

## Chapter IV

### Flow-Based Approach

#### A. Executive Summary

TIG proposes that Transmission Providers adopt a flow-based approach for the Northwest transmission system. Transmission Providers and other TIG Charter Committees would use the flow-based analysis for purposes of planning (long-term and operational), as well as for reliability purposes and to operate the transmission system. Transmission Providers would also use the flow-based ATC model to develop and post a system-wide flow-based ATC on the Common Northwest OASIS (see Chapter VIII). This flow-based ATC would provide the basis for the sale of new point- of- receipt (injection) to point- of- delivery (withdrawal) transmission rights. As detailed below, at this point, TIG proposes that the sale of such rights would be accomplished through the use of a regional tariff, filed at FERC by TIG on behalf of the FERC-jurisdictional Transmission Providers.

An underlying principle of TIG's proposal is that Transmission Providers would preserve and honor existing contract-path transmission rights. Transmission Providers and Transmission Customers would not need to translate existing contract-path rights into flow-based rights. Transmission Customers may, however, be required to schedule with more granularity than under current requirements (location and amounts of generator and load information would be required). In addition, in order for the methodology to work, a "critical mass" of Northwest Transmission Providers would need to participate (*i.e.*, significant parallel systems would have to agree to manage their systems on a flow basis).

TIG proposes that the transition to a flow-based approach be implemented in stages, with clear decision points.

#### 1. Current System

The Transmission Providers' current model for sales and use of transmission (system-to-system scheduling based on contract-path rights) does not accurately track the flow of energy on the physical transmission system. Because of this, when dealing with reliability issues, managing congestion, and assessing transmission capacity, Transmission Providers are forced to make educated guesses about what is happening on their systems. Certain tariff requirements (*e.g.*, cutting firm pro rata) are very difficult to implement. (Transmission Providers do not know what firm schedules to curtail in order to remedy a problem.) Reliability and emergency protocols do not precisely track what is happening on the system and are, in many cases, inefficient (more curtailments happen than are necessary) and, possibly, ineffective. All of this poses reliability concerns and

complications in addressing congestion, and may result in underutilization of the transmission system.

While a flow-based approach requires more specific information and would require changes in scheduling mechanisms and practices, it could be implemented within the Northwest's existing contract-path rights structure. Indeed, BPA currently issues new physical transmission rights based upon a flow-based analysis, and BPA is currently transitioning to a flow-based scheduling methodology through its Constraint Scheduling Management process.

## **2. Benefits of Transitioning to Flow-Based Approach**

A Transmission Provider with more specific information regarding the energy entering its system (the source of power and its point of withdrawal) would be able to model the flows in its system and parallel systems in order to identify flow patterns. This would provide Transmission Providers with a more coherent basis for operating the system. It would also allow the Transmission Providers to take more effective action for reliability and operational purposes within commercial constraints. To the extent there is capacity, a Transmission Provider would be able to identify and sell flow-based rights that would not increase or worsen congestion issues. This information will be essential for the NTP and TERC Processes (see Chapter VI) in determining when additional transmission facilities are needed, as Transmission Providers need to know how their systems are currently being used in order to know what and where to build. Finally, flow-based information could result in fairer allocation of cost responsibility. Transmission Providers would know who is using its paths and manage and assign responsibility for the costs of congestion as appropriate.

### **B. Functions**

Independent staff hired by the Transmission Providers would use the flow-based approach, including an ATC calculator, as the basis for evaluating and responding to transmission requests, scheduling, and redispatch. The flow-based model would interface with scheduling and tagging activity. The information provided by a flow-based analysis would not only allow for the sale of new flow-based rights, but would help Transmission Providers manage existing rights.

#### **1. Applicable Time Horizons**

Transmission Providers would use the flow-based model to analyze the system over the following time horizons:

- a. Planning Horizon (for purposes of long-term firm service, including conditional firm, if feasible);
- b. Operations Planning (for purposes of short-term firm service); and

- c. Preschedule/Real-time (for purposes of scheduling and hourly).

The modeling would be the same for each time horizon. Given that the Transmission Providers would have more information closer to real-time, fewer assumptions would be needed and the output of the methodology would be more reliable.

## **2. Scheduling**

The Transmission Providers would implement injection and withdrawal scheduling based upon bus groupings (see Subchapter V-B for an example). Transmission Providers would group buses in as large of a grouping as possible (based upon the minimum resolution to know impact on constraints). There could be multiple Transmission Providers within a single bus grouping. A bus grouping would be a set of electric bus points whose impact is similar (“similar” is not yet defined) on all the constraints being considered. The criteria to determine bus groupings would be defined later, but TIG expects that there would be more bus groupings than control areas, and fewer bus groupings than buses.

Further work is needed with respect to the specifics of scheduling. The proposal contemplates the use of established systems to the extent possible; however, an additional scheduling overlay would be required. Transmission Providers would agree on a method for Transmission Customers to provide the needed information (e.g., tagging) and a Transmission Provider means or mechanism to assemble such data so that it was in a usable form for the flow-based model. The approach would require an interface between the Transmission Providers and the staff that would involve exchanges of data in both directions. Some of this information may need to be confidential.

## **3. Flow-Based Model Computer System Requirements**

A number of vendors currently offer flow-based modeling products. At a minimum, the final model must either contain or have access to the following:

- a. Load and generation forecasting tools or processes (load and generation) at needed resolution;
- b. Base case database (basecase) that effectively implements the Transmission Providers’ assumptions;
- c. Path Utilization Factors (PUF) from power flows with all lines in service;
- d. Interface with state estimator that can provide current topology and resulting PUFs as a result of significant outages;
- e. Interface with Common Northwest OASIS (OASIS should have request engine that accesses PUF info, evaluates the requests, sends result to flow-based model, and posts flow-based model ATC output);

- f. Flow-based model that is flexible enough to accommodate for enhancements and changes; and
- g. Real-time study tools

#### **4. Transmission Provider and Modeling Assumptions**

The Transmission Providers would need to agree on the following assumptions:

- a. Mathematical similarity needed for clumping of buses to make a bus grouping;
- b. Amount of netting;
- c. The applicable transmission reliability margin (TRM);
- d. The applicable capacity benefit margin (CBM);
- e. Pre-existing NT network rights for flow;
- f. How pre-existing contracts (transmission rights) would function (the effect of this would be to set aside sufficient capacity to serve pre-existing contracts) (a number of issues would need to be addressed, e.g., whether sufficient capacity should be set aside to honor contract rights capacity as opposed to honoring projected use how curtailments would be managed (curtail first based upon actual rights, then curtail, if still needed, based upon actual use);
- g. How much risk to take that obligations would not be served if additional rights are sold, who would bear risk and how it would be remediated;
- h. What would constitute an impact at a flow gate (i.e., is there an amount that is considered insignificant and can be ignored?);
- i. How to account for parallel non-member systems;
- j. How to interface with external systems; and
- k. How to accommodate Hourly Coordination.

TIG anticipates that developing the assumptions would involve significant negotiations, especially with respect to Assumption Number 6 (how contracts would function). A

policy question that must be answered during these negotiations is who bears the risk if the assumptions are incorrect?

## **5. Existing Contract Rights**

Transmission Providers would honor existing contract rights. Transmission Providers would make assumptions in modeling the transmission system that acceptably accounts for the expected use of existing contract rights.

To the extent needed to implement the proposal, Transmission Providers would negotiate with each other regarding how to handle existing rights on their systems.

## **6. New Rights**

TIG proposes that Transmission Providers use the single flow-based model as a means to determine a system-wide ATC. (In short, Transmission Providers would determine their systems' capability and subtract what they have already sold, used, or otherwise committed. The Transmission Providers would then add up the capability that is left (their aggregated available transmission capacity) and use it as the basis for the sale of new rights. As system changes are made through upgrades or new facilities, the system's ATC would be recalculated.) Transmission Providers can use the system-wide flow-based ATC to sell schedulable, system-wide flow-based rights for use of existing system capacity.

### **a. Use of a Regional Tariff**

TIG proposes that these rights be sold, ultimately, under a regional tariff through a tariff administrator acting as the agent of the Transmission Providers. (The administrator would be responsible for handling all new rights, including those that resulted from transmission upgrades or expansions.)

While TIG's goal was not to create a regional tariff, it is TIG's current recommendation for the following reasons. The interconnected nature of the Northwest transmission system results in most transactions flowing over multiple systems. Without a precise accounting of Transmission Providers' rights across all paths (something that would be difficult to accomplish), it is difficult for individual Transmission Providers to sell flow-based injection and withdrawal rights. The charter group believes that it would be easier to resolve the issue of how revenues would be distributed from the sale of new rights under a regional, non-FERC jurisdictional tariff. That said, the group would welcome the development of additional approaches in the next stage of negotiations.

The regional tariff would be filed with FERC only on behalf of the FERC-jurisdictional Transmission Providers. The administrator of the joint regional tariff would sell system-wide, short-term flow-based rights as the agent of the Transmission Providers. (Transmission customers would buy rights from the administrator and would have a service contract with the administrator to effectuate the sale.) Initially, the administrator

would only sell short-term rights. During this time, Transmission Providers would continue to sell long-term rights, but would do so based upon the output of the centralized flow-based model and only after agreeing on what rights would be prudent to sell and which Transmission Provider should sell them.

#### **b. Pricing**

The administrator of the joint regional tariff would collect rates on behalf of Transmission Providers and would not set prices. The Transmission Providers will need to determine what rate should be applied to the regional product. TIG recommends that the Transmission Providers consider pricing the new rights at a higher-of price; specifically, the highest rate among the Transmission Providers whose systems would be used to support the injection and withdrawal right.

#### **c. Distribution of Revenues**

TIG has identified three options for allocating revenues to Transmission Providers:

- 1) Allocate revenues to the appropriate Transmission Provider based upon flow patterns (would need to establish precise ownership rights of Transmission Providers relating to unused capacity);
- 2) Allocate revenues to Transmission Provider based upon some determination of respective revenue requirements; or
- 3) Allocate pursuant to a some other negotiated allocation.

### **7. Additional Mechanisms**

While TIG is not proposing the adoption of a reconfiguration market, it should be noted that TIG's jurisdictional analysis suggests that the Grid West reconfiguration market could be implemented under the TIG non-FERC-jurisdictional framework.

### **8. Voluntary Redispatch Process**

As proposed in Chapter VII, Reliability and Security, TIG proposes a bulletin board voluntary redispatch process which would rely on the flow-based modeling and would provide an additional tool for Control Area operators to clear congestion just prior to and during real-time.

### **9. Independent Audit**

TIG proposes an independent audit of the flow-based ATC calculator, including the assumptions and the output. At a minimum, the independent auditor would determine

whether: (i) individual Transmission Providers have consistently applied agreed-upon principles to their systems in developing assumptions; (ii) individual Transmission Providers have inappropriately applied principles in developing assumptions; and (iii) individual Transmission Providers have been withholding capacity by applying assumptions too conservatively.

The Charter Group proposes that the Independent Market Monitor perform this audit. If, however, there is not an Independent Market Monitor, TIG proposes that the TPs retain an independent auditor. The independent auditor would conduct audits annually, or, at its discretion, it could determine that an audit is needed (e.g., when “X” percent of transmission requests are being denied).

TIG proposes that in the next development phase, Transmission Providers discuss whether the Flow-Based Analysis Agreement should identify remedies that would be available, should an audit disclose any problems.

## **10. Implementation Steps**

TIG proposes that Transmission Providers transition to a flow-based system for all purposes in carefully sequenced steps. While TIG proposes the following steps, it recognizes that the steps must be flexible so that they can be adjusted, as appropriate, to respond to the success or lack of success of earlier stages. TIG further recommends that there be clear decision points between each step to enable Transmission Providers and Transmission Customers to determine whether adjustments need to be made to the methodology or the implementation plan.

### **Step One**

- a. Agree on final methodology;
  - 1) Determine what changes, if any, are needed to scheduling practices
    - i) Identify the needed granularity of injection and withdrawal information (determine what information needs to flow to whom at what point in time)
    - ii) Make necessary modifications to scheduling practices
      - a) Transmission Providers participating in wesTTrans may already be scheduling and tagging with sufficient granularity

- b) BPA is already changing scheduling practices internally
    - c) Ultimately, may need finer resolution from all Transmission Providers
  - 3) Address interface data transfer issues (getting scheduling information from schedulers; determining how to translate and communicate contract path tag information to flow-based model (what is the software, how does information come in and go back out to control areas); communicating flow-based model output back to Control Areas)
- b. Develop methodology with testing; and
- c. Implement methodology.

### **Step Two**

- a. Run the flow-based model in parallel with current system models
  - 1) Give the region a chance to see how flow-based modeling would operate
- b. Use the flow-based model output for purposes of reliability and operations
  - 1) Does it result in more coherent operations (e.g., fewer curtailments)?
  - 2) Did it provide greater ability to see emerging problems before they became emergencies?
- c. Run simulations of virtual sales for purposes of fine tuning the model and getting it to work (would need to true-up the model to actual sales on an on-going basis); compare the virtual sales to actual sales under the pre-existing method
  - 1) Would the sale of rights based upon the flow-based model have resulted in an over-committment of the system (and impair existing rights)?
  - 2) What would be the impact on long-term planning?

### **Step Three**

- a. Sale new transmission rights based upon the flow-based model
  - 1) Stage One -- Regional tariff used to sell short-term rights; Transmission Providers sell long-term rights
  - 2) Stage Two – Regional tariff used to sell full complement of new rights

### **11. Proposed Timeline**

TIG proposes the following timeline (to be modified, as appropriate, to accommodate system development needs)

10/05 - 4/06	Continue development during negotiation of FBATC Agreement
4/06 – 10/07	Set up model, determine assumptions, make scheduling practice changes, if needed; set up interfaces with TOs Hone, test, train
10/07 – 10/09	Parallel Modeling
10/09	Begin sale of system-wide short-term injection and withdrawal rights
?	Begin sale of system-wide long-term injection and withdrawal rights

## **Subchapter V-A**

### **Legal Principles for Flow-Based Approach Agreement**

This is a description of the contract principles and mechanisms that will be necessary to implement a regional flow-based approach. It is pre-decisional and is only meant to outline an understanding of what issues will need to be addressed in a MOI for going forward, an agreement among the Transmission Providers to create and use a regional flow-based model (Flow-Based Approach Agreement), and a regional tariff for all new transmission contracts, should parties agree to develop one.

The MOI will indicate an expression of intent by Transmission Providers to work in good faith and fund an intense six-month effort to draft and sign the Flow-Based Approach Agreement. The MOI and Flow-Based Approach Agreement will allow for additional Transmission Providers to join during the effort.

For purposes of these principles, Recognized Committee or Entity means a group or function created under the TIG umbrella or any other regional organization that is performing functions associated with any TIG Charter Agreement.

1. Transmission Providers will be eligible to execute the contract. The contract will have a term of ten years and provide for extensions.
2. The Parties will negotiate the particulars of a methodology for a flow-based approach to reliability, operations, planning and expansion, and calculation of ATC.
  - A. The methodology will be contained in a software system provided by an agreed-upon vendor. The contract will anticipate that modifications that may be needed. The principle for selecting the appropriate vendor shall be to get the necessary functionality while minimizing cost.
  - B. The methodology will also include agreed upon bus grouping, but will allow for flexibility to adjust these groups to account for future transmission developments, uses, and changes.
  - C. The Parties will contract with permanent independent staff to run the calculator. This independent staff could either be housed at Dittmer under a hosting agreement with BPA similar to the current PNSC arrangement, or the parties could contract the staff functions with the OASIS vendor. Payment for the independent staff should be based on an annual budget allocated according total system usage or by some other means.
  - D. The model will be run for multiple purposes which involve different timelines. A longer-term calculation is needed for planning and selling longer-term transmission products, including conditional firm, if feasible; a daily calculation is needed for selling short-term products and making reliability decisions in the day-ahead timeframe; and an

hour-ahead calculation will be needed for reliability and congestion management activities. For all three of these calculations, and any others that are deemed useful by the various functions, the base methodology shall be the same, but the level of detail for the required inputs will increase as the model runs closer to real-time operations.

### 3. Inputs Provided by Parties

A. The ATC calculator will be driven by the inputs provided by the Parties. This aspect of the model is important to ensure that Parties, which have the best knowledge of their system uses, will continue to make the necessary assumptions and take risks associated with ATC determinations. This arrangement will also avoid the possibility having the independent staff subject to FERC jurisdiction.

B. In this contract the Parties will agree to inputs that can be set out in advance, such as the amount of TRM and how to consistently account for flows on parallel systems that are not Parties.

C. Many of the inputs will be based on anticipated uses of the Parties systems, such as load forecasting, projected generation dispatches, and the treatment of different kinds existing transmission contracts and native load obligations. The parties should include principles for making assumptions for these inputs, recognizing that some variability is necessary to account for differing uses of Parties systems and the unique character of some transmission contracts and obligations.

D. The Parties will commit to provide the required inputs consistent with an established timeline. This timeline will correspond to the various model runs described in section 3.3 above. For the longer-term runs the Parties will submit estimates and projections. The day-ahead run should rely on projected or actual schedules, while any posted day-ahead calculation would include changes to the system, exercised post day-ahead contract rights, firmer load estimates, and more reliable generation dispatch patterns.

E. In order to obtain the necessary granularity for scheduling information, the Parties will agree to common tariff and business practice changes, such as those currently contemplated in the Bonneville Congestion System Management process. These tariff and business practice changes will need to be filed and approved prior to the flow-based model becoming fully functional.

5. Once systems are in place the Parties will agree to \_\_\_ month test period in order for the Parties and independent staff to gain valuable experience. During the test period the Parties will submit the required inputs and the independent staff will run the flow-based model. The staff will track the resulting output and compare it to available real-time system information to ascertain the accuracy of the system and the inputs being provided by the Parties. Also during this test period, models shall be run with mock entities providing scheduling information, to determine if there are any loopholes or gaming opportunities that may need to be addressed.

## 6. Uses for the Flow-based Model

A. The flow-based model will be used by other TIG Charter Committees and incorrect or inaccurate inputs could lead to problems and poor decisions in these other functions. A dependable flow-based analysis, including a flow-based ATC calculation, will improve planning decisions, responses to reliability and congestion situations, and decisions regarding the sale of new transmission. Today the Transmission Providers are responsible for making these decisions and they should remain responsible once a region flow-based model is in place. The Parties will need to agree to a mutual release of liability for the other TIG functions that are relying on the flow-based model, if liability arises due to reliance on the flow-based model and the inputs provided are shown to have caused the liability to arise. In the case where the liability is traceable to a specific input, the Party responsible for that input shall be held responsible. In situations where the specific faulty input is not traceable to one Party, all the Parties will agree to joint and several liability.

B. The independent staff or vendor that runs the model needs to be indemnified by the Parties but, if possible, there should be some guarantee or an insurance requirement built into the contract with the software system vendor to protect against liability for system malfunctions that lead liability.

C. Once the flow-based model is operational its output will be available for the NTP planning function, the reliability visibility function, and for use by the congestion management broker. The flow-based model will be available to help the Parties make individual determinations regarding ATC for new transmission requests, however this function will not be fully realized until a common regional tariff is available for all new transmission.<sup>1</sup>

7. Parties intend to develop and file if required a new region-wide flow-based tariff for all new transmission after the Parties become comfortable with the performance of the flow-based model. This tariff would use the flow-based model to determine if new transmission is available from a POR to a POD.

8. The Parties will submit to audits by the Independent Market Monitor or another independent auditor that is agreed upon by a majority of the Parties. The audits would be performed whenever \_\_\_ percent of new transmission requests are rejected, and each Party would be audited annually. The purpose of the audits shall be an independent verification of the accuracy of the input information being provided by each Party. The audit would rely on the rules and principles set out above in section 4. If the auditor

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<sup>1</sup> The flow-based model will use the inputs from all Parties to determine actual flows over the system. Any new request will most likely have flows on more than one system and unless the parties agree to a form of path allocation, which may be very complex, it will require assumptions by the Parties similar to those made under the contract path method to sell new transmission rights.

determines that some aspect of a Party's inputs are outside the bounds of these rules and principles, the auditor will inform the Party of its finding and work with the Party to resolve the discrepancy. If the Party and the auditor are unable to resolve the discrepancy and it is an ongoing problem the auditor shall have the authority to report its findings to FERC and any appropriate State regulator as a possible case of market abuse.

**Subchapter V-B**

**Example of Bus Groupings**  
*[from John Phillips]*