1.0 EXECUTIVE SUMMARY

Current problems with managing transmission congestion are briefly reviewed focusing on the need for a comprehensive regional approach to congestion management. Methods for managing congestion are reviewed and the advantages to the Northwest of using the Grid West flow-based, physical rights model are identified. The Grid West plan for congestion management is evaluated for long-term, short-term and real-time periods, to see how various features inter-relate and address needs for each time period. The TSLG believes it has designed a congestion management approach for Grid West that will be workable, economically stable, cost-effective, and superior to current practices.[1]

2.0 PURPOSE

This reference paper describes the Grid West market and operational design from a congestion management perspective. Unlike the individual white papers that discuss specific design elements in some detail, this paper is a synopsis that looks across all design elements to show how the assembled whole provides a systematic approach to congestion management.

3.0 BACKGROUND

Congestion management refers to a system of mechanisms that control use of the transmission network to prevent exceeding the network's reliability operating limits, while enabling the most efficient and maximum use of the network.

- Today each transmission owner manages congestion within its portion of the network, and a contract path model is used for coordination of usage between transmission owners.
- Under the contract path model, transmission owners grant usage rights for only the facilities they own as if the effects of usage were limited to that owner's facilities. However, once transmission lines are interconnected to form a network, power flow over the interconnected network is governed by system physics without regard to ownership.

[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.

- Since each owner's operational view is restricted to its own facilities, rules have been devised to limit each owner's network use in order to mitigate the effect of any one party's use on other parts of the network.
- While this situation permits autonomous operation by owners, these limitations impose a cost in the form of underutilized transmission capacity, i.e., capacity that could be made available if the network was managed as a single system.
- Reliability suffers today when problems appear with little warning. Each operator sees only its part of the system, and there is not a single system view in advance of real time operations to help foresee problems and guide response. Also, reliability curtailments are sometimes ineffective because they lead to no actual change in generation dispatch; energy is simply rescheduled through systems that are unaware of the problem. At other times, curtailments can be greater than really required, which leaves capacity unused that would be available had the adjustments been directed centrally.
- The Grid West proposal will implement a flow-based approach to congestion management that will enable increased usage of transmission capacity based on a system-wide view of the collective capacity of the combined systems.

This paper shows how Grid West's flow-based approach to congestion management is woven into the fabric of its market and operational design.

- In Section 4.0, congestion management models are examined. First, consideration is given to the impact that open access requirements have had on the need to formalize congestion management. Next the Grid West physical rights approach to congestion management is described in general terms. The alternative financial rights approach is also described to clarify the differences between the Grid West physical rights proposal and the financial rights approach used in many ISOs and RTOs. Finally the advantages of the Grid West approach are described for meeting the transmission needs of the Northwest.
- In Section 5.0, the Grid West congestion management approach is evaluated in more detail by considering how the design functions in various time periods: for long-term service (greater than one year), for short-term service (less than one year) and for real-time service (within an operating hour).
- Section 6.0 draws conclusions regarding the suitability and workability of the proposed Grid West approach to meeting Northwest congestion management needs.

4.0 CONGESTION MANAGEMENT MODELS

4.1 Open Access

- In order to provide open access, operators of transmission systems needed a means of determining how much uncommitted capacity was available for use by parties requesting service. This need led to a formalization of congestion management practices in order to provide comparable transmission access.
- In most areas, the initial implementation of open access under Order No. 888 simply extended the traditional physical rights, contract path model.
- However, for tight power pools in the Northeast, Order 888 implementation led to a congestion management approach that uses a pooled generation dispatch with centralized unit commitment and financial transmission rights.
- As RTOs were considered under Order No. 2000, there was an extensive debate over the merits of the pool-dispatch, financial rights approach versus a further extension of the physical rights model.
- The financial rights model was particularly controversial in the Northwest, where resistance to it stalled the RTO West proposal.
- A re-examination of the Northwest transmission challenges in 2003 led to the development of the Grid West flow-based physical rights approach to congestion management.

4.2 Grid West's Physical Rights Congestion Management Model

- Grid West will implement a system-wide flow-based physical rights approach that manages congestion by requiring that any schedule for transferring power through the system must be accompanied by an appropriate transmission right.
- New transmission use rights will be issued by Grid West as Injection-Withdrawal Rights (IWRs), where each right is based on use of the combined capacity of the Grid West Managed Transmission System (GWMT) which connects the point of injection to the point of withdrawal. The analysis supporting issuance of each IWR considers how power flows will be affected on a system wide basis and assures that overloads will not be created when the right is used for power schedules.
- Existing transmission rights are protected and unchanged by the Grid West proposal.
    - This is possible because IWRs are a flow-based extension of the pre-existing physical transmission rights issued today.
    - It will not be necessary to convert pre-existing transmission rights into another form.

  - Grid West will inventory the existing obligations, reserving capacity needed to cover the injection and withdrawal impacts in the GWMT.
- The issuance of IWRs manages congestion ahead of time (or ex-ante); dealing with the congestion potential of an IWR at the time the right is issued. The cost of acquiring IWRs will be (in the short run) the de-facto forward congestion charge.

4.3 Financial Rights Congestion Model

In order to better understand the Grid West physical rights proposal, it is useful to consider the chief attributes of financial rights approach to congestion management that is used in many ISOs and RTOs.

- In a financial rights model, explicit congestion charges are applied to all transmission use.
- Unlike a physical rights approach, congestion is addressed after schedules are submitted, using centralized redispatch of generating resources in a day-ahead energy market to correct line overloads.
- Because congestion management is after the fact (or ex-post) under this approach, the user finds out at settlement what its congestion charges are.
- Transmission rights are not required to schedule, instead they serve as financial hedges against congestion cost exposure.
  - The RTO operating under financial rights has an obligation to assure delivery of all scheduled power, although it may charge the cost of clearing congestion necessary to make the delivery.
  - The holders of financial transmission rights receive a stream of revenue that is based on distributing the congestion charge collections among the holders of financial transmission rights.
  - The ability to adjust financial transmission right holdings occurs only at monthly (or longer) intervals.
- One of the key objections to the RTO West proposal was the need to convert existing transmission rights and obligations into a form of financial transmission rights. The conversion process was complicated by both the changed character of the rights and by a potential ongoing obligation for transmission owners to provide congestion management assets to honor the rights in their new form.

4.4 The Advantages of the Grid West Model for the Northwest

- Grid West will have a “big picture” view of GWMT usage, including all day-ahead schedules.

  - That knowledge that will permit Grid West to anticipate problems during the day-ahead process when there is more time for a measured response.
  - When corrective action is required, Grid West will be able to coordinate adjustments or curtailments based on the system-wide impact of changes made.
- Pre-existing rights are protected and integrated with the issuance of new physical transmission rights.
  - The contentious debate over right conversion is avoided.
  - While new mechanisms are provided for obtaining transmission rights as IWRs, the use of IWRs is a straight forward extension of existing scheduling practices.
- Transmission cost can be determined in advance.
  - Given its hydro-electric generation base, the Northwest has a long history of bilateral trade in forward energy.
  - Transmission price certainty has been viewed as desirable by market participants for such forward trades.
- Unit commitment remains with generation owners.
  - In the tight power pools of the Northeast and other areas, centralized unit commitment for thermal resources is a desirable feature that is integrated with a day-ahead energy market.
  - Given the generation mix in the GWMT, centralized unit commitment is neither needed nor desired by the region.
    - About two-thirds of the energy supply is from hydro – units that have start times measured in minutes rather than hours.
    - The operation of the collective hydro resource has extensive coordination to deal with the hydrological complexities of combining the fishery, navigation, flood control, recreation and power production obligations.
    - Much of the remaining energy comes from base-load thermal plants that do not start and stop on a daily or weekly basis.
- Since transmission right holders are required to submit any schedule, a lack of transmission capacity should be more likely to trigger investment in transmission expansion than has proven to be the case in financial right implementations.

5.0 A DETAILED DISCUSSION OF GRID WEST'S CONGESTION MANAGEMENT PROCESSES

The Grid West process provides a comprehensive approach to congestion management, with some features being more significant in different time periods than others. This section will look at three time periods (long term, short term and real-time) and evaluate the features of the Grid West design that respond to congestion management problems for that time period.

5.1 Long Term – Planning and Capacity Expansion

- Parties with long-term energy investments (i.e., for one-year or more) will want to have long-term transmission rights.
    - The rights will be needed for financing new projects to prove deliverability under a physical rights scheduling paradigm.
    - Long-term rights are desired by power purchasers and load serving entities (LSE) who wish to have certainty of delivery at a known cost.
- Long-term users see a lack of transmission as potential future congestion.
    - Funding expansion to obtain rights is a forward commitment made to avoid future congestion cost which would take the form of higher payments for short-term rights.
    - The cost of expansion serves as an upper bound on the cost of future congestion.
- Given the need to hold rights to schedule, the Grid West approach may be more likely to trigger expansion than has proven to be the case in financial right implementations.
- Grid West will sell long-term transmission rights both from any capacity that may be available within existing facilities and from construction of new facilities.
- Grid West will do the planning to support purchase of rights via capacity expansion.

5.2 Short Term – Reconfiguration

- The reconfiguration auctions enable trades in transmission rights.
    - Using the power flow mechanics, it enables trade among parties, whose rights for sale are not identical with those who need to purchases rights, i.e., they do not have the same injection and withdrawal points.
    - Auction prices provide a transparent source of information for all users about the value of transmission rights.

  - This transparency both encourages release of transmission rights that might otherwise go unused and provides a reference point for other trades in bilateral markets.
- Prices in the reconfiguration auctions will be based on the offer and bid prices supplied by the transmission customers. As a result, the clearing prices will be the de facto value of avoiding congestion (i.e., having the ability to schedule use) in future periods.
- Both released rights and available flow capacity (AFC) will be simultaneously available to meet transmission customer requests.
  - With Grid West being an independent party, having no gain or loss as a result of auction outcomes, market participants can reveal their true values to Grid West, knowing that they will get the best prices available for their sales and purchases.
  - Grid West will be a price-taker when selling AFC, so that it will assure the lowest appropriate prices are available to transmission buyers.

5.2.1 Annual, Monthly and Intra-monthly Auctions

- The reconfiguring auctions run in annual, monthly and intra-monthly intervals and will provide transmission customers with an opportunity to obtain rights shaped to meet different needs and to make adjustments as their needs change over time.
- Both on- and off-peak rights will be offered to allow prices to follow differences in system loading and energy value between on- and off-peak periods.
- As energy prices change over a year or a month, transmission clearing prices will change, implicitly capturing the perceived value of congestion (i.e., the inability to use preferred resources).

5.2.2 Day Ahead Auction – Added Features

- Some transmission rights have the flexibility to, for example, schedule to a single load from either of two generators. To accommodate this scheduling flexibility, transmission capacity for both alternative sources is withheld from AFC calculation even though only one source may be used at any given time. The Day-ahead reconfiguration service will not only include the IWR offers and AFC, but will also allow parties to be paid for giving up their scheduling flexibility.
  - Releases of scheduling flexibility optionality decreases the “head space” held back to enable post-day ahead scheduling of pre-existing rights increasing AFC.

  - Releases of scheduling flexibility approximate the generation commitments of a day-ahead market, making more transmission available on an economic basis. This is done without creating the settlement complications of a purely voluntary market where some parties retain the ability to change schedules until the cut-off to real time.
- Again, the clearing prices will represent the de facto congestion cost value of holding transmission rights.

5.2.3 Day Ahead to Real Time Adjustment Period

- After the completion of the day-ahead reconfiguration and day-ahead scheduling, uncommitted capacity will be made available by Grid West on a first come, first served basis. This will be roughly equivalent to the short term non-firm transmission available today.
- Because of Grid West's single system point of view, scheduling of this as available capacity will consider the impact on all critical network elements, thereby providing both better access to and better overall management of the available capacity across the combined network.

5.3 Real Time

5.3.1 Monitoring and Operational Activities for GWMT

- Grid West will be the Transmission Authority for the GWMT.
  - Grid West will use metering and state estimation to monitor flows on GWMT facilities, examine the effects of contingencies and maintain system reliability.
  - When potential problems are detected, Grid West will notify operators of balancing areas within the GWMT of the need to take appropriate actions to maintain reliability.

5.3.2 Real-Time Balancing Service for CCA

- Grid West will be the Balancing Authority for the Consolidated Control Area.
- In the operation of the Real-time Balancing Service, Grid West will select resources to respond to changes in load and generation using a security constrained economic dispatch.
  - Resources will be selected to meet balancing needs based on achieving the best overall value within system constraints.
  - The constraints considered include both the operating characteristics of the generators (responsiveness, max and min

limits, etc.) and the reliability operating limits of the transmission system (line ratings, system voltage levels, etc.)
    - Since Grid West is an independent operator, without a financial stake in energy trade, market participants will have the assurance that they can submit offers based on the true value of their resources without prejudicing their commercial position and with confidence that the resulting prices represent the best economic outcome for themselves and others.
- Differences in clearing prices for balancing energy between locations will represent the value of system congestion.
- The reporting of real-time prices, and their history over time, will provide a guide to bidders in reconfiguration auctions as they judge the value of transmission rights for avoiding future congestion.

5.4 Summary

Clearing prices in the reconfiguration auctions represent the buyers' and sellers' views of the value of transmission rights and are thus the value they collectively place on avoiding congestion cost, that is, the ability to use economically preferred resources to serve load. Unlike the financial rights models, where monthly auctions have been deemed sufficient, the intra-monthly and day-ahead auctions are needed in the Grid West model to make as much transmission capacity available as possible prior to scheduling.

In real time, Grid West monitoring of the entire network will allow it to provide guidance to non-CCA balancing area operators. Within the CCA, Grid West will use a security constrained dispatch to manage congestion while selecting the most economic offers to meet real-time balancing needs.

6.0 CONCLUSION

After many years of debate, the region settled in 2003 on key features needed to address transmission problems. First, a flow-based, physical rights approach to congestion management was to be used in preference to a financial rights approach. Second, pre-existing transmission rights were to be protected, with no forced conversion to another form of service. Third, there was a need to make better use of existing transmission capacity and provide a means for effective transmission expansion. Given these characteristics, as described in the Regional Proposal, the challenge for the region and the assignment of TSLG in particular, has been to develop within these constraints a congestion management approach that is physically workable, economically stable and cost-effective. TSLG believes that the Grid West market and operational design will meet these objectives.

- Grid West will be able to offer congestion management services, such as transmission right reconfiguration, that no single entity or affiliated entity could offer, because Grid West will be independent of market participants and have a big picture view of the entire GWMT.
- Moving to the Grid West's flow-based physical rights approach to congestion management will be workable, because it is an extension of existing practices. Transmission customers will be able to use the new products and procedures without major changes in their operational practice.
- In terms of market economics, the effect of Grid West markets and services will be incremental rather than revolutionary. Pre-existing transmission rights will remain in place and serve as the stable base of transmission usage as new services are added.
- TSLG believes that implementation can be cost-effective, because the new services associated with congestion management can be provided with minimal additional metering and using (with modest modifications) software systems that are already available from vendors.

The congestion management features of Grid West are woven into its market and operational design. The basic philosophy for Grid West congestion management is to control the issuance of transmission rights to avoid over committing the transmission system well in advance of operation and to avoid overloaded facilities at the time when scheduling occurs in the day-ahead process. Reconfiguration services are provided to allow transmission customers to adjust their transmission right holdings annually, monthly, within a month and just before day-ahead scheduling. These features will allow Grid West to effectively manage congestion and meet the overall design objectives of the Regional Proposal.