unit(s) for system reliability purposes.	ISO will have real-time dispatch control over the entire Generating Unit
6	Must-Offer Obligation	Not subject to must-offer obligation.	Subject to the ISO must-offer obligation for capacity not already committed through bilateral agreements.
7	Grid Management Charge (GMC)	GMC is settled like any other interchange schedule.	GMC and other related tariff costs would be handled like any other Generator Unit within the ISO BA.
8	Uninstructed Deviation Penalties	Subject to ISO Uninstructed Deviation Penalties and/or host BA deviation penalties.	Only subject to the ISO Uninstructed Deviation Penalties.
9	Control Area Services - Resources	The ISO <u>does not</u> provide control area services (reserves, voltage support, technical studies, station back-up etc)	The ISO will provide limited Control Area services.
10	E-Tags	All Energy transfers associated with dynamic schedules must be electronically tagged (e-tagged).	Same
11	Transmission meter multiplier/Generation meter multiplier	Subject to TMM. TMM and GMM should be equal at the scheduled tie point.	Subject to GMM. (Not subject to Pseudo Load). TMM and GMM should be equal at the scheduled tie point.
12	Market Clearing Price (MCP)	Will be able to set the MCP in accordance with the ISO tariff in all applicable ISO operated markets.	Same

13	Residual Unit Commitment	Participation in RUC is limited on the interties.	Can participate in RUC like any other unit within the ISO BA.
14	Outages/Maintenance	Subject to approval by the ISO for the dynamically scheduled portions of the unit(s).	Same
15	Day Ahead/ Hour Ahead Schedules	Must provide D/A and H/A Interchange Schedules.	Must provide D/A or H/A Generation Schedules.
16	Reliability Must Run	Cannot be designated an RMR unit.	Can be designated an RMR unit, but such designation is unlikely if the unit is not connected to an ISO Participating TO's transmission system.
17	Communication	Either ICCP or RIG could be used to participate in the Regulation market.	RIG is the requirement for internal units participating in the Regulation market.
18	Resource Adequacy	May count towards an LSE's resource portfolio to meet its Resource Adequacy obligation.	Same
19	SLIC Derates	Derates are based on the total dynamic schedules in the ISO Markets.	Derates would be based on the Pseudo Tie Generator Net Dependable Capacity.
20	Transmission Derates in the Host or Intermediary BAAs.	Derates would be communicated via Tags.	Same
21	Congestion Management	• Can be dispatched to mitigate congestion. • Subject to inter-zonal congestion, unless using ETC/FTR. • New firm use schedules are subject to congestion charges.	Can be dispatched to mitigate congestion, but mechanism for incorporation into the ISO congestion management process is yet to be determined. Requires special programming of ISO systems in order to incorporate into ISO Congestion Management system.
22	Generation Output	Only the Generation that is dynamically scheduled to the ISO is telemetered to the ISO.	The total Pseudo Tie Generator output is telemetered to the ISO and incorporated in the ISO load calculation.
23	Contracts	ISO pro forma dynamic scheduling agreements and the related Service Schedules to the	A specially-negotiated form of Participating Generator Agreement and a specially-

		associated Interconnected BA Operating Agreement need to be executed.	negotiated provision for the associated Interconnected BA Operating Agreement will need to be executed.
24	Advanced Application (State Estimator)	Dynamically scheduled resources are not represented in the network model.	Would be included in the network model when the sphere of the solved model area expands to the location of the Generating Unit.
26	Settlements Grid Management Charge (GMC)	GMC and market-based charges are settled like any other interchange schedule.	GMC and market based charges would be handled like any other Generating Unit within the ISO BA.
27	Test Energy	Need to submit interchange schedules and e-tags for the expected non-firm energy.	Need to submit generation schedules and e-tags for the expected non-firm energy.
28	Intertie Flow Control	Dynamic Energy flow monitored at source and on tie points	Same
29	Load	The native BA (where the load physically resides) is responsible to include the Load in its load forecast.	The attaining BA[1] is responsible for load forecasting and reporting.
30	Control Area Services - Load	The attaining BAis responsible for ensuring that agreements are in place to provide control area services.	The attaining BA is responsible for control area services required by the load. Should assume all regulation, contingency reserves etc.
31	Energy Exchange between BAAs	Metered or calculated energy for load and/or resources for the hour plus agreed upon transmission losses.	Same
32	Frequency Bias Setting	The attaining BA should include the dynamically scheduled load as part of its load forecast to set frequency bias requirement.	Both the host and attaining BAAs need to adjust their Frequency Bias to account for the Load/Generation being moved between areas.

[1] The Load does not reside in the attaining BA but is transferred to the attaining BA through a pseudo tie.

2.3. Chronology of ISO's Dynamic Transfers Agreements and Tariff Provisions

The ISO tariff currently incorporates provisions specifying the terms for imports of dynamic schedules into the ISO's BAA. Initial provisions to provide for dynamic imports of Regulation service into the ISO were added to the tariff in 2000. More detailed provisions regarding the implementation of dynamic scheduling functionality were added to the tariff in 2004 and have not been revised significantly since that time. Over time the ISO has identified issues with the implementation of imports of dynamic schedules that need to be resolved in order to permit the ISO to continue to facilitate and expand the use of this dynamic scheduling import functionality. These operational and market issues are described in Sections 4 and 5 of this paper. The purpose of this section is to provide the chronology of events which have led to the current provisions in the dynamic transfer tariff.

2.3.1. ISO honoring of grandfathered dynamic scheduling functionality

The ISO has had a variety of experiences with dynamic transfers over the years. The ISO inherited a number of arrangements for the dynamic scheduling of imports into the ISO BAA in existence at the time of the ISO's initial operations date. In order to honor these "grandfathered" pre-existing contractual arrangements, the ISO implemented dynamic scheduling arrangements for a limited number of generating facilities (or entitlements to portions of generating facilities) physically located outside of the ISO's BAA. Although the ISO made accommodations in its systems to facilitate the continued operation of these grandfathered dynamic scheduling arrangements, the ISO tariff did not initially include provisions addressing dynamic transfers to any significant extent.

2.3.2. ISO implementation of dynamic imports of regulation

Initially, the ISO tariff provided for the supply of regulation service only from generating units located within the ISO BAA, and not from System Resources (i.e., resources that are located outside of the ISO BAA that are capable of providing energy and/or ancillary services to the ISO). The tariff did permit scheduling coordinators to utilize transmission service under existing contracts for the self-provision of Regulation from resources located outside the ISO BAA, where technically feasible. The tariff also provided for the certification of System Resources to deliver imports of ancillary services other than Regulation (e.g., Spinning Reserve and Non-Spinning Reserve) to points of interchange with the ISO BAA. The energy called from these System Resources had to be provided under static schedules arranged by the ISO and the sending balancing authority. The restriction on imports of Regulation was necessary because the ISO did not have functionality in place to support the dynamic interchange with other balancing authorities that is required to implement such imports.

In the 1999-2000 time frame, a number of stakeholders urged the ISO to eliminate this restriction during the ISO's market redesign process, and the ISO agreed. The ISO concluded that facilitating the import of Regulation from resources outside the ISO BAA would deepen the supply of resources available to provide ancillary services in the ISO's markets. As a result, in tariff amendment 25 filed on January 27, 2000, the ISO removed the tariff restriction on imports of Regulation. However, the tariff revisions included certain technical and contractual requirements that must be satisfied before a scheduling coordinator can supply Regulation from a System Resource outside the BAA.

In order to ensure that all imports of Regulation are both technically feasible and consistent with WECC criteria, the ISO instituted a certification process for scheduling coordinators that seek to schedule imports of Regulation and balancing authorities from which such imports are to be scheduled. Since the supply of Regulation from System Resources is contingent upon the sending balancing authority's ability to support the dynamic interchange of such service based on control signals issued by the automatic generation control function within the ISO's energy management system, this certification includes a requirement that the sending balancing authority and the scheduling coordinator representing the System Resource demonstrate that they have made appropriate arrangements and have put in place the equipment and services necessary to deliver the Regulation to the point of interchange with the ISO BAA. In addition, the ISO requires the balancing authority from which imports of Regulation are to be scheduled to enter into an agreement with the ISO for interconnected BAA operations. These requirements are currently set forth primarily in tariff Section 8.3.7.2. Finally, the technical standards that must be satisfied to make such a demonstration are posted on the ISO website. The ISO's "Standards for Imports of Regulation" are posted on the ISO website at http://www.caiso.com/docs/2000/05/09/20000509165702192.pdf.

2.3.3. ISO implementation of dynamic scheduling of imports of energy and ancillary services other than regulation

Beyond the provisions of tariff amendment 25 to facilitate imports of regulation, from the time the ISO implemented dispatch and settlement of energy in its markets on a ten-minute basis, the ISO sought ways in which to allow imports of energy and ancillary services other than Regulation from outside the ISO BAA to respond to ISO dispatch instructions within an operating hour. Under its then-current tariff, scheduled imports remained static for the operating hour; the ISO could not make schedule changes within the hour because its systems accounted for the energy as delivered for the entire operating hour. The ISO and market participants recognized that through dynamic scheduling the ISO could make changes to schedules for external resources within the operating hour, comparable to the capability for resources within the ISO balancing authority area. The ISO sought to allow such imports through the very rudimentary provisions of the ISO tariff addressing dynamic scheduling and through pilot program-type arrangements that accommodated the dynamic scheduling of energy and ancillary services by market participants that had the need and the ability to schedule and deliver these products dynamically. At the time, there were few other details regarding dynamic scheduling functionality in the tariff beyond the provisions for imports of Regulation.

As market participant interest in dynamic scheduling increased, the need to formalize the ISO policies and practices concerning such transfers became apparent. In response to the significant interest expressed by market participants, the ISO initiated an effort in the 2003-2004 time frame to develop a comprehensive policy framework for implementation, operation, and settlement of energy and ancillary services to be delivered dynamically from resources external to the ISO BAA.

As one of the first steps in developing this policy framework, on January 9, 2004, the ISO filed with FERC in Docket No. ER04-389 three dynamic scheduling letter agreements that it had entered into previously. The letter agreements were part of an interim pilot program to allow the ISO to assess the ability of System Resources to: (1) deliver energy imports dynamically scheduled in the ISO's day-ahead and hour-ahead markets, and (2) participate in certain of the ISO's ancillary services and real-time (supplemental energy) markets in response to the ISO's within-the-operating-hour dispatch instructions. These letter agreements were accepted in a FERC order issued March 9, 2004. In the March 9 order, FERC directed the ISO to develop by May 1, 2004 generally-applicable provisions for a dynamic scheduling policy to be included in the ISO tariff. FERC also directed the ISO to provide for a stakeholder process for market participants to provide input regarding the ISO's proposed dynamic scheduling proposal.

In developing the proposed policy framework for dynamic scheduling of imports from System Resources, the ISO relied on its collective experience gained from, among other things, (1) operating pre-ISO dynamic scheduling functionalities, (2) the Regulation dynamic scheduling functionalities implemented in accordance with the ISO tariff and the Standards for Import of Regulation which were approved as part of tariff amendment 25, (3) operating non-Regulation dynamic scheduling functionalities with the three entities with whom the ISO had executed letter agreements, and (4) the feedback it received from the stakeholder process.

The ISO filed tariff amendment 59 with FERC on April 30, 2004 to establish a dynamic transfers policy for System Resources importing energy and ancillary services other than Regulation into the ISO BAA. The ISO expedited this development of formal standards for the dynamic scheduling of imports so that it could promptly place all System Resources that desired dynamic scheduling functionality on an equal footing with the pilots in response to FERC's directive in its acceptance of the three letter agreements that the ISO make a filing of these tariff revisions by May 1, 2004.Amendment 59 permitted dynamically scheduled imports of energy from any System Resource external to the ISO BAA provided that: (1) implementation is consistent with all applicable NERC/WECC policies, (2) all ISO operating, technical, and business requirements for the dynamic functionality are satisfied, and (3) operating agreements applicable to each System Resource, as well as the System Resource's host BAA and any intermediary BAAs, are duly executed. The ISO implemented its dynamic scheduling program on an integrated basis using three mechanisms: (1) ISO tariff modifications, (2) technical, operational, and business standards, which FERC ordered be incorporated into the "Dynamic Scheduling Protocol" set forth in Appendix X of the tariff, and (3) agreements between the ISO and the scheduling coordinator for the System Resource that will be dynamically scheduled, and agreements between the ISO and the host BAA (and all intermediary BAAs). The specific standards and requirements implemented by amendment 59, which are still in existence today, are discussed below.

2.3.3.1 Tariff provisions for dynamic scheduling of imports of energy and ancillary services other than Regulation

Amendment 59 implemented a number of the requirements for dynamic scheduling through revisions to the body of the ISO tariff, most notably in what is now Section 4.5.4.3. The requirements of Section 4.5.4.3 include the following: (1) dynamically scheduling of the System Resource must be technically feasible and consistent with all applicable NERC and WECC reliability standards; (2) the dynamically scheduled System Resource must comply with all technical, operational, and business standards and procedures set forth in the Dynamic Scheduling Protocol in Appendix X of the tariff; (3) the scheduling coordinator for the dynamically scheduled System Resource must execute an agreement with the ISO for the operation of the dynamic scheduling functionality; and (4) the System Resource's host and all intermediary BAAs must each enter into operating agreements with the ISO that will provide for dynamic scheduling.

In addition, a number of changes to various sections of the ISO Tariff were required to facilitate the implementation of dynamic scheduling of imports as proposed in the amendment. These changes include:

- Changes to provide that operators of System Resources from which dynamic schedules or bids are submitted to the ISO will provide communications links meeting ISO standards for dynamically scheduled imports from System Resources;

- Changes to provide that all dynamic schedules for ancillary services provided to the ISO from System Resources will be deemed delivered to the ISO;

- Changes to the definition of System Resource to make clear that a System Resource can be a single resource or a portion of a resource located outside of the ISO BAA, or an allocated portion of a balancing authority's portfolio of generating resources that are directly responsive to that balancing authority's AGC capable of providing energy and/or ancillary services to the ISO BAA;

- Changes to the definition of Tolerance Band to provide for a "PMax-like" value that is to be established for every dynamically scheduled System Resource to be used as the basis for the calculation of Uninstructed Deviation Penalties ("UDP") if and when UDP is implemented by the ISO; and

- Changes to specify that all dynamically scheduled System Resources must comply with the ISO's dispatch instructions unless such operation would impair public health or safety.

2.3.3.2 Technical, operational, and business standards incorporated in the Dynamic Scheduling Protocol

In its order on tariff amendment 59, FERC directed that the ISO's technical, operational, and business standards applicable to dynamically scheduled System Resources be set forth in the tariff. The ISO compiled these standards in the Dynamic Scheduling Protocol in Appendix X of the tariff. The Dynamic Scheduling Protocol sets forth in detail the specific technical and operational standards that apply to the implementation of dynamic scheduling functionality, as well as noting the applicability of certain requirements with regard to losses, financial settlement and compliance. The ISO intends that the Dynamic Scheduling Protocol serve as a "guidebook" for parties interested in dynamically scheduling imports of energy and ancillary services. In addition to setting forth technical and operational standards for dynamic schedules, the Dynamic Scheduling Protocol also identifies applicable requirements that are specified elsewhere in the ISO tariff and agreements that must be executed. In addition, the Dynamic Scheduling Protocol clarifies how certain existing market, scheduling, and settlements rules apply to dynamic schedules.

Many of the operating requirements set forth in the Dynamic Scheduling Protocol were taken from pertinent NERC and WECC policies, standards, requirements, and reference documents, particularly what was known at that time as the NERC dynamic transfer white paper. The technical requirements generally are control system implementation details that comport to prevailing industry standards. The ISO's dynamic scheduling policy requires that the scheduling coordinator make arrangements for firm, or non-interruptible for the operating hour, transmission service from the host BAA and through all intermediary BAAs, if applicable, to the ISO. NERC and the WECC require that all ancillary services be delivered over firm or non-interruptible transmission. Consequently, any Spinning Reserve or Non-Spinning Reserve service as well as the associated energy must be scheduled over firm or non-interruptible transmission for the operating hour. With regard to dynamic deliveries of energy from System Resources, the ISO treats such delivered energy as resource contingent (firm) energy, meaning that, for the purpose of determining of the ISO load responsibility and calculation of the ISO BAA Operating Reserve requirement, such dynamically imported System Resources are treated the same as ISO BAA internal generating units. Some of the other key points of the Dynamic Scheduling Protocol are that: (1) the dynamic schedule signal must be properly incorporated into all balancing authorities' Area Control Error ("ACE") calculation, (2) the dynamic schedule cannot exceed in real-time the associated transmission reservation, and (3) operators of dynamically scheduled System Resources, as well as their host balancing authorities, must be able to manually override the dynamic signal (e.g., for emergency or contingency reasons, or to ensure the ISO's compliance with operating requirements based on WECC or NERC standards). Any telemetry and communication requirements are based on prevailing industry applications and are no more stringent than those accepted by FERC with respect to dynamically scheduled Regulation imports.

The requirements concerning losses, settlements, and compliance, were based on prior ISO requirements applicable to the previously-implemented dynamic scheduling agreements.

2.3.3.3 Agreements for dynamic scheduling of imports of energy and ancillary services other than Regulation

Finally, in order to implement dynamic scheduling functionality for a particular resource, tariff amendment 59 specified that the ISO needs to execute certain agreements. Specifically, the ISO requires a dynamic scheduling agreement between the ISO and the scheduling coordinator for the dynamically scheduled System Resource, and a separate operating agreement between the ISO and the host and each intermediary BAA. Because a dynamic schedule is a schedule, the balancing authorities that host, transmit, and receive dynamic schedules are ultimately responsible for the proper implementation and operation of the dynamic functionality. Consequently, the ISO must have appropriate contractual mechanisms in place with all involved balancing authorities that will allow for the coordination that is required both during normal and emergency conditions. The ISO considers it critical to the implementation of the dynamic scheduling import functionality that both scheduling coordinators and other balancing authorities undertake a contractual commitment to abide by the ISO's standards and requirements for such dynamic scheduling. The ISO also considers it important to be able to include variances from the ISO's standards and requirements to accommodate the special circumstances of particular entities that may wish to engage in or facilitate dynamic scheduling of imports.

Amendment 59 established the following *pro forma* agreements: (1) a Dynamic Scheduling Agreement for Scheduling Coordinators (to be entered into by the scheduling coordinator for the dynamically scheduled System Resource); (2) an ICAOA Service Schedule 17 (setting forth inter-BAA requirements for scheduling and dynamic delivery of energy and energy associated with non-Regulation ancillary services to the ISO); and (3) a Dynamic Scheduling Host Control Area Operator Agreement (for balancing authorities participating in the submittal of dynamic schedules to the ISO but which are not signatories to an ICAOA with the ISO). These *pro forma* agreements are still applicable in forms very similar to those accepted with amendment 59.

2.3.4. Deferral of implementation of dynamic scheduling of exports

In the 2003-2004 time frame, the ISO received some informal inquiries from market participants regarding the possible development of a formal dynamic scheduling program for <u>exports</u> from the ISO BAA to other BAAs. However, the 2004 filing of tariff amendment 59 did not attempt to establish a broader dynamic scheduling policy that would apply to exports. This was because of the truncated timeframe in which the ISO had to make this filing, which required the ISO to focus its efforts on developing a comprehensive policy for imports. The ISO did not have sufficient time or adequate opportunity to study all of the issues associated with developing a formal policy regarding the dynamic scheduling of exports. The ISO observed that a dynamic scheduling policy for exports would require different standards than those required for dynamically scheduled imports due to the different operational and business relationship of the ISO to resources within the ISO BAA in contrast to imports from other BAAs. Moreover, unlike dynamically scheduled imports, the ISO had far more limited experience with the dynamic scheduling of exports, which experience would be instrumental in assessing potential future success of such a program.

Accordingly, the ISO offered to meet with parties who were interested in the dynamic scheduling of exports to discuss possible implementation of dynamic scheduling functionality for exports on an exploratory (or pilot) basis. The ISO believed that it was reasonable and prudent to consider implementing an exploratory or pilot program for dynamically scheduled exports so that the ISO could gain necessary experience that could serve as the basis for developing more formal standards for dynamic exports in the future. (Such approach would not be unlike that which the ISO took in implementing the standards for dynamic scheduling of imports, where the combined experience from operating three pilots filed with FERC on January 9, 2004 and experience from operating the pre-existing dynamic functionalities gave rise to enough operational confidence that this filing of standards for dynamic scheduling of imports became possible.) In any event, the ISO felt the need to undertake a reliability assessment regarding the dynamic scheduling of exports before developing formal standards for the dynamic scheduling of exports. Ultimately, no entities have identified any specific resources for pilot implementation of dynamic exports.

2.3.5. More recent dynamic scheduling and pseudo-tie agreements

Subsequent to the implementation of tariff amendment 59, the ISO negotiated several sets of agreements with System Resource owners and affected balancing authorities to implement dynamic scheduling of imports. Currently, the ISO has dynamic scheduling agreements in effect for over 3,000 MW of resources and ICAOA provisions or alternative forms of agreements with affected balancing authorities to facilitate these dynamically scheduled imports. In each case, at least some part of these arrangements has been filed with and accepted by FERC.

In addition, in response to requests related to the transition of the Sacramento Municipal Utility District and the Western Area Power Administration, Sierra Nevada Region from the ISO BAA to the separate new SMUD BAA, the ISO negotiated agreements including two pilot pseudo-tie arrangements. One set of agreements establishes the Calpine Sutter generating facility as a pilot pseudo-tie to the ISO BAA from the SMUD BAA. The other set of agreements establishes Western's New Melones generating facility as a pilot pseudo-tie from the ISO BAA to the SMUD BAA. These pseudo-tie pilots are described in more detail in Section 3 below.

Finally, in an effort to test the feasibility and functionality needed for the ISO to accept dynamic transfers of intermittent resources from other BAAs, the ISO is piloting a pseudo-tie of the Copper Mountain solar generating facility to the ISO BAA from the Nevada Power Company BAA.

3. Existing Dynamic Transfers

3.1. Pseudo-Ties

3.1.1. Existing Pseudo-Tie Pilots

As we have established previously, in the case of a pseudo tie, the BAA responsibility for the generator is transferred from the host or "native" BAA to the attaining BAA. The pseudo tie generator model as implemented in the ISO enables the attaining BAA (the ISO) to expand its services by effectively adding resources physically located within another BAA (with the host BAA"s approval) and, thereby, enhance system reliability and provide greater opportunities for the pseudo-tied resources to participate in Locational Marginal Pricing-based (LMP) markets.

The ISO has two existing pseudo tie arrangements as pilot programs, summarized below, both of which should help inform our initiative to develop protocols and amendments to the ISO tariff for dynamic scheduling and pseudo tie arrangements between the ISO and entities within other BAAs going forward. It should be noted that part of this initiative includes steps to establish a process for future entities to follow that wish to engage in a dynamic scheduling or pseudo tie arrangement with the ISO.

Summary of CAISO Pseudo Tie Pilot Program Experiences

Following is a summary of the ISO's two existing pseudo-tie pilot programs. The first pilot, the Sutter Pseudo Generator Agreement" (under the Pseudo Participating Generator Agreement—"PPGA") is an agreement between the ISO and Calpine Construction Finance Company, L.P. ("Calpine"). The second pilot, the "New Melones Pseudo Tie Agreement," (under the Pilot Pseudo Tie Implementation Agreement) is an arrangement between the ISO, the Sacramento Municipal Utilities District (SMUD), Pacific Gas & Electric (PG&E) and the Western Area Power Administration (WAPA). These two pilots have successfully tested the viability of the pseudo tie arrangement under both import (Sutter) and export (New Melones) conditions.

The Sutter Pseudo Tie Generator (PTG), a 525 MW Combined Cycle generation station, commenced operation as a Pseudo Participating Generator in December 2005. New Melones, a 384 MW U.S. Bureau of Reclamations hydroelectric plant, commenced operation as a pseudo tie to SMUD in December 2006. Given the time frame, the test pilot periods for both the Sutter and New Melones projects enabled the ISO to demonstrate viability of the arrangements under both the ISO's prior market design and, now with 8-9 months of experience, under the ISO's new LMP-based market design.

The pseudo tie pilot test consists of several operational and market requirements that are necessary to demonstrate viability of the two projects. These requirements are outlined below, followed by an assessment of pilot test observations.

<u>Sutter</u>

The Sutter Pseudo Participating Generator Agreement establishes the Sutter power plant, which is geographically located in the SMUD BAA, as a pseudo generator into the ISO BAA. The Pseudo Participating Generator Agreement allows a Scheduling Coordinator (SC) to submit self schedules and bids for energy and ancillary services into the ISO markets as a pseudo participating generator. In addition to scheduling energy and ancillary services as a pseudo participating generator in the ISO markets, the SC can schedule the energy as an export into the SMUD BAA. Through the ISO's agreements with the external generator and the external BAA that establishes the pseudo participating generator, the ISO models the generator at its specific location (i.e., at the location where the energy is produced), dispatches the external resource that supports interchange transactions, and has the same level of visibility (including telemetry and ISO polled revenue metering) of the resource's performance as other generators located within the ISO BAA. Although the pseudo tie resource is physically located in another BAA, for purposes of scheduling in the ISO markets, control responsibility, and interchange management, the resource functions and has the same obligations under the ISO tariff as a generator within the ISO BAA. Therefore, the ISO uses the LMP for the resource's specific location in Settlements, rather than the LMP that would otherwise apply to the Scheduling Point at which its interchange transactions are tagged. One exception from being treated exactly the same as an internal generator is that the pseudo tie generator must compete for transmission in congestion management during execution of the ISO's markets.

New Melones

The New Melones Pilot Pseudo Tie Implementation Agreement is an agreement between CAISO, SMUD, PG&D, and WAPA that provides the pseudo tie of a resource geographically located in the CAISO BAA into the SMUD BAA. Based upon this agreement, the SC schedules energy and AS through the ISO markets as a pseudo tie *export*. These pseudo tie export schedules are submitted as coordinated import and export "wheel through" forward power flow schedules at the specified import and export resources, utilizing a specified CRN. An Existing Transmission Contract (ETC), which is referenced in the agreement, is used for firm transmission reservations. ISO Settlements treats the "wheel through" energy according to the ETC rights when assessing payments and charges. In other words, the ISO has established specific resources and CRNs that correspond to the ETC rights and New Melones Pilot Pseudo Tie Implementation Agreement. The SC schedules wheel-through energy and AS in the Day Ahead Market and Hour Ahead Scheduling Process utilizing the identified resources and CRNs. Settlements assesses all charges associated with this Energy as normal import/export energy unless the tariff language has established specific treatment for ETC rights. Just as the ISO has sufficient visibility of the resources associated with pseudo tie imports into the ISO BAA to support the use of the LMPs at the resource's specific location in Settlements, the ISO has visibility of this resource that is geographically within the ISO's BAA and is associated with the pseudo tie export, and uses its LMPs in Settlements.

3.1.2. Lessons learned from pseudo tie pilots

Both the Sutter and New Melones pseudo tie pilots have resulted in successful market participation for the ISO and the affected market participants, and neither resulted in complications in market operations in the new market. Limitations in market functionality have been revealed through this experience with pseudo ties, as discussed below, but have not deterred the success of the Sutter and New Melones pilots.

An area where refinement in transmission constraints may be needed in the future is in the enforcement of intertie scheduling constraints. Congestion management for enforcement of both (1) flow-based constraints within the ISO BAA, to ensure that flows remain within thermal limits of transmission facilities, that adequate voltage support is available throughout the grid, and that inter-regional flows do not undermine regional stability, and (2) scheduling constraints that limit the volume of schedules that adjacent BAAs agree can be scheduled on a particular intertie, based on either thermal capacity or contractual limits, regardless of how the resulting energy flows through the grid. Intertie scheduling is limited by both what the ISO calls “market scheduling limits”, which place boundaries around scheduling points or sets of scheduling points that can be defined flexibly, but only limit energy schedules, and “intertie” constraints that maintain the sum of energy and ancillary service schedules within the defined limits but have a restriction that a resource can be subject to only one intertie constraint, due to current software functionality. The Sutter pseudo tie generator uses network transmission service to support its scheduling through the SMUD BAA, which allows delivery to the ISO at multiple alternative scheduling points. Thus, the ISO has been unable to define an intertie constraint that applies to Sutter. In Sutter’s case, this has not been an issue because sufficient transmission has been available across the SMUD to ISO boundary. The ISO is evaluating potential solutions for future pseudo ties in other BAAs.

Given RPS and GHG policies, the ISO is now receiving requests to engage in dynamic transfer arrangements with intermittent generating resources. Similar to issues faced with intermittent resources internal to the ISO, a host of issues are raised with intermittent power. Specifically, factors such as load balancing, load forecasting, frequency response and load following make the dynamic transfer of intermittent resources more complex both operationally and for purposes of adopting market protocols and cost allocation rules.

In order to understand the issues presented with dynamic transfer of intermittent resources, the ISO is currently entertaining a pseudo tie pilot project with an intermittent resource located in Nevada. The facility (a photovoltaic facility) will operate under the jurisdiction of the ISO in accordance with the ISO tariff just as any other generating unit of an ISO participating generator.

3.2. Dynamic Scheduling

3.2.1. Existing Dynamic Scheduling Arrangements

At start-up of the ISO, three jointly-owned resources Hoover (Nevada), Palo Verde (Arizona) and Four Corners (New Mexico) were established as pre-existing dynamic schedules (grandfathered) into the ISO BAA. These resources dynamically transfer up to 1,600 MW of energy and AS into the ISO BAA. Since start-up five additional dynamic import schedules have been added, which brings the total of dynamic imports capacity for energy and AS to approximately 3,500 MW.

The following are some of the lessons learned from the existing dynamic scheduling arrangements which will inform the specific changes which may be made to the existing tariff service.

3.2.2. Lessons learned from existing dynamic scheduling arrangements

Pro rata deviations -- Prior to 2007, the ISO assumed real-time balancing service for dynamic resources that scheduled less than 100% of the resource output into the ISO. The ISO’s Energy Management System was programmed such that the actual dynamic transfer equaled the actual plant output minus the static schedule. For example, assuming an external resource was actually generating 490 MW in real-time but had a dynamic import schedule of 100 MW to the ISO and a static schedule of 400 MW with another BAA, the actual dynamic transfer into the ISO would have been 90 MW (490 – 400), which means that the ISO assumed the entire 10

MW of deviation.

Layoffs -- Under the ISO's existing Pseudo Tie Pilots, layoffs (energy transfers within the host BAA) are allowed but the layoffs are treated as "firm static exports" from the ISO. In other words, the ISO assesses all export charges except wheeling charges to the layoffs since the layoffs do not actually flow through the ISO's transmission system. Moving forward, should layoffs to be treated as firm dynamic schedules from the ISO?

Intertie Curtailment –Dynamic unit response - In the event of a real time derate on the designated intertie or other transmission contingency event in close proximity, it is imperative that the dynamic resource, either conventional resource or intermittent, be "dispatchable" so as to be able to respond immediately to the dynamic interchange schedule (e-Tag) curtailment. A key issue with the expansion of dynamic import services to renewables, will be the ability of the resource to be "dispatcable" and to drop load in defined increments, to be immediately responsive to curtailment orders by the host or attaining BA. This ability may require the use of special operating procedures and equipment that to facilitate immediate response to such dispatch instructions, and the decisive reduction of output in pre-defined blocks of MWs. this agreement and unit ability will be particularly critical in the event of an overload condition at the associated pre-existing physical Intertie for grid reliability and NERC Interchange Standard compliance.

Contract issues -- As mentioned in Section 2.3.2, the ISO instituted a certification process for scheduling coordinators that seek to dynamically schedule ancillary services including Regulation and balancing authorities from which such imports are to be scheduled. This certification includes a requirement that the sending balancing authority and the scheduling coordinator representing the System Resource demonstrate that they have made appropriate arrangements and have put in place the equipment and services necessary to deliver the ancillary services to the point of interchange with the ISO balancing authority area. In addition, the ISO requires the balancing authority from which the ancillary services are to be scheduled to enter into an agreement with the ISO for interconnected balancing authority area operations. With the dynamic scheduling obligations captured in the agreement between the ISO and the balancing authority from which the ancillary services are scheduled, should there also be a requirement for the balancing authority to request certification of the ancillary services?

4. Operational Issues Associated With Dynamic Transfers of Conventional and Intermittent Resources

Extending the ISO dynamic transfer and pseudo tie service to intermittent renewable resources raises issues the ISO has not encountered with dynamic transfer of conventional resources. While the ISO faces many of these issues with intermittent resources that are native to the ISO BAA, the exponential growth of intermittent resources that would occur due to bringing unrestricted amounts of intermittent power under the control and responsibility of the ISO with a dynamic transfer arrangement necessarily causes the ISO to pause and reflect on operational, market and cost allocation consequences.

Following is a partial list of issues the ISO would like to consider as part of designing dynamic transfer procedures and tariff amendments going forward. We invite the perspectives of market participants and stakeholders on these as well as any new issues they choose to identify for resolution.

a) ***Real-time Balancing (Regulation)*** – The ISO currently shares the real-time balancing burden from an external conventional resource that is dynamically scheduled to the ISO, proportionate to the percentage of the resource that sinks to the ISO dynamically. Example: assuming an external resource is actually generating 490 MW in real-time but has a dynamic schedule of 100 MW import to the ISO and a static schedule of 400 MW with another BAA. The ISO would incur 2 MW of the 10 MW deviation (100/500 * 10). The host BAA maintains responsibility for the other 8 MW's of deviation burden.

   Should the ISO allow an intermittent resource to dynamically schedule a portion of its output to the ISO? The variability of intermittent resources is more noticeable when it is dynamically scheduled because the variability would be from a specific resource.

b) ***Treatment of Layoffs and Dynamic Exports*** **–** The ISO currently allows layoffs within the native BA from conventional resources that are pseudo tied to the ISO. However, these layoffs are treated as fixed static exports from the ISO. Should layoffs have an option to be treated as either a static or dynamic schedule? What rules need to apply to dynamic exports?

c) ***Increase Load following requirements*** -- The energy production levels from intermittent resources, by nature are less predictable and variable. The ISO concluded in its "Integration of Renewable Resources" report published in November 2007 that an increase of 1,000 MW of wind (up to 20% RPS[2]) would result in an increase of:

   - Upward Load Following Capacity Requirement of **190 MW,**
   - Downward Load Following Capacity Requirement of **214 MW,**

   The ISO expects its load following requirements to increase with dynamically scheduled and pseudo tied intermittent resources into the ISO.

   Should the need for additional load-following capacity be assessed to the intermittent resource?

d) ***Increase Regulation requirements*** -- The ISO also concluded in its "Integration of Renewable Resources" report that an increase of 1,000 MW of wind (up to 20% RPS[3]) would result in an increase of:

   - Upward Regulation Capacity Requirement of **60 MW,**
   - Downward Regulation Capacity Requirement of **120 MW.**

   Although the actual amount of additional regulation burden may be dampened somewhat due to geographic diversity of the external resources, should real-time balancing needs (regulation) be assessed to the intermittent resources?

e) ***Other Dynamic Import Requirements*** **–** Should there be a requirement for intermittent resources to comply with the ISO Tariff Appendix X "Dynamic Scheduling

[2] Extrapolating these requirements beyond 20% RPS is not recommended. A 33% RPS study would have to be done to determine the load following and regulation impacts.
[3] Extrapolating these requirements beyond 20% RPS is not recommended. A 33% RPS study would have to be done to determine the load following and regulation impacts.

Protocol (DSP)" and all other applicable requirements that conventional resources must meet before they can establish a dynamic transfer with the ISO?

f) ***PIRP Modifications*** – Should the ISO allow intermittent resources under dynamic transfers to participate in PIRP? Should the intermittent resources have to meet the same requirement including forecasting requirements as internal PIRP resources?

Currently, the ISO requires an hour-ahead wind forecast for renewable resources in the PIRP. A day-ahead forecast is not a requirement at this time but this could change with higher penetration of renewable resources. In the future, the ISO may require day-ahead and real-time forecasts of intermittent resources to facilitate day-ahead unit commitment and real-time operations.

Should all external renewable resource meet requirements (such as wind speed, ambient temperature, MW production, outage information etc.) that internal PIRP resources have to meet regardless of whether the external resource participates in the PIRP?

g) ***Communication/Telemetry Considerations*** – Should the communication and telemetry requirements to establish a dynamic transfer with the ISO be the same for intermittent resources as it is for conventional resources?

h) ***Generator-Only Balancing Authorities*** - There are several single unit BAAs operating within the WECC, of which two have requested the capability and approval to dynamically schedule into the ISO. These generator-only BAAs contract with a third party to provide real-time balancing services; however it's not clear exactly how the real-time balancing takes place and its impact on inadvertent flows. Should the ISO establish dynamic transfers from generator-only BAAs? What charges should apply for the services provided?

i) ***Unit Contingent*** – Unit contingent interchange schedules are usually e-Tagged as Firm Contingent (FC) by SCs. With the ISO existing Market design, SCs cannot specify Market interchange schedules as "unit contingent". Interchange schedules can only be specified as "firm" or "non-firm". The ISO currently uses a semi-automated process of extracting the e-Tags with the designation of "Firm Contingent[4]" from the NERC Tagging System after the hour-ahead market closes. The Control Area Scheduler tabulates the MW value of all unit contingent imports for each hour and pushes this data to the EMS system where it is included in the ISO's load responsibility.

For unit contingent and dynamic schedules, the supplier does NOT provide reserves associated with this schedule as with other firm interchange schedules. If the ISO were to treat the unit contingent interchange schedules as firm schedules it would result in an under calculation of the ISO's operating reserve requirements. Present market design may result in improper allocation of reserve obligations to SCs responsible for or serving load with renewable energy imports.

[4] The e-tags designated as "Firm Contingent" are not always completed by the close of the Day-Ahead Market so a better representation of the Unit Contingent Energy is obtained before the Hour-Ahead market closes.

Should intermittent resources be allowed to schedule energy into the ISO as unit contingent?

j) ***Limit of Dynamic Imports* –** A coordinated technical study with multiple BAAs within the WECC Interconnection would have to be done to determine the maximum transfer limits between BAAs. Should the ISO establish temporary limits prior to these technical studies? When a limit is exceeded in real-time would conventional and intermittent resources be curtailed on a pro rata basis?

k) ***Frequency Response* –** For reliability reasons, the ISO ensures that it has enough inertia through synchronized capacity on the system to arrest frequency decline following the loss of a generating resource in real-time. The ISO can rely on any frequency response provided from conventional resources that are pseudo tied to the ISO. Since intermittent resources cannot provide the inertia that conventional resources provide, should the ISO curtail intermittent resources to ensure adequate inertia is available on the system? If so, should intermittent imports and intermittent resources within the ISO's footprint be curtailed on a pro rata basis?

l) ***Aggregation of Conventional and/or Renewable Resources -*** Some external intermittent resources are contemplating aggregating resources to take advantage of geographic diversity in order to reduce real-time deviations. In some cases a conventional resource could be aggregated with an intermittent resource. What are the potential issues with this proposal and would such an aggregation be considered viable to establish dynamic scheduling functionality with the ISO?

5. Market Issues Associated With Dynamic Transfers of Conventional and Intermittent Resources

The ISO's existing tariff require dynamic scheduling of imports be "technically feasible and consistent with WECC and NERC reliability standards," which describe how dynamic scheduling occurs in order to maintain reliability. These standards require the ISO to define operational related functions to support dynamic scheduling, including financial settlements on a case by case basis. The purpose of this section is to review the market design aspects of expanding the ISO's tariff for dynamic scheduling and pseudo ties, including :

- Dispatchability requirements
- Congestion management and curtailment rules
- Transmission reservation
- Settlement of Uninstructed Imbalance Energy
- Responsibility for ancillary service charges
- Coordination with neighboring BAAs, to avoid creating seams issues

The impact of these issues is quite similar for both dynamic schedules and pseudo ties, and this discussion will distinguish between these scheduling options only if needed. Similarly, little if any reason is apparent for setting different requirements in market design for intermittent versus conventional resources. Issues such as the allocation of regulation costs may have increased prominence for intermittent resources, but the same standards will be considered for all types of resources.

Dispatchability requirements

One of the fundamental differences between dynamic and static interchange schedules is that static schedules are fixed for the duration of the operating hour, while dynamic schedules are dispatched as deviations by 5-minute interval within the operating hour, based on bid price, like generation within the ISO BAA, or as regulation reserve. Like generation within the ISO BAA, dynamic schedules can include self-scheduled MW supplies that are delivered into the ISO, as well as economic bid segments that have bid prices for use in market dispatch. Some traditional resources such as joint ownership shares of hydro, coal, or nuclear power plants that are "dynamically" scheduled in the ISO's markets offer limited dispatchability, and bids may be submitted that consist only of their self-schedules. In the case of these traditional resources, deviations within operating hours from fixed self-schedules are limited, because they maintain steady outputs. Some existing dynamic schedules exist as dynamic resources not because they are dispatchable, but rather what is contractually delivered is dynamically determined as a percent share of a plant that is externally controlled.

In the case of intermittent resources that will schedule dynamically, it can be common that there is no ability for price-responsive dispatch, even though the output is variable with operating conditions such as wind speed or cloud cover. These resources' deviations from hourly schedules would be problematic from both the market participants' and the ISO's perspectives, since the market participants would face financial settlements for uninstructed energy and the ISO's software would believe the resources will be delivering outputs that are not feasible to produce. These problems could be resolved if there were a way to adjust dynamic schedules within the operating hour, for reasons other than price-responsive dispatches or response as regulation reserve, but there is no single solution that is clearly the best. The ISO invites stakeholder comments on potential solutions. The ISO has identified three potential options for intra-hour schedule adjustments other than price-responsive dispatches and regulation, all of which have advantages and disadvantages. The ISO invites comments on these alternatives, and ideas for other solutions. The options are:

- Leverage the market functionality that was initially developed to support Metered Sub-Systems (MSS).[5] The ISO is in the process of evaluating whether this is a workable solution, but if this were the basis for a solution, the dynamic schedule would not become an MSS. Rather, the dynamic resource would be recognized in some ISO software systems as having a variable self-schedule, which in this case would be reported to the ISO as its expected output during some time interval (such as 5-minutes) and sent to the resource as the ISO's dispatch, in somewhat the same manner that a MSS informs the ISO where its load-following resources will be operating, and the ISO echoes back the operating point as a dispatch. Such a mechanism would allow a dynamic resource to update its self-schedule, which would otherwise be fixed for the operating hour, and thereby allow the ISO to maintain efficient operation of its interties and internal transmission.
- Treat dynamic schedules for intermittent resources as non-compliant with the ISO's dispatch, as occurs with intermittent resources within the ISO. If a dynamic resource were treated as non-compliant, the ISO could internally account for the resource deviation as an expected output in future intervals, while instructing the resource to return to its schedule. This solution would use existing software functionality and recognize the impact of the deviations when dispatching other resources. However, deviations of intermittent resources scheduled at interties can impact congestion

[5] An MSS is an electric utility system located within the ISO, which has operated before the ISO's formation as a municipal utility, water district, irrigation district, state agency or federal power marketing authority.

management if the market software sees a resource's output as either adding to or relieving congestion, on the intertie or within the ISO, but the software no longer has current information on the resource's output and assumes the resource will return to its previous hourly schedule. This solution also would not recognize forecasts of future deliveries that differ from the current level.

- Expect intermittent dynamic resources to report variations in their delivery as derates using outage reporting. The ISO's market software would reduce schedules to the derated capacity, but could only recognize deviations below initial schedules and not deviations above the schedules.

Congestion management and curtailment rules

Congestion management is a function that the ISO performs in scheduling all resources, both within the ISO and on its interties. When the ISO's market software determines schedules, it considers known transmission constraints, but sometimes conditions change after the market runs and changes to schedules must occur in order to maintain reliable operations. For example, when an intertie path has a derate within an operating hour, the ISO must ensure essentially an immediate reduction in intertie schedules that affect the path, although the response by some market participants has not always occurred as needed. If a market participant causes the ISO to incur a penalty for non-compliance with standards, existing tariff provisions allow the ISO to charge the market participant for the penalty, but these provisions only cover fairly extreme departures from reliable operation and may not be sufficient. The market software currently has some provisions for performing contingency dispatch to respond to events including outages or unexpected derates of interties, although at times manual intervention by operators is necessary. Dynamic scheduling allows the ISO to respond to changing congestion conditions within operating hours more than its very limited ability to adjust static hourly intertie schedules, but questions to be addressed involve whether current financial settlements adequately reflect needs for compliance with dispatches to dynamic resources. There is currently little difference in the price that is applicable in ISO settlements for instructed (i.e., scheduled or dispatched) energy versus uninstructed energy, although other settlement provisions have been considered from time to time.[6] Finally, what additional decremental dispatch rules need to be in place? If reduction on an overloaded line does not occur in a timely manner, what curtailment rules should apply?

Transmission reservation

A clarification to be made through this project involves the implementation of Section 8.3 of ISO Tariff Appendix X (Dynamic Scheduling Protocol), which states: "All Day-Ahead Market and HASP/RTM submitted Dynamic Schedules shall be subject to CAISO Congestion Management and as such may not exceed their transmission reservations in Real-Time (with the exception of intra-hour Dispatch Instructions of the Energy associated with accepted Ancillary Services Bids)." Electronic tags for dynamic scheduling contain capacity values for both expected delivery and maximum delivery. The ISO's market software manages dynamic schedules using

[6] For dynamic schedules for resource-specific system resources, the ISO's practice in developing new dynamic scheduling agreements is to divide uninstructed deviations of the generator proportionally between the ISO's schedule and other schedules supported by the generator. For example, consider an external resource with a dynamic schedule of 100 MW of import to the ISO and a static schedule of 400 MW with another balancing authority, which actually generates 490 MW in real-time. The ISO would incur 2 MW of the 10 MW deviation (100/500 * 10). The host balancing authority maintains responsibility for the other 8 MW of deviation. Because 100% of the output of pseudo-ties is delivered to the ISO, the ISO carries 100% of the responsibility for uninstructed deviations of pseudo-ties.

only the value for expected delivery. Thus, the value for expected delivery represents the transmission reservation for purposes of the ISO market. Within the ISO's market, it remains the scheduling coordinator's responsibility to only include capacity in the bid for a dynamic resource that can actually be scheduled if dispatched by the ISO. Further, the dynamic schedule remains subject to the scheduling practices of other BAAs between the ISO and the schedule's ultimate source or sink, and the value for maximum delivery may be significant to other BAAs.

The ISO's current practice has been to expect pseudo ties to have long-term reservations for their full capacity through other BAAs up to the ISO boundary, but the ISO does not reserve transmission from the ISO boundary for more than hour-to-hour intervals. The ISO recognizes a concern that its current practice could limit the availability of transmission to get to the ISO boundary, for bidding into the ISO's markets, when dynamic schedules do not use their entire maximum capacity as their expected delivery. As the use of dynamic scheduling increases, an option under consideration is to relax the requirement for long-term firm transmission capacity reservations in external areas. Simply having a firm transmission capacity reservation may be sufficient.

<u>Settlement of Uninstructed Imbalance Energy</u>

ISO tariff section 11.23 details Uninstructed Deviation Penalties (UDP) that are not currently active, but could be implemented if system conditions were to develop that would demonstrate to FERC that they should be activated. Among these provisions is an UDP component for positive Uninstructed Imbalance Energy that would be the amount of the Uninstructed Imbalance Energy, in excess of a tolerance band, multiplied by a price equal to 100% of the corresponding LMP for the resource's location. The result of this UDP component, netted with the payment for Uninstructed Imbalance Energy that would otherwise apply, is that the resource would not be paid for energy that is delivered outside of its tolerance band. Even though the UDP tariff provisions are not currently active for other resources, they may be a useful device for encouraging compliance with congestion management. The ISO seeks comments on whether application of this type of penalty is necessary to obtain compliance with the ISO's curtailment of dynamic imports, whether it would be adequate to obtain compliance, and whether the ISO should consider alternative provisions to ensure compliance with the ISO's dispatches.

<u>Responsibility for ancillary service charges</u>

Dynamic scheduling, including scheduling as a pseudo tie, creates opportunities both for supplying ancillary services to the ISO markets and for paying for the costs of procuring the ancillary services that the ISO requires. Dynamic system resources may supply regulation (if technically capable), spinning reserve, and non-spinning reserve through the ISO markets, provided that they meet specific performance requirements. Under ISO tariff section 11.10.4.2, dynamic imports carry an obligation for operating reserves (spinning and non-spinning reserve) on the same basis as unit-contingent imports (5% of hydro capacity plus 7% of non-hydro capacity). If the scheduling coordinator representing the dynamic import is not providing ancillary services to meet this obligation, it will be charged for the obligation that it is not provided through financial settlements. However, these provisions do not currently address obligations for regulation ancillary services. The ISO's analysis of the impacts of increased utilization of renewable energy (available at http://www.caiso.com/1ca5/1ca5a7a026270.pdf) poses a significant increase in the requirement for regulation as an ancillary service. This is one of the issues to be addressed in developing the ISO's Straw Proposal. The ISO recognizes alternative perspectives on this issue, and seeks stakeholder comments concerning them and any other perspectives:

- One perspective is that ancillary service obligations for imports using dynamic schedules and unit-contingent schedules will impose significant costs on the ISO markets and should include regulation as well as operating reserves, for comparability to demand served by the ISO. This perspective would lead to adding charges for dynamic imports to the existing obligations for operating reserves.
- An alternate perspective is that the increased interest that the ISO is experiencing in dynamic scheduling of intermittent resources is due to renewable energy standards that the state of California has determined to be in the interests of society, and the costs of regulation are simply one of many costs of meeting the renewable energy standards. This perspective may lead to a conclusion that the existing allocation of ancillary service costs should not change, and leave load responsible for most costs of ancillary services.

Coordination with neighboring balancing authority areas, to avoid creating seams issues

The final area to be noted in relation to market design options is that neighboring BAAs are currently facing similar issues with regard to integrating large amounts of intermittent resources. They face similar issues as those discussed in this Issue Paper and are developing their own solutions to these issues. It may be desirable to adopt provisions that share the regulation and operational burden among the balancing authorities rather than having the obligation fall on the sending or receiving balancing authority The current initiatives of other BAAs that the ISO will examine as part of its coordination with neighboring areas include:

- Joint Initiatives efforts: In mid-2008, representatives from Columbia Grid, Northern Tier Transmission Group, and WestConnect joined forces to pursue a number of projects that would benefit from a broader level of participation and geographic economices of scale. Current initiatives sponsored by the collaborative include facilitation of intra-hour energy and transmission transactions, dynamic scheduling protocols, and sharing of ACE diversity. Information is available at http://www.columbiagrid.org/ji-nttg-wc-overview.cfm.
- Defined intra-hour schedule changes across balancing authorities (every 10 minutes, 15 minutes, or 30 minutes). This would allow a sharing of the regulation and operational burden beyond simply shifting the burden to the sending or receiving balancing authorities.
- The Bonneville Power Administration (BPA) has developed a set of Wind Integration Charges that are applicable to intermittent resources located in its BAA. There may be merit in implementing similar charges for similar functions in BAAs such as the ISO that have significant amounts of interchange schedules with BPA.

The ISO invites input on all issues identified in this paper, as well as identification of any other issues which need to be resolved in fully defining terms and conditions for dynamic transfers. services in the tariff.

6. Next Steps

The following schedule has been proposed to proceed with the Dynamic Transfer tariff initiative:

December 7, 2009 – Stakeholder meeting on issue paper

December 14, 2009- Stakeholder comments due on issue paper

January 2010 – Straw Proposal published

February, 2010 – Stakeholder meeting/conference call to discuss Straw Proposal and receive written stakeholder comments

March, 2010 – Draft Final Proposal published, Stakeholder meeting/conference call and receive written stakeholder comments

April/May 2010 – Board of Governors decision on Dynamic Transfer initiative

June, 2010 – Tariff filing submitted to FERC for approval of Dynamic Transfer tariff changes.

7. Definitions

Dynamic Interchange Schedule or Dynamic Schedule: A telemetered reading or value that is updated in real-time and used as a schedule in the AGC/ACE equation and the integrated value of which is treated as a schedule for interchange accounting purposes. Commonly used for scheduling jointly owned generation to or from another Balancing Authority Area.

Dynamic Transfer: The provision of the real-time monitoring, telemetering, computer software, hardware, communications, engineering, energy accounting (including inadvertent interchange), and administration required to electronically move all or a portion of the real energy services associated with a generator or load out of one Balancing Authority Area into another. This is fully described in NERC's White Paper, http://www.nerc.com/docs/oc/is/Dynamic_Transfer_White_Paper_Draft_4.pdf, "Dynamic Transfer"

Interchange: Energy transfers that cross Balancing Authority boundaries.

Interchange Authority: The responsible entity that authorizes implementation of valid and balanced Interchange Schedules between Balancing Authority Areas, and ensures communication of Interchange information for reliability assessment purposes.

Interchange Schedule: An agreed-upon Interchange Transaction size (megawatts), start and end time, beginning and ending ramp times and rate, and type required for delivery and receipt of power and energy between the Source and Sink Balancing Authorities involved in the transaction.

Interchange Transaction: An agreement to transfer energy from a seller to a buyer that crosses one or more Balancing Authority Area boundaries.

Interchange Transaction Tag or Tag: The details of an Interchange Transaction required for its physical implementation.

Net Actual Interchange: The algebraic sum of all metered interchange over all interconnections between two physically Adjacent Balancing Authority Areas.

Net Interchange Schedule: The algebraic sum of all Interchange Schedules with each Adjacent Balancing Authority.

Net Scheduled Interchange: The algebraic sum of all Interchange Schedules across a given path or between Balancing Authorities for a given period or instant in time.

Overlap Regulation Service: A method of providing regulation service in which the Balancing Authority providing the regulation service incorporates another Balancing Authority's actual interchange, frequency response, and schedules into providing Balancing Authority's AGC/ACE equation.

Pseudo-Tie (ISO Contract Definition): The point at which an external generating facility is interconnected to its Native or Host Control Area in which it is physically located, with all of its output being dynamically transferred to its Attaining Control Area..

Pseudo Generating Unit: A Generating Unit (or group of Generating Units comprising a generating plant) interconnected externally to the CAISO BAA, authorized by a PPGA to receive applicable BAA services from the CAISO and to operate under the jurisdiction of the CAISO in accordance with the CAISO Tariff just as any other Generating Unit of a CAISO Participating Generator.

Host Balancing Authority Area: The NERC defined Balancing Authority Area where the Pseudo Generating Unit is physically interconnected to the electric grid.

Attaining Balancing Authority Area: The NERC defined Balancing Authority Area where the Pseudo Generating Unit output is fully included for purposes of calculation of Area Control Error ("ACE") and meeting BAA Load responsibilities.

8. NERC/WECC Requirements

Following are some specific requirements by NERC and/or WECC related to pseudo-ties:

- Operation and/or associated scheduling of pseudo-tie functionalities must be consistent with the NERC "Dynamic Transfer Reference Document," which was approved by the NERC operating committee on March 25, 2004 as a reference document, and any resulting NERC standards and/or policies.
- Operation of pseudo-tie functionalities must comply with all applicable NERC and WECC reliability standards, policies, requirements, and guidelines regarding inter-BAA scheduling.
- The pseudo-tie must be registered as a "Point Of Delivery" (POD) on NERC's "Transmission Service Information Network" (TSIN). All energy transfers associated with pseudo-ties must be electronically tagged (e-tagged).
- Pseudo-tie energy schedules (e-tags) are subject to the net scheduled interchange and NAI (Net Area Interchange) checkout processes between balancing authorities but "net" out, as the pseudo-tie "export" offsets the corresponding energy transfer or "import" at the designated physical intertie.
- Any external sales of energy from the pseudo-tie generator "laid off" to the native balancing authority are treated as "exports" from the attaining BAA. This "lay-off" energy schedule is subject to checkout like any other export from the ISO BAA.