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## Transmission Issues with the Integration of Large Scale Renewable Energy Projects

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### OVERVIEW

First the good news! With the passage of the Energy Policy Act in 2005, control area operators such as Bonneville Power Administration (BPA), which has 15,000 circuit miles of transmission in the Pacific Northwest, are under a Federal Energy Regulatory Commission (FERC) mandate to integrate any and all renewable energy projects that request transmission interconnection. Though this may sound like the solution to get most, if not all, renewable energy projects to their loads, other challenges remain, which may make getting a firm transmission contract difficult (or next to impossible) to get. Solutions to mitigate these transmission issues are being developed by BPA and several have been submitted to FERC for approval in 2005. This paper will discuss transmission challenges that exist in the Pacific NW, along with several innovative approaches developed by BPA, that may become available in most control areas in the near future.

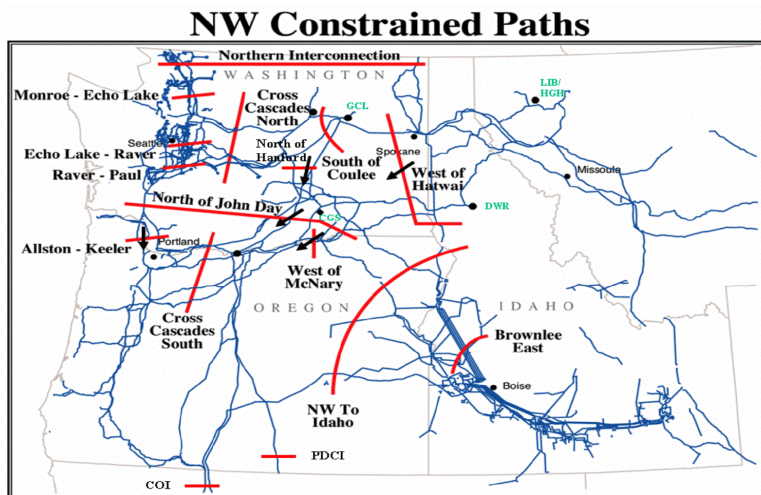
### “You Can’t Get There from Here”

This might date me and reveal where I went to college (University of Wyoming), but for those of you who were around, I’m sure you’ll remember that this was the title of the 1978 country classic by Lee Roy Parnel. In the song the story goes that a guy pulls up to a little country gas station on a small hill in his pick up truck where he can see in nearly all directions for over 50 miles. Way off in the distance, across a beautiful green valley, his spots another small town that he would like to drive to. When the station attendant walks up to his window to ask him what he wanted, he asks, “How to you get to that town down yonder?” The station attendant looks the man dead in the eye and says, “You can’t get there from here.” Such is the state of many transmission control areas in the United States. Just because you can see a power line close to your project and the control area operator lets you interconnect to the line, this doesn’t mean the power you want to get to your contracted load will get there. Please allow me to explain.

What many transmission control areas are faced with today are transmission constraints on their power systems, which may experience occasional congestion on a number of hours a year. The definition of congestion is that more power wants to go down the line than the line can carry. What this means is if you want to move your power to load, and a potential constraint exists (on some hours during the operating year), the transmission provider will not give you a firm transmission agreement (discussed below). Consequently, when a developer goes to the bank, he or she will have trouble getting the project financed since the banker does not know how many hours a year the project might be curtailed, which could potentially impact the revenue stream of the project. How did Lee Roy see this coming nearly 20 years ago? He must have been psychic. Pretty good for a cowboy. Please see current BPA transmission map below.

### Transmission — “Over Subscribed and Underutilized”

Access to transmission is determined by Firm and Non-firm transmission rights. Firm transmission is guaranteed access to transmission on all hours 24/7, 365 for the contracted amount



of energy along the contracted “path” from source to load. Firm is the most expensive transmission that can be purchased. If a problem occurs where more power is scheduled than the transmission line can carry, this power is the last to get cut back or “curtailed,” usually only in a power system emergency.

For example, wind generation is intermittent power generation. Due to a lack of accurate forecasting, wind projects often do not know how much generation will be produced from one hour to the next. Like new geothermal, wind enjoys a Production Tax Credit or PTC that provides a substantial tax incentive only for the energy generated from the project. Typically, wind plants generate wind energy only about 1/3 of their nameplate or potential output, on average, yet must reserve 100 percent of their nameplate output, just in case substantial wind comes into the system. What this means is more transmission is reserved than is actually utilized. Loads must reserve transmission as well and often do not know accurately how much transmission will be needed to meet expected loads on a given day, which is influenced by weather changes and other transmission or generation being disrupted. Consequently, loads may allocate transmission that may never be utilized on a given day, much like wind.

To utilize “unused” transmission, a secondary market often exists, called non-firm. For most control areas, the day before the start of the operating day (usually starting at midnight for the next 24 hours), unused transmission can be “sold back” or “offered for sale” to the control area, which remarkets the available transmission as non-firm. Non-firm is what the name implies, not always available 24/7 365 and is usually sold on hourly, daily, monthly, seasonal and annual blocks (usually never longer than one year). It has a higher risk of curtailment or chance of being cutback if a transmission line gets overloaded. The curtailment “order” is short to long term, so if a curtailment is needed, hourly, then daily out to annual is cut back until the overloaded line is relieved, usually only for just a few hours.

A cowboy (or any other generator who wants to get his or her generation to load) will struggle to get the project financed if firm transmission is not available for the project. The reason is the banker or investor who “ponies” up the money to build the project (pardon the pun) would assume a risk that the energy from a project would not make it to its contracted load on all hours, which would impact the revenue stream of the project. Bankers (and other “inscrutable” types) do not like unexpected risks, so will charge more to finance the project, if they finance it at all. This is not fair to some but is a reality of the marketplace.

To top off this bucking bronco on whether firm transmission is made available (or not), God or someone in a bit of a higher position than ourselves, has determined that not all power will follow its contracted path to load. For example, power in a remote part of the state – where some great geothermal project might be located - might travel over four or five transmission lines to get to the contracted load, mind you that the percent of the energy might be quite small (5 or 10% of the project output let’s say) on some circuits. The problem is that if any one of these circuits might get overloaded for the expected energy that might be carried (plus a reserve held

back on most lines in case another line or generator goes out of service and will be needed in an emergency), the transmission provider will not give a firm transmission contract. This may occur even if even if the chance of a curtailment is only one hour or a few hours in a given year. Consequently, most lines are never filled to capacity except for just a few hours or weeks of the year, or in other words, are “over subscribed and under utilized.” If you had the time to inspect and analyze the congested paths for your transmission line of interest, such as the Pacific NW picture above, you would soon realize that the worst congestion on a BPA’s transmission system is approximately 13 hours a year. Yet, if a generator wants to cross one of these paths to get to a contracted load, a firm transmission contract may be difficult or next to impossible to get.

## A Little Hope on the Horizon

Before you get on your horse and ride off to greener pastures (like maybe running for Congress), thinking that getting transmission for a geothermal project is hopeless, BPA has recognized that transmission capacity is often available on most hours, so it created an innovative transmission product called Condition Firm. What BPA has done is to establish, on circuits where congestion risk will not allow firm transmission to be sold, how many hours congestion might occur on the congestion planes listed in the picture above. For a price (not yet established until FERC approval is given – submitted by BPA in 2005), BPA will guarantee firm transmission on all hours, except for several weeks to months when a congestion risk may occur (again usually only on a few hours). When congestion curtails the line, BPA will either route the power to another load (called “redirect”), store the energy in its hydro system for delivery later (called “storage & shaping”) or move its hydro system to alleviate the constraint (called “redispatch”) so the power can get to load. BPA established a Storage & Shaping product in 2004. A Redispatch product was also submitted to FERC in 2005, but no formal ruling has been established (though one is expected soon).

## Riding the Bronco – For at Least 8 Seconds

In conclusion, all transmission providers are FERC jurisdictional or regulated by the federal government – like it or not. What might be a “no” from a transmission provider (to get a geothermal project to load) can often be turned to a “yes” (or a least a conditional yes) by understanding the transmission “rules of the road” or the tariff structure that the control area you are in must operate under. Bonneville Power Administration has transmission account executives whose job is it to find a solution to get your project to load to fulfill its FERC mandate, as do most transmission providers. The ultimate answer is for new transmission to be built, though this can be an expensive and drawn out process under current FERC rules (another paper could be written on this one). Through exploring every alternative – and being heads up on what transmission products might be available – a transmission solution may be found that will get your project to load.