FINAL REPORT PART I
WIND POWER RESOURCE ASSESSMENT
WARM SPRINGS RESERVATION TRIBAL LANDS
REPORT NO. DOE/GO/12103

SUBMITTED BY
WARM SPRINGS POWER & WATER ENTERPRISES
A CORPORATE ENTITY
OF
THE CONFEDERATED TRIBES
OF WARM SPRINGS
WARM SPRINGS, OREGON

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Notice

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Introduction and Project Summary

In 2002, the Confederated Tribes of Warm Springs were awarded a U.S. Department of Energy (DOE) grant to complete a comprehensive wind energy resource assessment and development feasibility study. A consultant team consisting of Warm Springs Power and Water (WSPWE) staff, Warm Springs Department of Natural Resources staff, researchers from Oregon State University (OSU), DW McClain and Associates, Bussard Engineers, Elcon Associates, Northwest Wildlife Consultants, and HDR/Brown, Vence & Associates was assembled to provide expertise in wind energy development and expertise regarding the site specific construction and operational constraints that must be incorporated into the wind energy development plan on the Warm Springs Reservation in central Oregon.

Wind energy resource development is attractive to the Confederated Tribes of Warm Springs because it can:

- Supply competitive electric power,
- Promote Tribal energy self-sufficiency,
- Reduce the environmental impact of energy consumption, and
- Provide economic development opportunities for the Tribes.

Monitoring and data collection were performed for two years on several sites to identify the area with the greatest potential for an economically viable wind power project. The Mutton Mountain site was identified as the most promising location for wind energy development, based on initial wind resource data collection, wildlife studies, and road and transmission access. An additional 12 months of detailed wind energy monitoring on the Mutton Mountains was subsequently undertaken to more thoroughly characterize the wind resource on the site and create a preliminary project design and economic analysis. Additional information was gathered regarding transmission access, road access, potential wildlife impacts, construction costs, permitting, financial incentives, and other factors affecting the feasibility of developing a utility scale wind power project on the Warm Springs Reservation.

The Mutton Mountains region presents an attractive site for wind power development, with an estimated annual average capacity factor of 29-33%. Preliminary economic models show returns on investment may be commercially viable. Returns will depend on the financial structure for development, the ability of the Tribes to capture and take advantage of incentives such as the federal Production Tax Credit (PTC), the changing prices of capital equipment in the current market, further detailed cost estimates for road upgrades, infrastructure requirements, siting studies, transmission interconnection, and detailed project design.

This study was funded by the DOE grant awarded under solicitation number DE-FC36-02GO12103. This report summarizes the results of work completed by the consultant team to date. It also presents an analysis of the wind resource, site, equipment, transmission, legal, and financial considerations, and the development scenarios currently under consideration by the Tribe.

Some parts of this report contain sensitive business information, and are considered confidential, not for public release. These parts are contained in a separate document, Warm Springs Wind Resource Assessment, Part II.

Project Background

The Confederated Tribes of Warm Springs

The Confederated Tribes of Warm Springs Reservation is located along the banks of the Deschutes River flanking the Eastern slopes of the Cascade Mountains in central Oregon. Home of the Warm Springs, Wasco and Paiute tribes, The Warm Springs Reservation is inhabited by over 4,000 tribal members, most of whom live on the Reservation.

Warm Springs Power and Water Enterprises (WSPWE)

Warm Springs Power and Water Enterprises (WSPWE) is a corporate entity owned by the Confederated Tribes of the Warm Springs, and is responsible for managing the Tribes' energy resources. WSPWE operates under the Plan of Operations approved by the Tribal Council. WSPWE is governed by an independent Board of Directors appointed by the Tribal Council. In 1955 the Tribes granted Portland General Electric the right to construct the Pelton/Round Butte Hydro Electric Project in exchange for payments under section 10 (e) of the Federal Power Act. The project consists of the Pelton dam, the Round dam and the Re-regulating dam (the Project). As part of the agreement, the Tribe reserved the right to install power generation at the Re-regulating Dam. In 1982 the Tribe installed generation at the Pelton Re-regulating Hydroelectric Dam under a PURPA contract with Pacific Power and Light. In 2001 as part of the relicensing process of the Project, the Tribes entered into a Global Settlement Agreement with Portland General Electric and became 33.33% owners of the Project. Prior to the end of the license period, the Tribe will be 50.01% owners of the Project. As part of the purchase, the Tribe became the first Tribe in the United States to issue revenue bonds for the purchase of an energy resource. WSPWE manages the Project on behalf of the Tribe. Power is currently sold to PGE under a combination of fixed price forward contracts and daily market sales.

With its considerable experience and success managing power and energy projects, WSPWE is currently investigating the potential to further develop the rich renewable energy resource potential on tribal lands, including geothermal, biomass, and wind power projects.

Drivers for Wind Energy Development on Tribal Lands

Wind power generation represents an opportunity for the Confederated Tribes to stimulate local economic development, while preserving air and water quality and ecosystem health, and conserving natural resources for future generations. Tribal Council is constantly considering new and varied sources of revenue to foster a sustainable and thriving economy. Wind energy is a local resource that has potential to accomplish these goals, while also reducing the environmental footprint of this economy.

Renewable power generation produces none of the harmful emissions produced by traditional fossil-fuel sources of power such as coal and natural gas. Utility scale wind farms can offset emissions of carbon dioxide (CO_2), sulfur oxides (SO_x), nitrous oxides (NO_x), and particulate matter (PM) that would otherwise be emitted by traditional fossil-fueled power plants. NO_x, SO_x, and PM contribute to local and regional air quality issues such as acid rain and smog, as well as being linked to health effects such as respiratory illness and asthma. Greenhouse gas emissions from fossil-fueled power plants, such as CO_2, are recognized by the international scientific community to contribute to global climate change via the greenhouse effect. Generation of 250 GWh per year from wind energy (roughly the amount produced by the proposed 100 MW wind farm) would be enough to meet the energy needs of 25,000 homes, and offset over 45,000 metric tons of CO_2, 69 metric tons of SO_2, and 58 metric tons of NO_x emissions, from power otherwise produced by the Oregon average electricity mix[1]. Over the course of a wind facility's expected lifetime, this would eliminate over 670,000 metric tons of CO_2, 1,000 metric tons of SO_2, and 860 metric tons of NO_x.

Proposed Project

As indicated in its charter, WSPWE is responsible for evaluating and developing renewable energy resources for the Warm Springs Confederated Tribes. WSPWE has been conducting an ongoing wind energy assessment of the Reservation lands since 2002 for commercial, utility scale, and wind energy development. Several locations have been evaluated through this assessment, and the Mutton Mountain site has been identified to have sufficient wind potential to support a commercial wind energy project. The project development team has completed preliminary wildlife studies, preliminary transmission interconnection studies, preliminary development concept, annual energy production estimate, and economic analysis. A utility scale, 69-100 MW wind power project is proposed, to take advantage of the wind resource at the site.

Site Location

The Warm Springs Reservation is located in north central Oregon, south of the Columbia River and west of the Deschutes River. A wind resource map of the Warm Springs Reservation and surrounding area is provided in Figure 1.

[1] EIA, 2006. http://www.eia.doe.gov/cneaf/electricity/st_profiles/oregon.html

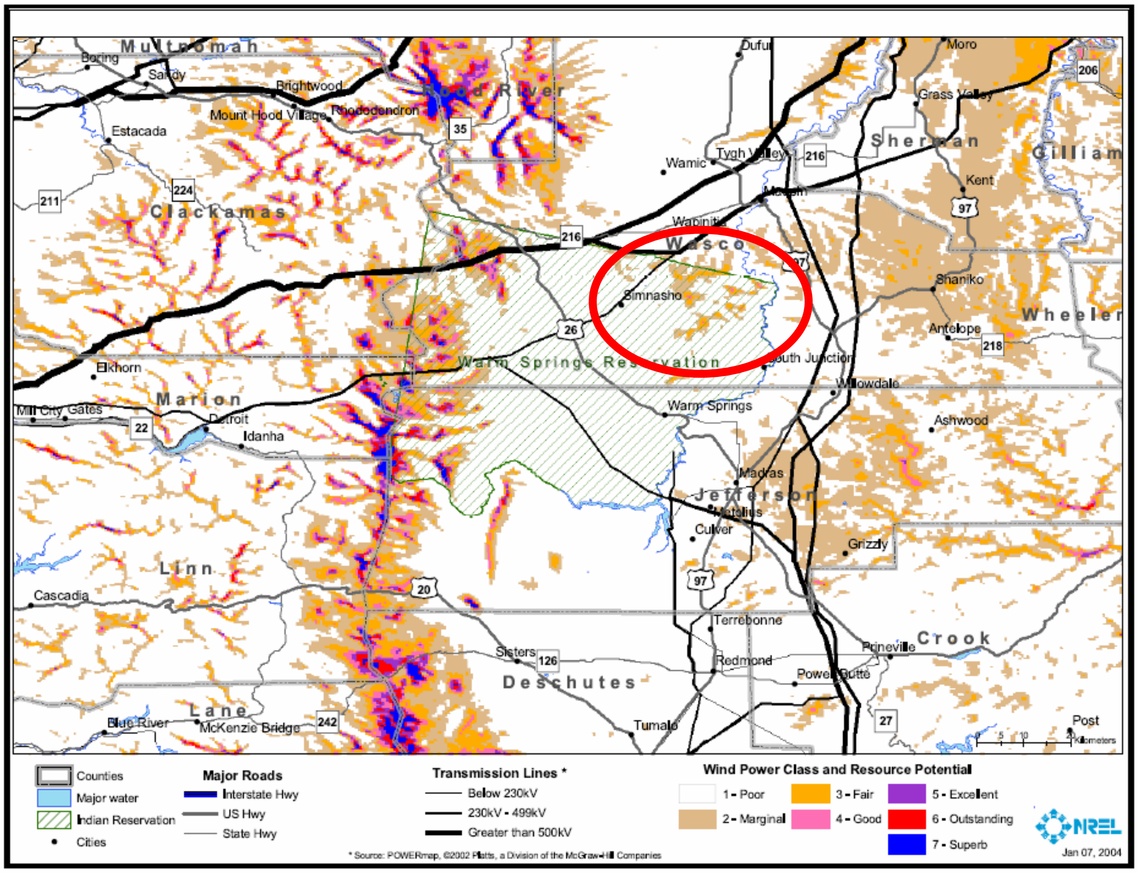

Figure 1 – Map of wind resources in the Warm Springs area at 50 m height. Green lines denote Tribal lands. Black lines denote transmission lines. The area under study is circled in red. Source: U.S. Department of Energy, National Renewable Energy Laboratory, 2006.

Work completed to date

A comprehensive wind energy assessment has been ongoing on the Reservation since 2002. Between 2003 and 2005, winds were monitored on four sites on the Reservation: Handley Ridge, Mutton Mountain, Eagle Butte, and Island Ridge.

Mutton Mountain and Shaniko Butte were identified as the most attractive of the four sites, due to factors including local wind resource quality, accessibility by road, environmental, cultural, and transmission interconnection considerations. Additional wind monitoring towers were installed on Mutton Mountain and Shaniko Butte in April-May 2005. One full year of wind data has been collected on five towers throughout the proposed Mutton Mountain site, and correlated to nearby long term wind records.

The following participants have been involved with the wind resource assessment, along with the Confederated Tribes of Warm Springs (CTWS):

- Warm Springs Power & Water Enterprises (WSPWE)
- Confederated Tribes of Warm Springs (CTWS) Dept. of Natural Resources
- DW McClain and Associates: Project Management

- Oregon State University (OSU) Energy Research Laboratory: Wind Modeling and Annual Production estimate
- Elcon Associates: Transmission System Studies
- Northwest Wildlife Consultants: Biological Review
- Windots, LLC: Wind Modeling Review and Preliminary Design Concept
- HDR/BVA: Feasibility Coordination, Preliminary Design, Market Characterization, and Economic Modeling

Each of these studies will be discussed in further detail in later sections of this report.

Initial Meteorological Data Review[2]

Between 2003 and 2005, winds were monitored on four sites on the Reservation: Handley Ridge, Mutton Mountain, Eagle Butte, and Island Ridge. The locations of these sites are shown in Figure 2.

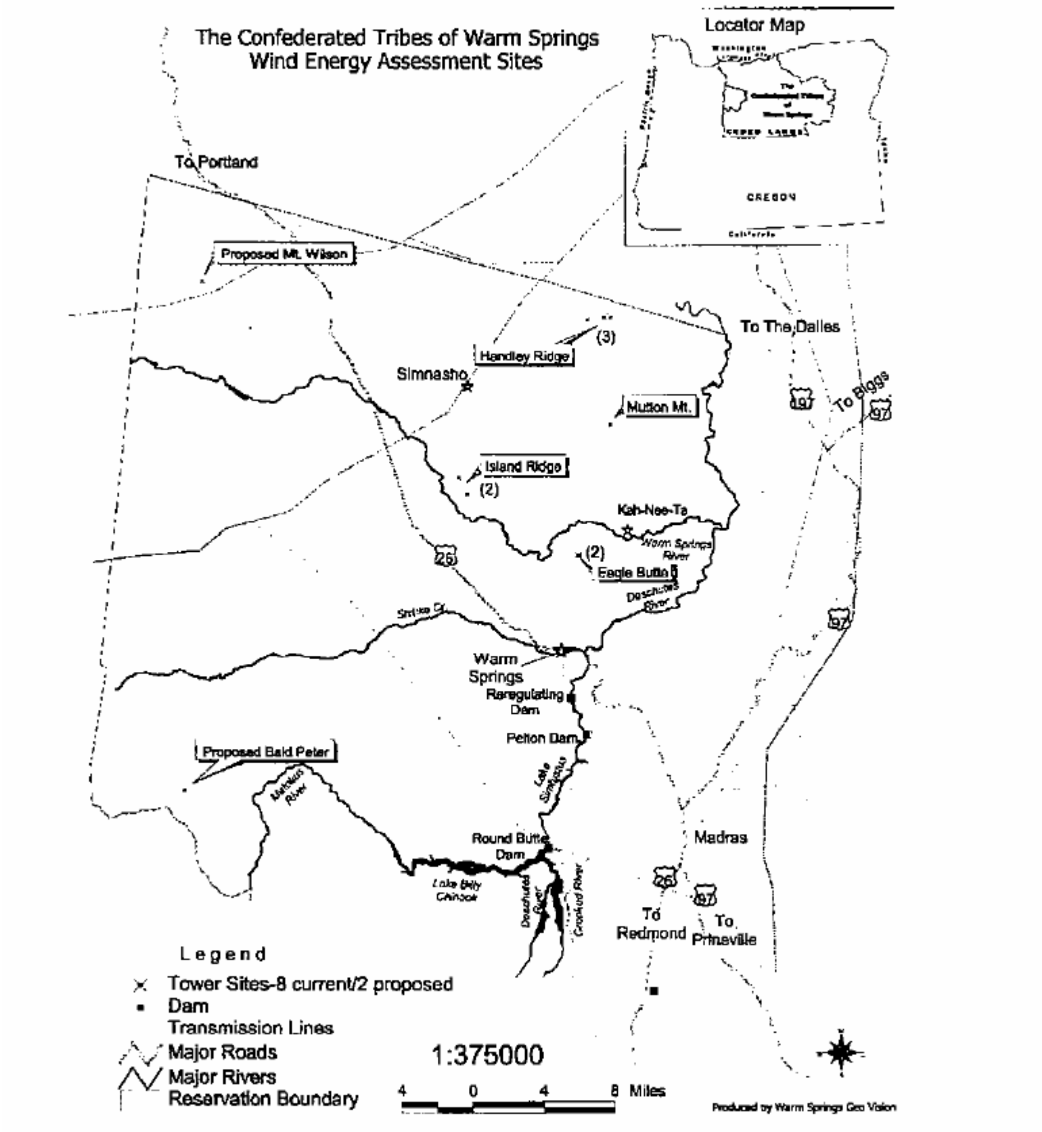

Figure 2 – Wind monitoring sites on the Warm Springs Reservation 2003-2005.[3]

Mutton Mountain and Shaniko Butte were identified as the most promising sites, due to wind resource, accessibility, environmental, cultural, and transmission factors. Additional

[2] Material in this section was contributed from Stel Walker's "Warm Springs Wind Energy Production Estimate" OSU Energy Resources Research Lab, 2006. This study is attached as Appendix A.
[3] Walker, Stel. "Warm Springs Energy Production Estimate."

wind monitoring towers were installed on Mutton Mountain and Shaniko Butte in April-May 2005. One full year of wind data has been collected on four towers throughout the Mutton Mountain site, in addition to the three prior years of data collected on the 1st tower on the site. One full year of data has also been collected from one tower on Shaniko Butte, from June 2005 to 2006. The towers were assembled with the help of WSPWE, Tribal members, and consultants, and the data was monitored by researchers from OSU. The towers remain in service, and wind data collection is ongoing at the time of this writing. Plans for additional wind monitoring towers, as well as investigation into sodar and lidar wind monitoring technologies, are under consideration at the time of this writing. The location of the existing monitoring towers is shown in Figure 3.

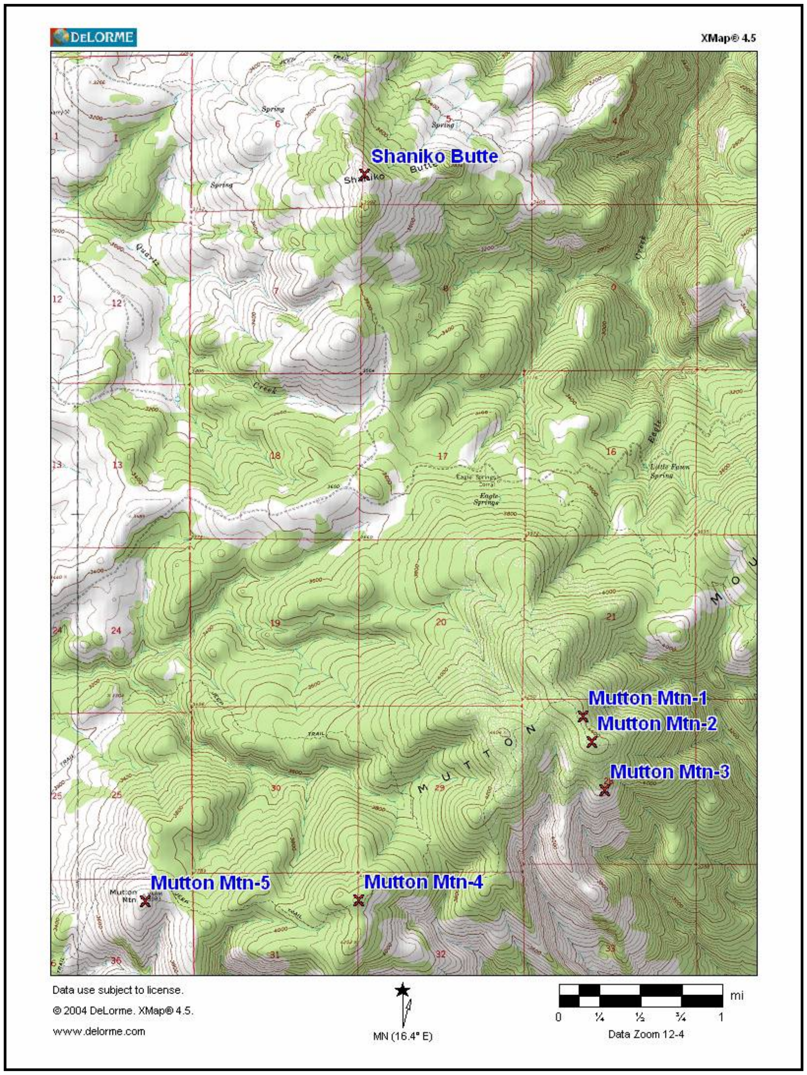

Figure 3 – Monitoring tower locations.[4]

Data collected over the course of study indicate an average wind speed, at 50 m height, of 6.7 meters per second at the Mutton Mountain site. Although annual average wind speed

[4] Ibid.

is a relatively poor indicator of resource quality, this roughly characterizes the wind resource as Class 3 (as compared to the best wind resources – Class 7 – averaging greater than 19.7 mph at this height). Table 1 shows the classification scheme for wind power resources, and the yellow highlighting identifies the Mutton Mountain wind resource on this scale. Since factors such as turbulence, wind shear (variation in wind speed with height from the ground), wind direction, and strength of gusts, all significantly affect the quality of the wind resource, and annual average wind speed does not capture these characteristics, wind class must be considered a very rough estimation of wind resource quality.

Table 1 – Wind Resource Classification

Class	Description	Speed at 50 m height m/s (mph)
1	Poor	<5.6 (12.5)
2	Marginal	5.6 – 6.4 (12.5 –14.3)
3	Fair	6.4 – 7.0 (14.3– 15.7)
4	Good	7.0– 7.5 (15.7 – 16.8)
5	Excellent	7.5 – 8.0 (16.8 – 17.9)
6	Outstanding	8.0 – 8.8 (17.9 – 19.7)
7	Superb	>8.8(19.7)

The maximum hourly mean wind speed at the Mutton Mountains site was determined to be about 27 meters per second (60 mph). The maximum 2-second gust recorded during the monitoring period was 40 meters per second (90 mph). These characteristics will be important for final turbine technology selection. The final engineering design will include a consideration of turbine cut-out speed (the wind speed at which the turbine must shut down), gust frequency and direction, wind shear due to the complex terrain of the ridge, and other factors such as humidity, frequency of icing conditions and storms, etc.

Preliminary Number and Type of Turbines

OSU researchers initially proposed two alternative turbine array designs, in order to estimate rough annual energy production for the site. Industry standard turbine spacing principles were used to populate five ridges with turbines: four ridges on the Mutton Mountain site, and one ridge at Shaniko Butte. OSU proposed rough array designs, using 1.5 MW turbines and 2.5 MW turbines manufactured by GE, as outlined in Table 2.

Table 2 – Number of turbines installed on each ridge, as initially modeled by OSU.

Ridge Identification Number (East to West)	Number of turbines (1.5 MW each)	Number of turbines (2.5 MW each)
1	14	11
2	11	8
3	9	7
4	7	6
Shaniko	8	7
Totals	49 turbines (73.5 MW)	39 turbines (97.5 MW)

The OSU annual energy production estimate shows that the 1.5 MW turbines may provide a slightly higher capacity factor (leading to greater annual energy sales revenues) than the 2.5 MW turbines. HDR's engineering review remarks that the greater number of smaller turbines may also entail higher construction costs, due to greater number of construction operations required (greater number of foundations poured, towers constructed, turbines assembled, and number of times the cranes must be moved to assemble each turbine). The 2.5 MW turbines have the advantage of economies of scale. Although the larger turbines may involve higher transport costs, the reduced number of construction operations is likely to significantly reduce the per-MW capital cost of the project.

Figure 4. Example illustration of tower assembly, Mars Hill, Maine.

Figure 5. Example illustration of 1.5 MW wind turbine assembly, on an 80 m (260 ft) tower, in Atlantic City, NJ.

As can be seen in Figure 4, assembly of the tower, nacelle, rotor and blades, requires several labor- and resource-intensive operations, and any reduction in number of operations can significantly reduce the construction cost for the project.

Site Considerations

Terrain

The Mutton Mountains are a complex series of ridges running north to south at elevations of about 3800-4000 feet above sea level. The area of interest is approximately 7 to 8 square miles of land, about 8 miles north of Ka-Nee-Tah Resort. The Engineering Cost Estimate Proposal for Wind Energy Development estimates that 10 miles of ridgelines are available for turbine construction.[5] Some of these ridgelines are forested, and some are exposed.

The complex terrain and limited access roads are of primary concern for the Mutton Mountain site. Currently, the only way to access the proposed turbine locations is via primitive dirt logging roads (Figure 6). A detailed engineering study is required to determine the quality and turning radius of these existing roads, and to estimate the costs of road upgrades, to meet turbine delivery and construction requirements.

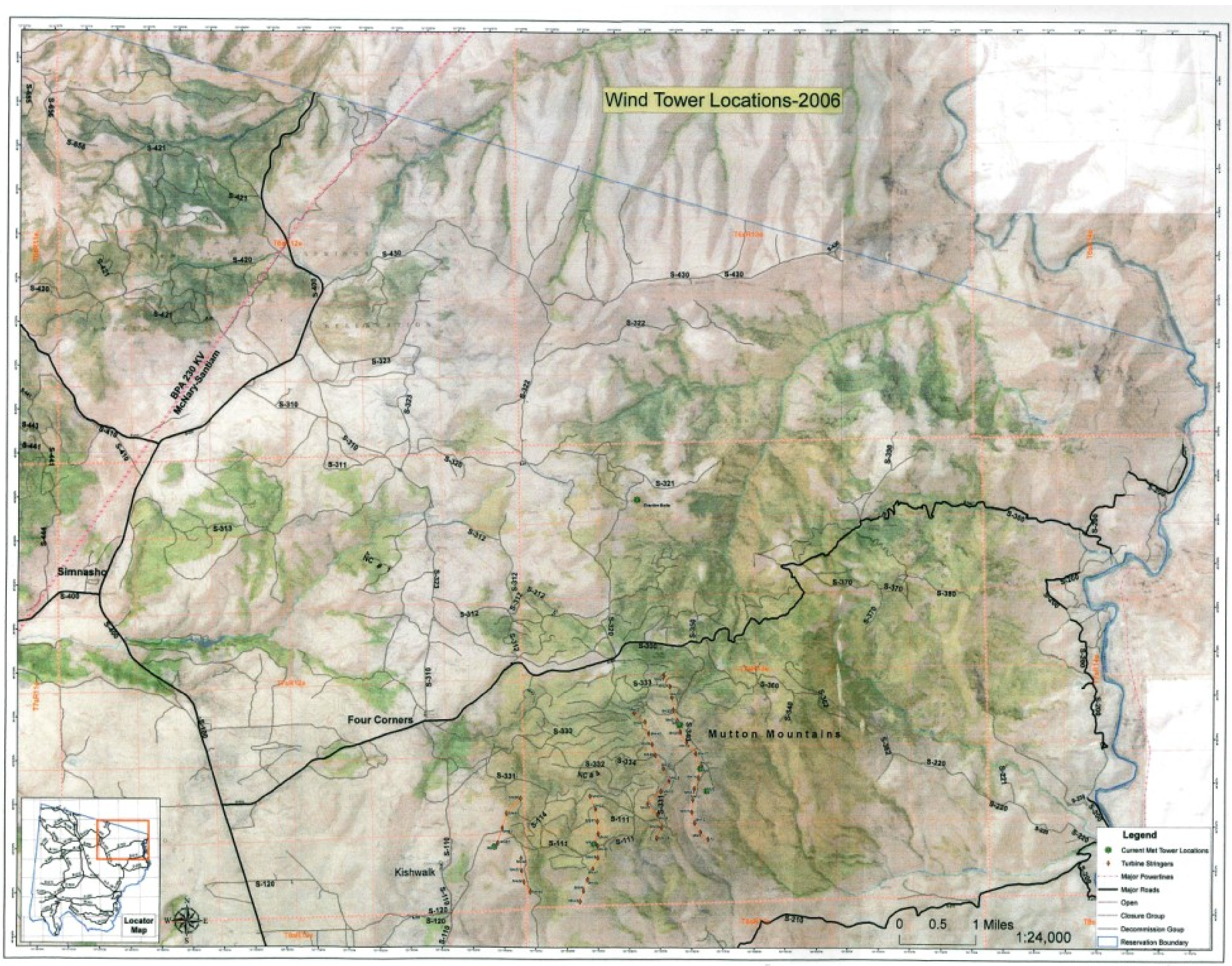

Figure 6. Site map with logging roads and existing transmission lines. This map is reproduced with greater resolution in Appendix A.

[5] WSPWE, 2007. Project Narrative Engineering Cost Assessment Proposal for Wind Energy Power at Mutton Mountain.

Utility scale wind project construction will involve the delivery of truck loads of concrete, steel, turbine towers, turbine blades, and nacelles. Figure 5 shows a large wind turbine blade in transport. These loads require very long trailers that have unique requirements regarding the turning radius, slope, humps and dips in the road. Each blade can require a vehicle over 220 feet long, with as many as 19 axles.[6] Turbine blade delivery typically requires a turning radius of at least 200 feet. Access roads commonly need to be 16 feet, with 10 foot shoulders on either side for a total width of 36 feet. Special road provisions are required on ridges, in order to walk cranes from turbine to turbine as much as possible, to avoid the costs associated with disassembling cranes for relocation, and re-assembly for each turbine erection.

Figure 7 – Truck load with one 2.5 MW turbine blade.

HDR's wind power engineering experience indicates that road grade should generally not exceed 10%, however up to 14% grade can sometimes be tolerated in mountainous terrain. Preliminary assessments of the existing roads at the Mutton Mountain site indicate that vertical grades of 13.8% are present on parts of Ridge 1. Roads in these areas may need to be modified to ensure that trailers can avoid sections with prohibitively steep grade, especially in sections with horizontal curves.

HDR has roughly estimated the cost of road construction, foundation work, and other civil work (based on experience with other wind projects) in the economic analysis for this report. However, a detailed engineering study is required, to identify the actual cost of road improvement and new road construction requirements, and to determine the geotechnical requirements for turbine foundations and heavy load delivery. The complexity of the terrain at this project site makes site-specific information particularly important. .

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[6] Oregon Department of Transportation, 2007. OTIA III State Bridge Delivery Program. http://www.oregon.gov/ODOT/HWY/OTIA/news_windmills.shtml

Potential Environmental Impacts

Northwest Wildlife Consultants, Inc. (NWC) conducted an initial wildlife resource review at the site, the results of which can be found, in detail, in "Warm Springs Wind Power Project: Initial Wildlife Reconnaissance", prepared by NWC on April 29, 2006 (Appendix B).

This initial review provided a brief assessment of species and habitats of concern that have been found or documented in the project area. This report "is not meant to be comprehensive enough to address all biological resources and potential project development impacts or to estimate fatalities of birds and bats. The initial information combined with results of site-specific field studies [will be] used during the planning phase of the project… to more thoroughly reduce or eliminate impacts to wildlife and/or habitat.[7]"

NWC found that the area is dominated by habitat typical of mid-elevation zones including grassland, shrubs, and coniferous trees. These habitats support numerous species of grassland birds, neo-tropical migrant songbirds, woodpeckers, elk and deer, smaller mammals, and larger carnivores like coyotes and cougars. Particular species of concern located near the area – those listed on Federal and State Threatened, Endangered, Candidate, and Sensitive-Status (TES) lists – include: Bald Eagle, Golden Eagle, Red-Tailed Hawk, Peregrine Falcon, Prairie Falcon, Flamulated Owl, Lewis' Woodpecker, Colombian Spotted Frog, Western Toad, and Silver-Haired Bat.

The primary species of concern for wind power development in the Mutton Mountain area, as identified in NWC's Initial Wildlife Reconnaissance report, are outlined in the figure below.

[7] Northwest Wildlife Council, Inc. 2006. Warm Springs Wind Power Project Mutton Mountain Vicinity Initial Wildlife Reconnaissance. Pendleton, OR.

Species	Federal Status	State Status	Status on Tribal Land
Bald Eagle	T, EPA		CS (one pair nests in the general area, site location withheld from this report)
Golden Eagle	EPA, BoCC		CS (need to list nearest known nest)
Red-tailed Hawk	N	N	CS
Owls (various species)	N	N	CS
American Peregrine Falcon	NW, BoCC	E	
Prairie Falcon	N	N	CS
Lewis's Woodpecker	N	SC	
Mule Deer	N	N	CS
Rocky Mountain Elk	N	N	CS
Big Horn Sheep	N	N	RP

Protection Status

Federal:

T Threatened
E Endangered
C Candidate
SoC Species of Concern
NW Not Warranted; delisted
EPA Eagle Protection Act
BoCC USFWS Birds of Conservation Concern (BCR 9, Great Basin)
Priority List 2 – Priorities for listing review are assigned to Candidate Species (USFWS 2004)
Note: All native migratory birds are protected by the Migratory Bird Treat Act (MBTA).

Oregon:

T Threatened
E Endangered
SC Critical; listing as threatened or endangered is pending or may be appropriate if immediate conservation actions are not taken.

Tribal: CS Culturally significant
RP Re-introduction Program

Note: Several species of passerines are also culturally significant for their colorful feathers (D. Calvin, pers. com.). They are Red-shafted Flicker, Mountain Bluebird, Western Bluebird, and Black-billed Magpie. Several mammalian species are also culturally significant because of their importance in Tribal lore. They are the Coyote and the Raven.

Figure 8. Primary wildlife species of concern for wind development in the Mutton Mountain area.

The initial survey did not identify any significant potential wildlife impacts. However, the results of this preliminary survey did not include data from breeding bird surveys or the Breeding Bird Atlas – two important data sources used to map sensitive species' habitat – because no inventories have been performed on tribal land. Basalt outcroppings near proposed turbine locations, and the high number of migrating raptors found in a survey conducted about 30 miles southwest of the site, both indicate the need for more detailed explorations into avian use of the area. A detailed wildlife and habitat assessment must be undertaken to determine the extent of possible impacts of wind development and to ensure that the risk associated with individual turbine placement is minimized.

Should planning move forward, NWC recommends submitting a formal data request on the presence of species of concern to the Oregon Natural Heritage Program and to the U.S. Fish and Wildlife Service. Also, the voluntary "Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines" can be consulted to guide additional monitoring and site design.[8] The cost of additional wildlife study is one component of the estimate of overall development costs used in the preliminary economic analysis. The actual cost will vary depending on how much additional monitoring is required by the permitting process.

Some photographs of the habitat in the area under consideration, and a map of the region's vegetation, are included below.

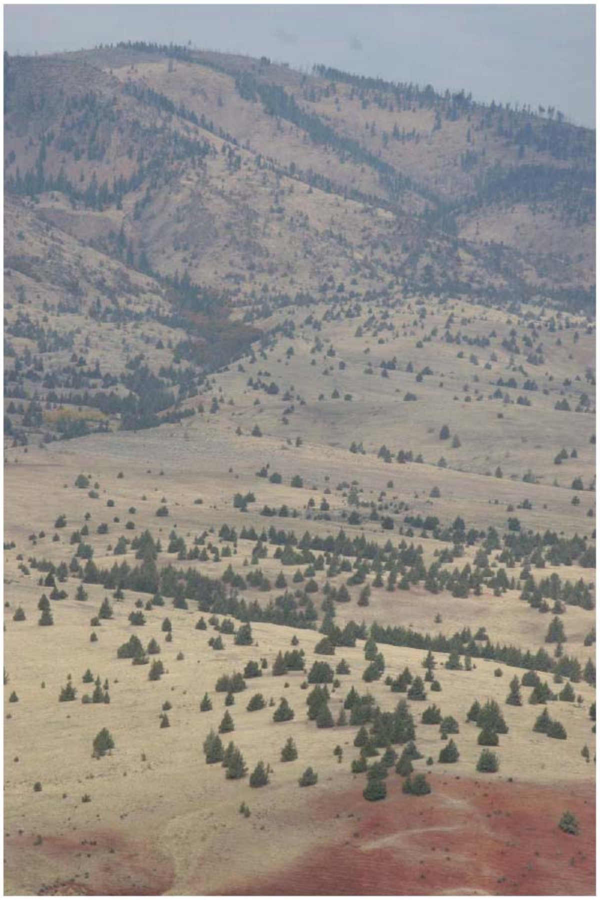

Figure 9. Looking northeast toward met tower 3 on ridge top.

[8] U.S. Department of the Interior Fish & Wildlife Service, 2003. Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines. http://www.fws.gov/habitatconservation/wind.pdf.

Figure 10. Habitat west of met tower 6.

Figure 11. Habitat south of met tower 6.

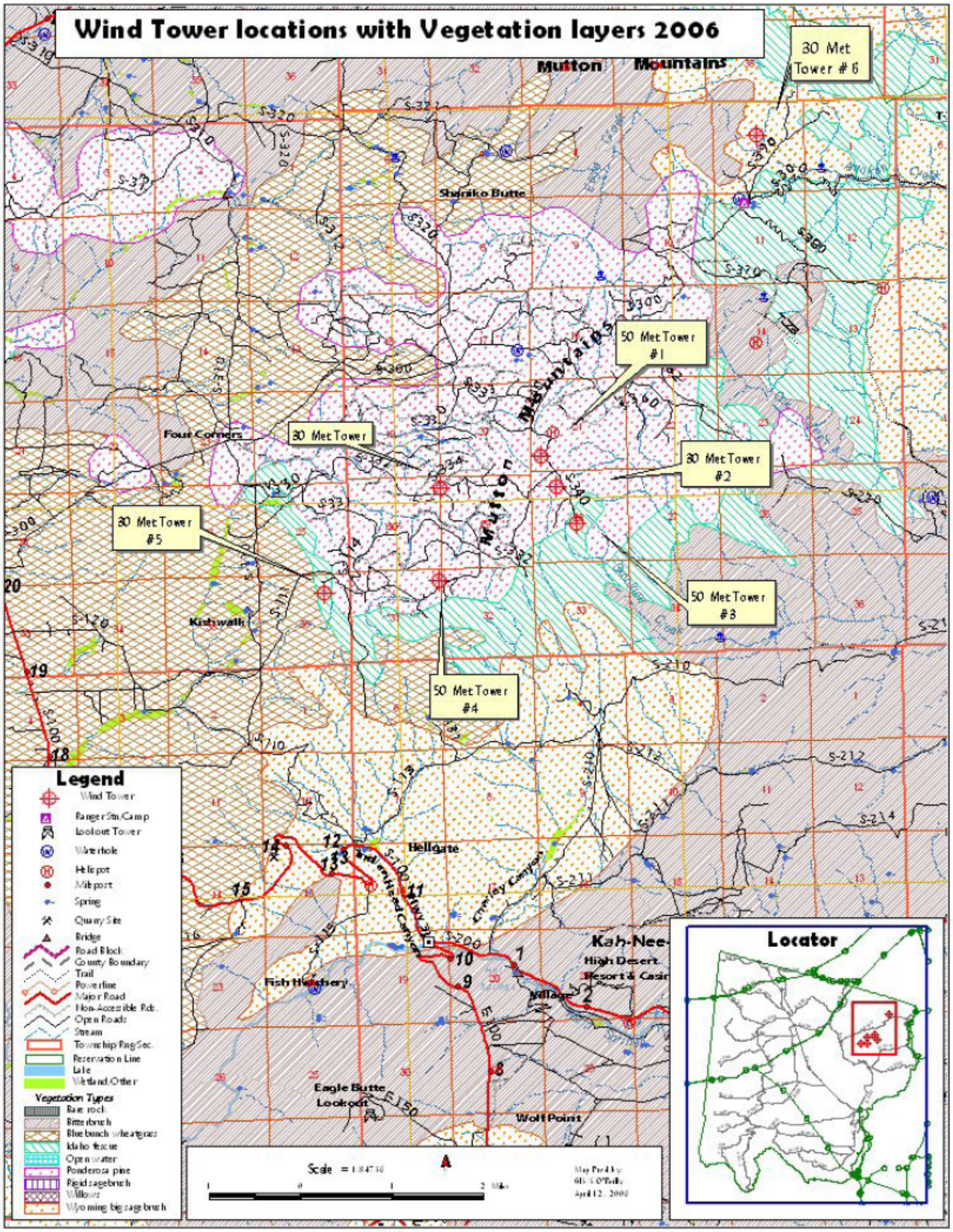

Figure 12. Map of vegetation layers, in region under consideration for wind power development

Land Ownership

In order to develop a wind power project on privately held land, land lease and wind easements, construction easements, and access easements are usually required. If WSPWE chooses to involve a private equity partner with a tax appetite, in order to take advantage of the Production Tax Credit, rather than owning the entire project outright, some kind of land rights/easements will be contracted. The lease typically guarantees legal rights for the project owner/operator to access and maintain their equipment on the land, for the expected life of the wind power project. Utilities, transmission owners, turbine manufacturers, and financing institutions typically require evidence of a clear and unencumbered lease, before signing a power purchase agreement, interconnection agreement, turbine supply agreement, or financing agreement.

The situation on tribal lands involves additional considerations. Title to most tribal and Indian lands is held in trust by the United States for the benefit of either the tribe or individual Indians called allottees. Accordingly, the United States must approve most leases and rights of way after finding that they provide for adequate compensation to the tribe or allottee.

Leases and rights of way on Warm Springs Tribal lands and allotments are governed by federal statutes and regulations and by tribal law. 25 USC §415 authorizes 99 year leases of lands within the Warm Springs Reservation, and of tribal lands outside the Reservation. Rights of way through Indian lands are governed by 25 USC §311 et. seq. Federal Regulations governing leases and rights of way are contained in 25 CFR Parts 162 and 169, respectively.

Since Tribes are sovereigns, just as state and federal governments are, the issue of sovereign immunity must be addressed in any contractual negotiations with Tribes to ensure that agreements are enforceable. Whereas this issue was an impediment to large commercial transactions with Indian tribes 20 years ago, it has now become routine to deal with this issue as many tribes have entered into development agreements in 8 and 9 figure transactions involving sophisticated financial entities. The Warm Springs Tribe has entered into a number of such transactions with energy companies, bond purchasers and lenders.

Transmission Access

The proximity of existing transmission infrastructure, and ability of the project to successfully interconnect, is critical components of wind project feasibility. Elcon Associates, Inc. has prepared a preliminary feasibility study on the transmission interconnection options for the proposed project. The detailed findings of this study are attached as Appendix C. This study was generated prior to the development of an additional interconnection option – a line that is under development at the time of this writing, to accommodate a biomass energy plant at the Warm Springs Saw Mill. An interconnection feasibility study and cost estimate, like the one performed by Elcon Associates, should be performed for this new transmission line.

Two existing interconnection options and one interconnection option currently in development, were evaluated in this wind resource assessment.

BPA 230 kV Transmission Line

Bonneville Power Administration (BPA) has right of way across tribal lands via a de-energized 230 kV double circuit, routed from Santiam Substation in Salem through the Reservation approximately 8 miles northwest of the proposed site. Some of the equipment on this line was salvaged by BPA and will need to be replaced before it can be reenergized. According to Elcon Associates, this line has the capacity to support a project as large as 100 MW at Mutton Mountain once the proper interconnection equipment is installed. The cost of installing the necessary transmission equipment and infrastructure upgrades required for connecting 100 MW to the grid via this circuit was estimated at $20.06 million.[9] This is the upfront project transmission cost, which could potentially be partially reimbursed, via transmission service credits, given out by BPA for improvements made to their infrastructure if BPA continues to own the line. The net cost after reimbursements was estimated to be $9.66 million.

Pacificorp 69 kV Transmission Line

A second option, for the smaller proposed project size, is to connect to the 69 kV Pelton Rereg circuit at the Warm Springs substation served by PacifiCorp about 16 miles south of the project site. Elcon estimates the cost of this interconnection scenario to be about $6.5 million. This interconnection option could support the smaller proposed project size, of 69 MW, without overloading the Regreg to Round Butte Circuit.[10]

New Transmission Line Under Development

A third option is to connect to a new line, which is under development to accommodate a biomass energy plant at the Warm Springs Saw Mill. This is likely to be a 115 kV line from Warm Springs that would connect to the PGE Round Butte Dam substation. This line is being designed to handle 115 kV; however, it will initially be energized at the lower voltage of 69 kV, until the higher capacity is needed to export power from the proposed wind energy facility. This option was not under development at the time of the initial transmission system studies report; therefore, cost estimates associated with interconnecting to the new line are not yet available. The transmission facilities will be located primarily on tribal land and will require tribal approval, a Federal Energy Regulatory Commission (FERC) Boundary Easement, and a United States Forest Service (USFS) Special Use Permit. WSPWE has already initiated the necessary approval processes and expects to complete construction by October, 2008.

The new transmission line appears to be the most attractive option, as it will likely be the shortest distance to the site, lowest cost, and owned by WSPWE. Connecting both the biomass facility and the wind facility to the new line will allow the Tribes to spread the

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[9] Elcon Associates, Inc. 2006. Mutton Mountain Wind Turbine Project: Transmission System Studies Report. Portland, OR.
[10] Ibid.

transmission equipment costs over multiple projects and avoid the costs required to upgrade transmission infrastructure in either of the other two interconnection options. Additional analysis similar to that conducted by Elcon Associates, Inc. must be performed, to more accurately determine the cost of connecting a utility-scale wind facility to this line.

Maps of the transmission lines near the site under consideration are included below:

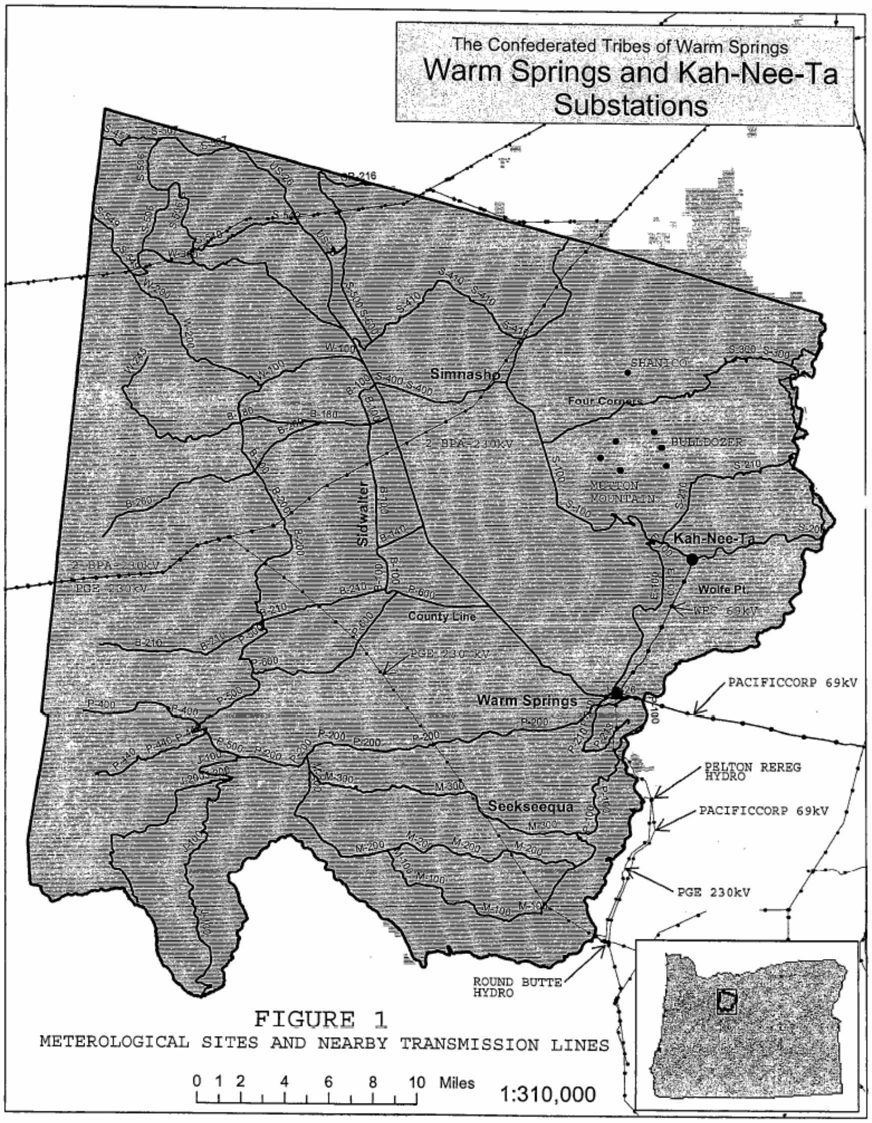

Figure 13. Map of transmission lines in vicinity of site.

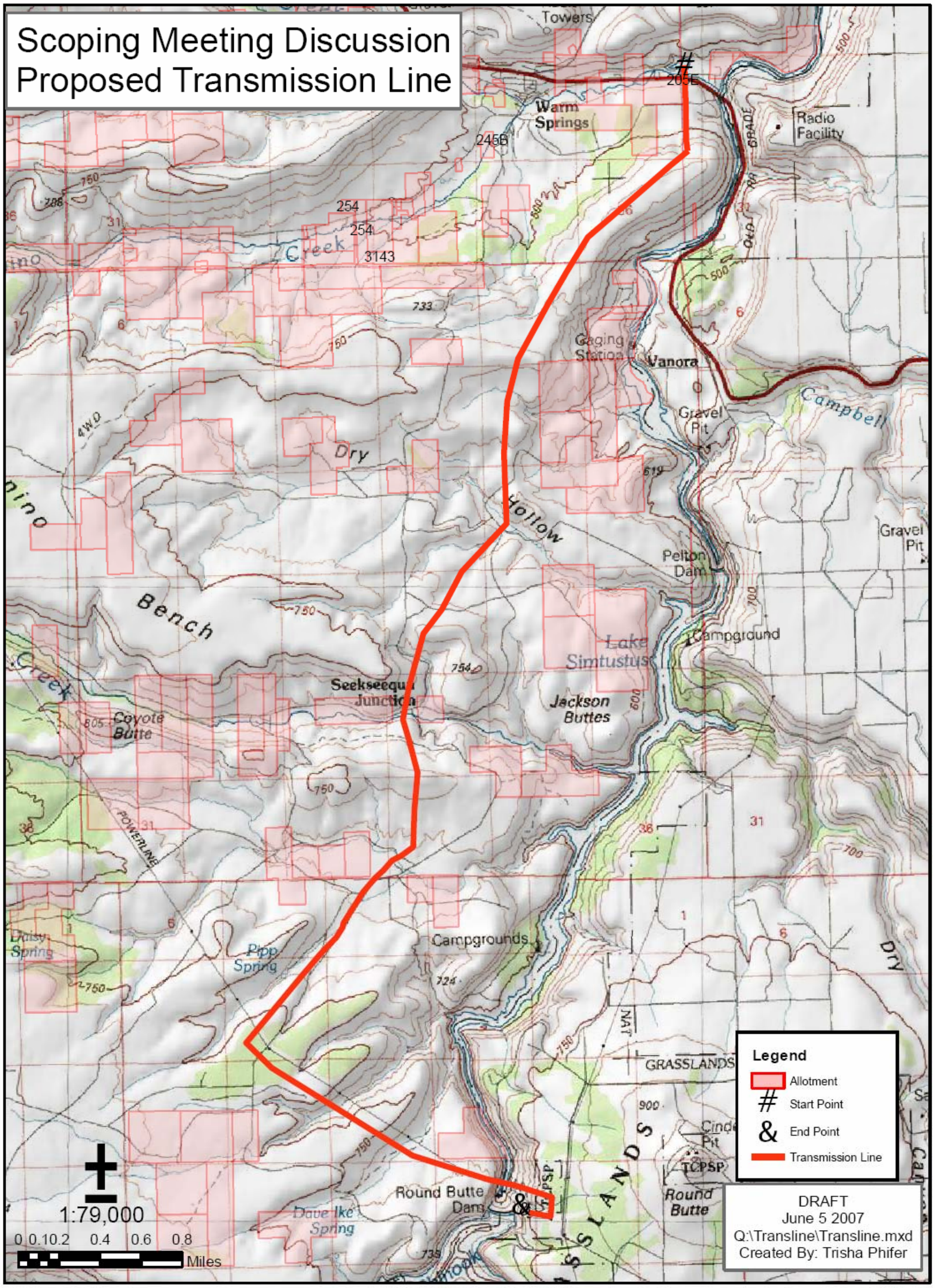

Figure 14. Map of proposed new transmission line route

The next steps in securing transmission access will depend on which interconnection option is selected; however, there are certain actions that must be taken for the interconnection process, regardless of which option is selected. These steps follow a sequential increase in detail and financial commitment, and culminate in the construction and operation of transmission facilities.

The first step in the interconnection process is an interconnection study request. In this step, the project developer contacts the transmission owner and exchanges basic project information. This initial application must introduce the project and demonstrate that WSPWE owns or has rights to develop the project site. The level of detail contained in the interconnection request varies among transmission owners but at a minimum will include technical project details, single-line diagrams, expected power generation and power system load flows, and transmission equipment needs.[11] This interconnection request will initiate a scoping meeting, to identify the next steps and establish timelines for completing them.

The next steps include an Interconnection Feasibility Study, an Interconnection System Impact Study, a NEPA environmental review (unless the project is deemed categorically exempt), and an Interconnection Facilities Study. Each of these studies is completed by the transmission owner at the expense of the developer. The developer will sign a study agreement with the transmission owner specific to each of these studies prior their commencement. The developer will also be required to provide ongoing project details and study support. The result of these studies will be detailed estimates of the necessary facilities, modifications, preliminary designs, system impacts, and construction costs to interconnect. These are the minimum necessary studies; additional studies including an initial NEPA review or optional additional interconnection studies that address project specific details may be required. These will be identified during the scoping meeting with the transmission owner.

The final steps to transmission interconnection are the signing of an Interconnection Agreement and a Facilities (or Engineering and Procurement) Agreement. The Interconnection Agreement will address facility ownership and ongoing operations and maintenance responsibilities. The Facilities Agreement will address the construction, testing, and acceptance of facilities needed for interconnection.

The steps involved with interconnection to BPA-owned equipment are outlined in Table 3, along with the deposit required for each stage of the process. Similar steps and deposits would apply for interconnection to equipment owned by PGE or PacifiCorp.

[11] PGE, 2001. Facility Connection Requirements for Generation Resources. http://www.portlandgeneral.com/business/products/power_options/customer_generation/pdfs/facility_connection_requirements.pdf
BPA, 2007. Large Generator Interconnection, Out for Comment. http://www.transmission.bpa.gov/includes/get.cfm?ID=932

Table 3 – Interconnection agreement steps and deposits required by BPA (Source: Large Generation Interconnection Procedures, BPA, 2007)

Deposit Name	Deposit Amount
Interconnection Request	$10,000
Initial NEPA Study Agreement	$10,000
Interconnection Feasibility Study	$10,000
Interconnection System Impact Study	$50,000
Final NEPA Study	Varies
Interconnection Facilities Study	Greater of $100,000 or est. study cost
Construction, Site Control Security Deposit	$250,000 (credited towards construction costs)

Permitting and Regulatory Considerations

The Mutton Mountain wind energy facility will consist of power plant site facilities (turbines and towers), new roads and/or road upgrades, and tribally owned and operated transmission facilities. The transmission facilities will be located on tribal land and will require tribal approval for environmental and cultural compliance. Federal actions may be required for interconnection across a FERC boundary and for use of USFS lands. Approvals for transmission equipment are already under way for the interconnection of a transmission line under development for the WSPWE Biomass Facility. Detailed siting studies will need to be undertaken to evaluate the approvals required for the wind power project to interconnect to this new transmission line. The wind project is also subject to several other regulatory processes.

Integrated Resource Management Plan (IRMP)

The Tribal Integrated Resource Management Plan, established in 1992, was established specifically to preserve, protect, and enhance resources on the Warm Springs Reservation. The IRMP requires an environmental review and clearance of development projects on the Reservation. The IRMP establishes best management practices, goals, and standards to protect natural resources that should be followed unless alternative management practices are shown to meet or exceed the intent of the IRMP.

The IRMP has different levels of assessment depending on the project size and potential scope of impact. For small projects, a project review process is used that lasts approximately one month. This process would be used for an activity such as erecting a single monitoring tower. For projects with a medium level of impact, the Project Assessment is the appropriate level of review, lasting approximately six months. For high-impact projects, a full Project Impact Statement is required, which can take a year or more.

The Project Assessment includes the following steps:

- Concept development during which the general scope of project and its related impacts are drafted.
- Public scoping session during which public input on impacts is solicited.
- Draft environmental assessment preparation which is submitted to Natural Resources Management Services (NRMS) for review.
- Approval of draft by NRMS

The Project Impact Statement follows the same steps as a Project Assessment except the review process is not confined to six months and it involves more project scoping. A federal review may be necessary in cases where federal funding or interconnection across a FERC boundary is involved. The IRMP Project Assessment conducted by the Tribe can be and is regularly used by BIA for NEPA compliance documents. The Project Assessment is subject to Tribal Council approval.

The Project Assessment will address multiple community considerations. Any potential impact on cultural or paleontologically significant resources (trails, artifacts, sites, structures, natural features, plants, or species harvested for traditional purposes, etc) should be identified during the Project Assessment. WSPWE can use the public review period as an opportunity to address these potential impacts and to develop strategies to mitigate or avoid them. Visual impacts may also become a community concern and as such, should also be addressed during the public review process.

Noise impacts may be of concern if there are any human residences, or endangered species nesting or mating habitats located in close proximity to the project site. The noise generated by current turbine technology is low enough to be masked by the sound of the wind (approximately 40 decibels at a 700 foot distance), however, construction activities may produce significantly higher noise levels. Again, if potential community impacts of noise are identified during the Project Assessment, WSPWE should use public review periods as an opportunity to encourage community involvement and minimize negative community impacts.

Permitting Considerations

In addition to demonstrating compliance with resource management objectives via a Project Assessment or Impact Statement, the project developer will need to obtain a series of permits to build and operate the wind facility. This section provides a preliminary guide to the permits that will be required.

Typically, energy facilities in Oregon must receive a site certificate from the Oregon Energy Facilities Siting Council[12], however, because the facility is on Tribal lands, the project is outside of FSEC jurisdiction, and alternative permitting processes apply.

A Building permit issued by the Tribal building department is required before the construction of project facilities. WSPWE will have to demonstrate compliance with local building code to obtain this permit to construct. Details of electrical components will need to accompany the building permit application to demonstrate compliance with National Electric Code (NEC).

Ordinance 68 in Chapter 490 of the Tribal Code requires a cultural clearance that will also comply with Section 106 of the National Historic Preservation Act (NHPA). The NRMS' Historic Preservation Officer will review the project for any potentially significant impacts on cultural resources.

Since the Tribe has assumed the authority to develop and enforce tribal water quality standards via the same processes as those contained in the Clean Air Act and the Clean Water Act, the facility will require a National Pollutant Discharge Elimination (NPDES) Permit issued by the Environmental Protection Agency to ensure that erosion, soil, and water impacts from construction are minimized. The region under consideration contains class 3 streams, but no class 1 streams (no anadromous fish). The tribal environmental office will be responsible for issuing 401 certification for any NPDES permits.

Finally, since the proposed development has towers and turbines that exceed 200 feet in height, WSPWE will need to submit Form 7460 (Notice of Proposed Construction or Alteration) to the Federal Aviation Administration. The FAA will undertake an aeronautical study and issue either a Determination of No Hazard, allowing the project to proceed with construction, or a Notice of Presumed Hazard (NPH) which will initiate an in depth technical analysis. A turbine site more than five nautical miles away from an airport runs little risk of a NPH, therefore FAA approval is likely to be of little concern for the Mutton Mountain project.[13]

Table 4 shows a preliminary outline of permits required for the wind power project at the Mutton Mountains site.

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[12] The Oregon siting process is explained at http://www.oregon.gov/ENERGY/SITING/process.shtml

[13] Massachusetts Technology Collaborative, 2007. "Airspace Issues in Wind Turbine Siting." http://www.mtpc.org/RenewableEnergy/Community_Wind/faaairspace.html

Table 4. Preliminary summary of permits required for wind power development on the Mutton Mountains site on the Warm Springs Reservation

Preliminary List of Permits and Approvals for Permitting Wind Power Projects on the Warm Springs Reservation		
Agency/Department	**Permit/Approval**	**Required For**
FEDERAL AGENCIES		
U.S. Environmental Protection Agency (EPA)	General Construction Activity Storm Water Permit	• Storm Water discharges associated with construction activity
BIA	NEPA Compliance	• Projects receiving federal funds or taking place on federal lands
Federal Aviation Administration	Notice of Proposed Construction	• Development exceeding 200 feet in height
STATE AGENCIES		
Oregon Department of Transportation (ODOT)	ODOT Encroachment Permit	• Activities within ODOT rights-of-way.
LOCAL AGENCIES		
Tribal Bureau of Natural Resources	Cultural Clearance	• Protection of archeological and cultural resources on the Reservation.
	Project Assessment	• Environmental review and clearance of projects on the Reservation.
Tribal Council	Reservation Right-of Way	• Authorization of transmission facilities on Tribal lands.
Tribal Department of Public Utilities	Building Permit	• Construction of Project facilities.

To ensure the successful permitting of the wind energy facility, the project developer must follow these guidelines for the permitting process[14]:

- Significant public involvement
- Issue-oriented process
- Clear decision criteria
- Coordinated permitting process
- Reasonable time frames
- Advanced planning
- Timely administrative and judicial review
- Active compliance monitoring

The permit application process shall begin as soon as possible. Many of the permit applications will involve detailed project information that may not be finalized. However, initiating the process early will allow the Tribe to identify any significant issues at an early stage of development while they can still be addressed without significant unexpected costs.

Estimated Annual Electricity Generation

Since the available power in the wind varies with the cube of the wind speed, a doubling of wind speed can cause a factor of eight increase in power output. Due to this and other non-linear effects such as wind shear, turbulence, icing, and humidity, simple annual average wind speed cannot be used to provide a reliable estimate of annual energy production. OSU used a mathematical model, and performance characteristics of General Electric 1.5 MW and 2.5 MW turbines, to estimate the annual electricity production on the site.

[14] National Wind Coordinating Committee, 2002. "Permitting of Wind Energy Facilities: A Handbook," NWCC Siting Subcommittee.

	1.5 MW Turbines	2.5 MW Turbines
Capacity Factors, if ridges 1,2,3,4, and Shaniko are developed	0.29	0.29
Annual Energy Production, if ridges 1,2,3,4, and Shaniko are developed	187 GWh	248 GWh
Capacity Factor, if ridges 1 and 2 only are developed	0.32 (25 turbines, 37.5 MW)	0.29 (19 turbines, 47.5 MW)
Annual Energy Production, if ridges 1 and 2 only are developed	105 GWh	121 GWh

HDR and consulting meteorologists, Windots LLC, reviewed this annual electricity production estimate, and provided additional analysis using different simulation engines.

Like OSU, Windots used a mathematical model to analyze hourly annual wind data collected at the site from 2002-2006, and to estimate annual electricity production, using a proposed array of 66 GE 1.5 MW xle turbines, at 80m hub height. Windots' analysis estimates a net annual capacity factor of about 29%, closely confirming the similar estimate reached by OSU. This capacity factor is calculated from an estimated gross annual capacity factor of 33%, for the 66 turbine array at 80-m hub height. This gross capacity factor must be reduced to account for losses as estimated in the table below:

Table 5. Losses when estimating annual net capacity factor for 66-turbine array.

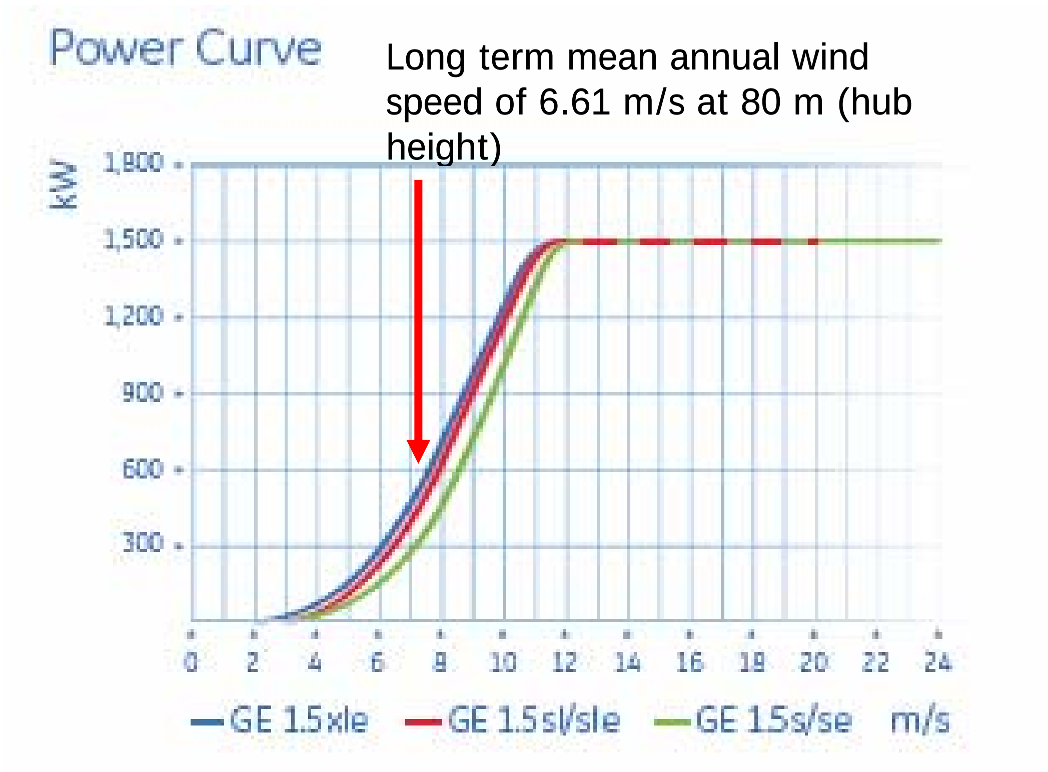
Type of loss	Percent of annual electricity production
Turbine availability	3%
Electrical system losses	3%
Wake losses	3%
Turbulence	1%
Blade contamination	1%
Icing	2%

The total discount is obtained from the product of the individual "efficiencies" (100% minus the loss) for each discount factor. For the Warm Springs project, this total discount is estimated at 12.3% for the GE-1.5xle. The resulting long-term mean annual net capacity factor projection for this 66-turbine array is roughly 29%. This means the annual electricity production (kWh) would be the same quantity as if the turbines were to generate power at their full rated output (1.5 MW) for 29% of the hours of the year.

This capacity factor estimate represents the P50 projection, meaning there is a 50% probability the annual production will be higher, and 50% probability it will be lower. Windots' P99 estimate is a capacity factor of 22%, meaning there is 99% probability that the annual capacity factor will be greater than 22%. As the wind data has not been statistically correlated with a nearby long-term wind speed record, this estimate requires further study for confirmation.

With increasing demand for wind power in Oregon, driven by green power marketing programs, and the new Renewable Portfolio Standard legislation recently passed in Oregon (more discussion of these factors is included under the section titled "Electricity Markets"), projects with capacity factors in this range are becoming increasingly attractive for commercial development at the time of this writing.

The figure below shows the power output of three different GE 1.5 MW turbines, with respect to wind speed. This figure shows that the turbines begin generating power at "cut-in" wind speeds of 2-4 meters per second (about 7 miles per hour), and power generation increases as wind speed increases, up to wind speeds of about 12 meters per second (about 26 miles per hour). At these higher speeds, the turbine reaches full rated power output. At speeds much higher than this, turbines use different control techniques, such as feathering or stalling the blades, or magnetic braking, to stop rotation, for generator and grid protection as well as protection of the turbine rotor and blades. The graphic below shows the estimated mean annual wind speed for the Mutton Mountain site. The total annual power produced will be equivalent to that which would be produced if the turbine was operating at this speed for all the hours of the year. This is a rough and simplified way of showing total annual energy production.



Design Concept

HDR and consulting meteorologists from Windots, LLC reviewed the turbine array design provided by OSU, and focused on development of Mutton Mt, instead of Shaniko Butte, because of the higher availability of wind data, and better accessibility for development. HDR's development team also provided two development scenarios, with revised total project capacity, in order to reflect the available transmission capacity for three possible transmission interconnection points.

HDR proposes two possible scenarios in the preliminary design concept. In one scenario, HDR assumes 69 MW project capacity, to take maximum advantage of the available capacity on the 69 kV PacifiCorp lines at Warm Springs, connecting into the Pelton re-regulation circuit. The other scenario assumes 100 MW project capacity, to take advantage of the capacity available on the existing nearby 230 kV lines owned by Bonneville Power Authority (BPA). Either project size could be supported by the new transmission line currently under construction for a biomass energy facility at Warm Springs.

The number and placement of the turbines will depend on the accessibility of desirable turbine sites by road, and the cost of road upgrades, to improve accessibility. Windots, LLC and HDR reviewed the site layout proposed by OSU, and identified additional candidate sites for individual turbine placement, according to expected highest energy potential at the additional sites. Figure 8 shows the sixty-six turbine conceptual array, proposed by meteorologists from Windots, LLC. The turbine array is oriented perpendicular to the prevailing wind direction, to minimize “wind shadow” effect between turbines. Potential turbine sites are located on the trailing edges of topographic features, with respect to the prevailing wind direction. This conceptual array is not intended to serve as a final wind power project design, but instead as an outline of most desirable turbine locations from a meteorological standpoint.

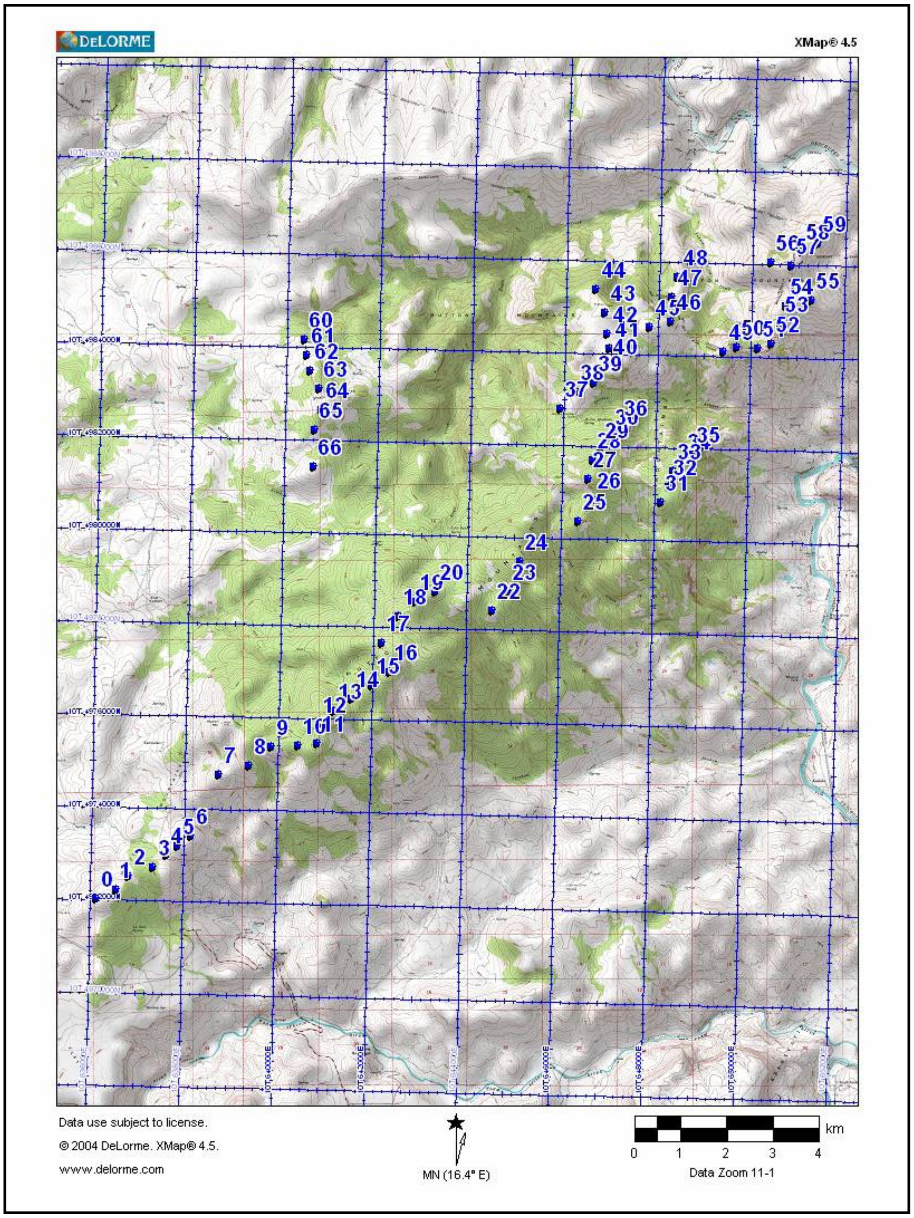


Figure 8 – Initial proposed turbine array design from Windots, LLC and HDR.

Prevailing winds on the site are from the northwest. Strong storm winds also occur from the southwesterly direction. These trends are shown in the "wind rose" in Figure 9, with the estimated fraction of annual energy production, from each direction.

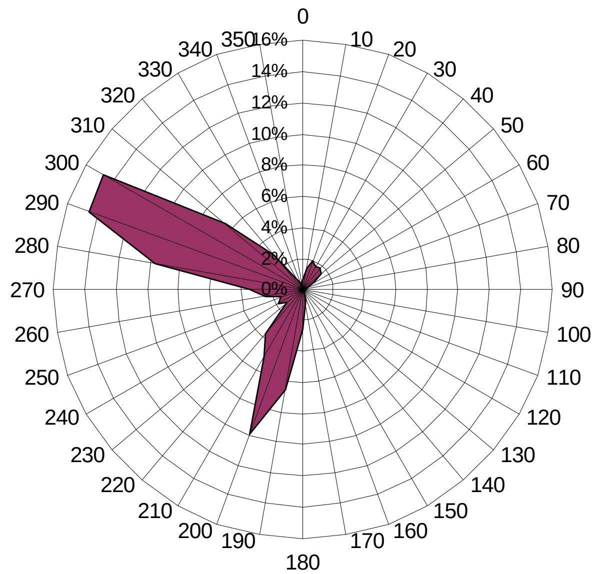


Figure 9 – 50 meter level wind energy rose at Mutton Mountain 2, Oregon. Data was collected from May 2005 through December 2006.

In their review of the meteorological data, Windots attempted to correlate the site-specific wind data to long-term data available at two nearby sites: the Redmond, Oregon 10-m airport and the 195-ft Goodnoe Hills, Washington site, managed by Oregon State University. Windots found that the correlation coefficients between these sites are rather low. Mutton Mountain 1, the longest-running on-site station, showed daily correlation coefficients of 0.66 to Redmond, and 0.5 to Goodnoe Hills. These correlation coefficients are too low to provide meaningful corroboration of long-term mean annual winds speeds, for the wind resource assessment. As such, the estimated mean annual wind speeds must be regarded with caution, due to the absence of available information for statistically significant correlation.

Windots's array design was produced utilizing available wind data, topographic maps, and meteorological experience. No advanced site optimization tools were used, and a more detailed engineering design will be necessary, when parameters, including the cost and viability of road upgrades, the availability of turbines appropriate to the site conditions, the project scale (as determined by investment appetite of project owners/developers), and the cost and location of the optimal transmission interconnection point are refined.

Power Sales and Electricity Market Options

Potential Customers

The wind energy facility owner can sell electricity to any utility, under Oregon's 1999 restructuring law (SB1149). Therefore, electricity will be sold to the utility that will give the best price and the longest term power purchase agreement (20 years or more is desirable in order to obtain a long-term loan).

The rural electric cooperatives that serve the surrounding areas are too small to offer a substantial enough market for electricity from a utility scale project, such as the one proposed here. Furthermore, as BPA affiliates, rural cooperatives buy wholesale power on contracts based on the annual average BPA price, currently about 2.85 cents per kWh. This price is well below the cost to produce electricity from wind. The cost of wholesale electricity to cooperatives is likely to increase in the next few years, as BPA will have to meet high water mark requirements that will cause a deficit of about 5% of the load by 2012; however, not at a fast enough rate to drive demand for relatively expensive wind energy at the community level.[15] At most, rural cooperatives may enter into contracts for small blocks of output from the proposed project.

The Bonneville Power Administration (BPA), the northwest's major wholesale electricity provider, is another potential customer for power. If output from the project is sold to BPA along BPA transmission lines, the cost of electricity will decrease (wheeling charges will not be levied). However, the average wholesale power price in the northwest is low due to the prevalence of hydropower. BPA sells electricity at an adjusted wholesale (undelivered) rate of $77.03 per MWh for New Resources.[16] BPA also provides wholesale power customers with opportunity to pay a premium for renewable energy credits. This Green Energy Premium (GEP) can range from $0-40/MWh and may allow the wind project developer to negotiate a higher price for electricity as a result of BPA's ability to charge a premium for renewable energy.[17]

Investor Owned Utilities (IOUs) will likely offer a higher price for wind electricity than Consumer Owned Utilities (COUs) or wholesale providers for several reasons. First, PURPA requires that both IOUs and COUs purchase electricity from qualifying facilities (less than 10 MW) at their current avoided cost. For COUs this is usually the cost of hydroelectricity which is very inexpensive. IOUs have higher avoided costs and, therefore, enter into higher purchase price contracts for their small projects, increasing the average overall price they pay for electricity. Second, IOUs will have the greatest liability under the recently passed Renewable Portfolio Standard and have specific plans for expansion of renewable resources in their Integrated Resource Plans. Finally, IOUs in Oregon also have pricing options for their customers to buy green power. As with BPA's

[15] Davis, Jeff, 2006. Personal Communication. General Manager, Wasco Electric Cooperative.
[16] BPA, 2006. Current Power Rates. http://www.bpa.gov/power/psp/rates/current.shtml#footnote1.
[17] Ibid.

GEP, green power purchase programs at both PGE and PacifiCorp increase the value of renewable electricity relative to power from fossil fuels sources. All of these factors contribute to an increased IOU appetite for renewable power purchase agreements.

WSPWE has a long-standing relationship with Portland General Electric and PacificCorp. The Tribe currently sells power to PGE from their interest in the Pelton/Round Butte Project and sold power to PacificCorp form the Re-regulating Project, As such, it would be wise to propose an unsolicited Power Purchase Agreement with PGE or PacificCorp first. If the terms of the PPA with PGE or PacificCorp are favorable, a broad market review to determine the best possible electricity price may be unnecessary.

The wind power project owner could also sell the project output to a third party power marketer, but this may be considered a less secure arrangement than a PPA by financial institutions, and this may make financing more difficult, or cause institutions to offer less favorable financing terms.[18]

Market Conditions: OR Renewable Portfolio Standard

A Renewable Portfolio Standard (RPS) is a state policy that mandates that a certain percentage of the electricity serving a state must be derived from renewable resources.

The Renewable Portfolio Standard (RPS) passed in the Oregon Renewable Energy Act (SB 838) on May 23, 2007 requires Oregon's largest utilities to obtain 25% of their electricity from renewable sources by 2025.[19] Interim targets are set at 5% by 2011, 15% by 2015, and 20% by 2020. These targets can be met by ownership of qualifying resources – which includes wind, solar, wave, geothermal, biomass, and others – or by purchasing Renewable Energy Certificates (RECs). A REC is a certificate associated with one kWh of electricity generation from a renewable source and represents the green attributes of renewable electricity. RECs can be kept by the owner of renewable generation facilities to meet their RPS quota or sold.

This requirement will significantly increase the demand for renewable power in Oregon. The wind energy facility developer could potentially sell unbundled RECs independently to any utility with liability under the RPS, or enter into a higher-price PPA and transfer ownership of the RECs (RECs bundled with electricity) to the utility that buys the electricity. Since the most likely buyers of electricity from the project (PacifiCorp and PGE) have liability under the RPS, the RECs will most likely be bundled with the electricity under the PPA.

The RPS will also encourage utility investments in renewable energy to meet their green power purchasing program requirements. As part of the RPS, utilities in Oregon must offer their customers the option to buy renewable energy at a premium (1.5-1.8 cents per kWh) over baseline retail prices. However, because customers purchasing green power

[18] http://www.windustry.com/newsletter/2003FallNews.htm
[19] http://egov.oregon.gov/ENERGY/RENEW/docs/Oregon_RPS_Summary_June2007.pdf

expect that they are driving new growth, these purchases do not count towards the utilities' RPS requirement. Therefore, utilities must account for renewable energy equivalent to both the amount demanded by customers and the amount set by the RPS goal separately.

Economic Modeling

HDR used an economic model to estimate the commercial performance of the proposed project, making assumptions for financial parameters, based on industry experience, discussions with experts, and prior studies. In the preparation of this report, and the opinions and recommendations that follow, we have made certain assumptions with respect to conditions that may occur in the future. In addition, we have used and relied upon certain information and assumptions provided to us by sources that we believe to be reliable. We believe the use of such information and assumptions is reasonable for the purposes of this report; however, some assumptions will invariably not materialize as stated herein or will vary significantly due to unanticipated events and circumstances. Therefore, the actual results can be expected to vary from those projected to the extent that actual future conditions vary from those assumed by us or provided to us by others.

The principal considerations and assumptions made by us and the principal information and assumptions provided to us by others include construction costs, interconnection cost, annual variable costs (operation and maintenance, shaping and integration, wheeling charges, and other miscellaneous costs that are a function of the amount of electricity produced on the site), annual fixed costs (service warranty and parts, equipment insurance, management and administration, utilities, and property taxes), annual cost inflation, equity partner's role and income tax rate, asset depreciation schedule, annual average capacity factor, electricity sale price, and debt financing rate and term.

The economic model suggests that this utility-scale wind energy project may present commercially attractive returns on investment, under the assumptions outlined above. The model suggests that the proposed project merits further cost estimate refinements and development effort. Details of the assumptions used in the economic model are considered sensitive and confidential material. Discussion of these details is included in Warm Springs Wind Resource Assessment Part II, Appendix F, Economic Modeling Assumptions.

Incentive Programs and Tax Considerations

Federal Production Tax Credit

The Federal Production Tax Credit (PTC) is a tax credit, set at 1.9 cents per kWh at the time of this writing, and scheduled to expire in December of 2008. Facilities must be in commercial operation by January 1, 2009 and the owners must have federal tax liability to receive this credit. It is unlikely that the project could be operational by this deadline; therefore, it was assumed that the PTC will be extended until 2013. A proposed extension of the PTC until December 31, 2013 was discussed by the House Committee of Ways and Means on January 4, 2007. The return on investment calculated in this analysis assumes that WSPWE or equivalent Tribal business entity will partner with an entity with significant federal tax liability to take advantage of the PTC.

To do this, an entity with large federal tax liability will own a majority of the project (typically 90-99%) for the first ten years while the project is still eligible for the PTC. This entity will receive a tax credit in the amount of 1.9 cent per kilowatt-hour generated. After the PTC expires, ten years after generation begins, ownership will revert completely to WSPWE. A more detailed discussion of this ownership structure is provided under the section entitled "Business Strategy."

Another important consideration is that the PTC suffers a "haircut", in the amount of any state incentives received, to eliminate "double dipping." The PTC is the single biggest incentive available to wind projects, and if possible, the project should use the PTC to its fullest, and state incentives will likely be less significant.

There have been some legislative proposals to establish a mechanism for Tribes and other non-taxable entities to take advantage of the PTC directly; however, no legislation has been put in place to date that would allow WSPWE to do so.

Federal Accelerated Depreciation Deduction

Section 179 accelerated depreciation schedule is another federal tax incentive available to most wind projects.[20] Depreciation is the annual deduction that allows tax payers to recover the cost of their business or investment property over a certain number of years. A normal straight line depreciation schedule would allow an owner of an investment lasting 20 years to deduct 5 % of the investment's value from their taxable income each year. The "Modified Accelerated Cost Recovery System" (MACRS) allows the owner of certain types of properties, including certain energy facilities, to depreciate their investment over a much shorter timeframe than the service life of the investment (standard depreciation). This analysis assumes that the facility is eligible for an accelerated depreciation schedule and that an equity partner with federal tax liability is able to take advantage of this deduction. In 2006, the five year recovery period MCARS schedule was 20% in the first year, 32% in the second, 19% in the third, 12% in the fourth and fifth, and 6% in the sixth.

Oregon State Business Energy Tax Credit (BETC)

Oregon offers a tax credit to business owners and non-profit entities, including tribes that invest in renewable energy generation projects. The credit is equal to 35% of project costs; however, the total eligible cost is capped at $10 million.[21] A 75-100 MW project would cost well over ten times this cap; therefore, the total amount of the BETC available to the project is assumed to be $3.5 million. The federal PTC is offset by the amount of

[20] Internal Revenue Service, 2006. Instructions for Form 4562 Depreciation and Amortization. U.S. Department of the Treasury.
[21] Oregon Department of Energy, 2006. Oregon Business Energy Tax Credit Application for Preliminary Certification for Renewable Energy Resource Generation Projects.

any state incentives, so unless the project is unable to take advantage of the federal PTC, the BETC has a negligible effect on the project's economic performance.

Tax Assumptions

The financial incentives outlined above rely on the assumption that a project owner or partner has significant federal tax liability to be able to take advantage of federal tax credits and deductions. For the purposes of this analysis, the tax equity partner was assumed to be in the highest federal corporate income tax bracket (taxable income over 18.3 million) of 35%. Oregon has a flat 6.6% corporate income tax rate and no sales tax.[22]

Additional Sources of Revenue

Clean Renewable Energy Bonds

Clean Renewable Energy Bonds (CREBs) present one possible finance option available to tribal governments. CREBs are bonds in which the Federal Government pays the interest, in the form of tax credits. The project owner is only responsible for repaying the principle amount and the bondholder receives tax credits in lieu of interest payments; therefore, CREBs act as an interest-free loan. A majority (95%) of the CREB allocation must be used on project capital expenditures. Also, the potential maximum size of the CREB allocation is not clear. Allocations are awarded to all eligible projects, starting with the smallest requested amount first, until all of the total CREB volume cap (approximately $300 million for non-governmental bodies) is allocated. One wind project received over $30 million during the first round of allocations; however, most projects were awarded much smaller amounts. It is possible that the project owner could secure some amount of tax free finance via a CREB allocation. The amount requested should balance the large size of the project with the desire to be competitive during the allocation process (projects requesting smaller amounts receive first awards).

Oregon Energy Trust

The Oregon Energy Trust is a non-profit organization established to manage the funds that the two largest investor owned utilities, Portland General Electric and Pacific Power & Light (PacifiCorp), collect through a 3% public benefits charge assessed to ratepayers. It provides financial support to renewable energy projects on a case by case basis, based on the completeness of the development plan and the project's cost performance relative to the industry standard. To be eligible for funding from the Energy Trust, the project must be located within the service territory of PGE or PacifiCorp or the power from the project must be sold to one of the two utilities. The Energy Trust has provided anywhere from $100,000 to $4.5 million to wind projects.[23]

[22] Federation of Tax Administrators, 2006. http://www.taxadmin.org/fta/rate/corp_inc.html.
[23] West, Peter, 2006. Personal Communication. Director of Renewable Energy, Oregon Energy Trust.

No level of support from the energy trust is included in the pro forma analysis; however, it is an avenue of funding that should be pursued.

Business Strategy

There are several typical business strategies which could be employed for the development of this wind energy facility. In one wind development scenario, the developer negotiates a lease with the landowner, including an upfront payment to the landowner which is highly project-specific, and additional annual royalty payments (usually some fraction of annual revenues from electricity sales)[24]. In this scenario, the developer assumes responsibility for financing, implementing, owning, and operating the project, and decommissioning the project at the end of its useful life. If WSPWE chooses to work with such a developer, then some form of legally binding land-use agreement will be necessary. Some Tribes have negotiated annual royalties in the range of 2-4% of annual electricity revenues. For a 100 MW project operating at about 29% capacity factor on the Mutton Mountain site, this could represent about $380,000-$760,000 per year in royalty payments. This estimate is intended for illustrative purposes only, as the royalty option is only one financial structure for project development, and project capital cost and project performance will significantly affect annual revenues.

As an alternative development model, the Tribes may choose to form a legally separate Tribal business entity to develop, own, and operate the wind power project, alone or in conjunction with an equity partner in order to take advantage of the PTC. Historically, tribal enterprises have been formed either under the Tribe's Constitution and bylaws that empower the Tribal Council to charter subordinate organizations for economic purposes, or under the Tribe's Federal Corporate Charter which authorizes the tribal membership, by referendum, to establish enterprises to be governed by a Plan of Operation adopted by the Tribal Council. Both of these types of enterprises are considered political subdivisions of the Tribe and have governmental attributes, such as sovereign immunity. Over the last 40+ years all major developments on the Warm Springs Reservation have followed this model.

The Tribe is now considering the use of non-governmental entities to carry out some future development opportunities. For example, the Tribe owns Cort Software, a state chartered corporation. It is also using a Delaware LLC to carry out its biomass electrical generation development project, and has enacted its own LLC statute authorizing the formation of tribally chartered LLCs that can be used by either the Tribe or its members.

Lending transactions are complicated by the inability of the Tribe to pledge any interests in trust property, including trust lands, as collateral. Accordingly, alternative forms of collateral to secure the loans must be pledged. This typically takes a variety of forms including such items as power purchase agreements, letters of credit, and cash reserves, all of which have been used by the Tribe in its commercial transactions.

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[24] More information about lease terms can be found through the New York State Energy Research and Development authority's Power Naturally program at http://www.powernaturally.org/Programs/Wind/toolkit/14a_LeaseAgreements.pdf

Structure Development Team

To proceed forward with a wind energy development on the Warm Springs Reservation, the following key development team partners need to be identified:

- Project owner/operator
- Power Purchaser
- Financier
- Engineers
- Meteorologists
- Construction firm
- Legal Council

The Tribes have existing relationships with several experienced business partners who can fill many of these roles. Other roles may be filled via competitive and/or targeted solicitation.

Business Strategy Options

The role that the Tribes will play in the development of wind energy on the Warm Springs Reservation can vary depending on the level of risk that the Tribes choose to bear. This section will provide an analysis of ownership options which the Tribes can consider and includes a discussion of potential risk and revenues to the Tribes under the different ownership options. The primary options examined are:

- Lease tribal land to a non-tribal developer with no tribal investment.
- Tribal development and ownership with the Tribes assuming full risk.
- Joint Development through a build, own, operate concession contract with eventual ownership transfer to the Tribes.
- Joint development through a turn key build, start-up and ownership transfer contract with a non-tribal developer that shelters the Tribes from development risk.
- Joint development through a turn key design construction agreement, with an option for the Tribes to buy out and an option for the developer to continue to operate for a fee.

Lease Tribal Land

The standard approach to wind development on federal lands has been to lease the exploration area to a developer that takes all the risk of development. Under the lease approach the Tribes would lease the wind resource area to a wind developer that can finance the design and development of the wind power project. This is the lowest risk approach for the Tribes and would involve the Tribes issuing a lease to a non-tribal entity that would take all the exploration and development risk. Under the lease approach the Tribes' revenue would be limited to royalty and rental payments. A typical lease rental rate is $2.00 per acre per year. A typical royalty rate is 2-10% of annual electricity sales revenues from the project. For a 69 MW wind power development, the annual royalty revenues can be estimated at about $650,000 per year, and for a 100 MW project, annual royalty revenues are estimated at about $950,000 per year for the Tribes.

Tribal Development, Build-Own-and-Operate (BOO)

Tribal ownership and development assumes the Tribes will finance all aspects of the project and assume all development risk and will not share the revenues with the construction contractors. Under the BOO ownership scenario the Tribes selects a developer and power plant engineering and construction turn key contractor to manage the project's resource development, engineering, procurement, construction and start-up. The Tribes would finance, construct, own, operate and maintain the wind power development from which it would recover its total investment, operating and maintenance costs plus a reasonable return. Under this project ownership and development scenario the Tribes, which own the assets, may assign its operation and maintenance to a facility operator under a separate operations and maintenance contract. Since the Tribes have no federal tax appetite, however, the Tribes would forego the additional revenue stream of 1.9 cents per kWh provided by the federal production tax credit.

Joint Development With Other Parties

There are several types of joint development agreements that have been used in wind development. It is common in the wind industry for developers to obtain concession contracts to develop the wind power project with conditions that eventually return the ownership to the community or local government after a specified period that allows the developer to receive a return on its investment and risk. Three types of joint development agreement are reviewed in the following section.

Build-Own-Operate-and-Transfer (BOOT)

A BOOT is a type of concession contract where the Tribes select a private company (or consortium) to develop, finance, build, own and operate the power project for a designated period of time. After the contract term has been completed, the project is transferred back to the Tribes without compensation or at a depreciated value. The longer the term of the agreement, the lower the project value becomes at the time of transfer. The private developer generally is granted a concession for a fixed term for no less than 10 years and usually does not exceed 30 years. These types of contracts can also contain an option to extend the concession agreement for another 10 year period after the primary term expires. These types of agreements also provide the resource owner an option to buy-out the developer at a negotiate value. A BOOT contract usually includes a contractual arrangement for continued supply of critical parts, technology transfer, and training for tribal members. BOOT Contracts can also have a contractual arrangement for continued operation of the facility by the private company but under tribal ownership.

Build-and-Transfer (B&T)

A B&T is a contractual arrangement whereby a project developer undertakes the financing and construction of the wind power project. The developer retains ownership and site control of the project until after its completion, start-up, and typically a one year warrantee operation period. The developer then turns the project over to the Tribes, which pays the developer on an agreed schedule for the developers total investments expended on the project, plus a reasonable rate of return thereon. The developer is bought out by the Tribes when the project has demonstrated it can operate at capacity and fulfill the payment terms of permanent financing. This type of contract shelters the Tribes from the risk of development but also increases the cost of the buy out. A typical B&T arrangement is often employed in the construction of any infrastructure or development project facilities which for strategic or political reasons, must be operated directly by the government (i.e. a military facility). Under this project ownership and development scenario the Tribes, after taking ownership of the assets, can operate the facility itself or may assign its operation and maintenance to a facility operator under a separate operations and maintenance contract.

Build-Transfer-and-Operate (BTO)

A BTO is very similar to a B&T contract. Under a BTO contractual arrangement the Tribes contract out the development of the wind power project to a private entity such that the contractor builds the facility on a turn-key basis. The developer assumes the risk of cost overruns, delays, and specified performance risks. The developer provides development and construction financing and the Tribes provide permanent financing that takes out the developer's retained interest. Once the facility is commissioned satisfactorily, title is transferred to the Tribes at a predetermined price at closing of the permanent financing. The private entity, however, continues to operate the facility on behalf of the Tribes under a separate long term operating agreement with a term of 5 to 10 years.

Project Package

There are many individual elements of the project that must be undertaken by the project owner. These include:

- Wind easements and right of way access
- Environmental and other permits
- Equipment selection and refined site layout
- Power Purchase Agreement
- Transmission system impact study
- Updated economic analysis to support financing
- Interconnection agreement
- Turbine supply agreement and down payment
- Finance plan and contracts

Whether or not the Tribe plans to maintain ownership of the project all the way through construction, it is recommended that the Tribe proceed with the next steps of development. Beginning to assemble the components of the project package is necessary if the Tribe plans to maintain ownership. However, if the Tribe does decide to work with an equity partner, if more components of the project package are completed, this will attract more beneficial partnership options.

Next Steps

An example schedule for project development is attached as Appendix I. This schedule is intended as an example for illustrative purposes only, and no dates or steps outlined therein are necessarily representative of the tribe's planned course of action.

Continue On-Site Wind Data Monitoring

The six towers originally installed on the Mutton Mountain and Shaniko Butte sites remain in service at the time of this writing, and wind data is continually being gathered from these towers, to provide the longest possible historical meteorological record for this site. Current plans include installation of additional wind monitoring towers, of greater height. Sodar and lidar wind monitoring technologies are also under consideration at the time of this writing, to enhance the robustness of the wind data collected on the site, and to compensate for the absence of nearby long-term wind speed records for long-term predictive correlation.

Detailed Wildlife Assessment

Data deficiencies identified by the preliminary wildlife assessment must be addressed by conducting additional surveys. Breeding bird data has not yet been collected on Tribal lands. This data should be collected, especially for protected species. Detailed habitat mapping should be conducted for the project area and a two-mile buffer, including notes on structural stages of trees and snags, dominant plant species, basalt outcroppings and cliffs, and individual trees with high potential for raptor nesting. Surveys for habitat, avian use, bat species, rare plants, and an aerial survey for raptor nests should be conducted for the construction zones and a buffer. Statistical analysis should be performed on survey results, to determine the potential impact of the project. A qualified wildlife biologist should participate in project planning and turbine and infrastructure siting.

Evaluate New Interconnection Option

The new transmission line under development for the biomass facility must be evaluated to ensure that capacity is available to accept the output of the wind power project, and interconnection costs must be evaluated and included in the economic model.

Define Business Strategy

The Tribes should assess which business strategy and level of risk is most appropriate before proceeding with the next major project developments (financing, PPA negotiation, etc). WSPWE has expressed a preference for maintaining significant project ownership. The Tribe will determine whether an equity partner is desired, and if so, under what partnership structure, to take advantage of the strengths that each partner brings to the table. The Tribe can approach institutions with whom they have worked on previous energy projects, or solicit new project partners, with the guidance of the engineering consultant team.

Refine Turbine Array Design and Engineering Cost Estimates

Detailed engineering cost estimates should be prepared for road and other infrastructure upgrades. Geotechnical studies should be undertaken to inform these estimates. The development team should determine the optimal size for the project based on available capital resources. Once this has been determined, a wind farm design engineer can prepare a detailed site layout. The final array design will optimize electricity production considering the constraints of site access, existing road infrastructure and upgrade costs, and the mitigation of any site impacts identified during the Project Impact Assessment conducted for NRMS.

Detailed civil engineering cost estimates will be refined iteratively, as turbine locations are finalized, such that road upgrade cost and electricity collection and transmission equipment cost estimates more precisely reflect the final design.

Begin Discussions With Electricity Offtakers

As utilities, such as PGE, Pacificorp, and BPA, issue Requests for Proposals (RFPs) for renewable energy, the development team will initiate discussions offering electricity sale from this project. The development team may also approach potential offtakers with an unsolicited offer for renewable electricity sale.

The term of the PPA should be sufficiently long to amortize the project debt. The development team will seek a PPA of at least 20 years, to assure financing institutions that there will be electricity revenues for the life of the loan.

Negotiations for the PPA can occur concurrently with, or even before, other development opportunities, as long as there are “off-ramp” provisions that allow the development team to terminate the power purchase agreement in the event of any unforeseen events that make the project infeasible. Off ramp provisions usually include provisions for the inability to secure necessary transmission access, environmental approvals, project financing, or other critical project agreements.

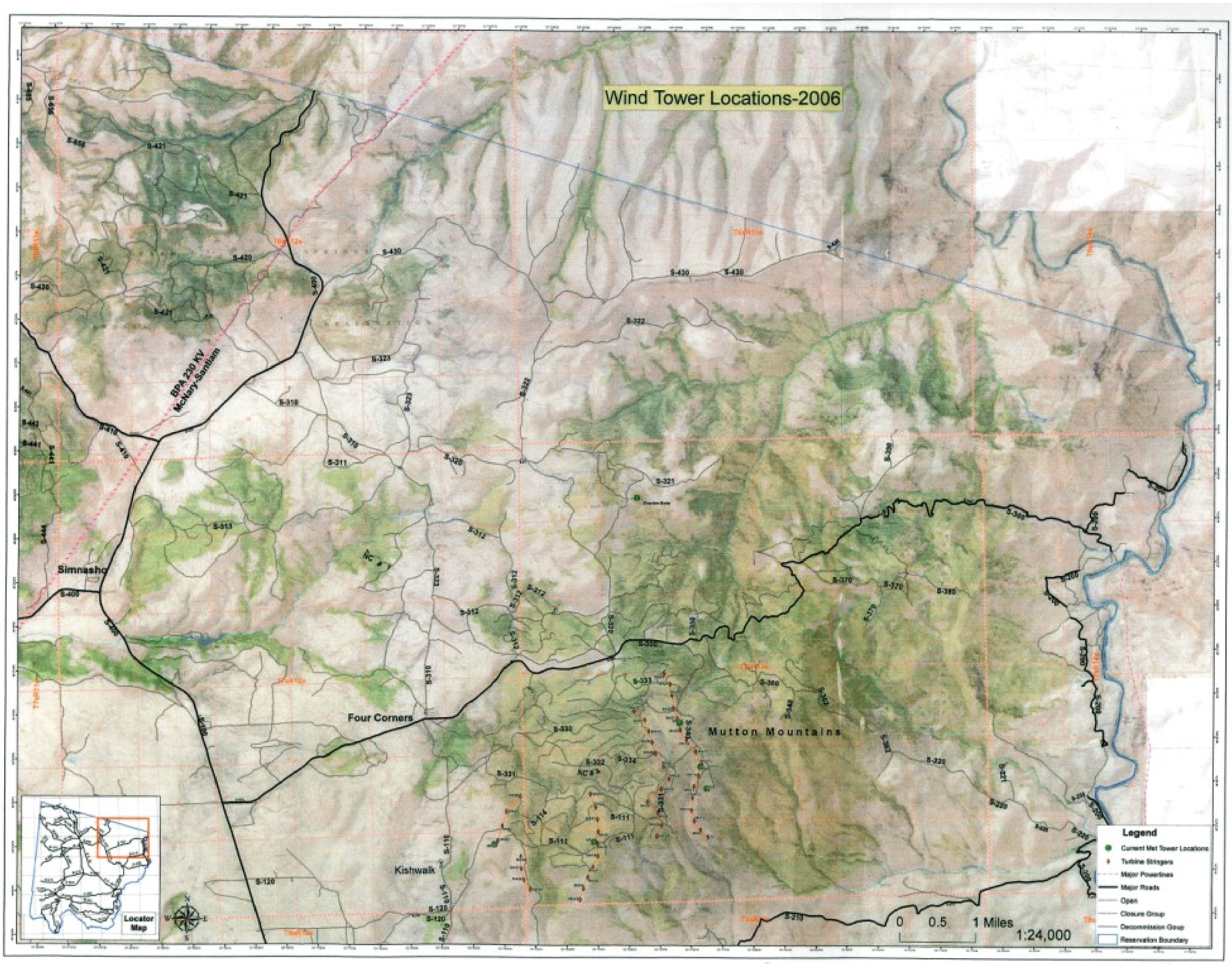
Begin Interconnection Process

An interconnection request must be submitted to the relevant transmission owner (Bonneville Power Administration, PGE, or Pacificorp), to enter the Generation Interconnection Queue. This will initiate the study agreement process during which interconnection study requirements and completion timelines are negotiated. Further details and the expected deposit associated with each step in the interconnection process were discussed in the section on transmission access.

Conclusion

The Mutton Mountain site on the Warm Springs Reservation presents a promising option for commercial wind power development. With several attractive transmission interconnection options available, no significant wildlife or habitat impacts currently foreseen, a 29-33% estimated annual average capacity factor, and estimated returns of 11-12%, this project is an opportunity for economic growth, clean renewable energy generation, air and water emissions reductions, and natural resource conservation, for the Tribes and surrounding communities. This preliminary wind resource assessment and feasibility study provides the technical and economic basis for future development activity. It also represents the collaborative efforts of many stakeholders whose participation will be critical to ensuring project success. Many development activities now require prompt action, in order for the project to contribute to Oregon’s aggressive Renewable Portfolio Standard goal of 25% renewable electricity by year 2025.

Appendix A: Mutton Mountain Site Map



Appendix B: Northwest Wildlife Consultants Preliminary Reconnaissance Report

Warm Springs Wind Power Project

Mutton Mountain Vicinity

Initial Wildlife Reconnaissance

Final

April 29, 2006

Prepared for

Warm Springs Power Enterprise
5180 Jackson Trail Road
Warm Springs, Oregon

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INTRODUCTION

Warm Springs Power Enterprises is currently reviewing an area for potential wind energy development on the Confederated Tribes of Warm Spring Reservation lands (WS Tribe). The areas of interest are located on land owned by the WS Tribe in north-central Oregon. The general landscape of primary interest is approximately five miles west to east and six miles north to south, referred to as "general project area" in this report. It is within and near the Mutton Mountains which are located approximately 20 miles north of the town of Madras, 42 miles south of the Columbia River and west of the Deschutes River (Figure 1). The primary area of interest is approximately 7-8 square miles. The sites of interest have been studied for wind resources. Wind meteorological (met) towers were initially installed from approximately 2003 through 2005.

This report summarizes an initial wildlife resources reconnaissance of the proposed project area. The investigation was conducted by biological staff of Northwest Wildlife Consultants, Inc. (NWC), a wildlife-consulting firm with considerable wind power wildlife and botanical monitoring experience. Two NWC biologists and one wildlife/botanical technician, all with extensive experience accumulated during the past 12 years in the wind power industry, conducted this initial reconnaissance. The company's corporate office is located in Pendleton, Oregon and a field office is located in Goldendale, Washington. Most of their field experience has been within the Columbia Basin of Oregon and Washington in similar habitats to those found on the Warm Springs Reservation.

An initial reconnaissance (also referred to as a review, a screening, or a Phase I Assessment) of proposed wind energy developments provides the developer and permitting agency staff with a brief overall assessment of wildlife species and habitats of interest or concern that have been documented or potentially occur in the energy project area. An initial wildlife and habitat reconnaissance is not meant to be comprehensive enough to address all biological resources and potential project development impacts or to estimate fatalities of birds and bats. The initial information and the results of further site-specific pre-field data collection efforts combined with results of site-specific field studies are used during the planning phase of the project's facility placement to more thoroughly reduce or eliminate impacts to wildlife and/or habitat resources. The initial investigation aids in focusing these study needs where data is needed to predict project impacts. In addition, the reconnaissance can highlight special habitat types or features as well as species of concern that may alter project development.

METHODS

This reconnaissance consisted of three primary methods: 1) one site visit, 2) in-office data searching and vegetation map preparation, and 3) interviews with knowledgeable specialists. The Warm Springs Geographic Information System (GIS) staff provided data for information provided on Figure 1. No specific boundary was provided for the wildlife review so instead, this report focuses on species which may have a small home range (a few acres), others that may forage a long distance from their nests or roosts (raptors), and migrants. Based on current knowledge of what is generally addressed during most wind energy development in eastern Oregon, the focus is primarily on birds, bats and unique habitats.

The site visit was conducted on October 25, 2005. Two NWC biologists, Karen Kronner and Bob Gritski, were escorted to several wind resources sites (Figure 2). In addition, the wildlife biologists drove most public roads within and adjacent to the project area boundary and scouted for wildlife as well as unique habitat features. During the site tour notes were recorded on the general landscape setting such as habitat types and indication of recent land use practices. The area was scanned for wildlife using binoculars and a spotting scope. The area was searched for unique features and structures such as tall cliff faces, large snags, and large bodies of water where wildlife might concentrate. Unique or uncommon wildlife species noted. Photos were taken of representative habitat types within and adjacent to the project area.

One tribal biologist with an extensive knowledge of the project area was interviewed about his knowledge of wildlife species of concern and species habitats occurring in the potential project area. Warm Springs Indian Reservation Tribal wildlife biologist Doug Calvin was consulted. Two private wildlife consultants were also consulted — Gary Clowers of Redmond, OR and Rick Gerhart of Bend, OR. Rick manages a raptor migration station near Mt Hood, OR, for HawkWatch International, a non-government raptor conservation and research organization. Both were recommended by Jim Manion of Warm Springs Power Enterprises as individuals with recent field experience in the general area.

Warm Springs Geographical Information System (GIS) specialist Sammi O'Reilly prepared the vegetation map (Figure 1) for the site from a variety of sources.

RESULTS

Site Visit

Habitat

The proposed Mutton Mountain project area is located between the eastern slopes of the Cascade Mountains and the more xeric southern Columbia Basin, northwest of the Ochoco Mountains. It is bounded on the east by the north-south oriented Deschutes River and is in Township 7 south, Range 13 east. The project area ranges in elevation from approximately 3500 ft. to 4500 feet (GIS to confirm). Precipitation and soil types have greatly influence the current vegetative cover which is generally described as "Steppe" and "Forested" (Franklin *et al.* 1988). Upland vegetation in this general zone is described as grassland, shrubland, juniper woodlands or juniper/grassland mosaic, oak woodlands, and coniferous forest. Loose basalt rocky outcroppings and pinnacles are found scattered in some locations and on steep slopes. No large prominent cliff faces were noted during the review although basalt outcroppings suitable for raptor nesting were found near the far northeastern portion of the review area, near Met Tower 6 (Figure 1). Outside of the project boundary, extensive basalt cliffs are found along portions of the Deschutes River and along the edges of some side drainages near the river.

Most of this proposed project area is dominated by vegetation typically occurring at mid-elevation zones – variable coverage of grassland, interspersed with shrubs and more dense shrubs with coniferous trees occurring as elevation increases. Areas of native bunchgrass (Idaho fescue, bluebunch wheatgrass, etc.) mixed with non-native annual grass species, such as cheatgrass, occur on the slopes and ridges in the deeper soils. Numerous forbs also are present in the area, including yarrow, buckwheat and balsamroot. Open stands of Ponderosa pine mixed with Douglas fir and some western juniper are common throughout the project area. The entire Mutton Mountains complex burned in 1996, and this fire destroyed quite a bit of the coniferous tree stands, as illustrated in some of the photos. The tree coverage is now more open allowing sunlight to reach the forest floor and a shrub component has overtaken the understory. This includes species such as ceanothus, various willow species, and rabbitbrush.

These varied habitat types support numerous species of native grassland birds, neo-tropical migrant songbirds (winter in Latin America countries), woodpeckers, elk and deer, smaller mammals and larger carnivores such as bobcat and cougar. Mature juniper trees are sparsely scattered throughout most mid to lower slopes of the main ridges, and Oregon white oak can be found in the lower elevations in habitat referred to as oak woodlands.

Other native habitats such as riparian corridors with deciduous trees and shrubs are found along some wet drainages. Towards the southwest of the area of interest, mature cottonwood trees, scattered ponderosa pine, willow, and other shrubs are found and wetlands are present. Narrow shrubby draws drain into the canyon, mostly on the west side.

Several photographs of the general project area and the ridges of interest for wind energy development are found in the last Section, pages 15-20. Figure 1 displays a habitat mosaic. Not illustrated are recent timber harvest units in the forested areas.

Wildlife

The wildlife and habitat assessment field trip was conducted during the early fall season. The weather pattern had been warm and dry and no significant weather fronts had yet moved into the area so wildlife presence was very low. Likely due to the warm dry period, small bird activity was low; no species of potential concern were observed. No threatened, endangered, candidate or sensitive wildlife species were observed during the field review. Of note was one medium to large-sized grouse flushed in open grassland 500 meters from Met Tower 5; identification was not possible.

Wildlife Assessment

This section describes the wildlife species or avian groups that are likely to use the project area at various times of the year. This assessment is primarily based on habitats present in the project area. More species-specific detail is provided in the section on Interviews.

Raptors

Raptors in general have been the focus of concern for wind power development. This section describes potential raptor use at various times of the year by relatively common species; some of these species may be of concern to local wildlife agencies and the Tribe.

The general project area likely supports nesting and foraging red-tailed hawks, a common large raptor species tolerant of forest habitat alterations resulting in small patches of trees and they are known to tolerate human activity more than other raptors. They have been observed in the area by others (D. Calvin, pers. com). Nesting and foraging golden eagles have been documented in and around the project area. Prairie falcons can be found nesting on cliffs along the Deschutes River and may also nest in the general project area at a few scattered rock outcroppings (these features not mapped). The same may be true for the peregrine falcon, as this species appears to be expanding its range. It is also possible that flamulated owls may nest and forage in the area. Migrating raptors likely include prairie falcon, golden eagle, bald eagle, red-tailed hawk, Cooper's hawk, sharp-shinned hawk, goshawk, northern harrier, and American kestrel. Wintering raptors expected to be found hunting in and around the project area are golden eagle, red-tailed hawk, rough-legged hawk, Cooper's hawk, sharp-shinned hawk, and northern harrier. Bald eagles have also been known to forage along the Deschutes River. HawkWatch International has a raptor banding site on Bonney Butte, which is about 25 miles northwest of the proposed project area. Migrating raptors are captured and a band placed on their leg. The migration information from this site was used to make predictions about possible migrating raptors in the Mutton mountain area.

Passerines (songbirds)

Because of the diversity of the habitat in the project area and also because of the variable elevation, it is highly probable that numerous passerine species, nest and forage in and around the project area. Migrating passerines likely migrate through in moderate to high numbers. This group of birds migrates mostly at night. Since the general project area is bound by a major north-south river canyon and corridor on the eastern side, migrating passerines using the river corridor likely follow the north-south orientation, utilizing habitats within and immediately along the canyon. They may fly over the proposed turbine locations, especially in the vicinity of Met Tower Site 6. Birds may stop over during long migrations to forage and rest in cover provided by the timbered ridges and canyons and may also use these habitats to escape strong weather fronts, which are encountered during long-distance migrations. Not much is known about the level of night-migrating birds in this area.

Federal and State Threatened, Endangered, Candidate, and Sensitive-Status (TES) Species

Some raptor species "of concern" are discussed above in the section on raptors. State or federal threatened or endangered wildlife are not expected to use the project area for nesting or denning; they may forage or migrate through.

Although golden eagles are not a listed species, they are protected under the Eagle Protection Act, and they are also a USFWS Bird of Conservation Concern (USFWS 2002). There are some project development activities to be taken into consideration. For example, raptor nests must be protected from January 1 through August 31. No disturbing activities will be conducted within one-quarter mile of any known active site. The buffer will be extended to one mile when loud decibel disturbance occur, as determined by the wildlife biologist. (IRMP for the Forested Area, p. 32).

Two state sensitive amphibian species, the Columbian spotted frog and western toad, may be found in drainages closer to the project perimeter in ponds and some moist habitats. Western toads may be found further upland than spotted frogs because they are adapted to traversing drier conditions.

Other Wildlife – Small Mammals

Bats

Not much is known about bat use within the various habitat types of the Columbia Basin. A few studies of local bat populations have been conducted in specific habitats but most of the knowledge of migrating bats and has come from the results of post-construction wildlife monitoring conducted at three wind power projects in the eastern portion of the Columbia Basin (Erickson *et al.* 2004, Fishman 2003 and Johnson *et al.* 2003). Available evidence indicates that impacts occur primarily to the migratory species. Although only 1-2 bat fatalities per turbine per year are typical for most projects in the Northwest, Rocky Mountains, and upper Midwest where the habitat is open prairie and farmland (NWCC 2004; Arnett *et al.* 2005, Johnson 2005), the number of bat kills becomes more significant as the number of operating turbines increases nationwide into the thousands (Arnett 2005). Fatalities are typically recorded July through September. Some of these bats may be dispersing from maternity sites at higher elevations or local sites, while they are searching for more mild sites to over-winter, or others may be traveling through from north to south or even east to west. Much has been written on the subject and many references about bats and wind turbine interactions are available (NWCC 2004).

Documented declines in some Pacific Northwest bat species (Perkins and Levesque 1987), combined with a lack of specific information on bat populations, have led both the U.S. Fish and Wildlife Service (USFWS) and ODFW to designate 9 of the 15 species known to occur in Oregon as federal species of concern or State sensitive species (Csuti et al. 1997).

The list of known wind turbine bat fatalities in eastern Oregon primarily includes hoary bat, silver-haired bat – a few casualties of little brown and big brown bat were also found. The silver-haired is the only state-sensitive status species. The Mutton Mountain project area can be expected to have a similar composition of bat species, based on habitats present. It is difficult to predict the level of bat use. The adjacent riparian corridors and cliff faces of the Deschutes may support other species and perhaps higher numbers of bats, again due to the suitable habitat features for roosting and for serving as maternity sites.

There is information available on bat species composition in an area approximately 25 miles south of the project area. The Pelton Round Butte Hydroelectric Project (FERC No. 2030) is located in central Oregon at the transition between the East Slope Cascades and High Lava Plains physiographic provinces. This landscape is very similar to the Mutton Mountain wind project area.

In 1998 Portland General Electric (PGE) was in the process of re-licensing the Hydroelectric Project with the Federal Energy Regulatory Commission (FERC). One of the requirements of the FERC was to conduct bat surveys in and around the Hydroelectric Project area. The following summarizes results of a bat investigation conducted for the re-licensing project.

In summer 1998 PGE conducted bat surveys within the Hydroelectric Project vicinity and on company-owned lands in the Metolius Mule Deer Winter Range. The Pelton Round Butte Project is located on the Deschutes, Crooked, and Metolius Rivers, approximately 25 miles from Mutton Mountains.

Based on published distribution maps for bats in Oregon, 10 of the 15 species known to occur in Oregon were considered probable in the study area. The 1998 bat surveys documented the presence of these 10 species in the study area, as well as two other species — the western pipistrelle and Townsend's big-eared bat-species that were not expected. This group included seven TES species. In addition, captured females of eight species were pregnant or lactating, indicating that maternity roosts were likely nearby.

Three species new to the Deschutes River corridor north of Redmond, Oregon — the pallid bat, Townsend's big-eared bat, and the western pipistrelle (Maser and Cross 1981, Perkins 1986) — were documented in the study area during the surveys. This data extended the known range of the western pipistrelle in Oregon and the distributions (between known locales both north and south in Oregon) of the Townsend's big-eared and pallid bats. Of these three species, only the Townsend's big-eared bat has special status. In Oregon it is Sensitive-Critical status.

Other Small Mammals

Mountain cottontail, marmots, and California ground squirrels and various other small mammals could be present in parts of the area of interest.

Interviews, Report Reviews, etc.

Doug Calvin, Warm Springs Indian Reservation tribal biologist, was interviewed on Jan. 17, 2006, about wildlife and wildlife concerns/issues he has for the general project area. The following summarizes his initial comments and information on the wildlife use of the project area.

Big game - California big horn sheep were re-introduced on the Reservation in 2002, when 20 animals were released. The herd now consists of 50–60 animals. There is no hunting season for bighorns. Deer and elk are also numerous in the area. These two species receive the most interest from tribal members. They are sought after for cultural and religious ceremonies, and for subsistence. (IRMP, non-forested areas, p. 96)

Waterfowl - In general, waterfowl do not commonly utilize any of the project areas. It is not a high use area for ducks and geese or waterfowl hunters. There are no holding areas such as ponds and back bays of a nearby river that would "hold" waterfowl in the area. Waterfowl use is fairly high on the Deschutes River.

Raptors - Various raptor species such as golden eagle, nest in the Mutton Mountains and more than likely hunt in and around the project area. He estimates the number of golden eagles using the area to be less than six. There are no known bald eagle evening communal roosts but the species may hunt the uplands for carrion or afterbirth at livestock calving areas and roost along the Deschutes River. There is one known bald eagle nest along the eastern face of the Deschutes River (approx. X ? miles from the project site).

Bats - No site-specific information on bat use of the project area is available. However, there is some suitable habitat such as cliffs, caves, talus slopes and snags where bats might roost during the day or night. Some of these sites could support maternity colonies. Bats are expected to be more concentrated along major drainages where they hunt for insects concentrated around moist areas and shorelines. Bats may fly over ridges during late spring and early fall migration periods. Scattered are snags within or adjacent to most of the sites being considered for wind energy.

Gary Clowers of Redmond, OR was interviewed on Jan. 16, 2006 about wildlife of the proposed project area. The following summarizes his knowledge and perspective of wildlife in the proposed area.

Raptors - Golden eagles nest in the general vicinity. Other raptors present are prairie falcon, northern harrier, and red-tailed hawk. Ospreys are very numerous along the Deschutes, and may migrate over the project area. He also noted that the golden eagles have a wide variety in their diet, which includes a mammalian and avian prey. This is because the population of black-tailed jackrabbits has declined sharply. The eagles are preying on several species of ducks, eating up to one duck per day. He also believes that peregrine falcons may now nest in and around the general Mutton Mountain area.

Big game - The Mutton Mountains have a growing herd of California bighorn sheep. The growth of the herd has been limited due to predation and disease.

Habitat - The burn in 1996 opened up the area for better foraging, and may have also made an improved migration corridor for passerines. This also improved the habitat for raptors, including owls.

Bats - There are several species present, but he could not offer any specifics. He did note that PGE has surveyed bats in that area, especially along the Deschutes.

Lewis' Woodpecker - They are very common along the Deschutes, and are known to nest breed within a half-mile of the river, where they feed their clutches with stonefly (a riparian insect that lives and breeds along the Deschutes River and is a very important food source for both bird and fish species). They also nest and forage in and around the project area in oak woodlands and pine habitat. In Oregon, their status is Sensitive-Critical (ONHIC 2004).

Rick Gerhart operates the banding station of Hawkwatch International at Bonney Butte, Oregon. He was interviewed on January 19, 2006 about wildlife of the general project area.

Spotted Owls - Mr. Gerhart has done spotted owl surveys for the Warm Springs Tribe. He has conducted a few spot checks for spotted owl in the Mutton Mountain area, and has concluded that no suitable habitat or spotted owls are present in this area. However, flammulated owls are present there. The flammulated owl status in Oregon is Sensitive-Critical (ONHIC 2004).

Raptor Migration - Although this area is not known to be a major north-south spring or fall season migration corridor, it does border the high desert to the east which could result in a "funnel effect" where raptors are moving though in a more concentrated pattern, staying oriented with the parallel landscape features. He also reiterated the fact that there are golden eagles and prairie falcons in the proposed area of interest for wind power development.

Peregrine Falcon - Mr. Gerhart noted that in fall 2005 at the Bonney Butte migration station they captured four peregrine falcons, as compared to three in the last eight years. He also believes that it is possible that there is a PEFA eyrie on the Mutton Mountain side of the Deschutes River. The status of Peregrine in the State of Oregon Threatened (ONHIC 2004).

Other Data Sources

Bird Survey Routes - The USGS map of Oregon Breeding Bird Survey (BBS) routes was reviewed for locations of these annual 24.5-mile long driving transect surveys conducted by volunteers. The closest route (#69203 – Badger Creek) is further northwest within the east slope of the Cascade Mountains. This data may be helpful for identifying possible passerine species in the project area because it is approximately 30 miles away, contains similar habitat and is close to the same elevation. The BBS database has not been reviewed as part of this wildlife reconnaissance.

Bird Inventories – Atlas - Another source of breeding-season passerine use data is the statewide Breeding Bird Atlas (BBA). This method provides information on the breeding distribution of all species of birds within a defined area (usually a state) at a particular point in time (usually over five years). An "Atlas" is a type of area search, but it does not require the standardization of effort or replication that are important in area searches and other types of monitoring. An Atlas can be most useful in identifying where uncommon or rare species are breeding (to the finest scale that the atlas employs) to target these areas for more rigorous monitoring. The BBA database has not been reviewed as part of this wildlife reconnaissance because no inventories have been performed on tribal land.

Green Ridge Hawk Migration Station – In 2004 the East Cascades Bird Conservancy began exploring the viability of creating a new raptor migration site in Central Oregon in order to learn more about where the raptors are going after they leave the Bonney Butte HawkWatch site (located near Mt. Hood). After some initial research, it was found that a previous effort had been made at a site called Green Ridge in Jefferson County. When this area was reviewed again it was found to support very high numbers of migrating raptors.

Surveys were conducted in mid-September through mid-October 2005. The total number of raptors tallied for the entire project was 1009. The survey tallied 14 species, with the majority of the raptors being sharp-shinned hawks. Other raptors with high numbers of occurrence were red-tailed hawk, Coopers hawk, bald eagle, golden eagle, turkey vulture and merlin. The remaining species were peregrine falcon, northern goshawk, northern harrier, American kestrel, rough-legged hawk, prairie falcon and osprey (Tran and Gates 2005).

The Green Ridge site is south of the Warm Springs Indian Reservation along the Metolius River, and approximately 30 miles southwest of the Mutton Mountains. Therefore it is possible that some raptors may also pass through the Muttons or nearby.

SUMMARY

Habitat within the general project area is primarily a mosaic of open grassland and coniferous forests with junipers and scattered shrubs throughout the area. The population of wintering raptors is expected to be similar to other mid-elevation areas in the Columbia Basin; no large numbers are expected. No unusually high numbers of any raptor species are expected to be present during any season, based on limited exploratory investigations and anecdotal information obtained during interviews. Golden eagles and prairie falcons may be more abundant in the project area than further east in more agricultural lands since the project is close to the Deschutes River and there are suitable basalt outcroppings near proposed turbine sites that may support nesting.

Moderate to high numbers of migrating passerines may pass over the area. Drainages with trees and shrubs within the general project perimeter may support migrating passerines. No specific diurnal or nocturnal studies addressing migrant bird use have been conducted but local birders may have additional information; they were not interviewed. No state or federal threatened, endangered or candidate mammal or bird species are expected to nest/breed within the proposed development area (defined as turbine strings, roads, etc.) although the final project facility layout is not known at this time. Some special status raptor nesting along the Deschutes and Columbia Rivers may forage in the project area during the breeding season and may migrate through the area.

Other potential sources of wildlife information not yet explored include Audubon members with local birding experience in the area, nearby landowners, local Natural Resources Conservation Service biologists, Tribal game officers, and the Breeding Bird Atlas database. In addition, should project planning move forward, a formal data request on presence of species of concern can be submitted to the Oregon Natural Heritage Program and to the U.S. Fish and Wildlife Service. The responses are usually received in 4-6 weeks. It is likely that any records are already in the internal Warm Springs wildlife database but this step is a standard procedure during initial project planning and may provide records not currently on file internally.

Based on the review of existing information and extensive input from Doug Calvin, Table 1 includes wildlife of primary interest or concern for development of wind energy at the Mutton Mountain area.

Scientific names of plants and animals used in this report are available upon request.

Table 1. Primary Wildlife Species of Concern for Wind Power Development at Mutton Mountain Area.

Species	Federal Status	State Status	Status on Tribal Land
Bald Eagle	T, EPA		CS (one pair nests in the general area, site location withheld from this report)
Golden Eagle	EPA, BoCC		CS (need to list nearest known nest)
Red-tailed Hawk	N	N	CS
Owls (various species)	N	N	CS
American Peregrine Falcon	NW, BoCC	E	
Prairie Falcon	N	N	CS
Lewis's Woodpecker	N	SC	
Mule Deer	N	N	CS
Rocky Mountain Elk	N	N	CS
Big Horn Sheep	N	N	RP

Protection Status

Federal:

T	Threatened	SoC	Species of Concern
E	Endangered	NW	Not Warranted; delisted
C	Candidate	EPA	Eagle Protection Act

BoCC USFWS Birds of Conservation Concern (BCR 9, Great Basin)
Priority List 2 – Priorities for listing review are assigned to Candidate Species (USFWS 2004)
Note: All native migratory birds are protected by the Migratory Bird Treat Act (MBTA).

Oregon:

T Threatened
E Endangered
SC Critical; listing as threatened or endangered is pending or may be appropriate if immediate conservation actions are not taken.

Tribal: CS Culturally significant
RP Re-introduction Program

Note: Several species of passerines are also culturally significant for their colorful feathers (D. Calvin, pers. com.). They are Red-shafted Flicker, Mountain Bluebird, Western Bluebird, and Black-billed Magpie. Several mammalian species are also culturally significant because of their importance in Tribal lore. They are the Coyote and the Raven.

REFERENCES AND OTHER RESOURCES

Integrated Resources Management Plan for the Forested Area (IRMP I) 1992. Confederated Tribes of the Warm Springs Reservation of Oregon, Natural Resources Branch. Bureau of Indian Affairs, Warm Springs Agency.

Integrated Resources Management Plan and Project Assessment for the Non-forest and Rural Areas (IRMP II) 1997. Confederated Tribes of the Warm Springs Reservation of Oregon, Natural Resources Branch. Bureau of Indian Affairs, Warm Springs Agency.

Calvin, D. Warm Springs Indian Reservation Tribal Biologist. Personal communication with Jerry Baker on January 17, 2006.

Clowers, G. Independent Biologist. Personal conversation with Jerry Baker on January 16, 2006.

Csuti, B., A.J. Kimerling, T. A. O'Neil, M. M. P. Huso. 1997. Atlas of Oregon wildlife: distribution, habitat, and natural history. Oregon State University Press, Corvallis, Oregon.

DeLorme Topo USA 5.0. Topographic software.

Erickson, W.P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Final Report, July 2001 – December 2003. Technical report submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Washington Stateline Technical Advisory Committee.

Fishman, Ecological Services LLC. 2003. Carcass survey results for SeaWest WindPower, Inc., Condon Site 2002-2003. Prepared for SeaWest WindPower, Inc., Condon Wind Project, Gilliam County, OR.

Franklin, J. F. and C.T. Dyrness. 1988. Natural vegetation of Oregon and Washington. Oregon State University Press, Corvallis, Oregon. 452 pp.

Gerhart, R. Hawkwatch International, Bonney Butte, Oregon. Personal conversation with Jerry Baker on January 19, 2006.

Johnson, G.D., W.P. Erickson, and J. White. 2003c. Avian and bat mortality at the Klondike, Oregon Phase I Wind Plant, Sherman County, Oregon. Technical report prepared for Northwestern Wind Power by WEST, Inc.

Maser, C., and S. P. Cross. 1981. Notes on the distribution of Oregon bats. Res. Note, PNW-379. 31 pp.

National Wind Coordinating Committee (NWCC). 2004. Wind Turbine Interactions with Birds and Bats: A summary of research results and remaining questions.

Oregon Natural Heritage Information Center. 2004. Rare, threatened and endangered species of Oregon. Oregon State University. Institute for Natural Resources.

Perkins, J. M. 1988. 1998 bat surveys, final report. Pelton Round Butte Hydro Electric Project, FERC No. 2030. Pacific Northwest Bat Research Team.

Perkins, J. M. and C. Levesque. 1987. Distribution, status, and habitat affinities of Townsend's big-eared bat (*Plecotus townsendii*) in Oregon. Oregon Dept. of Fish and wildlife. Tech Rept. #86-5-01. 50 pp.

Tran, K. and C. Gates. 2005. Green Ridge Fall Raptor Migration Count.

United States Fish and Wildlife Service (USFWS). 2003. Service interim guidelines on avoiding and minimizing wildlife impacts from wind turbines.

United States Fish and Wildlife Service (USFWS). 2002. Birds of Conservation Concern (list).

Photo 1. Habitat around Met Tower Site 3.

Photo 2. Burned snags are scattered on hillsides.

Photo 2. Looking northeast toward Met Tower Site 3 on ridgetop.

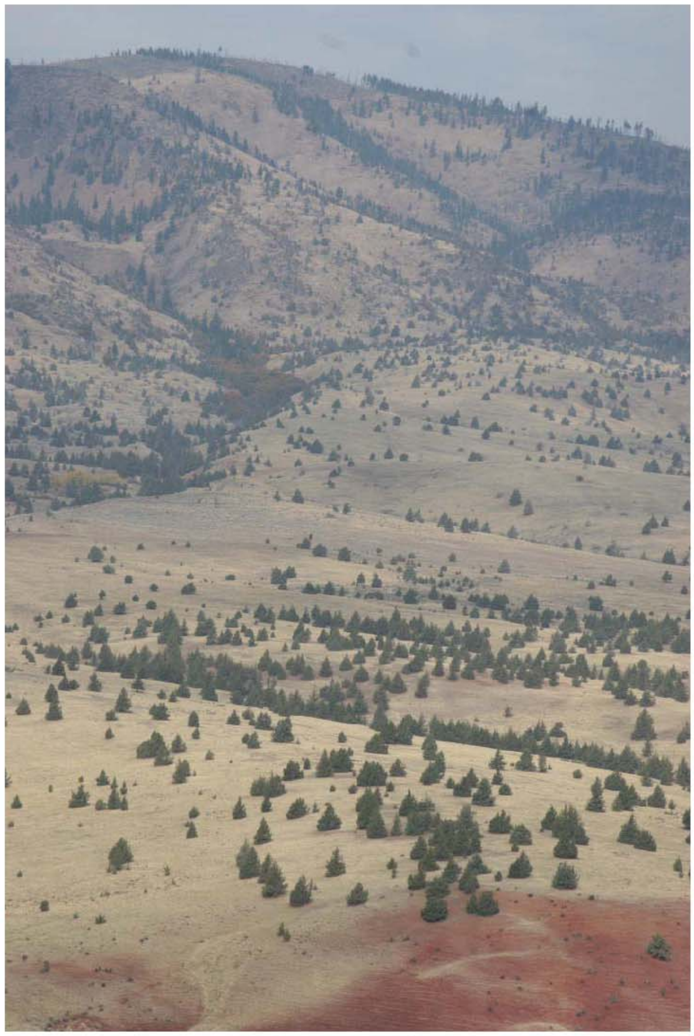


Photo 3. Habitat around Met Tower Site 4.

Photo 4. Habitat west of Met Tower Site 6

Photo 5. Habitat at Met Tower Site 6.

Photo 6. Burned snags and conifers are scattered throughout.

Photo 6. Habitat south of Met Tower Site 6.

Photo 7. Habitat at Shaniko Butte Met Tower (no number)

Photo 8. Looking towards Shaniko Butte Met Tower.

Photo 9. Habitat in landscape west of Shaniko Butte

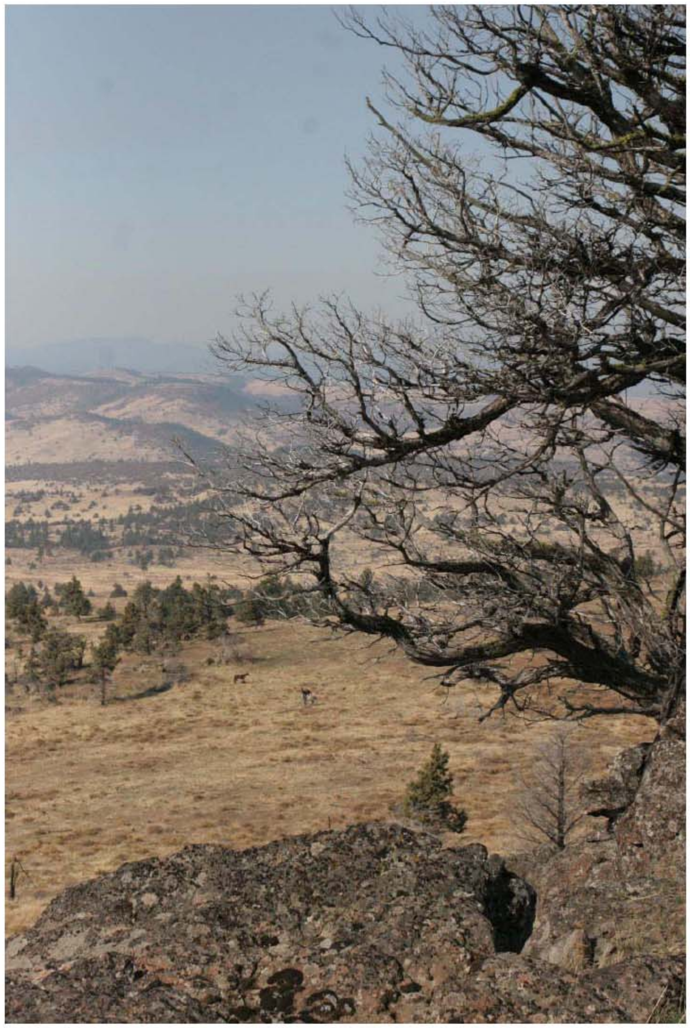
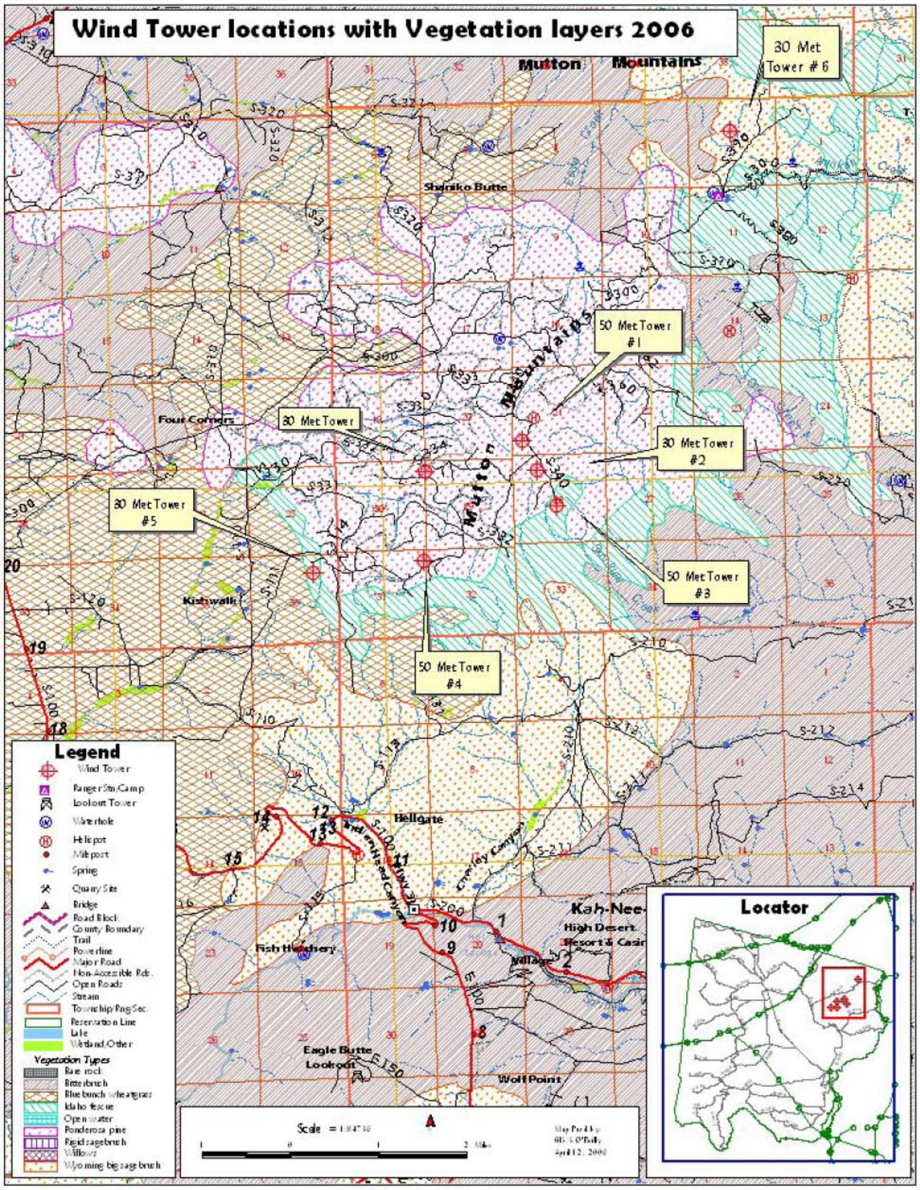


FIGURE 1. HABITAT



Appendix C: Elcon Associates Transmission Interconnection Report

MUTTON MOUNTAIN
WIND TURBINE PROJECT

TRANSMISSION SYSTEM STUDIES
REPORT

February 7, 2006

Prepared by:

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MUTTON MOUNTAIN WIND TURBINE PROJECT
TRANSMISSION SYSTEM STUTIES REPORT

1.0 INTRODUCTION

Elcon Associates, Inc. (ELCON) has completed a feasibility study for ***Warm Springs Power Enterprises (WSPE)*** on the transmission interconnection of a wind generation project in the Mutton Mountains. The Mutton Mountains are located in the Northeast corner of the Warm Springs Reservation approximately eight miles North of Kah-Nee-Ta. The project has three potential generation sites in the area: 75 – 100 MW on Mutton Mountain, 25 – 50 MW at Shaniko and 25 MW at Bulldozer. Meteorological tower sites and nearby transmission lines are located in Figure 1.

This report examines potential interconnection options and identifies their approximate capacity. Cost estimates for the interconnection switching station, the transmission line tap, the project step-up substation, the collector system and the turbine step-up transformers are presented. Potential wheeling costs and associated costs for losses on the transmission provider's system are also identified.

2.0 SUMMARY AND CONCLUSIONS

2.1 Existing Transmission System

Bonneville Power Administration (BPA) has two 230kV circuits that are routed west and north of the site. The 230kV circuits are about eight miles from the proposed site. One of these 230kV circuits connects McNary Substation to Santiam Substation. It is part of the BPA defined west of McNary Flowgate – a group of four circuits routed west from McNary Substation. The other 230kV circuit is idle.

There is a 69kV system located south of the proposed site. The nearest 69kV interconnection possibility is 8 miles south at ***Wasco Electric Cooperative's (WEC's)*** substation in Kah-Nee-Ta. This substation is served from a radial circuit, which originates eight miles further south from PacifiCorp's Warm Springs Substation. The Warm Springs Substation is normally supplied from PacifiCorp's Pelton Rereg Circuit. A 69kV alternate source is routed through Cherry Point and Madras to the Warm Springs Substation. Both circuits originate at the Round Butte 69kV Substation.

2.2 Transmission Options

Six transmission options were identified – two involving the BPA 230kV circuits and four involving the 69kV interconnections. Power flow studies were employed to determine the amount of power that could be delivered into the grid via these options (See Section 5.0). The power flows are based on loads, generation and system components and configuration projections by the Western Energy Coordinating Council's in January 2005 for the winter and summer of 2006. Some of the power flows have included two recently approved 200 MW wind generation projects, which will interconnect into one of the above referenced BPA 230kV circuits.

The plans are listed in Table 1. Included in the tables is the level of power that can be input into the grid by each option. All 175 MW can be inserted into the de-energized 230kV circuit. The maximum amount of power that can be inserted into the 69kV system with one transmission circuit is 69 MW.

2.3 Electrical System Costs

The electrical system costs for the 230kV and 69kV transmission options are presented in Table 2. The costs include the cost of the interconnection switching station, the transmission line tap, the project step-up substation, the collector system and the turbine step-up transformers. These cost components are identified and discussed in Section 4.0.

The electrical system cost and the cost per MW are presented both as initial cost and as the cost after the project has been reimbursed for items considered as upgrades to the BPA or PacifiCorp network. This includes items such as the BPA interconnection switching station and reconductoring of the PacifiCorp circuit. The cost for these items must be financed by ***WSPE***. However, they are later reimbursed via credits to transmission wheeling charges. ***WSPE*** can expect to receive full credit for these charges within five to eight years (See Section 4.3.5).

2.4 Wheeling and Loss Reimbursement Costs

Depending on the location of the Point of Delivery and the selected route, ***WSPE*** will be required to pay wheeling charges to ***BPA***, ***WEC*** and/or ***PacifiCorp***. Power must also be purchased on the open market to make up for losses on the ***BPA*** or ***PacifiCorp*** systems. Examples of these costs are presented at the bottom of Table 2.

2.5 Conclusions

We conclude the following:

1. **Generation Levels –** Generation levels that exceed 70 MW should be inserted into the ***BPA*** 230kV circuit. Generation less than 70 MW can be inserted into the PacifiCorp 69kV system.

2. **Delivery Costs –** The costs to deliver power to the Point of Delivery (POD), the power purchaser receiving point, depends on the investment required to connect into the regional power grid and thc wheeling and loss reimbursement rates required be the wheeling utility. Balance of Plant construction costs, after reimbursement for network improvements, range from $82,900 to $197,100, depending on the option selected. Wheeling to loads via the ***BPA*** system and the ***PacifiCorp*** system costs $8.1 per MW/hr versus $11.81 respectively. Costs are further identified in Table 2.

3. **Meeting with *BPA* –** We have had discussions with ***BPA***, ***PacifiCorp*** and ***Wasco Electric Cooperative*** representatives. A follow-up meeting with ***BPA*** representatives would be helpful. ***BPA*** has suggested that an Interconnection Application be submitted to ***BPA***. After a preliminary review, ***BPA*** would arrange a meeting within 30 days and the feasibility of interconnecting into ***BPA***'s could be discussed. The application requires a deposit of $10,000. If the application process is terminated after this initial meeting, approximately $8,000 would be returned.

3.0 EXISTING TRANSMISSION SYSTEM

3.1 *BPA* 230kV Circuits

BPA has a 230kV double circuit routed in a northeastern direction from Santiam Substation in Salem through the reservation approximately eight miles west and north of the wind turbine projects. The distance between the potential interconnection point and Santiam Substation is about 61 miles. One of the circuits continues on to McNary Substation. The other is de-energized. It ends approximately two miles from Santiam Substation on the West end and near Maupin Substation at the other end. Both circuits are 1,272 KCM ACSR capable of about 255 MVA in the summer and 560 MVA in the winter. Major portions of the circuits are rated for a maximum of 50 Degrees C operation.

The McNary – Santiam transmission line is one of four circuits collectively referred to as "The West of McNary Flowgate". It is a major path for power, which is transmitted from generation plants located east of the mountains to load centers west of the mountains. There is limited capacity on the flowgate for additional generation.

3.2 *PacifiCorp* 69kV Pelton Rereg Circuit

PacifiCorp has a 69kV 795 KCM AAC circuit to Warm Springs from Round Butte Substation via the Pelton Rereg Switching Station. Its rated capacity is 90 MVA in the summer and 136 MVA in the winter.

3.3 *PacifiCorp* 69kV Madras/Cherry Lane Circuit

PacifiCorp also has an alternate 69kV circuit to Warm Springs from Round Butte. It is routed through Madras and Cherry Lane substations. The circuit from Cherry Lane Substation to Warm Springs Substation consists of various conductors including 4.5 miles of #2 ACSR capable of about 20 MVA in the summer and 25 MVA in the winter. The first two miles of the line out of Round Butte is heavily loaded and the capacity may be exceeded with summer peak loads. This circuit cannot serve Warm Springs and Kah-Nee-Ta except during light load conditions. Generation introduced in the vicinity of Warm Springs would reduce this loading by delivering power directly to the local area.

3.4 *WEC* 69kV Circuit

WEC has a 69kV 3/0 ACSR circuit to Kah-Nee-Ta from Warm Springs with a capacity of 38 MVA in the summer and 44 MVA in the winter.

4.0 INTERCONNECTION OPTIONS AND COSTS

4.1 Introduction

Six interconnection options are discussed in the following sections – two 230kV options and 4 69kV options. The 230kV options involve interconnection into ***BPA***'s 230kV circuits, which are routed about eight miles from the project center. The 69kV options involve connection into the 69kV system, which lies south of the project. The nearest 69kV option is at Kah-Ne-Ta, about 8 miles south of the project. Warm Springs is approximately eight miles further south of the project than Kah-Nee-

Ta. Warm Springs Substation is served by ***PacifiCorp*** with a main circuit serving both the Pelton Rereg project and Warm Springs Substation (the Pelton Rereg Circuit) and an alternate circuit, which serves Madras and Cherry Lane Substations (the Madras/Cherry Lane Circuit). Both circuits originate at the Round Butte 69kV bus.

The six options are summarized in Table 2. Associated construction costs are listed in Table 3. The costs must be considered as representative costs – costs that ***WSPE*** might encounter as an electrical system is developed to interconnect with the regional grid under the various options presented. For example, we have used typical costs for the collector system since the wind farm layout has not been defined and more exact costs cannot therefore be determined.

Wheeling costs are presented in Section 4.3. Finally, power flows are presented and discussed in Section 5.1.

4.2 Interconnection Options

4.2.1 230kV Interconnection Options

The full 175 MW generation potential could be delivered into the BPA 230kV system anytime during normal system operation. One is an idle circuit from Maupin Substation to within two miles of Santiam Substation in Salem. The other is a circuit from McNary Substation to Santiam Substation. Refer to Section 5.0 "winter and summer power flow Cases 2 and 2a" for illustration of these interconnections and the associated power flows under normal operation conditions.

Option 1

BPA 230kV Idle Circuit to Santiam

The idle 230kV circuit appears to be an attractive interconnection option. This is especially attractive because it would deliver power directly into the "I-5 corridor" most likely displacing generation from east of the mountains and therefore relieving loads on some of the cross mountain circuits.

One challenge for this option is connecting the west end of the idle circuit into Santiam Substation. It is our understanding that between one and two miles of the circuit next to Santiam Substation has been removed.

An eight mile 230kV transmission line from the project substation to the interconnection point would be required. A three breaker switching station may be required if the ***BPA*** line is connected into the grid on the east end at a later date. (Another option that may be considered is to tie the two BPA circuits together at the point of interconnection via a four breaker switching station). ***BPA*** currently estimates the cost of a three breaker switching station to be $8,000,000.

Option 2

BPA McNary – Santiam 230kV Circuit

The McNary Santiam 230kV linc is critical for delivery of power from the East side of the mountains to the load centers on the west side of the mountains. It is one of four circuits in the West of McNary Flowgate. Power Flow S2b shows that, with the addition of 400 MW into this circuit at

John's Canyon Substation, the loading on the circuit from the point of interconnection to Santiam Substation is at 138 % of capacity. Preliminary indications from ***BPA*** are that no additional generation will be allowed on the circuit. Additional exploration with ***BPA*** is recommended. We will not present interconnection to this circuit as a viable option at this time. No cost estimates are presented for this option.

4.2.2 69kV Options

There are two potential interconnection points at the 69kV level, Kah-Nee-Ta and Warm Springs. Refer to winter and summer power flow cases 3, 4 and 5 for illustration of these interconnections and the maximum amounts of power that can be inserted into the system at peak load times.

Option 3

69kV Interconnection at Kah-Nee-Ta

Kah-Nee-Ta Substation is located about eight miles south the project. It is served by ***Wasco Electric Cooperative*** via an eight mile radial circuit from ***PacifiCorp's*** system at Warm Springs. A 69kV transmission line from the project to Kah-Nee-Ta would be required. We have also assumed that a 69kV breaker position would be installed at Kah-Nee-Ta Substation to insure that outages on the project's 69kV line would not affect the ***WEC*** loads at Kah-Nee-Ta.

Power flow S3 shows that the Kah-Nee-Ta to Warm Springs line is loaded to 93% with 40 MW from the wind farm and 2 MW load at Kah-Nee-Ta. If the Kah-Nee-Ta load was set to zero, the wind farm generation set at 38 MW and the voltage at the interconnection point set at 69kV, the Kah-Nee-Ta to Warm Springs circuit would be loaded to 100% of capacity. We have therefore set the maximum generation allowed under Option 3 to be 38 MW.

Option 4

69kV Interconnection at Warm Springs into the Pelton Rereg Circuit

Power Flow S4 shows that with 85 MW from the project inserted into Warm Springs and a 2 MW load at Kah-Nee-Ta, a 9 MW load at Warm Springs, 3 MW generation at Warm Springs Lumber and 15 MW generation at the Rereg Dam, the circuit from the Rereg Dam to Round Butte is loaded to 98%. If the generation at Warm Springs is increased to its maximum level of 9 MW and if the loads at Kah-Nee-Ta and Warm Springs is set to 0, then the project generation cannot exceed 69 MW without overloading the Rereg to Round Butte Circuit. (***PacifiCorp*** requires that substation loads on a radial circuit be set at zero when determining allowable generation levels on the circuit.) We have therefore set the maximum generation allowed under Option 4 to be 69 MW.

Option 5

69kV Interconnection at Warm Springs into the Madras/Cherry Lane Circuit with no Reconductoring of the #2 ACSR

The Madras/Cherry Lane circuit to Warm Springs contains two sections of 4.5 miles of #2 ACSR, which limits delivery to 21 MW in the summer. (Power flow S4 shows that 20 MW loads the circuit to 94%).

Option 6

69kV Interconnection at Warm Springs into the Madras/Cherry Lane Circuit with Reconductoring of the #2 ACSR to 397.5 kcm ACSR

If the #2 ACSR segments of the Warm Springs to Cherry Lane circuit are replaced with larger conductor, additional project generation could be accommodated by the Madras/Cherry Lane circuit. Project generation could be increased to 40 MW without overloading the circuit, even with the substation loads set at 0.

4.3 Wheeling Costs

4.3.1 Introduction

Depending on the location of the Point of Delivery and the selected route, ***WSPE*** will be required to pay wheeling charges to ***BPA***, ***WEC*** and/or ***PacifiCorp***. Power must also be purchased on the open market to make up for losses on the ***BPA*** or ***PacifiCorp*** systems. The following sections present the charges that can be expected for wheeling and loss reimbursement.

The following sections apply to power that is delivered into the grid. We can expect that approximately 2% of the power generated will be consumed as losses between the wind turbines and the point of interconnection.

All wheeling cost elements for Firm Power Transmission are presented except for energy imbalance charges. It is difficult to estimate these charges before operational experience is realized.

WSPE will also have the opportunity to employ non-firm wheeling to deliver power. Wheeling rates under these conditions will be less. For example, BPA wheeling rates, depending on scheduling effectiveness, could be about 60% of the firm wheeling rates. (WSPE would also have to pay for scheduling, however). Expenses for losses will not change. If losses are included, non-firm wheeling plus loss expense will be approximately 65% of firm wheeling plus loss expense. With non-firm wheeling, WSPE would, probably on rare occasions, be subject to curtailment.

4.3.2 *BPA* Wheeling Rates

1. Basic assumptions and 2006 rates

a. Point to Point demand rate (PTP) = $1.216/KW-mo

b. Scheduling, Control and Dispatch (SCD) = $0.203/KW-mo

c. Generation Supplied Reactive (GSR) = $0.085/KW-mo

d. Operating Reserves Spinning and Supplemental (ORSS) = $0.000396/KW-hr

e. Regulation and Frequency Response (RFR) = $0.00032/KW-hr (For service to loads in ***BPA*** control area only)

f. Transmission Losses = 1.9% of scheduled energy (Losses need to be returned to ***BPA*** by ***WSPE*** through a qualified provider probably at market rates)

2. Wheeling charges for 1 MW at a 32% plant factor

a. PTP = $1,216/mo

b. SCD = $203/mo

c. GSR = $85/mo

d. ORSS = $93/mo

e. RFR = $75/mo (Add for loads served in ***BPA*** control area)

f. Total Wheeling Costs = $1,216 + $203 + $85 + $93 + $75 = $1,671/MW-mo, $20,555/MW-yr

Total Wheeling Costs = $7.15/MW-hr

g. Losses = $222/mo (assuming replacement power costs $50/mo)

h. Total Wheeling and Loss Cost = $1,216 + $203 + $85 + $93 + $75 + $222 = $1,893/MW-mo, $22,718/MW-yr

Total Wheeling and Loss Cost = $8.10/MW-hr

4.3.3 *PacifiCorp* Wheeling Rates

1. Basic assumptions and 2006 rates

a. Point to Point demand rate (PTP) = $2.025/KW-mo

b. Scheduling, Control and Dispatch (SCD) = $0.00/KW-mo

c. Generation Supplied Reactive (GSR) = $0.00/KW-mo

d. Operating Reserves Spinning and Supplemental (ORSS) = $0.000746/KW-hr

e. Regulation and Frequency Response (RFR) = $0.00016/KW-hr (For service to loads in ***PacifiCorp*** control area only)

f. Transmission Losses = 4.48% of scheduled energy (Losses need to be returned to ***PacifiCorp*** by ***WSPE*** through a qualified provider probably at market rates)

2. Wheeling charges for 1 MW at a 32% plant factor

a. PTP = $2,025/mo

b. SCD = \$0.0/mo

c. GSR = \$0.0/mo

d. ORSS = \$174/mo

e. RFR = \$37/mo (Add for loads served in PacifiCorp control area)

f. Total Wheeling Cost = \$2,025 + \$0 + \$0 + \$174 + \$37 = \$2,237/MW-mo, \$26,840/MW-yr

Total Wheeling Cost = \$9.57/MW-hr

g. Losses = \$523/mo (assuming replacement power costs \$50/mo)

h. Total Wheeling and Loss Cost = \$2,025 + \$0 + \$0 + \$174 + \$37 + \$523 = \$2,760/MW-mo, \$33,119/MW-yr

Total Wheeling and Loss Cost = \$11.81/MW-hr

4.3.4 *WEC* Wheeling Rates

WEC does not have a generalized wheeling rate schedule. ***WEC*** has, however, recently developed wheeling rates for a wind farm developer who is now using ***WEC's*** system to deliver power to its customer.

The annual wheeling rate for the existing wind farm has been set at 3.63% times the installed costs of the affected system. In this case, the affected system was a newly installed 115kV circuit constructed to deliver power from the wind farm site into the ***BPA*** system. If we apply this rate to the installed cost of the Kah-Nee-Ta 69kV breaker (assume \$600,000) and the installed cost of the 8 mile, 3/0 ACSR 69kV circuit from Warm Springs to Kah-Nee-Ta (assume \$400,000), annual wheeling rates are determined to be \$36,300. This annual cost is increased to \$238,000 if we add the cost of losses (assuming a peak generation of 38 MW on a 69kV line, a plant factor of 0.32 and a 3/0 ACSR conductor).

Based on the above discussion, we can estimate that ***WEC*** cost for wheeling power will be:

\$79.6/MW-mo   \$955.2/MW-yr

\$0.34/MW-hr

The cost for Wheeling and Losses together will be:

\$521.9/MW-mo   \$6,262.8/MW-yr

\$2.22/MW-hr

4.3.5 Reimbursement of System Costs

Federal Energy Regulatory Commission (FERC) policy allows for reimbursement of system upgrade costs on network facilities by the transmission provider. ***BPA*** has adopted in part the ***FERC*** practice and ***BPA*** will reimburse the network interconnection cost through transmission service credits. ***BPA*** has yet to define what is considered network facilities associated with a three-breaker ring bus connected to the network. Most likely, these facilities will be considered network.

BPA applies interest on the outstanding balance at rates established by ***FERC*** to determine the duration of wheeling credits. ***FERC*** publishes interest rates for refund purposes. For the first quarter of 2006, the annual rate is 6.78%. The rates can change from quarter to quarter. For example, the quarterly rates in 2004 and 2005, starting in the first quarter of 2004, have been 4.00, 4.00, 4.00, 4.22, 4.75, 5.3, 5.77 and 6.23%.

Based on the following assumptions, ***WSPE*** could expect to recover its ***BPA*** interconnection charges by avoiding wheeling rates for 8 years, 2 months:

a. $10,400,000 reimbursable interconnection charges (Option 1 with ***BPA*** interconnection switching station included).

b. 100 MW wheeling contract.

c. Application of the 2006 Point-to-Point wheeling rate of $1.216/KW/mo.

d. Continued ***FERC*** interest rates of 6.78%.

If the wheeling contract were for 175 MW and the other assumptions remained the same, then the cost would be reimbursed in 5 years, 2 months.

PacifiCorp can be expected to follow essentially the same reimbursement policy.

5.0 POWER FLOW STUDIES

5.1 Introduction

The power flow studies consist of January and August 2006 winter and summer Base Cases, with and without project generation added. They are based on ***WEC***'s January, 2005 projection. These studies are for the system's normal steady state condition.

Since the Base Cases were developed, two wind farms with a combined generation of 400 MW have been approved for interconnection into the ***BPA*** grid at a proposed interconnection point about west of the DalReed substation. A new substation called John's Canyon is to be installed at the interconnection point on the McNary – Santiam 230kV circuit. The addition of this generation will significantly affect the loading of the circuit but will have little effect on the other circuits in the area – there will be very little difference on the circuits shown in the power flow diagrams.

There may be single or double contingency outage conditions where generation would have to be curtailed. This will be determined as ***BPA*** or ***PacifiCorp*** determines their capacity availability through engineering studies, which will include examination of system performance under outage conditions.

Power Flows discussed in Section 5.2 – 5.4 and presented at the end of the report.

5.2 Power Flows for Peak Winter Loads, January 2006 Winter Base Case

Case W1 – The 1.9 mile 69kV circuit from Round Butte to the Cove tap of the Culver-Madras line is loaded to 90% of its winter rating. No other capacity limits are exceeded and voltage performance in the area is satisfactory.

Case W1a – This is the same as Case W1 except that 400 MW of generation has been inserted at John's Canyon on the McNary – Santiam circuit. The loading on the Santiam end of this circuit is increased from 28% to 48% of capacity.

Case W2 – The winter Base Case with 175 MW of generation connected to the deenergized ***BPA*** 230kV circuit to Santiam Substation. The end of this line is two miles from Santiam and would somehow need to be extended to the 230kV system in the Salem area. This generation has no adverse effect on the local transmission system.

Case W2a – The winter Base Case with 175 MW of generation connected to the Santiam – McNary 230kV circuit. This generation has no adverse effect on the local transmission system. The loading of the portion between the project and Santiam is increased from 28% to 44% of its winter rating, while the loading of the remainder of the flowgate is reduced slightly. This generation has no other adverse effects on the local transmission system.

Case W2b – This is the same as Case W2a except that 400 MW of generation has been inserted at John's Canyon on the McNary – Santiam circuit. The loading on the Mutton Mountain to Santiam part of the circuit is increased from 48% to 65% of capacity.

Case W3 – The winter Base Case with 50 MW of generation added at Kah-Nee-Ta. This utilizes the winter capability of the ***Wasco Electric Cooperative*** 3/0 ACSR circuit if it coincides with peak load at Kah-Nee-Ta. It may exceed the capacity during periods of little or no load. The project may need to absorb reactive power when generation is high to avoid an over-voltage condition at Kah-Nee-Ta. This generation has no other adverse effects on the local transmission system.

Case W4 – The winter Base Case with 155 MW of generation added to the 69kV system, 130 MW at Warm Springs and 25 MW at Warm Springs on the alternate circuit from Cherry Lane Substation. This represents the winter capabilities of these two circuits. The loading of the 1.9 mile 69kV circuit from Round Butte to the Cove tap of the Culver-Madras line is reduced from 90% to 54% of its winter rating due to the insertion of 25 MW of generation. This generation has no adverse effects on the local transmission system.

Case W5 – The winter Base Case with 175 MW of generation added to the 69kV system, 120 MW at Warm Springs and 55 MW at Warm Springs on the Circuit from Cherry Lane Substation. 4.5 miles of #2 ACSR is replaced with 397 ACSR between Cherry Lane and Warm Springs substations. The 69kV circuits are loaded to about 90% and the Cove 230-69kV transformers (at Round Butte) to 95% of winter capacity. Note that this coincides with heavy load in the area and nominal generation at Pelton, Opal, and Warm Springs Lumber. There may be occasions when a full 175 MW cannot be received by the system due to limitations of the 69kV circuits or the Cove transformers. The loading of the 1.9 mile 69kV circuit from Round Butte to the Cove tap of the Culver-Madras line is reduced from 90% to 34% of its winter rating due to the insertion of 55 MW of generation. This generation has no other adverse effects on the local transmission system.

5.3 Power Flows for Peak Summer Loads, August 2006 Summer Base Case

Case S1 – The 1.9 mile 69kV circuit from Round Butte to the Cove tap of the Culver-Madras line is loaded to 111% of its summer rating. No other capacity limits are exceeded and voltage performance in the area is satisfactory.

Case S1a – This is the same as Case S1 except that 400 MW of generation has been inserted at John's Canyon on the McNary – Santiam circuit. The loading on the Santiam end of this circuit is increased from 54% to 98% of capacity.

Case S2 – The summer Base Case with 175 MW of generation connected to the deenergized ***BPA*** 230kV circuit to Santiam Substation. The end of this line is two miles from Santiam and would somehow need to be extended to the 230kV system in the Salem area. This generation has no adverse effects on the local transmission system.

Case S2a – The summer Base Case with 175 MW of generation connected to the Santiam – McNary 230kV circuit. The loading of the portion between the project and Santiam is increased from 54 % to 89 % of its summer rating, while the loading of the remainder of the flowgate is reduced slightly. This generation has no adverse effects on the local transmission system.

Case S2b – This is the same as Case S2a except that 400 MW of generation has been inserted at John's Canyon on the McNary – Santiam circuit. The loading on the Mutton Mountain to Santiam part of the circuit is increased from 98% to 135% of capacity.

Case S3 – The summer Base Case with 40 MW of generation added at Kah-Nee-Ta. This utilizes the summer capability of the Wasco Electric Co-Operative 3/0 ACSR circuit if it coincides with peak load at Kah-Nee-Ta. It may exceed the capacity during periods of little or no load. The project may need to absorb reactive power when generation is high to avoid an over-voltage condition at Kah-Nee-Ta. This generation has no adverse effects on the local transmission system.

Case S4 – The summer Base Case with 105 MW of generation added to the 69kV system, 85 MW at Warm Springs and 20 MW at Warm Springs on the alternate circuit from Cherry Lane Substation. This represents the summer capabilities of these two circuits. Note that this coincides with heavy load in the area and nominal generation at Pelton and Warm Springs Lumber. There may be occasions when a full 105 MW cannot be received by the 69kV circuits. The loading of the 1.9 mile 69kV circuit from Round Butte to the Cove tap of the Culver-Madras line is reduced from 111% to 75% of its summer rating due to the insertion of 20 MW of generation. This generation has no adverse effects on the local transmission system.

Case S5 – The summer Base Case with 125 MW of generation added to the 69kV system, 85 MW at Warm Springs and 40 MW at Warm Springs on the Circuit from Cherry Lane Substation. This represents the summer capabilities of these two circuits after 4.5 miles of #2 ACSR is replaced with 397 ACSR between Cherry Lane and Warm Springs substations. Note that this coincides with heavy load in the area and nominal generation at Pelton and Warm Springs Lumber. There may be occasions when a full 125 MW cannot be received by the 69kV circuits. The loading of the 1.9 mile 69kV circuit from Round Butte to the Cove tap of the Culver-Madras line is reduced from 111% to 56% of its summer rating due to the insertion of 20 MW of generation. This generation has no adverse effects on the local transmission system

5.4 Power Flows for Peak Spring Loads

Case L1 – Spring 2006 Base Case. This is considered the moderate or normal load scenario. The 1.9 mile 69kV circuit from Round Butte to the Cove tap of the Culver-Madras line is loaded to 92% of its thermal rating during periods of moderate ambient temperature. No other capacity limits are exceeded and voltage performance in the area is satisfactory.

TABLE 1

Table 1
Generation Interconnection Options

Interconnection Option	Allowable Generation	Comment
1a. BPA 230 kV, Idle Circuit to Santiam	175	Circuit loaded to 65 % of capacity during the summer (See PF S2).
1b BPA 230 kV, Idle Circuit to Santiam	100	
2a. BPA 230 kV, McNary - Santiam Circuit	0	Preliminary discussions with BPA representatives have revealed that BPA is reluctant to allow additional generation interconnections to this circuit. We have therefore set the "Allowable Generation" to 0. Cost estimates have therefore not been developed for this option.
2b. BPA 230 kV, McNary - Santiam Circuit	0	Same as "2a".
3. Wasco Electric Cooperative, 69 kV Interconnection at Kahneeta	38	With zero load at Kahneeta during the summer and 69 kV at the point of interconnection, generation can be set at 38 MW before the Warm Springs to Kahneeta circuit becomes loaded to 100 % of capacity (See PF 3).
4. PacifiCorp, 69 kV Interconnection at Warm Springs, Connection into the Pelton Reregulation circuit	69	With zero load at Kahneeta and Warm Springs during the summer and with the Warm Springs Lumber generation set at the maximum level of 9 MW, generation can be set at 69 MW befort the Pelton Rereg to Cove circuit becomes loaded to 100 % of capacity (See PF 4).
5. PacifiCorp, 69 kV Interconnection into the Madras Circuit, No Reconductoring of PacifiCorp Circuit	21	With generation set at 21 MW, the circuit from Warm Springs to Cherry Lane becomes loaded to 100 % during the summer (See PF 4).
6. PacifiCorp, 69 kV Interconnection into the Madras Circuit, Reconductor Warm Springs to Cherry Lane Circuit	40	With zero load at Cherry Lane during the summer, the generation can be set at 40 MW before the circuits from Warm Springs to CECC Tap become loaded to 100 % (See PF 5). This assumes that the #2 ACSR portion of circuit from Warm Springs to Cherry Lane (4.51 miles) has been reconductored to 397 kcm ACSR.

TABLE 2

Table 2
Generation Interconnection Options

Interconnection Option	Interconnection Capacity (MW)	Initial Cost: Cost	Initial Cost: Cost per MW	Cost after Reimbursement: Cost	Cost after Reimbursement: Cost per MW
1a. BPA 230kV, Idle Circuit to Santiam w/o Interconnection Switching Station	175	16,905,000	96,600	14,505,000	82,900
BPA 230kV, Idle Circuit to Santiam with Interconnection Switching Station	175	24,905,000	142,300	14,505,000	82,900
1b. BPA 230kV, Idle Circuit to Santiam w/o Interconnection Switching Station	100	12,060,000	120,600	9,660,000	96,600
BPA 230kV, Idle Circuit to Santiam with Interconnection Switching Station	100	20,060,000	200,600	9,660,000	96,600
3. Wasco Electric Cooperative, 69kV Interconnection at Kah-Nee-Ta	41	4,236,000	103,300	4,236,000	103,300
4. PacifiCorp, 69kV Interconnection at Warm Springs, Connection into the Pelton Reregulation circuit	69	6,515,000	94,400	6,515,000	94,400
5. PacifiCorp, 69kV Interconnection into the Madras Circuit, No Reconductoring of PacifiCorp Circuit	21	4,139,000	197,100	4,139,000	197,100
6. PacifiCorp, 69kV Interconnection into the Madras Circuit, Reconductor Warm Springs to Cherry Lane Circuit	40	5,734,000	143,400	5,324,000	133,100

Table 2
Generation Interconnection Options

		Annual Wheeling and Loss Reimbursement Cost (1)		
		Per MW	**For Capacity**	**Point of Delivery**
1a. BPA 230kV, Idle Circuit to Santiam, with and without three Breaker Ring Bus Interconnection Switching Station	175	$22,718	$3,975,650	PGE at Salem and Other West Side Locations
1b. BPA 230kV, Idle Circuit to Santiam, with and without three Breaker Ring Bus Interconnection Switching Station	100	$22,718	$2,271,800	PGE at Salem and Other West Side Locations
3. Wasco Electric Cooperative, 69kV Interconnection at Kah-Nee-Ta	38	$6,263	$237,986	PacifiCorpService Area, Madras, etc
		$39,382	$1,496,508	PGE at Round Butte
4. PacifiCorp, 69kV Interconnection at Warm Springs, Connection into the Pelton Reregulation circuit	69	$0	$0	PacifiCorpService Area, Madras, etc

		Annual Wheeling and Loss Reimbursement Cost (1)		
		Per MW	**For Capacity**	**Point of Delivery**
		$33,119	$2,285,211	PGE at Round Butte
5. PacifiCorp, 69kV Interconnection into the Madras Circuit, No Reconductoring of PacifiCorp Circuit	21	$0	$0	PacifiCorpService Area, Madras, etc
		$33,119	$695,499	PGE at Round Butte
6. PacifiCorp, 69kV Interconnection into the Madras Circuit, Reconductor Warm Springs to Cherry Lane Circuit	40	$0	$0	PacifiCorpService Area, Madras, etc
		$33,119	$1,324,760	PGE at Round Butte

(1) For non-firm wheeling, WSPE can expect to pay less. For example, for BPA non-firm wheeling, WSPE will pay about 65% of the firm wheeling and loss reimbursement costs.

TABLE 3

Table 3
Cost Estimates,
Interconnection Options

Interconnection Option	Generation (MW)	Description	Initial Cost	Cost After Reimbursement
1a. BPA 230kV, Idle Circuit to Santiam	175			
Interconnection Station		230kV Position at Santiam Substation	$1,000,000	$0
Transmission Line		Two Mile Construction at Santiam End of Idle Circuit, 795 kcm ACSR and Eight Mile Tap to Idle Circuit, 230kV Circuit, 795 kcm ACSR	$3,800,000	$2,400,000
Project Step-up Station		Two 60/80/100 MVA Transformers, 6 collector positions, 60 MVA Capacitor bank (Multi Stepped)	$5,000,000	$5,000,000
Collector System		35 miles of Collector Circuits	$4,725,000	$4,725,000
Wind Turbine Step-up Transformers		70 - 2.5 MVA, 690v - 34.5kV Step-up Transformers	$2,380,000	$2,380,000
			$16,905,000	**$14,505,000**
Future Interconnection Station		Three-Breaker Ring Bus if 230kV circuit becomes connected into Grid of the east end of the circuit.	$8,000,000	$0
			$24,905,000	**$14,505,000**

Table 3
Cost Estimates,
Interconnection Options

Interconnection Option	Generation (MW)	Description	Initial Cost	Cost After Reimbursement
1b. BPA 230kV, Idle Circuit to Santiam	100			
Interconnection Station		230kV Position at Santiam Substation	$1,000,000	$0
Transmission Line		Two Mile Construction at Santiam End of Idle Circuit, 795 kcm ACSR and Eight Mile Tap to Idle Circuit, 230kV Circuit, 795 kcm ACSR	$3,800,000	$2,400,000
Project Step-up Station		One 60/80/100 MVA Transformers, 3 collector positions, 30 MVA Capacitor bank (Multi Stepped)	$3,200,000	$3,200,000
Collector System		20 miles of Collector Circuits	$2,700,000	$2,700,000
Wind Turbine Step-up Transformers		40 - 2.5 MVA, 690v - 34.5kV Step-up Transformers	$1,360,000	$1,360,000
			$12,060,000	**$9,660,000**
Future Interconnection Station		Three-Breaker Ring Bus if 230kV circuit becomes connected into Grid of the east end of the circuit.	$8,000,000	$0
			$20,060,000	**$9,660,000**

Table 3
Cost Estimates,
Interconnection Options

Interconnection Option	Generation (MW)	Description	Initial Cost	Cost After Reimbursement
3. Wasco Electric Cooperative, 69kV Interconnection at Kah-Nee-Ta	38			
Interconnection Station		69kV Position at Kahneeta Substation	$400,000	$400,000
Transmission Line		Six Mile, 69kV, 795 kcm ACSR	$600,000	$600,000
Project Step-up Station		One 30/40/50 MVA Transformer, 2 collector positions, 15 MVA Switched Capacitor bank (Multi Stepped)	$1,700,000	$1,700,000
Collector System		8.4 miles of Collector Circuits	$1,026,000	$1,026,000
Wind Turbine Step-up Transformers		15 - 2.5 MVA, 690v - 34.5kV Step-up Transformers	$510,000	$510,000
			$4,236,000	**$4,236,000**
4. PacifiCorp, 69kV Interconnection at Warm Springs, Connection into the Pelton Rereg circuit	69			
Interconnection Station		69kV Position at Warm Springs Substation	$600,000	$600,000
Transmission Line		Fourteen Mile, 69kV, 795 kcm ACSR	$1,400,000	$1,400,000
Project Step-up Station		One 30/40/50 MVA Transformer, 2 collector positions, 15 MVA Switched Capacitor bank (Multi Stepped)	$1,700,000	$1,700,000
Collector System		13.8 miles of Collector Circuits	$1,863,000	$1,863,000
Wind Turbine Step-up Transformers		28 - 2.5 MVA, 690v - 34.5kV Step-up Transformers	$952,000	$952,000
			$6,515,000	**$6,515,000**

Table 3
Cost Estimates,
Interconnection Options

Interconnection Option	Generation (MW)	Description	Initial Cost	Cost After Reimbursement
5. PacifiCorp, 69kV Interconnection into the Madras Circuit, No Reconductoring of PacifiCorp Circuit	21			
Interconnection Station		69kV Position at Warm Springs Substation	$600,000	$600,000
Transmission Line		Fourteen Mile, 69 kV, 795 kcm ACSR	$1,400,000	$1,400,000
Project Step-up Station		One 15/20/25 MVA Transformer, 2 collector positions, 7.5 MVA Switched Capacitor bank (Multi Stepped)	$1,300,000	$1,300,000
Collector System		4.2 miles of Collector Circuits	$567,000	$567,000
Wind Turbine Step-up Transformer		8 - 2.5 MVA, 690v - 34.5kV Step-up Transformers	$272,000	$272,000
			$4,139,000	**$4,139,000**

Table 3
Cost Estimates,
Interconnection Options

Interconnection Option	Generation (MW)	Description	Initial Cost	Cost After Reimbursement
6. PacifiCorp, 69kV Interconnection into the Madras Circuit, Reconductor Warm Springs to Cherry Lane Circuit	40			
Interconnection Station		69kV Position at Warm Springs Substation	$600,000	$600,000
Transmission Line		Fourteen Mile, 69kV, 795 kcm ACSR to Warm Springs and 4.1 mile Reconductor of the #2 ACSR part of the PacifiCorp Cherry Lane to Warm Springs Circuit	$1,810,000	$1,400,000
Project Step-up Station		One 30/40/50 MVA Transformer, 2 collector positions, 15 MVA Switched Capacitor bank (Multi Stepped)	$1,700,000	$1,700,000
Collector System		8.0 miles of Collector Circuits	$1,080,000	$1,080,000
Wind Turbine Step-up Transformer		16 - 2.5 MVA, 690v - 34.5kV Step-up Transformers	$544,000	$544,000
			$5,734,000	**$5,324,000**

TABLE 4

Table 4
Power Flow Summary
Saddle Mountain Generation Project

Case	Description	Generation	Comments
January, 2006 Base Case			
W1	Adjusted Warm Springs load to 13 MW		Cove-Cove Tap 69kV Loaded 90%
W1a	Adjusted Warm Springs load to 13 MW, Added 400 MW gen at Proposed John's Canyon Substation on McNary - Santiam line.		Cove-Cove Tap 69kV Loaded 90%, John's Canyon - Santiam loading increased to 48 % from 28%.
W2	230kV Interconnection, Idle Circuit to Santiam	175 MW	No adverse effects on local system
W2a	230kV Interconnection, McNary - Santiam	175 MW	No adverse effects on local system
W2b	230kV Interconnection, McNary - Santiam. Added 400 MW gen at Proposed John's Canyon Substation on McNary - Santiam line.	175 MW	No adverse effects on local system, Load from Mutton Mt. Interconnection point to Santiam increased to 65% from 48%.
W3	69kV Interconnection at Kah-Nee-Ta	50 MW	High Voltage at Ka-Nee-Ta
W4	69kV Interconnection at Warm Springs	155 MW	69kV circuits loaded to capacity
W5	69kV Interconnection at Warm Springs	175 MW	Replace #2 ACSR, Cherry Lane to Warm Springs Cove Transformers loaded to 95%
August, 2006 Base Case			
S1	No Changes		Cove-Cove Tap 69kV Loaded 111%
S1a	Added 400 MW gen at Proposed John's Canyon Substation on McNary - Santiam line.		Cove-Cove Tap 69kV Loaded 110%, John's Canyon - Santiam loading increased from 54% to 98%.
S2	230kV Interconnection, Idle Circuit to Santiam	175 MW	No adverse effects on local system
S2a	230kV Interconnection, McNary - Santiam	175 MW	No adverse effects on local system
S2a	230kV Interconnection, McNary - Santiam. Added 400 MW gen at Proposed John's Canyon Substation on McNary - Santiam line.	175 MW	John's Canyon - Santiam loading increased from 98% to 135%.
S3	69kV Interconnection at Kah-Nee-Ta	40 MW	High Voltage at Ka-Nee-Ta
S4	69kV Interconnection at Warm Springs	105 MW	69KV circuits loaded to capacity
S5	69kV Interconnection at Warm Springs	125 MW	Replace #2 ACSR, Cherry Lane to Warm Springs
Spring, 2006 Base Case			
L1	No Changes		Cove-Cove Tap 69kV Loaded 92%

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P:\Mutton Mountain Transmission Study\Table 4, Mutton Mt Power Flow Summary.xls

FIGURE 1

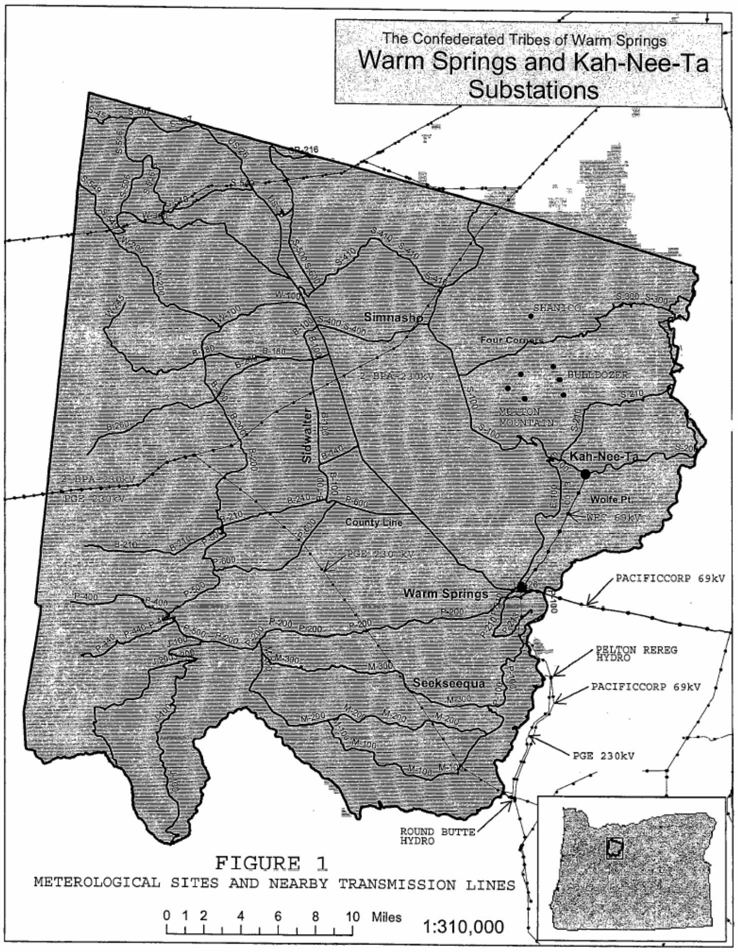
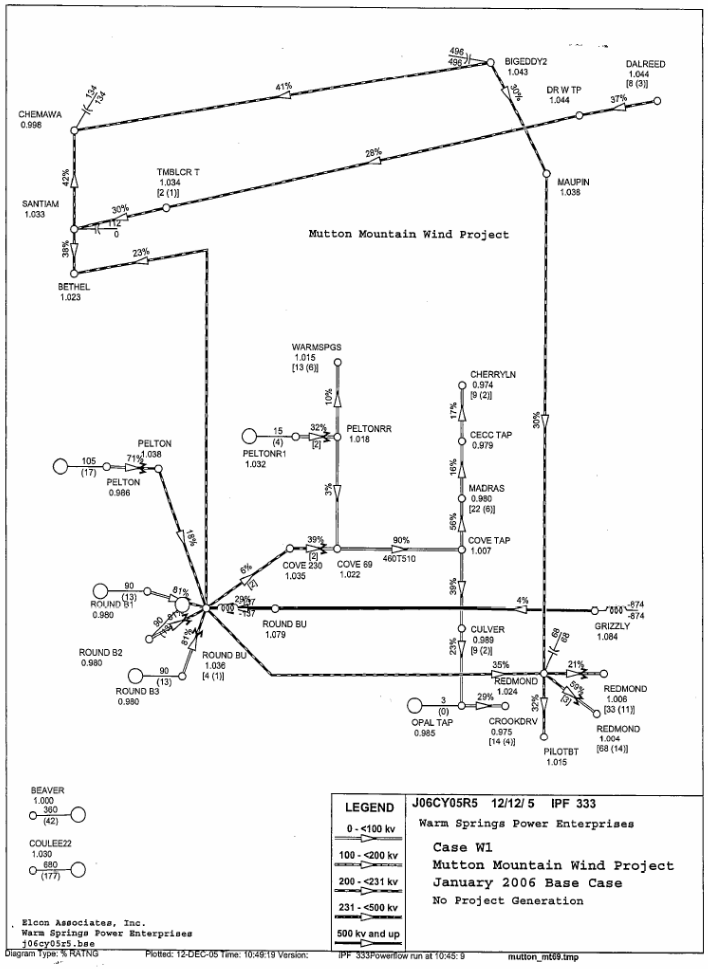


FIGURE 1
METEROLOGICAL SITES AND NEARBY TRANSMISSION LINES

POWER FLOW STUDIES



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WARMSPGS
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PELTON
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MADRAS
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Warm Springs Power Enterprises
Case W1
Mutton Mountain Wind Project
January 2006 Base Case
No Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
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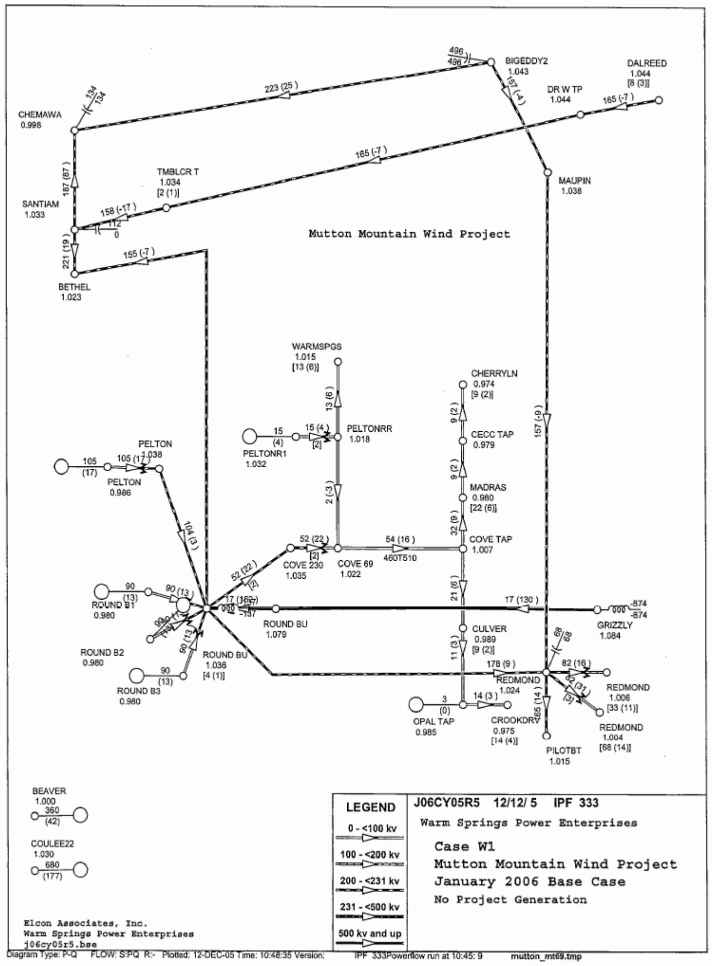

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500 kv and up
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Warm Springs Power Enterprises
Case W1
Mutton Mountain Wind Project
January 2006 Base Case
No Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
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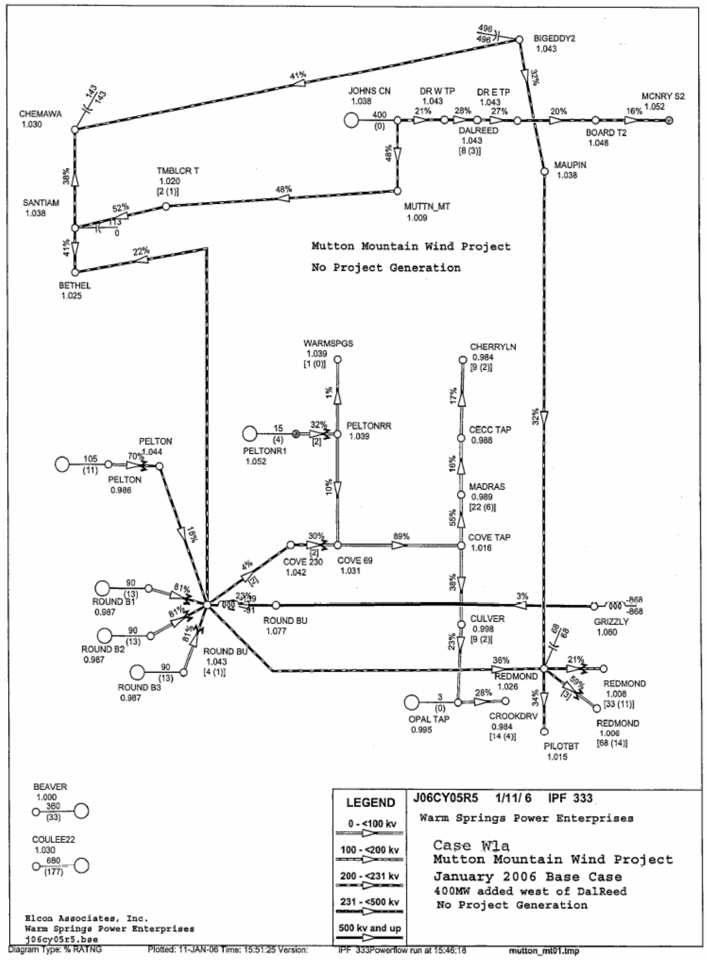
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Warm Springs Power Enterprises
Case W1a
Mutton Mountain Wind Project
January 2006 Base Case
400MW added west of DalReed
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Elcon Associates, Inc.
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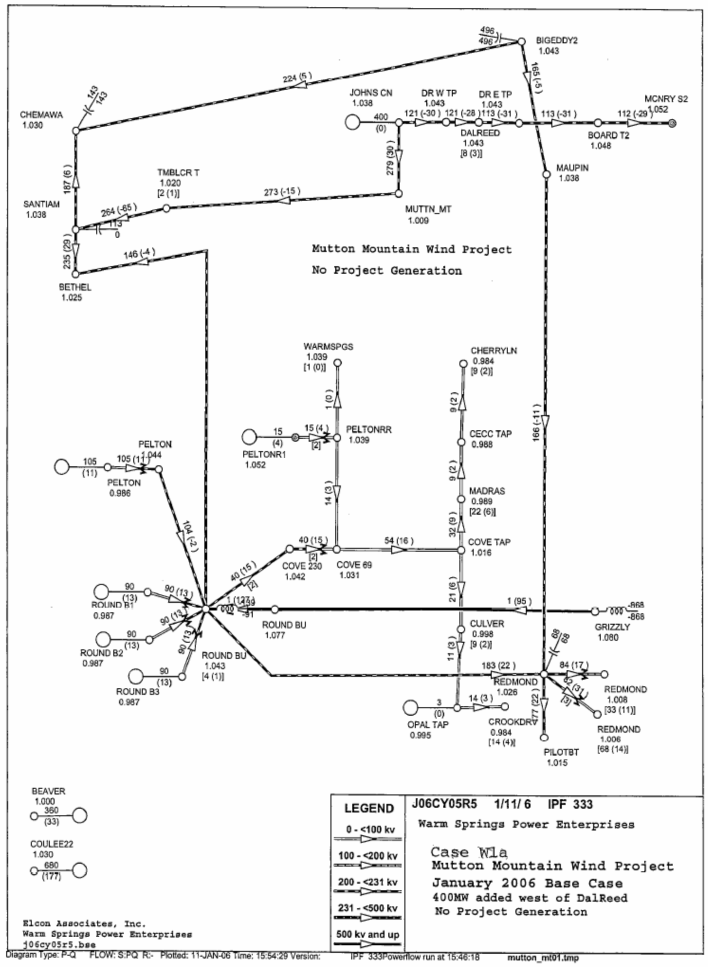
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Case W1a
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400MW added west of DalReed
No Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
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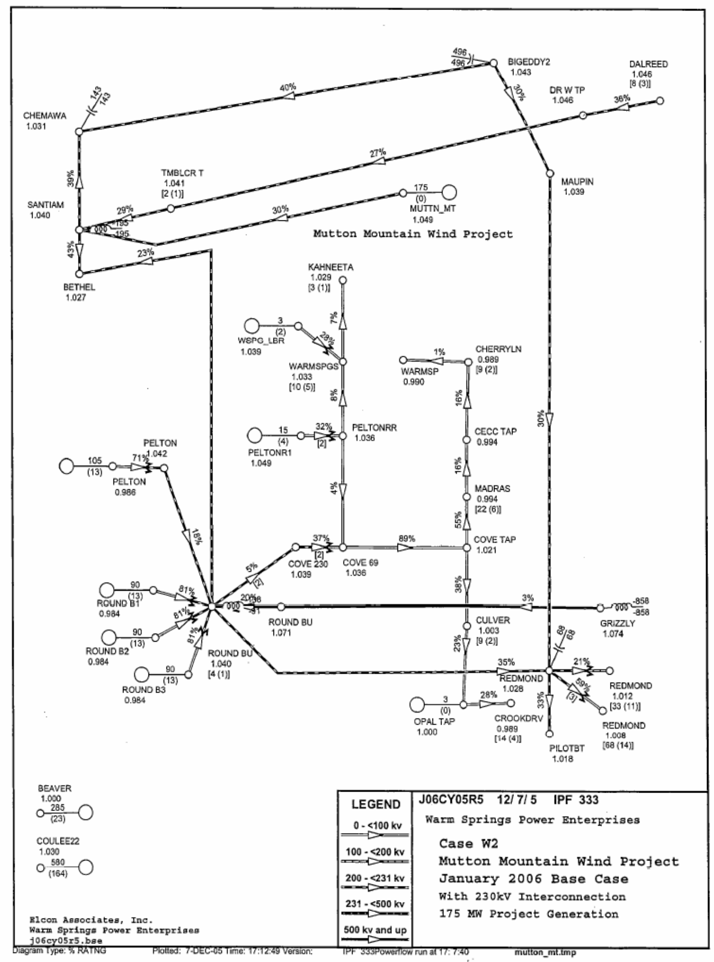
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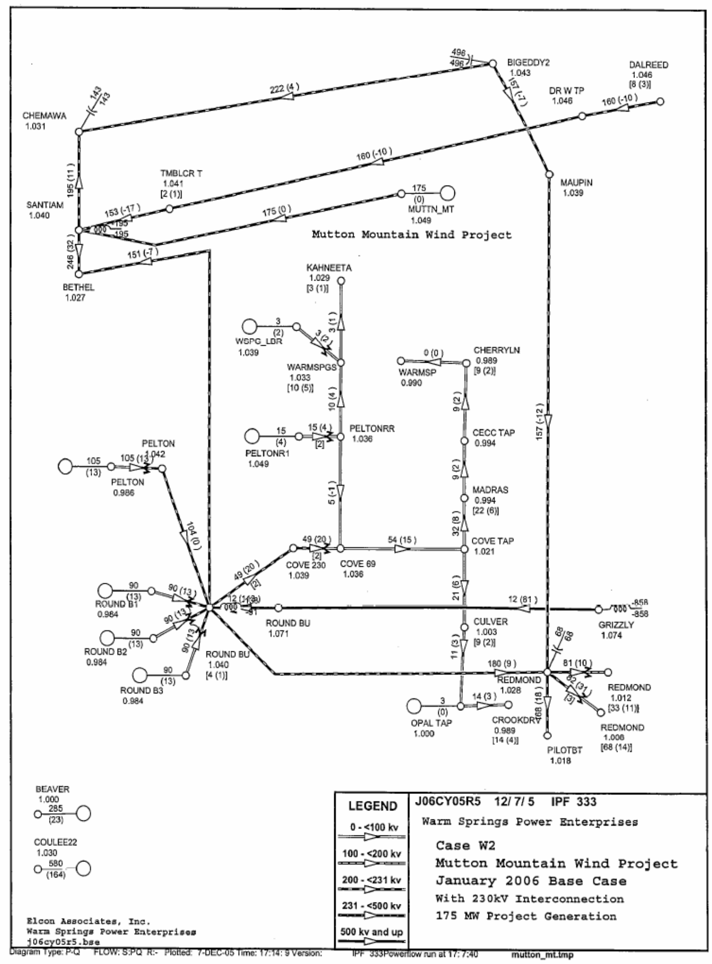
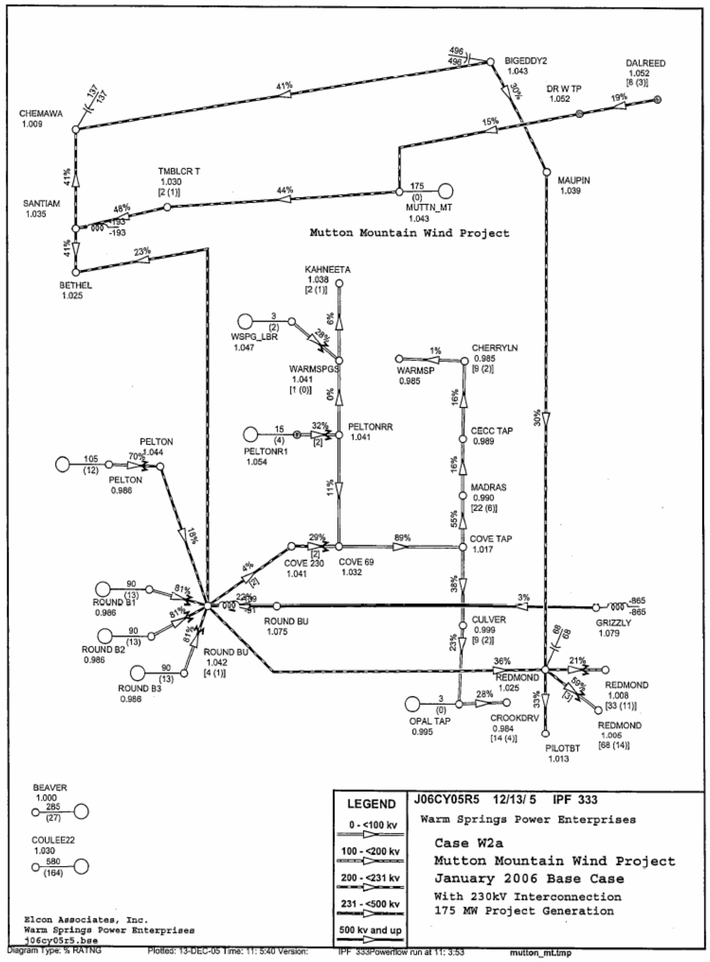
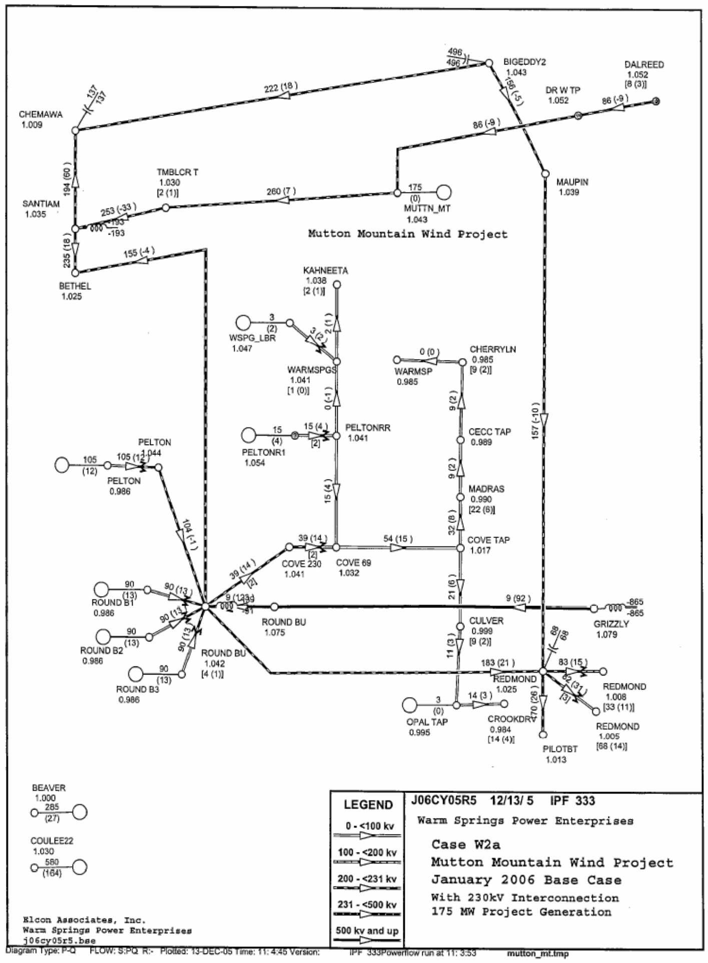
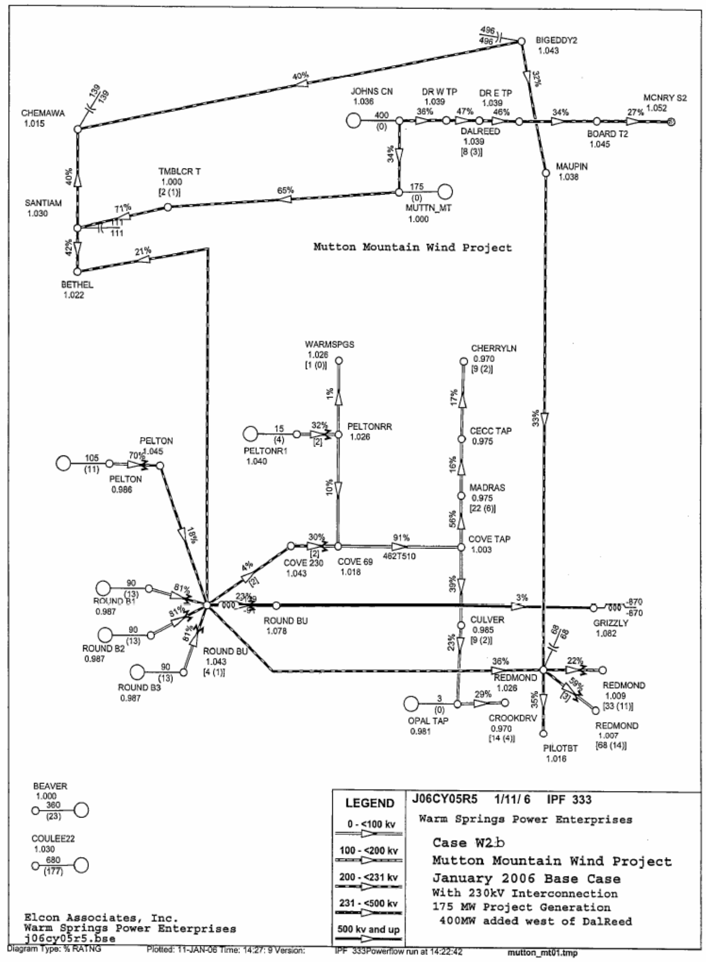
CHERRYLN
WARMSP
PELTONRR
PELTONR1
CECC TAP
PELTON
MADRAS
COVE TAP
COVE 230
COVE 69
ROUND B1
ROUND BU
GRIZZLY
CULVER
ROUND B2
ROUND B3
REDMOND
OPAL TAP
CROOKDRV
PILOTBT
BEAVER
COULEE22
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
J06CY05R5 12/ 7/ 5 IPF 333
Warm Springs Power Enterprises
Case W2
Mutton Mountain Wind Project
January 2006 Base Case
With 230kV Interconnection
175 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
j06cy05r5.bse
Diagram Type: % RATNG
Plotted: 7-DEC-05 Time: 17:12:49 Version:
IPF 333Powerflow run at 17: 7:40
mutton_mt.tmp

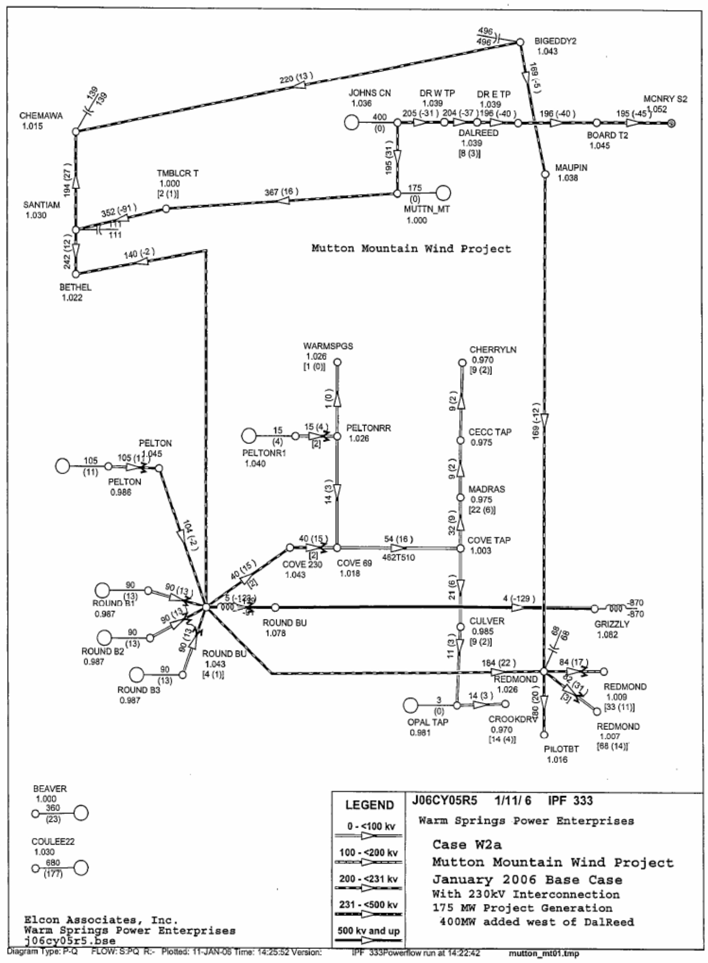

Mutton Mountain Wind Project
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
J06CY05R5 12/ 7/ 5 IPF 333
Warm Springs Power Enterprises
Case W2
Mutton Mountain Wind Project
January 2006 Base Case
With 230kV Interconnection
175 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
j06cy05r5.bse
CHEMAWA
SANTIAM
BETHEL
TMBLCR T
MUTTN_MT
BIGEDDY2
DALREED
DR W TP
MAUPIN
KAHNEETA
WSPC_LDR
WARMSPGS
WARMSP
CHERRYLN
PELTONRR
PELTONR1
CECC TAP
MADRAS
COVE TAP
PELTON
COVE 230
COVE 69
ROUND B1
ROUND B2
ROUND B3
ROUND BU
GRIZZLY
CULVER
REDMOND
OPAL TAP
CROOKDRV
PILOTBT
BEAVER
COULEE22

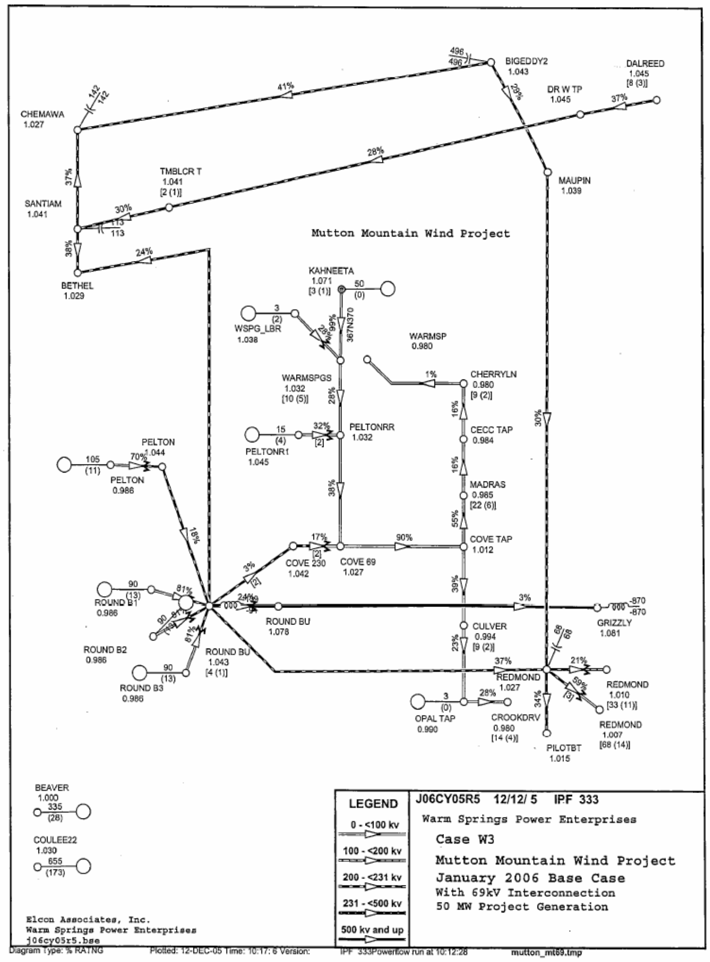


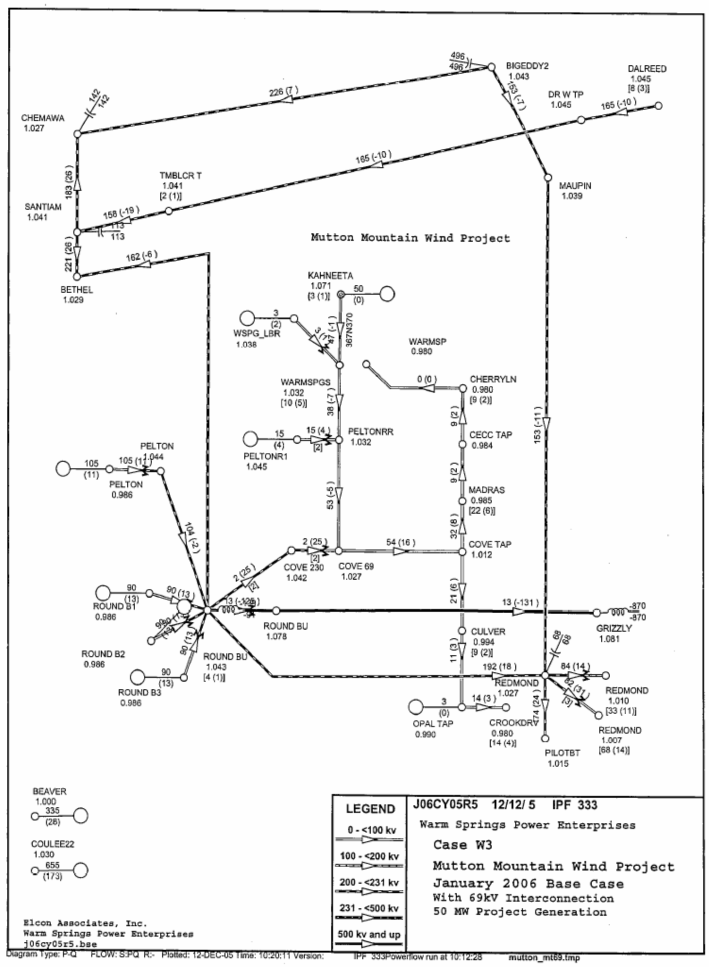
Mutton Mountain Wind Project
CHEMAWA 1.009
SANTIAM 1.035
BETHEL 1.025
TMBLCR T 1.030
BIGEDDY2 1.043
DALREED 1.052
DR W TP 1.052
MAUPIN 1.039
MUTTN_MT 1.043
KAHNEETA 1.038
WSPG_LBR 1.047
WARMSPGS 1.041
CHERRYLN 0.985
WARMSP 0.985
PELTONRR 1.041
PELTONR1 1.054
CECC TAP 0.989
MADRAS 0.990
PELTON 1.044
PELTON 0.986
COVE TAP 1.017
COVE 230 1.041
COVE 69 1.032
ROUND B1 0.986
ROUND B2 0.986
ROUND B3 0.986
ROUND BU 1.042
ROUND BU 1.075
CULVER 0.999
GRIZZLY 1.079
REDMOND 1.025
REDMOND 1.008
REDMOND 1.006
OPAL TAP 0.995
CROOKDRV 0.984
PILOTBT 1.013
BEAVER 1.000
COULEE22 1.030
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
J06CY05R5 12/13/ 5 IPF 333
Warm Springs Power Enterprises
Case W2a
Mutton Mountain Wind Project
January 2006 Base Case
With 230kV Interconnection
175 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
j06cy05r5.bse
Diagram Type: % RATNG
Plotted: 13-DEC-05 Time: 11: 5:40 Version:
IPF 333Powerflow run at 11: 3:53
mutton_mt.tmp

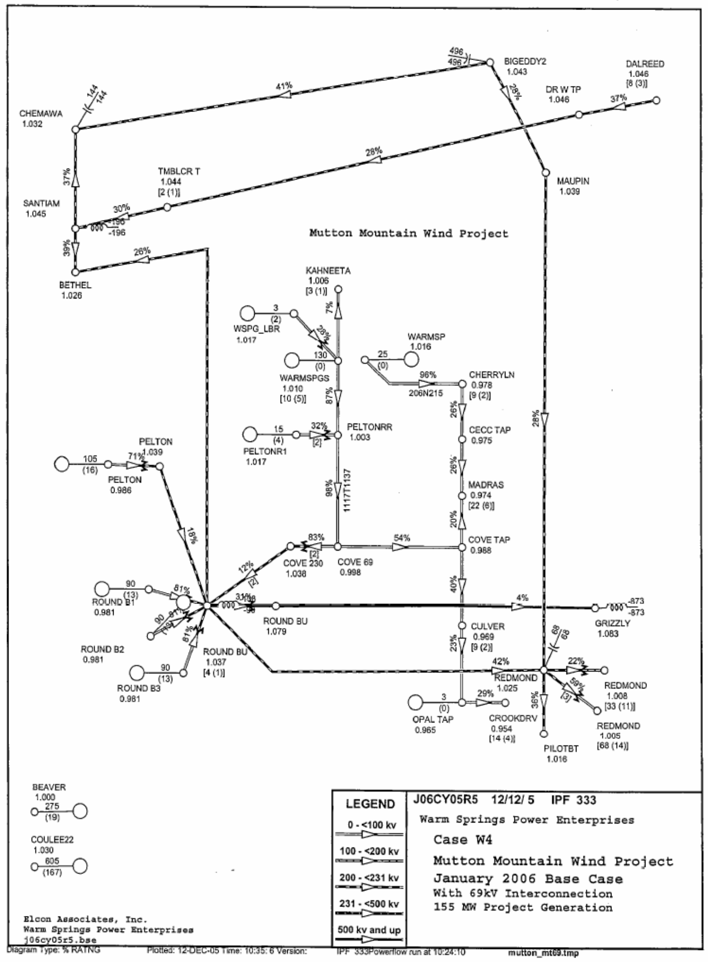

Mutton Mountain Wind Project
CHEMAWA
1.009
BIGEDDY2
1.043
DALREED
1.052
DR W TP
1.052
SANTIAM
1.035
TMBLCR T
1.030
MUTTN_MT
1.043
MAUPIN
1.039
BETHEL
1.025
KAHNEETA
1.038
WSPG_LBR
1.047
WARMSPGS
1.041
WARMSP
0.985
CHERRYLN
0.985
PELTONRR
1.041
PELTONR1
1.054
CECC TAP
0.989
PELTON
1.044
PELTON
0.986
MADRAS
0.990
COVE TAP
1.017
COVE 230
1.041
COVE 69
1.032
ROUND B1
0.986
ROUND B2
0.986
ROUND B3
0.986
ROUND BU
1.075
ROUND BU
1.042
CULVER
0.999
GRIZZLY
1.079
REDMOND
1.025
REDMOND
1.008
REDMOND
1.005
OPAL TAP
0.995
CROOKDRV
0.984
PILOTBT
1.013
BEAVER
1.000
COULEE22
1.030
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
J06CY05R5 12/13/ 5 IPF 333
Warm Springs Power Enterprises
Case W2a
Mutton Mountain Wind Project
January 2006 Base Case
With 230kV Interconnection
175 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
j06cy05r5.bse
Diagram Type: P-Q FLOW: S:PQ R:- Plotted: 13-DEC-05 Time: 11: 4:45 Version: IPF 333Powerflow run at 11: 3:53 mutton_mt.tmp

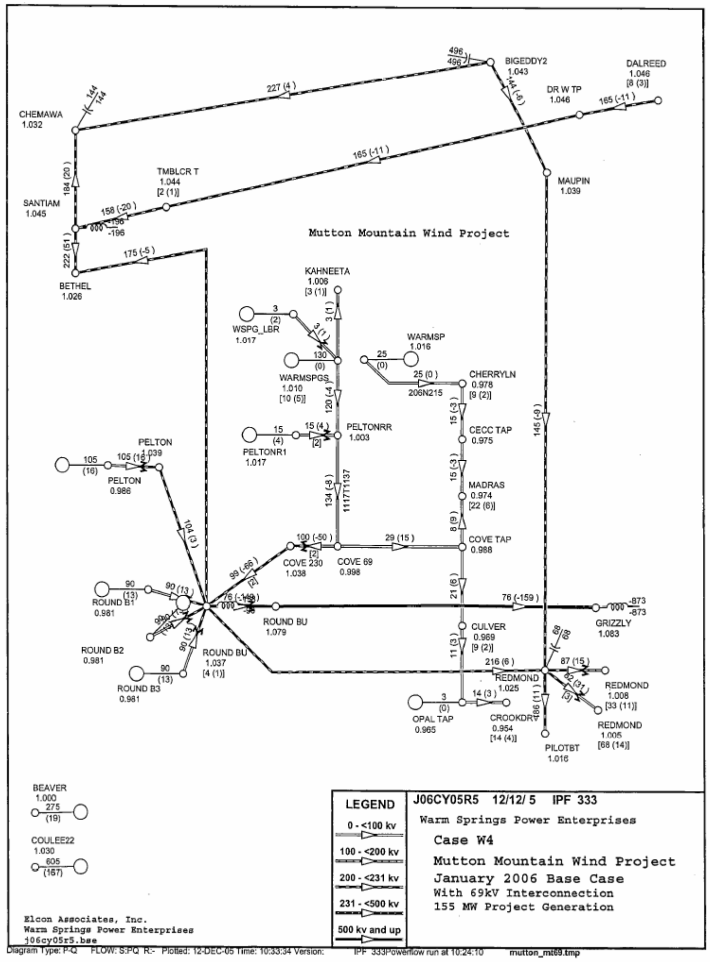

Mutton Mountain Wind Project
BIGEDDY2
1.043
CHEMAWA
1.015
JOHNS CN
1.036
DR W TP
1.039
DR E TP
1.039
DALREED
1.039
MCNRY S2
1.052
BOARD T2
1.045
MAUPIN
1.038
TMBLCR T
1.000
SANTIAM
1.030
MUTTN_MT
1.000
BETHEL
1.022
WARMSPGS
1.026
CHERRYLN
0.970
PELTONRR
1.026
PELTONR1
1.040
CECC TAP
0.975
PELTON
1.045
PELTON
0.986
MADRAS
0.975
COVE TAP
1.003
COVE 230
1.043
COVE 69
1.018
ROUND B1
0.987
ROUND BU
1.078
GRIZZLY
1.082
CULVER
0.985
ROUND B2
0.987
ROUND BU
1.043
ROUND B3
0.987
REDMOND
1.026
REDMOND
1.009
OPAL TAP
0.981
CROOKDRV
0.970
REDMOND
1.007
PILOTBT
1.016
BEAVER
1.000
COULEE22
1.030
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
J06CY05R5 1/11/ 6 IPF 333
Warm Springs Power Enterprises
Case W2b
Mutton Mountain Wind Project
January 2006 Base Case
With 230kV Interconnection
175 MW Project Generation
400MW added west of DalReed
Elcon Associates, Inc.
Warm Springs Power Enterprises
j06cy05r5.bse
Diagram Type: % RATING
Plotted: 11-JAN-06 Time: 14:27: 9 Version:
IPF 333Powerflow run at 14:22:42
mutton_mt01.tmp

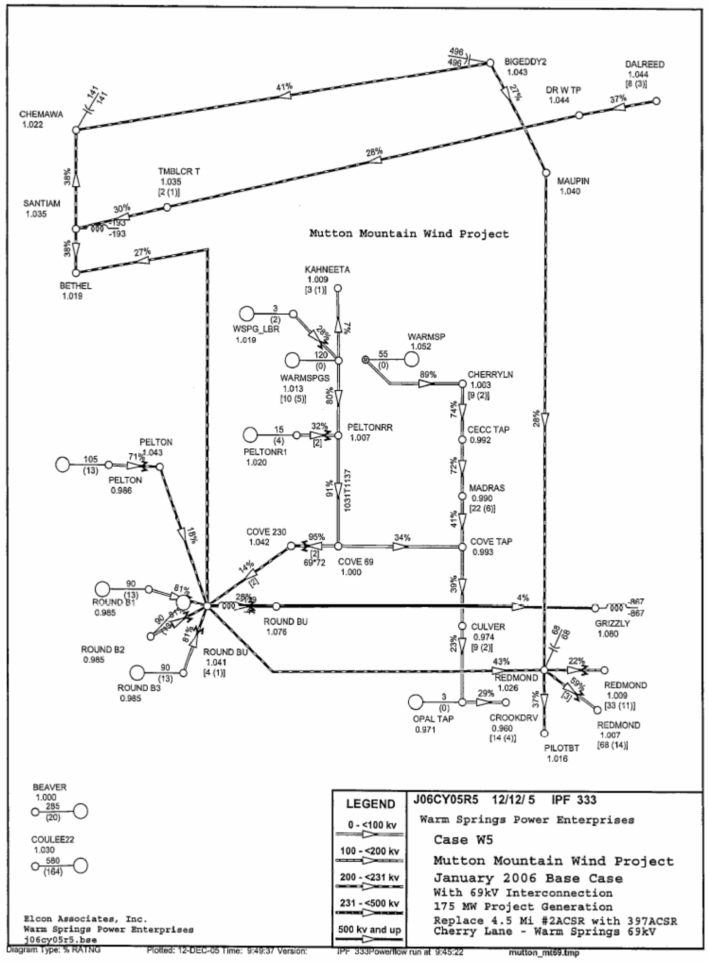

Mutton Mountain Wind Project
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
J06CY05R5 1/11/ 6 IPF 333
Warm Springs Power Enterprises
Case W2a
Mutton Mountain Wind Project
January 2006 Base Case
With 230kV Interconnection
175 MW Project Generation
400MW added west of DalReed
Elcon Associates, Inc.
Warm Springs Power Enterprises
j06cy05r5.bse


BIGEDDY2
1.043
DALREED
1.045
DR W TP
1.045
CHEMAWA
1.027
TMBLCR T
1.041
SANTIAM
1.041
MAUPIN
1.039
Mutton Mountain Wind Project
BETHEL
1.029
KAHNEETA
1.071
WSPG_LBR
1.038
WARMSP
0.980
WARMSPGS
1.032
CHERRYLN
0.980
CECC TAP
0.984
PELTONRR
1.032
PELTONR1
1.045
PELTON
1.044
PELTON
0.986
MADRAS
0.985
COVE TAP
1.012
COVE 230
1.042
COVE 69
1.027
ROUND B1
0.986
ROUND BU
1.078
GRIZZLY
1.061
ROUND B2
0.986
ROUND BU
1.043
CULVER
0.994
ROUND B3
0.986
REDMOND
1.027
REDMOND
1.010
OPAL TAP
0.990
CROOKDRV
0.980
REDMOND
1.007
PILOTBT
1.015
BEAVER
1.000
COULEE22
1.030
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
J06CY05R5 12/12/ 5 IPF 333
Warm Springs Power Enterprises
Case W3
Mutton Mountain Wind Project
January 2006 Base Case
With 69kV Interconnection
50 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
j06cy05r5.bse
Diagram Type: % RATNG
Plotted: 12-DEC-05 Time: 10:17: 6 Version:
IPF 333Powerflow run at 10:12:28
mutton_mt69.tmp

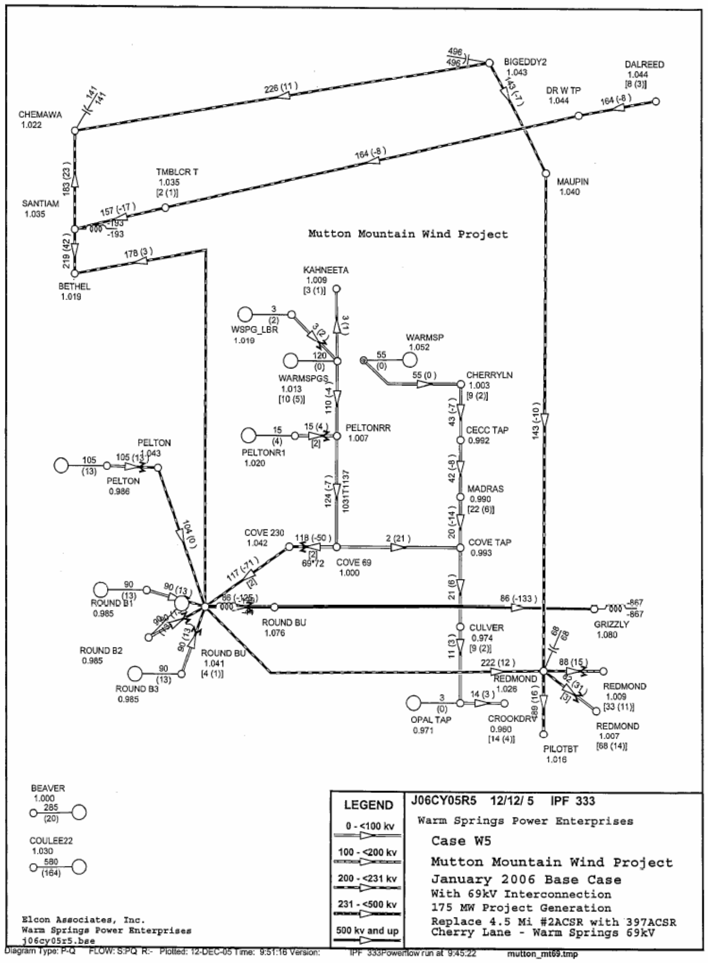

Mutton Mountain Wind Project
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
J06CY05R5 12/12/ 5 IPF 333
Warm Springs Power Enterprises
Case W3
Mutton Mountain Wind Project
January 2006 Base Case
With 69kV Interconnection
50 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
j06cy05r5.bse
BIGEDDY2
DALREED
CHEMAWA
SANTIAM
TMBLCR T
MAUPIN
BETHEL
KAHNEETA
WSPG_LBR
WARMSP
WARMSPGS
CHERRYLN
PELTONRR
PELTONR1
CECC TAP
PELTON
MADRAS
COVE TAP
COVE 230
COVE 69
ROUND B1
ROUND BU
GRIZZLY
ROUND B2
CULVER
ROUND B3
REDMOND
OPAL TAP
CROOKDRV
PILOTBT
BEAVER
COULEE22

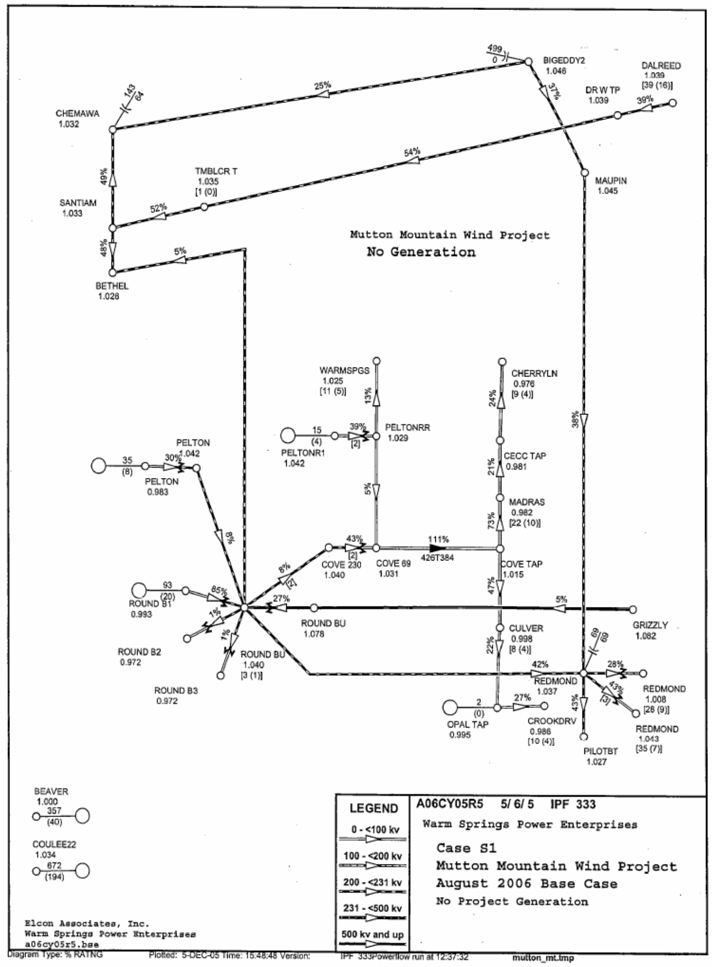

Mutton Mountain Wind Project
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
J06CY05R5 12/12/ 5 IPF 333
Warm Springs Power Enterprises
Case W4
Mutton Mountain Wind Project
January 2006 Base Case
With 69kV Interconnection
155 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
j06cy05r5.bse
Diagram Type: % RATNG


Mutton Mountain Wind Project
BIGEDDY2
DALREED
DR W TP
CHEMAWA
TMBLCR T
SANTIAM
MAUPIN
BETHEL
KAHNEETA
WSPG_LBR
WARMSP
WARMSPGS
CHERRYLN
CECC TAP
PELTONRR
PELTONR1
PELTON
MADRAS
COVE TAP
COVE 230
COVE 69
ROUND B1
ROUND B2
ROUND B3
ROUND BU
GRIZZLY
CULVER
REDMOND
OPAL TAP
CROOKDR
PILOTBT
BEAVER
COULEE22
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
J06CY05R5 12/12/ 5 IPF 333
Warm Springs Power Enterprises
Case W4
Mutton Mountain Wind Project
January 2006 Base Case
With 69kV Interconnection
155 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
j06cy05r5.bse

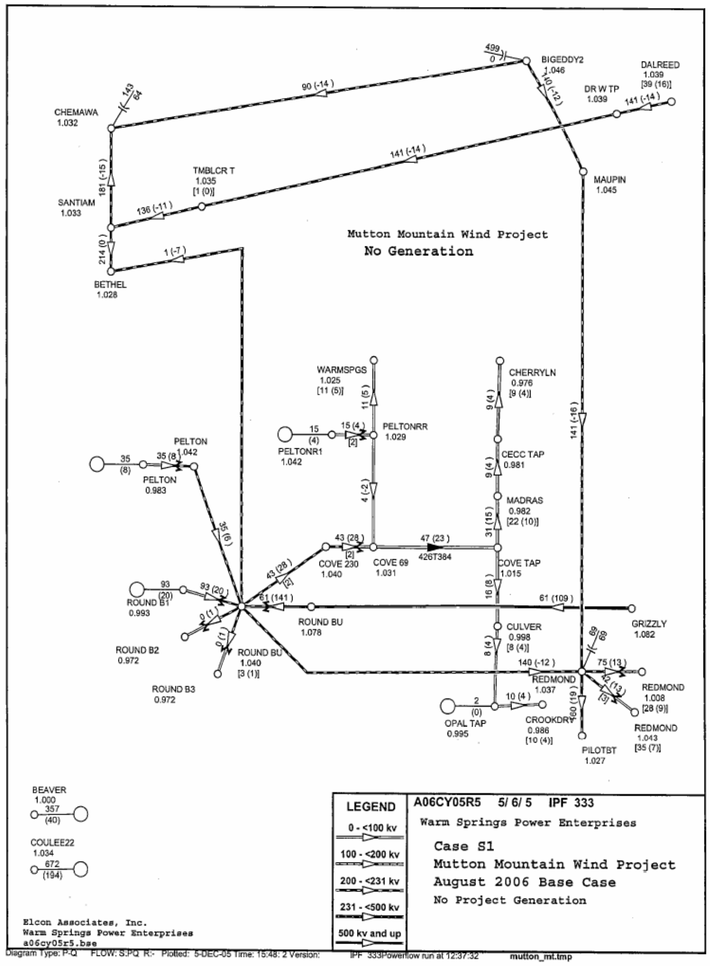


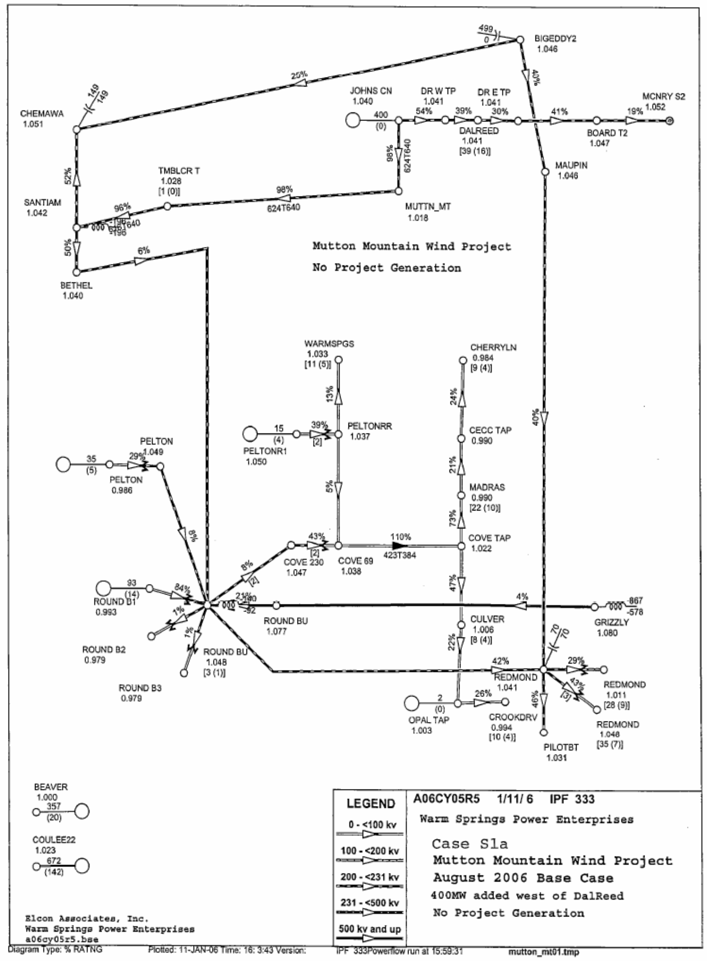
Mutton Mountain Wind Project
BIGEDDY2
1.043
DALREED
1.044
CHEMAWA
1.022
SANTIAM
1.035
TMBLCR T
1.035
MAUPIN
1.040
BETHEL
1.018
KAHNEETA
1.009
WSPG_LBR
1.019
WARMSP
1.052
WARMSPGS
1.013
CHERRYLN
1.003
CECC TAP
0.992
PELTONRR
1.007
PELTONR1
1.020
PELTON
1.043
PELTON
0.986
MADRAS
0.990
COVE 230
1.042
COVE 69
1.000
COVE TAP
0.993
ROUND B1
0.985
ROUND BU
1.076
GRIZZLY
1.060
CULVER
0.974
ROUND B2
0.985
ROUND BU
1.041
ROUND B3
0.985
REDMOND
1.026
REDMOND
1.009
OPAL TAP
0.971
CROOKDRV
0.960
REDMOND
1.007
PILOTBT
1.016
BEAVER
1.000
COULEE22
1.030
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
J06CY05R5 12/12/ 5 IPF 333
Warm Springs Power Enterprises
Case W5
Mutton Mountain Wind Project
January 2006 Base Case
With 69kV Interconnection
175 MW Project Generation
Replace 4.5 Mi #2ACSR with 397ACSR
Cherry Lane - Warm Springs 69kV
Elcon Associates, Inc.
Warm Springs Power Enterprises
j06cy05r5.bse
Diagram Type: % RATNG

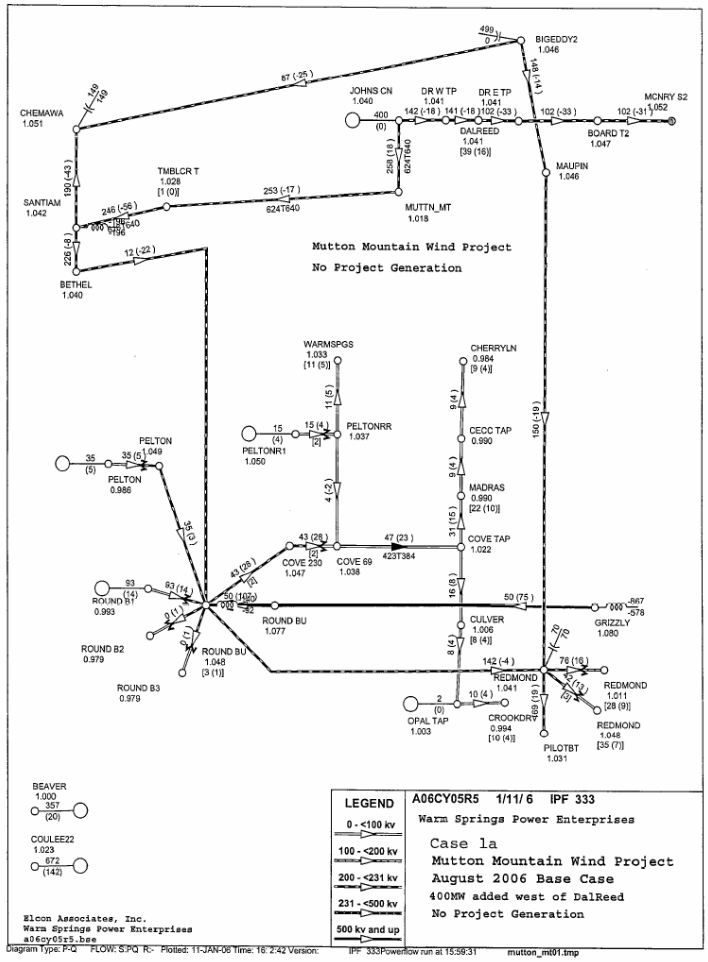

Mutton Mountain Wind Project
BIGEDDY2
1.043
DALREED
1.044
[8 (3)]
DR W TP
1.044
CHEMAWA
1.022
TMBLCR T
1.035
[2 (1)]
SANTIAM
1.035
MAUPIN
1.040
BETHEL
1.019
KAHNEETA
1.009
[3 (1)]
WSPG_LBR
1.019
WARMSP
1.052
WARMSPGS
1.013
[10 (5)]
CHERRYLN
1.003
[9 (2)]
CECC TAP
0.992
PELTONRR
1.007
PELTONR1
1.020
PELTON
1.043
PELTON
0.986
MADRAS
0.990
[22 (6)]
COVE 230
1.042
COVE 69
1.000
COVE TAP
0.993
ROUND B1
0.985
ROUND BU
1.076
GRIZZLY
1.080
ROUND B2
0.985
ROUND BU
1.041
[4 (1)]
ROUND B3
0.985
CULVER
0.974
[9 (2)]
REDMOND
1.026
REDMOND
1.009
[33 (11)]
OPAL TAP
0.971
CROOKDRV
0.960
[14 (4)]
REDMOND
1.007
[68 (14)]
PILOTBT
1.016
BEAVER
1.000
COULEE22
1.030
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
J06CY05R5 12/12/ 5 IPF 333
Warm Springs Power Enterprises
Case W5
Mutton Mountain Wind Project
January 2006 Base Case
With 69kV Interconnection
175 MW Project Generation
Replace 4.5 Mi #2ACSR with 397ACSR
Cherry Lane - Warm Springs 69kV
Elcon Associates, Inc.
Warm Springs Power Enterprises
j06cy05r5.bse
Diagram Type: P-Q FLOW: S:PQ R:- Plotted: 12-DEC-05 Time: 9:51:16 Version: IPF 333Powerflow run at 9:45:22 mutton_mt69.tmp



Mutton Mountain Wind Project
No Generation
499
0
BIGEDDY2
1.046
DALREED
1.039
[39 (16)]
DR W TP
1.039
39%
37%
25%
143
64
CHEMAWA
1.032
54%
49%
TMBLCR T
1.035
[1 (0)]
SANTIAM
1.033
52%
MAUPIN
1.045
48%
5%
BETHEL
1.028
WARMSPGS
1.025
[11 (5)]
13%
CHERRYLN
0.976
[9 (4)]
24%
38%
15
(4)
39%
[2]
PELTONRR
1.029
PELTONR1
1.042
CECC TAP
0.981
21%
PELTON
1.042
35
(8)
30%
PELTON
0.983
5%
MADRAS
0.982
[22 (10)]
73%
8%
43%
[2]
111%
426T384
COVE 230
1.040
COVE 69
1.031
COVE TAP
1.015
47%
8%
[2]
93
(20)
85%
ROUND B1
0.993
27%
5%
GRIZZLY
1.082
1%
1%
ROUND BU
1.078
CULVER
0.998
[8 (4)]
22%
69
69
ROUND B2
0.972
ROUND BU
1.040
[3 (1)]
42%
28%
REDMOND
1.037
REDMOND
1.008
[28 (9)]
ROUND B3
0.972
2
(0)
27%
43%
43%
[3]
OPAL TAP
0.995
CROOKDRV
0.986
[10 (4)]
REDMOND
1.043
[35 (7)]
PILOTBT
1.027
BEAVER
1.000
357
(40)
COULEE22
1.034
672
(194)
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 5/ 6/ 5 IPF 333
Warm Springs Power Enterprises
Case S1
Mutton Mountain Wind Project
August 2006 Base Case
No Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
a06cy05r5.bse
Diagram Type: % RATNG
Plotted: 5-DEC-05 Time: 15:48:48 Version:
IPF 333Powerflow run at 12:37:32
mutton_mt.tmp


Mutton Mountain Wind Project
No Generation
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 5/ 6/ 5 IPF 333
Warm Springs Power Enterprises
Case S1
Mutton Mountain Wind Project
August 2006 Base Case
No Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
a06cy05r5.bse
CHEMAWA
SANTIAM
BETHEL
TMBLCR T
BIGEDDY2
DALREED
DR W TP
MAUPIN
WARMSPGS
PELTONRR
PELTONR1
PELTON
CHERRYLN
CECC TAP
MADRAS
COVE 230
COVE 69
COVE TAP
ROUND B1
ROUND B2
ROUND B3
ROUND BU
GRIZZLY
CULVER
REDMOND
OPAL TAP
CROOKDRY
PILOTBT
BEAVER
COULEE22


Mutton Mountain Wind Project
No Project Generation
BIGEDDY2
CHEMAWA
JOHNS CN
DR W TP
DR E TP
DALREED
MCNRY S2
BOARD T2
MAUPIN
TMBLCR T
SANTIAM
MUTTN_MT
BETHEL
WARMSPGS
CHERRYLN
PELTONRR
PELTONR1
CECC TAP
PELTON
MADRAS
COVE TAP
COVE 230
COVE 69
ROUND B1
ROUND BU
GRIZZLY
CULVER
ROUND B2
ROUND B3
REDMOND
OPAL TAP
CROOKDRV
PILOTBT
BEAVER
COULEE22
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 1/11/ 6 IPF 333
Warm Springs Power Enterprises
Case S1a
Mutton Mountain Wind Project
August 2006 Base Case
400MW added west of DalReed
No Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
a06cy05r5.bse
Diagram Type: % RATNG
mutton_mt01.tmp


BIGEDDY2
1.046
JOHNS CN
1.040
DR W TP
1.041
DR E TP
1.041
MCNRY S2
1.052
CHEMAWA
1.051
DALREED
1.041
[39 (16)]
BOARD T2
1.047
MAUPIN
1.046
TMBLCR T
1.028
[1 (0)]
SANTIAM
1.042
MUTTN_MT
1.018
Mutton Mountain Wind Project
No Project Generation
BETHEL
1.040
WARMSPGS
1.033
[11 (5)]
CHERRYLN
0.984
[9 (4)]
PELTONRR
1.037
PELTONR1
1.050
CECC TAP
0.990
PELTON
1.049
PELTON
0.986
MADRAS
0.990
[22 (10)]
COVE TAP
1.022
COVE 230
1.047
COVE 69
1.038
ROUND B1
0.993
ROUND BU
1.077
GRIZZLY
1.080
CULVER
1.006
[8 (4)]
ROUND B2
0.979
ROUND BU
1.048
[3 (1)]
REDMOND
1.041
REDMOND
1.011
[28 (9)]
ROUND B3
0.979
OPAL TAP
1.003
CROOKDRV
0.994
[10 (4)]
REDMOND
1.048
[35 (7)]
PILOTBT
1.031
BEAVER
1.000
COULEE22
1.023
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 1/11/ 6 IPF 333
Warm Springs Power Enterprises
Case 1a
Mutton Mountain Wind Project
August 2006 Base Case
400MW added west of DalReed
No Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
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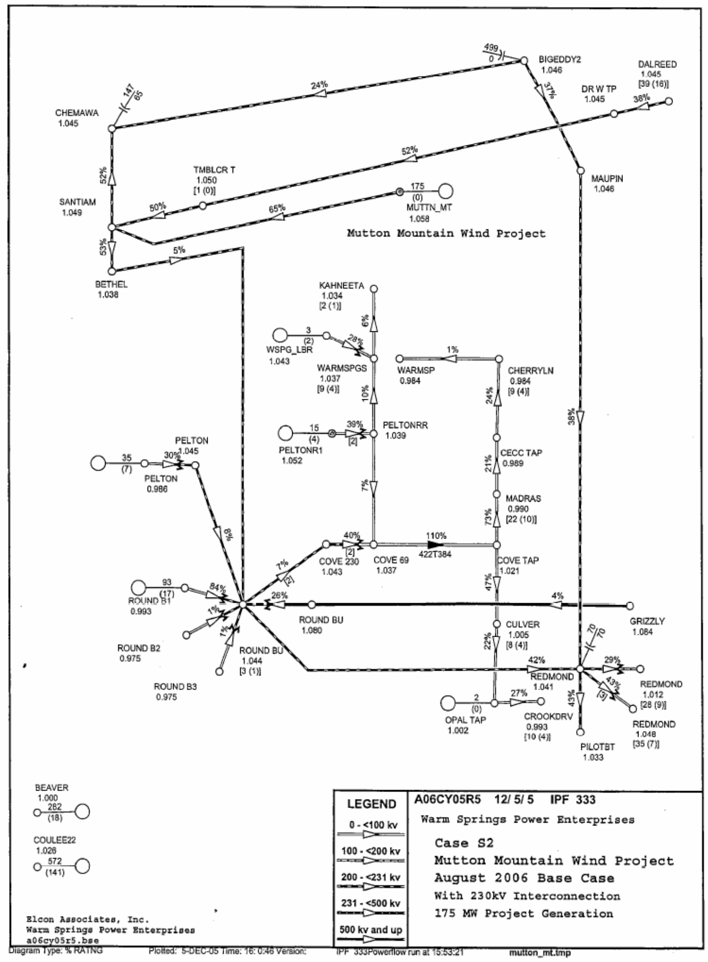
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231 - <500 kv
500 kv and up
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Warm Springs Power Enterprises
Case S2
Mutton Mountain Wind Project
August 2006 Base Case
With 230kV Interconnection
175 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
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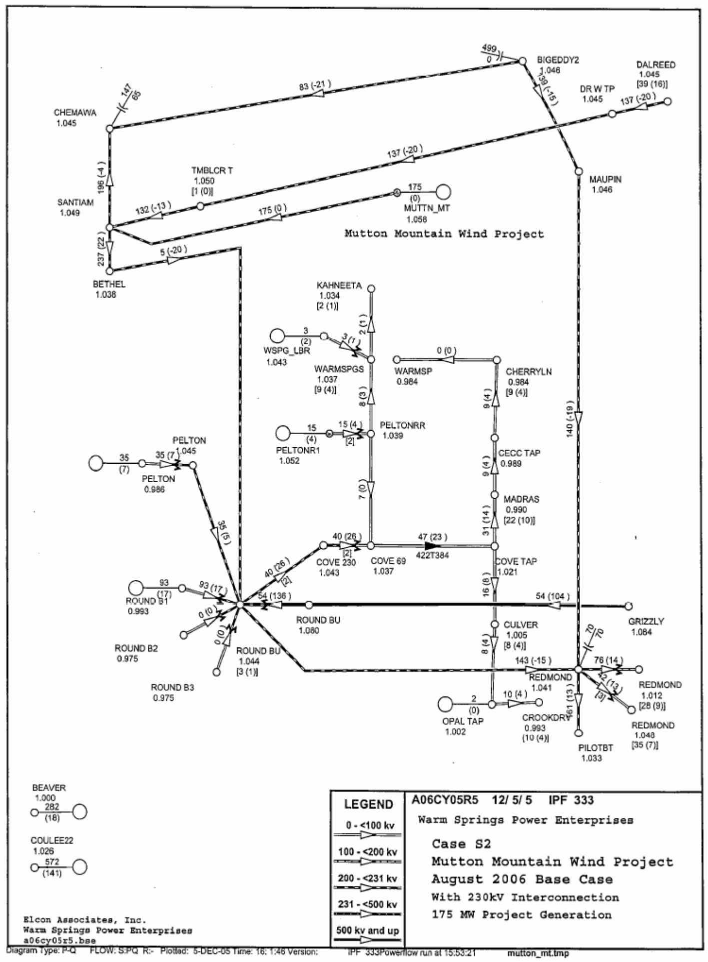
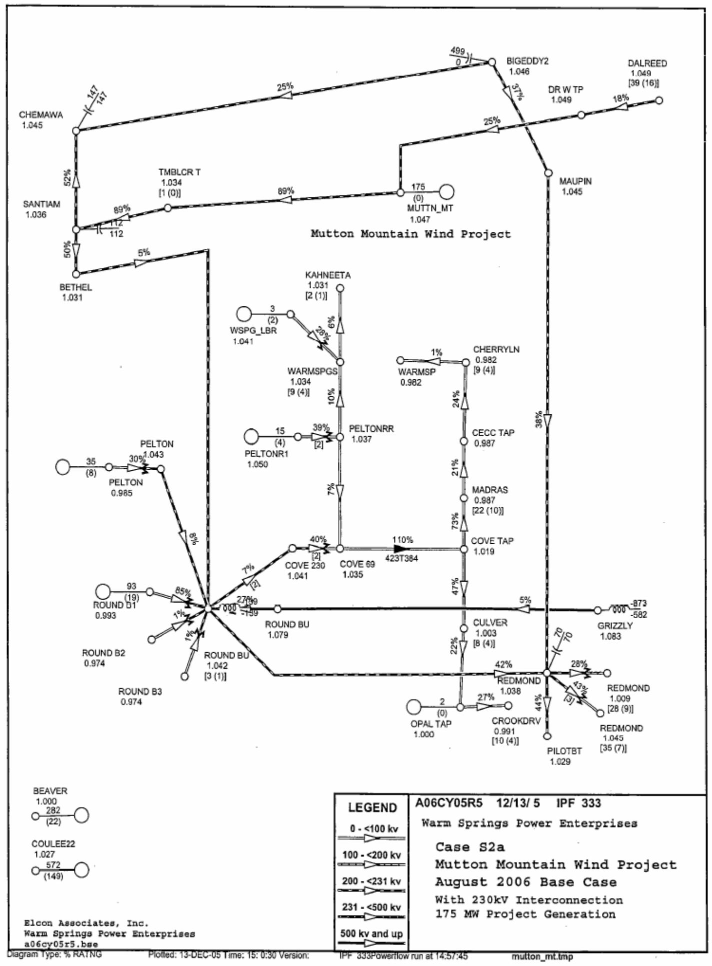
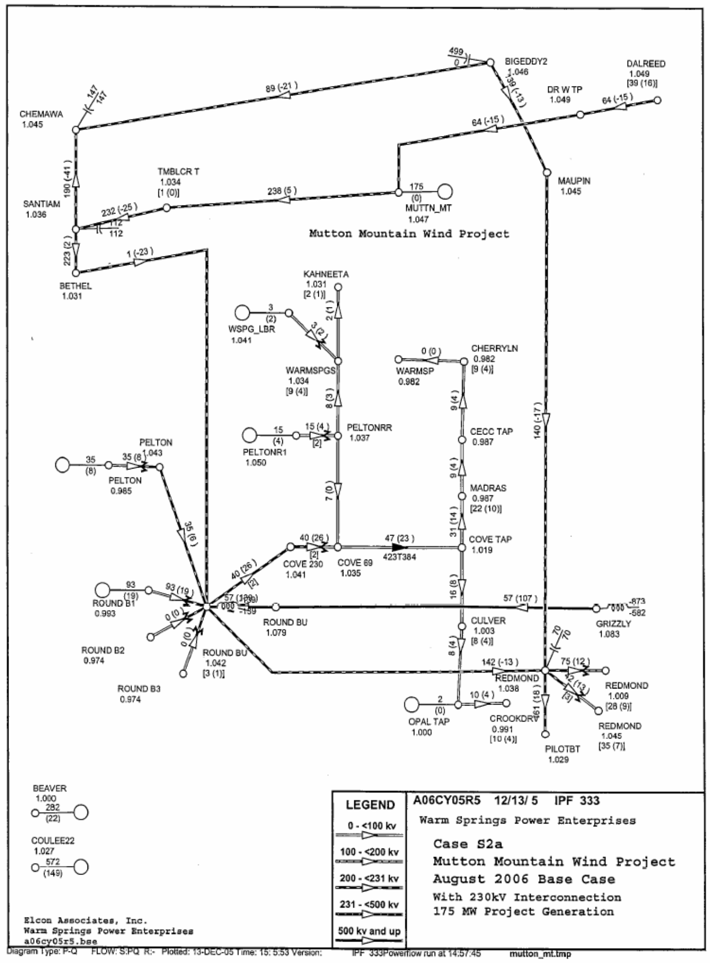

BIGEDDY2
DALREED
DR W TP
CHEMAWA
MAUPIN
TMBLCR T
SANTIAM
MUTTN_MT
Mutton Mountain Wind Project
BETHEL
KAHNEETA
WSPG_LBR
WARMSPGS
WARMSP
CHERRYLN
PELTONRR
PELTONR1
CECC TAP
PELTON
MADRAS
COVE 230
COVE 69
422T384
COVE TAP
ROUND B1
ROUND BU
GRIZZLY
CULVER
ROUND B2
REDMOND
ROUND B3
OPAL TAP
CROOKDRY
PILOTBT
BEAVER
COULEE22
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 12/ 5/ 5 IPF 333
Warm Springs Power Enterprises
Case S2
Mutton Mountain Wind Project
August 2006 Base Case
With 230kV Interconnection
175 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
a06cy05r5.bse
mutton_mt.tmp


Mutton Mountain Wind Project
LEGEND
A06CY05R5 12/13/ 5 IPF 333
Warm Springs Power Enterprises
Case S2a
Mutton Mountain Wind Project
August 2006 Base Case
With 230kV Interconnection
175 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises


Mutton Mountain Wind Project
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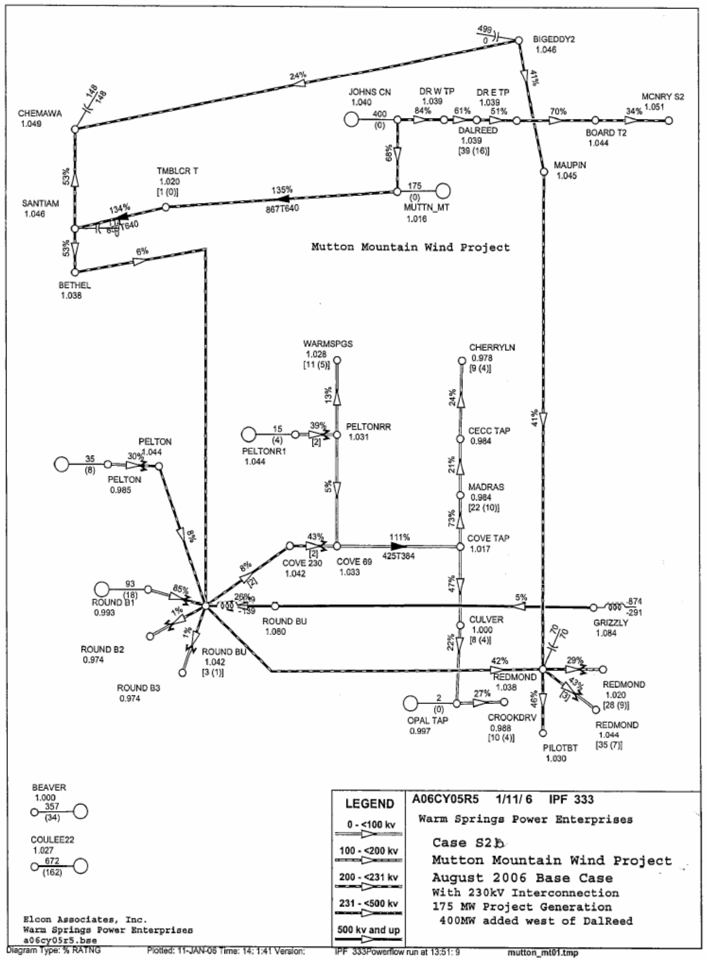
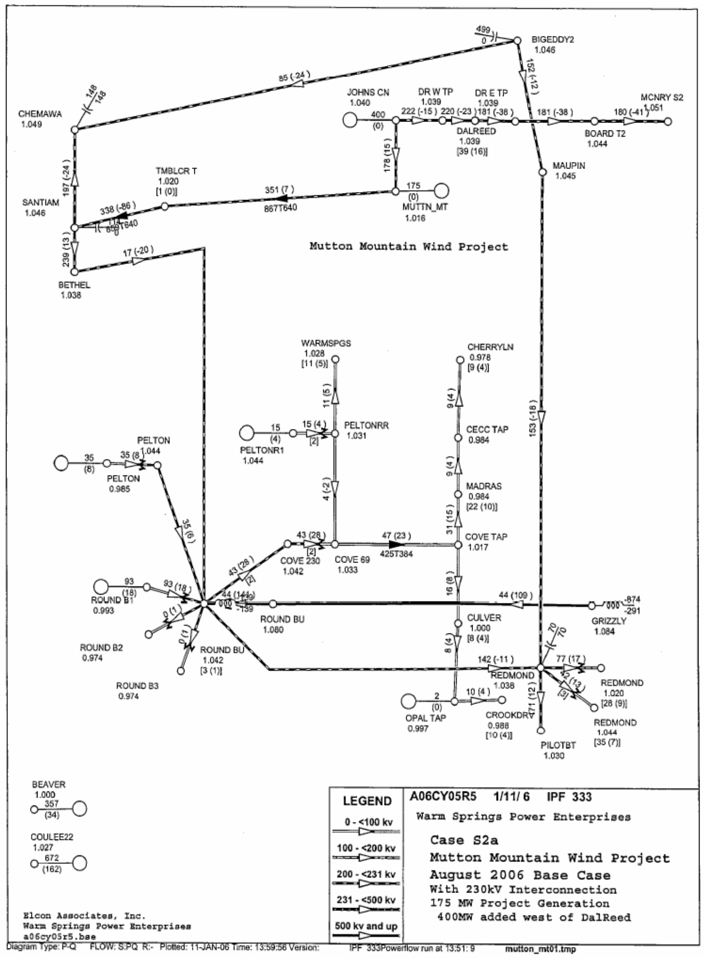
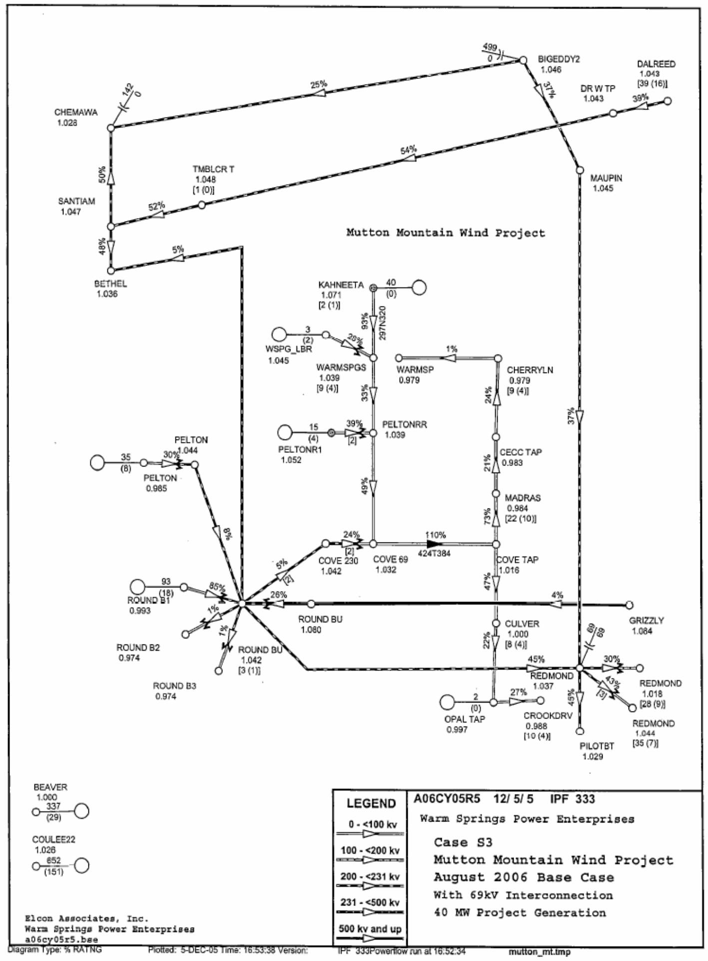
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 12/13/ 5 IPF 333
Warm Springs Power Enterprises
Case S2a
Mutton Mountain Wind Project
August 2006 Base Case
With 230kV Interconnection
175 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
a06cy05r5.bse
BIGEDDY2
DALREED
DR W TP
CHEMAWA
MAUPIN
TMBLCR T
SANTIAM
MUTTN_MT
BETHEL
KAHNEETA
WSPG_LBR
WARMSPGS
CHERRYLN
WARMSP
CECC TAP
PELTONRR
PELTONR1
PELTON
MADRAS
COVE TAP
COVE 230
COVE 69
ROUND B1
ROUND BU
GRIZZLY
CULVER
ROUND B2
ROUND B3
REDMOND
CROOKDRV
OPAL TAP
PILOTBT
BEAVER
COULEE22



Mutton Mountain Wind Project
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 1/11/ 6 IPF 333
Warm Springs Power Enterprises
Case S2b
Mutton Mountain Wind Project
August 2006 Base Case
With 230kV Interconnection
175 MW Project Generation
400MW added west of DalReed
Elcon Associates, Inc.
Warm Springs Power Enterprises
a06cy05r5.bse
Diagram Type: % RATNG



Mutton Mountain Wind Project
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 1/11/6 IPF 333
Warm Springs Power Enterprises
Case S2a
Mutton Mountain Wind Project
August 2006 Base Case
With 230kV Interconnection
175 MW Project Generation
400MW added west of DalReed
Elcon Associates, Inc.
Warm Springs Power Enterprises
a06cy05r5.bse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1.046
DALREED
1.043
[39 (16)]
DR W TP
1.043
CHEMAWA
1.028
TMBLCR T
1.048
[1 (0)]
SANTIAM
1.047
MAUPIN
1.045
BETHEL
1.036
KAHNEETA
1.071
[2 (1)]
297N320
WSPG_LBR
1.045
WARMSPGS
1.039
[9 (4)]
WARMSP
0.979
CHERRYLN
0.979
[9 (4)]
PELTONRR
1.039
PELTONR1
1.052
CECC TAP
0.983
PELTON
1.044
PELTON
0.985
MADRAS
0.984
[22 (10)]
COVE 230
1.042
COVE 69
1.032
424T384
COVE TAP
1.016
ROUND B1
0.993
ROUND BU
1.080
GRIZZLY
1.084
ROUND B2
0.974
ROUND BU
1.042
[3 (1)]
CULVER
1.000
[8 (4)]
REDMOND
1.037
REDMOND
1.018
[28 (9)]
ROUND B3
0.974
OPAL TAP
0.997
CROOKDRV
0.988
[10 (4)]
REDMOND
1.044
[35 (7)]
PILOTBT
1.029
BEAVER
1.000
COULEE22
1.026
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 12/ 5/ 5 IPF 333
Warm Springs Power Enterprises
Case S3
Mutton Mountain Wind Project
August 2006 Base Case
With 69kV Interconnection
40 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
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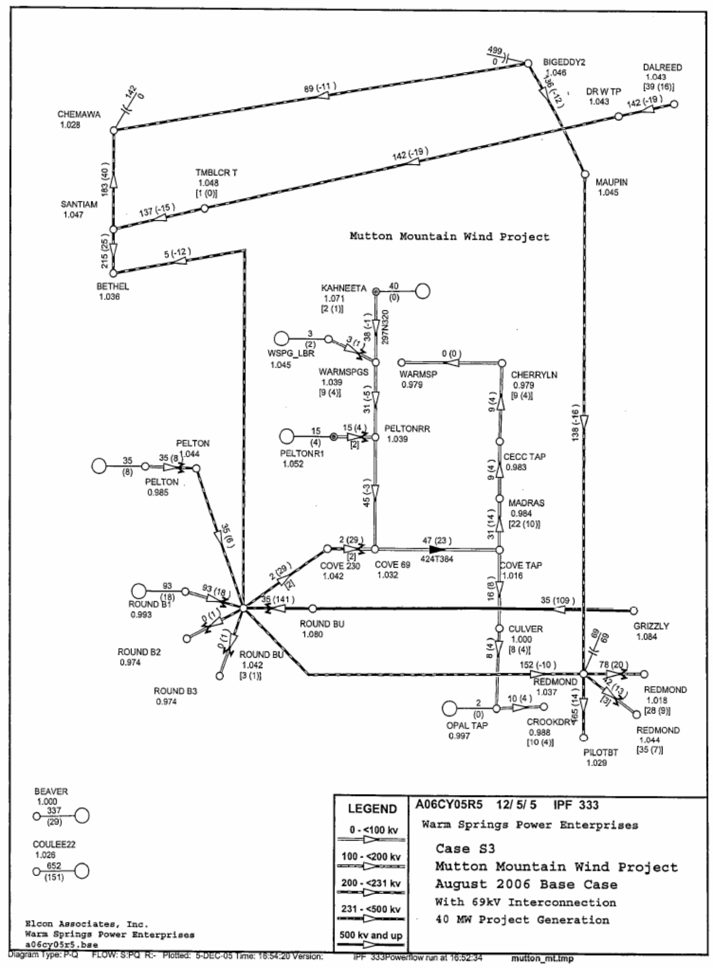
Mutton Mountain Wind Project
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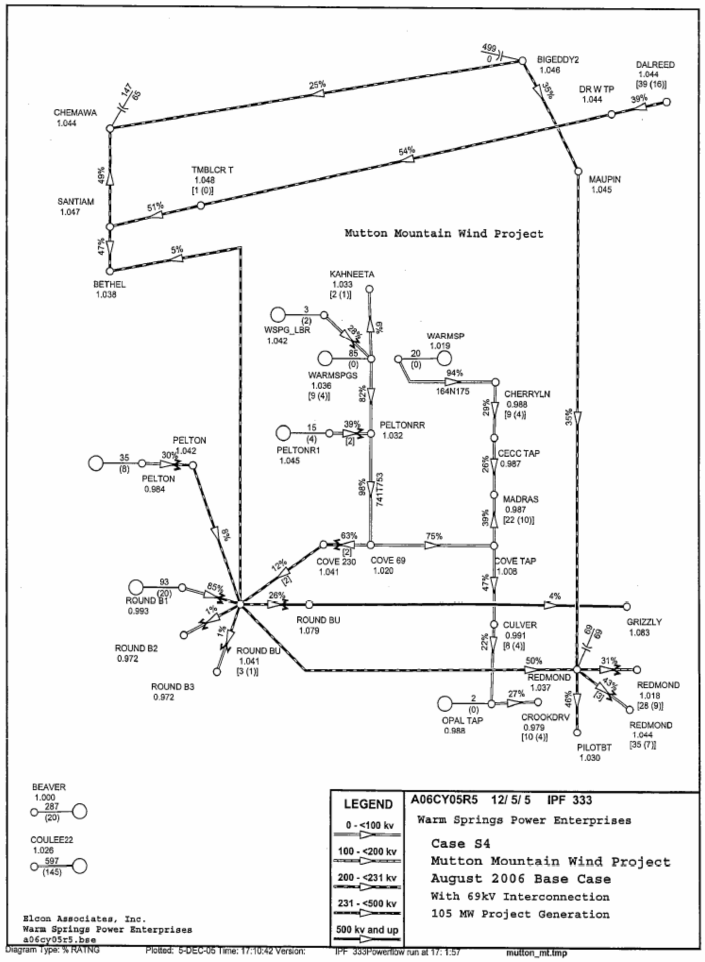
CHEMAWA
DALREED
DR W TP
SANTIAM
TMBLCR T
BETHEL
MAUPIN
KAHNEETA
WSPG_LBR
WARMSPGS
WARMSP
CHERRYLN
PELTONRR
PELTONR1
PELTON
CECC TAP
MADRAS
COVE 230
COVE 69
COVE TAP
ROUND B1
ROUND B2
ROUND B3
ROUND BU
GRIZZLY
CULVER
REDMOND
OPAL TAP
CROOKDRY
PILOTBT
BEAVER
COULEE22
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 12/ 5/ 5 IPF 333
Warm Springs Power Enterprises
Case S3
Mutton Mountain Wind Project
August 2006 Base Case
With 69kV Interconnection
40 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
a06cy05r5.bse


Mutton Mountain Wind Project
BIGEDDY2
1.046
DALREED
1.044
DR W TP
1.044
CHEMAWA
1.044
TMBLCR T
1.048
SANTIAM
1.047
MAUPIN
1.045
BETHEL
1.038
KAHNEETA
1.033
WSPG_LBR
1.042
WARMSP
1.019
WARMSPGS
1.036
164N175
CHERRYLN
0.988
PELTONRR
1.032
PELTONR1
1.045
CECC TAP
0.987
PELTON
1.042
PELTON
0.984
MADRAS
0.987
COVE 230
1.041
COVE 69
1.020
COVE TAP
1.008
ROUND B1
0.993
ROUND BU
1.079
GRIZZLY
1.083
ROUND B2
0.972
ROUND BU
1.041
CULVER
0.991
ROUND B3
0.972
REDMOND
1.037
REDMOND
1.018
OPAL TAP
0.988
CROOKDRV
0.979
REDMOND
1.044
PILOTBT
1.030
BEAVER
1.000
COULEE22
1.026
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 12/ 5/ 5 IPF 333
Warm Springs Power Enterprises
Case S4
Mutton Mountain Wind Project
August 2006 Base Case
With 69kV Interconnection
105 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
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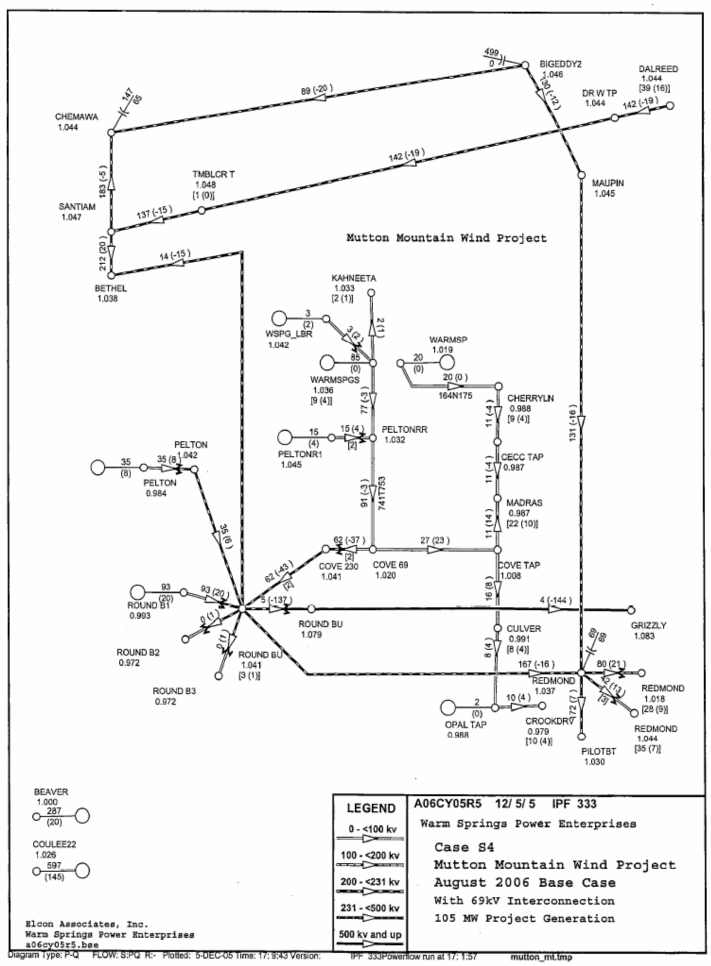

Mutton Mountain Wind Project
BIGEDDY2
1.046
DALREED
1.044
[39 (16)]
DR W TP
1.044
CHEMAWA
1.044
TMBLCR T
1.048
[1 (0)]
SANTIAM
1.047
MAUPIN
1.045
BETHEL
1.038
KAHNEETA
1.033
[2 (1)]
WSPG_LBR
1.042
WARMSP
1.019
WARMSPGS
1.036
[9 (4)]
CHERRYLN
0.988
[9 (4)]
PELTONRR
1.032
PELTONR1
1.045
CECC TAP
0.987
PELTON
1.042
PELTON
0.984
MADRAS
0.987
[22 (10)]
COVE 230
1.041
COVE 69
1.020
COVE TAP
1.008
ROUND B1
0.993
ROUND BU
1.079
GRIZZLY
1.083
CULVER
0.991
[8 (4)]
ROUND B2
0.972
ROUND BU
1.041
[3 (1)]
REDMOND
1.037
REDMOND
1.018
[28 (9)]
ROUND B3
0.972
OPAL TAP
0.988
CROOKDRV
0.979
[10 (4)]
REDMOND
1.044
[35 (7)]
PILOTBT
1.030
BEAVER
1.000
COULEE22
1.026
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 12/ 5/ 5 IPF 333
Warm Springs Power Enterprises
Case S4
Mutton Mountain Wind Project
August 2006 Base Case
With 69kV Interconnection
105 MW Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
a06cy05r5.bse
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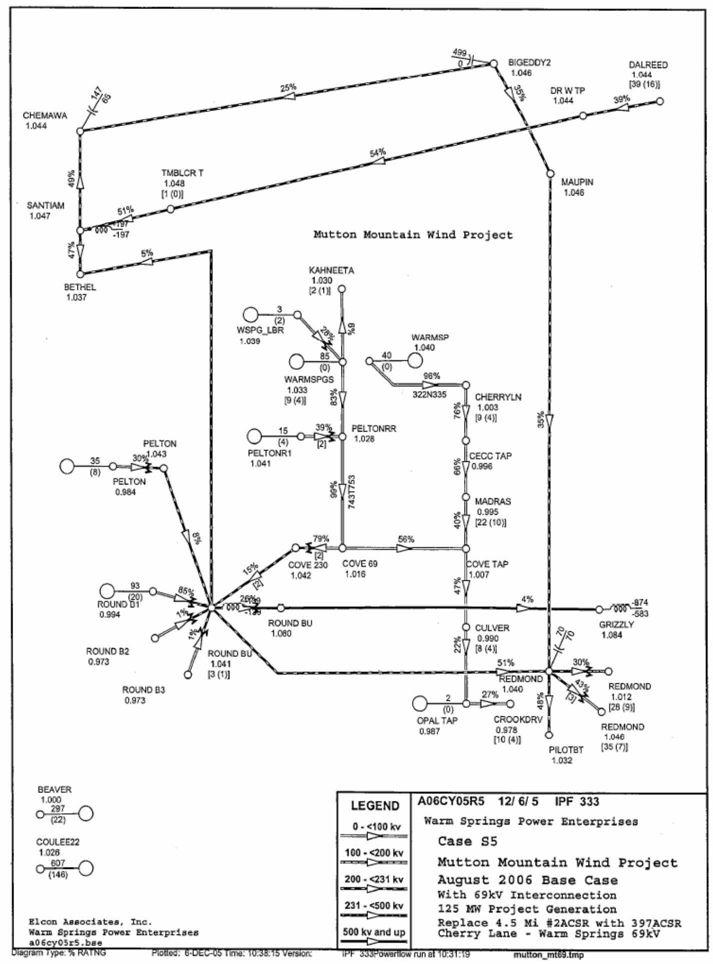
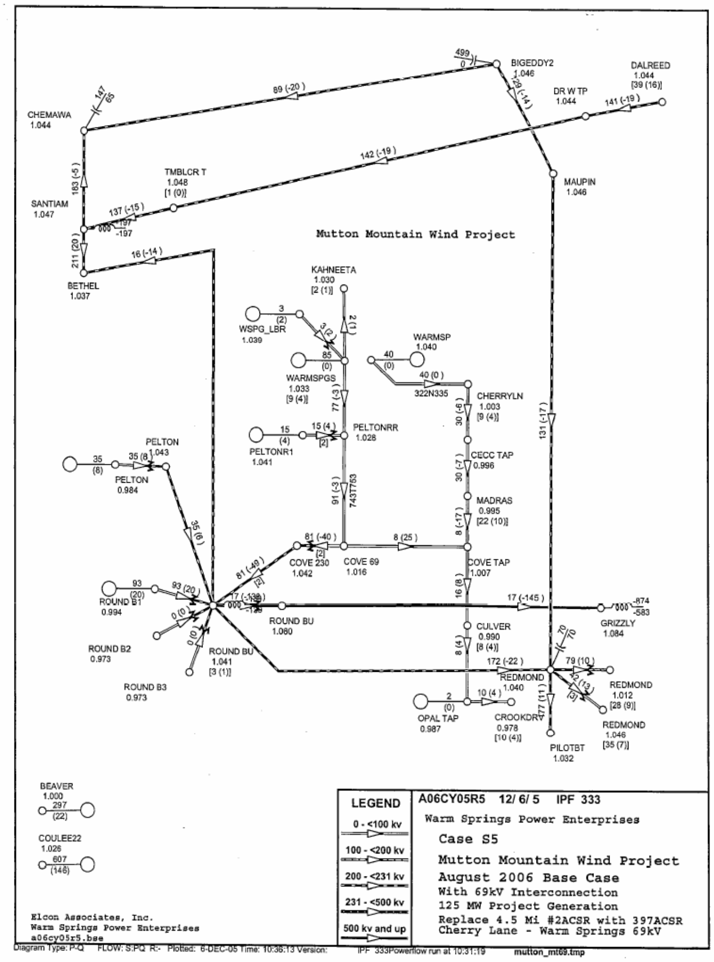
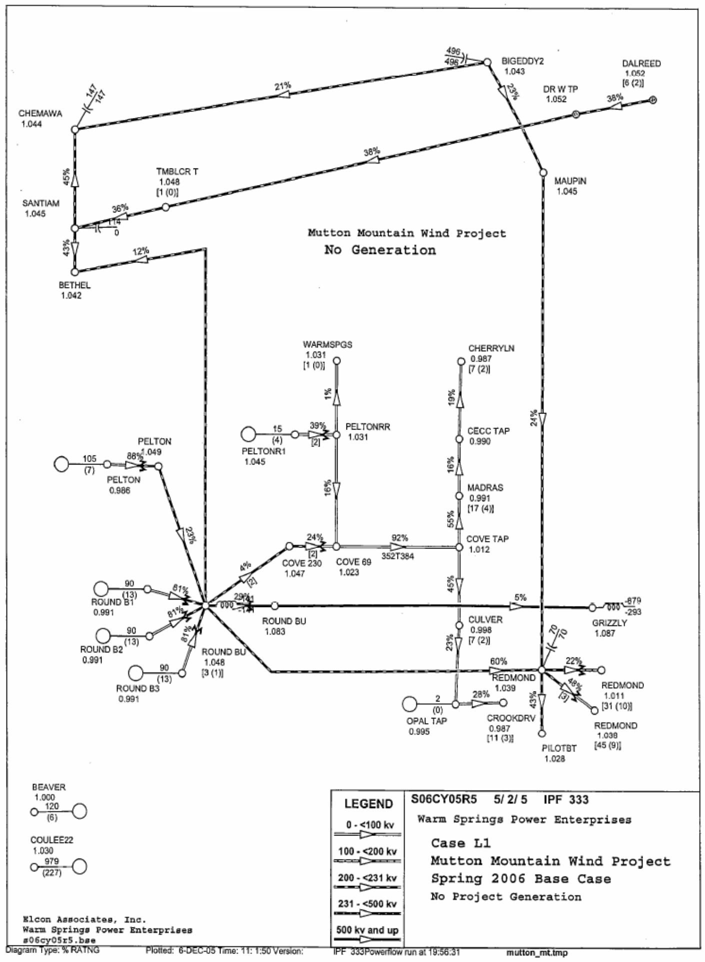
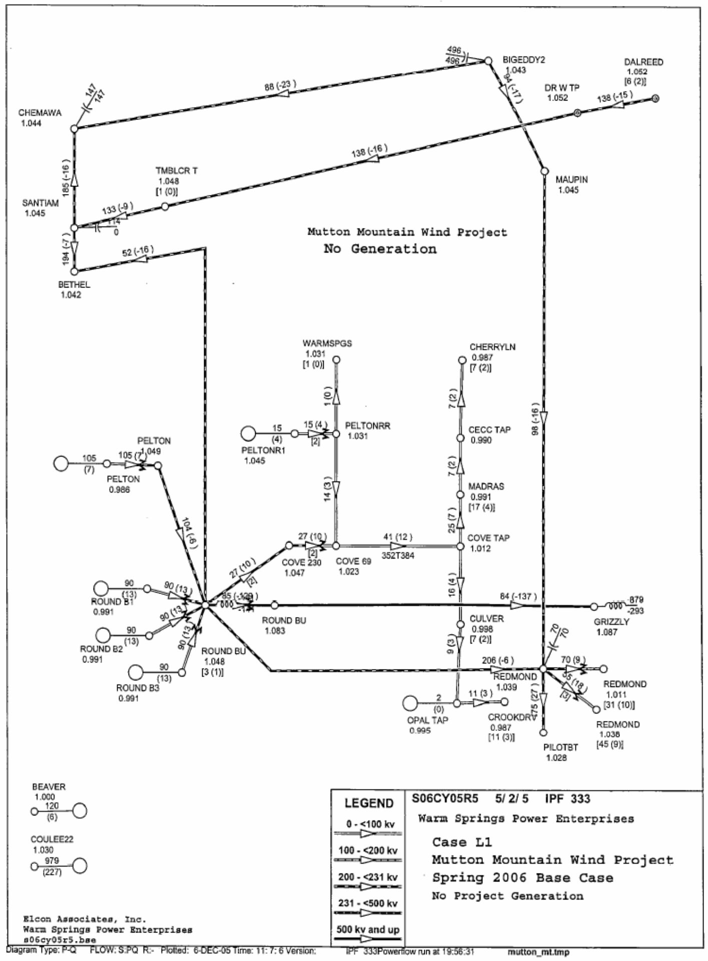

Mutton Mountain Wind Project
CHEMAWA 1.044
SANTIAM 1.047
BETHEL 1.037
TMBLCR T 1.048 [1 (0)]
BIGEDDY2 1.046
DR W TP 1.044
DALREED 1.044 [39 (16)]
MAUPIN 1.046
KAHNEETA 1.030 [2 (1)]
WSPG_LBR 1.039
WARMSPGS 1.033 [9 (4)]
WARMSP 1.040
CHERRYLN 1.003 [9 (4)]
PELTONRR 1.028
PELTONR1 1.041
PELTON 1.043
PELTON 0.984
CECC TAP 0.996
MADRAS 0.995 [22 (10)]
COVE 230 1.042
COVE 69 1.016
COVE TAP 1.007
ROUND B1 0.994
ROUND BU 1.080
ROUND B2 0.973
ROUND BU 1.041 [3 (1)]
ROUND B3 0.973
GRIZZLY 1.084
CULVER 0.990 [8 (4)]
REDMOND 1.040
REDMOND 1.012 [28 (9)]
REDMOND 1.046 [35 (7)]
OPAL TAP 0.987
CROOKDRV 0.978 [10 (4)]
PILOTBT 1.032
BEAVER 1.000
COULEE22 1.026
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 12/ 6/ 5 IPF 333
Warm Springs Power Enterprises
Case S5
Mutton Mountain Wind Project
August 2006 Base Case
With 69kV Interconnection
125 MW Project Generation
Replace 4.5 Mi #2ACSR with 397ACSR
Cherry Lane - Warm Springs 69kV
Elcon Associates, Inc.
Warm Springs Power Enterprises
a06cy05r5.bse
Diagram Type: % RATNG
IPF 333Powerflow run at 10:31:19
mutton_mt69.tmp



Mutton Mountain Wind Project
BIGEDDY2
1.046
DALREED
1.044
[39 (16)]
DR W TP
1.044
CHEMAWA
1.044
TMBLCR T
1.048
[1 (0)]
SANTIAM
1.047
MAUPIN
1.046
BETHEL
1.037
KAHNEETA
1.030
[2 (1)]
WSPG_LBR
1.039
WARMSP
1.040
WARMSPGS
1.033
[9 (4)]
CHERRYLN
1.003
[9 (4)]
PELTONRR
1.028
PELTONR1
1.041
PELTON
1.043
PELTON
0.984
CECC TAP
0.996
MADRAS
0.995
[22 (10)]
COVE 230
1.042
COVE 69
1.016
COVE TAP
1.007
ROUND B1
0.994
ROUND BU
1.060
GRIZZLY
1.084
CULVER
0.990
[8 (4)]
ROUND B2
0.973
ROUND BU
1.041
[3 (1)]
REDMOND
1.040
REDMOND
1.012
[28 (9)]
ROUND B3
0.973
OPAL TAP
0.987
CROOKDRV
0.978
[10 (4)]
REDMOND
1.046
[35 (7)]
PILOTBT
1.032
BEAVER
1.000
COULEE22
1.026
Elcon Associates, Inc.
Warm Springs Power Enterprises
a06cy05r5.bse
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
A06CY05R5 12/ 6/ 5 IPF 333
Warm Springs Power Enterprises
Case S5
Mutton Mountain Wind Project
August 2006 Base Case
With 69kV Interconnection
125 MW Project Generation
Replace 4.5 Mi #2ACSR with 397ACSR
Cherry Lane - Warm Springs 69kV
Diagram Type: P-Q FLOW: S:PQ R:- Plotted: 6-DEC-05 Time: 10:36:13 Version: IPF 333Powerflow run at 10:31:19 mutton_mt69.tmp



Mutton Mountain Wind Project
No Generation
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
S06CY05R5 5/ 2/ 5 IPF 333
Warm Springs Power Enterprises
Case L1
Mutton Mountain Wind Project
Spring 2006 Base Case
No Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
s06cy05r5.bse
Diagram Type: % RATNG


Mutton Mountain Wind Project
No Generation
LEGEND
0 - <100 kv
100 - <200 kv
200 - <231 kv
231 - <500 kv
500 kv and up
S06CY05R5 5/ 2/ 5 IPF 333
Warm Springs Power Enterprises
Case L1
Mutton Mountain Wind Project
Spring 2006 Base Case
No Project Generation
Elcon Associates, Inc.
Warm Springs Power Enterprises
s06cy05r5.bse
CHEMAWA
SANTIAM
BETHEL
TMBLCR T
BIGEDDY2
DR W TP
DALREED
MAUPIN
WARMSPGS
PELTONRR
PELTONR1
PELTON
CHERRYLN
CECC TAP
MADRAS
COVE TAP
COVE 230
COVE 69
CULVER
GRIZZLY
ROUND BU
ROUND B1
ROUND B2
ROUND B3
REDMOND
OPAL TAP
CROOKDR
PILOTBT
BEAVER
COULEE22

Appendix D: OSU Preliminary Wind Energy Production Estimate

Report No. WSPE 2006-03

WARM SPRINGS
WIND ENERGY PRODUCTION ESTIMATE

(Revision to WSPE 2006-02 to include Mutton Mtn Ridges designated three and four and Shaniko Mtn)

Prepared for

WARM SPRINGS POWER ENTERPRISES
P.O. BOX 960
WARM SPRINGS, OREGON 97761

Prepared by

Energy Resources Research Laboratory
Oregon State University
Corvallis, Oregon 97331

July 31, 2006

NOTICE

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Report No. WSPE 2006-03

WARM SPRINGS
WIND ENERGY PRODUCTION ESTIMATE

(Revision to WSPE 2006-02 to include Mutton Mtn Ridges designated three and four and Shaniko Mtn)

Prepared for

WARM SPRINGS POWER ENTERPRISES
P.O. BOX 960
WARM SPRINGS, OREGON 97761

Prepared by

Stel N. Walker, Ph.D.

Energy Resources Research Laboratory
Oregon State University
Corvallis, Oregon 97331

July 31, 2006

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NOTE

This report is a revised version of report number WSPE 2006-02 dated June 16, 2006 which was a wind energy production estimate for development of only ridges one and two of the Mutton Mountains. This report includes estimates for development of ridges designated three and four of the Mutton Mountains and Shaniko Mountain.

Warm Springs Wind Energy Production Estimate

1.0 Introduction

During the period May 2003 thru Jan 2005 wind speed data was collected from four areas of the Warm Springs Indian Reservation: Handley Ridge, Mutton Mountain, Eagle Butte, and Island Ridge as shown in Figure 1 below. Based on that data, it was determined that the Mutton Mountain area had the best potential for wind development (WSPE 2005-01). This area was further instrumented with additional meteorological sites installed in late April 2005 with data collection beginning May 5, 2005 for Mutton Mountain site #2 and May 8, 2005 for Mutton Mountain site # 3 which are both located on the same ridge of Mutton Mtn site # 1 (original site instrumented in May 2003). Sites on ridges to the west of that ridge were also instrumented with data collection beginning on June 8, 2005 at Mutton Mtn site #5 and on June 11th at Mutton Mtn site #4. In addition, the Shaniko Butte area was identified as one of several other sites that may have wind potential. A site on this ridge was also instrumented and data collection began on June 9, 2005.

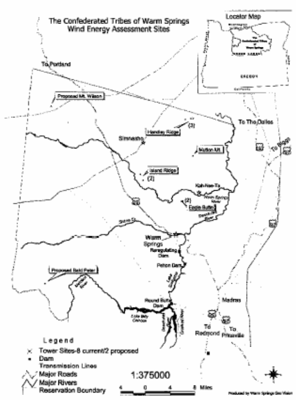


Figure 1. Wind energy assessment areas on the Warm Springs Indian Reservation.

The Mutton Mountains is a mountain range of fairly complex terrain running southwest to northwest but composed of ridges running north to south. It is located in the northwest corner of the reservation. The elevation varies considerably. Considering ridges or areas with elevations of 3800 to 4400 feet above sea level, it may be estimated that almost ten miles of ridge line may exist for development. A 50 meter tower was installed along the highest ridge in this mountain range in 2003. Based on data obtain during the three years of the study at the MM1 site, the annual average wind speed at 10 meters was 11.2 mph, at 30 meters it was 14.3 mph, and at 49 meters it was 15.3 mph. The dominant wind energy direction was from the west. The average shear coefficient was estimated to be 0.134 (30m-49m). Using this shear factor to estimate the wind speed at 100 meters, would yield a wind speed estimate of 18.0 mph. A wind flow model predicted the annual average wind speeds for this anemometer location to be 11.9 mph at 10 meters, 14.4 mph at 30 meters, and 15.6 mph at 50 meters with a shear of 0.17 (from 10m). The wind flow model would yield a 100 meter wind speed of 17.6 mph. These estimates are very close to the actual data. The average wind speeds for site MM2 for June 2005 thru 2006 were 11.5 mph at 10m, 15.0 mph at 30 meters. The average wind speeds for site MM3 for June 2005 thru May 2006 were 13.4 mph at 10m, 14.3 mph at 30m, and 15.1 mph at 49 m. The estimated 100m wind speed for this location using the (30-49m) shear (0.12) is 17.5 mph. The average wind speeds for site MM4 for July 2005 thru June 2006 were 10.7 mph at 10m, 13.2 mph at 30m, and 14.3 mph at 50m. The estimated 100 m wind speed for this location using the (30-49m) shear (0.158) is 16.0 mph. The average wind speeds for MM5 for July 2005 thru June 2006 were 12.4 mph at 10m and 13.7 mph at 30m. The estimated 100m wind speed for this location using the (10-30m) shear(.095) is 13.8 mph.
At Shaniko Mtn site the average wind speeds for July 2005 thru June 2006 were 14.2 mph at 10m and 15.5 mph at 30m. The estimated 100m wind speed for this location using the (10-30M) shear(.089) is 15.6 mph.

Possible turbine row locations are shown as red lines in Figures 2 and 3 for the Mutton Mountains and Figures 4 and 5 for Shaniko Mountain to define initially the most developable ridges. We will label these ridges 1 to 4 from east to west in Figure 2 for the Mutton Mountains. It would be expected that ridges 1 and 2 would be involved in the first phase of a development and a second phase might include turbines on ridge 3 and possibly on ridge 4. The actual orientation and number of turbines will require more data sites for ridges 2 thru 4. This report will give estimates for the development of ridges one and two. In section two of this report, two possible turbines are chosen and estimates are made as to the number of these turbines that could be installed. In section three, an estimate is prepared on installed wind farm capacity assuming the two different turbines for development of ridges one and two, and in section four a discussion of the results of these estimates is given with recommendations.

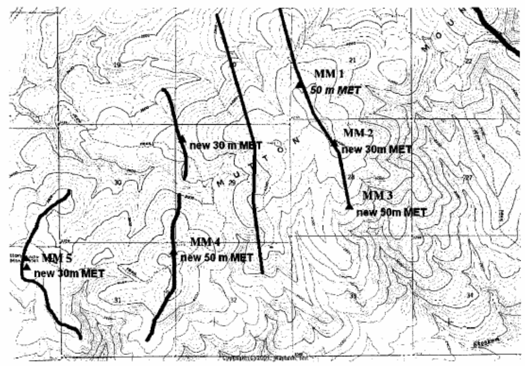


Figure 2. Map of Mutton Mountains

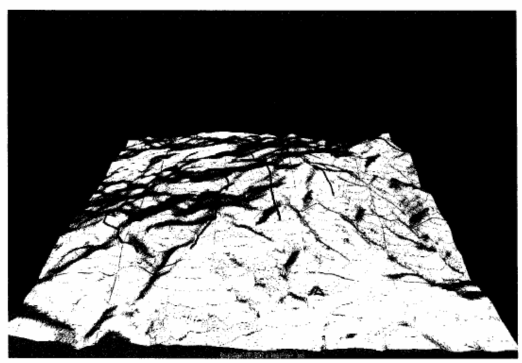


Figure 3. 3-D Perspective of Mutton Mountains

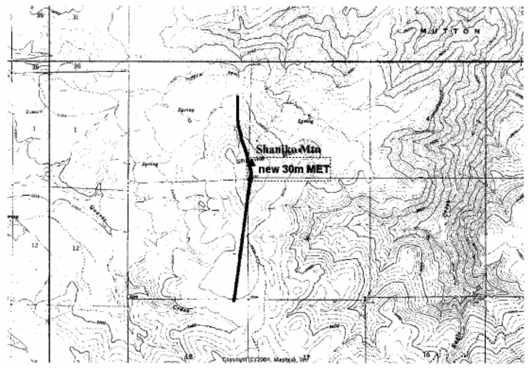


Figure 4. Map of Shaniko Mountain.

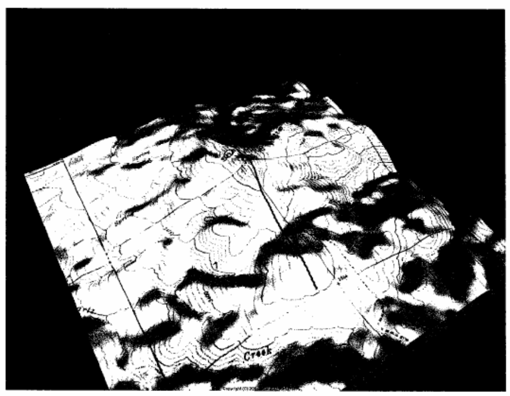


Figure 5. 3-D Perspective of Shaniko Mountain.

2.0 Estimates of Installed Capacity

To produce estimates of wind energy production, two wind turbines have been chosen - the General Electric(GE) 1.5 MW wind turbine and a new GE wind turbine that is rated at 2.5 MW that may be available in 2007. Basic specifications for these turbines are listed below in Table 1. Power curves were obtained from the manufacturers website figures of power output vs wind speed. The turbines chosen have good power curves for this site and are suppose to be available on 100 meter towers. Choosing different turbines can significantly alter the results. Appendix A contains the estimates of capacity factors for eight different wind turbines for the three anemometer sites.

Table 1. Turbine specifications

Specifications	**GE 1.5 xle**	**GE 2.5 xl**
Diameter(m)	82.5	100
Tower Height(m)	100	100
Rated Capacity(MW)	1.5	2.5
Cut-in wind speed (m/s)	3.5	3.5
Rated wind speed (m/s)	12.5	12.5
Cut-out wind speed (m/s)	20	25

We have chosen three diameter lateral spacing along ridges as can be seen in Figures 6 and 7 for the 1.5 MW wind turbines. For 2.5 MW turbine you would have roughly four (2.5 MW turbines) for every five (1.5 MW turbines) along the ridges. You may also need to eliminate some turbines due to upwind turbines and also have possibly a higher array loss for the 2.5 MW wind turbines. The downwind spacing is on the order of 7 to 8 diameters from ridge 2 to ridge 1.

Table 2. Installed capacity estimates

Ridge Number (E-W)	Gross Turbine Locations	Turbines (1.5 MW) Installed Capacity with 10% loss of locations	Turbines (2.5 MW) Installed Capacity with 10% loss of locations
1	16	21.0	27.5
2	12	16.5	20.0
3	10	13.5	17.5
4	8	10.5	15.0
Shaniko	9	12.0	17.5
Totals	46	73.5	97.5

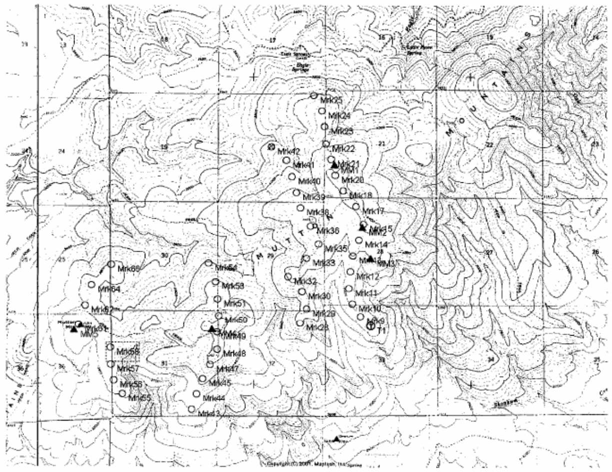


Figure 6. Possible turbine locations for GE 1.5 xle wind turbines (some turbines would be excluded because of wake loss/turbulence effects.

Table 3 provides the wind rose distribution for the 30 m level of site MM2 which may be useful in further wind farm planning. Wind direction data from site MM1 was determined to be unreliable, since the tower orientation when it was installed has been in question and directions were substantially different from that obtained at sites MM2 and MM3. Directional data should be used from site MM2 for planning. MM1 data may be corrected if the error is due to initial tower-boom orientation is determined, but this has not been resolved. Appendix B provides wind rose figures for the months June 2005 thru May 2006.

Table 4 provides the diurnal wind speed distributions for the 50 m level of site MM1 for the three year historical record. Wind speeds are generally strong for most of the months of the year from 1400 in the afternoon till around 0800 in the morning each day. During the period from 0800 to 1400 in the afternoon the winds are generally the lightest.

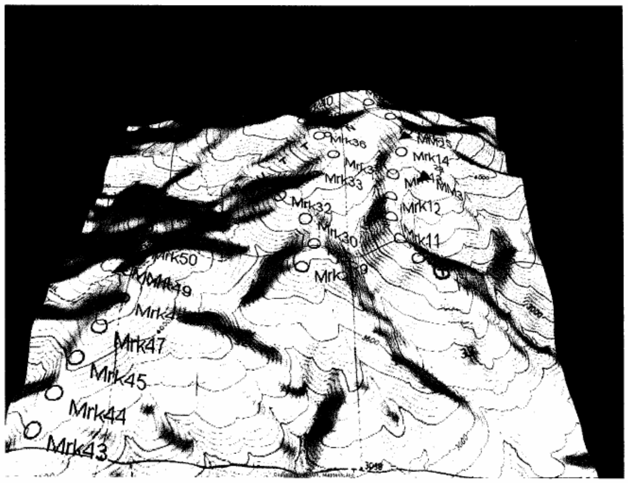


Figure 7. 3-D perspective of possible turbine locations for GE 1.5 xle wind turbines

Table 3. Wind Rose Distribution for 30 m Level of Site MM2

STATION - MM2
WIND ROSE FOR ALL DATA - 8683 OBSERVATIONS
DATA PERIOD OF RECORD - 6/2005 - 5/2006

SPEED CATEGORIES(MPH)

DIR	0 TO 10	10 TO 13	13 TO 16	16 TO 19	19 TO 22	22 TO 25	25 TO 28	28 TO 31	31 TO 34	34 TO 37	37 TO 40	40 TO 43	43 TO 46	46 TO 49	49 TO 52	52 TO 55	>= 55	TOTAL %	MEAN SPEED (MPH)
N	1.1	1.2	0.8	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	12.2
NNE	1.3	1.4	1.2	0.7	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	13.3
NE	1.3	0.4	0.5	0.4	0.4	0.4	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	15.1
ENE	1.6	0.7	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	9.8
E	2.8	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	7.3
ESE	1.7	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	7.1
SE	1.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	6.6
SSE	1.9	0.2	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	9.2
S	2.9	1.1	0.8	1.0	1.0	1.3	1.0	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	16.6
SSW	2.7	1.6	2.0	2.2	2.0	1.2	0.8	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.2	16.3
SW	2.3	1.2	1.4	1.0	0.7	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2	13.4
WSW	1.3	0.9	0.9	0.4	0.5	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	14.0
W	2.0	1.6	2.0	2.2	1.8	1.0	0.8	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.9	16.7
WNW	1.6	1.4	1.7	2.5	2.9	2.6	1.7	1.0	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	16.1	19.7
NW	1.2	1.1	1.4	1.6	1.4	0.9	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	16.3
NNW	0.6	0.4	0.4	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	12.4
CALM																		1.2	
TOTAL %	29.3	13.9	13.7	13.0	11.6	8.4	5.4	2.6	1.2	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	100.0	14.9

NOTE: MEAN SPEED OF THE TOTAL IN A WIND ROSE MAY DIFFER FROM THE SPEED FREQUENCY DISTRIBUTION FOR A GIVEN PERIOD DUE TO DATA SELECTION. SPEED FREQUENCY DISTRIBUTIONS REQUIRE ONLY A WIND SPEED OBSERVATION BE PRESENT. WIND ROSES, ON THE OTHER HAND, REQUIRE BOTH SPEED AND DIRECTION BE PRESENT FOR EACH OBSERVATION.

Table 4. Diurnal Wind Speed Distribution for Site MM1 for the Three Year Historical Record

STATION - MM1
DIURNAL WIND SPEEDS (MPH)
DATA PERIOD OF RECORD - 6/2003 - 5/2006

MON	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	AVG SPD
JAN	19.2	19.3	18.8	18.4	18.5	18.6	18.7	18.8	18.6	18.2	17.8	17.4	16.9	16.9	16.8	17.3	17.5	17.6	18.0	17.8	17.9	18.8	19.1	19.6	18.2
FEB	16.2	16.8	16.4	16.1	16.6	17.1	17.5	16.8	15.7	15.1	15.2	15.0	14.8	15.1	14.8	14.6	14.7	15.0	14.9	15.1	15.4	15.8	15.6	15.5	15.7
MAR	15.6	16.0	15.7	15.6	16.1	15.9	15.9	15.7	15.5	15.4	15.3	15.7	15.2	15.3	15.9	16.3	16.3	16.3	15.7	15.4	16.1	15.9	15.7	15.3	15.7
APR	14.8	14.6	14.7	14.4	14.2	13.9	12.9	12.2	12.1	12.6	12.6	13.4	13.5	14.2	14.9	15.7	15.9	16.0	15.8	15.5	14.6	14.1	14.1	14.3	14.2
MAY	15.2	14.6	14.7	14.9	14.5	14.3	13.8	12.8	12.6	12.5	12.7	13.8	14.8	15.3	16.1	16.8	17.3	17.4	17.0	16.6	16.3	16.1	16.1	15.7	15.1
JUN	16.4	16.1	15.5	15.4	15.2	14.0	12.5	11.5	11.5	11.6	12.0	12.3	13.4	14.5	16.2	17.7	19.2	19.7	19.1	18.9	18.3	17.9	17.1	16.8	15.5
JUL	14.5	14.4	14.3	14.2	13.8	12.6	10.9	9.3	8.7	8.6	8.7	9.5	10.5	11.9	14.0	15.8	17.7	19.1	18.7	17.8	16.9	16.0	15.1	14.7	13.7
AUG	14.0	14.2	14.5	14.2	14.1	13.4	11.9	10.6	10.0	9.7	9.9	10.6	11.6	12.8	14.2	16.2	17.7	18.1	17.9	17.4	16.2	15.4	14.8	14.1	13.9
SEP	15.2	15.2	15.1	15.2	15.1	14.7	13.8	12.4	11.2	10.2	10.6	11.1	12.0	13.2	14.0	14.9	15.7	16.3	16.1	16.1	15.0	15.0	15.1	15.3	14.1
OCT	15.5	16.1	16.6	17.0	17.0	17.3	17.5	16.4	15.3	14.3	14.1	14.0	13.7	14.0	14.2	14.7	15.2	15.3	14.7	14.3	14.6	14.9	15.0	15.4	15.3
NOV	16.9	17.0	17.3	17.4	17.7	17.5	17.5	17.5	17.2	16.3	15.9	16.2	15.7	15.5	15.1	14.9	15.6	15.5	15.3	15.8	15.9	16.4	16.8	16.5	16.4
DEC	16.5	16.3	16.5	16.1	15.5	15.4	15.4	15.7	15.6	15.8	15.7	15.4	15.1	15.0	15.4	16.1	16.3	16.6	17.1	17.2	17.4	17.2	17.0	16.7	16.1
AVG SPD	15.8	15.9	15.8	15.7	15.7	15.4	14.8	14.1	13.6	13.3	13.3	13.7	13.9	14.4	15.1	15.9	16.6	16.9	16.7	16.5	16.2	16.1	15.9	15.8	15.3

3.0 Wind Farm Capacity Factor Estimates

Estimates of energy production and capacity factors were prepared using a wind energy simulation program and the Warm Springs Mutton Mountain wind data for anemometer locations MM1 thru MM5 and Shaniko Mtn. (see Table 5). This analysis combined with the estimated number of representative turbines that was associated with each site as indicated in Table 6 for both Ridges 1 thru 4 of the Mutton Mountains and Shaniko Mountain enabled a wind farm capacity factors to be estimated. The wind energy simulation program fits Weibul distributions to the hourly averaged data and adjusts the data to hub height if two levels of wind are available to compute a shear coefficient or provides for an inputted shear exponent to adjust the winds from measured height to hub height. The program then calculates total energy for the period and the capacity factor for eight selected turbines. This approach it is not as sensitive to missing data, since the fitted distribution is used for the analysis data period. However, this approach can yield different results than if the actual data was adjusted on an hourly basis to hub height and power generation estimated. The difference will depend on how well the actual frequency distribution can be fitted by a Weibul distribution and adjustments for missing data and shear calculations. This program was run based on sea level performance data obtained from published data from the manufacturers of the following turbines: Vestas 66 1650 KW, Vestas 80 2000 KW, NEG MICON 64 1500 KW, NEG MICON 72 2000 KW, NORDEX 80 2500 KW, GE WIND 70.5 1500 KW, GE WIND 100 2500 KW and the GE WIND 82.5 150 KW. The program also makes density corrections to site elevation. In comparing turbines, the program uses manufacturers' data at a hub height the manufacture states is available for the turbine. Different results would be obtained if you put all the turbines at the same hub height. Only the results from the GE Wind 2.5 xl and the GE Wind 1.5 xle are presented below which are both expected to be available on 100 meter towers.

The average gross wind farm capacity factor for each month for both turbine types using the coincident data period of June 2005 thru May 2006 for ridges one and two has been calculated and is presented in Table 7. For the GE Wind 1.5xle turbine, the gross capacity factor was calculated to be 0.41 and for the GE Wind 2.5xl turbine the gross capacity factor was 0.37. Tables 7a thru 7c give gross capacity factors for ridges three and four of the Mutton Mountains and for Shaniko Mountain based on the data period July 2005 thru June 2006.

Table 8 shows a comparison of site MM1 with the long term reference site of Goodnoe Hills, WA. This table shows that the wind speed for the 2005-2006 period is about 3 to 4% higher than the 2003-2005 average wind speed. Using data from site MM1, we would expect that the 2005-2006 capacity factor to be 6% higher for the GE 1.5xle turbine than the previous two years of data 2003-2005 and 7 % higher for the GE 2.5xl turbine. Therefore, correcting the gross wind farm capacity factors by these amounts would yield gross wind farm capacity factors of 0.385 and 0.344.

Table 5. Meteorological sites

Name	Site Elev (m)	Elev (ft)	Latitude	Longitude	Site Number	50 m 164 ft Lv Code	30 m 98 ft Lv Code	10 m 33 ft Lv Code
Mutton Mtn 1	1372	4501.5	44 56.000	121 11.300	1232	MA	MB	MC
Mutton Mtn 2	1356	4449.0	44 56.282	121 11.230	1241		MD	ME
Mutton Mtn 3	1303	4275.1	44 56.028	121 11.139	1242	MF	MG	MH
Mutton Mtn 4	1292	4239.1	44 55.443	121 12.975	1243	MI	MJ	MK
Mutton Mtn 5	1216	3989.7	44 55.439	121 14.569	1244		ML	MM
Shaniko Mtn	1218	3996.3	44 59.276	121 12.929	1245		MN	MO

Table 6. Number of turbines assumed represented on ridges 1 and 2 by reference site MM1 - MM3, for ridges 3 and 4 by MM4 and MM5, and Shaniko Mountain by the Shaniko Mountain reference site.

Reference Site	Turbines (1.5 MW)	Turbines (2.5 MW)
MM1	9	7
MM2	7	6
MM3	9	6
MM4	9	7
MM5	7	6
SHANIKO	8	7
Total	49	39

Table 7. Gross wind farm capacity factors for 2005/2006 for Ridges 1 and 2

Site	Turb #	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Ave
GE 1.5 MW	25	0.42	0.36	0.38	0.33	0.27	0.46	0.47	0.58	0.50	0.35	0.34	0.37	0.41
GE 2.5 MW	19	0.38	0.32	0.35	0.29	0.23	0.43	0.44	0.55	0.47	0.32	0.30	0.33	0.37

Table 7a. Gross wind farm capacity factors for 2005/2006 for Ridge 3.

Site	Turb #	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Ave
GE 1.5 MW	9	0.31	0.37	0.28	0.19	0.40	0.35	0.40	0.44	0.32	0.27	0.30	0.31	0.33
GE 2.5 MW	7	0.35	0.40	0.31	0.23	0.44	0.39	0.45	0.48	0.36	0.31	0.34	0.35	0.37

Table 7b. Gross wind farm capacity factors for 2005/2006 for Ridge 4.

Site	Turb #	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
GE 1.5 MW	7	0.26	0.32	0.22	0.17	0.33	0.39	0.47	0.37	0.32	0.25	0.28	0.27	0.30
GE 2.5 MW	6	0.30	0.36	0.26	0.20	0.37	0.43	0.50	0.40	0.36	0.28	0.32	0.31	0.34

Table 7c. Gross wind farm capacity factors for 2005/2006 for Shaniko Mtn.

Site	Turb #	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
GE 1.5 MW	8	0.31	0.34	0.27	0.25	0.42	0.47	0.64	0.48	0.40	0.32	0.35	0.327	0.38
GE 2.5 MW	7	0.35	0.38	0.30	0.28	0.45	0.50	0.66	0.52	0.44	0.36	0.39	0.37	0.42

Table 8. Comparison of MM1 wind speeds to the long term reference site Goodnoe Hills.

Goodnoe Hills 195 ft level wind speed (mph)

period	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Ave
2003-04	17.6	17.4	15.3	13.8	15	15.3	11.3	11	11.5	17.1	14.4	16.8	14.7
2004-05	15.9	16.7	15.6	16.1	14.3	12.1	12.4	11.1	12.1	15.7	15.5	16.6	14.5
2005-06	19.2	17.2	15.5	14.5	12.9	12.5	11.3	16.7	15.8	13.5	15.2	15.1	15.0
AVE	17.6	17.1	15.5	14.8	14.1	13.3	11.7	12.9	13.1	15.4	15.0	16.2	14.7
1980-2005	16.5	15.5	13.9	13.2	13.1	11.7	12.8	12.5	14.1	16	16.8	17.1	14.5

MM1 Wind Speeds(mph) 164 ft level

period	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Ave
2003-04	15.6	13.5	12.3	14.6	16.8	15.9	14.6	16.4	14.5	17.4	13	15.9	15.0
2004-05	15.4	14	14.9	13.9	16.4	15.2	16	17.6	13.4	15.7	15.3	14.4	15.2
2005-06	15.6	13.5	14.6	13.9	12.8	18	17.9	20.9	18.8	14.2	14.2	14.9	15.8
AVE	15.5	13.7	13.9	14.1	15.3	16.4	16.2	18.3	15.6	15.8	14.2	15.1	15.3

The gross wind farm capacity factors also need to be corrected by energy losses due to a number of items itemized in Table 9 . Assuming these losses amount to 15% would yield net wind farm capacity factors of 0.32 and 0.29 for development of ridges one and two as shown in Table 10. Ridge 3 alone development would yield net wind farm capacity factors of 0.259 and 0.285. r Ridge 4 alone development it would yield net wind farm capacity factors of 0.240 and 0.265. For Shaniko Mountain alone development, the net wind farm capacity factors are 0.30 for the 1.5 MW wind turbine and 0.324 for the 2.5 MW wind turbine.

Table 9. Energy losses

Loss Type	**Percentage Loss**
Array Losses (3 x 8 spacing)	6 - 7 %
Availability Loss	1 - 3%
Electric Line/Transformer Losses	1.5 - 2.0 %
Yaw, turbulence, control, blade soiling	2.0 %
Icing Loss	1 %
High Wind Cycling	0.25 - 0.50 %
Overall	**11 - 15 %**

Table 10. Net average wind farm capacity factors (reduced ~21% or 22% for losses and inter-annual variability) from Table 7 for Ridges 1 and 2.

Site	Turb #	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Ave
GE 1.5 MW	25	0.33	0.28	0.30	0.26	0.21	0.37	0.37	0.46	0.40	0.28	0.27	0.29	0.32
GE 2.5 MW	19	0.30	0.25	0.27	0.23	0.18	0.33	0.34	0.43	0.37	0.25	0.24	0.25	0.29

Table 11. Net average wind farm capacity factors (reduced ~21% or 22% for losses and inter-annual variability) from gross wind farm capacity factors for different development inclusions.

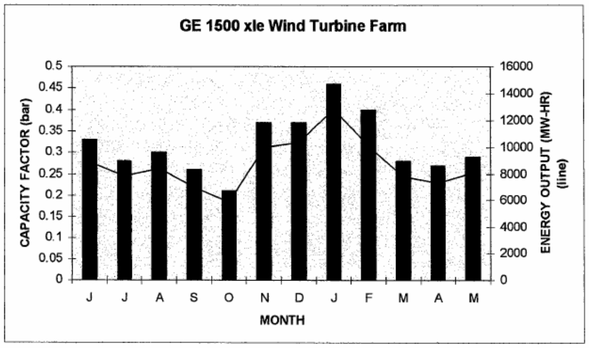
Sites	1.5 MW (# turbines)	2.5 MW(# turbines)
Ridge 1,2	0.32 (25)	0.29 (19)
Ridge 1,2,3	0.30 (34)	0.30 (25)
Ridge 1,2,3,4	0.29 (41)	0.29 (31)
Ridge 1,2,3,4 & Shaniko	0.29 (49)	0.29 (39)

If a different wind turbine, for example a NEG Micon 64 1500 KW with a hub height 197 ft was chosen then the net wind farm capacity factor would be on the order of 0.24. Appendix A has the estimates of monthly capacity factors for eight turbines for each of the meteorological sites. Wind shear has been used as measured between the 30 meter and 49 meter level for these calculations. For site MM2, shear levels measured at site MM1 were used, since this site had only a 30 meter tower with instrumentation at 10 and 30 meters. The shear levels between 10 and 30 meters was very similar between these sites.

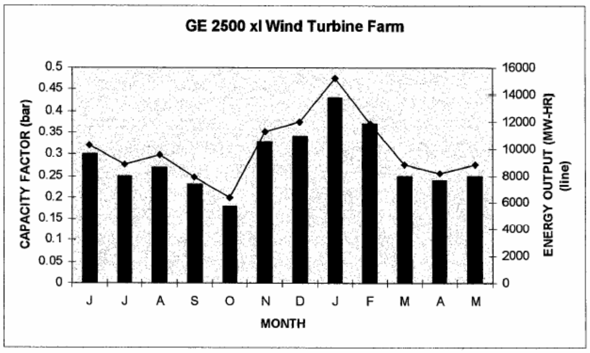
Energy production may be estimated by multiplying a net wind farm capacity factor (Table 10) times the installed capacity times the number of hours that the capacity factor represents. For the annual energy production one would use 8760 hrs times the average annual capacity factor. The monthly variation in energy production may be calculated using the monthly net capacity factors times the number of hours in a particular month times the installed capacity. The annual energy production for ridges one and two using the GE 1.5xle turbine is therefore calculated as (1500 kW)(25 turbines)(0.32)(8760) = 105,120,000 kW-hr or 105,120 MW-hr. Using the GE 2.5 xl, yields an annual energy production estimate of 120,669,000 kW-hr or 120,669 MW-hr. Figure 8 shows the expected monthly variation in wind farm capacity factor and energy production for both turbines for ridges 1 and 2 development of the Mutton Mountains.

Figure 8. Monthly variation in capacity factor and energy output in MW-hr (a) using GE 1500 xle wind turbines (b) using GE 2500 xl wind turbines for ridges 1 and 2 of Mutton Mountains.

(a)



(b)



4.0 Conclusions and Recommendations

The Mutton Mountains appear to have the potential for wind development in the future with the turbines discussed in this estimate. However, at this time, there exists a number of uncertainties which prevents a more definitive answer. These are:

- The availability of wind turbines for wind development is a current problem. Actual turbines to be used in a development will be subject to availability and cost at the time of the development. As previously indicated changing turbines may alter turbine heights, turbine placement, the number of turbines and performance predictions.
- Wind speed estimation at hub height using wind shear between 30 and 50 m has uncertainty. It would be recommended that a 100 meter meteorological tower be installed or a wind SODAR or LIDAR unit be employed to measure wind profiles over the swept area if wind turbines with 80 to 100 meter hub heights are to be employed. These hub heights are probably needed because of the trees in this area.
- Ridges two, three, four and Shaniko Mountain would need to be instrumented at several locations rather than just inferring wind speed estimates from the sites on ridge one for ridge two or from just one site on each of the other ridges and Shaniko Mountain..
- At this time, environmental and development site constraints are unknown. Ridges two and three will likely need to be cleared of trees at the ridge line. Wildlife endangerment is also unknown, like birds of prey. Also any cultural restrictions or historical sites in the area are unknown.
- Winter storm winds from October thru February or March are generally from the south. Since the ridges of the Mutton Mountains and Shaniko Mountain run generally south to north, turbine placement and number may need to be different from what was used in this estimate or operationally some turbines would be turned off when winds are from the south to minimize array losses and turbulence effects on turbines.
- It is expected some additional turbines may be located on ridge three, while ridge four may not be economically viable. Shaniko Mountain area appears to have potential, but will need some additional monitoring sites.

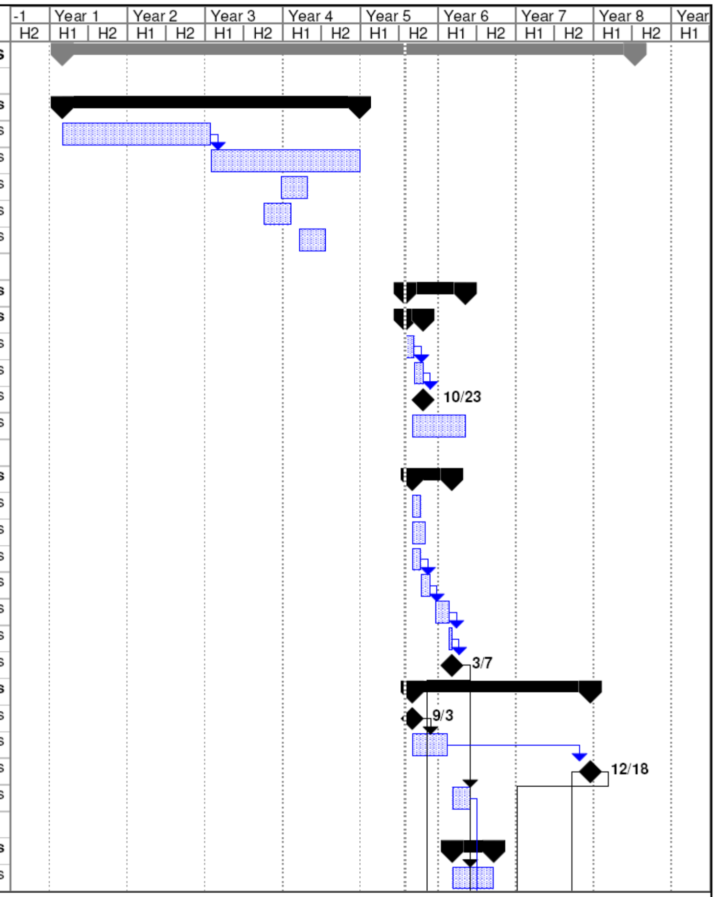
The final decision, on feasability can only be made when the cost of energy can be estimated. The costs of installed turbines and their availability are best determined by wind developers who have direct connections to the manufacturers for current quotes and experience with site development charges. Wind turbine prices have been rising due to inflation of raw materials and also because of supply and demand.

It is recommended that the wind monitoring sites should remain intact and data should continue to be collected whether or not wind development is anticipated at this time. The data will be very useful for future consideration of the area. If there are not enough financial resources, then I propose to let the sites operate until there is a failure and just archive the data for later processing. It would also be desirable to get the wind direction issues at the MM1 site resolved.

Appendix E: Example Project Development Schedule

This schedule is intended as an example for illustrative purposes only, and no dates or steps outlined herein are necessarily representative of the tribe's planned course of action.

ID	Task Name	Duration
0	**Tribal Wind Power Project Example Timeline**	**1926 days**
1		
2	**Wind Resource Assessment**	**1000 days**
3	Wind monitoring 4 sites: Handley Ridge, Mutton Mt, Eagle Butt	500 days
4	Intensive wind Monitoring Mutton Mountain	500 days
5	Wildlife Reconnaissance	90 days
6	Tranmission Interconnection Preliminary Study	90 days
7	Initial Site Layout and Preliminary Energy Production Estimate	90 days
8		
9	**Financing**	**203 days**
10	**Form legal business entity for project ownership**	**60 days**
11	Evaluate developers/equity partners	30 days
12	Developers/equity partners bid project	30 days
13	Select partners	0 days
14	Equity and Debt Financing	180 days
15		
16	**Preliminary Design and Cost Estimate**	**135 days**
17	Interconnection cost estimate for new line	30 days
18	Road upgrade cost estimate	45 days
19	Geotechnical survey - fatal flaw analysis	30 days
20	Turbine foundation cost estimate	30 days
21	Single-line-drawing project design	45 days
22	Update economic analysis	10 days
23	Go/No-go decision	0 days
24	**Turbine procurement**	**600 days**
25	Initiate discussions with turbine suppliers	0 days
26	Secure turbine supply agreement	120 days
27	Turbine and equipment delivery	0 days
28	**Detailed engineering design**	60 days
29		
30	**Marketing**	**140 days**
31	Power Purchase Agreement - proposals and negotiations	140 days



Project: Tribal Wind Power Project Ex
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Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	

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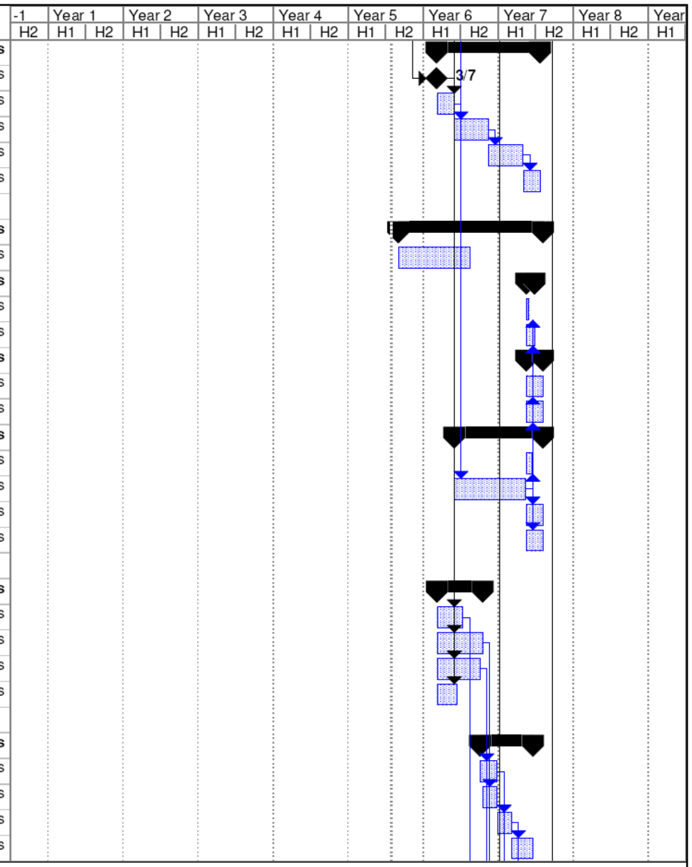
ID	Task Name	Duration
32	**Transmission Interconnection**	**360 days**
33	Interconnection Request ($10-20k deposit)	0 days
34	Interconnection Feasibility Study ($10k deposit)	60 days
35	System Impact Study ($50k deposit)	120 days
36	Facility Study ($100k deposit)	120 days
37	Preparation of Interconnection Agreement	60 days
38		
39	**Permitting**	**505 days**
40	Detailed wildlife and habitat assessment	250 days
41	**Federal Agencies**	**30 days**
42	Construction Activity Stormwater Permit (USEPA)	10 days
43	Notice of Proposed Construction to FAA	30 days
44	**State Agencies**	**60 days**
45	ODOT Encroachment Permit	60 days
46	Transportation Permit	60 days
47	**Tribal Agencies**	**310 days**
48	Cultural Clearance - BNR	20 days
49	IRMP Project Assessment - BNR	250 days
50	Reservation Right of Way - Tribal Council	60 days
51	Building Permit - Tribal Department Public Utilities	60 days
52		
53	**Engineering**	**160 days**
54	Site Compound layout, telecommunications, power	90 days
55	Electrical collection, substation, interconnect switchyard design	160 days
56	Foundation design	150 days
57	O&M Building design	70 days
58		
59	**Procurement**	**185 days**
60	Bid Structural Engineering	60 days
61	Bid Electrical Engineering	50 days
62	Bid Foundation Construction	50 days
63	Bid tower/turbine erection	75 days



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Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	

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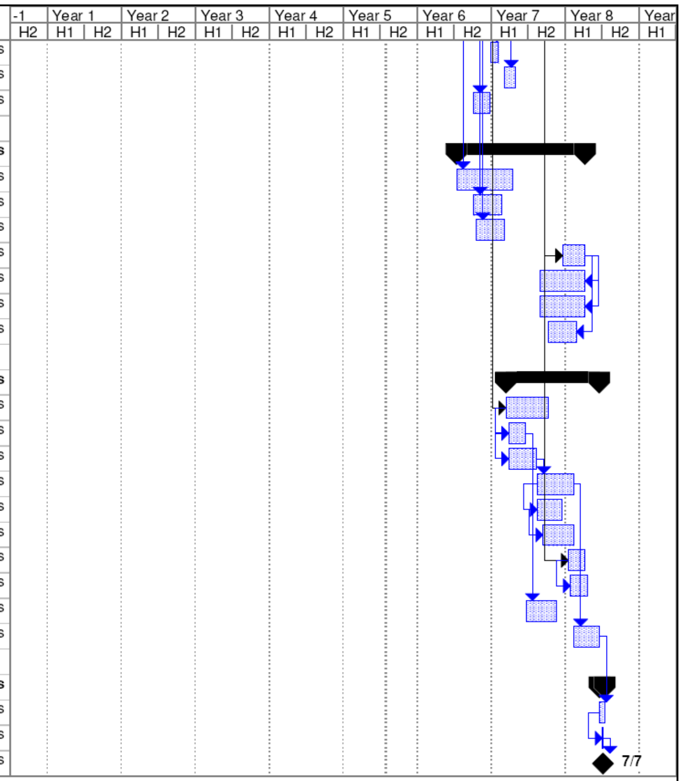
ID	Task Name	Duration
64	Bid site prep and roads	30 days
65	Bid trenching and buried cable	40 days
66	Bid permanent met mast	60 days
67		
68	**Materials**	**455 days**
69	Rock for roads	200 days
70	Foundation material	100 days
71	Electrical material	100 days
72	Turbine delivery and special tools for erection	80 days
73	Substation Material	160 days
74	Interconnect Switchyard material	160 days
75	O&M Building Material and SCADA equip	100 days
76		
77	**Construction**	**330 days**
78	Construction Management GCs and Contingency	150 days
79	Site prep and clearing	60 days
80	Roads and other civil	100 days
81	Foundations	130 days
82	Permanent Met mast	90 days
83	Collection System	110 days
84	Substation	60 days
85	Interconnect Switchyard	60 days
86	O&M Building	110 days
87	Turbine Erection	90 days
88		
89	**Commissioning and Startup**	**20 days**
90	Commissioning	20 days
91	Startup & Power Generation	3 days
92	Project Online Date	0 days



Project: Tribal Wind Power Project E>
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Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

FINAL REPORT PART II
WIND POWER RESOURCE ASSESSMENT
WARM SPRINGS RESERVATION TRIBAL LANDS
REPORT NO. DOE/GO/12103

SUBMITTED BY
WARM SPRINGS POWER & WATER ENTERPRISES
A CORPORATE ENTITY
OF
THE CONFEDERATED TRIBES
OF WARM SPRINGS
WARM SPRINGS, OREGON

Submittal Date: September 10, 2007

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