Chapter 7: Transmission

Summary of Key Findings 1
Background 1
Northwest Transmission Planning 6

SUMMARY OF KEY FINDINGS

For a number of years leading up to the Fifth Power Plan (May 2005), there was concern that there had been little progress on addressing the developing transmission issues in the region, both in operating the existing system and in planning for new major transmission lines. Since then, there has been significant progress in both areas. The Western Electricity Coordinating Council (WECC) has created two new reliability coordination centers in the West with new operating tools, which they share with the interconnection's balancing authorities, to address operational reliability issues. Other operating challenges posed by the large increase in wind generation in the region and in the West are being addressed as well. That issue is explored in more depth in Chapter 12.

On the planning side, there have been major changes and significant progress in the last five years. Both regional and WECC-wide organizations have been created and are producing or developing plans or system assessments, partly in response to the needs of their members and partly in response to increased federal interest in transmission planning and development. A number of new projects are in the development and study stage, sponsored by utility members of the two regional planning groups, ColumbiaGrid and Northern Tier Transmission Group (NTTG), and by merchant developers.

On a case-by-case basis, the Federal Energy Regulatory Commission (FERC) is reviewing and modifying its financing and study process requirements, and the Bonneville Power Administration has taken advantage of this to propose a useful new approach to financing transmission for access to wind resources. Currently proposed legislation in Congress would increase the federal backstop siting authority that already exists in the Energy Policy Act of 2005 for projects that are supported by regional and interconnection-wide planning efforts.

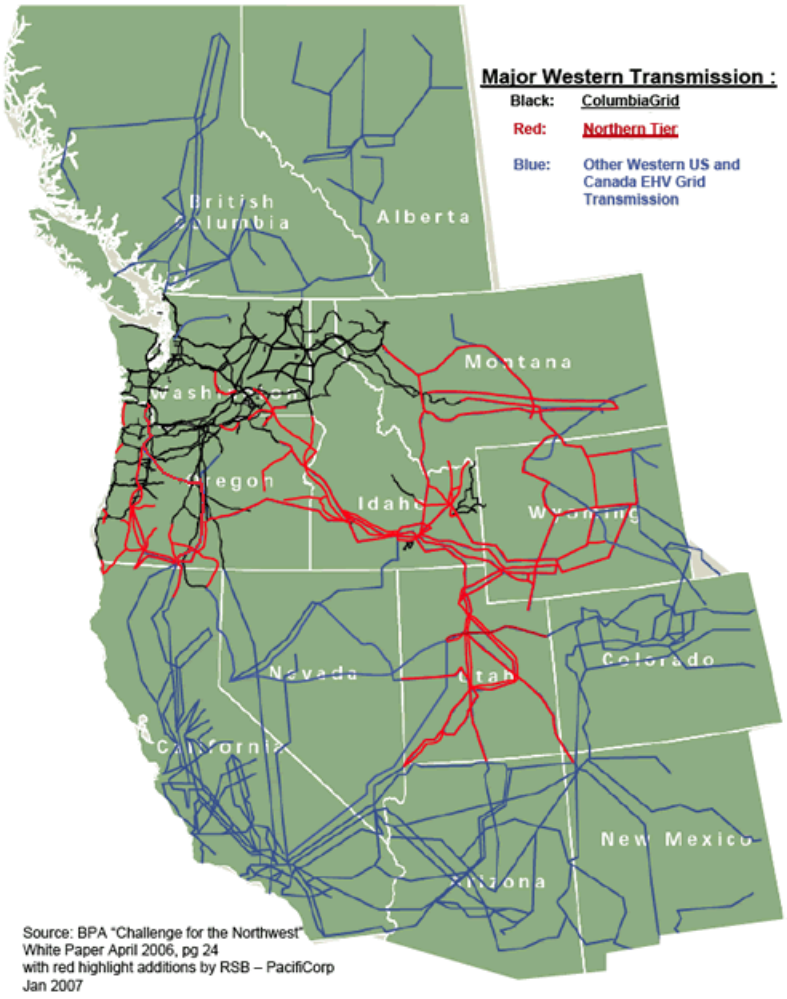
Nonetheless, for the most part the region's utilities are just getting to the stage when they have to address siting and construction of the projects that have been planned. Siting can present significant difficulties. Siting also can present challenges for utilities that may be depending on getting projects built on time, if there are delays. The utilities may be forced to rely on backstop plans in order to assure themselves of meeting their loads reliably. The Council supports and encourages regional transmission planning efforts, recognizing that new transmission investment can be key both to maintaining reliable load service and to bringing new renewable resources in to meet regional loads.

BACKGROUND

The regional transmission system is an integral part of the regional power system. It functions roughly like the highway system, allowing power to flow from generators all across the region (and outside the region in the rest of the Western Interconnection) to loads. Figure 7-1 below

shows a schematic of the entire Western high-voltage transmission system, which is operated in a coordinated fashion in order to maintain system reliability although it is constructed and built by individual utilities to meet their own needs. As can be seen from the map, the Northwest transmission system is closely integrated into the overall western system. The colors highlight the systems of the two Northwest subregional planning groups described below, ColumbiaGrid and Northern Tier Transmission Group.

Figure 7-1: Major Western Transmission



Despite the similarities, the transmission system differs from a highway system in key ways. When the highway system gets overloaded, traffic slows down or stops at one point or another. These conditions can persist for hours until the traffic volume drops down, as for instance, when an extended rush hour is over.

In the electric transmission system, however, the system is not actually allowed to get overloaded in normal circumstances, and in the case of an outage, either of a generator or of part of the transmission system, overloads are allowed to persist for only very short periods of time. Moreover, the amount of the allowed overload is limited by constraints on the amount of power that can be allowed to be generated and flow over the transmission lines ("scheduled"), in normal, non-outage, conditions.

This is done for reliability reasons because serious overloads will often lead to automatic load or generation disconnections that can in turn lead to wider, uncontrolled cascading losses of load, like the 2003 Northeastern blackout. Overloads can be created almost instantaneously by sudden generation or transmission outages. The limits that require these operator or automatic actions are set by transmission operators according to standards of the North American Electric Reliability Corporation (NERC) and the Western Electricity Coordinating Council (WECC) and are based on extensive computer simulations by system planners and operators of the behavior of the transmission system under many different operating conditions. Margins for reliable operation are built into operating standards, so that the system does not collapse when there is a sudden outage on the system. The operating standards may require that transmission schedules be cut in the event of a system outage in order to bring power flows and other system parameters within the acceptable limits of the reduced system.

Operating limits are set for and managed by system operators at a number of points or paths on the system. Figure 7-2 below shows the locations of the major constrained paths in the western transmission system. A path can often consist of several lines or sets of lines in parallel to each other (several examples of this occur in the Northwest, e.g. the "North of John Day" path). Most of the paths in the Northwest are constrained, in the sense that there is little to no capacity available to sell and under certain operating conditions they need to be monitored by system operators to ensure they do not exceed system operating limits. West of Hatwai, however, in the Spokane area is an example of a path that was upgraded by additional line construction several years ago.

Figure 7-2: Western Constrained Paths

When the loading on an individual path, controlled by individual balancing authorities in coordination with their neighbors (see Chapter 12 for more details on what balancing authorities do) reaches these predefined limits, operators do not allow additional transactions to be scheduled. The system can be said to be congested at that point, though it is not overloaded, but is operating normally.

Congestion can occur in a longer-term time frame as well. The amount of long-term transmission service that can be sold in advance is limited so that the total amount sold can actually be scheduled within the reliability limits. This case, when there is no more available

transmission capacity (ATC), is also a form of congestion, even though it does not necessarily lead to a congested operating condition if all of the transmission service that has been sold is not used fully at the same time.

The transmission system is built and upgraded incrementally to meet projected service requirements, so that new service for new loads or from new generation can be accommodated within reliable operating limits. Relieving congestion can be costly. Because of the high cost of transmission system upgrades (as a general approximation, 500 kilovolt transmission lines can cost in the range of $2-$3 million per mile to construct, depending on the terrain and land use), transmission is not constructed speculatively. It is constructed to meet forecast native load service requirements and to meet specific service requests from third parties[1] like independent generators or parties wishing to wheel power across a utility's transmission system to a load outside it.

The high cost of expanding the transmission system, particularly with long, high voltage lines and intermediate substations means that some congestion on the system, either on an operating basis or as shown by the absence of ATC for sale, may be an economically appropriate result. This is generally not the case for congestion that could impact reliable load service, but could be for projects designed to access cheaper or alternative energy supplies in order to reduce operating costs.

Transmission system improvements range from lower-voltage upgrades that may be part of an ongoing system-upgrade process at a utility to major high-voltage projects that can cost hundreds of millions of dollars and take five or more years to plan and construct. Typically the former do not get as much attention, as they cost less, are done on a more routine basis, and depend more on local conditions and requirements, though some higher-voltage local projects or those in sensitive areas can be expensive and difficult to site and can be subject to uncertainty. The latter, however, because of their cost and land-use impacts can get considerable attention.

For a number of years leading up to the Fifth Power Plan, there was little major transmission project development, although there continued to be upgrades to meet local reliability needs. Partly this was a result of the ability to site natural gas generation closer to load centers and with a smaller requirement for transmission. However, when the Council developed the Fifth Power Plan, there was reason to be concerned about the transmission system. There had been some progress on improving the operation of the transmission system to allow better use of limited existing capacity by implementing remedial action schemes (RAS), but there had been little activity in planning for major transmission system expansion. The regional transmission system was being loaded closer and closer to capacity.

These problems are now being addressed. There have been important changes in operations though WECC's creation of two new reliability coordination centers in the West and funding of new software that gives the reliability coordinators and the West's balancing authorities clearer and more current information on the instantaneous state of the system. Other operational changes are being considered and implemented in large part because of the pressure to integrate

[1]These third-party service requests are governed by the FERC Open Access Transmission Tariff (OATT). The OATT specifies the study procedures and financial circumstances under which the transmission owner must respond to third-party service requests.

large amounts of variable generation, primarily wind. The operational changes related to wind integration are discussed in Chapter 12.

On the transmission-planning side, two subregional planning groups, ColumbiaGrid, centered on Bonneville and the Washington utilities, and Northern Tier Transmission Group, focused primarily on the east side of the region, have been formed and are conducting planning studies and coordinating transmission development efforts across the Northwest. They are also jointly leading efforts to address some of the operational changes mentioned above and described further in Chapter 12.

In addition, the Transmission Expansion Planning Policy Committee (TEPPC) has been formed by WECC to develop West-wide commercial transmission expansion planning studies and coordinate and provide information to subregional planning efforts. Finally, a number of projects are being proposed by both utilities and merchant developers, largely in response to the state RPS requirements and increasing emphasis on reducing carbon emissions across the West.

There has also been a significant increase in interest in transmission planning and siting at the federal level. In the Energy Policy Act of 2005, the federal Department of Energy (DOE) was required to conduct triennial transmission-congestion studies and allowed to designate National Interest Electric Transmission Corridors, and FERC was given a backstop siting role for transmission proposals in those corridors for which state siting authorities did not act promptly. At the time the Council adopted the Sixth Power Plan, Congress was considering energy legislation. The House of Representatives passed the American Clean Energy and Security Act of 2009 (know as the Waxman-Markey bill, for its sponsors) in June of that year. The bill contained provisions for regional transmission planning entities to submit plans to FERC, and gave FERC additional backstop siting authority in the Western Interconnection for projects vetted through and supported by a regional transmission plan.

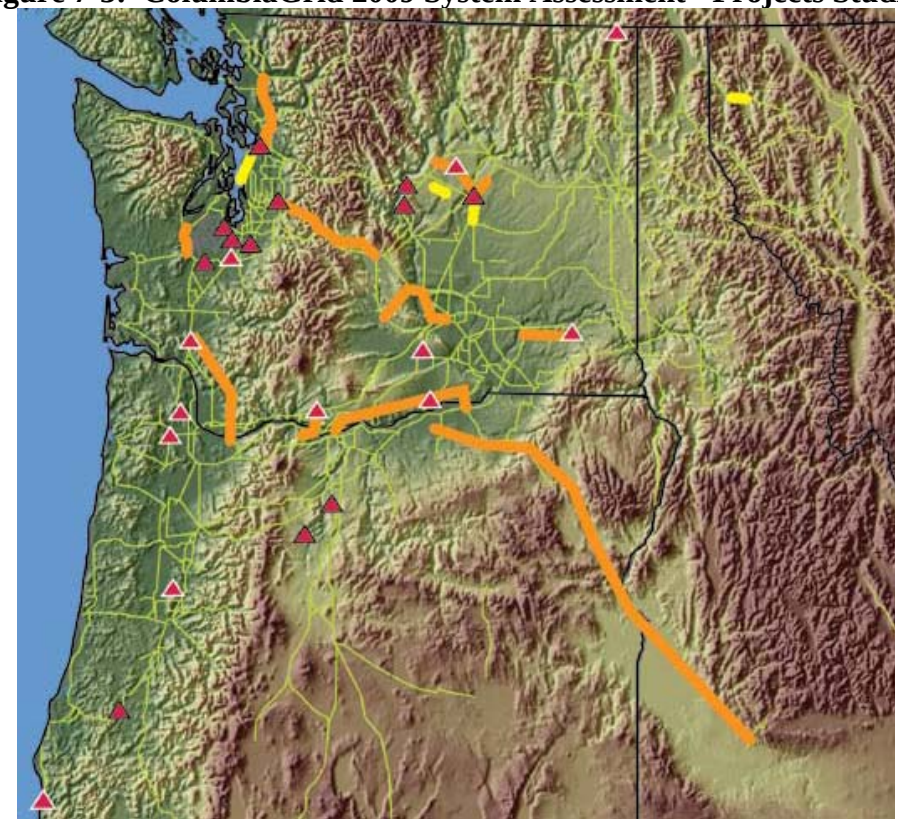
The American Recovery and Reinvestment Act (ARRA) provided DOE with funding for technical support of interconnection-based transmission plans, including support for state and relevant non-governmental organizations to participate, as well as support for state resource-planning efforts. WECC, through TEPPC, worked with the Western Governors' Association (WGA) to develop an application for funding, which was successful. Some of the WGA funding will be used to support completion of the Western Renewable Energy Zone (WREZ) project, which will help coordinate state and utility efforts to target specific areas for renewable development, along with the necessary transmission corridors. This is intended to provide basic input information into the TEPPC transmission planning effort.

NORTHWEST TRANSMISSION PLANNING

ColumbiaGrid, formed in 2006, along with its members develops a system assessment and biennial transmission plan for its members. It finished its first biennial plan in 2008, which was approved by its board of directors and published in February 2009. It has recently published a draft 2009 system assessment, highlighting the areas in its members' systems that need to be addressed, either by the individual owners, or in the case of issues involving several owners, by a ColumbiaGrid study team. Joint study teams are also formed to address issues and projects that overlap between ColumbiaGrid and adjacent planning groups like NTTG.

This current draft system assessment identified a number of potential reliability issues over the next five and 10 years that would need to be addressed by the transmission owners, ranging from relatively local issues such as service in the Olympic Peninsula over the 115-kilovolt system up to wider-scale issues such as service over the 500-kilovolt West of Cascades paths to loads in the I-5 corridor main grid. The transmission owners have identified potential mitigation projects for a number of these issues, which will be studied further in the ColumbiaGrid biennial plan. The main projects studied are shown on Figure 7-3 below. The underlying transmission system shown on the map comprises the facilities of ColumbiaGrid members. The Hemmingway - Boardman project is also in the study set, although its sponsor, Idaho Power, is not a ColumbiaGrid member.

Figure 7-3: ColumbiaGrid 2009 System Assessment - Projects Studied



Source: ColumbiaGrid

Bonneville, which is a member of ColumbiaGrid, has developed an innovative approach to identifying transmission development to provide long-term firm transmission service, which is particularly helpful for dispersed generation projects like wind farms. The first use of this network-open-season approach was in 2008, and a second open season was conducted in 2009. The Bonneville approach, approved by FERC, provides for a cluster study of requests in the transmission-service request queue, an offer of service at embedded-cost rates with Bonneville providing the financing (to be recovered through wheeling rates when service commences), and reordering of the queue positions for those requestors not willing to commit to take service with the proposed transmission project. This approach was very successful in 2008 and led to Bonneville's determination to move forward with several major transmission projects, including the West of McNary project and the I-5 corridor reinforcement project. Bonneville also was

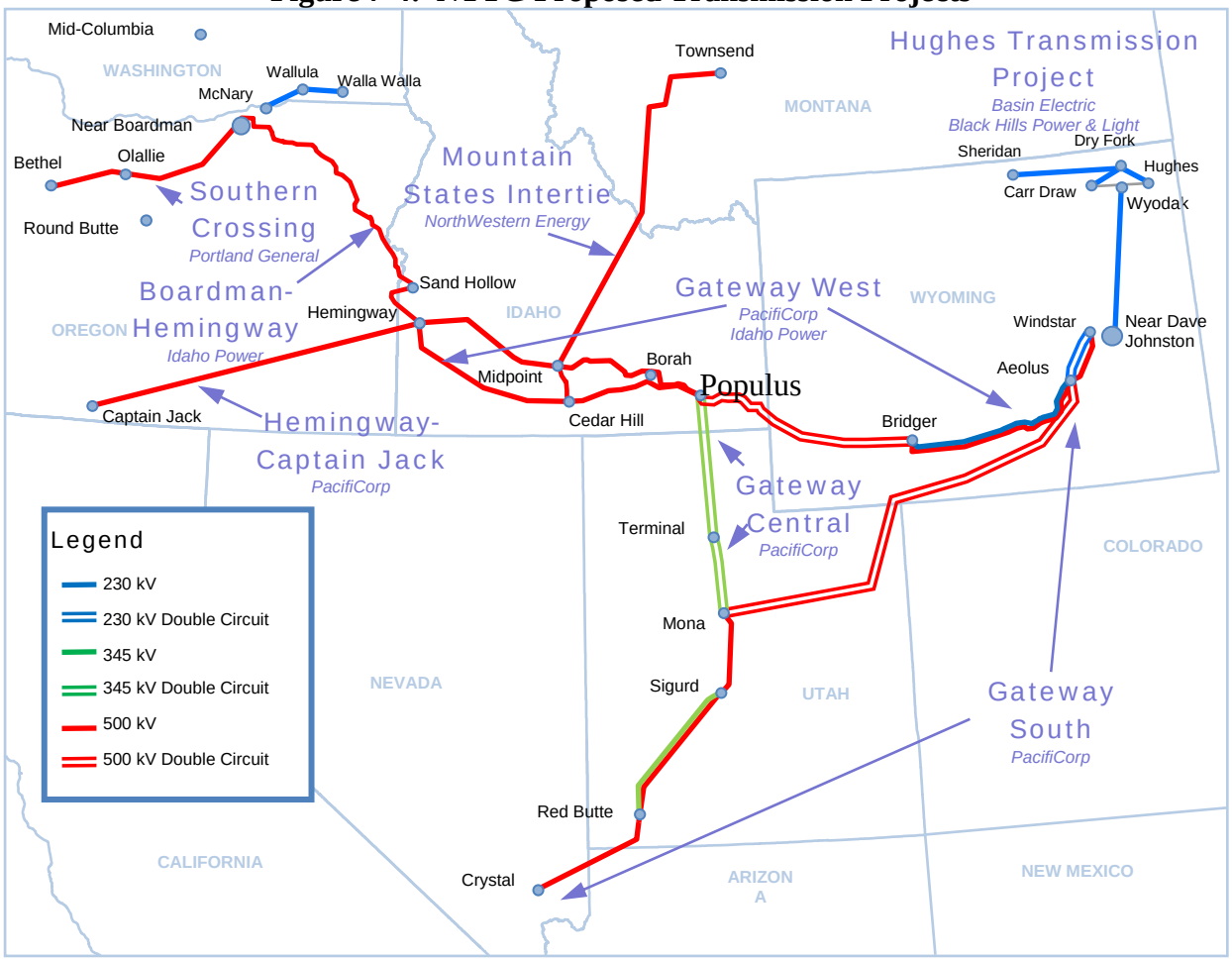
aided in the ability to finance these projects by the availability of federal economic-stimulus funding, which provided increased borrowing authority and allowed Bonneville to ramp up its capital-expenditures program.

This approach improves the default process, required by the FERC OATT, which both requires that service requests be studied in the order in which they were received and puts the financing burden primarily on the entity requesting transmission service. Both of these conditions served as significant impediments to development of large transmission projects to serve a number of smaller wind developments.

Bonneville's approach is one of several modifications to the OATT approach to financing new transmission for renewables that FERC approved. In a 2007 order on the California ISO, FERC allowed modifications to OATT financing requirements for a renewable collector project in the Tehachapi area of Southern California. In October 2008, FERC allowed an incentive rate of return on PacifiCorp's Energy Gateway projects (described below), taking into account their ability to move large amounts of renewable energy to load centers. In March 2009, FERC conducted a technical conference on integrating renewable resources into the transmission grid, which may result in modifications to the OATT itself, building on the case-by-case approach employed so far. The Council supports actions such as these to enhance the ability of the transmission system to support renewables and robust markets.

Northern Tier Transmission Group, formed in 2007, focuses its efforts on larger transmission projects that move power across its footprint, and connect with adjacent sub-regional groups' footprints (ColumbiaGrid and WestConnect). Lower-voltage, more local projects are addressed by the individual NTTG transmission-owning members. NTTG members have proposed a set of primarily 345-kilovolt and 500-kilovolt projects to meet native load service and transmission service requests under the OATT from potential exporters from the NTTG footprint. These projects are shown on Figure 7-4 below.

Figure 7-4: NTTG Proposed Transmission Projects

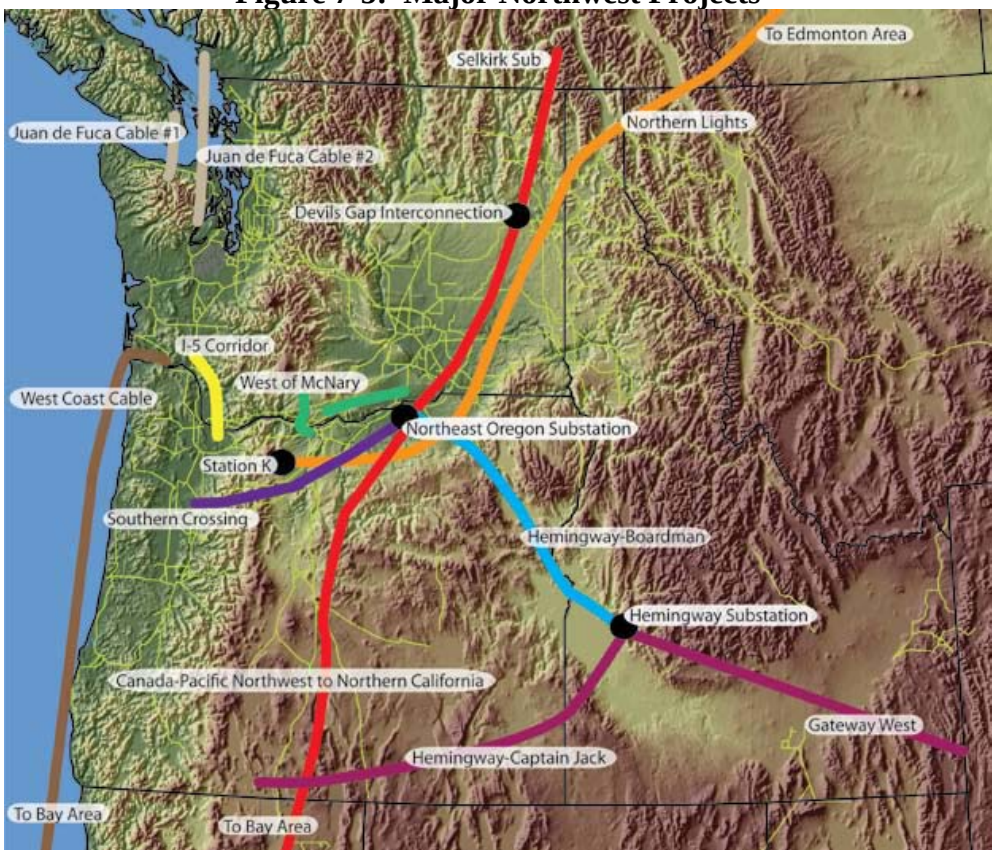


Source: NTTG

The Transmission Coordination Work Group or TCWG (composed of PGE, Avista, Idaho Power, PacifiCorp, Pacific Gas and Electric, TransCanada, Sea Breeze Pacific-RTS, and Bonneville) is sponsoring a project-review process to examine potential interactions among various major project proposals that connect with or pass though the McNary area of Northeastern Oregon. The examination of project interactions is a fundamental part of the process of getting an approved rating for a project under WECC procedures. The rating is a foundational part of the determination of reliable operating limits for transmission lines and paths.

The map in Figure 7-5 below shows projects sponsored by Columbia Grid members, like Bonneville's West of McNary and I-5 Corridor projects, those sponsored by NTTG members, like the Gateway, Hemmingway - Boardman, Hemmingway - Captain Jack, and Southern Crossing projects, and those sponsored by others, like TransCanada's Northern Lights, PG&E's Canada - California project, and the Sea Breeze cable projects. There is some overlap between what is shown on Figure 7-4 and Figure 7-5.

Figure 7-5: Major Northwest Projects



Source: ColumbiaGrid

Although there has been a substantial improvement in coordinated regional transmission planning and development over the period since the Fifth Power Plan, some utilities still face difficulties in getting transmission access to market hubs and to resources they are planning on to meet future loads or to meet their transmission-service obligations to generators under their OATTs. Even the projects that are farthest along in development, like Bonneville's West of McNary project, have not yet surmounted all the possible problems on the path to completion.

Whether this situation comes from difficulties in siting large transmission lines or from the planning process itself taking longer than anticipated, it can leave utilities in the position of having to acquire back-stop resources to make up for those that they were not able to access reliably due to transmission limitations. The Council recognizes that this can also lead to differences in resource timing and acquisition strategy from those described for the overall region in the power plan. The inability to site needed transmission can also force utilities to make less-desirable resource choices than might otherwise be made, by precluding access to distant renewables and to regional and other markets. The Council supports and encourages regional transmission planning efforts, recognizing that new transmission investment can be key both to maintaining reliable load service and to bringing in new renewable resources to meet regional loads.