**SCHEDULING – MODULE 3a**

***Market Information System*** – Explains data and functional features of an information system that provides OASIS services, public information through a general website, and a private portal for scheduling, submission of bids and offers in markets, transmission of market results, settlement statements, etc.

***Outage Coordination*** – Describes the proposed process Grid West will use to take a leading role in coordinating transmission outages. Generation outage information will be requested by Grid West to aid in reliability determinations, but coordination will not generally be performed and such data will not be made public.

***Scheduling & Schedule Adjustments*** – Describes process and data needed by Grid West and its participants to schedule transactions including tagging, timing, etc. The paper describes the proposed process for adjusting schedules and checkout procedures required to ensure accurate interchange schedules and Net Scheduled Interchange between Balancing Authorities in or adjacent to the GWMT.

***Transmission Losses –*** Confirms no change in the treatment of losses for pre-existing agreements and describes a proposed methodology to be used for calculation of loss responsibilities for schedules using IWRs.

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## 1.0 EXECUTIVE SUMMARY

Grid West will be the single Transmission Service Provider (TSP) for new and converted transmission services. Transmission Owners (TOs) will continue to serve as the TSP for existing services with the TOs serving those OASIS needs.

These services require Transmission Customers to exchange information with Grid West. This information exchange requires several communication tools and applications, collectively referred to as the Grid West Market Information System (MIS).

Grid West will provide a single market information system for the Grid West Managed Transmission System (GWMT).[1]

This system will include the following components:

- A single Open Access Sametime Information System (OASIS) node
- A public Web site
- A private market portal

Grid West will post relevant information related to both regional and Consolidated Control Area (CCA) services.

## 2.0 PURPOSE

The purpose of this white paper is to describe the collection of systems making up the Market Information System and discuss the data available on the MIS. The MIS will be the primary interface between Grid West and its customers[2]. Grid West's need for scheduling, market operation and other internal information systems is not discussed in this paper.

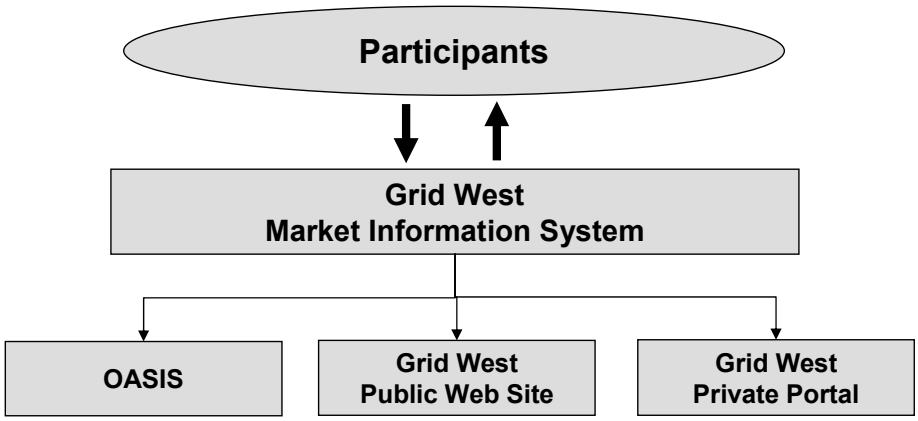
## 3.0 BACKGROUND

Grid West will perform several roles in the operations of Grid West's transmission system and the CCA. These roles require an efficient means for data to be communicated openly between Grid West and its transmission and non-transmission customers. The MIS depicted in Figure 3.0 is comprised of:

[1] Given the differently situated regulatory regime in Canada and British Columbia, in particular, the operating assumption is that the Grid West market design will be mirrored in British Columbia, to the extent possible within that regulatory regime. Details regarding the market design in British Columbia are anticipated to be completed as part of detailed design phase of this effort.
[2] The tag system will likely be independent of MIS, which remains to be determined.

- A single OASIS for the GMWT,
- A public Web site (www.gridwest.com) and
- A private market portal.

Figure 3.1 -- Overview of Grid West's Market Information System




Grid West will establish and maintain a single OASIS node for the entire GWMT system. The region currently has multiple sites so the consolidation into a single node will allow for more efficient communication of market and transmission-related information. A similar OASIS consolidation effort has been wesTTrans.net. Grid West should look to leverage existing solutions where possible in order to minimize cost. For example, some of the functions of the OASIS node may be provided by third-party service providers.

## 4.0 GRID WEST OASIS

For new and converted services, Grid West will provide a single OASIS node for transmission service providers who sign a transmission agreement with Grid West, replacing the need for transmission customers to go to multiple sites, as has been the case to date. In establishing the single OASIS node, Grid West will comply with the basic requirements and business practices for the OASIS network as defined in Federal Energy Regulatory Commission (FERC) Order No. 889, including the standards and formats for OASIS nodes, and any additional FERC Orders or Western Electricity Coordinating Council (WECC) business practices. This site will provide a common interface for transmission customers taking pre-existing service from their TSPs and transmission customers taking service directly from Grid West.

Grid West will independently calculate total flowgate capacity (TFC) and available flowgate capacity (AFC) for all the flowgates in the GWMT. Grid West's OASIS will maintain transmission information for Grid West transmission customers; provide CCA-related market information for the CCA service providers and users; and allow access to any of this information as appropriate to other authorized users of Grid West's OASIS site.

The public information posted on OASIS will be open to all transmission customers and to the public. Private information about transmission requests will be directed to the private portal where private information about specific transmission customers is protected and only available to the registered users that are authorized by the transmission customers' companies.

This paper describes the general functions of the Grid West OASIS perform, such as the posting of system information.

### *4.1 Transmission Service Requests*

An eligible transmission customer can request transmission service using Grid West's MIS[3]. Responses will also be received via the MIS.

Grid West's planning department will process the long-term requests (requests longer than one year) using planning tools and other evaluation methods[4]. A system impact study will usually be needed and its study results will be sent to the requesting transmission customer via OASIS. A manual procedure will be used for this purpose.

Requests for Firm Transmission with durations less than one year will be processed as part of the Reconfiguration Service (RCS)[5]. Grid West has defined the following RCS products:

- Annual On/Off Peak
- Monthly On/Off Peak
- Balance of Month On/Off Peak
- Daily

[3] New transmission requests for service on the GWMT will come to Grid West. Requests for new rights will no longer be provided by the transmission owners. Requests to exercise features of pre-existing rights like redirects would go to the original TSP interface, and the functionality to enable that could be built into the OASIS if it is reasonable and done today.
[4] See also the white paper on Regional Planning & Capacity Expansion.
[5] See the Reconfiguration white paper for additional detail.

All requests will be accumulated and processed simultaneously by the RCS process. The RCS results will be available to requesting transmission customers via the MIS. This process will be automated.

The last RCS auction for a given operating day will be completed as a part of the Day-Ahead process. Requests submitted after the close of the daily scheduling process will be processed on a first-come first-served basis.[6] In evaluating these requests, Grid West will use a flow-based approach by which flows on all constrained or potentially constrained flowgates are computed by using the applicable Path Utilization Factors (PUFs) and the proposed schedule or schedule changes. Responses to these requests will be available to requesting transmission customers via the MIS. This process will be automated.

## *4.2 Transmission Information*

### 4.2.1 Posting Service Products and Prices

Regional and market-related products and services offered by Grid West will be described on the MIS, along with the link to the applicable tariffs and business practices. The transmission-related services for the region include:

- Reconfiguration services (RCS)
- Long-term expansion services
- Loss management
- Registration for the secondary rights market
- Scheduling services
- Transmission-related ancillary services

The market-related services for the CCA include:

- Reserve services
- Real-time balancing services

### 4.2.2 Posting Transmission Capacity

Grid West will calculate and post available AFCs and PUFs. In addition, Grid West will post the methodologies for calculating the transmission capacity prior to the start of Grid West operation.

The frequency of posting and updating for various data elements on the MIS has not been determined. However, it will be consistent with OAISIS

[6] See white paper on Scheduling Adjustment.

requirements. It will be necessary for Grid West to update and post the AFCs before and after the various RCS auctions and before and after the day-ahead scheduling process at a minimum.

The timeframe for the AFCs has not been determined yet. Grid West will, however, match the timeframes of the posted AFC with the timeframes of the products used in the various RCS auctions.

### 4.2.3 Posting Transmission System Information

Grid West will post detailed information of all potentially constrained flowgates within the GWMT. Grid West will also post scheduling-related information such as curtailments, transmission outages, and the inventory of points of receipt and delivery, also referred to as injection points and withdrawal points.

Grid West will post day-ahead to seven-day ahead load projections in the GWMT and other host control areas, as well as the flowgate constraint projection information if available.

Grid West will post outage information that impacts the AFCs. The planned transmission facility outage schedule for the current month and the following three months will be posted[7]. The outage schedule for the planned generation facility will not be published.

Grid West will post information on loss factors for transmission customers to evaluate their loss obligations for the following seven days.

### 4.2.4 Posting List of Studies

When Grid West receives a long-term request, a system impact study may be conducted. The study on whether there are enough AFCs to accommodate the request will be available to the requesting customer. However, a list of all studies will be posted.

## *4.3 Posting Reserve Service Offerings and Prices*

The types of reserve services that may be provided to the CCA will include the following:

- Regulating reserves

[7] See white paper on Outage coordination.

- Spinning reserves
- Non-spinning reserves

The auction prices will be posted after the close of the reserve auctions.[8]

Aggregated, non-confidential market summary data (e.g. summarized bid quantities and market clearing prices) for the reserve services will be posted after the close of the reserve markets.

### *4.4 Posting Real-time Balancing Service Offerings and Prices*

Grid West will post real-time clearing prices for the CCA service area when they become available.

Grid West will post real-time or anticipated system conditions impacting the CCA real-time balancing services.

Aggregated, non-confidential market summary data (e.g. bid quantities, market clearing prices) for real-time balancing services will be posted when the information is processed and available.

## 5.0 TRADITIONAL OASIS SERVICES

Grid West's OASIS will also provide the traditional OASIS services using a common interface for each of the TSPs joining Grid West. Transmission customers will be able to use the Grid West OASIS to access service under the pre-existing arrangements from their existing TSP.

Examples include:

- Posting transmission for bilateral re-sales
- Re-assigning transmission rights
- Re-directing transmission points of delivery and receipt

These services will also be provided for transmission customers taking service from Grid West as applicable under FERC rules and WECC business practices.

[8] Additional information will be in the Reserve white paper.

## 6.0 GRID WEST PUBLIC WEB SITE

The Grid West public Web site (http://www.gridwest.com) will be used to publish public information on how to conduct business with Grid West. Examples include:

- Grid West Tariff
- Grid West Protocols
- Grid West Business Practices
- Grid West Bylaws
- Grid West Market Data

## 7.0 GRID WEST PRIVATE MARKET PORTAL

The Grid West private market portal will be used to accept and publish private information related to markets such as:

- Rights management and translation services
- Reconfiguration service (IWR auctions)
- Day-ahead scheduling and curtailments, as appropriate
- Schedule changes after day-ahead scheduling, including transmission redirects
- Real-time balancing data
- Reserve service
- Other market notifications
- Settlement data

Participants will require proper credentials to gain access to private market data.

The Grid West private market portal may assume some of the traditional OASIS functionality of the existing OASIS of the transmission owners who will become part of Grid West as described in Section 5. The interfaces and data flow are to be discussed with TSPs joining Grid West. However, it will be consistent with applicable orders (e.g., Order 638, 605, 889, etc.).

## 8.0 MARKET BENCHMARK

The design of Grid West's MIS will be similar to existing RTOs in terms of its functional capability. Robust markets, such as MISO and PJM, have developed programmatic interfaces to facilitate the automated exchange of information.

## 9.0 TECHNOLOGY SOLUTIONS

The major components of the MIS include[9]:

- OASIS
- Public Web site
- Private market portal
- Programmatic interface using XML that conforms to a published schema or set of schemas (to facilitate automated data exchange between Grid West and participants).

## 10.0 COST DRIVERS

Existing markets use a robust market portal with programmatic interfaces for some of the functions described above. The primary cost drivers for Grid West's MIS implementation relate to the technology costs and some operational costs.

- Number of market interfaces
- Programmatic features
- Number of market products
- Report posting frequency
- AFC and RCS posting frequency

One cost consideration for Grid West is the possibility of outsourcing a portion of the MIS (e.g. OASIS) to a third party.

## 11.0 DESIGN ISSUES FOR CONSIDERATION IN NEXT DEVELOPMENT LAYER

The next layer of design should include a review of the following design issues:

- *Tag and scheduling system* - Besides the Market Information System, Grid West will need a system for processing tags and interchange, which should be further considered.

[9] The identified requirements may overlap with these identified in the Interchange and other white papers.

## 1.0 EXECUTIVE SUMMARY

As envisioned in the Regional Representative Group's (RRG) regional proposal, Grid West will be the central scheduling entity for the Grid West Managed Transmission (GWMT) System. As such, Grid West will administer the day-ahead scheduling process. This paper describes the proposed scheduling process for Grid West.[1]

Highlights of this paper include:

- Pre-existing rights holders will continue to submit schedules to the Transmission Owners (TOs) who issued the rights
- TOs will combine their customers' schedules and submit balanced schedules to Grid West
- Injection/Withdrawal Rights (IWR) Transmission Customers will submit their balanced schedules directly to Grid West
- Grid West will validate submitted schedules against customers' rights
- If necessary, Grid West will use pro rata curtailments to resolve infeasibility
- Post day-ahead scheduling changes will be evaluated on a "first-come, first-served" basis
- All schedule submissions must be balanced
- Schedules crossing control area boundaries will require e-tags
- Grid West will administer schedule checkout

## 2.0 PURPOSE

The purpose of this white paper is to discuss the following processes of the proposed scheduling design:

- Day-ahead scheduling
- Day-ahead schedule adjustment
- Post day-ahead schedule changes
- Interchange scheduling
- Checkout

[1] Given the differently situated regulatory regime in Canada and British Columbia, in particular, the operating assumption is that the Grid West market design will be mirrored in British Columbia, to the extent possible within that regulatory regime. Details regarding the market design in British Columbia are anticipated to be completed as part of detailed design phase of this effort.

## 3.0 BACKGROUND

Currently, no single entity has a regional view on a day-ahead basis of the planned use of the Pacific Northwest transmission system[2]. The region's transmission capacity is managed on a "contract path" basis by individual control areas. Schedules under the contract path methodology do not match the actual physical power flows on the transmission grid. In addition, each transmission provider determines its Available Transfer Capability (ATC) based upon its own criteria. Each transmission provider maintains either its own Open Access Same-Time Information System (OASIS) or its own environment on a common OASIS and manages its transmission reservations and energy schedules.

From the perspective of Transmission Customers, transmission service requests are generally processed through the use of a transmission provider's OASIS. The service durations can be divided into long-term and short-term (hourly, daily, weekly and monthly). The short-term service can also have different priorities as firm and non-firm.

Once the service is granted, most Transmission Customers submit their schedules to their transmission providers. The transmission providers typically require that all interchange schedules have associated OASIS reservations supporting these schedules. However, a transmission customer often can designate a scheduling agent for all aspects of its transmission scheduling. Load-serving Entities (LSE) may need to create e-tags for schedules impacting net scheduled interchange, although some transmission providers request the provision of e-tags for other types of flows. Lastly, each transmission provider decides on its own curtailment or adjustment procedure when transfer capability is insufficient.

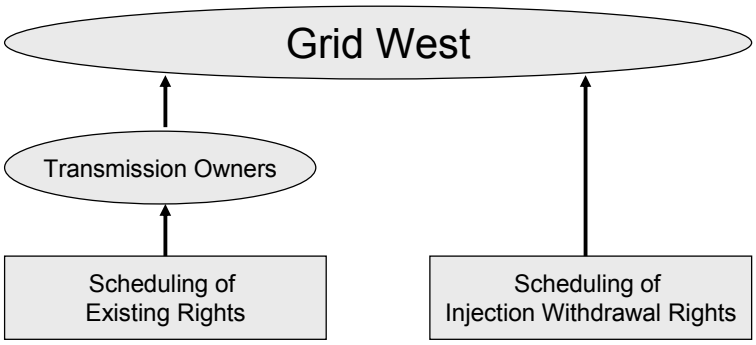
Grid West is expected to become the Transmission Service Provider for the GWMT system, responsible for administering the scheduling of the transmission systems of TOs signing a Transmission Agreement (TA). As the Transmission Service Provider for the GWMT, Grid West will not only have a regional view of the transmission system, but also centrally manage transmission capacity as an independent party. This new scheduling arrangement will honor pre-existing transmission rights, as will be discussed in this paper.

[2] The Pacific Northwest Security Coordinator receives sufficient operational information to provide a comprehensive view of the entire Northwest Power Pool in real-time.

## 4.0 DAY-AHEAD SCHEDULING

During the day-ahead scheduling process, each IWR holder can submit its proposed and balanced schedules to Grid West. Transmission customers with pre-existing transmission rights will submit schedules to the TO[3] who issued the rights. The TOs will verify that submitted schedules are consistent with the terms of the pre-existing rights, combine these schedules with the TO's affiliated merchant's (or Load-serving Entity's) non-contract based schedules (e.g., for native load service), and submit them to Grid West. Transmission customers with pre-existing transmission agreements will continue to provide loss obligations to their TOs using their contractual loss factors. Loss obligations for schedules using IWRs will be computed using the applicable loss factor[4] and losses schedules to meet these obligations will be submitted to Grid West. The proposed process of schedule submission to Grid West is shown in Figure 4.1. The proposed schedules will be submitted through the Grid West's Market Information System (MIS).

Figure 4.1 -- Day-ahead Schedule Submission




A summary of Grid West's day-ahead scheduling process and activities is presented below in Table 4.1 and in Figure 4.2. The timelines shown are illustrative; the actual scheduling timeline will be established in Grid West's protocols which will be developed prior to commencement of actual operations.

Table 4.1 -- Day-Ahead Scheduling Process and Activities

| Time Period | Grid West | Transmission Customer | Transmission Owner |
|---|---|---|---|
| By 08:00 | | • Bilateral trading | |

[3] It is expected that a process will be in place for transmission customers with pre-existing rights to translate their rights to IWRs and schedule directly with Grid West.
[4] See the white paper on losses for details.

| Time Period | Grid West | Transmission Customer | Transmission Owner |
|---|---|---|---|
| | | • Submit bids and offers to DA-RCS | |
| By 09:00 | • Perform DA-RCS | | |
| By 10:00 | • Update existing rights inventory<br>• Update AFC based on the DA-RCS results | | |
| By 11:00 | | • Existing Rights Holders submit schedules to TOs | |
| By 12:00 | | • IWR holders submit schedules to Grid West | • Submit aggregated schedules to Grid West |
| By 13:30 | • Validate schedules against rights inventory<br>• If feasible, Grid West will accept the schedules and publish final schedule<br>• If infeasible, Grid West will perform curtailment procedures | | |
| By 14:00 | • Post curtailment notices and publish final schedule | | |
| By 15:00 | | • Obtain final schedule<br>• Create E-tags | • Obtain final schedule |
| By 16:30 | • Tag Approval | | |
| By 17:00 | • Day-ahead checkout | | |
| On-going from 14:00 to 20 minutes before the start of operating hours | • Evaluate, accept or deny schedules ("first-come, first-served") using PUF and AFC | • Submit schedule change or new request | • Submit schedule change or new request[5] |

[5] For schedule change of pre-existing rights, TO will be responsible for submitting the change requests to Grid West.

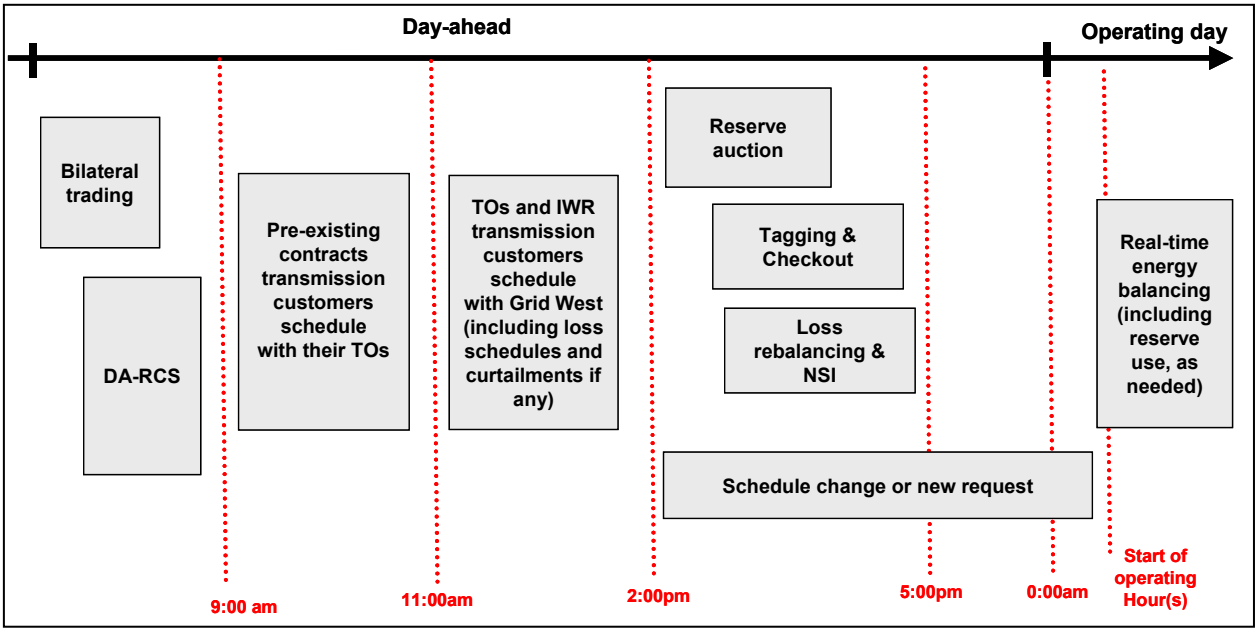



Figure 4.2 -- A Summary of Grid West's Day-ahead Scheduling Processes

## 5.0 DAY-AHEAD SCHEDULE ADJUSTMENT

After combining all proposed day-ahead schedules submitted by Transmission Customers and Transmission Owners, Grid West will analyze the transmission usage and identify potential transmission problems. Grid West will manage congestion using a flow-based approach, relying on the ex ante nature of physical rights. This approach is intended to deal with congestion by preventing energy schedules that would cause congestion, i.e., loading in excess of line (or path) ratings. If all transmission rights are properly defined, the GWMT should have sufficient transmission capacity to support all rights holders' transactions. However, because there will be inevitable differences between expected conditions when rights are issued and actual conditions, it is possible that the combined schedules may be physically infeasible within system reliability limits even though all schedules are covered by physical transmission rights. This may be due to forced outages, changes in generation conditions or an unexpected loss of diversity for over-subscribed paths. In practice, some limited over-subscriptions are reasonable to further increase the utilization of the transmission systems because not all contract rights will be used simultaneously.

If, for any of these reasons, the proposed schedules are physically infeasible to accommodate all schedule requests simultaneously, a backstop process for schedule adjustment and curtailment will be used to satisfy the system reliability limits.

When transmission problems are present as described above, Grid West will reduce schedules using a methodology which minimizes the curtailment amount and provides a means for equitable curtailments.

The adjustment procedure will curtail the proposed schedules proportional to their contributions to congestion or infeasibilities, or proportional to their rights on the constrained facilities. Grid West will not distinguish schedules based on IWR or pre-existing rights for curtailments, i.e., all schedules are on equal footing for curtailment purposes[6].

The schedule curtailments are not the same as load shedding. Curtailed schedules mean reduction of both injection and withdrawal quantities. However, transmission customers can still serve loads through other means, such as scheduling different resources in the post day-ahead period, just as they do today. If transmission customers fail to provide resources to match their load, they may face imbalance charges.

Grid West will develop and use pro rata curtailment with a flowgate-specific procedure. This approach is based on the current curtailment procedures in many of the Northwestern utilities. The main procedure is a two-step process:

1. Identify the contributing schedules causing the infeasibilities (schedules with negligible impacts to the constrained flowgates can be ignored)
2. Perform pro rata reduction of the schedules to resolve infeasibilities

Specific procedures are to be developed based on off-line analyses and study for specific flowgates by taking the special circumstances around the flowgates[7]. After identifying the contributing schedules, the pro-rata allocation of the desired reduction amount can be based on either the scheduled amount or the contracted entitlement amount. Currently, the practice of pro-rata reduction varies with different utilities. For example, in BPA's practice, the allocation of the reduction uses the actually scheduled MW quantity on the constrained path. In

[6] Curtailment of dynamic schedules and pseudo ties will be considered along with the typical transmission schedules. Details of this consideration will be investigated in a later time.
[7] For example, BPA has developed specific curtailment procedures (curtailment calculators) for specific flowgates at Paul – Allston, North of Hanford, West of McNary, and others.

Avista's practice, however, the allocation of the reduction is based on the entitlement to use a path.[8]

A numerical example of the pro-rata allocation is given in Appendix A showing the process and steps of curtailment calculation in a looped network.

## 6.0 POST DAY-AHEAD SCHEDULING

The Post Day-ahead Scheduling period covers the period from the close of day-ahead scheduling to a time close to the ramping period of the operating hour. During this time period, Grid West will accept both schedule adjustments and new requests for transmission service. These requests will be submitted through the Grid West's Market Information System.

Each request will be evaluated on a "first-come, first-served" basis. Grid West will perform the following actions for each request:

- ***Rights Validation:*** Schedule change requests should be consistent with rights.
- ***Impact Analysis:*** All requests will be analyzed based upon Available Flowgate Capacity (AFC) and Path Utilization Factors (PUF).

In the post day-ahead adjustment period, Grid West will assign lower priority to unused capacity granted after the close of the day-ahead scheduling process. In case of subsequent curtailments, post –day-ahead schedules will be curtailed first before the curtailments of the approved day-ahead schedules.

Grid West will use a flow-based approach for evaluating requests for transmission service under the Regional Tariff. Under a flow-based approach, flows on constrained facilities (flowgates) are computed by using the applicable PUFs and the proposed schedule. Grid West will ignore those flowgates on which the impact of the requests is minimal based upon a threshold it will establish for measuring this impact. When a new request results in overloading a path, e.g., load exceeds the AFC on any of the constrained and potentially constrained flowgates excluding constraints which are deemed minimal, say below 1 MW, the transmission service schedule change or new request will not be approved.

[8] A more comprehensive discussion of this issue is given in **"**Possible Pro Ration Methods for Mid-Hour Curtailments", John Anasis and Laura Oliver, BPA Transmission Scheduling, TBL Customer Forum, January 21, 2003, //www.bpa.gov.

Under OATT, Transmission Customers can request to modify Point of Delivery (POD) and Point of Receipt (POR) without being obligated to pay any additional costs. This redirect option is granted when there is adequate transmission capability to accommodate the request. Grid West will treat redirects as a change request to the original schedule; these requests will also be subject to availability of AFCs on the applicable paths. The tracking of redirects and notice to the original transmission provider need to be further considered in system development. The treatment of redirects will comply with the North American Energy Standards (NAESB) Wholesale Electric Quadrant (WEQ) redirect standards.

## 7.0 INTERCHANGE SCHEDULING

The GWMT may be composed of several balancing authorities, including the consolidated control area (CCA) and any non-CCA balancing authorities. Grid West will classify schedules as either: 1) interchange, or 2) internal as described in Table 7.1. An interchange schedule is a schedule between balancing authorities. An internal schedule is a schedule within a single balancing authority.

Table 7.1 -- Grid West Schedule Classification Example

| Schedule Instance | | Schedule Classification |
|---|---|---|
| **POD (or POR)** | **POR (or POD)** | |
| CCA | CCA | Internal schedule |
| Non-CCA | The same non-CCA | Internal schedule |
| CCA | Non-CCA | Interchange schedule |
| CCA | Non-GWMT | Interchange schedule |
| Non-GWMT | Non-GWMT[9] | Interchange schedule |
| Non-CCA | A different Non-CCA | Interchange schedule |
| Non-CCA | Non-GWMT | Interchange schedule |

In compliance with North American Electric Reliability Council (NERC) Version 0 Reliability Standards, Grid West will require tags to be submitted for all interchange schedules between balancing authorities, which will be generated by the Purchasing/Selling Entity's (PSE) LSE. Grid West can also create the

[9] i.e., "through and out" wheeling transactions.

necessary tags on behalf of the Transmission Customers[10]. Grid West will comply with NERC's tag timing requirements. Tags may be used to compute net schedule interchange for the balancing areas, which is needed for Automatic Generation Control (AGC) operations. Grid West can also compute net schedule interchange (NSI) for Balance Authorities not in the CCA if such an arrangement is made between Grid West and these Balance Authorities. Transactions within the CCA balancing authority or within the same non-CCA balancing authority will not need to be tagged.

Western Electricity Coordinating Council (WECC) business practice requires tags to include the transmission segments segregated along control area boundaries even though Grid West will be the Transmission Service Provider for the entire region. Because of the regional and flow-based nature of day-ahead schedules, interchange schedules may cross several control area boundaries. Within Grid West, the schedules across balancing area boundaries will be evaluated in terms of the flow-based effects of the combined Grid West schedules rather than contract paths.

Grid West will serve as the transmission provider to the GWMT and balancing authority for the CCA, approving or denying tags as appropriate for these functions. Grid West's scheduling system will validate and automatically approve or deny NERC tags matching the final day-ahead schedules. This can be accomplished by comparing the common reference numbers on the tag against the scheduling database. The loss reallocation tag will also be generated and approved in this process. This automation requirement will improve the efficiency and tag processing.

## 8.0 CHECKOUT PROCESS

To ensure accurate interchange schedules and net scheduled interchange with neighboring interchange authorities, Grid West will conduct checkout for the entire GWMT. In accordance with NERC Version 0 Reliability Standards on interchange scheduling, every balancing authority has the responsibility to verify their net interchange with their own neighboring balancing authorities, which can be done after Grid West finalizes all scheduled interchange.

In a typical checkout process, two adjacent balancing authorities perform the checkout based on approved E-tags between them. The balancing authorities work to resolve any discrepancies arising in the checkout process. The end result

[10] Agreements between Grid West and transmission customers are needed.

of the checkout process is that all interchange schedules between adjacent balancing authorities are verified and consistent.

There are three separate checkout processes for a balancing authority:

- Day-ahead checkout
- Pre-real-time checkout
- After-the-fact checkout

Grid West will be responsible for the day-ahead, pre-real-time (before-the-fact), and after-the-fact checkout processes for the CCA.

The WECC is in the process of implementing an automated tool for the checkout process. This tool is called the Western Interchange Tool (WIT), which will provide a mechanism for verifying and crosschecking scheduled net interchange values based on tags. WIT will facilitate adjacent net interchange checkout and provide a single source of information on confirmed interchange. When this tool is available, Grid West will leverage WIT to reduce costs and improve the efficiency of the checkout process.

## 9.0 ROLES AND RESPONSIBILITIES

### *9.1 Grid West*

Grid West will:

- Calculate and publish updated AFCs after the close of the RCS market
- Update the latest inventory of IWR rights after the close of the RCS market
- Receive and validate submitted day-ahead schedules
- Perform analysis of submitted day-ahead schedules
- Perform day-ahead schedule adjustments, if necessary
- Approve interchange schedules and tags for all transactions in the GWMT
- Communicate the final resource schedules and/or NSIs to the balancing authorities within GWMT and its Transmission Customers
- Receive and validate the submitted scheduling change requests after day-ahead
- Respond to scheduling change requests
- Approve the request if the flowgate sufficient AFC is available
- Manage loss provision

- Manage the day-ahead and near real-time checkout processes for the CCA
- Manage the after-the-fact checkout processes on behalf of the CCA
- Perform balancing authority responsibilities for the CCA

### *9.2 IWR Transmission Customers*

IWR Transmission Customers will:

- Submit proposed day-ahead transmission and loss schedules to Grid West
- Resolve any validation issues after receiving notifications from Grid West
- Create tags for interchange schedules as appropriate
- Submit schedule requests consistent with the specification by Grid West
- Request tag changes or create new tags, as necessary, from the approved request

### *9.3 Transmission Customers with Pre-existing Rights*

Pre-existing rights Transmission Customers will:

- Submit balanced day-ahead schedules within their rights to the appropriate TO
- Schedule the loss obligations to their TOs per pre-existing agreements
- Ensure creation of tags for their interchange transactions where they are the LSE
- Submit proposed day-ahead transmission and loss schedules to their TOs
- Submit proposed post day-ahead change or new requests to their TOs as appropriate

### *9.4 Transmission Owners*

Transmission Owners will:

- Validate, combine and submit schedules of Transmission Customers with pre-existing rights, including those of non-contract customers, such as affiliated merchants or LSEs serving native load

### *9.5 Balancing Authority Operators*

Balancing authority operators will:

- Manage the after-the-fact checkout processes

## 10.0 MARKET BENCHMARKS

For day-ahead scheduling, Grid West is unique compared to most RTO/ISOs because physical rights are required and only small and infrequent adjustments to submitted balanced schedules are expected. A curtailment process is used as a backstop mechanism to manage congestion when the combined schedules (all covered by valid transmission rights) prove to be infeasible due to unforeseen system conditions. Existing RTOs use a day-ahead congestion management process to derive final schedules from market bids and offers. In contrast, Grid West will rely upon a schedule adjustment process in the post day-ahead process which is similar to current practices of the Transmission Owners. Grid West's interchange scheduling and checkout processes are similar to the interchange scheduling practice in many existing RTOs. The main differences for interchange scheduling lie in the specific timing requirements and in the procedures related to Grid West's unique market structure, which involves multiple Balancing Authorities.

Table 10.1 includes a comparison with existing RTOs in the schedule adjustment in the day-ahead and the post day-ahead periods, and Table 10.2 includes a comparison with existing RTOs in interchange and checkout processes.

Table 10.1 -- A Short Comparison of Scheduling Adjustment Process

| Timing | Grid West | ERCOT | PJM and MISO |
|---|---|---|---|
| Day-ahead Scheduling Adjustment | • Use physical rights and pro rata adjustment if necessary | • Zonal based congestion management using zonal Shift Factor<br>• Adjust balancing energy to resolve congestion and uplift costs. | • LMP based on central energy market in the new MISO design |
| Post Day-ahead Scheduling Adjustment | • Flow based and "first-come first-served" | • Similar to OATT procedure | • PJM allows only interchange schedules, others go to real-time market<br>• MISO uses real-time market and allows changes for physical bilateral |

| | | | |
|---|---|---|---|
| | | | transactions |

Table 10.2 -- Interchange Scheduling and Checkout Benchmark

| Process | Grid West | Other RTOs/ISO |
|---|---|---|
| E-tag | Standard | Standard |
| Schedule classification | Internal and interchange | PJM: External<br>MISO: Physical bilateral and financial |
| Loss | Not used | Many uses a marginal or scaled marginal loss price component embedded in the Location Marginal Prices (LMP) |
| Special features | CCA and non-CCA bilateral transactions | Pool-like and financial transactions |
| Day-ahead checkout | Standard (except no checkout needed between balancing authorities within GWMT) | Standard |
| Near real-time checkout | Standard (except no checkout needed between balancing authorities within GWMT) | Standard |
| After-fact checkout | Standard | Standard |

## 11.0 TECHNOLOGY SOLUTIONS

The major components of the scheduling system include[11]:

- Market Information System, including OASIS
- Scheduling system
- Tag applications and interfaces
- AFC update and calculation
- Day-ahead adjustment application
- Request evaluation application in post day-ahead

[11] The identified requirements may overlap with these identified in other white papers.

## 12.0 COST DRIVERS

The primary cost drivers for implementation relate to the required software systems and personnel requirements. The primary cost drivers are:

- Number of day-ahead and post day-ahead schedules
- Frequency of schedule infeasibilities and curtailments
- Number of interchange schedules
- Number of tagging errors
- Number of schedules for checkout
- Number of checkout discrepancies to be resolved
- Extent of information to be verified after-the-fact

The costs may be reduced if Grid West:

- Streamlines the scheduling, interchange scheduling and tag creation processes with automated software applications
- Leverages existing systems and software for its needs in scheduling and tag management

## 13.0 DESIGN ISSUES FOR CONSIDERATION IN NEXT DEVELOPMENT LAYER

The next layer of design should include a review of the following design issues:

- Economic approach for avoiding curtailments.

- Balanced schedule requirement for curtailed portions of schedules.

- Loop flow and outage-related curtailments in real-time operation. Grid West should also consider the impact of loop flow curtailment on the AFC and scheduling changes in post day-ahead period.

- *DC lines scheduling* - The coordination of DC scheduling and its impact on Grid West's AC system need to be considered.

- *Phase shifter scheduling* - Grid West should develop procedures for determining phase shifter setting in order to maximize market value and transmission utilization.

- *Dynamic schedule tagging requirements* - Same as reserve tags in reserve paper.

- *Tagging before day-ahead* - Tags can be created before day-ahead for some transmission users. Grid West's approval is conditioned on the final

schedules in day-ahead. A procedure of approving pre-day-ahead tags may be needed.

## Appendix A: Schedule Adjustment Examples

This section provides a comprehensive example illustrating the application of adjustment procedures.

### Base Case Situation

The example case has three buses with equal 120 MW total flow capacity (TFC) on each link, as shown In Figure A1.

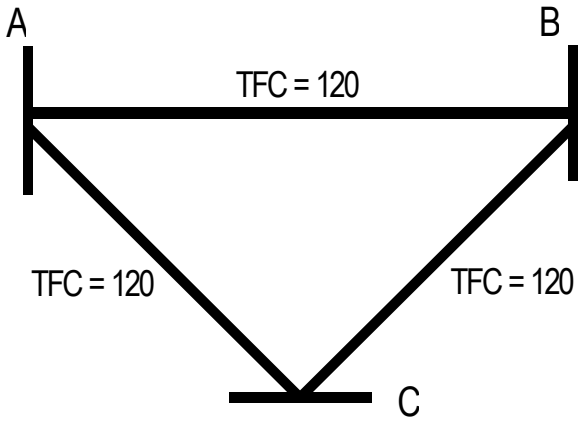



Figure A.1: Example System and Base Situation

Assume in the day-ahead scheduling process, there are six submitted schedules as shown in Table A.1. The predominant flows are from A to C and from A to B. The last three schedules (Schedules 4 to 6) are small and generate some counter flows on the three paths.

Table A.1: Proposed Schedule Data for the Base Situation

| Schedules | POR | POD | MW |
|---|---|---|---|
| 1 | A | C | 150 |
| 2 | A | B | 90 |
| 3 | B | C | 60 |
| 4 | C | B | 15 |
| 5 | C | A | 6 |
| 6 | B | A | 9 |

The line flows resulting from the applications of these schedules are listed in Table A.2. The flows from A to B and B to C are within their operational limits. However, the flow on the flowgate between A and C exceeds its limit by 18 MW.

Grid West must decide how to adjust the six schedules in order to achieve the 18 MW reduction on A to C.

Table A.2: Line flows of the Base Situation

| From | TO | MW |
|---|---|---|
| A | B | 87 |
| B | C | 51 |
| A | C | 138 |

**Adjustment Solution using Pro Rata Cut**

Given the infeasibility, Grid West decides how to adjust the six proposed schedules in order to achieve the 18 MW reductions on A to C.

This sub-section illustrates the pro rata reduction method. The results of reduction calculation process and resulting flows are listed In Tables A3 and A4.

In order to achieve an expected reduction of 18 MW from A to C, several steps are needed:

Step 1. Grid West first computes the use of A to C, as shown in third column of Table A3, by evaluating all submitted schedules, as shown in the second column of Table A3.

Step 2. Grid West then identifies schedules contributing to the flow from A to C. In this case, the schedules 1- 3 are contributing schedules as flagged in the fourth column of Table A3.

Step 3. The pro rata allocation of required 18 MW reductions from A to C is performed based on the use of A-C. The results are shown in the fifth column of Table A3.

Step 4. The required reduction from A to C needs to be reflected to the original submitted schedules. The results of schedule reductions are shown in the sixth column of Table A3.

The Schedule Reduction * Applicable PUF = Allocated Flow-based Reduction

Step 5. The final schedules are the differences of the proposed schedules and the schedule cut, as shown in the seventh column of Table A3. Note the total cut of the schedule is 36MW.

Table A.3 - Adjusted Schedule Data Using Pro Rata Cut

| Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 | Column 7 |
|---|---|---|---|---|---|---|
| Schedule | Submitted | Use of A | Contributing | Allocated | Required | Final |

| | Schedule | to C | Schedules | Pro rata Cut from A to C | Reduction | Schedule |
|---|---|---|---|---|---|---|
| 1 | 150 | 100 | Y | 12 | 18 | 132 |
| 2 | 90 | 30 | Y | 3.6 | 10.8 | 79.2 |
| 3 | 60 | 20 | Y | 2.4 | 7.2 | 52.8 |
| 4 | 15 | -5 | N | 0 | 0 | 15 |
| 5 | 6 | -4 | N | 0 | 0 | 6 |
| 6 | 9 | -3 | N | 0 | 0 | 9 |

Table A.4 -- Line flows after Pro Rata Cut

| From | TO | MW |
|---|---|---|
| A | B | 76.2 |
| B | C | 43.8 |
| A | C | 120 |

## 1.0 EXECUTIVE SUMMARY

The Northwest Power Pool (NWPP) maintains the outage coordination process for the region. Currently, BPA coordinates this process. As a part of Grid West Basic Features, Grid West will coordinate the process. For Transmission Owners who do not participate in Grid West, the existing outage coordination process is still applicable.

Transmission Owners who participate in Grid West will submit planned transmission outage requests to Grid West, which will manage the outage notification process under the procedures developed in conjunction with NWPP. For transmission outages, Grid West will review the outage requests, evaluate the schedules against reliability criteria and known generation outages, and approve the requests (if such an approval authority is vested in Grid West by the Transmission Agreement) or propose changes. Grid West will publish the transmission outage plan on OASIS. Grid West will exchange transmission outage information with other control areas for regional coordination.

Grid West will continue to work with regional stakeholders to improve the outage coordination process in order to minimize the negative impacts of outages on the stakeholders.[1]

Highlights of this paper include:

- Outages impact reliability – Grid West needs to be notified
- Proposed coordination methodology is based on the existing NWPP process
- Set of notification, comment, review and approval processes are needed
- Generation and transmission outages are treated differently
- Both generation and transmission outages are submitted by facility owners
- Grid West will propose alternatives if conflicts exist
- Grid West authority will be defined within Transmission Agreements
- Outage coordination is a regional service

## 2.0 PURPOSE

The purpose of this white paper is to review the proposed generation and transmission outage coordination design. This white paper discusses Grid

[1] Given the differently situated regulatory regime in Canada and British Columbia, in particular, the operating assumption is that the Grid West market design will be mirrored in British Columbia, to the extent possible within that regulatory regime. Details regarding the market design in British Columbia are anticipated to be completed as part of detailed design phase of this effort.

West's generation and transmission outage coordination processes for managing regional scheduling operation. Specifically, the paper describes the notification of generation and transmission outages, and the review processes by Grid West.

## 3.0 BACKGROUND

Regional transmission outage coordination and information sharing in the Northwest area is accomplished through the Northwest Power Pool (NWPP), a voluntary and member-based organization. The NWPP currently coordinates scheduled outages. The timeframe of the outage coordination covers the subsequent 120 days (Grid West will also collect outage information beyond 120 days if available and share it with stakeholders if possible[2]). The timeline and processes among Transmission Owners (TOs) and NWPP are highlighted in Table 3.1 below (or go to www.nwpp.org/pdf/OM-H2004May.pdf to see Section H "Coordination of Scheduled Outages"). In addition, the NWPP sponsors the NWPP Long Range Planning and Outage Coordination meetings.

Table 3.1 -- Current Timeline for Transmission Outage Coordination

| Timeline (approximate) | Coordination Process |
|---|---|
| 45 days prior to the outage month | Deadline for submitting significant transmission outages. |
| 40 days prior to the outage month | List of significant transmission outages with capacity estimates posted on OASIS for customer comment. |
| Varies | Customer comment period closes. |
| Varies | Outage Coordination group meets to develop draft outage plan. |
| Varies | Draft transmission outage plan: approved transmission outage plan with capacity estimates posted on OASIS for customer comment. |
| 30 days prior to the outage month | Customer comment period on approved transmission outage plan closes. |
| 15 days prior to the outage month | Final transmission outage plan: plan with capacity estimates posted on OASIS. |

Grid West will continue to participate in the regional coordination and information sharing efforts through the NWPP. For Transmission Owners who did not sign Transmission Agreements in Grid West, the current transmission outage coordination process as defined by the NWPP is still applicable. Transmission Owners who participate in Grid West will submit their planned outage requests to Grid West, which will be responsible for managing the outage notification process of NWPP. In addition, the Grid West will assume the responsibility for hosting the NWPP Long Range Planning and Outage Coordination meetings.

[2] Mechanism of the information sharing will be addressed in next design layer.

In its role as a regional service provider, Grid West will ultimately be responsible for maintaining reliable and coordinated system operation for the Grid West Managed Transmission (GWMT) System, which is affected also by outages outside GWMT. Therefore, Grid West will rely on information on planned and/or forced outages of key transmission and generation facilities provided in the outage-coordination process. In addition, outage information should also be exchanged with other control areas because the impacts of planned outages will not be restricted to the local control area within an interconnected electric power system[3].

## 4.0 GRID WEST'S AUTHORITY

Grid West's authority to approve or deny a planned outage of transmission facilities will be established contractually between Grid West and the Transmission Owners (e.g., Transmission Agreement (TA)).

Grid West will not have the authority to approve or deny generation outages.

## 5.0 TRANSMISSION OUTAGES

### *5.1 Notifications of Transmission Outages*

Grid West will make available an electronic outage notification application to be used by Transmission Owners to submit or change transmission outage schedules.

Grid West will publish a listing of the transmission facilities in the Grid West transmission system subject to the notification requirements. Grid West will obtain from transmission facility owners their planned outage schedules in compliance with the NWPP Coordinated Outage System (or its successor) and procedures.

WECC has been charged to implement two systems for outage information sharing (Grid Alert System and WECCNet messaging system). Grid West will take advantage of these systems and follow the protocols set forth by WECC and NWPP notification requirements.

### *5.2 Data Needed for Transmission Outages*

A transmission facility outage request should include the following information:

[3] The extent of information exchanged is to be determined.

- Transmission facility name and Grid West reference code;
- Nature of the transmission outage and maintenance to be performed;
- Amount of unavailable MW capacity[4];
- Start date, end date and time of the outage;
- Flexibility data (e.g. alternative periods of outage, time required to terminate the outage and restore the transmission facility to normal capacity);
- Known constraints regarding the outage (e.g., snow pack);
- Contact information; and
- Interdependencies or associations with other work or outages.

### *5.3 Public Comments on Transmission Outages*

Transmission Customers will have opportunity to comment on the proposed transmission outage requests as well as the initial outage plans. The plans will be available through Grid West's Market Information System and/or NWPP's Coordinated Outage System. Grid West will consider these comments in the review process and will respond to these comments appropriately.

### *5.4 Review of Transmission Outages*

Grid West will review transmission outage requests by considering the following factors:

- WECC critical maintenance work;
- Forecasted peak transmission demand conditions;
- Forecasted peak load conditions;
- Other known generation and transmission facility outages, both inside and outside Grid West;
- Impacts on Grid West's ability to honor the awarded Injection/Withdrawal Rights (IWR) and any flexibility of the existing transmission agreements;
- Violation of pre- and post-contingent rating of transmission facilities;
- Market prices of power;
- Potential load curtailments;
- Outage plans of adjacent control areas; and
- Comments and requests of stakeholders.

Grid West will use various network software applications to analyze transmission outages to establish operational transfer capabilities; determine

[4] Grid West will also independently verify and assess the unavailable MW Capacity,

their effects on transmission system reliability; determine if any one or a combination of proposed outages will violate reliability criteria; and develop mitigating actions as applicable. The evaluation objective will be to maximize the market value of power delivered by the transmission system subject to the applicable reliability constraints and criteria. Analysis tools include power flow, contingency analysis, stability analysis, market analyses and other study tools. If a conflict is found between two or more planned outage schedules, Grid West will give priority to the request with an earlier submission date if their impacts to reliability are similar and if other factors do not overrule. The timing requirements for Grid West's evaluation have not been defined, but will be compatible with the general timeline set forth by NWPP.

When Grid West determines there are reliability concerns in the proposed transmission outage schedules, Grid West will develop an alternative transmission outage proposal to relieve those concerns. Grid West will work with the transmission facility owners to discuss the proposal and help implement the alternative outage schedules. Grid West may approve or deny the initial request if such an approval authority is vested in the Transmission Agreement, but will provide a reasonable alternative for the rejected outage schedule(s).

Grid West will continue to work with regional stakeholders to improve the transmission outage coordination process in order to minimize any negative impacts of transmission outages. Grid West's future improvements may include:

- Transmission outage coordination at the seams, such as with the Pacific AC and DC ties and among different transmission systems; and
- Potential modifications in the timeline in order to provide for more thoughtful analysis and comment before transmission outage plans are finalized.

### *5.5 Publishing of Transmission Outage Plan*

Grid West will publish the initial transmission outage plan for facilities under its control 30 days before the month in which the outage will occur. Grid West will publish the final transmission outage plan 15 days before the month in which the outage will occur. In addition, NWPP may also publish the approved transmission outage plan for the entire region of the NWPP members.

# 6.0 GENERATION OUTAGES

## *6.1 Notifications of Generation Outages*

Grid West will make available a generation outage notification form to be used by generation owners to submit or change notification of generation outage schedules.

Generation owners will be asked to submit their planned generation outage schedules at least 45 days ahead of the outage for all generators with a given MW nameplate capacity for the current and next calendar years (threshold to be determined). Grid West will not make generation outage information public.

## *6.2 Data Needed for Generation Outages*

A generator outage notification should include the following information:

- Generating unit name and its Grid West reference code;
- Nature of the generation outage and maintenance to be performed;
- Unavailable MW capacity;
- Start date, end date and time of the planned generation outage;
- Flexibility data, if any (e.g. alternative periods of generation outage, time required to terminate the generation outage and restore the unit to normal capacity);
- Contact information; and
- Interdependencies or associations with other work or outages.

## *6.3 Review of Generation Outages*

Grid West will assess the reliability impact of submitted outage notices.

When Grid West determines there are potential reliability impacts associated with the proposed generation outage schedules, Grid West will:

- Notify the generation owners and may seek to negotiate alternative outage schedules if possible.
- Take necessary measures to mitigate the concerns not resolved by negotiations with generation owners, such as derating the impacted flowgates, etc.

## 7.0 FORCED GENERATION AND TRANSMISSION OUTAGES

For forced outages within the Consolidated Control Area (CCA), Grid West will request immediate notification of all forced outages (unplanned outages) of both generation and transmission resources after they are identified. The facilities' owners will report generation and/or transmission outage details to Grid West using Grid West's outage notification system or other systems if appropriate.

For forced generation and/or transmission outages outside the CCA but within the GWMT, the host balancing area and Grid West will both be notified immediately. Grid West will work with the host balancing areas to develop a reporting requirement for all forced outages of both generation and transmission resources.

## 8.0 INFORMATION DISSEMINATION

Grid West will publish proposed and approved outage schedules of transmission facilities (subject to security consideration).

Grid West will also determine the level of transmission outage information to be exchanged with other control areas in the region.

Grid West will not reveal any specific information on generator outages.

## 9.0 IMPACT ON OTHER GRID WEST PROCESSES

Once transmission and/or generation outage plans or actual outages are known, Grid West will need to account for their impact on other modeling and processes as part of the approval and coordination process. For example, the Rights Translation and Reconfiguration Service (RCS) will need to use the updated Available Flowgate Capacity (AFC) data. Other models and processes (such as the determination of x-factors or non-firm sales) possibly affected by the change of AFCs are to be determined.

## 10.0 ROLES & RESPONSIBILITIES

### *10.1 Grid West's Responsibilities*

Grid West will:

- Make available outage notification systems for generation and transmission facility owners to send outage schedules to Grid West;

- Develop the criteria of transmission outage evaluation;
- Manage outage notification system;
- Evaluate planned outages and develop alternatives to the proposed outages if negative impacts are identified;
- Accept or reject schedules for planned outages of transmission facilities in accordance with the terms of the contractual agreement between Grid West and the Transmission Owners;
- Post approved schedules for planned transmission facilities outages;
- Establish and implement record keeping procedures for the retention of all requested planned outages and forced outages; and
- Perform the functions associated with supporting the NWPP Coordinated Outage Process.

### *10.2 Facility Owners' Responsibilities*

Transmission and generation facility owners will be asked to:

- Notify Grid West of planned outages through the outage notification system whenever they are identified;
- Notify Grid West of forced outages in the CCA whenever they are identified; and
- Report forced transmission outages and generation outages, if they are known.

## 11.0 MARKET BENCHMARKS

Outage coordination is a standard process used by nearly all RTOs in North America. Some differences lie in the specific timing requirements and procedures related to Grid West's unique market structure as listed in Table 11.1.

Table 11.1 -- Outage Coordination Benchmark

| Process | Grid West | Other RTOs/ISOs |
|---|---|---|
| Notification requirements | Yes | Yes |
| Generation outage approval authority | No, but voluntary information sharing with generators will be sought. | No |
| Transmission outage final approval authority | Based on contractual agreement between Grid West and TOs | Yes |
| Yearly generation maintenance plan requirement | Not used [Grid West will collect longer term outages (beyond 120 | Some |

| | | |
|---|---|---|
| | days) in advance and share them with stakeholders if possible.] | |

## 12.0 TECHNOLOGY SOLUTIONS

The major components of the outage notification system are:

- Outage notification system and Web interfaces;
- Off-line study tools and databases for outage evaluation;
- Interface to move data from the offline outage notification to the Grid West rights administration database; and
- Interfaces with NWPP.

## 13.0 COST DRIVERS

The primary cost drivers for interchange implementation relate to the required software systems and personnel requirements. Cost drivers include:

- Number of planned outages to evaluate;
- Number of outage requests requiring proposed changes;
- Complexity of analysis typically required;
- Posting frequencies; and
- Record-keeping requirements.

## 14.0 DESIGN ISSUES FOR CONSIDERATION IN NEXT DEVELOPMENT LAYER

The next layer of design should include a review of the following design issues:

- *Exchange of transmission outage information between Grid West and other control areas* - The extent of information exchanged is to be determined between control areas.
- *Reliability and other criteria of transmission outage evaluation* - Grid West will need to clarify details of reliability evaluation methods and the market value determination for transmission outage evaluation.
- *Grid West's role as outage facilitator or approval authority* - The details of Grid West's roles should be clarified in developing Grid West's transmission agreements.
- *Outage rescheduling costs* - Costs associated with outage plan modifications.

## 1.0 EXECUTIVE SUMMARY

When Grid West's Injection/Withdrawal Right (IWR) Transmission Customers submit balanced energy schedules to Grid West, they are responsible for losses associated with their transmission use. To meet this responsibility, they will need to schedule losses during the day-ahead scheduling process.[1]

Highlights of the proposed loss methodology include:

- Pre-existing transmission service rights and their associated loss provisions will be honored;
- Grid West's loss methodology will apply only to IWR schedules;
- Ex-ante loss factors will be used for IWR schedules;
- A simplified loss methodology will be used by Grid West for developing the IWR loss factors;
- The loss methodology will recover expected average, not marginal, losses; and
- IWR Transmission Customers will provide concurrent losses in the day-ahead scheduling process.

## 2.0 PURPOSE

This white paper discusses the proposed Grid West loss methodology to be applied to IWR schedules. It attempts to satisfy the objectives established by the Regional Representatives Group (RRG). The objectives of the loss methodology are:

- Minimize cost shifts;
- Maintain loss provisions of pre-existing transmission service rights and obligations;
- Create a reasonable match between loss collection mechanisms and actual loss effects on the transmission system;
- Use ex ante loss factors to provide certainty to Transmission Customers in advance;
- Eliminate multiple loss charges (i.e. multiple loss charges for a single transaction) for IWR schedules within the Grid West Managed Transmission (GWMT) system; and

[1] Given the differently situated regulatory regime in Canada and British Columbia, in particular, the operating assumption is that the Grid West market design will be mirrored in British Columbia, to the extent possible within that regulatory regime. Details regarding the market design in British Columbia are anticipated to be completed as part of detailed design phase of this effort.

- Be equitable and easy to implement and consistent with the scheduling model.

In practice, not all objectives can be achieved simultaneously because of inherent conflicts in the objectives. This paper proposes a simplified approach as a starting point. Future improvements could be considered and phased in later.

## 3.0 BACKGROUND

Currently, pre-existing transmission rights include loss provisions. These loss provisions will not be altered by Grid West. The loss factors and the receipt of energy scheduled to meet loss responsibilities will continue to be governed by the pre-existing arrangements.

Grid West will meet requests for additional transmission service over the GWMT. Grid West service will be in the form of IWRs acquired, for instance, through the Reconfiguration Service (RCS). As with pre-existing rights, users of IWRs will have a responsibility for system losses. However, since IWRs are issued from the combined systems that make up the GWMT, no single company loss factor will apply to IWRs. For this reason, a new loss methodology is needed for use with IWRs.

Developing a new loss methodology is challenging for the reasons that follow:

- Transmission losses are not linear; they vary with the square of the current; and
- Transmission losses are a result of the simultaneous activities of all users of the transmission system.

As a result, it is not possible to know in advance the loss effects of specific transactions. Instead, estimated loss factors are used to allocate losses to Transmission Customers based on a measure, in some manner, of their expected usage. [I think this is what it is supposed to mean—Linc.]

Given the scope of Grid West, some concern has been expressed that a single number for all of the GWMT for all hours would not be very accurate. At the same time, a complex loss factor method would impose a burden on the users of the system. The loss methodology to be suggested for use with Grid West IWRs strikes a balance between two competing interests – accuracy and simplicity. It is suggested here that the Grid West IWR loss factors be developed based on marginal loss information, scaled down to recover estimated overall losses, in a manner that has been simplified to a reasonable number of time periods per year and to generalized locations. [Is two dozen “few?” We need to leave open the

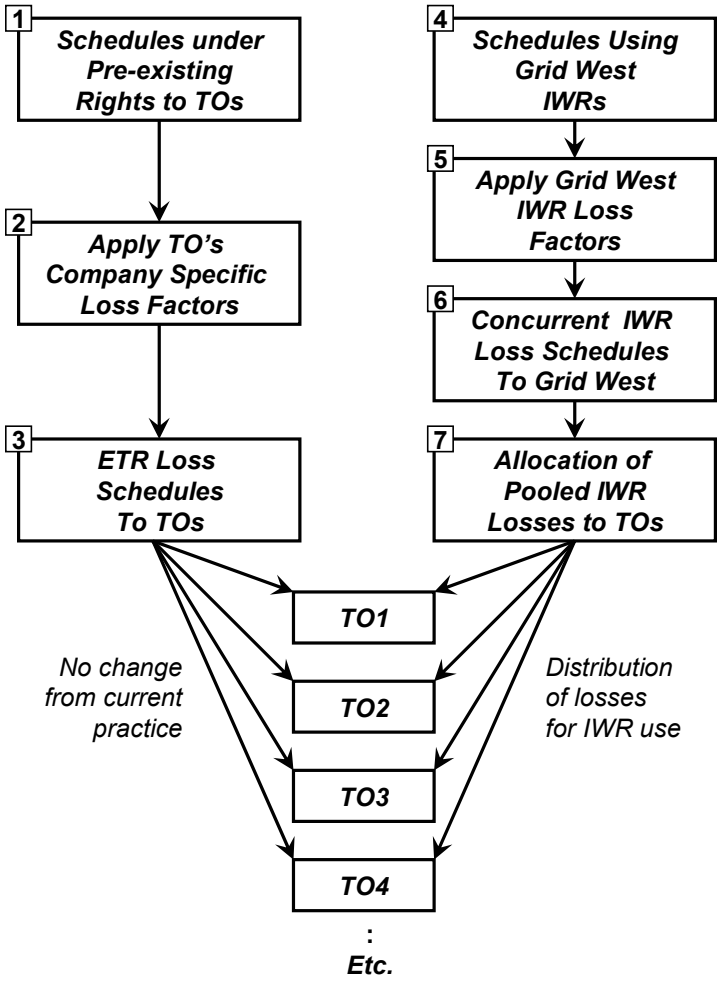
possibility of 24 time periods a year.] This approach retains a measure of the locational and timing accuracy benefits of marginal losses, but minimizes over collection.

## 4.0 LOSSES FOR PRE-EXISTING RIGHTS

Based on the Regional Proposal, the loss requirements for Transmission Customers with pre-existing transmission rights agreements will not change. The losses provided and the methods of delivery to Transmission Owners (TOs) will be unchanged from current practice. Retaining current provisions will prevent a cost shift that would occur if there was a change in loss responsibility for pre-existing services. Loss scheduling practices, whether concurrent, delayed or financially settled, will also remain under the provisions of pre-existing agreements. Since the great majority of use of the GWMT in the early years of Grid West is planned to fall under these pre-existing agreements. some Transmission Customers will not have a substantial impact.

## 5.0 DAY-AHEAD SCHEDULING

Figure. 5.1 -- The Grid West Loss Collection and Allocation Process




Losses are provided in the day-ahead scheduling processes as depicted in Figure 5.1 above. Boxes 1-3 in the figure depict scheduling of pre-existing transmission rights, as follows:

- Transmission Customers with pre-existing rights submit their schedules to the TO who issued those rights;
- The applicable company loss factor for the TO is applied to the energy schedule to produce the required losses to be supplied to the TO; and
- The Transmission Customer submits a loss schedule to the TO, according to the provisions of the pre-existing agreement—for example, 168 hours later so specified.

- The TO is responsible for deviations between the losses provided by Transmission Customers and the actual expected losses on its system.

Since the loss schedules go directly to the TOs as they do today, there is no shift in loss responsibility for system usage that is based on the use of pre-existing rights. Boxes 4-7 of the figure depict the scheduling of IWRs issued by Grid West, as follows:

- Transmission Customers using IWRs submit their schedules to Grid West.
- The appropriate Grid West loss factor is applied to each IWR schedule.
- The Transmission Customer submits a *concurrent* loss schedule to Grid West, i.e., the losses are not submitted on a delayed basis but are provided at the time of scheduling.
- Grid West pools the loss energy scheduled to it by IWR users and allocates that pool back to the Transmission Owners in *concurrent* loss schedules.

The concurrent loss scheduling requirements should be noted, since they differ from the practice of some Transmission Owners today. Grid West will have no energy resources of its own. As a result, concurrent loss scheduling is desired to avoid a situation where Grid West would have to buy energy to meet losses in high-load periods and sell energy to dispose of extra energy in light-load periods.

The methodology for development of the loss factors (box 5) and for allocation of losses among the TOs (box 7) is described in Section 6.0 below. An IWR Transmission Customer's loss obligations can be met either directly or indirectly.

- ***Direct:*** Transmission Customers submit a separate concurrent loss schedule for the losses attributed to their aggregate schedules as shown above.

- ***Indirect:*** Third-party loss providers submit a concurrent loss schedule on behalf of the Transmission Customer for the losses attributed to their aggregated schedules.

In any ex-ante loss factor method, there is a difference between the losses scheduled and actual losses incurred in real-time operation. Today, the transmission owner makes up the difference, supplying energy when actual losses are greater than scheduled losses (heavy load periods) and absorbing energy when scheduled losses exceed the actual losses (light load periods). This scheduled loss to actual loss difference will continue to be made up by the individual TOs for Grid West IWR service. More details and illustrations are provided in Appendix C to demonstrate that loss responsibility is not shifted by the Grid West methodology.

## 6.0 LOSS METHODOLOGY DESCRIPTION

The Grid West loss methodology for IWRs has three components: (1) ex-ante loss factor computation, (2) loss obligation determination, and (3) allocation of loss schedules to balancing areas. Each of these components is covered briefly in this section. The attributes of the proposed methodology are further discussed in Appendix A. The volume of loss collections for IWR use is likely to be relatively small compared to the losses collected for pre-existing agreements. While the overall effect of the new methodology will grow over time, its initial impact is likely to be incremental. As experience is gained with the new method, it may be able to be modified to correct concerns that may arise. Such a change may require, however, a Special Issues List vote of the members.

**Ex-Ante Loss Factor Computation:** Grid West will use ex-ante loss factors to calculate loss obligations for schedules using IWRs. Ex-ante loss factors will provide Transmission Customers with certainty in energy scheduling. In order to calculate these loss factors, Grid West will use a power flow model based on various operating scenarios (e.g. Peak, Off-Peak, seasons, etc.). Based on these detailed loss factors, Grid West will develop a set of aggregated loss factors that have some degree of time and location variation that balance the competing desires for accuracy and ease of use. In practice, the degree of granularity should be determined based on detailed studies conducted prior to implementation. The study results will provide a basis for determining how much error is introduced by a given level of aggregation.

**Loss Obligations Determination:** Grid West will provide the loss factors to Transmission Customers through the Market Information System (MIS). The Transmission Customer (and Grid West) will calculate the loss obligation for each submitted schedule using IWRs. The loss obligations for a Transmission Customer are accumulated for the scheduled transactions. A Transmission Customer or its loss provider should submit a separate concurrent loss schedule to Grid West as part of the day-ahead scheduling submission process.

**Allocation of Loss Schedules to Balancing Areas**: Grid West will manage transmission losses at the GWMT level as part of the day-ahead process. Transmission Customers are not required to provide losses at a specific bus or within a specific balancing area. In other words, delivery location of the scheduled losses can be to any point within or on the boundary of GWMT system.[2] As more fully described in Appendix C, the real-time losses in each balancing area are part of the total load within the balancing area. As tie-line

[2] However, if experience with the new methodology demonstrated a need for locational delivery of losses, procedures will be developed at that time to address the need.

metering is used to hold the net schedule interchange with North American Reliability Council (NERC) requirements, variances in losses and real-time load are met simultaneously. A huge investment in metering would be required to actually separate losses from load in real time. Instead, each Transmission Owner covers the loss variance as part of its total load.

The loss schedules provide in-kind compensation to the Transmission Owner for providing this service, i.e., providing extra energy when losses are higher than the scheduled losses and absorbing energy when the reverse is true. Over time, the in-kind contribution is intended to balance out the balancing authorities' cost. When losses are scheduled directly to the Transmission Owner, as described above for losses for pre-existing rights, there is no need to allocate losses among the Grid West Transmission Owners. This allocation is accomplished through the use of interchange schedules.

After receiving the loss schedules from Transmission Customers, Grid West will create interchange schedules to allocate the IWR loss collections among the balancing areas within the GWMT. Within the Consolidated Control Area (CCA) operated by Grid West, the losses allocated to the CCA will be further allocated to the consolidating Transmission Owners (or their load-serving entities), where the allocated share of the IWR losses will become part of the total energy input used to settle imbalances. The end results of loss allocation schedules will be that all balancing areas within the GWMT will receive their share of expected losses associated with IWR use. An example is given in Appendix B to illustrate how this loss allocation schedule is to be achieved.

The allocation factors for distributing IWR loss collections among balancing areas (and CCA Transmission Owner/load-serving entity load areas) will be based upon power flow modeling. One proposal is that the IWR losses be allocated based on the power flow estimate of percentage of actual losses in each balancing area (or Transmission Owner load area for the CCA). Another possibility to be considered is using the percentages of the incremental losses for each area attributable to IWR use. The details of the allocation procedure will be evaluated with quantitative analysis before startup in order to determine which of these methods (or perhaps another method) is preferable. Since IWR losses are incremental above the pre-existing losses, the allocation of IWR losses among the areas is not a matter of cost shifting unless there is a mismatch between the allocation and incurrence of IWR losses.

# 7.0 ROLES AND RESPONSIBILITIES

## *7.1 Grid West's Responsibilities*

Grid West will:

- Calculate and publish applicable loss factors for IWRs at a reasonable time before the scheduling process; such a publication might be in the form of a matrix of loss amounts between injection and withdrawal areas (or points).
- Evaluate loss obligations of IWR Transmission Customers for all submitted day-ahead schedules;
- Determine the IWR loss allocation factors for distributing loss schedules among balancing areas;
- Create interchange loss schedules to implement the allocation.

## *7.2 IWR Transmission Customers' Responsibilities*

IWR Transmission Customers will:

- Meet their loss obligation by submitting loss schedules either directly or through third-party loss providers.

## *7.3 Loss Providers' Responsibilities*

Loss providers will:

- Schedule the loss obligations for IWR Transmission Customers that they represent.

Loss providers may:

- Represent multiple Transmission Customers if they choose.

## *7.4 Existing Transmission Owners' Responsibilities*

Existing Transmission Owners will:

- Act as the default loss providers for Transmission Customers that have pre-existing transmission service rights agreements, subject to the provision of losses by the Transmission Customers in accordance with those agreements.
- Act as the swing provider for the variance between loss factors and hour-to-hour losses, as they do presently, providing the shortfall in high loss hours and absorbing the overscheduled loss amounts during low loss hours.

## 8.0 MARKET BENCHMARKS

One fundamental difference exists between Grid West and existing RTOs. The day-ahead regional services and loss schedules cover the GWMT while the real-time markets cover only the CCA. In most RTOs/ISOs, there are day-ahead and real-time markets that have the same geographical boundaries. Except for this difference, many similarities can be observed from the existing business practices for losses among the existing RTOs and ISOs in North America. A comparison of the proposed loss methodology with the loss methodology of existing RTO/ISOs is given in Table 8.1 below.

Table 8.1 -- A Comparison of Loss Methodology with RTOs/ISOs

| Loss Methodology Attributes | Grid West proposal | CAISO Current | ERCOT | LMP markets (NYISO/MISO CAISO future[3]) |
|---|---|---|---|---|
| Ex ante vs. ex post | Ex ante | Ex ante and ex post (hour-ahead) true up | Ex ante | Ex post for financial settlement. The quantity may be ex ante. |
| Pre-existing transmission service rights agreement | Each TO will be responsible for recovering any losses mismatch[4] | Each TO will be responsible for recovering any losses mismatch | | In MISO, transmission customers settle directly with MISO with marginal losses rebated to existing contract holders |
| In-kind Loss Return option | None for IWRs; existing contracts may allow such returns | No | No | Some |
| Locational signal | Partial | Partial | Partial | Yes |
| Loss factor calculation | Scaled marginal | Scaled marginal | Scaled marginal | Marginal |
| Loss factor granularity | Monthly (or some other time period) peak and off-peak | Hourly | Seasonal peak and off-peak as base and extrapolation to 15 minutes interval. | Hourly |

[3] CAISO will implement LMP-based loss methodology soon.
[4] This mismatch is the difference between the total losses scheduled and the total losses computed using power flow. Also see discussion in Appendix C.

| Loss Methodology Attributes | Grid West proposal | CAISO Current | ERCOT | LMP markets (NYISO/MISO CAISO future[3]) |
|---|---|---|---|---|
| Over collection | No | No | No | Yes |

## 9.0 TECHNOLOGY SOLUTIONS

The implementation of the loss methodology is a scheduling function of Grid West operations. There are no specific technology components for the loss implementation since the loss methodology is embedded in the scheduling and settlement systems. The major elements of the impact to the overall technology solution are:

- Power system modeling software,
- Scheduling system,
- Settlement system and
- OASIS posting

## 11.0 COST DRIVERS

The primary cost drivers for loss methodology implementation relate to the complexity of the solution. For example, the costs will be reduced if Grid West:

- Uses the simplified methods with long-term (year or season) and area loss factors.

On the other hand, the costs will increase if Grid West:

- Develops power models and computes loss factors to account for all the delivery periods;
- Includes a loss true-up process; or
- Assumes the responsibility of the mismatch of pre-existing contractual losses and loss obligations defined in this proposal.

## 12.0 DESIGN ISSUES FOR CONSIDERATION IN NEXT DEVELOPMENT LAYER

- *Avoidance of unintended consequence of "cherry-picking" by pre-existing transmission service rights holders.* When an existing transmission contract holder assesses the benefits of holding onto its existing contract or terminating it in order to obtain standard IWR rights, it would probably consider the difference between company loss factors for pre-existing rights and the newer IWR loss factors. If this

option is available to the contract holders, the difference in loss obligations may be sufficient to induce a contract holder to selectively switch the pre-existing contracts to standardized IWR rights, all other factors being equal. This creates the possibility for cost shifting between the Transmission Owners because the loss allocations for IWRs will not match the pre-existing loss collections. Grid West will need to consider appropriate measures to avoid such unintended consequences as part of its overall consideration of rollover of pre-existing contracts, requests for new service, ability to offer into the RCS markets, etc.

- *"No charge" transmission reservation.* In the current practice of many Northwest utilities, loss–return schedules enjoy the benefit of not needing transmission rights with associated charges. It is not clear whether such a benefit should be maintained for loss provisions by IWR Transmission Customers in their loss–provision schedules.
- *Treatment of curtailments*. If some day-ahead schedules are infeasible after the TOs have adjusted for their existing-contract use, Grid West may have to adjust or reject proposed transactions. The adjustments or rejections may impact the loss obligations of the Transmission Customers. At this time, it is unclear whether such an iterative process should be developed.
- *Use of area loss factors.* Caution must be exercised in defining areas, because the use of very large areas will blunt any accuracy gains for loss responsibility from the new methodology.

# APPENDIX A: PROPERTIES OF THE PROPOSED LOSS METHODOLOGY

The following sections describe some of the attributes of the proposed loss methodology.

## A.1 Additive Property

The additive property of a loss methodology (also having been called transitiveness) measures if two equal and opposite transactions will cancel out one another's flows and the associated loss obligations. The proposed loss factor is additive since it conforms to the objective to reflect the actual costs of transactions. For example, if there are two transactions with same quantities from A to B and from B to C, a loss methodology with additive property will result in the same amount of loss obligations as a transaction from A to C while a non-additive loss methodology will generally not.

The additive property has another advantage in that it encourages power supply and load proximity (including swapping), all else equal.

The additive property is generally preserved for the Locational Marginal Pricing (LMP) type loss methodology that has been adopted in several RTO/ISOs.

## A.2 No Multiple Loss Charges

Multiple loss charges of a single transaction have been generally regarded as detrimental to economic efficiency. Multiple loss charge refers to the payment of multiple transmission rates for one transaction (e.g. a transaction scheduled across multiple transmission systems with a cost to use each one). There is a major distinction, however, between multiple transmission rates and losses. Losses are a real variable cost of production, while transmission rates reflect usually the fixed cost of a transmission system. Because losses are a real variable cost of production, the proposed loss methodologies should be designed to be an improvement upon the traditional pancaked loss charges.

For transactions involving external control areas, Transmission Customers are responsible for their external losses. The seams issues related to losses remain to be resolved.

## A.3 Locational Loss Signals

Although the proposed loss methodology is not directly distance sensitive, it is location dependent. The loss obligations of a transaction depend on the loss factors at its Injection Point and Withdrawal Point, thus leading to locational effect of loss obligations. The result is sensitive to relative impedances, predominant flow patterns, etc., in addition to the raw geographic distance between two points.

## A.4 Attributes Summary of the Proposed Loss Methodology

The following table shows how the proposed loss methodology addresses the objectives.

Table A.4 -- Attributes of the Proposed Loss Methodology for IWR Schedules

| Objectives | Proposed methodology | Comments |
|---|---|---|
| Pre-existing rights honored | Yes | Otherwise, costs shifts are unavoidable. |
| Actual losses reflected (minimize cost shifts) | Strong cost causation to transactions. | It is difficult to have a qualitative measure for this objective, but the additive property and strong locational and timing signals in the proposed methodology will result in more accurate loss recovery.<br>A mechanism is needed to avoid cost shifting between Balancing Areas and their customers, as well as the cost shifts in real-time operations (see Appendix C). |
| Multiple loss charges eliminated | Yes | Within GWMT for IWR usage. |
| Losses certainty | Yes | No true-up is proposed. |
| Additive (Transitive) property | Yes | Reflect actual costs more accurately, if cost shifts are allowed, because some will pay more and some pay less to ensure that the same level of losses is collected (assuming loss measures are accurate today). |
| Easy implementation consistent with economic objectives | Yes | See implementation details that are presented as part of the proposed methodology. |
| Consistency with market operations | Yes | See implementation details that are presented as part of the proposed methodology. |

## APPENDIX B: EXAMPLES OF ONE LOSS ALLOCATION METHOD OF IWR LOSS COLLECTIONS FOR DAY-AHEAD SCHEDULING

Assuming that Transmission Customers in the day-ahead scheduling process have delivered the loss obligations for IWRs to Grid West, we illustrate the loss allocation scheduling method to balance the loss obligations for IWRs among different balancing areas in the GWMT.

In this example, we further assume there are only three balancing areas (A, CCA and B) whose configuration is given in Figure B.1.

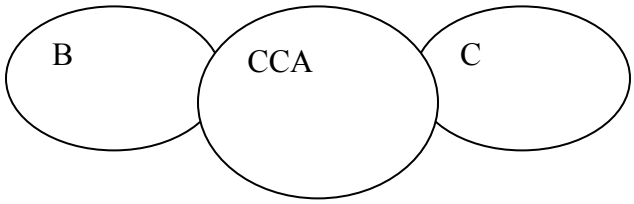



Figure B.1 -- Example Configuration of Balancing Areas

As shown in Table B.1, the losses computed by the power flow model are 300, 200 and 100 MWhs for balancing areas CCA, B and C, respectively. These calculated losses are the target values for each balancing area to receive[5]. Assume that 60 MW were collected by Grid West from users of IWRs. The allocation factors and the MW schedules are shown in Table B.1.

Table B.1 -- Example of Loss Reallocation Data

| Balancing Area | Estimated Losses as computed by Power Flow | Allocated share of IWR losses to each Balancing Area | Loss Schedule from Grid West to Balancing Area |
|---|---|---|---|
| CCA | 300 | 50% | 30 MW |
| B | 200 | 33% | 20 MW |
| C | 100 | 17% | 10 MW |

[5] Small loss errors between actual losses and computed losses are expected. The system balance is maintained by real-time balancing resources to meet aggregated loads and losses. The loss errors between balancing areas will be part of the unaccounted-for-energy (UFE) accounting.

## APPENDIX C: EXAMPLES OF LOSS PROVISIONS BY TOs

### C.1 Current Loss Provision by TOs

An example in Figure C.1 is a typical situation where a Transmission Customer TC1 pre-schedules energy for both its load and losses from a source beyond its meter (G2). In real time, the net outflow/inflow at the balancing area boundary is deemed delivered. The difference of the measured values by interconnection meters (M4, M6 and M7) and the scheduled value is treated as inadvertent energy and dealt with separately between the balancing authorities. G3 is dispatched in real time to cover any imbalance within the balancing area. Within the balancing area boundary, the composite load (customer load plus losses) is equal to the sum of generation (meters M2+M3) less the interchange that flows across balancing area boundary (meters M4+M6+M7)[6]. Loss schedules supplied by Transmission Customers are energy sources used by the balancing authority to meet the composite load, and the balancing energy adjustments made by the operator will simultaneously meet both the variance of load from pre-schedule and the variance in losses from the loss factors used to calculate loss schedules. The responsibility for under/over collection between actual losses and average loss factors falls to the balancing area operator.

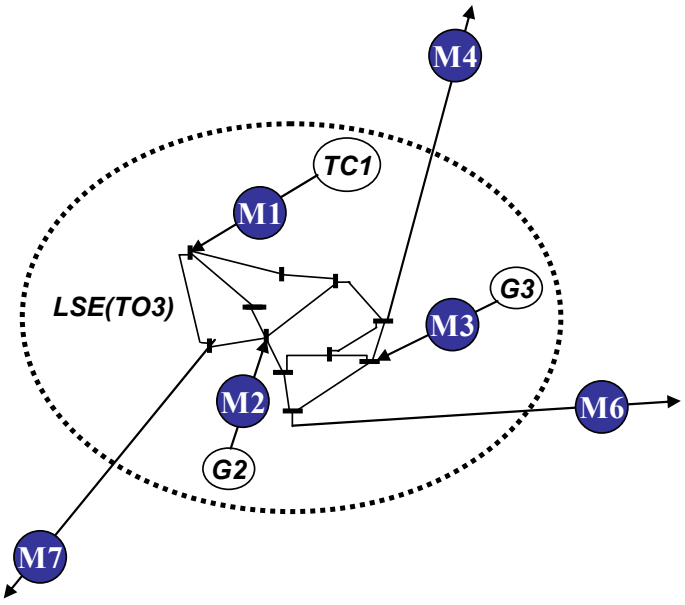



Figure C.1 -- A Single Balancing Area with Control Metering Shown for the Load Serving Entity of Transmission Owner 3 Labeled as LSE (TO3).

[6] Interchange assumed to be positive for exports

## C.2 Loss Provision by the LSEs of Transmission Owners under Grid West

Under Grid West, each balancing authority will be in the same position with regard to metering as exists for today's transmission provider control areas. Figure C.2 depicts a situation where today there are three control areas, but after Grid West forms, two of the control areas choose to join the CCA while one of the control areas wishes to continue to operate a separate balancing area within Grid West. The separate balancing area, LSE (TO4), will continue to be the swing provider of losses in real time within its boundaries.

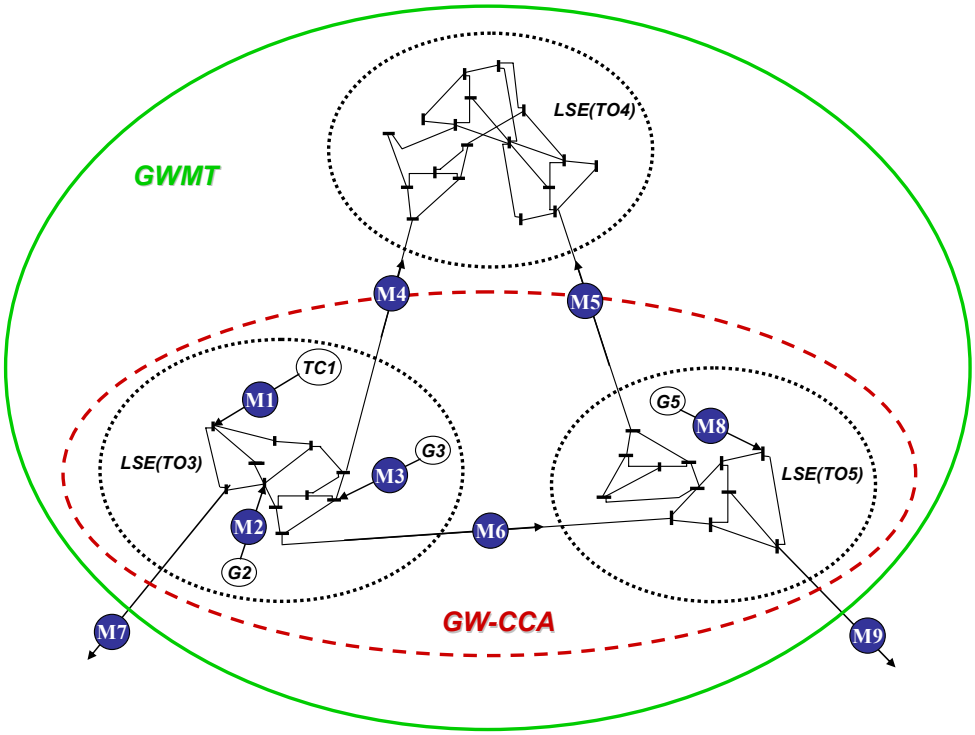



Figure C.2 -- Grid West Balancing Areas with Metering Shown for CCA.

This consolidation of balancing authorities into the CCA raises a question, "How will the loss mismatch be handled within the CCA balancing area and allocate that responsibility among the consolidating parties?" As in Section C.1 above, the answer to this question lies in understanding the nature of the existing metering scheme and how it would be applied within the CCA. The balancing actions of the operator for the CCA will be the same as those described above for other Grid West balancing areas. As the operator of the CCA, Grid West will use the Real-Time Balancing Service to meet load and loss variance from schedules. In doing this, it is also the swing loss provider for the CCA.

Continuous dispatch adjustment of balancing resources (G3 and G5) will ensure the total generation (G2, G3 and G5) will meet the aggregate load, losses and scheduled net interchange at the CCA boundary (meters M4, M5, M7 and M9). The composite load within the Grid West CCA boundary will be the sum of internal generation (meters M2+M3+M8) less the net interchange (meters M4+M5+M7+M9).

The aggregated load and losses will be met within the CCA with balancing energy. Because the measurement of load for each LSE will continue to be based on the metering that existed when they operated separate balancing areas, the responsibility for losses will inherently remain with the same LSEs who carried that responsibility in the past. This can be seen by reference to Figure C2.

The composite load for LSE (TO3) will be equal to the generation injected (meters M2+M3) less the energy flowing out across the metered boundary (meters M4+M6+M7). This will be the same composite load that would have been measured had LSE (TO3) not joined the CCA. Thus the responsibility for losses within the metered boundary will remain the responsibility of LSE (TO3), i.e., the responsibility of each party who chooses to consolidate will remain unchanged. The energy pre-scheduled to Grid West as IWR loss schedules and allocated to each LSE (see Section C.3 below) and the energy received from Transmission Customers using pre-existing transmission rights will net against the actual imbalance of each of the LSEs within the CCA when net imbalance is determined.

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