Note to Readers: *This overview paper has been prepared by the Transmission Service Liaison Group (TSLG) to provide an overview of the conceptual framework for implementing Grid West's Basic Features in a market and operational design. The information provided in this updated draft is current as of the date shown below and contains modifications made since the first version was posted in March 2005.*

The preparation of the white papers described in this overview paper is drawing to a conclusion. This updated overview paper draft is being provided to assist the preparation of those who will be attending the May 25-26 Seminar. The overview paper will help the reader understand how the individual white papers fit into the larger context of the Grid West market and operational design.

1.0 GRID WEST MARKET & OPERATIONAL DESIGN

1.1 Contents of the Overview Paper

This overview paper has been prepared by the Transmission Service Liaison Group (TSLG) to help interested parties understand TSLG's proposal materials. It explains what the TSLG has set out to accomplish and provides background information about the transmission problems and opportunities the TSLG proposals seek to address. It explains the relationships among the various subject areas and introduces the white papers that are the focus of the TSLG's current activities.

Section 1 of this paper provides general background information. Section 2 explains how transmission providers currently manage contractual obligations and describes the operational challenges created by the present approach to transmission capacity management. Section 3 provides an overview of core elements of the TSLG's proposal for a new approach to providing transmission service. Section 4 describes voluntary control area consolidation and the services Grid West will provide to enable such consolidation. Section 5 introduces the white papers and explains how they fit together to define the conceptual framework of Grid West's market and operational design. Appendix A provides summaries of all white papers and reference papers produced by TSLG to document the conceptual framework for Grid West's market and operational design.[1]

[1] This Overview Paper together with the other Whitepapers and Reference papers, were developed in a manner that considers federal and state jurisdictional roles and relationships in the United States. 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

1.2 TSLG's Assignment

The TSLG's assignment is to develop a market and operational design framework for Grid West's Basic Features. The complete design work is divided into four layers, each with an increasing level of complexity. The purpose of the first two layers is to develop a conceptual framework prior to Decision Point #2, while Layers 3 and 4 will increase design detail to support Decision Points #3 and #4.

a. Layer 1 – Major functions were defined in 2004.

b. Layer 2 – Methodology, responsibilities, and costs are to be identified in 2005.
   - A series of white papers has been developed to describe the conceptual framework and address major design features in some detail.
   - The set of reference papers has been developed to cover topics that are applicable to more than one of the white papers.
   - Figure 1.1 shows the titles of all the papers, organized by the TSLG work modules with which they are associated. A complete list of all the above papers with their summaries is also provided in Appendix A.
   - A glossary of Grid West terms used in the papers will also be provided on the Grid West website.

c. Layer 3 – Will develop protocols for market rules, business rules, transactions, etc.

d. Layer 4 – Will prepare tariffs, functional specifications, interface designs, detailed technology requirements, etc.

1.3 Market Monitoring

While market monitoring will be a part of the complete Grid West structure, the organizational form, authority and scope of the market monitor's activities are beyond the scope of TSLG's assignment. However, in the white papers, potential market power issues are described when they have been identified and possible mitigation strategies are discussed. In general, the organization of formal markets for transmission rights, reserves and balancing energy are expected to assist market monitoring activities.

possible within that regulatory regime. Details regarding the market design in British Columbia are anticipated to be completed as part of the detailed design phase of this effort.

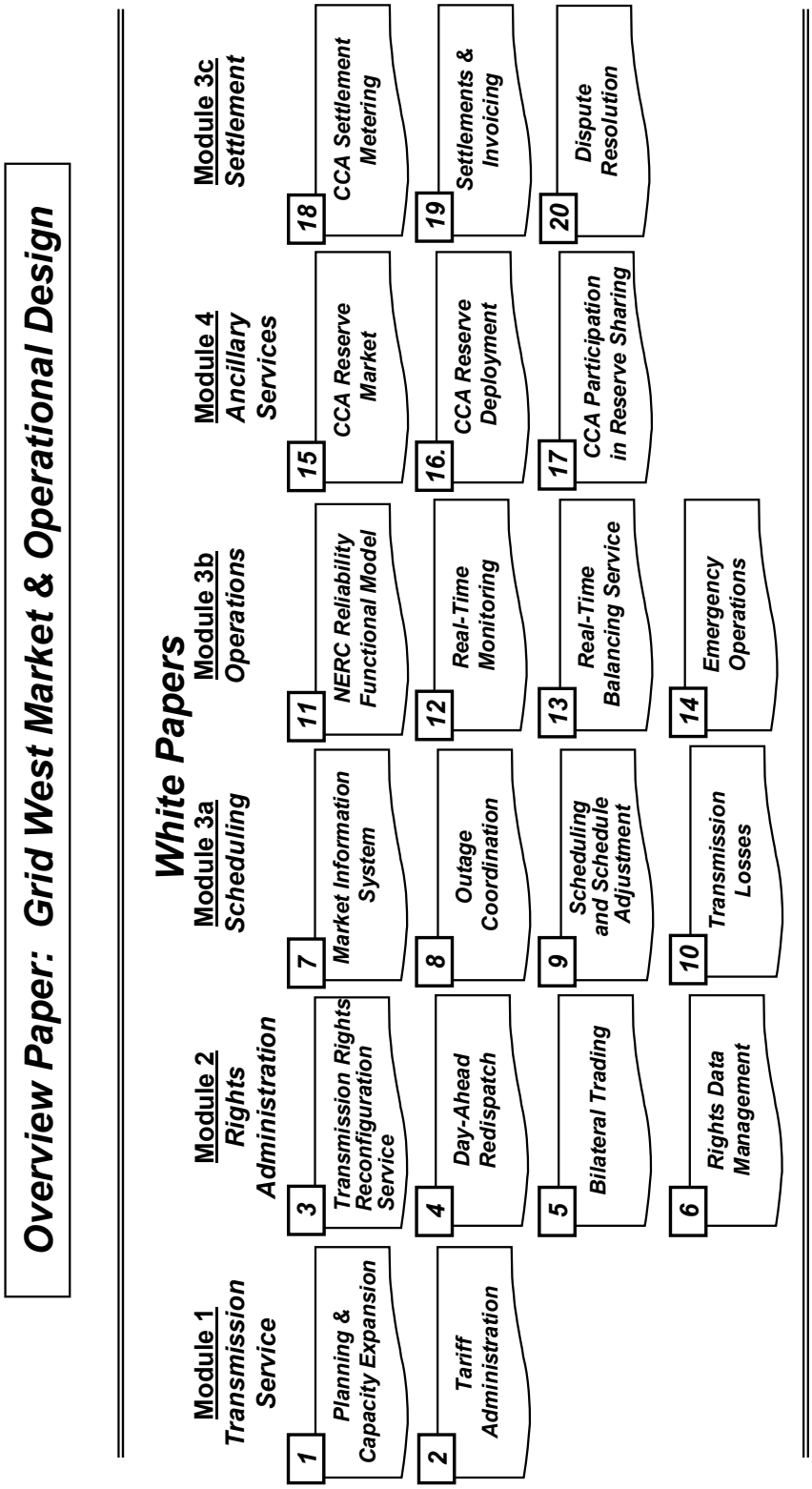


Figure 1.1 Chart of TSLG paper describing the conceptual framework of Grid West's market and operational design. Paper numbers are keyed to the list of paper summaries provided in Appendix A.

2.0 A COMMERCIAL USAGE MODEL TO MATCH PHYSICAL REALITY

This section explains how transmission providers currently manage contractual obligations and describes the operational challenges created by the present approach to transmission capacity management. It provides valuable background on both the evolution of the regional grid and the rationale for the need to change the commercial usage model.

2.1 Interconnected Systems

a. Transmission Function & Value. The function of a transmission system is too reliably and economically delivery energy from generation to loads. Reliability of supply is a clear expectation in our society. To meet this expectation, the transmission system must be designed and operated to withstand the contingencies that occur over time; for instance, the loss of a generator due to a mechanical failure or the loss of a transmission line due a lightning strike.

   At the same time, the economic value of the transmission system's delivery capacity is based on the value of the resources it can deliver. This is a reflected value rather than a direct value, since a transmission line has no value without energy to deliver. As a result, generation really doesn't compete with transmission; rather, transmission enables competition to occur between remote and local generation.

b. Reliability and Economy. Transmission systems were relatively straightforward in the beginning; a line was built from a generator to a load. In the West much of the early transmission was built from remote hydro resources to either cities or mining centers.[2] There was an early recognition of opportunities for improvements in reliability and for obtaining economic savings if these simple systems were interconnected. As interconnections grew, utilities were able to provide back-up to each other for contingencies, and they were also able to take advantage of load and resource diversity to trade energy among themselves to reduce the cost of serving their respective customers.

   Whenever an interconnection of AC systems occurs, a new joint system is created, which becomes in effect a single, very large machine. All the generators in an AC network are synchronized, i.e., they all operate at the same frequency. Further, because of governor action, they respond jointly to

[2] Thomas P. Hughes, Networks of Power, Electrification in Western Society, 1880-1930, Johns Hopkins University Press, Baltimore, MD 21218, 1983, pp. 282-283.

maintain standard frequency when there are changes in load or loss of generation or transmission. The transmission system provides the ligaments that tie the generators together and connect them to load.

Such a multi-owner regional system is by nature a single system electrically, and facility ownership has no bearing on power flow. The flow of power through the interconnected network is governed by system physics, i.e., the systems topology, its line impedances, and the location of generation and load. Because there are no electrical valves[3] in the transmission system, the ability to alter power flows occurs primarily by changing the generation dispatch, i.e. the pattern of generation injections at various locations in the system.

c. Problem of the Commons. Whenever a single system is created in which there are multiple owners, there will be what has been called the "problem of the commons," i.e., the temptation for each user/owner to maximize its own benefits from a shared resource without regard for the detrimental effects on other users.

   This problem of the commons is complicated in the case of interconnected electrical systems by the fact that every action of one party affects others to some degree. In addition, each of the multiple owners has different levels of investments, and those investments were made at different points in time. This leads to different perceptions about each owner's appropriate usage share in the combined system. Over time, a set of usage rules (the contract path model) developed for the interconnected transmission system to define each owner's share of the jointly created transmission capacity of the system. However in recent years there has been increasing concern that the current set of usage rules is inadequate.

2.2 Do We Need a New System Usage Model?

a. The Contract Path Model. Today, transmission owners provide transmission services using an approach that is known as the contract path model. The base assumption of the contract path model is that separate owners can act autonomously. However, once interconnections began, this was never really true. As explained in more detail in Section 2.3, the contract path model was workable when it was applied to early interconnections because the transmission network was simpler, had far fewer interconnections, and there was sufficient "margin" in the system to compensate for the mismatches

[3] Phase shifting transformers, also called phase angle regulators, can provide a limited degree of power flow control. They are located in a few strategic locations to meet specific needs, however, generation dispatch remains the primary means for controlling power flow in the network.

between the way the contract path model assumed energy would flow along the "contract path", and how energy actually moves across the system. These mismatches have come to be called unscheduled flow or, more commonly, "loop flow."

b. Contract Path Workability. The contract path approach is becoming less and less workable over time as the system is more frequently operated closer to its physical limits. At the same time, methods used by transmission providers to mitigate the problems of the contract path model (described in Section 2.4 below) are not as effective as they need to be, because the contract path model is not based upon actual power flow effects.

c. A Flow-Based Model. A new and practical commercial service model of system usage is needed that will align transmission right issuance and scheduling with the physical realities of power flow in the transmission system. To meet this objective of the Regional Proposal, TSLG has developed a flow-based methodology (described in Section 3 of this paper) that recognizes that the actions of each transmission user affect all other transmission users to a greater or lesser degree based on system physics.

2.3 The Challenges of the Existing Contract Path Usage Model

a. Problems & Opportunities. During the summer of 2003, the Regional Representatives Group (RRG) developed a list of problems and opportunities[4]. The contract path model of system usage was identified as a significant factor in underutilization of transmission capacity. An opportunity exists to develop improved usage rules that allow existing capacity to be better utilized while still maintaining system reliability.

b. Contract Path Assumptions. The contract path model is a simple "transportation" model. For commercial purposes, transmission is assumed to be provided, and power is assumed to travel (or flow), on specific lines as if MWs were cars on a highway network. This simplifying approximation was acceptable when the pattern of interconnections was fairly simple and there was surplus capacity in the transmission system. However, this simple model has been retained past its useful life, because of its apparent simplicity and because of uncertainty about the outcome when converting existing obligations from one usage model to another.

c. A Growing Mismatch. The mismatch between the simple contract path and physical reality grew with the rapid growth of the system after World War II.

[4] "Regional Representatives Group, Regional Transmission Problems and Opportunities List, Organized by General Categories - Update and Accompanying Notes," August 14, 2003, http://gridwest.org/Doc/RRGA_RefinedListClean_Aug142003.pdf.

In the 30 years after World War II there was a burst of transmission construction.

- Canada and the Pacific Northwest were tied to California by the lines that make up the elements of the Pacific Interties.
- Transmission was strengthened within the greater northwest as interior hydro and coal-fired resources were developed.
- Ties were closed at Glen Canyon and in the Four Corners area that connected Arizona and New Mexico to Colorado and Utah (and from them to the greater Northwest).
- Transmission was built to import coal-fired resources into California from Arizona and New Mexico.

Around 1970, the completion of the major interconnections described above "closed the loop" and gave the Western Interconnection its current system topology. Disputes quickly arose among the owners operating different portions of the transmission system because of inherent mismatch between actual system flows and the contract path model. This mismatch was dubbed *"loop flow."*

d. Loop Flow. Loop flow is the reality that belies the fiction that each path owner can act independently of other operators. Years have been spent in a fruitless debate over who the loop flow culprits are, when the real culprit is a commercial use model that doesn't square with reality. Figures 2.3b shows the assumed path of energy injected in system T and withdrawn in system R with system S providing transmission service. Figure 2.3b shows what actually occurs. Components of transmission flow move across the entire system, following the past of least resistance. There inability to recognize the impact on the physical system is the inherent flaw in the contract path model.

Figure 2.1a. An assumed contract path power flow over the facilities owned by systems R, S and T.

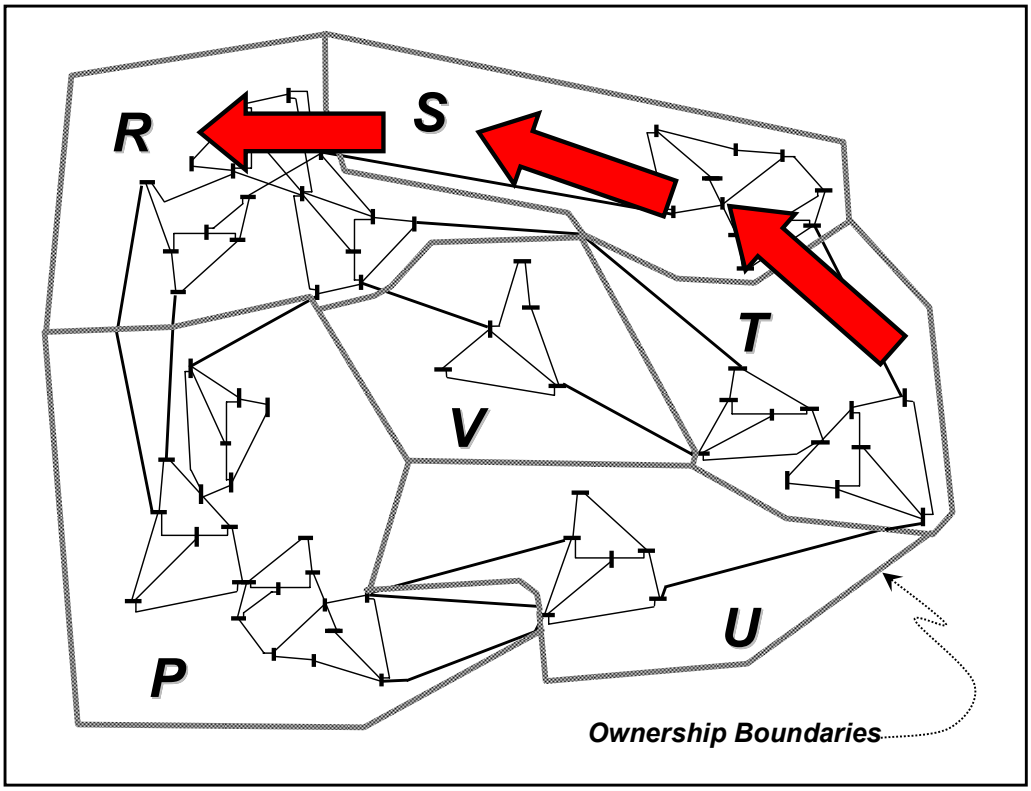
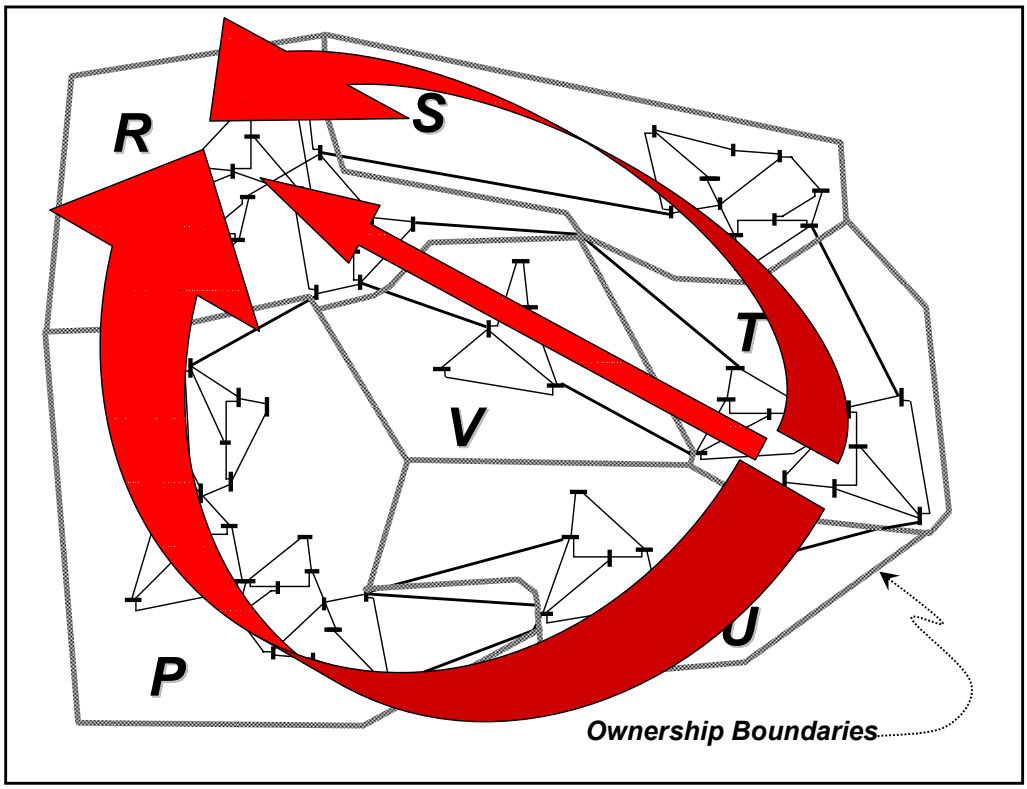


Figure 2.1b. A schematic representation of the actual power flows associated with the contract path flows shown in Figure 2.1a.



e. Contract Path Inefficiencies. Loop flow is an evidence of the inefficiency forced into system operations by use of the contract path model. In order to protect an owner's autonomous use of its share of system capacity, limits are placed on other owners' use of their own facilities. These limitations endeavor to protect system reliability, however because they are made *a priori*, they lead to underutilization of transmission system capacity. The contract path model provides has no reasonable economic means for transferring usage rights between owners as transmission user needs change.

f. Inability to Predict Loop Flow. An added problem with loop flow is that it cannot be predicted in advance under today's commercial arrangements. As a result, when loop flow problems occur in real-time, operators must use non-economic adjustment measures, i.e., the curtailment of schedules, to correct path overloads. Curtailments are made based on an owner's view of only its own system. Sometimes, these curtailments lead to no actual change in flow because generation dispatch is unchanged. The energy is simply

rescheduled through other 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. This is not particularly effective, but it is the only tool available to operators today.

2.4 Mitigating Contract Path Model Problems

When the network was growing rapidly, temporary excess capacity tended to lessen the impact of contract path model problems. As utilization rose and transmission owners began to face unexpected costs,[5] efforts were made to adjust the contract path model have been made to mitigate loop flow effects and find a way to "live with" the problems.

a. Building Ahead of Need. When transmission systems were expanding rapidly prior to the 1980's, there was a tendency to build capacity ahead of need. This occurred in part because transmission line investments are "lumpy," i.e., you get the entire capacity of a transmission line when the line is energized, not just the capacity you need at the time. Surplus capacity, when it exists, tends to mask the impact of the actual flow to scheduled flow mismatch, making it more tolerable.

   Because the system was growing quickly in the 1970's, the extra capacity from a project would be needed in one or two years to move additional generation, so the economic burden of extra capacity was small. These conditions no longer apply. System load is growing slowly. New generation tends to be gas fired, may well be owned by a non-utility entity, and located close to load. New investment in transmission has lagged far behind load growth over the past 15 years[6], and public resistance to transmission line siting is much more vigorous than it was 20-30 years ago.

b. Simultaneous Path Ratings. Even with surplus capacity designed into early system by the construction effects, there were still many hours when the presence of loop flow created operational problems. As a result there was clear appreciation of the need to recognize (at least in part) the effect of the actual flows on the major parallel paths in the Western Interconnection. That need led to simultaneous ratings of parallel paths. Simultaneous path ratings provide an approximate, flow-based division of system capacity between

[5] In spite of the difficulties of loop flow, no system has ever proposed cutting its interconnections to other systems in the West. This is unspoken testimony to the great value of interconnected transmission systems for both economic savings and system reliability.

[6] Keeping Current – Wanted: One-utility transmission for the Pacific Northwest, Bonneville Power Administration, March 2005, p. 2,(http://www.bpa.gov/corporate/pubs/Keeping/05kc/kc0305.pdf).

parallel paths. While the simultaneous ratings nomograms[7] provide bounds for operations, they do not provide a way of determining what operating point is "best" or a mechanism for dynamically allocating path capacity.

In order to protect autonomous use by each path owner, the scheduled use of a path must be limited to the path rating even if actual flow is below the rating. At the same time, actual flow also must be limited to the path rating, even if the schedule was below the path rating. The requirement to abide by this dual constraint causes capacity to go unused. The full system may be capable of moving more energy, but there is no way to enable heavier use on one owner's system if the owner of the parallel path is to be able to autonomously exercise its "share" of the simultaneous rating. While the simultaneous rating process has reduced disputes among the owners, it has not resolved the underlying problem of underutilization.

c. Coordinated Operation of Phase Shifting Transformers. Another mitigation measure taken over the past 20 years is the installation and coordinated operation of phase shifting transformers[8] to partially regulate loop flow. Because the range of such devices is limited, they can only reduce loop flow but not eliminate it. Their operation is not without cost, because altering system flows by increasing phase angle also raises system losses. As with path rating, the consequences of the mismatch problem are mitigated but not resolved.

d. Increasing Problems. The difficulty of reconciling the contact path mismatch with the realities of system physics will continue to increase.
   - There has been limited transmission construction over the past decade, yet network usage continues to grow. The combined effect reduces the slack in the system that previously made tolerable the mismatch between scheduled and actual flows.
   - New construction will only make network topology more complex and increase the number of places where the mismatch between actual flows and scheduled flows creates operational problems.
   - Passage of the Energy Policy Act of 1992 opened wholesale market access to the transmission system and increased the number of transactions the network needs to accommodate.

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[7] A nomogram is a graphic representation of the interdependence among transmission paths. These graphs show the tradeoff that must be made in reaching a simultaneous maximum flow. As flow is increased on one path it must be reduced on a parallel path.

[8] Also called phase shifters or phase angle regulators, these devices installed in one of two parallel systems, can provide limited control of power flow by altering the apparent phase angle between their terminals and force (or draw) flow onto (or from) the parallel facilities.

- The addition of new generation has become difficult, especially for remote resources like wind generation.
- Available transmission capacity is in short supply when measured using the contract path usage model. However, studies of rated paths show that actual flows approach rated capacity in a relatively few number of hours each year.

2.5 Moving to a Flow-based Usage Model

As the preceding sections demonstrate, the old contract path model is not an effective tool for making best use of the transmission system. Its basic assumption of the contract path model is untenable, namely, that separate owners can act autonomously. To address the problems inherent in the contract path model, a flow-based methodology is needed.

a. The modifications of the contract path model described above trim owner actions to a degree, but they offer no systematic, simultaneous approach to deal with actual flow effects.

b. The establishment of the Pacific Northwest Security Coordinator (PNSC) was a first step to looking at the combined real-time effects of system usage for the Northwest Power Pool control areas; however, the commercial model used for scheduling remains unchanged.

c. A structural change is needed, to reconcile the commercial model with system physics, thereby recognizing the effect that the actions of each transmission user have on all other transmission users.

3.0 THE FLOW-BASED INJECTION-WITHDRAWAL MODEL

3.1 Why is the Proposed Flow-based Model Better?

a. Desired Model Characteristics. A good commercial transmission model must align usage with physical realities, and it must be practical to implement.[9] The Grid West proposal for an Injection-Withdrawal model meets these criteria:
   - It is consistent with POD/POR designations in pre-existing transmission rights.
   - It does not require the user to be a network expert.
   - It is adaptable as the network changes.

b. Implementing a Flow-based Model. Due to the externalities (i.e., loop flow) previously discussed, implementation of a flow-based usage model is most practical when done over large regions of an interconnection. The California ISO (currently moving to a flow-based model) and Grid West are each large enough to increase grid efficiencies in its region, and both offer another key requirement for a regional transmission capacity manager using an injection-withdrawal usage model – a single, independent "gatekeeper" for use of system capacity.
   - The capacity manager makes evaluations of existing commitments and future use based on a grid-wide, flow-based examination of the whole system as an integrated regional network.
   - While the governance of the entity charged with the capacity management function must be responsive to regional needs, it must at the same time be independent of the market participants and not have a stake in market outcomes.
   - Grid West is designed to meet this need for a capacity manager for the region's transmission system capacity. Grid West's function is

[9] The region's first attempt at using flowgate rights in RTO West Phase 1 was too complex for practical implementation. The flowgate, physical rights model required each party to maintain a large, continually changing portfolio of rights on a set of critical flowgates. Limiting the number of critical flowgates to be considered was an approximation made to ease the user's burden. However by only considering a given set of identified constraints, adaptation was difficult as the system changed. If a new flowgate were deemed critical, each user's portfolios of rights would have to be restated each time a change occurred. However, the *coupe de grace* of this approach was the intractable problem of converting pre-existing rights to a distributed set of fractional rights. No unique set of such rights existed that would be agreeable to all parties.

analogous to the function of an air traffic controller managing usage of shared air space.

3.2 Pre-conditions for Adopting a New Flow-based Model

In order for Grid West to adopt a flow-based model acceptable to regional users, the following conditions must be met.

a. New services should be made available to make better use of the system.

b. The pre-existing transmission rights should be preserved and allowed to be used as they were in the past.

c. The implementation of the new model should avoid known or foreseeable market power problems and not create gaming opportunities.

d. There needs to be a reasonable and reliable transition path from today's operational model to putting the new model into operation, one that does not preclude the ability to make adaptations as system needs may change in the future.

3.3 General Features of the Grid West Flow-based Model

The general features of the Grid West flow-based model are responsive to goals and objectives described in the Regional Proposal.

a. Pre-existing obligations and agreements are unchanged in order to preserve pre-existing transmission rights. Only voluntary choices made by right holders will alter their current rights.[10]

b. A flow-based methodology with injection and withdrawal rights is adopted using a central administrator (Grid West) to manage the use of transmission capacity and to recognize the "one-system" (i.e. flow-based) reality of the regional system.

c. One-stop shopping for transmission services across the network is implemented through Grid West which will include transmission planning, capacity expansion and a single queue for long-term transmission service requests (one year or longer).

d. Transmission right reconfiguration services are implemented to enable better access to available capacity. These services combine release of capacity by transmission right holders with Available Flowgate Capability (AFC)[11] to

[10] See Section 3.2a for more discussion on pre-existing transmission rights. Discussion of participation of pre-existing right holders in the Reconfiguration Services is provided in Section 3.3b and 3.3b.

[11] The term Available Transmission Capacity (ATC) has been used with the contract path model to designate an owner's uncommitted contract path capacity. In a flow-based method, the contract path no

provide wider trade in transmission rights. This improves access to short-term services (from hourly service for the next operating day up to service for a full year).

e. Voluntary consolidation of control areas using a day-ahead reserve market and a real-time balancing market is enabled, consistent with the Regional Proposal.

f. A staged implementation will be used for building up Grid West's Basic Features. The implementation plan will allow functionality to be increased over time with a cycle of testing, user training and successful operation. The process will be repeated each time new features are added. This has proven to be a successful, cost-effective approach compared to a "big bang" start with all features at the outset.

3.4 Providing Transmission Service

a. An Incremental Change. Early in the first layer of the design process, a transmission service framework was developed that to allow the implementation of the flow-based methodology while leaving in place the pre-existing obligations and agreements of the Transmission Owners. This is not a wholesale change in the provision of transmission service, but rather an incremental change. Because the pre-existing rights remain in place the effect on the overall market will be quite modest. A flow-based approach will account for existing commitments when new rights are issued and right trading is enabled.

b. Pre-Existing Rights Undisturbed. Transmission users with pre-existing rights may continue to use their rights as they have in the past. The contracts that establish such rights will continue to define the rights granted and the limitations imposed. The implementation of the Grid West flow-based model will not force any change in pre-existing agreements and obligations. The holders of pre-existing rights will have the option of using Grid West's broader transmission services or continuing to take transmission service as defined by their pre-existing contracts.[12]

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longer exists. Instead, service availability is determined according to the physical capacity of critical elements or flowgates. Flowgate may be a single line or transformer or a set of parallel facilities that can be treated as a single network constraint. The uncommitted physical capacity of a flowgate is called Available Flowgate Capability (AFC). AFC is not based on ownership but on actual network effects of a transmission reservation. A given injection-withdrawal right will result in use of multiple flowgates; however, the Transmission Customer is not required to manage these details.

[12] See the Tariff Administration White paper for further discussion of pre-existing rights and obligations, rollover, load growth, etc.

3.5 The Transmission Service Framework

The framework for Grid West transmission service has two key aspects: (1) the transmission service structure and (2) the transmission tariff structure.

a. Transmission Service Structure. Grid West will offer a Regional Network Service (RNS), a new suite of services that will allow users to obtain transmission rights to schedule energy across the Grid West network. This service suite includes:
   - Reconfiguration Services.
   - Capacity Expansion Service.
   - Scheduling Services.

b. Qualifying for RNS. As described in early 2004 discussions, a Transmission Customer would qualify for RNS by meeting a System Access Requirement (SAR). As originally conceived, the SAR requirements would be matched to a Transmission Customer's commercial role.

   [Note to readers: In recent discussions of the pricing model for fixed cost recovery, it has become clear that the access fee concept carried over from the RTO West model does not fit the Grid West service model. The SAR was intended to verify that a Transmission Customer would be making an appropriate contribution to recovery of the system's fixed costs (i.e., the Transmission Owners' Revenue Requirements in order to qualify to obtain RNS). Further discussion will be needed to clarify the need for the SAR, and for the qualification standard described below.]

   - Load Serving Entities—Where pre-existing rights cover an entity's full load, the SAR is met. This allows the entity to use RNS to release unused rights for sale or to obtain rights to reach new resources not covered by their pre-existing rights. Load not covered by pre-existing agreements will pay a load based rate to cover such load, thus making RNS available to the entity.
   - Generators—The SAR is met by paying for interconnection with the system. Those with pre-existing rights maintain those rights by continuing to pay the contract charges for the agreements that grant those pre-existing rights. Additional transmission rights can be obtained using RNS.
   - Marketers—Marketers without generation or load must meet the technical and credit standards common to all users of RNS, but have no other intrinsic obligation. If they have pre-existing rights, like generators, they maintain those rights by paying the contract charges for the pre-existing agreements. Additional rights may be obtained using RNS.

c. Recovering Embedded Fixed Costs. When Grid West commences operation, the bulk of the embedded fixed costs of the Transmission Owners, will continue to be met by revenues associated with pre-existing long-term transmission agreements. The charges under these agreements will continue to be paid to the Transmission Owners according to the terms of those agreements. However, because Transmission Owners will no longer issue new transmission rights, the revenues for short-term firm and non-firm service currently received by Transmission Owners will no longer exist. The short-term and non-firm services will be replaced by IWRs purchased using the Reconfiguration Services or obtained from Grid West as available after the end of the day-ahead process.

d. Regional Revenue Requirement Adjustment (R3A). The R3A is a mechanism designed to recover any short-fall in Transmission Owner revenue requirements, with the R3A being paid by those who choose to use RNS.[13]
   - Grid West's sales of AFC through the Reconfiguration Service may recover part (and perhaps most) of the revenue that was previously recovered by the Transmission Owners' sale of non-firm and short-term firm transmission service.
   - The R3A will cover the net cost of offering AFC, i.e., any administrative costs associated uniquely with RNS markets and the residual lost revenue from short-term firm and non-firm sales not recovered by sales of AFC.
   - The R3A could be zero if AFC sales fully offset the lost non-firm and short term revenues and RNS specific costs. Any surplus could be used to reduce other Grid West costs, to reduce the Company Rates of the Transmission Owners, etc.

3.6 The Transmission Tariff Structure

[Note to readers: The following information on tariff structure is based on the Module 1 work done during 2004 Layer 1 design work. While it is the best information currently available, there will be changes in this section as further work is done by the Pricing Work Group and as the tariff structure is revisited in light of their work.]

The above transmission service structure will be implemented through the issuance of a set of tariffs. Pre-existing rights will continue be covered by the transmission tariffs and contracts under which they were established by the Transmission Owners. New services will be covered by either a Grid West Tariff or Transmission Owner Tariffs. The Grid West Tariff[14] will contain general provisions to cover requests for transmission service, planning and capacity expansion, scheduling, the

[13] The rate design for collecting the R3A will be covered by the Pricing Work Group.

recovery of Grid West's costs through a Grid Management Charge, etc. Other provisions may include:

- Coordination and dispute resolution for transmission interconnections. Interconnections will be covered in provisions in Transmission Owner Tariffs.
- The rules for RNS—Qualification (the SAR as applicable), the issuance of IWR (1) through the Capacity Expansion Service for longer than one year, (2) through the Reconfiguration Service for one year or less and (3) during the post day-ahead adjustment period, using residual AFC not otherwise committed, made available on a first-come-first-served basis.
- Company Rates of Transmission Owners – The rates listed will either be the rate listed in a Transmission Owner's Tariff or the rate set by Grid West if a Transmission Owner chooses to have their Company Rate set under the Grid West Tariff.

3.7 Trading Transmission Rights

a. Bilateral Trading of Rights. In Grid West's flow-based injection-withdrawal model, the scheduling rights of a Transmission Customer are defined by Injection Points (IPs), where power enters the Grid West Managed Transmission System (GWMT), and Withdrawal Points (WPs), where power leaves the GWMT. Since Transmission Customers have usage rights that are tied to these points, bilateral transmission right trading is limited to transactions in which there is an identical match between the buyer's and seller's injection and withdrawal points. Since few Transmission Customers will have the matching injection and withdrawal points, bilateral trade will be quite constrained without a centralized mechanism that can consider the system-wide effects of transmission right transactions.

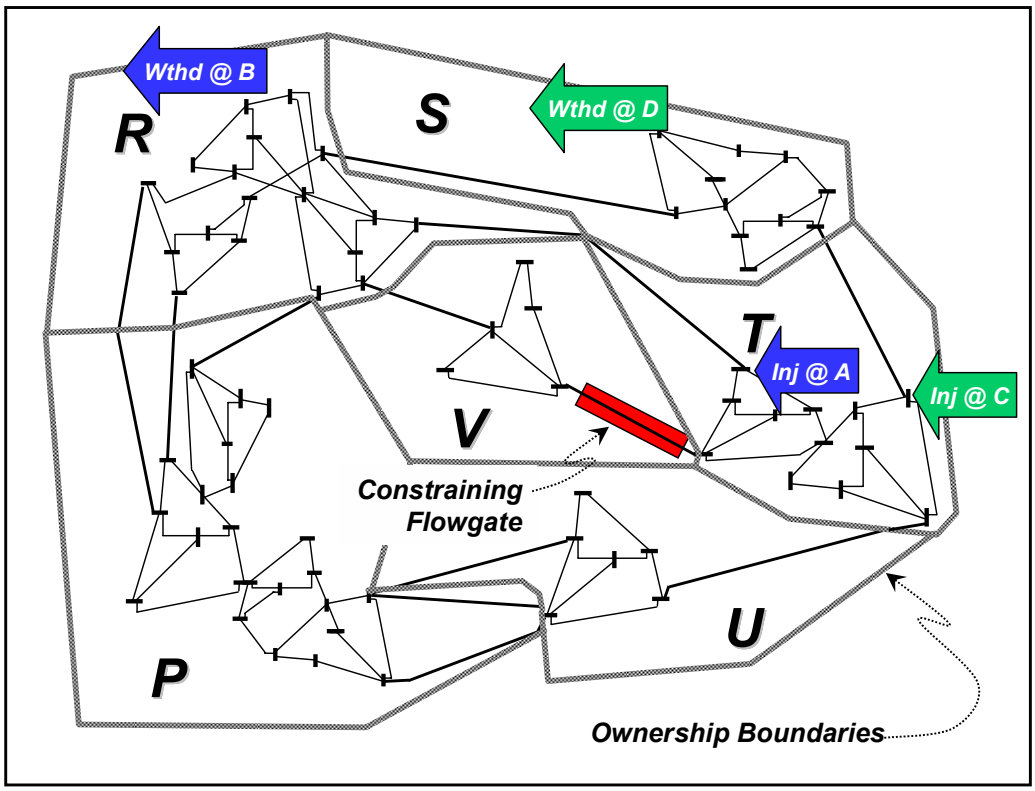
b. The Reconfiguration Concept. To overcome this one-to-one trade limitation, the Grid West proposal includes a Reconfiguration Service (RCS) that allows transmission right holders to sell rights between one set of points and buy rights between a different set of points at the same time. This ability to reconfigure rights is made possible by Grid West's role as the single "gatekeeper" — the only party who can issue new transmission rights in the Grid West Managed Transmission System.

[14] The form of the Grid West Tariff and its relationship to Transmission Owner Tariffs has yet to be determined. Some propose that there be a standard set of new Transmission Owner Tariffs with Grid West acting as agent, while others propose a unified Grid West Tariff. At the completion of the Module 1 work, an owner option was suggested, but again the exact form of the tariff was not determined as of the date of this draft.

The Reconfiguration Service is based on a central auction of short-term transmission rights conducted by Grid West.

- IWRs released to the auction increase AFC on specific flowgates.
- Requests made can now be granted by using the combined AFC (both uncommitted capacity and capacity released by right holder offers to sell).
- Trade no longer requires a one-to-one match of injection points and withdrawal points.

Figure 3.6 An example of IWR reconfiguration for an offer of A→B.



c. A Reconfiguration Example. Figure 3.6 shows how IWR reconfiguration works for a simple case of a single IWR release offer and a single bid to buy IWRs.

- *Situation:*
  - Party X holds an IWR from A to B of 100 MW that it is willing to sell next month.
  - Party Y wants to purchase an IWR from C to D for 200 MW that for next month.

- *Without Reconfiguration Service:*
  - Since the points of injection and withdrawal for the A→B right do not match those of the C→D right requested, no direct trade of rights is possible
  - The two IWRs have different effects upon the constraining flowgate that for this example is within the ownership boundaries of V. The Path Utilization Factor (PUF) for an A→B injection-withdrawal pair is 30;%; that is, for a 100 MW schedule there will be an incremental flow increase of 30 MW on the constraining flowgate. The PUF for C→D is 20%.
- *With Reconfiguration Service*:
  - Using the RCS a trade can be affected.
  - Party X offers its 100 MW A→B for release (sale), which makes the AFC on the constraining flowgate 30 MW (PUF_{A-B} x Offer).
  - Party Y bids to buy 200 MW C→D which would require 40 MW of AFC on the constraining flowgate.
  - Y's full request cannot be satisfied, but 30 MW is available, so a 150 MW C→D IWR can be issued. (AFC / PUF_{C-D})
  - Without the trade, the capacity held for X's use would have gone unused, yet there was no way for such a trade to have occurred on a bilateral basis.
  - Note that the MWs for the two IWR are different because of the impact of each IWR on the constraining flowgate. This demonstrates the reason that bilateral trading must be restricted to identical one-to-one exchanges. The trading parties on their own have neither a means of measuring impacts of altered usage nor are they authorized to make changes in the rights issued to them.

d. Practical Implementation of Reconfiguration. In actual practice, many offers to release and bids to buy will be submitted and processed simultaneously. The auction software for reconfiguration trading uses a power flow algorithm that can simultaneously award IWRs while keeping all subscriptions within AFC limits. Existing software is available from vendors which can be modified enable trading of physical, flow-based rights through Grid West. The characteristics of IWRs issued by Grid West, whether from a reconfiguration auction or in connection with long term expansion, will be standardized, with terms of use to be defined by the Grid West tariff. The nature of released (sold) rights of whatever vintage or source will have no impact on the characteristics of an IWR.

e. Addressing Scheduling Flexibility. A day-ahead redispatch feature was included in the Regional Proposal[15] as a Basic Feature of Grid West. The purpose of the day-ahead redispatch was to enable greater use of the transmission system by getting advance scheduling commitments. However, major difficulties were encountered in attempting to design such a day-ahead redispatch:
   - A voluntary day-ahead redispatch is a partial energy market that must be settled against a real-time energy market, but since not all parties participate, the optimization achieved can be undone by parties who retain their pre-existing scheduling flexibility.
   - Measurement and settlement of committed schedules would be difficult because not all of them would be settled in the same balancing market, i.e., some within the CCA and some in non-CCA balancing areas.
   - Finally, it appeared that there were potential gaming problems that would have to be addressed.

f. The Day-Ahead Reconfiguration Service. When day-ahead redispatch was revisited after the reconfiguration service had taken shape, it became clear that much of the desired effect of the day-ahead redispatch (i.e. commitments to a specific generation plan) could be accomplished by allowing parties to release a portion of their generation scheduling flexibility through the Day-Ahead Reconfiguration Service (DA-RCS).
   - If transmission right holders[16] give up their options for scheduling flexibility in the DA-RCS there is a reduction in the "headspace"[17] that must be set aside to meet obligations for pre-existing rights.
   - This reduced headspace becomes AFC that can be sold as IWRs.
   - The typical day for pre-scheduling fits the general pattern in use today:
     - Trades for the next day occur very early in the morning.
     - Requests are made for transmission from various transmission providers.
     - Pre-schedules are submitted.

[15] "Narrative Description of RRG Platform Group Regional Proposal", December 24, 2003, pp. 7-8, http://gridwest.org/Doc/FinalNarrative_RegionalProposal_Dec242003.pdf. The Regional Proposal described an Independent Entity (IE) that has since been given the name Grid West.

[16] These flexible scheduling rights include those used for native load service by Transmission Owner and the largest potential source of releases of existing scheduling flexibility.

[17] Headspace is a term used to describe the capacity set aside prior to an RCS auction to preserve pre-existing rights, including the scheduling flexibility (or optionality) of transmission right holders to change their schedules after the close of the day-ahead scheduling process.

By enhancing the DA-RCS to handle releases of scheduling flexibility, the complications of the day-ahead redispatch service can be avoided while achieving a good deal of the objectives, namely making more capacity available through voluntary offers to restrict changes in generation patterns for the following day. The enhanced DA-RCS allows individual Transmission Customers to find transmission through a central auction conducted by Grid West, where AFC is made available by releases of scheduling flexibility along with offers of IWRs and AFC.

3.8 Rights Data Management

Providing both new transmission rights and honoring pre-existing rights will require Grid West to have an accurate record of all transmission right obligations for the GMWT. The process of Rights Data Management will meets this need and will be made up of four processes.

a. Physical Rights Inventorying. Grid West will compile a data base that records all obligations for the GWMT. This will include IWR issued by Grid West and the Transmission Owner rights obligations associated with pre-existing transmission rights. For the inventory of Transmission Owner obligations, Grid West will work directly with the Transmission Owners to determine and inventory their aggregate obligations. This inventory will be used to support: (1) the calculation of AFC, (2) the validation of schedules and (3) the operation of the Reconfiguration Service.

b. ETR Certification. If a Transmission Customer wants to schedule directly with Grid West or offer its scheduling flexibility into the Day-Ahead Reconfiguration Service, it will request Existing Transmission Right (ETR) Certification from Grid West. Certification will produce a set of Certified Existing Transmission Rights (CETRs). Each CETR will include a set of scheduling points and their associated scheduling flexibility.

c. IWR Translation Query: If a Transmission Customer wishes to release IWRs into the Reconfiguration Service, it will submit an IWR Translation Query to Grid West. The Transmission Customer will indicate what portion of its CETR it wants to have identified as potential IWRs. In the translation process, Grid West will use a flow-based model to calculate the IWR value available from the CETR for a specified time period and indicate the value of any remaining transmission rights not used to enable the creation of IWRs. Information provided in response to a query does not commit the Transmission Customer to offer IWRs. The customer may continue to use its CETR as before, or it may make a release into a specific Reconfiguration auction. If offers are not taken, the Transmission Customer's rights revert to its CETR.

d. Bilateral Trade Registration. When bilateral trade of IWRs occurs in the secondary market Grid West will provide a registration service that permits the purchaser to schedule against the IWR, in effect a title transfer.

4.0 CONTROL AREA CONSOLIDATION

4.1 Voluntary Control Area Consolidation

The Regional Proposal[18] noted that some of the Transmission Owners expected to be within the Grid West footprint were discussing the possibility of consolidating their individual control areas. Grid West would provide the services needed by the consolidating parties to operate the Consolidated Control Area (CCA). The motivations of those considering participating in the CCA include increased reliability and operational efficiencies.

a. Reliability. Consolidation of control areas by those Grid West Transmission Owners expected to voluntarily participate will put certain control functions for a substantial portion of the regional grid under a single operator who will have authority to take appropriate actions when needed. The need for wider visibility outside of individual control areas has been identified as a means of improving the capability of operators to make proactive adjustments to protect system reliability.[19] Consolidation of control areas with an associated investment in infrastructure will be necessary to obtain this benefit.

b. Operational Efficiencies. Consolidation is expected to reduce the total requirement for regulating reserves and balancing energy, due to diversity among the loads and generation within the CCA. Furthermore, the establishment of a market for providing the Interconnected Operations Services (IOS)[20] necessary for operating the CCA is expected to reduce the cost of ancillary services.

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[18] "Narrative Description of RRG Platform Group Regional Proposal", December 24, 2003, pp. 11-12, http://gridwest.org/Doc/FinalNarrative_RegionalProposal_Dec242003.pdf.

[19] "A principal cause of the August 14 blackout was a lack of situational awareness, which was in turn the result of inadequate reliability tools and backup capabilities… Improved visibility of the status of the grid beyond an operator's own area of control would aid the operator in making adjustments in its operations to mitigate potential problems. The expanded view advocated above would also enable facilities to be more proactive in operations and contingency planning." Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations, U.S.-Canada Power System Outage Task Force, April 2004 pp. 159-160.

[20] IOS are generation services that, when combined with transmission services create ancillary services.

c. Transmission Utilization. The CCA will be able to make full use of transmission capacity within its boundaries in real-time to follow load, provide regulation and imbalance energy requirements, respond to contingencies, etc., without regard to facility ownership.

d. Voluntary Participation. In keeping with the voluntary nature of control area consolidation, each existing control area operator will make its own decision about whether or not to join the CCA based on it is own assessment of the benefits to be obtained.

4.2 Grid West as a Control Area Operator

Grid West will operate a Consolidated Control Area (CCA) for those who voluntarily choose to consolidate to obtain the benefits described in Section 4.1. The IOS needed by Grid West for CCA operation are:

- Capacity arranged day-ahead to obtain contingency reserve and regulating reserve needed for system operations.
- Energy offers (i.e., incremental and decremental offers) for balancing load, generation and interchange in real-time.

Grid West will obtain IOS by operating markets since it is neither an owner of, nor in control of, any of the assets needed to provide these services. These markets will provide price transparency, which will benefit both buyers and sellers and assist in market monitoring efforts.

- A Reserves Market will be used to obtain capacity related IOS.
- A Real-Time Balancing Service will be a market using voluntarily offered real-time energy options for system balancing requirements.

Grid West will encourage all market participants to make offers to provide these IOS to the CCA. Their participation will provide a wider range of options with lower production costs and greater efficiency. Service costs for CCA operation will be separated from other Grid West activities that apply to the entire Grid West Managed Transmission System.

5.0 THE WHITE PAPERS AND REFERENCE PAPERS

As noted above, TSLG divided its assignment into five work modules. Module 5, which will produce a Grid West cost estimate, is not covered by the white papers, but will be produced separately. This section of the Overview paper will describe the white papers that cover TSLG's work on the other four modules and will compliment Sections 2 and 3

that described the concepts involved in moving to a flow-based, physical rights model of transmission service. Descriptions of each paper are provided in Appendix A.

5.1 Module 1 – The Transmission Service White Papers

Two white papers will cover Grid West's provision of transmission service: (1) Planning and Capacity Expansion and (2) Tariff Administration. Neither of these papers is currently available. In the Regional Proposal, it was anticipated that Grid West's planning process would be adapted from the RTO West proposal. RRG discussions on planning are still unresolved, so work on the planning paper was put on hold by TSLG. Early work on the tariff structure is described below. As the Pricing Work Group completes its work, the tariff issues will be revisited in order to produce the tariff paper.

5.2 Module 2 – The Rights Administration White Papers

The papers on rights administration cover the key features of the flow-based, physical rights model for transmission service. These four papers are: (1) Transmission Rights Reconfiguration Service, (2) Day-Ahead Redispatch, (3) Bilateral Trading and (4) Rights Data Management. The Reconfiguration Service paper is the heart of this work module. It provides narrative discussion of the mechanism to be use to implement the reconfiguration services. It also provides extensive examples in its appendices using a three-bus transmission model to explain the reconfiguration process step by step.

5.3 Module 3a – The Scheduling White Papers

Module 3 describes that systems and operational process needed to implement the system-wide view of the transmission system and the flow-based model of transmission service. Module 3 was broken into three parts, with Module 3a covering issues related to scheduling use of the transmission system in four papers: (1) Market Information System, (2) Outage Coordination, (3) Scheduling and Schedule Adjustment and (4) Transmission Losses. The Market Information System will meet OASIS requirements, provide website access to public data and provide a private portal for the exchange of market related information (offers, bids, awards, etc.). Grid West will take a lead role in regional outage coordination in its role as a Transmission Authority for the GWMT. The day-ahead scheduling process is described in the scheduling paper using illustrative timelines, and the process for obtaining transmission service after the close of the day-ahead process is also described. The loss provisions of pre-existing rights will remain unchanged with loss schedules going to the original transmission service provider under the terms of the applicable agreements. The loss paper describes the mechanism to be used to determine loss responsibility when using IWRs issues by Grid West.

5.4 Module 3b – The Operations White Papers

Module 3b addresses operational activities of Grid West. Three of the papers cover general operational issues: (1) NERC Reliability Functional Model, (2) Real-Time

Monitoring and (3) Emergency Operations. The functional model paper discusses roles, authorities and responsibilities for system operations as provided in the NERC Reliability Functional Model, and the paper explains how these roles will be met when Grid West is operational. As a Transmission Authority, Grid West will be responsible for real-time monitoring and for providing direction in emergency conditions. The fourth paper in this module covers the Real-Time Balancing Service, used by Grid West in its role as the Balancing Authority for the CCA.

5.5 Module 3c – The Settlements White Papers

The Module 3c papers are: (1) CCA Settlement Metering, (2) Settlements and Invoicing and (3) Dispute Resolution Process. These are essential administrative services. The dispute resolution process covers billing, rights certification and IWR translation query disputes. The settlement process for Grid West markets is illustrated in the settlement and invoicing papers. The metering paper covers the metering needed by Grid West for settling the Real-Time Balancing Service used to meet CCA needs. Most metering needs can be met using existing equipment.

5.6 Module 4 – The Ancillary Services White Papers

The three papers in Module 4 are focused on the reserve aspect of ancillary services – regulating and contingency reserves: (1) CCA Reserve Market, (2) CCA Reserve Deployment and (3) CCA Participation in Reserve Sharing. Within the CCA, Grid West will operate a market to obtain needed reserves and will deploy them in real-time to meet the needs of the CCA. The Grid West CCA will be a participant in the Northwest Power Pool's Pro-Rata Reserve Sharing program for contingency reserves.

5.7 The Reference Papers

The White Papers investigate specific design features in some depth. TSLG recognized the need for more general treatment of some issues that reach across more than one subject area. The four Reference Papers address this need. One reference paper, Congestion Management, is a synopsis that examines Grid West congestion management features that are woven into the market and operational design by looking at how the pieces fit together to make a consistent whole. The other three reference papers look at concerns common to many of the white papers: (1) Auction Pricing, (2) Commercial Model and (3) Grid West Seams Issues. The auction pricing paper explains why a market clearing price approach was selected for all Grid West markets. The seams paper discusses issues that will need to be addressed in dealing with neighboring systems. The commercial model paper is not yet available, but will be completed prior to the start of Layer 3 work. The purpose of the commercial model paper is to serve as a bridge between the White Papers of

Layer 2 and the Protocols to be developed in of Layer 3.. The Commercial Model paper will define the roles of participants and identify the relationships between entities. This information will be used to establish procedures for the registration of arties to participate in markets, perform given functions, , etc..

APPENDIX A: LIST OF TSLG LAYER 2 DESIGN PAPERS

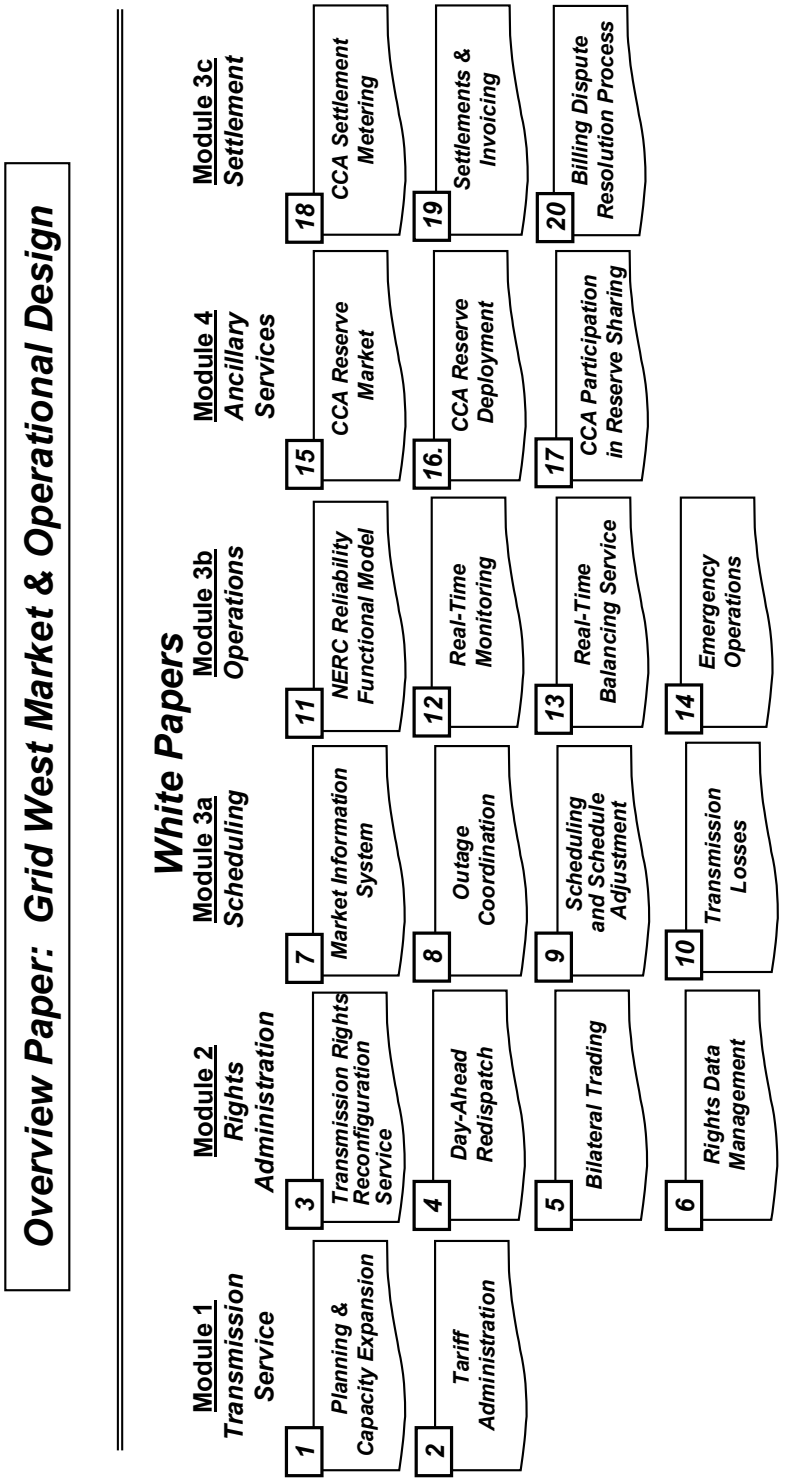

Figure A.1 Chart of TSLG paper describing the conceptual framework of Grid West's market and operational design.
Paper numbers are keyed to the list of paper summaries provided below.

This appendix contains a complete list of the TSLG papers prepared in the Layer 2 effort to describe the conceptual framework for Grid West's market and operational design. The titles are shown in Figure A.1, organized by work module. The paper numbers shown in Figure A.1 correspond to the numbering of the list of summaries provided below. The white papers listed in Section A.1 cover individual design features in some detail. Unlike the white papers, the reference papers listed in Section A.2 look across all design elements from the perspective of a single issue and consider how that issue is addressed or should be addressed when the design is considered as a whole.

A.1 List of White Papers

1. ***Planning & Capacity Expansion*** – *(Not completed)* Describes the regional planning process to be facilitated by Grid West and the mechanisms for capacity expansion. Grid West will develop an open transmission planning process that examines expansion needs from a single system perspective, tests for transmission adequacy and considers non-transmission alternatives to meeting system needs. The capacity expansion service will deal with requests for long-term service requests (greater than one year). If capacity is not available to meet the request, the capacity expansion service enables market driven transmission projects to meet requests. It also provides for expansion backstops for maintaining existing transfer capability and meeting transmission adequacy standards.

2. ***Tariff Administration*** – *(Not completed)* Describes the provision of transmission service through the Grid West Tariff and the related Transmission Owner tariffs. It describes the roles of Grid West, the Transmission Owners and the Transmission Customers, and it provides discussion of issues related to pre-existing contracts, such as load growth, contract termination or roll-over, etc.

3. ***Transmission Rights Reconfiguration –*** Describes the implementation of the reconfiguration service: mechanisms for determining pre-existing obligations, auction rules and pricing of IWRs sold and purchased. A series of auctions addresses different time periods:
   - Annual for monthly on-peak and off-peak IWRs.
   - Monthly for monthly on-peak and off-peak IWRs for the balance of the annual period of the auction cycles.
   - Intra-monthly for daily on-peak and off-peak IWRs for the balance of a month.
   - Day-Ahead for hourly IWRs for the next day. The Day-Ahead Reconfiguration Service (DA-RCS) will have an enhanced feature to enable trading of scheduling flexibility options.

4. ***Day-Ahead Redispatch*** – Describes the day-ahead redispatch service envisioned in the original Regional Proposal and explains how the objectives of day-ahead redispatch will be met by enhancements to the Day-Ahead Reconfiguration Service without encountering the difficulties of reconciling day-ahead bids with real-time imbalances that were discovered during TSLG's Layer 1 work.

5. ***Bilateral Trading*** – Evaluates the effects of Grid West proposed services and functions on current bilateral trading practices within the Grid West Managed Transmission System.

6. ***Rights Data Management*** – Describes the processes and functions used by Grid West to manage transmission rights data, including:
   - Inventorying of the injection and withdrawal commitments associated with pre-existing agreements and obligationsl
   - Certification of existing rights to enable the release of scheduling flexibility options into the day-ahead reconfiguration auction.
   - Translation of certified existing transmission rights into IWRs, either in whole or in part, prior to release into reconfiguration auctions.

7. ***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.

8. ***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.

9. ***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.

10. ***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.

11. ***NERC Reliability Functional Model –*** Describes proposed roles and responsibilities for Grid West and participants to meet the requirements of the NERC reliability functional model.

12. ***Real-Time Monitoring*** – Describes the proposed real-time monitoring process including the data needed to support both reliability and market functions.

13. ***Real-Time Balancing Service –*** Describes the operation of the balancing service used to obtain real-time Interconnected Operations Services for the CCA, while accounting for the nature and types of energy offers and selection of resources. It also describes the dispatch processes for resources selected by Grid West for the Real-Time Balancing Service including dispatch granularity, dispatch frequency, control signals process and routing, etc.

14. ***Emergency Operations*** – Describes the proposed emergency operations roles and responsibilities of Grid West for the GWMT as a Transmission Authority. The topics covered include emergency conditions, operating limits, NERC standards, the NWPP Energy Emergency Plan, and Grid West's operational responsibilities.

15. ***CCA Reserve Market*** – Describes the proposed operation of the reserve market used by Grid West to cost-effectively obtain contingency and regulating reserves for the CCA. The topics covered include the reserve products, reserve requirements, market timing, market operation, etc.

16. ***CCA Reserve Deployment*** – Describes the procedures to be used in real-time to deploy the reserves of the CCA that were obtained through the Reserve Market.

17. ***CCA Participation in Reserve Sharing –*** Describes the current Northwest Power Pool reserve sharing agreement and discusses the impact of the Pro Rata Reserve Sharing program on the operation of the CCA.

18. ***CCA Settlement Metering*** – Describes the process associated with the collection and management of CCA settlement meter data including what data is required and who is responsible for providing it.

19. ***Settlement & Invoicing*** – Describes the proposed process for market settlement and invoicing. The topics covered include settlement statements, periodic invoicing, payment issues, and an illustrative timeline for settlement and invoicing.

20. ***Dispute Resolution*** – Describes the proposed dispute resolution process for resolving settlement, billing disputes, certification and translation disputes.

A.2 List of Reference Papers

21. Congestion Management – Describes the Grid West market and operational design from the perspective of congestion management, providing a synopsis that considers how the design elements work together to provide a systematic approach to congestion management.

22. Auction Pricing – Describes the pros and cons of two auction pricing methods – market clearing price and as-offered-price – and the rationale for selection of the market clearing price for use in Grid West markets.

23. Commercial Model – *(Not yet completed)* Describes the Grid West commercial model, identifying the entities and assets that will use Grid West service and information that must be collected through a registration process, including the relationships among the entities and their relationship to Grid West.

24. Grid West Seams Issues – Describes the seams coordination issues that may impact Grid West operations. Two types of seams issues are considered: those that involve operational and procedural considerations and those that affect congestion management at the seams.