RECOMMENDATION TO FERC:
ASSESSING THE UTILIZATION OF TRANSMISSION PATHS IN THE WESTERN INTERCONNECTION
February 18, 2005

This document presents the Federal Energy Regulatory Commission (FERC) a roadmap to study the nature and reasons for unused transmission capacity in the Western Interconnection. Existing studies indicate there are many paths with low historical flows but zero or minimal posted available transfer capacity (ATC). This proposed study would identify the reasons for the low flow/no ATC paradox and help to inform the Commission on potential changes in the implementation of Orders 888/889 that would encourage the use of such capacity.

Overview of the Proposed Study

Phase 1 – Conduct a preliminary analysis of selected transmission paths that assesses the availability and usability of ATC data from OASIS sites, and compares historical flows with OTC, schedules and posted ATC.

Step a. – Identify a small number of transmission paths (e.g., five) for an initial screening study to determine the availability and usability of data for the proposed analysis. The criteria to selecting the initial paths for study are:

i) Commercially important paths;
ii) At least one path with multiple owners;
iii) Paths with historic flows significantly below Operating Transfer Capability (OTC);
iv) At least one path linking good wind resources to loads;
v) Paths identified as problematic in the 2000 biennial transmission plan by the Regional Transmission Association (RTA).

Step b. – Collect data from the selected paths on:

i) ATC from western OASIS sites and evaluate the consistency of ATC calculation and posting methodologies;
ii) Actual flows and hourly operating limits from WECC's EHV database; and
iii) Net schedule data from WECC's EHV database.
iv) Net schedule data in both path directions from OASIS sites

Step c. – Report on the usability of available data and identify issues and problems. Make recommendations on how to proceed with the study.

Step d. – Perform an analysis on the selected transmission paths comparing the posted ATC with calculated Unused Transmission Capacity

(UTC). Evaluate differences between historical flows, schedules and posted ATC levels.

Step e. -- Prepare recommendations for an expanded study in Step 2.

Phase 2 –Perform an expanded analysis of the major paths (e.g. 33) in the Western Interconnection that compares historical flows and schedules, unused capacity and posted ATC.

Phase 3 – Conduct an in-depth assessment of specific paths identified in Phases 1 and 2, to understand the reasons for differences between historical flows and schedules, unused capacity and posted ATC levels.

Terminology

TTC – Total Transfer Capacity, as defined in NERC document and Order 888
OTC – Operating Transfer Capacity, as defined by WECC
ATC – Available Transfer Capacity, as defined by WECC
UPC–Unutilized Physical Capacity, defined as the difference between OTC and actual flows
STC – Scheduled Transfer Capacity
Historical flows – As recorded for paths in the WECC Extra High Voltage (EHV) data pool

Data Sources

WECC EHV data pool for all major paths in the Western Interconnection

- Hourly historical flows
- Net hourly schedules
- Hourly Operating Transfer Capacity (or TTC)

OASIS sites

- Hourly ATC – Firm and Non-Firm
- One-year ATC – Firm and Non-Firm
- Are the ATC calculation methodologies available on OASIS sites?

BPA Web Site

Potential Data Problems

The proposed research will need to obtain data on historical flows, OTC, STC, and posted ATC flows across selected western transmission paths. This section identifies potential problems in the collection and analysis of transmission data based upon insights from studies by the Seams Steering Group-Western Interconnection (SSG-WI) and the Rocky Mountain Area Transmission Study (RMATS). The key data problem issues include the following six items:

- Collecting a large amount of data and managing the data for analysis;
- Discrepancies in data reporting among different transmission providers, e.g., differences in the way ATC is calculated; some OASIS sites not reporting schedules in both directions on a path; some transmission owners reporting hourly OTC while others report maximum annual OTC;
- Availability and usability of historical ATC data from OASIS sites and EHV data (which is archived for three years);
- Reconciling data on paths with multiple owners; and
- Accounting for loopflow (i.e. unscheduled flows) on paths.

Data from WECC. The proposed research effort must develop a strategy to manage a large amount of data. A SSG-WI study on historical flows across western transmission paths examined hourly data on 33 transmission paths across the Western Interconnection. The data was derived from the WECC Extra High Voltage (EHV) database. Future research must be able to collect this vast amount of information plus ATC data and derive meaningful insights without becoming buried by the data.

The first study using hourly data from the EHV database and from OASIS sites was done in 1998 by the Regional Transmission Associations (RTA). Attachment 1 contains the RTAs' suggested improvements in the EHV database. The shortcomings in the EHV database identified by the RTA have not been rectified.

WECC staff report that the EHV database contains net schedule data and phase shifter information. WECC releases data with a time delay. (WECC staff also notes that the Rocky Mountain security coordinator is suggesting an alternative source of data to the EHV database, and that WECC is exploring the idea.)

WECC conducts audits of control areas on reliability issues but does not look at ATC calculations. WECC performs reliability audits of control areas every three years and audits non-control areas every five to six years.

The RMATS, SSG-WI, and RTA analyses all encountered consistency problems in the data collected by different entities. RMATS researchers recommend use of data status flags and equipment upgrade flags to denote significant equipment changes, upgrades and outages.

Data from OASIS. ATC data is available on individual company Open Access Same Time Information System (OASIS) web sites. In the West, a large number of transmission providers are part of the enhanced OASIS site named westTTrans.net. Open Access Technology, International (OATI) developed and manages the wesTTrans software. OATI performs the ATC calculations for Southwest entities and began archiving data in April 2004. Historical ATC data should be on individual OASIS sites. OATI relies on information provided by the individual transmission providers to derive ATC firm and non-firm values. The wesTTrans site does not provide information on net schedules.

Even though the industry through WECC and NERC adopted methodologies and definitions to calculate ATC, transmission providers utilize different specific procedures and assumptions to derive their posted ATC values. A preliminary review ten different OATT Attachment C filings by western transmission providers showed considerable variation in the scope and detail of their respective explanations of how they assess ATC. The Bonneville Power Administration (BPA) is in the process of revising its own methodology to calculate ATC, shifting from a contract-based approach towards a combined flow-based and contract-based methodology.

RMATS Lessons. RMATS researchers[1] examined three transmission paths that were important corridors for moving wind energy to load centers: 1) Montana to the Pacific Northwest; 2) West of Naughton, across Wyoming to Utah and Idaho; and 3) TOT3, from southern Wyoming to the Colorado Front Range.

In the Montana to the Pacific Northwest path, the data from WECC was of such low quality that the researchers decided not to pursue this path for further analysis. (However, the SSG-WI analysis of historical flows did not encounter similar data problems.) Moreover, the researchers determined that the serial nature of the path would have required that they collect data from other constrained paths in order to compute potential new flows from Montana to the Northwest**.**

In the West of Naughton case, the researchers did not pursue this path because it was not a scheduled path (operated internally by PacifiCorp) and the anticipated future upgrades would make the historical data on this path a poor indicator of future performance.

For the TOT3 path, researchers ran into complications analyzing the WECC data since there are several owners who share multiple lines in the operations on TOT3. The joint owners are responsible for scheduling their respective shares over the TOT3 path. Researchers considered the WECC data for historical flows and OTC as being generally good.

The TOT3 analysis illustrated the important role of the hydro cycle and loop flows in the West. During wet periods, Northwestern hydro generation increases and excess power is exported south. Western transmission lines experience increased loop flows and transmission utilization rates rise. In dry years, Northwestern hydro generation decreases, less power travels south, the amount of loop flows declines, and transmission utilization rates decline. In order to understand the impacts of variations in the hydro cycle and loop flows, the proposed study should collect data over periods that represent wet, average and dry hydro conditions.

Congestion Measures

The following terms are commonly used to determine the available transfer capacity of transmission paths.

[1] NREL managed this study under a contract with Peak Power Engineering, Inc.

ATC = Available Transfer Capability
OTC = Operating Transfer Capability
TTC = Total Transfer Capability
CU = Committed Uses, composed of
(1) native load uses,
(2) prudent reserves,
(3) existing commitments for purchase/exchange/deliveries/sales
(4) existing commitments for transmission service
(5) other pending potential uses of transfer capability
TRM = Transmission Reliability Margin
CBM = Capacity Benefit Margin

The corresponding relationships between these terms are:

ATC = TTC – CU

CU = TRM + Existing Transmission Commitments (including CBM)

More specific explanations of these terms can be found in WSCC's *Determination of Available Transfer Capability Within the Western Interconnectio*n, June 2001; NERC's *Available Transfer Capability Definitions and Determination*s, June 1996, and NERC's *Transmission Capability Margins and Their Use in ATC Determinatio*n, June 1999.

The West's electric industry adopted different definitions compared to the East of terms relating to transmission capacity. The West calculates TTC assuming various line outage contingencies whereas the East does not include line outages in TTC. The East accounts for reduced capability from line outages in TRM. The West's calculation of TRM does not include line outages since that factor is already included in the TTC calculation. In the West, OTC represents the better measure of effective transfer capacity of transmission lines than TTC. OTC represents the real time operating capability that recognizes the actual line operating conditions at that hour.

For the proposed study, we suggest defining new terms, the Unutilized Physical Capacity (UPC), to represent the difference between OTC and actual flows in megawatts on a given transmission path and the Scheduled Transfer Capacity (STC) to represent the historic net scheduled transfers.

Transmission congestion can be measured in a variety of indicators. The following three formulas represent potential transmission congestion measures. These measures use the hourly data defined above over a season or year. The results of the measures can be plotted as frequency distributions.

Reliability Congestion (RC) = Actual flows/OTC

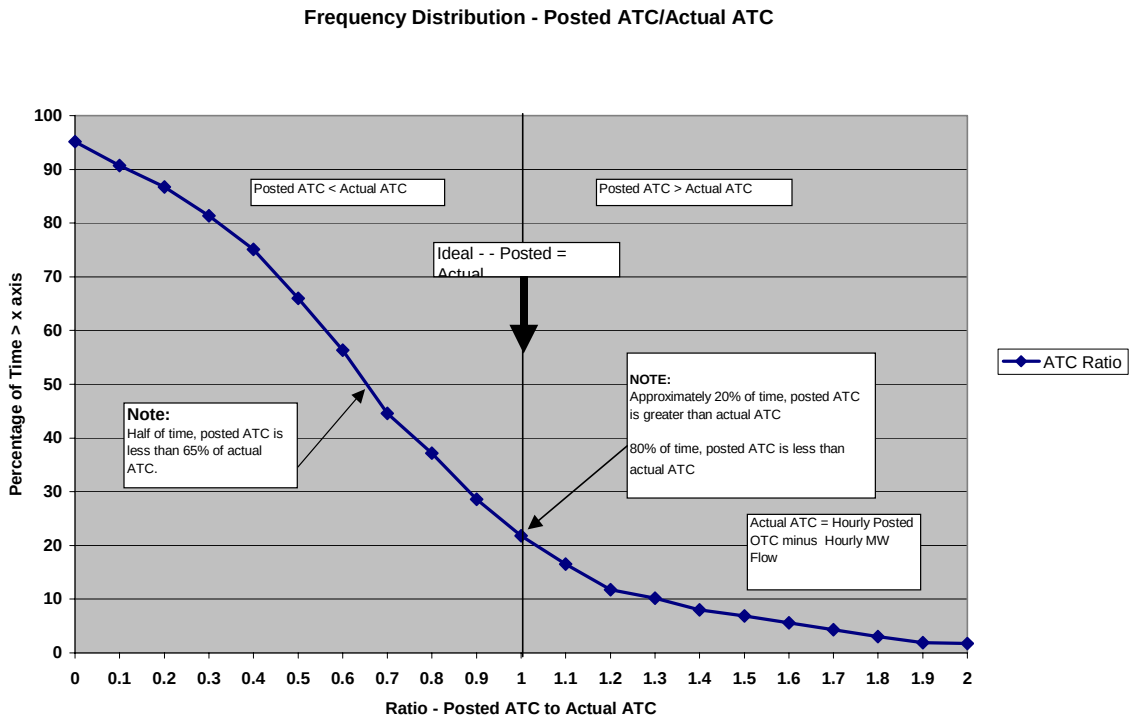
Higher RC values indicate higher flows relative to available capacity. A path with actual flows equal to the operating capacity (OTC) would have a value of 1.0.

Commercial Congestion (CC) = 1 – (ATC/OTC)

Higher CC values reflect higher commercial use. If a transmission path is fully subscribed (ATC=0), then the corresponding CC value would be 1.0. If the ATC for the path equals the operating capacity (ATC=OTC), then CC falls to zero.

Ratio of Posted ATC to Unutilized Physical Capacity **= ATC/(OTC-UPC)**

The expected ratio would probably fall between 0 and 1.0. A ratio of 1.0 indicates that the posted ATC equals the apparent available capacity based on actual flows. If the ratio is less than 1.0, the posted ATC is less than the apparent available capacity based on actual flows. If the ratio is greater than 1.0, this means the posted ATC is greater than the apparent available capacity based on actual flows. The following graph illustrates a plot of the comparison of ATC and UPC. Points on the curve to the left of the vertical center line are times when there is greater UPC than ATC. Points to the right of the vertical line are when ATC exceeds UPC.



In-depth Assessment of Specific Paths (Phase 3)

Following the screening of the selected major paths in the Western Interconnection, priorities should be set for in-depth assessments of discrepancies between actual flows and ATC. FERC should focus its initial in-depth assessments on:

- Paths with significant discrepancies between historical flows, OTC and ATC in both low and high hydro years;
- Paths with significant discrepancies between scheduled flows and historical flows.

The plan for developing an in-depth assessment by FERC would be developed at a later date.

ATTACHMENT 1

Excerpt from 2000 Biennial Transmission Plan

II. RECOMMENDATIONS TO IMPROVE THE WECC EHV DATA POOL DATABASE

1. Recommendations

   The following are suggestions for improving the coordination of transmission planning and the collection and dissemination of planning data in the Western Interconnection:

   Suggested improvements to the EHV Data Pool transmission data base:

   - Develop and document "Data Reporting Guidelines" for submitting data into the EHV Data Pool to achieve consistent data reporting.

   - All submitters of data into the EHV Data Pool should review and verify that the data submitted is being done correctly. During preparation of this report, data errors were found in the following:

     - Path 53 (Billings Yellowtail) data is actually the Montana Southeast path
     - Schedule data being submitted for Path 15 (Midway- Los Banos) is not correct according to the California ISO. Also the OTC data reported is not correct according to the California ISO.
     - OTC data being submitted for Path 3 (Northwest to Canada) is incorrect.

   - All paths should report net schedules on all transmission paths on which schedules exist. Several paths are not reporting net Schedule data on scheduling paths (Paths 17, 15, 46, 5, 14, 26, 5, 50, 4, 51, 24, and 45).

   - All paths should report OTC. As a minimum, this should be the seasonal OTC. This value should change when system conditions (outages, etc.) cause the path OTC to change. Several paths are not reporting path limits or are reporting the TTC as the path OTC limit.

   - Use consistent directional polarity nomenclature for all paths. This needs to be standardized and documented in the Data Reporting Guideline document suggested above.