



**WYOMING WIND COLLECTOR
AND TRANSMISSION TASK FORCE**

**Report to the Legislative Task Force on Wind Energy
Transmission Sub-Committee**

October 9, 2009



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1. Executive Summary

The demand for renewable energy in the United States – and in particular in Arizona, California, Nevada, Oregon and Washington – has increased significantly in recent years and is expected to experience further dramatic increases in coming years. This increased demand comes from state and federal energy policies focused on developing sustainable domestic resources and on the overall increasing demand for electricity.

As everyone in Wyoming knows, the wind blows fairly regularly in Wyoming. In fact, Wyoming has some of nation's very best wind resources. Having some of the best energy resources in the country that could be delivered to western markets at competitive prices is not a unique position for Wyoming. However, in the case of renewable energy where resource development can be done on a small scale in many locations, Wyoming's advantage over resources in other states is not as significant. The most likely and logical markets for the bulk of Wyoming's wind energy is to the west of Wyoming in states such as Arizona, California, Nevada, Utah and Oregon, which all have instituted renewable energy goals and various forms of in-state preferences.

Six proposed Wyoming transmission lines are currently under development to improve reliability and to serve the increasing demand for energy, Wyoming's wind industry and the out-of-state renewable energy markets. These lines could also deliver electricity produced by other renewable and fossil-based energy sources.



Given the regional demand for renewable energy, Wyoming's superior wind resources, the wind development activity under way, and the capacity of the proposed transmission lines, the upper limit of wind resource development in the state of Wyoming is projected to be 10,000 to 15,000 MW. This scale of development will enhance Wyoming's economic base significantly.

Transmission development is challenging from both a commercial and public acceptance aspect due to its scale. From a commercial perspective, electric transmission requires large investments and thus a high degree of certainty of revenues in order to obtain financing. From a public acceptance perspective, transmission at this scale is very visible and requires a contiguous route through areas that may or may not be directly served by these portions of a regional system. While everyone benefits from a robust regional transmission system, it is often difficult to accept the impacts associated from part of the system within one's environment.

The Wyoming Wind Collector and Transmission Task Force was formed to focus on one of the key elements required to get Wyoming's wind resources to market at a competitive price: the connection lines between generators and the hubs of the proposed transmission lines. Connection lines can be built as sole-purpose lines between the generators and the hubs. However, given the scale of the potential development and the distances between potential generator sites and transmission hubs, it would be difficult to accommodate the full-scale development with these types of lines alone. The Task Force reviewed alternative collector system designs to accommodate the full-scale development under several wind deployment scenarios and found:

- The scale of the collector system would be several hundred miles of 500 kV and 230 kV lines throughout south-central and eastern Wyoming with an estimated cost on the order of \$5 billion.
- The amount of transmission would increase relative to the amount of eastern Wyoming resources developed due to the westerly direction of export from the state.
- There are several design alternatives to be considered that would impact flexibility, reliability and cost. Within all alternatives, sole purpose generation tie lines would be utilized to connect the wind generation facilities to either the collector system or directly to the transmission hubs.
- There are elements of the existing and planned transmission system that may be able to be expanded to serve as part of the overall collector system. This is a key reason for the diverse participation in the Task Force from transmission project sponsors (a federal transmission owner/operator, a state authority, a load-serving utility and three independent transmission developers) in Wyoming.

These are preliminary findings and additional analysis is required before recommendations on these aspects could be made.

The Task Force believes there may be some unique opportunities in Wyoming to expand Wyoming's energy-based economy by facilitating the development of a coordinated, environmentally responsible wind collector system by:

- Fostering a public and private partnership to develop the in-state collection system. The partnership could include state, federal and private entities that already have a presence within Wyoming in either operating and/or developing transmission.
- Coordinating among federal, state and local permitting processes, potentially through the development of a coordinated corridor plan that expands upon the federally designated energy corridors.
- Public recognition by the Wyoming State Legislature of the economic development opportunity by expanding Wyoming's energy portfolio to include renewable energy development and transmission development in an environmentally responsible manner.

2. Introduction

The United States' security and economy depends upon having a reliable, stable, cost-effective supply of electricity to power homes, businesses, and public facilities. The nation is turning its attention to the need to generate not only *more* electricity but also a higher percentage of *renewable* energy from sources like wind, solar, biofuels and geothermal to serve overall demand. Given Wyoming's rich resources and the current advantages of wind-generated renewable power, Wyoming wind is a logical, cost-effective choice to satisfy a portion of the demand for renewable energy in the region. Wyoming's existing intrastate and export transmission capacity is fully utilized. If Wyoming is to be a part of a solution to satisfy renewable energy and load growth now and into the future, interstate and intrastate energy delivery development issues must be addressed and resolved. In this instance, the only way to deliver and sell power generated by Wyoming resources in the form of wind and clean burning fuels is via new and/or rebuilt transmission lines.

The Wyoming Wind Collector and Transmission Task Force, formed in June 2009, includes the Wyoming Infrastructure Authority, the Western Area Power Administration¹, and four interstate transmission developers: LS Power, PacifiCorp, TransCanada and TransWest Express LLC². The Task Force participants represent a diverse group of interests.

¹ The Western Area Power Administration (Western) is a power marketing administration within the U.S. Department of Energy. Western is participating in the Wyoming Wind Collector and Transmission Task Force to assist in the development of a coordinated plan to collect energy from potential renewable resource projects and deliver it to hubs for export over proposed interstate transmission lines. Western's participation in the Task Force is not intended to advocate policy positions before the Wyoming State Legislature, or to imply that this report fully represents the views of the U.S. Department of Energy.

² This report reflects collective input from the Task Force members and not necessarily the interests of any one or all of the participants.

The Wyoming Infrastructure Authority (WIA) is an instrumentality of the state of Wyoming that is focused on diversifying and growing Wyoming's economy through the development of electric transmission. The WIA has been directly involved in four transmission projects in Wyoming and is supportive of all projects identified in this report.

Western Area Power Administration is a Federal Power Marketing Administration that owns and operates transmission facilities, including facilities in Wyoming, and provides transmission service. PacifiCorp is an investor-owned utility that owns and operates transmission facilities, including facilities in Wyoming, and provides transmission service. PacifiCorp and Western coordinate and collaborate with their transmission customers in the planning of transmission to cost-effectively and reliably serve these load customers while minimizing impacts to communities, the environment, and other factors.

TransCanada, TransWest Express and LS Power are independent transmission developers focused on developing interstate transmission projects to export renewable energy to markets outside of Wyoming. All of these groups actively participate in regional and sub-regional transmission coordination and planning groups to ensure regional needs are met, system reliability is maintained and impacts are minimized.

The primary focus of the Task Force is to provide input to assist in the development of a coordinated plan to collect energy from renewable resource projects located in Wyoming and deliver it to hubs for export over proposed new interstate transmission lines. In addition, the Task Force is also working to inform policy makers with regard to key issues on developing safe, reliable improvements and the expansion of the transmission system in Wyoming for both the utility and the independent projects. While the following sections are focused more on the collector system, the challenges described further in the report may be applicable to merchant and load service projects.

As of October 2009, the Task Force is not yet in a position to provide specific recommendations to the state's leaders. However, this report is designed to provide education and factual background about the realities of the transmission and wind industries, especially as they apply to the concept of a Wyoming wind collector system. As transmission system engineers and experts, our goal is to help better inform the public and Wyoming elected officials as plainly and simply as possible about these important infrastructure issues facing the state.

3. Background

a. Demand for renewable energy

The demand for renewable energy in the United States has never been greater than it is today. Population in the Western U.S. is growing rapidly, which in turn is driving an increasing demand for electricity. Reflecting an increasing nationwide interest in environmental and sustainability matters, state and national leaders are setting goals and passing legislation that requires the use of more renewable electricity (Renewable Portfolio Standards or RPS) and requires the reduction of carbon emissions typically associated with fossil fuels.

In California, for example – the most populous U.S. state with nearly 40 million citizens – utilities will be required to source 33% of their energy from renewable sources by 2020. California has also adopted goals to cut its greenhouse-gas (GHG) emissions to 1990 levels by 2020. Arizona, Nevada, Washington and Oregon, among others, also have legislated targets for renewable energy use and emissions reductions. To meet these goals and mandates, utilities and developers must invest in new renewable energy resources including wind, solar and geothermal power sources.

Again, using the example of California, the state's RPS and electricity sales growth requirements are forecasted to create demand for an additional 75,000 GWh/yr by 2020. In its June 2009 "33% RPS Implementation Analysis Preliminary Results Report," the California Public Utilities Commission stated that California's 33% RPS will require "nearly triple the amount of electricity from renewable sources in the next 10 years."

Moreover, in a January 2008 RPS and energy demand report for the entire west, the Western Electric Industry Leaders – a group of CEOs of the major western utilities – found that to meet its RPS goals, California would require an additional 21,000 MW of renewable energy development. Yet according to the June California Public Utilities Commission report, only 800 MW of renewable energy have been developed in California since 2002.

Tasked with both delivering more renewable energy and delivering energy at the best price, utilities must look to a range of potential solutions to deliver the required supplies. Studies and data such as the July 2008 National Grid report, "*The West's Renewable Energy Future: A Contribution by National Grid*," have shown that tapping Wyoming wind-generated electricity should be considered to help states like Arizona, Nevada and California meet RPS and GHG reduction goals due to its potential scale and quality, which is unmatched by any other region. The same report concludes that the most likely and logical market for the majority of Wyoming wind energy is the Desert Southwest region of Arizona, Nevada and California. While Wyoming wind could be competitively priced and delivered to a city like Los Angeles, it likely could not be competitively priced and delivered to cities like Chicago – especially given the strong wind resources available from closer states like North Dakota, South Dakota, Nebraska and Kansas.

b. Supply of renewable energy

Wyoming is fortunate to have pockets of some of the nation's best wind resources – including Class 6 and 7 (the maximum on the scale developed by the National Renewable Energy Laboratory). A report published by the Western Governors Association in partnership with NREL entitled "*Western Renewable Energy Zones – Phase 1 Report*" found that over 50% of the developable Class 5 and above wind sites in the west can be found in southern Wyoming.

No in-state market exists for all of Wyoming's potential wind electricity supply. According to a 2009 Harvard University study published in *Proceedings of the National Academy of Sciences of the United States*, the wind energy potential in Wyoming exceeds current total electricity sales in Wyoming by a factor of 220: "the resource in this region...is significantly greater than local demand." Therefore, finding export opportunities for Wyoming wind power in the broader western markets makes economic and environmental sense.

Because of the high quality of Wyoming's Class 5, 6 and 7 wind resources, this energy can potentially be delivered at a lower cost to consumers than most other renewable energy resource technologies and locations in the west. Several recent studies have identified the relative favorable market position of Wyoming's wind potential versus other renewable resource

alternatives. It is important to note that the renewable energy market is a subset of the overall electric energy market. This renewable energy market is driven by the states that have implemented renewable

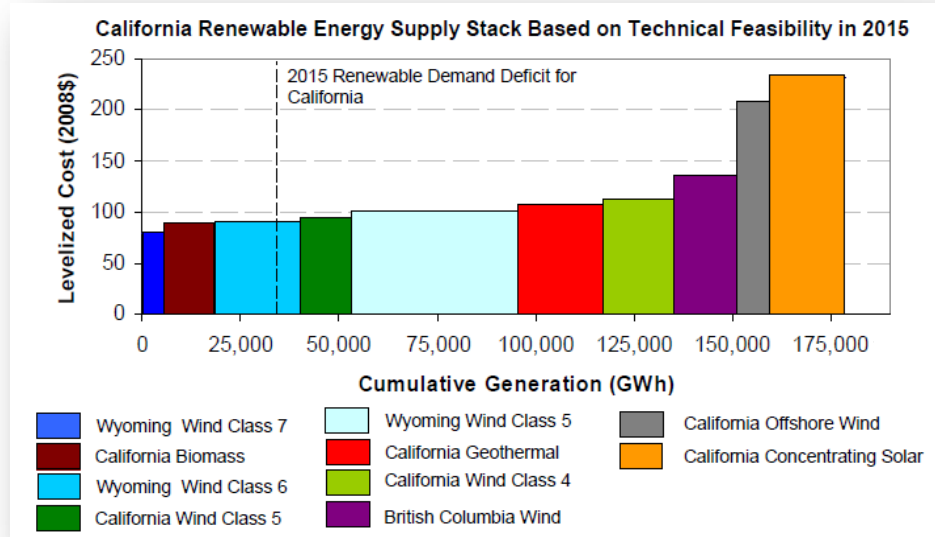
energy targets (i.e. RPS). All forms of renewable energy receive

certain federal subsidies, regardless of location, to help offset the comparatively higher cost of these less mature technologies. Therefore, Wyoming renewable energy resources are not any more competitive due to federal subsidies.

These broad market analyses that point to Wyoming's favorable position focus on the high-quality winds and business development policies adopted by Wyoming. While the analyses point to a general notion of Wyoming's favorable position, they do not include some of the basic factors used by wind developers in identifying economic sites, such as relatively level land, access to transportation hubs, access to transmission and changes within Wyoming's development policies (i.e. taxes, environmental policy, etc.), which all factor into the economics of a potential wind generating facility.

These regional studies also do not account for the production downgrade that results from lower air densities found at higher elevations, such as in Wyoming. This downgrade represents a **20% to 25% reduction** in energy output compared to a turbine located in the same wind class at sea level. This reduction in energy output results means that a NREL Class 4 wind site at elevation actually performs more like a Class 3 site at sea level.

These lower power production capabilities, coupled with Wyoming's distance from western market centers, means that NREL Class 4 wind in Wyoming is not likely developable for delivery to out-of-state markets at competitive prices. According to the June 2005 BLM Programmatic Environmental Impact Statement for wind energy development, which refers to




Wyoming's market position relative to other renewable resources. Wyoming Class 6 and 7 winds are among the lowest-cost potential resources to supply the California market, for example. Assumptions used do not include reduced production due to low air density. Source: National Grid, April 2008

the NREL wind maps, “Developers using currently available wind turbine technologies have found that sites with wind power densities at Class 4 or higher represent economically viable sites for a wind generating facility.” If a Wyoming wind site actually reflects Class 3-type energy production, it likely will not be as practical or economic to develop as a wind site with higher energy production.

Wyoming wind resources are well positioned to potentially be delivered to markets at competitive prices. However, Wyoming also presents a number of challenges to wind development that reduce its competitiveness and places the viability of wind at risk. Below are some additional obstacles identified by the Task Force and the Wyoming Power Producers Coalition (WPPC) that are not specifically addressed elsewhere in this report. All of these obstacles act to reduce the competitive position of Wyoming wind.

- **Taxation:** The tax burden on a Wyoming wind resource is higher than surrounding states that contain renewable resources competing in the same marketplace. With the sunset of the renewable energy sales/use tax exemption, Wyoming has one of the highest sales tax burdens in the west. In addition, Wyoming’s property tax burden is also one of the highest in the west. For example, a 100 MW wind facility in Wyoming will pay about 6% in sales tax and \$1,900,000 in property taxes in its first year. A similar 100 MW wind project in Montana will pay 0% sales tax and about \$400,000 in property taxes in its first year. Wyoming does not have a corporate income tax, but because business will be conducted across state lines, this advantage is not likely to offset the high burden of sales and property taxes. The comparison between Montana and Wyoming is important because both are similarly suited in that they both have very good wind resources that are far removed from large markets and are in need of new transmission to reach these markets.
- **Time factors:** Renewable energy has different values based on the time of the year and time of the day in which the energy is generated. Renewable generation during the summer months and the afternoon hours receive the highest prices. Typically the Wyoming wind resource produces the least in the summer, and the production profile throughout the day varies from location to location in Wyoming. These factors combined with price declines in solar and other renewable energy technologies may create alternatives to Wyoming wind.
- **Subsidy structures:** Federal or state renewable subsidies that are not dependent on the amount of energy produced, such as the federal investment tax credit, act to remove the advantage of a higher capacity factor.
- **State support:** In contrast to other states that have publicly embraced and encouraged renewable energy and the associated economic benefits, Wyoming’s unfocused position has created uncertainty within the industry.
- **In-state preferences:** Many state regulators across the west have expressed a preference for in-state renewable resources. Some states such as Colorado (125% renewable energy credit for in-state resources), Nevada and Arizona provide incentives to in-state renewable energy production. Other states, including California, have been considering similar incentives.



The question is often posed about how much developable wind exists in Wyoming. Sources such as NREL estimate there are 116,670 MW of developable Class 5-7 winds in Wyoming, and that Wyoming has over two-thirds of the developable Class 7 wind and over one-half of the developable Class 6 wind in the onshore United States. The American Wind Energy Association (AWEA) ranks Wyoming seventh in terms of its future wind potential, with 85,200 MW of potential capacity estimated; however, when considering Class 6 and 7 developable wind, Wyoming ranks first in the U.S.

However, the general industry viewpoint is that the amount of wind that actually will be developed in Wyoming is far lower than estimates provided by NREL or AWEA, due to a mix of environmental and economic factors. The Western Renewable Energy Zones initiative estimates that about 14,200 MW of Class 5 and above wind resources will likely be developed in Wyoming. The numbers generally heard in industry discussions related to wind and transmission is that between 10,000 and 15,000 MW of Wyoming wind in total are likely to be developed. This amount of wind energy development is within the capacity of the interstate transmission lines currently planned for development in Wyoming.

In addition to abundant wind resources, Wyoming has traditional energy resources that can benefit from expanding the state's transmission and wind industries. Wyoming is in the top three states in the U.S. in natural gas production. Since wind is an intermittent energy resource, it requires to be backed up by a generation resource that can respond flexibly to changes in demand and to seasonal, daily or unexpected fluctuations in the wind energy produced. Natural gas fired generation is excellent for this purpose.

Historic data for the monthly performance profile of Wyoming wind indicates that it is 60% more abundant in the winter months (November-March) than the other months on an average monthly basis. This characteristic blends well with the pricing of natural gas, which is generally higher in the winter. Ultimately, customer utilities will likely require a more stable or "firm" energy resource rather than an intermittent product.

As a result, the development of wind resources in Wyoming can be expected to encourage the development of natural gas generation. These are complementary resources that both can provide significant benefit to Wyoming.

Transmission infrastructure is designed to have a service life of over 40 years. Over the lifetime of this infrastructure, new generation technologies will undoubtedly be developed and matured. Extensive research continues with the goal of developing more cost-effective clean coal generation and carbon capture processes. Great strides have been made in the carbon sequestration field as well. At some point in the future, these technologies will likely become major contributors in meeting the energy needs of the marketplace.

If Wyoming possesses significant export transmission facilities, those facilities will greatly increase the possibility of these new generation technologies being deployed within Wyoming.

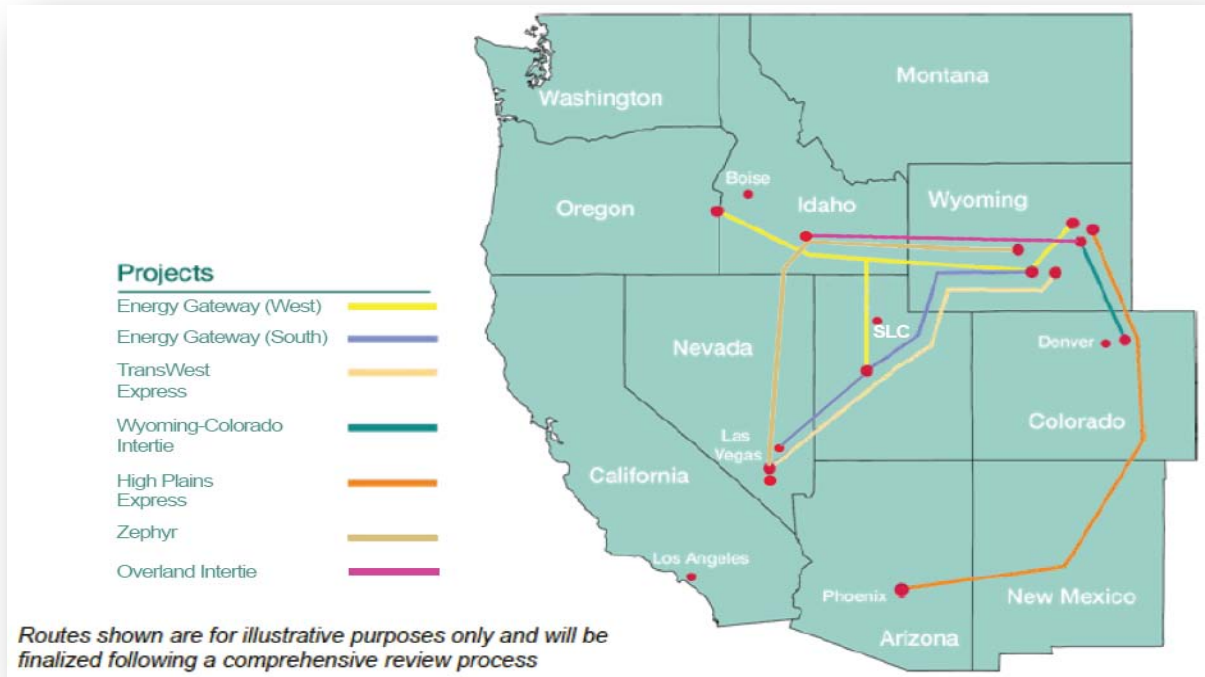
c. Overview of current planned interstate transmission projects

In 2003, Wyoming Governor Dave Freudenthal and then Utah Governor Mike Leavitt announced the formation of the Rocky Mountain Area Transmission Study (RMATS). The governors found that: “For many years, utilities and other entities have been reluctant to make investments in needed electric transmission infrastructure. This was due to a number of factors, including protracted uncertainties in the regulatory environment and nascent regional transmission organizations under development. As a consequence of this lack of transmission expansion, transmission congestion and bottlenecks were increasing. While this was a problem throughout the western interconnect, it was becoming an acute issue in areas of the Rocky Mountain sub-region.”

In order to encourage and assure the development of new transmission originating in Wyoming, the Wyoming Infrastructure Authority was formed by the Wyoming Legislature in the same year as the release of the RMATS Report, 2004. The WIA has participated in three of the six transmission projects currently under development and is supportive of the remainder.

There are six interstate transmission projects originating in Wyoming currently in development. Five of these projects are being developed primarily to serve the renewable energy markets described in the previous supply and demand sections. The interstate project proposed by PacifiCorp, the Energy Gateway Project, is being designed primarily to provide reliable service to its customers and to make improvements to serve the growing needs of the communities they serve. The Energy Gateway Project includes substantial improvements to the transmission system in Wyoming that are needed to serve PacifiCorp’s Rocky Mountain Power customers as well as to provide opportunity for Wyoming wind developers to export power within the region. The Energy Gateway Project – consisting of Gateway West, Gateway South and other elements in Utah, Idaho and Oregon – is considered as a single project within this report.

Wyoming Transmission Projects



Project Details

Energy Gateway: Designed as a single-circuit 500 kV AC transmission line between Wyoming and Idaho (**Gateway West**) and Wyoming and Nevada (**Gateway South**). Also designed to have the capability to construct adjacent lines for double the capacity, which would be staged as load service and customer needs mature.

- Capacity: designed for a maximum total of up to 6,000 MW for Gateway West and Gateway South combined (initial capacity will be less than the design)
- Length: part of a 2,000 mile system that includes Gateway West and Gateway South
- Developers: PacifiCorp/Idaho Power, Gateway West; PacifiCorp, Gateway South
- Year Initiated: 2007; In-service date: 2014 - 17 Gateway West; 2017 - 2019 Gateway South
- Project Link: www.pacificorp.com/Article/Article79554.html

High Plains Express: Two single-circuit 500 kV lines or a new double-circuit 500 kV AC transmission line between Wyoming and Arizona with on-ramps and off-ramps in Colorado and New Mexico.

- Capacity: 4,000 to 8,000 MW
- Length: over 1,200 miles each
- Developers: The WIA and 11 other parties
- Year Initiated: 2007; In-service date: 2017-2018
- Project Link: www.highplainsexpress.com

Overland Intertie: A new 500 kV transmission line between Wyoming and Idaho to connect with the Southwest Intertie Project to southern Nevada.

- Capacity: 2,000 to 3,000 MW
- Length: over 560 miles
- Developer: Jade Energy Associates LLC, an affiliate of the LS Power Group
- Year Initiated: 2009; In-service date: 2014 - 2015
- Project Link: www.lspower.com/projects.htm

TransWest Express: A new 600 kV DC transmission line between Wyoming and Nevada.

- Capacity: 3,000 MW
- Length: approximately 750 miles
- Developer: TransWest Express LLC, an affiliate of The Anschutz Corporation
- Year Initiated: 2006; In-service date: 2014
- Project Link: www.transwestexpress.net

Wyoming-Colorado Intertie: A new 345 kV AC transmission line between Wyoming and Colorado that will resolve a long-standing transmission constraint known as TOT 3.

- Capacity: 850 MW
- Length: 180 miles
- Developers: The LS Power Group and the WIA
- Year Initiated: 2005; In-service date: 2013
- Project Links: www.wyia.org/wci; www.wcintertie.com; and www.lspower.com/projects.htm

Zephyr: A new 500 kV DC transmission line between Wyoming, Idaho and Nevada.

- Capacity: 3,000 MW
- Length: 1,100 miles
- Developer: TransCanada
- Year Initiated: 2005; In-service date: late 2014
- Project Link: www.transcanada.com/company/zephyr_chinook.html

Summary of Wyoming Transmission Projects

Of the six Wyoming transmission projects currently in development, four projects representing about 85% of the proposed export capacity are planned to serve markets to the west of Wyoming. This is consistent with the information provided that concludes the demand for renewable energy is the greatest in the regions west of Wyoming (i.e. Intermountain, Desert Southwest and West Coast).

Two of the proposed Wyoming transmission projects are planned to serve markets south or southwest of Wyoming by routes through Colorado's Front Range. Transmission developers have not focused on serving markets to the east of Wyoming. The distance to the eastern markets and the quality of resources located closer to those markets places Wyoming resources at a disadvantage. The transmission projects proposed in terms of targeted markets and scale are consistent with the results of the RMATS study and other more recent analyses.

Given the higher-quality wind resources, the buildable sites and the westerly direction of the proposed transmission projects, two-thirds of the proposed export capacity is slated to have terminals located in south-central Wyoming. One-third of the proposed export capacity is planned to have terminals located in eastern Wyoming. This is where high-quality winds exist and relatively fewer environmental issues exist for wind developers. The eventual selected location of the wind developments and the markets they serve will likely drive additional transmission needs within Wyoming.

4. Economic benefits of transmission and wind development in Wyoming

Wyoming has an abundance of natural and energy resources. The planned and sound development of these resources has resulted in strong economic and employment opportunities. Wyoming also possesses an abundance of renewable energy resources and is increasingly becoming a green energy provider. As with the other energy resource issues that Wyoming has addressed, wind energy is not without its challenges, which must be addressed as development continues. The development of Wyoming's renewable resources will result in benefits to the state and its citizens. Among these benefits are increased local employment opportunities, increased state and county revenue base from sales and property taxes, and increased revenue to Wyoming landowners.

Employment opportunities tied to wind energy and transmission development exist both in the short-term and long-term. In the short-term, jobs are required to design, permit, prepare and construct wind generation facilities and the associated equipment. While the wind turbines are the most noticeable of the development features, local work is also required for site preparation and site reclamation at both the wind sites and the necessary new transmission facilities. In order to complete each of the necessary development steps, materials, construction equipment and employees are required.

In the long-term, employees are needed to operate and maintain the wind and transmission facilities. In addition to the direct jobs created by developing Wyoming’s wind resources there are significant indirect and induced jobs created, often called the multiplier effect. These include supplier and consumer jobs, such as the new jobs created by a cement plant in order to increase production or the jobs required to open new restaurants.

As previously mentioned, it is estimated that there are 10,000 MW to 15,000 MW of realistically developable wind resources in Wyoming after considering environmental and other limiting factors. The table below demonstrates some of the direct economic benefits that could be realized from development of the wind generation. This table does not consider the economic benefits of new transmission or the multiplier effect, but those listed are certain to increase the benefits.

Estimated Direct Economic Benefits to Wyoming 12,000 MW of Wind Generation	
Permanent, full-time O&M jobs	700
Construction jobs	800 per year for 10 years (assuming 600 turbines built per year)
Sales taxes	\$1.404 billion
Property taxes	\$1.7 billion to \$2.6 billion over 20 years

Sales taxes are applied to equipment installed for the development of the wind resource. The magnitude of the capital investment required to install a single wind turbine is significant. When the costs of equipment for an entire wind generation complex are added together, the total investment is even more significant. The sales tax applied to this equipment can generate a large revenue stream to the state, the county and incorporated cities and towns.

Similarly, property taxes are assessed against each project when they have been completed and are operating. These property taxes represent a long-term revenue stream for state and local governments.

The following tables represent an example of the benefits resulting from a large wind energy development project and the associated transmission. The tables present estimates for employment, sales and property taxes. This benefits information summary is based upon a project 3,000 MW in size, roughly the size of one major transmission project.

Benefits to Wyoming During Construction (Over 3 years)

In millions of dollars							
	Total Capital Cost	Capital in Wyoming	Direct Employment	Multiplier Effect	Property Taxes	Sales Tax	Total
3,000 MW Transmission	\$3,000	\$1,500	\$168	\$135	\$17	\$32	\$350
3,000 MW Wind Generation	\$6,000	\$6,000	\$600	\$480	\$93	\$267 *	\$1,440
Collector System **	\$800	\$800	\$153	\$123	\$12	\$15 *	\$300
Total	\$9,800	\$8,300	\$920	\$740	\$120	\$310	\$2,090

* Assumes the sales tax exemption for renewable resources expires before project procurement

** AC lines from the wind farm to the 3,000 MW transmission system

Annual Benefits to Wyoming During Operation

In millions of dollars						
	O&M Contracts and Direct Employment	Multiplier Effect	Property Taxes ***	Sales Tax	Total	# Full Time Employees
3,000 MW Transmission	\$22	\$9	\$9	\$1	\$41	13
3,000 MW Wind Generation	\$144	\$58	\$46	\$7 *	\$255	160
Collector System **	\$9	\$4	\$6	1*	\$20	3
Total	\$175	\$71	\$61	\$9	\$316	176

* Assumes the sales tax exemption for renewable resources expires before project procurement

** AC lines from the wind farm to the 3,000 MW transmission system

*** Property Taxes may decline slightly over time depending on Fair Market Value assessments

The previously represented tables do not address the economic return to landowners for the development of the wind resource. While the tables reflect the employment and tax benefits from a typical project, they do not reflect the land payments and production revenues that landowners receive from wind development on their property. Although the income associated with these payments is not part of the state tax revenue base, it does represent an economic infusion for landowners and indirectly into local communities.

5. Challenges in building transmission

While the benefits of expanding the transmission system in Wyoming are generally well understood, the scale to support 10,000 MW to 15,000 MW of renewable energy exports is immense and requires a significant undertaking on many fronts. As a rough example, 15,000 MW of export capacity would require a comprehensive collector transmission system consisting of approximately ten 500 kV lines; with up to forty 230 kV lines connecting large wind generating facilities to the collector system. A number of significant challenges and obstacles exist that stand in the way of developing high voltage transmission expansion projects in and out of the state. These challenges generally fall under three categories: commercial, siting and permitting, and operations.

A. Commercial

Commercial challenges generally relate to issues around how new transmission is financed and how the costs and benefits of that construction are allocated to customers.

Investment Structures

A number of different investment structures (i.e., business models) exist among developers of transmission projects. The two most common structures are: (i) development of transmission facilities by a regulated utility (e.g. PacifiCorp) and (ii) development of transmission facilities by independent developers using a merchant model. Typically, under the model of a regulated utility expansion, all prudently incurred construction costs are allocated to customers of that utility. With merchant projects, a developer proposes a facility and looks for customers willing to sign up for service under a wide range of contractual considerations. TransCanada and LS Power are developing projects under the merchant model. TransWest Express is using a hybrid approach where the ultimate structure will be determined later in the development process.

Cost recovery – Who Pays

Under either investment structure, developers seek to recover the construction, financing and operational costs of transmission developments from wholesale customers under an Open Access Transmission Tariff (OATT) approved by the Federal Energy Regulatory Commission (FERC). This allows a transmission provider to charge transmission customers for use of the transmission network. While it is a simple concept, successful implementation of this model is not so easy. Following are some specific areas that make revenues or cost recovery uncertain for developers.

High cost of construction – New transmission lines are magnitudes more costly than existing lines. It is not uncommon to have construction costs that exceed \$2 million per mile, resulting in large projects costing billions to construct. Placing the payment obligation onto wind developers and select transmission customers for new line construction is difficult, due to the risk associated with the large investment and uncertainties related to transmission line construction.

Service agreement / contract requirements – Transmission lines are long-term investments, often lasting 40 to 50 years, which requires long-term financing supported by long-term customer contracts. In the utility investment structure, the long-term customer contracts take the form of network service to provide end use customers access to resources. In the merchant model, transmission customers are typically generators. These customers are faced with developing business cases for funding on at least three fronts that align: (i) power purchase agreements, which provide their revenue stream, (ii) wind development construction and production costs, (iii) long distance interstate transmission costs, and potentially (iv) local or collector system transmission costs.

This can create a very complex “chicken or egg”-type dilemma since end use customers (e.g. utilities), turbine manufacturers, and interstate and local transmission providers all have very different constraints and financing needs. Yet a wind generation developer will clearly need to avoid a substantial binding commitment on any one element while they remain uncertain on the other elements. Furthermore, even when this is achieved, continuing to maintain an alignment of these necessary elements can be very difficult.

Cost uncertainty – Service requests and contract offers for the transmission service are tendered and signed prior to line construction. Customers must know, with some level of certainty, their cost requirements before signing a long-term commitment. Unfortunately, various factors create cost uncertainty for any construction project requiring a 5- to 10-year time frame to complete, as is the case with large transmission projects. A limited set of factors that can vastly affect costs include final routing decisions, right-of-way costs, design variations, permitting requirements, environmental mitigation, level of intervener interest, material and contractor availability, and other project delays. The transmission provider and transmission customer may not be able to accept the potential for cost escalation risk associated with the unknowns of a transmission construction project.

Credit requirements – Transmission customers must provide credit support for a long-term power delivery commitment, for the long-term transmission commitment, and to a lender who finances a new generation project. Often the credit requirements far exceed a developer’s capability. The transmission provider cannot construct a billion-dollar project without protecting itself from customer default risk.

Schedule risk – Transmission lines require time to construct and are impacted by numerous factors, including environmental permitting, landowner and right-of-way issues, material procurement, contractor availability and weather. Transmission customers who sign delivery requirements over a long-term contract require certainty related to when transmission service can begin. Any long-term project comes with schedule risks, making it extremely difficult for the customer to sign commitments.

B. Siting and Permitting

Once a sound business plan is in place and a project has been announced, it will proceed into a detailed siting and permitting process. There are significant cost, time and successful execution uncertainties with the current process. In the 2009 report, “Transmission Siting in the Western United States” by Holland & Hart, challenges to transmission siting, permitting and construction are discussed. As the report suggests, challenges faced by developers of major transmission projects in the western U.S. are “daunting” and one of the reasons transmission enhancements take a long time to make. Traditionally, state siting practices were largely developed at a time when power moved within local utility systems. Today’s need for interstate and regional transmission projects are not adequately addressed in existing requirements for transmission infrastructure.

Some of the key challenges related to transmission siting and permitting include:

Conflicts between local, statewide and regional interests (Holland & Hart 2009) – Unlike pipelines (that have access to the FERC and a federal approval), transmission line permitting processes still provide broad discretion to local, county or state bodies. Such entities find it difficult to support such developments, if supported only by projected broad regional or national benefits, with no direct benefit to the state or local jurisdiction through which the transmission line will pass. Furthermore, there is no single entity that decides who will ultimately benefit from a new transmission project and how costs will be shared accordingly.

Public Opposition (Holland & Hart 2009) – Transmission siting processes can be encumbered by the “Not in My Back Yard” (NIMBY) syndrome. Not only do many people object to the aesthetic impacts of a transmission line, but there is also a growing number of objections to power lines on public lands remote from population centers. Land use obstacles are common since lines often traverse protected habitat, scenic areas and historic trails.

Environmental sensitivities – Sensitivities regarding species, land use and other considerations can have a significant impact on the siting and location of potential projects. In 2008, Wyoming Governor Dave Freudenthal issued Executive Order 2008-2, which outlined the Core Sage Grouse Area Strategy. Following the Order, state representatives participated in the Western Governors Association’s Western Renewable Energy Zone project in an effort to better define renewable energy hubs in Wyoming. While wind and transmission developers are working to respond to these refinements in policy, some key questions remain such as how much wind and transmission expansion the state will support through core sage grouse areas or other environmentally sensitive areas.

Common corridors – Placing multiple transmission lines in common corridors in order to minimize the environmental impact is a sound goal that is challenging to implement. While multiple lines can technically function within a single corridor, this creates an increased exposure to the risk of a single incident interrupting service (e.g. a blackout)

and is therefore restricted or not allowed under federal (electrical system) reliability criteria. The WIA recently commissioned a study on the reliability impacts of lines placed in the same corridor, specifically looking into the minimum distance between lines.

Transmission line “right-sizing” – The “super-sizing” or “right-sizing” of transmission lines to minimize the environmental impact has similar challenges of multiple lines within a corridor. An outage of one “super-sized” line can also represent significant risk to a transmission provider and its customers. The Task Force has agreed that a 3,000 MW transmission line would be at the upper limit, or “super-sized,” in the western United States. This limit could be increased, as it has been in other parts of the country; however, a substantial amount of system upgrades would be required to do so. Super-sizing is also difficult to implement from a commercial perspective, since benefits from the oversized portion of the transmission line may not be realized for many years.

Permitting Challenges

Federal and state environmental reviews (Holland & Hart 2009) – Multiple federal and state environmental review requirements are often not complementary, can require years to complete and may serve as the venue for litigious efforts by project opponents. Examples of environmental review requirements include the National Environmental Policy Act (NEPA), Endangered Species Act, Migratory Bird Treaty Act and California Environmental Quality Act. In addition, the time required to complete the siting process may exceed the shelf life of an environmental review and will require additional reviews.

Federal land authorizations (Holland & Hart 2009) – Along with NEPA and other review processes, a major transmission project in the west must navigate through an array of federal public land management requirements administered by federal land management agencies including the Bureau of Land Management, the Forest Service, the Fish and Wildlife Service, the National Park Service and the Bureau of Reclamation. In addition, a major project may require amendment of an agency’s land use management plans, and will require additional time and expense.

Multiple jurisdictions – Multi-jurisdiction permitting can be challenging, expensive and uncertain. The lack of a state permitting entity that, consistent with planning activities and expectations, works cooperatively with the Bureau of Land Management and other federal agencies adds to the complexity of permitting activities.

Agency resources – The extent of permitting reviews requires numerous resources to be expended by the various agencies. Given the scale and resource requirements of these reviews, the project sponsors are rightly obligated to provide financial resources to conduct these reviews under the direction of the agencies in order to maintain the independence of the process. As such, the agencies need sufficient qualified staff to manage and direct these reviews. Any changes in permitting requirements adopted by the legislature should make provisions to ensure limited agency resources do not become a barrier to executing high quality and timely environmental reviews.

C. Operating Challenges

All high-voltage grids are a complex, delicate system within which the supply and demand for electricity must be kept in constant balance. Unlike natural gas, electricity cannot be stored, even for a fraction of a second. We are painfully reminded of the consequences of failing to maintain this balance when we experience wide-scale blackouts, as occurred in California and the Northwest in 1996 and the failures of the Northeast in 1965, 1977 and 2003.

In practice, the balancing of supply and demand is undertaken at a sub regional level in what are known as “balancing areas.” These do not necessarily follow logical political or electrical system boundaries but mostly reflect ownership boundaries. Integrating intermittent generation resources, particularly those located remote from load centers, creates an additional level of complexity to the challenges of maintaining balance within the electric system. The following situations, described in more detail in the North American Electric Reliability Corporation’s 2009 report “Accommodating High Levels of Variable Generation,” are examples that contribute to these operational and reliability hurdles.

Regulating resources adequate to support a 15,000 MW renewable model in Wyoming do not exist today and must be developed. The cost for adding these resources adds to the barriers of developing a 15,000 MW system in Wyoming.

- Wind resource output can change quickly, compared to the more gradual and predictable changes of electricity demand and the output of traditional generation. Managing these rapid changes can be challenging for system operators, particularly if the change in wind and demand is in the opposite direction.
- Fuel availability may not occur during periods of high consumer demand for electricity, making it difficult to balance load and energy supply.
- Voltage control, stability and regulation issues may occur when locating generation away from load centers, as the power system must have sufficient reactive power resources (both dynamic and static) to maintain reliability.

6. Wyoming Collector System

a. Need for a collector system

The earlier sections outlined the fundamentals that support the development of Wyoming's renewable energy infrastructure. The earlier sections have also, however, reflected on the significant challenges wind generation and transmission developers must overcome to achieve this goal. Developers have thus far focused on the interstate transmission solutions and the actual wind development, which are the most fundamental and challenging pieces. However, a vital infrastructure element that also requires attention is building transmission infrastructure between the wind farms and the major Wyoming transmission line terminals.

With conventional generation, where individual facilities operate on the larger scale, the most common "collector" approach is to build single purpose lines (known as "generator tie lines") between the generation facility and the high-voltage transmission system. These are typically built and owned by the generation facility for their sole use, which keeps the contractual structure simple and avoids another potential "chicken or egg"-type dilemma.

This model works less well with wind generation facilities because they operate on the smaller scale and because there may be multiple generation owners within one region. In the particular case of Wyoming, where major transmission line hubs may be located hundreds of miles away from wind generation plants, building multiple single-purpose transmission lines is an even less attractive approach, since it increases environmental impact and reduces the economic viability of Wyoming wind. While it may be practical for multiple generators to collaborate and build larger, more economic lines, the competitive nature and other factors (e.g. timing, risk) make these arrangements quite difficult.

Wyoming's existing transmission infrastructure is weak and has little capacity available, causing the unlikelihood of wind developers using the existing system for delivery to the major transmission projects. Further, the existing fragmented ownership pattern of transmission, particularly between the eastern and western portions of the state, coupled with the regulatory charging structure for such facilities based upon the costs of the utilities' whole transmission system (referred to in the industry as rate "pancaking"), causes additional costs that might make the delivered energy uneconomical in the remote market place.

A "collector system" can take many shapes and forms, ranging anywhere from a radial system to a completely integrated system. Ultimately, the market will select the winners and losers and determine the shape of the collector system. As discussed in the following section, each collector system build-out has its own advantages and disadvantages. The developers of the collector system must keep a balance between improved reliability, market flexibility and economics so that the collector system does

not make Wyoming wind uneconomical. If done in the proper manner, a collector system has potential to add value to the wind projects through improved economics and market flexibility, increase reliability and reduced environmental impacts.

These challenges, on top of the inherent development risks of all transmission (i.e. permitting and siting, and the “chicken or egg” problem with aligning PPA, turbine order and interstate transmission), make it very difficult for wind developers to organize a robust plan on their own. Furthermore, even if they were to undertake these developments on their own, the solution would likely not accommodate broader societal benefits for Wyoming, such as facilitating and encouraging future wind generation developments.

A coordinated “collector system” has potential to aid with the integration of intermittent wind resources, which is one of the key challenges facing the electric industry. The electrical grid is unlike “storage and pipe” systems (i.e. water, oil and gas) since electrical energy cannot be stored within the system. Electrical generating resources must increase or decrease their output as demand varies with consumer use. As a result, a premium is placed on the resource certainty and the ability for resources to respond to changing demand. Wind is an intermittent resource that is not as predictable as other resources and cannot be increased on command as other resources can. The use of new and existing gas fired resources can complement wind resources and deliver a more certain product. Resource requirements, including generation reserves and generation capable of increasing and decreasing output quickly to support the intermittent wind resources, will be significant. New non-wind generation capacity with these fast acting controls will be required. A collector system can help facilitate the development and delivery of both wind and gas fired generation.

A potential operational benefit of a broader collector system could be to expand the pool of resources used to balance the system. These resource pools are called “balancing areas” within the electrical industry. Each area is operated by a group of system dispatchers that keep the flows in and out of the system balanced at all times. It has been found that the expansion of these balancing areas allows more resources to be pooled, such that the impacts of intermittent resources are mitigated to an extent.

Wyoming is split between two Western Electricity Coordinating Council (WECC) certified Balancing Areas. The eastern portion of Wyoming is included within a Balancing Area operated by the Western Area Administration that includes Colorado and Nebraska. The western portion of Wyoming is included within a Balancing Area operated by PacifiCorp that includes Utah and Idaho. While each of these Balancing Areas is large on their own, both operators are looking for ways to share resources more effectively to help integrate wind resources. Elimination of the barriers between the eastern and western portions of the transmission systems within the state of Wyoming could help facilitate the statewide development of resources to supply multiple markets.

All of these factors suggest that public support or involvement (either federal or state, or a combination thereof) to facilitate a Wyoming Collector System is desirable. This will actively encourage these major developments and ensure that the local transmission infrastructure is developed in a way that supports Wyoming's long-term interests.

Although the form of such support is yet to be identified, this may be viewed similarly to a state or a municipality assisting with building road infrastructure to encourage employment that will create industrial or commercial developments. As discussed earlier in this report, such benefits may not be restricted to new wind generation facilities but will likely extend to gas fired generation facilities (to provide balance to the wind generation) and future clean coal or carbon sequestered generation facilities.

b. Commercial Realities

Perhaps the biggest commercial issue with a coordinated collector system is who will pay for the construction of the system. It is unlikely that the end use market demand and the wind generation will be built out at the same time such that the collector system can be fully utilized. This could create a first mover disadvantage. For example, two wind projects may be able to use a portion of the same transmission facility, but their in-service dates may be separated by five years. If the facility is built to accommodate both projects, a portion of it may go unutilized for five years, and neither the wind developers nor the transmission developer would support the funding of unutilized transmission.

These issues are not unique to Wyoming. Several states, most notably Texas and California, have adopted policies that support the proactive development of the transmission system to resource-rich areas to help stimulate the development of the resources.

In the case of Texas, the rate payers (i.e. retail customers) are funding the transmission expansion through a regulated process managed by the Texas Public Utility Commission and an independent transmission entity, the Energy Reliability Council of Texas (ERCOT). In this system, wind generator developers have access to the transmission plans being implemented and the cost certainty of how they can price their output to the various buying entities within Texas. The transmission and wind industry in Texas has one of the highest levels of capital deployment and infrastructure development in the country. This model works well since all new transmission investments are approved as part of a statewide plan, and the construction costs are recovered through an annual pass-through to retail customers.

In California, a new form of transmission funding has been adopted for "locational constrained resources." Within this framework, California ratepayers are initially funding the expansion of the transmission system through a regulated process managed in part by an independent transmission entity, the California Independent System Operator (CAISO).

These expansions, which are initially funded directly by energy consumers, will ultimately be paid by the generators that interconnect and use the lines. Ultimately, only the specific energy consumers of the wind facilities will pay for the transmission service. This system also affords the wind developers in California with a transparent plan and certainty on access and the cost of transmission to include within their marketing plans.

Both the Texas and California frameworks provide some insight on how transmission could be expanded within Wyoming to serve both the Wyoming consumers and the wind development community with transparent transmission expansion plans into the most economic resource areas with cost certainty. There are two major distinctions between these states and Wyoming. The most notable exception is that Texas and California have the wind development and their ultimate consumers within a single state. This allows each state's respective regulators to control the overall expansion to best serve the ultimate consumer of these resources. While Wyoming consumers will use portions of the transmission system and the resources, particularly if a national renewable energy policy is implemented, they will always remain the minority consumer group for the planned infrastructure. This is similar to other energy export industries in the state (i.e. oil, gas, coal exported by pipe, rail and wire).

Without direct access to the ultimate consumers, the cost of transmission expansion within Wyoming will need to be borne by the wind developers and/or the major transmission lines. In turn, these entities would pass the costs to the ultimate energy consumers within the targeted markets as part of the delivered energy price, thus avoiding any inappropriate obligations placed on Wyoming consumers. While charging either of these developers for the expansion makes sense in the long run, the missing element is the lack of direct access to a broad range of consumers that could both initially fund the development and provide a financial backstop until the costs can be passed through to the end customers. Individual developers have shown an inability to work with competitors and an unwillingness to share the cost risk for an expansion beyond their own needs.

The second distinction between these states and Wyoming is that Texas and California have an independent transmission entity that facilitates coordinated state wide transmission planning. Coordination and support from state and/or federal agencies could potentially be used to bridge the gap between individual developers and the ultimate end use customers.

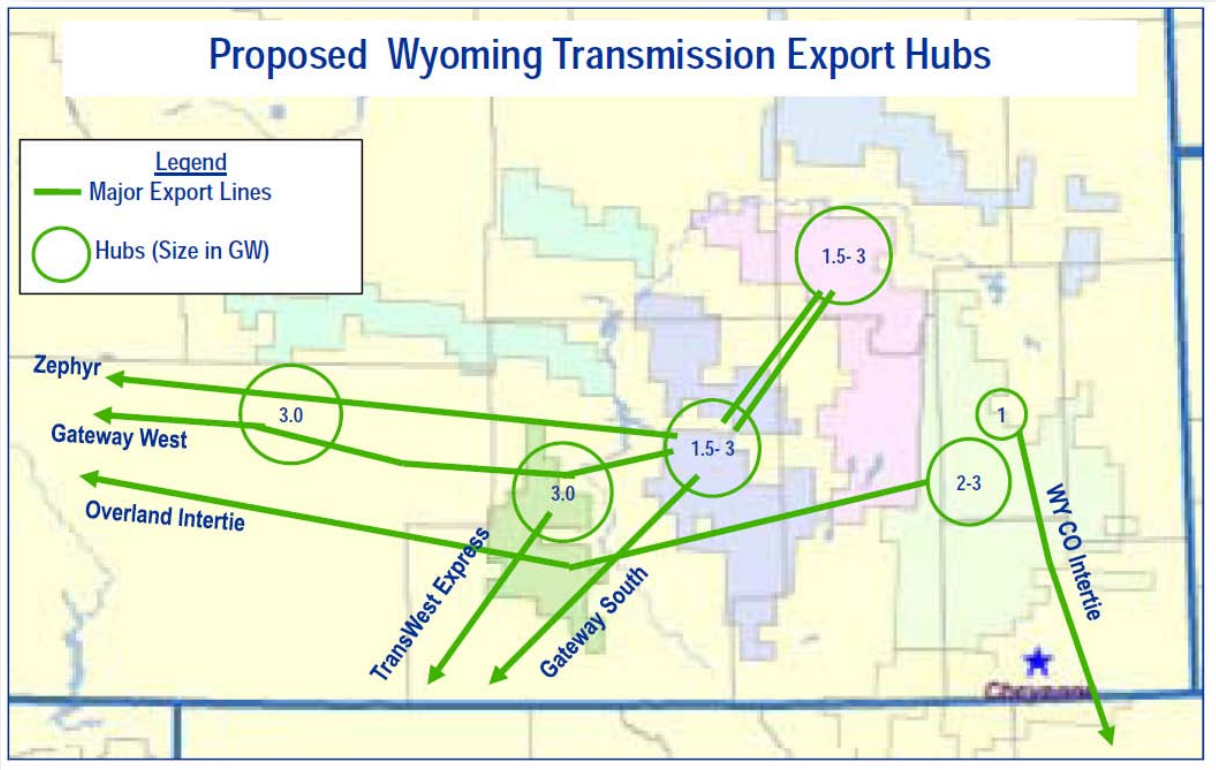
While a transmission collector system has much potential in Wyoming, there are a number of commercial realities that cannot be ignored. For instance, depending on the location of the wind and the hub of the transmission project; the collector system alternative may have a higher cost than a generator tie line and the benefits of a collector system may not be economically justified. In this case, the developers should be able to develop a generation tie line and not be forced to utilize the broader collector system.


c. Conceptual plan for a collector system

The sponsors of five of the Wyoming transmission projects each individually submitted Statements of Interest to the Western Area Power Administration for participation in Western’s Transmission Infrastructure Program. Through leadership provided by the Western Area Power Administration and the Wyoming Infrastructure Authority, Task Force members have focused on the technical aspects of a collector system scaled to serve all of the projected developable wind resources in Wyoming and the proposed transmission projects, roughly between 10,000 MW and 15,000 MW.

Such a conceptual (or “master”) plan is typically used to provide a framework on which to evaluate smaller incremental projects to ensure they ultimately fit into a coordinated larger system, similar to the way a city plan forms a framework for reviews of individual developments. The Task Force employed traditional transmission planning steps to develop a range of scenarios based on different system inputs, outputs and interconnection configurations. One of the fundamental objectives in long-range planning for any type of infrastructure is to provide flexibility for a range of potential outcomes without unduly prejudicing any particular outcome.

As shown in the following figures, the Task Force designed a number of conceptual collector systems that would deliver wind energy to the hubs of the proposed Wyoming transmission projects.





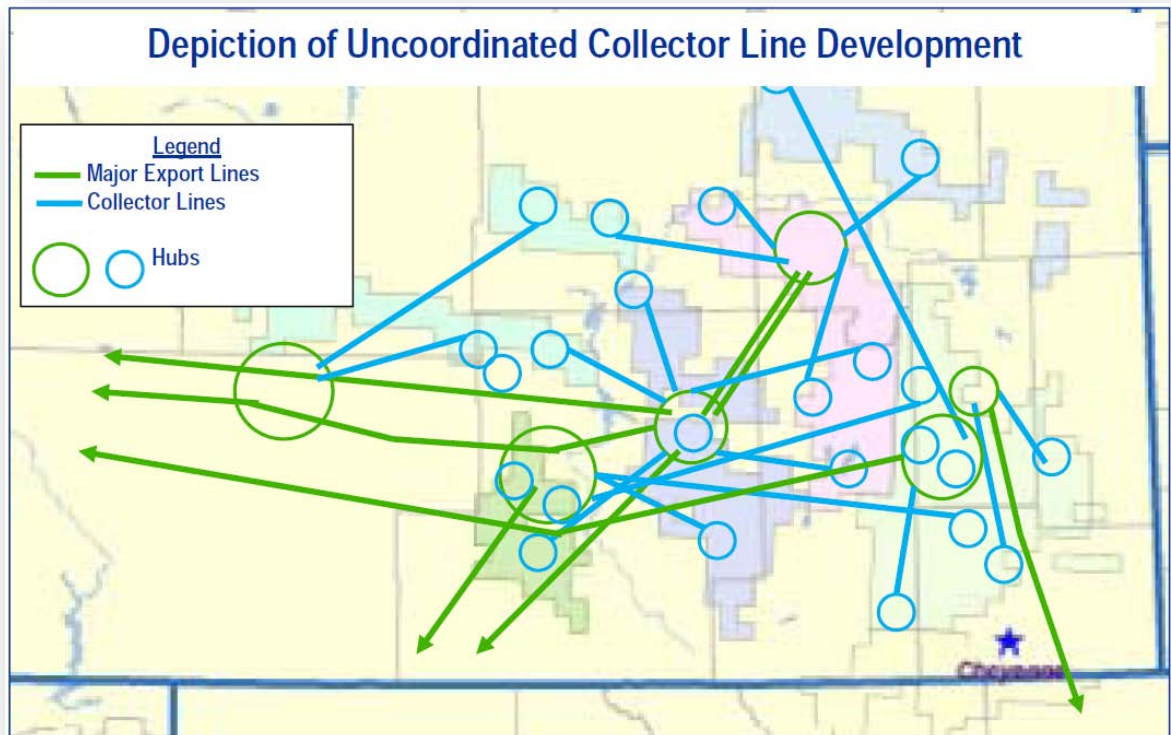
Two resource development scenarios were examined to capture the range of possible wind generator development outcomes that would most impact the collector system design. Given the location of the transmission hubs and potential resource areas, the biggest factor that will impact the collector system design is the relative amount of wind development in south-central versus eastern Wyoming. The colored areas depicted on the hub maps are the areas with the highest development potential based on a detailed screening of development factors including wind speed, site development and environmental constraints.

With the majority of capacity being built to exit Wyoming towards the west, the cost and environmental impact of the collector system will be greater as more wind development takes place in the eastern part of the state.

The greater cost and impact of the collector system will ultimately be balanced through a series of decisions by numerous developers as they weigh the relative economics of various wind regimes and development risks inherent in various locations. While the south-central areas may have higher wind speeds and are located closer to the target markets, the eastern resources may be seen as having lower development risk due to the Sage Grouse Core Area Strategy recently implemented by the State of Wyoming.

The Task Force created what might be called an uncoordinated development scenario that could be imagined in an environment where there is no coordinated development of the collector system. The characteristics of this scenario are under-utilized, duplicative, and criss-crossing lines throughout Wyoming. While it is hard to imagine such a system would be built, there is little to point to in the current generation tie line commercial framework (see the challenges section for more explanation) that would help coordinate development. This scenario is constructed as a worst case scenario. It may be more likely that generators would seek to use the nearest available transmission hub, even though this would limit their marketing flexibility.

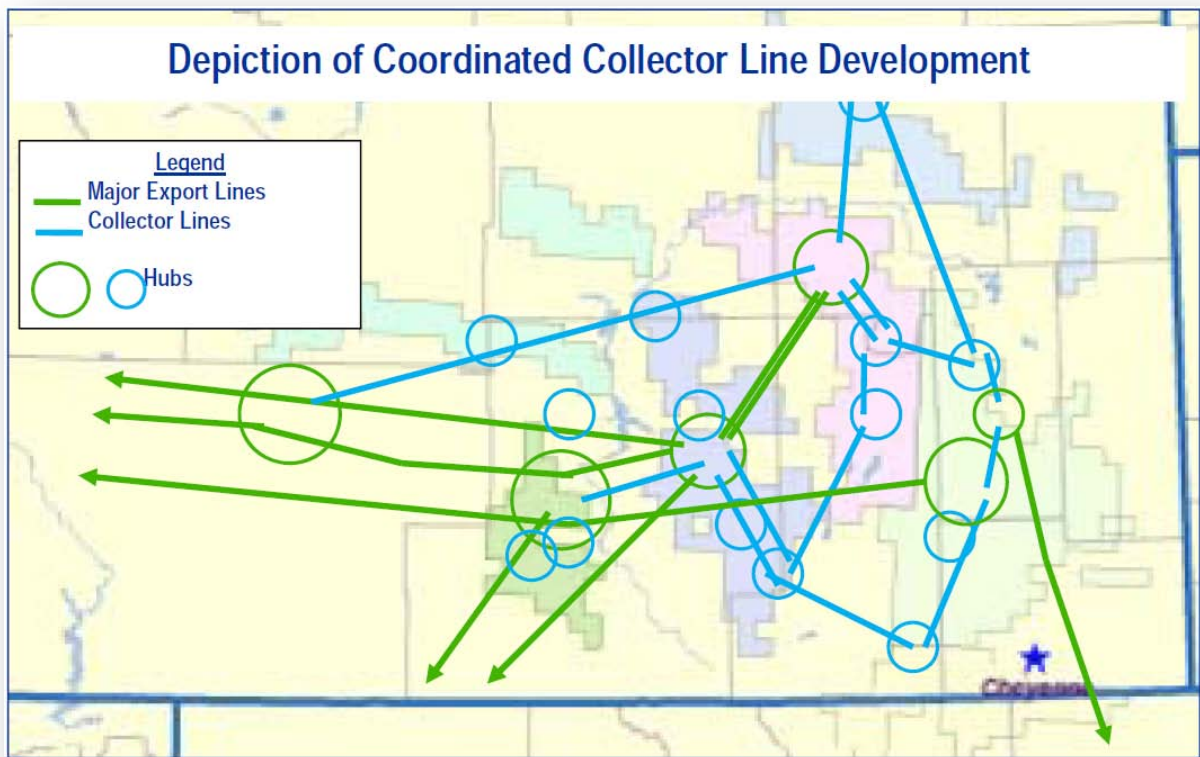
Note that the map shown is for a central Wyoming-dominated wind resource development. The eastern Wyoming development scenario would have all of the collector lines ending in the east and routed through the Laramie Mountain Range.



The Task Force considered several alternate coordinated collector system designs, each featuring a different degree of interconnectivity between the hubs and the wind generation sub hubs. The Task Force hasn't reached any conclusive determinations on the optimal configuration; however, some general findings are that the alternatives all cost approximately the same and include the same amount of lines.

Generally, the more interconnectivity between hubs and sub hubs, the more flexibility and reliability the grid provides; however, these benefits come at a slightly increased price. The order of magnitude cost for the collector system to support a 10,000 MW to 15,000 MW Wyoming wind industry is preliminarily estimated to be on the order of \$5 billion.

Below is a map that shows one of the more integrated collector system networks considered. Note that the collector system maps do not include the necessary generation tie lines that would be needed to connect the hubs or sub hubs to the respective wind generating facilities.




7. Conclusion: Findings and Opportunities

The Wyoming Wind Collector and Transmission Task Force set out to develop a conceptual plan for a coordinated transmission network within Wyoming to collect wind energy from the potential resource areas to the hubs of the proposed transmission lines. This long-range plan is scaled to support the collection of between 10,000 MW and 15,000 MW of Wyoming wind capacity from regions throughout south-central and eastern Wyoming for delivery to markets in other Western states.

The scale of the collector system is significant, although it only represents about one-tenth of the overall in-state economic development that the system would support within Wyoming. Given the immense scale of the in-state overhead transmission system required, the Task Force concludes that some form of coordinated collector system is essential to the effective, efficient and environmentally responsible development of Wyoming's vast wind resources.

The Task Force reviewed alternative collector system designs to accommodate the full scale development under several wind deployment scenarios and found:

- The scale of the collector system would be several hundred miles of 500 kV and 230 kV lines throughout south-central and eastern Wyoming, and the estimated cost would be on the order of \$5 billion.

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- The amount of in-state transmission would increase relative to the amount of eastern Wyoming resources developed due to the westerly direction of export from the state.
 - There are several design alternatives to be considered that would impact flexibility, reliability and cost. Within all alternatives, sole-purpose generation tie lines would be utilized to connect the wind generation facilities to either the collector system or directly to one of the transmission hubs.
 - There are elements of the existing and planned transmission system that may be expanded to serve as part of the overall collector system.

These are preliminary findings, and additional analysis is required before recommendations on these aspects could be made.

There are a number of challenges in the development of any form of a regional infrastructure system. Electric transmission has been found to be one of the more difficult types of infrastructure to develop because of the unique commercial and technical challenges. There are currently six proposed Wyoming transmission lines in advanced stages of development within Wyoming. The developers of these projects have taken on these very difficult challenges to develop very large-scale multi-state transmission projects under a variety of commercial models. These developers see the opportunity to serve the emerging wind and the overall energy industry of Wyoming and the needs of the West's consumers in large metropolitan areas for decades to come.

One common element needed to support the wind industry in Wyoming is a degree of certainty that wind developers will be able to gain access to these remote markets at a cost that maintains their competitive position with respect to the wide array of alternatives to Wyoming resources. The utilization of the existing commercial arrangements for transmission development have been found to be a significant constraint on the development of large scale wind collection systems throughout the country.

Other states have implemented new transmission development frameworks that could be modified to work in the case of Wyoming. Wyoming is unique from these other states that have developed specific renewable energy, primarily wind, collection system frameworks, in that the ultimate customers of the system are not located within the state or more specifically the same regulatory jurisdiction. Implementation of a federal or regional renewable energy transmission cost allocation framework is unlikely to happen in a timely manner without significant changes in state and federal law.

The Task Force believes there may be a unique opportunity in Wyoming to develop some form of public/private partnership that could develop an in-state collection system to serve the wind industry and the citizens of Wyoming through development of a coordinated system.

There is already a federal transmission network presence in Wyoming; there is a state authority with the mission to enhance Wyoming's economy through transmission development that has been authorized by Legislature to provide private bonding for transmission and generation tie lines. As mentioned earlier, there are several private companies utilizing different business models that are actively developing transmission expansion in Wyoming.

The Task Force has initially focused on the technical aspects of the collector system and has only been able to complete a high-level conceptual planning effort. The Task Force will continue to refine this technical evaluation and start to focus on a commercial evaluation. Therefore, the Task Force has only been able to define the need and potential opportunity for a public/private partnership to coordinate expansion of Wyoming's transmission system.

Other opportunities identified by the Task Force include:

- Coordination among federal, state and local permitting processes potentially through the development of a coordinated corridor plan that expands upon the federal west-wide energy corridors.
- Public recognition by the Wyoming State Legislature of the economic development opportunity by expanding Wyoming's energy portfolio to include renewable energy development and transmission development in an environmentally responsible manner.
- A significant level of transmission, wind generation and generation tie line development is under way within Wyoming. Any legislative or policy enhancements considered should be screened to ensure that developers are not burdened with any unintended barriers to continuing with development and operation.

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