CHAPTER 2: PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This chapter presents information concerning the Applicant; describes the Applicant's proposal, including the project location, project facilities, safety features and control systems, and construction, operations and maintenance, and decommissioning activities; describes the costs for the project; identifies mitigation measures inherent in the design; describes the No Action Alternative; and discusses alternatives considered by the Applicant but eliminated from detailed evaluation. The information presented in this section is primarily based on information provided by the Applicant in the ASC (Sagebrush Power Partners LLC 2003a, Sections 2.1, 2.3, 2.4, 2.12, 2.14, 2.16, and 9.1). Where additional information has been used to evaluate the potential impacts associated with the proposal, that information has been referenced.

Rules published under the SEPA require that this EIS describe the proposal and alternative courses of action. Reasonable alternatives include actions that could feasibly attain or approximate a proposal's objectives, but at a lower environmental cost or decreased level of environmental degradation. The rules also require that the impacts of these alternatives be compared with the impacts of not implementing the alternatives (No Action) and that the advantages and disadvantages of delaying the approval for some future date be discussed. As this chapter explains, alternative wind energy technologies, alternative project sites, and an alternative project layout were considered in developing and siting the wind turbine towers. These alternatives, however, were eliminated from further study because they either did not meet the proposal's objectives, were not practical or feasible, or would result in higher environmental costs (compared to the proposed action). Therefore, this EIS evaluates the potential impacts of the Kittitas Valley Wind Power Project and its associated facilities (the proposed action), as described in this chapter, and the No Action Alternative.

2.1.1 The Applicant

The Applicant for the Kittitas Valley Wind Power Project is Sagebrush Power Partners LLC, a wholly owned subsidiary of Zilkha Renewable Energy. A partial list of other wind power projects developed, under construction, or planned in the near term by Zilkha Renewable Energy include the following (Taylor, pers. comm., 2003):

<u>Blue Canyon Wind Farm, Oklahoma (75 MW)</u>

Zilkha Renewable Energy is in the process of building the 75-MW Blue Canyon wind project near Lawton, Oklahoma. The project is scheduled to be on-line by December of 2003. Zilkha will serve as the operations manager at Blue Canyon during the operational phase of the project. Energy is being sold under a long-term power purchase agreement (PPA) to Western Farmers Electric Cooperative of Andarko, Oklahoma.

Meyersdale Wind Energy Center, Pennsylvania (30 MW)

Zilkha Renewable Energy and its partner Atlantic Renewable Energy Corporation co-developed the 30-MW Meyersdale wind project. Development began in 2001, and the project is expected to be on line by December 2003. Energy is being sold under a long term power purchase agreement to FirstEnergy of Akron, Ohio.

Top of Iowa Wind Farm, Iowa (80 MW)

Zilkha Renewable Energy and its partner Midwest Renewable Energy Corporation co-developed the 80-MW Top of Iowa wind project. Development began in 2000, and the project came on line in October 2001. Energy is being sold under a long term power purchase agreement with Alliant Energy of Madison, Wisconsin. Zilkha and its partner secured the land for the project including transmission easements, obtained permits, marketed the energy from the project, and negotiated the PPA. Zilkha Renewable Energy serves as the operations management for the project.

Somerset and Mill Run, Pennsylvania (24 MW)

Zilkha Renewable Energy and Atlantic Renewable Energy built and developed these projects in 2001, totaling 24 MW of installed capacity. Output from both projects is sold to Exelon Powerteam under a long term power purchase agreement. Zilkha and its partner Atlantic Renewable secured the land for the project including transmission easements, obtained permits, marketed the energy from the projects, and negotiated the PPAs. Zilkha financed construction of the project with its own resources and managed operation of the projects until their sale to FPL Energy in early 2003.

Pine Tree Wind Project, California (120 MW)

In 2003 Zilkha Renewable Energy and its partner Prometheus Energy negotiated an agreement with the Los Angeles Department of Water and Power (LADWP) for the turnkey construction and development of a 120-MW wind project near Tehachapi, California. Under the agreement Zilkha will develop and build the project, and hand it over to LADWP upon successful completion.

Tierras Morenas, Costa Rica (24 MW)

Zilkha Renewable Energy and its partner Energia Global co-developed the 24-MW Tierras Morenas wind project near Tilaran, Costa Rica. Zilkha's team spearheaded the final development, construction, and operations of this project. The project came online in 1999. The output is sold under a long term power purchase agreement to ICE, the state-owned Costa Rican electric utility. Sagebrush Power Partners was created as a Delaware limited liability company for the sole purpose of developing, permitting, financing, constructing, owning, and operating the Kittitas Valley Wind Power Project. Sagebrush Power Partners LLC will own and operate the Kittitas Valley Wind Power Project and manage all of the facility's affairs, including activities related to obtaining permits and other approvals required for project development.

2.1.2 Scope of this EIS

The scoping phase of the EIS process was completed on March 14, 2003. Based on the comments received and information compiled during the scoping phase, EFSEC, the SEPA lead agency, determined that the scope of this EIS consists of a description of the proposed action and alternatives; a discussion of the affected environment; an evaluation of the project's potential direct, indirect, and cumulative impacts; and an identification of suitable mitigation measures associated with the construction, operation, maintenance, and decommission of all components (and connected actions) of the proposed project, including the turbines, electrical collector infrastructure, substations, access roads, operations and maintenance facility, and meteorological towers.

In evaluating potential impacts from construction and operation of these components and connected actions, the following elements of the natural and built environment are addressed in this EIS:

- Earth Resources
- Vegetation, Wetlands, Wildlife and Habitat, Fisheries, and Threatened and Endangered Species
- Water Resources
- Health and Safety
- Energy and Natural Resources
- Land Use and Recreation
- Socioeconomics
- Cultural Resources
- Visual Resources
- Transportation
- Air Quality
- Noise
- Public Services and Utilities

2.2 DESCRIPTION OF PROPOSED ACTION

2.2.1 Project Overview

Sagebrush Power Partners LLC proposes to construct and operate a series of wind turbines that would harness the natural wind at the proposed Kittitas Valley Wind Power Project site in Kittitas County, Washington. Energy from the spinning turbines will be turned into 181.5 to 246 megawatts of power, which would be sold through long term power purchase contracts. Although these contracts have been proposed to a number of local and regional utilities, as of the time this Draft EIS was published no contracts had been negotiated or executed. Elements of the project include wind turbine generators, roads, foundations, underground and overhead electrical lines, grid interconnection facilities, one or two substations, an operations and maintenance (O&M) facility, and associated supporting infrastructure and facilities. Figure 2-1 illustrates the general site layout of these key elements. Project construction could begin in the spring of 2004 immediately after obtaining site certification from EFSEC, and it is anticipated that it would take approximately one year to construct the facility. The expected service life of the facility is 20 years. Refer to Section 2.2.6 for details addressing upgrade of older equipment with more efficient turbines (repowering) after the initial 20-year period.

The project would install three-bladed wind turbines on tubular steel towers ranging in size from 1.3 MW to 3 MW (generator nameplate capacity) in the project area.

The final selection of the exact make and model of wind turbine to be used for the project depends on a number of factors including equipment availability at the time of construction. The number of turbines and the resulting nameplate capacity of the project would depend on the type of technology used. Therefore, to capture a "reasonable range" of potential project impacts, this EIS defines and evaluates the following three project scenarios:

- Lower End Scenario: The lower end scenario represents the project configuration with the lowest number of turbines erected. For turbines with a nameplate capacity of 3 MW, up to 82 turbines would be used, resulting in nameplate capacity of 246 MW.
- Middle Scenario: The middle scenario represents the project configuration that would be chosen based on current pricing and performance for wind turbine technology presently on the market. For turbines with a nameplate capacity of 1.5 MW each, 121 turbines would be used for a total for a total of 181.5 MW. This scenario is illustrated in Figure 2-1.
- Upper End Scenario: The upper end scenario represents the project configuration with the highest number of turbines erected. For turbines with a nameplate capacity of 1.3 MW each, up to 150 turbines would be used, resulting in a project total nameplate capacity of 195 MW.

Figure 2-2 illustrates the maximum dimensions not be exceeded of the three project scenarios. For comparison purposes, Figure 2-2 also depicts, to scale, a Bonneville transmission tower that presently occupies the project area.

Tables 2-1 and 2-2 summarize the proposed project facilities and the total area that would be permanently and temporarily occupied, respectively, by each project element for the three defined project scenarios. The permanent project footprint (for the life of the project) would occupy between 93 and 118 acres for wind turbines, access roads, substations, and other facilities. Between approximately 231 and 371 acres would be temporarily occupied during construction by facilities such as staging areas and equipment laydown areas. The only features that would vary in size between the three project scenarios would be the temporary laydown areas at each wind turbine during construction and the permanent roadway and turbine and transformer pad footprints; under the lower end scenario, roads would be wider to accommodate larger construction cranes. The amount of land disturbance required for the operations and maintenance facility, substations, and meteorological towers would not change under the three scenarios.

Figure 2-1

Figure 2-2: Typical Wind Turbine Dimensions

Between 82 and 150 turbines would be arranged in numerous “strings” labeled A through J throughout the project site, for a maximum of 23 total miles of turbine strings (Figure 2-1). The length of the 10 turbine strings would remain constant under the three project scenarios; only the density of turbines sited within each string would change. The height of the turbines (referred to as the “tip height”) would range from about 260 feet to 410 feet from the ground to the blade tip in its highest position, depending on the turbine size selected (see Figure 2-2). In any scenario chosen by the Applicant only a single size of turbines would be used; different sizes of turbines would not be mixed.

To access and service the wind turbines and other facilities at the site, up to 7 miles of existing private roads would be improved, and up to 19 miles of new access roads would be constructed. One O&M facility, approximately 5,000 square feet on a 2-acre site, also would be constructed. Electrical lines would be installed to connect the turbines and strings (see Figure 2-1). Lines connecting individual turbines in each string would be located underground, and lines connecting the strings primarily would be underground with some overhead.

2.2.2 Project Location and Project Site

The project site is located on open ridgetops between Ellensburg and Cle Elum, about 12 miles northwest of the City of Ellensburg in Kittitas County, Washington. The estimated 90-acre project site lies within an area covering approximately 3.5 miles (east-west) by 5 miles (north-south). For purposes of this EIS, the terms “project site” and “project area” are defined as follows:

- Project site: Actual locations within the project area where construction and operation activities would occur. As shown in Tables 2-1 and 2-2, below, the size of the project site depends on the project phase (i.e., construction vs. operations) and the project scenario.
- Project area: The general area that surrounds the project site; this includes the tax parcels where all project facilities are proposed.

Project site ridges rise as high as 1,300 feet above the surrounding valley floor. Strong northwest winds in the project area are compressed as they pass by Lookout Mountain and are further accelerated as they pass over the site’s ridgetops. The center of the site is located approximately at the intersection of the main Bonneville and PSE east-west transmission line corridors with US 97.

Table 2-1: Permanent Disturbance Footprint for Range of Proposed Turbines

Facilities	Number	Approximate Footprint Area (total acres)		
		Lower End 82 Turbines/ 3 MW	Middle 121 Turbines/ 1.5 MW	Upper End 150 Turbines/ 1.3 MW
Project site roadways	Existing: 7 miles New: 19 miles	95	67	67
Turbines and crane pads	82/121/150	5.4	8	9.9
O&M facility with parking	1	2	2	2
Overhead line pole footprint	50	0.25	0.25	0.25
Step up substation	2	6	6	6
Turn-around areas	18	9	9	9
Meteorological towers	Up to 9	0.75	0.75	0.75
Total Footprint (acres)		118	93	94.9

Source: Sagebrush Power Partners LLC 2003e

Table 2-2: Temporary Disturbance Footprint for Range of Proposed Turbines

Facilities	Approximate Footprint Area (total acres)		
	Lower End 82 Turbines/ 3 MW	Middle 121 Turbines/ 1.5 MW	Upper End 150 Turbines/ 1.3 MW
Disturbance beside roads	41	41	41
Laydown area at turbines	169.4	250	309.9
Material laydown area at substation	5	5	5
Meteorological tower temporary footprint	3.7	3.7	3.7
Temporary overhead line pole footprint	8.8	8.8	8.8
Temporary area at O&M facility	3	3	3
Total Footprint (acres)	231	311	371

Source: Sagebrush Power Partners LLC 2003e

Under the middle, or reasonably expected project scenario, wind turbines would be installed along the roadways shown in Figure 2-1. The layout design is based on wind turbines with a rotor diameter of approximately 230 feet. Because of possible variances that may be discovered during the final site survey, some flexibility in determining the exact facility locations is required. Generally, it will not be necessary to relocate roads significantly from their proposed locations; however, the exact location of the turbines along the planned roadways may need to be altered from the plan shown in Figure 2-1 because of a number of factors including:

- The results of geotechnical investigations to be conducted at each surveyed turbine location may reveal underground voids or fractures. In this case, the turbine location may need to be altered or eliminated.
- The final onsite field survey with the meteorologists may dictate that turbines be spaced slightly closer together in some areas and farther apart in other areas.
- If, at the time of construction, a turbine with a larger rotor diameter is to be used (i.e., under the lower end scenario), the turbine spacing would be increased and the overall number of turbines would be reduced. Conversely, if a turbine with a smaller rotor diameter is to be

used (i.e., under the upper end scenario), turbine spacing would be decreased and the overall number of turbines would be increased.

- The final field measurement test surveys of communication microwave paths may require that some turbine locations be adjusted slightly to avoid line-of-sight interference.

Given that rotor diameters proposed for the wind turbines would range from approximately 200 feet under the upper end scenario to 295 feet under the lower end scenario, turbines would not vary from their proposed locations by more than 350 feet. Adjustments to final turbine tower locations would not bring them closer to public roads, power lines, property lines of non-participating landowners, or residences; the setbacks currently shown in Figure 2-1 would be not be reduced.

Figure 2-1 shows property ownership at the time the ASC was prepared (January 2003). Property ownership is fluid, and changes over time. Therefore, between the time the ASC and Draft EIS were issued, several parcels of land in the project area have changed ownership. Table 2-3 identifies new property owners in the KVWPP area as of September 2003.

Table 2-3: Property Ownership Changes in KVWPP Area (as of September 2003)

Location	Previous Owner	New Owner
T20, R17, Section 35	W. Flowers	J. Hunter
T20, R17, Section 35	Korthanke	T. Sween
T19, R17, Section 13	Gallagher	E. Garrett
T19, R17, Section 13	Garrett	C. Wilkins
T19, R17, Section 1	Brooke	Aronicha
T19, R17, Section 2	Mathias	Oberhamsley
T19, R17, Section 2	Sambrano	Morraitis
T19, R17, Section 4	Archambeau	The Henley Group

Source: Foote 2003.

Project Setbacks

The minimum setbacks incorporated into the proposed project layout are based on several factors, including safety and avoidance of nuisance concerns, industry standards, and on the Applicant's experience in operating wind power projects. Some are fixed distances (i.e., 1,000 feet) that are based on estimates or modeling of potential nuisance impacts such as noise and shadow-flicker. Others, such as tip height, are related to the size of the actual turbines to be installed. (Tip height refers to the total distance from the base of the turbine to the tip of the blade at its highest point; see Figure 2-2.) Tip height setbacks are primarily safety-related (e.g., if an entire tower and turbine were to collapse from a massive earthquake either combined with or independent from hurricane force wind, they would not fall on a public road or a neighbor's property). The proposed setbacks for the project's proposed turbine towers are as follows (Sagebrush Power Partners LLC 2003c, Section 2.3.12):

- Setback from residences of neighboring landowners (i.e., those without signed agreements with the Applicant): 1,000 feet.

- Setback from property lines of neighboring landowners: 50 feet beyond the tip of the blade at its closest point to the property line.
- Setback from county/state roads: Turbine tip height.
- Setback from residences with signed agreements with the Applicant: At least blade tip height. However, it may be greater based on the property owner's approval. Some landowners want to have turbines closer than 1,000 feet to their residence in exchange for more turbines on their land and the revenue generated by them.
- Setback from property lines of landowners with signed agreements with the Applicant: None. All property owners with signed agreements with the Applicant have agreed to a zero setback from property lines, as this allows the most efficient and lowest impact of wind turbines on various landowners' property.
- Setback from Bonneville/PSE transmission lines: Blade tip height.

If the final turbine selected for the project is larger or smaller than the turbine scenario layout presented in Figure 2-1 (the middle scenario), minor adjustments would be made to the proposed project layout such as moving the turbine tower foundations to maintain the setbacks described above. The proposed setback for the meteorological towers from public roads and residences is tip height. There are no designated setbacks for the other project components such as the O&M facility, substations, and gravel access roads.

2.2.3 Facilities

The project would be located on privately-owned open rangeland and rangeland owned by DNR pursuant to leases negotiated between the landowners and the Applicant. These leases would allow construction and operation of wind facilities for a negotiated term. In exchange, each landowner leasing property would receive financial compensation.

The project would consist of wind turbines, associated electrical systems (including an electrical collector system, substations, and interconnection facilities), meteorological towers, access roads, and an operation and maintenance building (see Figure 2-1). Each of these features is described in more detail below.

Wind Turbines

Wind turbines consist of three main components—the turbine tower, nacelle, and rotor blades. A typical wind turbine tower is shown in Figure 2-3. The nacelle is the portion of the wind turbine mounted at the top of the tower, which houses the wind turbine itself, the rotor, hub, and gearbox (Figure 2-4). The 1.3- to 3-MW wind turbines under consideration for the project have the design features shown in Table 2-4.

Table 2-4: Wind Turbine Features, Kittitas Valley Wind Power Project

Design Feature	Description		
	Upper End Scenario	Middle Scenario	Lower End Scenario
Rated output of turbine	1.3 MW	1.5 MW	3 MW
Number of turbines	150	121	82
Axis	Horizontal	Horizontal	Horizontal
Rotor orientation	Upwind	Upwind	Upwind
Minimum wind speed for turbines to begin operating	7-10 miles per hour[1]	7-10 miles per hour[1]	7-10 miles per hour[1]
Number of blades	Three	Three	Three
Rotor (blade) diameter	197 feet	231 feet	295 feet
Tower type	Tubular steel	Tubular steel	Tubular steel
Tower hub (nacelle) height	150 feet	215 feet	262 feet
Total (tip) height (to top of vertical rotor)	260 feet	330 feet	410 feet
Rotational speed	10-23 rotations per minute	10-23 rotations per minute	10-23 rotations per minute
Nacelle	Fully enclosed steel or steel or reinforced fiberglass	Fully enclosed steel or steel reinforced fiberglass	Fully enclosed steel or steel reinforced fiberglass
Color	Neutral gray	Neutral gray	Neutral gray

Source: Sagebrush Power Partners LLC 2003a

1 Wind turbines rotate in winds as low as 2-3 mph, but generator cut in occurs at 7-10 mph.

Towers

Towers would be approximately 150 to 260 feet tall at the turbine hub (referred to as the "hub height") under the upper and lower end scenarios, respectively. With the nacelle and blades mounted, the total height of the wind turbine ("tip height") would be approximately 260 to 410 feet high with a blade in the vertical position. The towers would be a tubular conical steel structure manufactured in multiple sections depending on the tower height and approximately 12 to 16 feet in diameter at the base. The towers would be painted a neutral gray color to be visually less obtrusive. A service platform at the top of each section would allow for access to the tower's connecting bolts for routine inspection. A ladder inside the structure would ascend to the nacelle to provide access for turbine maintenance. The tower would be equipped with interior lighting and a safety glide cable alongside the ladder.

The towers would be fabricated and erected in two to three sections. Turbine tower sections would be transported to the site on trailers that could each carry one tower section per truck. Tower sections would be delivered by truck to a staging area and then to each tower location. They would be erected using a large construction crane.

Figure 2-3:

Figure 2-4:

Nacelle

The nacelle houses the main mechanical components of the wind turbine generator—the drive train, gearbox, and generator. The nacelle would be equipped with an anemometer and a wind vane that signals wind speed and direction information to an electronic controller. A mechanism would use electric motors to rotate (yaw) the nacelle and rotor to keep the turbine pointed into the wind to maximize energy capture. An enclosed steel-reinforced fiberglass shell houses the nacelle to protect internal machinery from the elements.

Rotor Blades

Modern wind turbines have three-bladed rotors. The diameter of the circle swept by the blades would range from approximately 200 to 300 feet under the upper and lower end scenarios, respectively (that is, each blade would be approximately 100 to 150 feet long). The blades would turn at about 10 to 23 rotations per minute (RPM). Generally, larger wind turbine generators have slower rotating blades, but the specific RPM values depend on aerodynamic design and vary across machines. The rotor blades would be typically made from glass-reinforced polyester composite.

Electrical System

The project's electrical system would have two key elements: (1) a collector system, which would collect energy at between 575 and 690 volts (V) from each wind turbine (depending on the type of turbine used), increase it to 34.5 kilovolts (kV) through a pad-mounted transformer, and connect to the project substations; and (2) the substations and interconnection facilities, which would transform energy from the collection lines (at 34.5 kV) to the transmission level (230 kV for the PSE line and Bonneville's Columbia to Covington line or 287 kV for Bonneville's Grand Coulee to Olympia line). A schematic of the electrical collection system and interconnection facilities is shown in Figure 2-5.

Collector System

Power from the wind turbines would be generated at 575 V to 690 V depending on the type of wind turbine used for the project. A set of heavy gauge, armored, flexible drop cables would connect to the generator terminals in the nacelle and would pass from the nacelle into the tower where they would drop down to a cable support saddle located about 20 to 30 feet below the top tower platform. From the support saddle, the cables would be directed along the side of the tower, along the internal ladder in cable trays, or they would be hung straight down to the base bus cabinet and breaker panel inside the base of the tower. The drop cables would terminate inside the bus cabinet. Another set of cables would run from the bus cabinet through conduits in the foundation to the pad transformer, ranging in size from 50 to 120 square feet in area; the pad transformer would step up the voltage to 34.5 kV. Some wind turbine generators, such as the Vestas V-80, have the transformer in the nacelle. For the V-80, the drop cables would be at 34.5 kV, and the base bus cabinet would be a switchgear breaker panel. No outdoor pad transformer would be required (Sagebrush Power Partners LLC 2003c, Section 2.3.4).

From the transformer, power from the turbine would be transmitted by underground 34.5-kV electrical cables installed in a trench typically 3 to 4 feet deep, depending on the underlying soil and rock conditions, and up to 5 feet wide. Underground collection cables would be used in most areas; overhead collectors on wood structures would be used where there are steep slopes or canyons to cross (see Figure 2-1). Approximately 23 miles of underground and 2 miles of overhead 34.5-kV electrical power lines would be used to collect power from the turbines and terminate at the main substation.

An estimated 1.2-mile section of the overhead system would be along Bettas Road parallel to two existing sets of overhead transmission lines and the access road that serves them. Another overhead section is proposed to link turbine strings B and C. In the original site layout (Figure 2-1), this connection was shown as either underground or overhead. Based on subsequent input from the Washington Department of Fish and Wildlife, the Applicant proposes to build this as part of the overhead system to minimize impacts on the riparian habitat between the two ridgetops. For these short overhead portions of the electrical collection system, wooden poles, non-reflective conductors, and non-refractive insulators would be used (Sagebrush Power Partners LLC 2003d). Overhead poles typically would be approximately 60 feet tall and positioned so that poles and electrical conductors are spaced at least 200 feet apart. The poles would be buried 8 to 10 feet deep. Pole insulators would be spaced four feet apart. Anti-perching devices would be installed on the poles to limit potential raptor use.

The electrical collection system would include junction boxes and pad-mounted switchgear panels that would be installed to connect cables coming from different directions and to allow for the isolation of particular turbine strings. In total, it is estimated that 15 junction boxes and 10 switch panels would be required for the electrical collection system (Sagebrush Power Partners LLC 2003c, Section 2.3.4).

Junction Boxes

The junction boxes would be either steel-clad or fiberglass panels mounted on pad foundations roughly 4 feet wide, 6 feet long, and 6 feet high. The pad foundation would have an underground vault about 3 feet deep where the underground cables come in. The junction boxes also would have a buried grounding ring with grounding rods tied to the collection system and a common neutral.

Switch Panels

The switch panels would be steel-clad enclosures mounted on pad foundations roughly 7 feet wide, 7 feet long, and 5 feet high. Switches would allow particular collector lines and turbines strings to be turned off or isolated. This isolation would allow maintenance and repair to take place without shutting down the entire project. The pad foundation would have an underground vault about 3 feet deep where the underground cables come in. Switch panels also would have a buried grounding ring with grounding rods tied to the collection system and a common neutral .

Figure 2-5:

Substations and Interconnection Facilities

The Applicant is seeking a permit for and is designing the project so that it could interconnect with either the PSE or Bonneville electrical transmission lines traversing the site or possibly both. If connected to Bonneville's system, the project would interconnect directly with either the Grand Coulee to Olympia 287-kV line or the Columbia to Covington 230-kV line. If connected to PSE's system, the project would interconnect directly with PSE's Rocky Reach to White River 230-kV line. There is the possibility that power would be fed to both the PSE and Bonneville systems; therefore, this analysis evaluates the need to construct two substations since the lines have different voltages.

The Applicant would build and maintain up to two fenced substation sites, each occupying approximately 3 acres. The proposed PSE substation would be in the northwest corner of the intersection of US 97 and Bettas Road, and the Bonneville substation would be approximately 2,200 feet southwest of the PSE substation, south of Bettas Road near the Bonneville transmission lines. The main function of the substations and interconnection facilities would be to step up the voltage from the collection lines (at 34.5 kV) to the transmission level (230 or 287 kV) to interconnect to the appropriate utility grid. The basic elements of the substation and interconnection facilities are a control house, two main transformers, outdoor breakers, relaying equipment, steel support structures, and overhead lightning suppression conductors. All of the elements would be installed on concrete foundations designed for site-specific soil conditions.

Meteorological Towers

Meteorological towers are used to measure wind conditions, including wind speed, direction, and temperature. The Applicant proposes to erect up to nine permanent meteorological towers in the project area, although it is likely that only four would be constructed. The potential location of the nine proposed permanent meteorological towers is shown in Figure 2-1. The permanent meteorological towers installed for the project would be approximately as tall as the turbine tower hub height (i.e., 150 to 262 feet) and would consist of a central lattice structure supported by three to four sets of guy wires that extend up to 100 to 210 feet from the base of each tower, on a 16-foot-by-16-foot base. The towers may alternatively be of a free standing design. The meteorological towers would be constructed upwind of turbine strings or groups of turbine strings to monitor wind strength and to confirm turbine performance. Meteorological towers greater than 200 feet in height would require lighting in compliance with the Federal Aviation Administrations' (FAA) aircraft safety lighting requirements (see the lighting discussion below for further detail).

Meteorological towers would be installed with a grounding system that protects the meteorological sensors and loggers from electrostatic discharge and lightning. Lightning dissipaters or rods would be installed at the tops of the towers to provide an umbrella of protection for the upper sensors (Sagebrush Power Partners LLC 2003c, Section 2.3.8).

Access Roads

Access to the various rows of turbines would be achieved by graveled access roads branching from US 97 and two county roads—Bettas and Hayward roads. The project would improve some existing private roads and construct new gravel roads to provide access for construction vehicles and equipment. Up to approximately 7 miles of existing private roads would need to be improved and up to 19 miles of new roads would be constructed. The roads would be 24 feet wide including shoulders for small wind turbine generators (i.e., under the middle and upper end scenarios) and 34 feet wide including shoulders for larger wind turbine generators (i.e., under the lower end scenario) with a compacted gravel surface. In areas of steeper grades, a cut and fill design would be implemented to keep grades below 15% and to prevent erosion. After the project is constructed, use of the improved and new access roads on private lands would be limited to the landowner and to project maintenance staff.

Operation and Maintenance Facility

A permanent O&M facility would be constructed near the northwest corner of US 97 and Bettas Road. It would consist of approximately 5,000 square feet of enclosed space, including offices, spare parts storage, kitchen, restrooms, and a shop area. Water for the bathroom and kitchen would be obtained from a new domestic well; anticipated water use would be less than 1,000 gallons a day. Wastewater from the facility would be discharged to an onsite domestic septic tank. There also would be graveled outdoor parking, a turnaround area for larger vehicles, outdoor lighting, and gated access with either partial or full perimeter fencing. The overall area of the building and parking would be approximately 2 acres. Vehicle access to the O&M facility would occur from Bettas Road.

Information Kiosk

An information kiosk and public viewing area near the proposed O&M facility off Bettas Road would be constructed. Signs would be provided to direct tourists to this site (Sagebrush Power Partners LLC 2003c, Section 5.3). Vehicle access to the information kiosk and public viewing area would occur from Bettas Road at the same location as the access to the O&M facility.

Safety Features and Control Systems

Turbine Control Systems

Wind turbines would be equipped with sophisticated computer control systems that would constantly monitor variables such as wind speed and direction, air and machine temperatures, electrical voltages, currents, vibrations, blade pitch, and yaw angles. The main function of the control system would be nacelle and power operations. Generally, nacelle functions include yawing the nacelle into the wind, pitching the blades, and applying the brakes if necessary. Power operations controlled at the bus cabinet inside the base of the tower include operation of the main breakers to engage the generator with the grid as well as control of ancillary breakers and systems. The control system would always run to ensure that the machines operate efficiently and safely.

Each turbine would be connected to a central Supervisory Control and Data Acquisition (SCADA) system. The SCADA system would allow for remotely controlling and monitoring individual turbines and the wind plant as a whole from both the central host computer or from a remote personal computer. In the event of faults, the SCADA system can also send signals to a fax, pager, or cell phone to alert operations staff. The turbine towers and foundations would be designed to survive a gust of wind more than 90 miles per hour (mph) with the blades pitched in their most vulnerable position, a speed which exceeds the 100-year expected peak gust of 73 mph in the project area and the recent maximum recorded gust of 56 mph.

Braking Systems

The turbines would be equipped with two fully independent braking systems that can stop the rotor either acting together or independently. The braking system is designed to be fail-safe, allowing the rotor to be brought to a halt under all foreseeable conditions. The system would consist of aerodynamic braking by the rotor blades and by a separate hydraulic disc brake system. Both braking systems would operate independently such that if there is a fault with one, the other can still bring the turbine to a halt. Brake pads on the disc brake system would be spring loaded against the disc, and power would be required to keep the pads away from the disc. If power is lost, the brakes would be mechanically activated immediately. The aerodynamic braking system also would be configured such that if power is lost it would be activated immediately using back-up battery power or the nitrogen accumulators on the hydraulic system, depending on the turbine's design.

After an emergency stop is executed, remote restarting is not possible. The turbine must be inspected in-person and the stop-fault must be reset manually before operation could be reactivated. The turbines also would be equipped with a parking brake used to keep the rotor stationary while maintenance or inspection is performed.

Built-in Fire Safety

Each turbine's nacelle would be equipped with an internal fire detection system with sensors located in the nacelle as well as at the tower base. The fire detection system would be connected to the main controller and the central SCADA system. In the event of a fire, the turbine would be immediately halted and an alarm activated in the control system that can send a page or message to a cell phone of the on-call operators and/or the local fire district as required.

Climbing Safety

Normal access to the nacelle would be accomplished with a ladder inside the tower. Standard tower hardware would include equipment for safe ladder climbing including lanyards and safety belts for service personnel. Internal ladders and maintenance areas inside the tower and nacelle would be equipped with safety provisions for securing lifelines and safety belts.

Lightning Protection

The turbines would be equipped with an engineered lightning protection system that connects the blades, nacelle, and tower to a grounding system at the base of the tower. The grounding system would include a copper ring conductor connected to grounding rods driven down into the ground at diametrically opposed points outside the tower foundation. The system would provide a firm grounding path to divert harmful stray surge voltages away from the turbine. The blades would be constructed with an internal copper conductor and an additional lightning rod that extends above the wind vane and anemometer at the rear of the nacelle; both would have conductive paths to the nacelle bed frame, which in turn would connect to the tower.

Lighting

In compliance with the FAA's aircraft safety lighting requirements, project turbines, as well as meteorological towers greater than 200 feet tall, would be marked with lights that flash white during the day (at 20,000 candela) and red at night (at 2,000 candela). (A candela is a unit of luminous intensity.) The lights would be designed to concentrate the beam in the horizontal plane, minimizing light diffusion downward toward the ground and upward toward the sky. After it has reviewed final project plans, the FAA would specify the exact number of turbines that would require lighting. Under current (June 2003) FAA regulations, the navigation lights would need to be mounted on the first and last turbine of each string and every 1,000 to 1,400 feet in between.

The substations and O&M facility would be equipped with nighttime and motion-sensor lights for safety and security. Sensors and switches would be used to keep lights turned off when not required. Emergency lighting with back-up power is included to allow personnel to perform manual operations during an outage of normal power sources.

2.2.4 Construction Activities

Project construction would be performed in several stages and would include the following main activities:

- Grading the field construction office and substation areas (also used for the O&M facility);
- Constructing site roads, turnaround areas, and crane pads at each wind turbine location;
- Constructing turbine tower foundations and transformer pads;
- Installing the electrical collection system—underground and overhead lines;
- Constructing and installing the substations;
- Transporting and assembling wind turbines;
- Commissioning and energizing the plant; and
- Cleaning up the site.

The Applicant intends to enter into two primary agreements for project construction including an agreement for the supply, erection, and commissioning of the wind turbines as well as an engineering, procurement, and construction (EPC) contract for all other project facilities and infrastructure such as the roads, electrical collection system, substations, and O&M facility.

Table 2-5 lists the estimated type, number, and duration of construction equipment needed during project construction under the middle scenario. Project construction would require approximately the same type, number, and duration of equipment regardless of whether 82 units of large size turbines (lower end scenario) or 150 units of small wind turbines (upper end scenario) are built (Sagebrush Power Partners LLC 2003f).

Table 2-5: Estimated Type, Number, and Duration of Project Construction Equipment

Construction Phase	Estimated Average Number of Vehicles Onsite Daily during Construction	Estimated Duration (Months)
Site Preparation and Road Construction		
Bulldozer	4	3
Dump truck	10	3
Excavator	4	3
Front end loader	4	3
Motor grader	4	3
Vibratory roller	3	3
Water truck	5	8
Foundations		
Backhoe	4	4
Crane and boom truck	3	4
Concrete pump truck	2	4
Concrete truck	8	4
Drill rig	3	4
Dump truck	6	4
Trackhoe excavator	5	4
Front end loader	3	4
Small loader	3	4
Transportation truck – materials	6	4
Electrical		
Cable spool truck	3	4
Concrete truck	3	4
Boom truck	2	4
Fork truck to offload spools	2	4
Man lift bucket	2	4
Rock trencher	2	4
Transportation truck - materials	8	4
Winch truck	3	4
Substation and Interconnect		
Backhoe	3	3
Bulldozer	2	3
Concrete truck	4	3
Drill rig	2	3
Dump truck	4	3
Man lift bucket truck	2	3
Trencher	2	3
Winch truck	1	3
Excavator	2	3
Wind Turbine Assembly and Erection		
Boom truck	4	4
Forklift	4	4
Rough terrain crane	4	4

Table 2-5: Continued

Construction Phase	Estimated Average Number of Vehicles Onsite Daily during Construction	Estimated Duration (Months)
Transportation truck - materials	20	4
Truck mounted crane	4	4
Project Cleanup		
Dump truck	2	2
Front end loader	2	2
Motor grader	2	2
Transportation truck - materials/waste	3	2
Daily Construction Traffic		
Minimum of 20 full size pickups, FedEx, UPS, and other delivery trucks daily	35	10

Source: Sagebrush Power Partners LLC 2003c

Field Survey and Geotechnical Investigations

Before construction can commence, a site survey would be performed to identify the precise location of the wind turbines, site roads, electrical cables, access entryways from public roads, and substation areas. Once the surveys are complete, a detailed geotechnical investigation would be undertaken to identify subsurface conditions that would dictate much of the design work of the roads, foundations, underground trenching, and electrical grounding systems. Typically, the geotechnical investigation involves a drill rig that bores to the required depths (typically 8-inch-diameter drill, 30 to 40 feet deep) and a backhoe to identify the subsurface soil and rock types and strength properties by sampling and lab testing. Testing also would be conducted to measure the soil's electrical properties to ensure proper grounding system design. A geotechnical investigation would be performed at each turbine location, at the substations, and at the O&M facility.

Design and Construction Specifications

Using data gathered for the project including geotechnical information, site specific environmental and climatic conditions, and site topography, the Applicant's engineering group would establish a set of site-specific construction specifications for various portions of the project. The design specifications would be based on established sets of construction standards set forth by standard industry practice groups such as the American Concrete Institute, Institute for Electrical and Electronic Engineers, National Electric Code, National Fire Protection Agency, and Construction Standards Institute. The design and construction specifications would be custom tailored for site-specific conditions by technical staff and engineers. The project engineering team also would ensure that all aspects of the specifications, as well as the actual onsite construction, comply with applicable federal, state, and local codes and good industry practice.

Equipment procurement would be according to the project's site specifications. The primary EPC contractor would use the design specifications as a guideline to complete the detailed construction plans for the project. The design approach ensures that the project would be designed and constructed to meet the minimum 20-year design life.

Site Preparation: Road Construction and Staging and Laydown Areas

Construction activities would begin with site preparation, including constructing project access entryways from public roads. The project roads would have a gravel surface and would be designed with a low profile without ditches to allow stormwater to pass over the top. Road construction would be performed in multiple phases starting with rough grading and leveling roadway areas. Once rough grade is achieved, base rock would be trucked in, spread, and compacted to create a road base. A capping rock would then be spread over the road base and compacted to the finished grade.

Once heavy construction is complete, a final pass would be made with the grading equipment to level out road surfaces, and more capping rock would be spread and compacted in areas where needed. Water bars, similar to speed bumps, would be cut into the roads in certain areas as needed to allow for natural drainage of water over the road surface and to prevent road washout. During grading activities, excavated soil and rock would be spread across the site to the natural grade and would be reseeded with native grasses to control erosion by water and wind. Larger excavated rocks would be disposed of offsite or crushed and reused onsite as backfill or roadway material. The Applicant does not propose to bring a rock crusher onsite, but would transport this material to the existing permitted quarry located just north of turbine F1 for crushing prior to reuse (Taylor, pers. comm., 2003).

During wind turbine installation, temporary staging and laydown areas would be required. These areas would include a 3-acre main staging area and a 5-acre material laydown area at the O&M facility location adjacent to the proposed PSE substation (Figure 2-1). These areas would be used for parking construction vehicles, construction employees' personal vehicles, and other construction equipment. Six to eight temporary office trailers powered by the existing local distribution line running along Bettas Road also would be installed at this location.

Under the middle and upper end scenarios, flat areas adjacent to each turbine location, approximately 30 feet by 60 feet (1,800 square feet), would be cleared, compacted, and laid with gravel as necessary to place turbine blades and other turbine components and to station a construction crane as each tower is erected. Wind turbine generators larger than 1.5 MW (e.g., under the lower end scenario) would require installation by a crawler crane operating on a crane pad approximately 50 feet by 100 feet (5,000 square feet). At the end of most turbine strings (except where a turbine string is adjacent to a through-traffic road), an area approximately 900 feet by 24 feet (21,600 square feet or 0.5 acres) also would be needed to allow construction equipment to turn around. After construction has been completed, laydown and staging areas would be graded and reseeded to restore the area as close as possible to its original condition.

Foundation Construction

The project would require several foundations including bases for each turbine and pad transformer, substation equipment, and the O&M facility. Once the roads are complete for a particular row of turbines, turbine foundation construction would commence on that completed road section. Foundation construction occurs in several stages including drilling, blasting, and hole excavation, outer form setting, rebar and bolt cage assembly, casting and finishing concrete, removing the forms, backfilling and compacting, constructing the pad transformer foundation, and foundation site restoration.

Foundations for the turbine towers would consist of either spread footing-type foundation design or a vertical mono-pier foundation. The specific type of foundation would be determined based on site-specific geotechnical information to be collected after project approval. The foundation design would be tailored to suit the soil and subsurface conditions at the various turbine sites. Typical dimensions for spread footing-type foundation design under the lower, middle, and upper end scenarios are shown in Table 2-6.

Under the middle scenario, spread footing foundations would require holes approximately 100 feet by 100 feet square and about 18 feet deep. Backfill would be compacted in the bottom of the hole and reinforced square concrete footing would be poured. A reinforced concrete pedestal approximately 10 feet high would be mounted on the concrete footing to hold the tower. The concrete footing would be covered with approximately 6 to 8 feet of compacted backfill and 4 to 6 inches of topsoil depending on soil conditions.

Table 2-6: Typical Spread-Footing Type Foundation Dimensions

	Lower End Scenario 82 Turbines/3 MW	Middle Scenario 121 Turbines/1.5 MW	Upper End Scenario 150 Turbines/1.3 MW
Foundation Base Line	80’ x 80’	60’ x 60’	50’ x 50’
Pad Depth	10’	8’	6’
Pedestal Height	12’	10’	8’
Overall Depth	22’	18’	14’
Hole Dimensions	120’ x 120’	100’ x 100’	80’ x 80’
Hole Depth	22’	18’	14’

Source: Sagebrush Power Partners LLC 2003f.

Vertical mono-pier foundations would require excavating a hole up to 35 feet deep and up to approximately 18 feet in diameter. If the underlying rock is cohesive, competent and strong enough, rock anchors can be used which will allow the excavation to be as shallow as 15 feet deep.

The construction process for the foundations would vary depending on the foundation engineer’s requirements and soil conditions found at the site. The construction process may have variances from site to site if soil conditions are different from location to location; however it generally follows the same main steps regardless of which turbine configuration is used for the project as follows:

Mono-Pier Type Foundation

- Clearing and grubbing the area with a bulldozer at the exact surveyed turbine location
- Initial excavation of the foundation hole with a track hoe
- Drilling and setting of charges and blasting out excavation center and perimeter simultaneously
- Loosen rock with hydraulic jack hammer
- Excavation of foundation hole with the track hoe
- Installation and setting of the outer corrugated metal pipe (CMP) form and backfill or slurry into place
- Construct the bolt cage inside the CMP
- Insert inner CMP
- Backfill the inner CMP with remaining suitable spoils
- Set outer forms for tower floor and electrical conduits
- Pour Concrete into place for foundation
- Remove Forms
- Dispose of remaining spoils
- Restore temporarily disturbed surfaces

Spread Footing Type Foundation

- Clearing and grubbing the area with a bulldozer at the exact surveyed turbine location
- Initial excavation of the foundation hole with a track hoe
- Drilling and setting of charges and blasting out excavation area center and perimeter
- Loosen rock with hydraulic jack hammer
- Full excavation of foundation hole with the track hoe
- Installation and setting of the outer forms and pour concrete base mat (3-4 inches thick)
- Construct reinforcement bar (rebar) mat and pedestal anchor bolt cage
- Assemble forms in place for pedestal, Pour concrete, allow to set and remove forms
- Backfill the excavation
- Set outer forms for tower floor pad and electrical conduits and pour Concrete into place for floor
- Dispose of remaining spoils
- Restore temporarily disturbed surfaces

Excavation and foundation construction would be conducted in a manner that would minimize the size and duration of excavated areas required to install foundations. Portions of the work may require overexcavation and/or shoring. Foundation work for a given site would commence after excavation of the area is complete. Backfill for the foundations would be installed immediately after approval by the engineer’s field inspectors. The Applicant plans to use onsite excavated materials for backfill to the extent possible. The excess excavated materials not used as backfill for the foundations would be used to level out low spots on the crane pads and roads consistent with the surrounding grade. The top soil layer of the excavated materials would be reseeded with a designated mix of grasses and/or seeds around the edges of the disturbed areas. Larger cobbles would be disposed of offsite or crushed into smaller rock at the nearby existing permitted quarry for use as backfill or road material.

Electrical Collection System Construction

Underground Cables

Once the roads, turbine foundations, and transformer pads are complete for a particular row of turbines, underground cables would be installed on that completed road section. First, a trench would be cut with a rock trencher typically 3 to 4 feet deep depending on the underlying soil and rock conditions and up to 5 feet wide. Because of the rocky conditions at the site, clean fill would be placed above and below the cables for the first several inches of fill to prevent cable pinching. All cables and trenches would be inspected before backfilling. Once the clean fill covers the cables, the excavated material would be used to complete the backfilling. In areas where solid rock is encountered close to the surface, blasting would be performed or a shallower trench would be cut using rock-cutting equipment, and the cables would be covered with a concrete slurry mix to protect the cables and comply with code and engineering specifications.

The high voltage underground cables would be fed through trenches and into conduits at the pad transformers at each turbine. The cables would run to the pad transformers' high voltage (34.5 kV) compartment and would be connected to the terminals. Low voltage cables would be fed through another set of underground conduits from the pad transformer to the bus cabinet inside the base of the wind turbine tower. The low voltage cable would be terminated at each end and the whole system would be inspected and tested prior to operation.

Overhead Cables

The two runs of overhead cable would require a detailed field survey to determine exact pole locations. Once the survey and design work are completed, the poles and cross-arms to support the conductors would be installed. The poles would be assembled and fitted with cross-arms, cable supports, and insulator hardware on the ground at each pole location. Holes, approximately 150 square feet (8 feet by 8 feet to 12 feet by 12 feet) in size and 8 feet to 10 feet deep for each pole, would be excavated or drilled and the poles would be erected and set in place using a small crane or boom truck. Once set in place, concrete would be poured in place or a clean fill would be compacted around the tower base according to the engineer's specifications.

Excavated soil and rock not reused in backfilling the trenches would be spread across the site to the natural grade and be reseeded with native grasses to control water and wind erosion. Larger excess excavated rocks would be disposed of offsite.

Substation and Interconnection Facility Construction

Constructing the substations and interconnection facilities would involve several stages of work including, but not limited to, grading; constructing foundations for the transformers, steel work, breakers, control houses, and other outdoor equipment; erecting the steel work and outdoor equipment; and completing electrical work for the required terminations. Once these activities are completed, an inspection and commissioning test plan would be executed prior to substation operation.

The utility (PSE or Bonneville) would be responsible for constructing the interconnection facilities because they would remain under the utility's control and jurisdiction. The high-voltage side of the substation would remain under the control of the utility and the low-voltage side of the substation would belong to the project. A fence may be installed between the high and low voltage sections to delineate control and jurisdiction, and there would likely be two control houses—one for the utility high-voltage side relaying and interconnection facilities controls and one for the project substation low-voltage side relaying and controls.

Transporting Tower Sections and Assembling Towers

The wind turbines would have three main components—towers, nacelles, and rotor blades. Other smaller components include hubs, nose cones, cabling, control panels, and internal tower facilities such as lighting and ladders. Turbine components would be delivered to the project site on flatbed transport trucks and main components would be off-loaded at the individual turbine sites. Turbine erection would be performed in multiple stages including: setting the bus cabinet and ground control panels on the foundation, erecting the tower (usually in three to four sections), erecting the nacelle, assembling and erecting the rotor, connecting and terminating the internal cables, and inspecting and testing the electrical system prior to operation.

Plant Commissioning and Energizing

Plant commissioning and energizing would occur after construction is completed and would not require the use of heavy machinery.

Erosion Control, Site Cleanup and Temporary Site Disturbance Restoration

A detailed construction Storm Water Pollution Prevention Plan (SWPPP) would be developed for the project to help minimize the potential for discharge of pollutants from the site during construction. The SWPPP would be designed to meet the requirements of the Washington State Department of Ecology's General Permit to Discharge Storm Water through its stormwater pollution control program (Chapter 173-220 WAC) associated with construction activities. The SWPPP would include both structural and non-structural BMPs. Examples of structural BMPs could include installing silt curtains or other physical controls to divert flows from exposed soils, or otherwise limit runoff and pollutants from exposed areas of the site. Examples of non-structural BMPs include management practices such as materials handling and disposal requirements and spill prevention methods. The Applicant would prepare and submit a SWPPP meeting the conditions of the General Permit to Discharge Storm Water to EFSEC along with a Notice of Intent (NOI) for construction activities prior to the start of project construction.

After construction is completed, site restoration activities would consist of restoring temporarily disturbed areas as close as possible to their original condition. This excludes the service roads, which would remain in place for the life of the project. For example, after backfilling excavated areas disturbed to construct underground electrical cables, excess excavated soils would be spread around the surrounding areas and contoured to the natural grade. The areas affected by construction would then be seeded with an appropriate seed mix where there is adequate soil moisture, as appropriate to the location, and would be re-seeded if healthy cover vegetation does not grow. Similar restoration activities would be followed at areas temporarily disturbed for construction staging, equipment laydown, and temporary construction access. Onsite construction management would monitor the area for erosion and implement additional control measures if necessary.

Since project cleanup generally consists of landscaping and earthwork, it is weather- and season-sensitive. Landscaping cleanup is generally completed during the first allowable and suitable weather conditions after heavy construction activities have been completed. As described above, disturbed areas outside of the graveled areas would be reseeded to control erosion by water and wind. Construction cleanup and permanent erosion-control measures would be carried out in accordance with the project SWPPP. Other project cleanup activities might include interior finishing of the O&M facility, landscaping around the substation area, washing towers, painting scratches on towers and exposed bolts, and other miscellaneous tasks that are part of normal construction cleanup.

Construction Site Security

A full-time security plan would be implemented during project construction. A full-time bonded security officer would be on duty and would patrol the project site 24 hours per day, seven days per week. The officer would patrol the entire project site but would focus on those portions of the site that were under active construction. Site staff and subcontractors would be required to wear an identity badge and display vehicle clearance tags at all times. Newcomers to the project site would have to check in, log in, and log out at the main site's construction trailers. The construction trailers would be equipped with outdoor lighting and motion-sensor lighting as required.

Construction materials would be stored at the individual turbine locations or at the laydown area around the perimeter of the O&M facility and site construction trailers. Temporary fencing with a locked gate would be installed for a roughly 1.5-acre area adjacent to the site trailers for the temporary storage of special equipment or materials. After construction is completed, the temporary fencing would be removed and the area reseeded with an appropriate seed mix.

The site project manager would work with a security contractor to develop a plan to effectively monitor the overall site during construction including drive-by surveys and specific checkpoints. The security inspection and monitoring plan would be changed throughout the course of construction based on the level of construction activity and amount of sensitive or vulnerable equipment and materials in specific areas.

Construction Schedule and Workforce

The Applicant anticipates that project construction would occur over a period of approximately one year from the time of site certification to commercial operation and would require the involvement of 253 personnel (Table 2-7). However, not all workers would be onsite at the same time. A peak workforce of up to 160 workers would be onsite during the busiest construction month when multiple disciplines of contractors complete work simultaneously (Table 2-8). It is estimated that local workers from Kittitas County would fill at least 40 of the projected 253 construction jobs.

Project construction would require approximately the same level of manpower and time regardless of whether 82 units of large size turbines (lower end scenario) or 150 units of small wind turbines (upper end scenario) are used. The larger turbines require a higher level of manpower and time for construction and erection since the foundations and roads are larger and preparation work for assembly requires more manpower on a per unit basis compared to the smaller turbines, however there are fewer units to build. Regardless of the project configuration, it would require a total of approximately 253 staff to construct the project (Sagebrush Power Partners LLC 2003f). Some of the labor trades anticipated to be required during project construction include electricians, riggers, crane operators, blasting specialists, and heavy equipment operators (Taylor, pers. comm., 2003).

Table 2-7: Construction Labor Force Mix (Approximate Number of Personnel)

Construction Phase	Project Management and Engineers	Field Technical Staff	Skilled Labor and Equipment Operators	Unskilled Labor	Total
Engineering/surveying/design	6	12	0	0	18
Road construction	5	5	15	5	30
Foundation construction	3	4	23	30	60
Electrical collection system construction	2	3	23	12	40
Substation construction	5	3	8	4	20
Wind turbine assembly and erection	4	6	15	15	40
Commissioning and energizing the plant	5	10	15	0	30
Construction punchlist cleanup	1	1	3	10	15
Total	31	44	102	76	253

Source: Sagebrush Power Partners LLC 2003a, Section 2.12.3

Table 2-8: Construction Labor Resource Loading (Approximate Number of Personnel)

Number of Months Prior to Commercial Operation	Project Management and Engineers	Field Technical Staff	Skilled Labor and Equipment Operators	Unskilled Labor	Total
14	6	0	0	0	6
13	6	12	0	0	18
12	5	5	15	5	30
11	8	9	38	35	90
10	10	12	61	47	130
9	10	12	61	47	130
8	10	10	54	46	120
7	10	10	54	46	120
6	14	16	69	61	160
5	14	19	38	19	90
4	9	16	30	15	70
3	9	16	30	15	70
2	9	16	30	15	70
1	5	10	15	0	30
0	5	10	15	0	30
Cleanup	1	1	3	10	15

Source: Sagebrush Power Partners LLC 2003a, Section 2.12.3

2.2.5 Operation and Maintenance Activities

Routine Operation and Maintenance

The amount of downtime from scheduled maintenance is predictable from year to year. The proposed project's operating plan includes a planned outage schedule that consists of wind turbine inspections and maintenance after the first three months of operation, a break-in diagnostic inspection (includes inspection of oil and all other elements of the wind turbine generator) and subsequent services every six months. The six-month servicing generally takes a wind turbine off-line for one day. The six-month routine consists of inspecting and testing safety systems; inspecting wear and tear on components such as seals, bearings, and bushings; lubricating the mechanical systems; performing electronic diagnostics on the control systems; verifying pre-tension of the mechanical fasteners; and inspecting the overall structural components of the wind turbines. Blades would be inspected and, if heavily soiled, rinsed once per year to maintain overall aerodynamic efficiency. Blade washing is not anticipated as a requirement for the project since fall and spring rains would remove most if not all of the dirt.

Electrical equipment such as breakers, relays, and transformers requires weekly visual inspections, which does not affect overall availability, and testing or calibrations every one to three years, which may force outages. To the extent practical, the short-term off-line routine maintenance procedures would be coordinated with periods of little or no wind to minimize the impact on the amount of overall energy generation.

Unscheduled Maintenance - Forced Outages

Historically, modern wind power projects operate with availabilities in the 95 to 99% range. Several components and systems of an individual wind turbine can be responsible for forced, non-routine outages such as the malfunction of mechanical and electrical components, or computer controls. It is anticipated that most of the outages would result from auxiliaries and controls, not malfunction or failure of the heavy rotating machinery. Most machinery failures are found during routine inspections, with the failing part being replaced before complete failure.

Although the newer control systems have added a high level of detection and diagnostic capability, they normally require frequent minor adjustments in the first few months of operation. As a result, available energy from wind power projects is generally lower in the first few months until the turbines are fully tuned. Once a wind plant is properly tuned, unplanned outages are rare and downtime is limited to the routine service schedule.

The O&M facility would be stocked with sufficient spare parts to support high levels of availability during operation. The modular design of modern wind turbines allows most of the parts to be quickly changed, especially in the electrical and control systems. This modularity and the fact that the turbines would be identical means components could be swapped between turbines to quickly determine causes of failures even if the correct spare part is not in stock. As part of their supply agreements, almost all major turbine equipment vendors guarantee the availability of spare parts for 20 years.

General project operations would require between 12 and 20 onsite staff consisting of a plant/site manager, operations manager, administration manager, administrative assistant, and operating technicians. The number of onsite personnel is not only determined by the number of turbines, but also the type of turbine selected since some turbines require more man-hours of maintenance per year than others. Under the upper end scenario, using 150 units of relatively maintenance-intensive wind turbines could require up to 18 to 20 personnel. Under the lower end scenario, 82 units of less maintenance intensive turbines would require as few as 12 to 14 onsite staff. The middle scenario assumes a conservative estimate of 121 units of relatively low maintenance turbines for which it was estimated that 12 to 14 onsite staff would be required for operations (Sagebrush Power Partners LLC 2003f). It is estimated that approximately one half of the full-time staff would be hired locally (i.e., from within Kittitas County).

Site Security

The plant operations group would prepare a detailed security plan to protect the project and project personnel. Site visitors including vendor equipment personnel, maintenance contractors, material suppliers, and all other third parties would require permission for access from authorized project staff at the O&M facility prior to entrance to secured project areas such as the turbines and substations. The plant operations manager, or designee, would grant access to critical areas of the site on an as-needed basis. Arrangements would be made with adjacent landowners that have legal ingress and egress easements across areas where project facilities would be located to ensure continued access to their property.

Currently, almost all existing field access driveways in the area are equipped with lockable gates. Similarly, access to the main O&M facility area, site trailers, and all wind turbine string roads would be constructed with lockable gates. The access gates would be open during working hours and would be secured by project security personnel after working hours.

Both the O&M facility and the substations would be equipped with outdoor lighting and motion-sensor lighting. The PSE substation would be visible from the O&M facility. An 8-foot-tall chain-link fence would surround the substations with razor wire along the top. Wind turbines, pad transformers, pad-mounted switch panels, and other outdoor facilities would have secure, lockable doors.

An Emergency Response Plan would be established for the project to ensure employee safety for emergencies such as personnel injury, fires, explosions, and other scenarios where project evacuation would be required. The Emergency Response Plan would cover project employees, site visitors, and onsite contractors, and would be administered by the project operations manager or designee.

2.2.6 Decommissioning

The design life of major project equipment such as the turbines, transformers, substations, and supporting plant infrastructure is at least 20 years. The trend in the wind energy industry has been to repower older wind projects by upgrading older equipment with more efficient turbines. It is likely that after mechanical wear takes its toll, the project could be upgraded with more efficient equipment and could have a useful life longer than 20 years. Such upgrades may require additional EFSEC review and approval in advance of the repowering being performed.

If the project were terminated, the Applicant would request the necessary authorizations from EFSEC and landowners with which leases have been established to decommission the facilities. Foundations would be removed to a depth of 3 feet below grade and unsalvageable material would be disposed of at authorized sites. The soil surface would be restored as close as reasonably possible to its original condition.

The project substation(s) is generally valuable and often times in older power projects, the substation would revert to the ownership of the utility (PSE or Bonneville). If the overhead power lines could not be used by the utility, all structures, conductors, and cables would be removed (Sagebrush Power Partners LLC 2003a, Section 7.3.2). The Applicant proposes to leave the underground electrical collection system in place subject to landowner approval. At the time of decommissioning, the Applicant would consult with the applicable landowner(s) to determine the appropriate disposition of the O&M facility (Taylor, pers. comm., 2003).

Reclamation procedures would be based on site-specific requirements and techniques commonly used at the time the area would be reclaimed and would include regrading, adding topsoil, and revegetating all disturbed areas. Decommissioned roads would be reclaimed or left in place based on landowner preferences, and rights-of-way and the leased property would be vacated and surrendered to the landowners.

2.3 CONSTRUCTION COSTS

The total project construction cost, including the equipment, construction, development, financing, legal, and study costs, is estimated to be $1,050 per kilowatt of installed nameplate capacity. Therefore, for a project size that ranges from 181.5 MW (under the middle scenario) to 246 MW (under lower end scenario), the project would cost approximately $190.5 to $258.3 million.

2.4 MITIGATION MEASURES INHERENT IN THE PROJECT DESIGN

In addition to complying with applicable codes and standards and implementing best management practices for erosion and sedimentation control, a number of measures have been included in the facility design to eliminate or minimize the project's impacts on the environment. These measures are presented throughout Chapter 3, Affected Environment, Impacts, and Mitigation Measures, for each resource topic. These measures have also been summarized in Table 1-3.

2.5 DESCRIPTION OF NO ACTION ALTERANTIVE

Under the No Action Alternative, the project would not be constructed or operated, and the environmental impacts described in this EIS would not occur. The No Action Alternative assumes that future development would comply with existing zoning requirements for the project area, which is zoned Agriculture-20 and Forest and Range. According to the County's zoning code, the Agriculture-20 zone is dominated by farming, ranching, and rural lifestyles, and permitted uses include residential and agriculture and forestry practices. Permitted uses in the Forest and Range zone include logging, mining, quarrying, and agricultural practices, as well as residential uses (Kittitas County 1991). However, if the proposed project is not constructed, it is likely that the region's need for power would be addressed by the development of a gas-fired combustion turbine. Such development could occur at conducive locations throughout the state of Washington. Because constructing and operating a gas-fired combustion turbine is a predictable consequence of not building the project, it is considered a predictable outcome of the No Action Alternative (Bonneville et al. 2002).

Because the project has a nameplate capacity of approximately 181.5 MW (under the anticipated middle scenario) and is expected to have a 33% net capacity factor, a natural gas-fired combustion turbine would have to generate 60 average MW of energy to replace an equivalent amount of power generated by the project. (An average MW or "aMW" is the average amount of energy supplied over a specified period of time, in contrast to "MW," which indicates the maximum or peak output [capacity] that can be supplied for a short period.) Table 2-9 presents the basic parameters of a hypothetical 60 aMW natural gas-fired combustion turbine. The hypothetical combustion turbine could either be a new facility or an expansion of an existing facility.

Table 2-9: Potential Annual Requirements of Energy Generation for a 60-Average Megawatt Natural-Gas-Fired Combined-Cycle Combustion Turbine

Acreage Requirements	Onshore Gas Extraction	Transportation	Generation[1]
Permanent (acres)	NQ	NQ	14
Temporary (acres)	NQ	NQ	N/A
Employment			
Construction (employees/year)	1.74	27	130
Operations (employees per year)	0.18	0.78	9
Water Resources			
Consumption (acre-feet)	N/A	N/A	204
Discharge (acre-feet)	0.348 (drilling mud)	N/A	0.486
Air Pollutant Emissions[2]			
Sulfur oxides (tons)	57	0.024	1.8
Oxides of nitrogen (tons)	3.36	15.96	348.6
Particulate (tons)	0.078	N/A	1.8
Carbon dioxide (tons)	0	N/A	234,297
Carbon monoxide (tons)	0	N/A	133.8

Source: Bonneville and U.S. Department of Energy 1993
N/A = not applicable
NQ = not quantified
1 Acreage and employment estimates assume 65% capacity factor.
2 Emission estimates are based on 1993 data; correcting for technology improvements in emissions control, projected generation emissions are anticipated to be lower. See Section 3.11, Air Quality, for further discussion.

Impacts from gas-fired combustion turbine projects include air emissions and other impacts of construction and operation near the new plant, and impacts associated with natural gas extraction and transport. Combustion turbine projects require significant amounts of water, the extraction of which may have adverse impacts on surface water or groundwater resources. Gas extraction impacts include those related to drilling and associated development activities, and those related to ongoing operation of gas wells and associated delivery systems that would occur for the life of the project. Although it is speculative to estimate impacts of a similarly sized combustion turbine because of the uncertainty of the location and type of technology, impacts of a typical combustion turbine are identified in the No Action Alternative sections of Chapter 3 for informational purposes (Bonneville et al. 2002).

2.6 ALTERNATIVES CONSIDERED BUT REJECTED

During the development phase of this project, the Applicant considered alternative wind turbine technologies to be used, alternative wind turbine locations, and an alternative project layout. The alternatives considered but rejected are described below.

Table 2-10: Comparison of Various Wind Turbines

Technology Type	Typical Generator Size	Typical Size	Approximate Number of Units Required for 181.5 MW	Typical Rotational Speed
(A) Darrieus rotor	50-100 kW	100-150 feet	2,400	50-70 RPM
(B) Two bladed (downwind)	50-200 kW	150-200 feet	2,400	60-90 RPM
(C) Three bladed (upwind)	500-750 kW	240-300 feet	290	28-30 RPM
(D) Three bladed (upwind) (Proposed Project)	1,300-2,500 kW (1.3-2.5 MW)	300-400 feet	121	10-23 RPM

Source: Sagebrush Power Partners LLC 2003b

2.6.1 Alternative Wind Energy Technologies

Several types of wind energy conversion technologies have been pursued over the past 30 years. Figure 2-6 and Table 2-10 compares various wind turbine technologies on the basis of the relative scale of commercially used wind turbine units and their typical sizes. For comparison purposes, Figure 2-6 also depicts, to scale, the existing Bonneville transmission lines in the project area. Although larger scale versions of these models have been produced, the diagram illustrates the average size of versions that have been implemented on a large scale with hundreds of units installed.

The proposed action contemplates the use of megawatt-class wind turbines, identified in Figure 2-6 and Table 2-10 as technology "D." Compared to the other three technologies illustrated, this type of turbine requires fewer machines, covers a smaller overall project footprint, and is anticipated to have fewer avian impacts because of a smaller Rotor Swept Area (RSA) and lower RPM. A discussion of other available wind energy technologies and the reasons for their rejection is presented below (Sagebrush Power Partners LLC 2003b). The choice of the three bladed, upwind, horizontal axis wind turbine (HAWT) technology meets the Applicant's need for: producing power cost effectively; maximizing equipment reliability; producing power at a commercially viable utility scale; maximizing power conversion efficiency; minimizing turbine footprint and associated ground disturbance, and minimizing avian impacts.

Vertical Axis Darrieus Wind Turbines (Technology "A")

French engineer D.G.M. Darrieus invented the most widely used vertical axis wind turbine (VAWT) in the 1920s. It is called the Darrieus wind turbine, Darrieus rotor, and is commonly referred to as the "eggbeater" (see Figure 2-6).

The Darrieus turbine was experimented with and used in a number of wind power projects in the 1970s and 1980s including projects in California; an experimental machine installed by FloWind on Thorp Prairie is located about 2 miles southwest of the Kittitas Valley Wind Power Project site. Despite years of design, experimentation, and application, the Darrieus turbine never reached full commercial-scale maturity and success to the level that the horizontal axis turbines have for a number of reasons including many inherent design and operation disadvantages, as discussed below.

<u>Higher Wind Speeds Higher Above the Ground</u>

Darrieus rotors are designed with much of their swept area close to the ground compared to HAWTs. As the wind speed increases with the height above ground, HAWTs benefit from having higher wind speeds and higher wind energy incident to their rotor plane that can be extracted.

<u>Start-up Wind Speed</u>

VAWTs require a higher level of wind speed to actually start spinning compared to HAWTs. In older VAWT machines, the generator was used as a motor to start up the rotors. Modern VAWTs do not require generator to start up the rotor. HAWTs require less wind speed for start-up and most have the advantage of variable pitch blades, which allow the turbine to start up by a simply change to the blade pitch.

<u>Variable Pitch</u>

VAWTs do not have variable pitch capability and rely on stall regulation, which results in less efficient energy capture. Most modern HAWTs have mechanisms that pitch blades along their axis to change the blade angle to catch the wind. Variable pitch allows the turbine to maximize and control power output.

<u>Bird Crash Hazards – Guy Wires</u>

VAWTs are constructed with guy wires that add to the overall disturbed airspace area. Guy wires have been shown to be a greater hazard to birds than turbines themselves because they are difficult for birds to see. HAWTs are typically erected on free-standing tubular steel towers and do not require the use of guy wires.

Figure 2-6:

Turbine Footprint

VAWTs are fitted with four sets of guy wires that span from the top of the central tower and are anchored in foundations. Including the tower base foundation, VAWTs require a total of five foundations all spread apart. The result is that the overall footprint and disturbed area for a VAWT is larger than that for a comparably sized HAWT. HAWTs on freestanding towers use only one main foundation and have a smaller overall footprint.

Fatigue Life Cycles

Because of their design, VAWTs have higher fatigue life cycles than HAWTs, resulting in earlier and more frequent mechanical failures. As the VAWT rotor blades rotate through one full revolution, they pass upwind, downwind, and through two neutral zones (directly upwind of the tower and directly downwind of the tower). In contrast, the rotor blades on a HAWT do not pass through similar upwind/downwind neutral zones, and their fatigue life cycles are lower.

Two-Bladed Downwind Wind Turbines (Technology "B")

The most widely used vertical two-bladed wind turbines are of the downwind variety and are in the size range of 50 to 200 kW. They are referred to as downwind since the blades are downwind of the supporting tower structure. Although there is continued experimentation with prototype wind turbines of this design of a larger scale (300-500 kW), they are not as well proven as the three-bladed upwind technology. The two-bladed turbines require a higher rotational speed to reach optimal aerodynamic efficiency compared to a three-bladed turbine. Two-bladed turbines and the rotors also are more difficult to balance and this, combined with the downwind tower shadow, results in more mechanical failures compared to the three-bladed counterparts. As in the case of Darrieus turbines, two-bladed downwind turbines use guy wires, with higher associated avian impacts.

Smaller Three-Bladed Upwind Wind Turbines (Technology "C")

Over the past 20 to 30 years, wind turbines have become larger and more efficient. For comparison purposes, a smaller 660 kW turbine is about 73% the height of a 1500-kW (1.5-MW), while its output is only 44% that of the 1.5 MW turbine. Compared to the proposed action, using smaller turbines in the 500 to 750 kW range would be less cost-effective and would require more than twice as many total turbines for an equivalent energy output. This would result in more turbine foundations, a larger project footprint, and an overall higher impact on the surrounding environment. Compared to the proposed project, use of such smaller turbines would also result in a greater total RSA to produce the same amount of energy, and therefore a greater incidence of avian impacts.

2.6.2 Alternative Wind Turbine Locations

Alternative Project Sites Considered by the Applicant

The siting of wind turbines is constrained by the need for a location with a sufficient wind resource to allow the project to operate in a commercially and technically viable manner. Therefore, wind turbines must be sited in locations where data show there are sufficient wind speeds on a regular basis throughout the year (Bonneville et al. 2002).

The Applicant's proposal for the Kittitas Valley Wind Power Project identified only the proposed project area for development. The study area was chosen primarily for its energetic wind resource suitable for producing electricity at competitive prices and access to several sets of power transmission lines that traverse the site and have adequate capacity to allow the wind-generated power to be integrated into the power grid. Other factors considered were site accessibility and surrounding land use compatibility. These combined factors rendered the proposed site the most practical and feasible from a technical and economic standpoint.

Other possible project site locations could jeopardize a project's feasibility because of a lack of sufficient wind resource (leading to operational problems and a lower return on investment) and/or remoteness from nearby transmission lines (which would require constructing a lengthy transmission line to interconnect with the power grid) (Bonneville et al. 2002). In Washington, the choice of potential project sites for producing wind-generated power is severely limited by the lack of sites with adequate wind resource potential to produce electricity at competitive prices. Compared with other states, Washington is ranked in the bottom tier in terms of wind energy potential (Pacific Northwest Laboratory 1991). Although there are other areas of the state predicted to have a wind resource adequate for producing energy at competitive prices, long-term ground-based measurements would be necessary to confirm the wind resource in these areas, and many of the areas would not be suitable for wind power development because of site inaccessibility (e.g., Cascade mountaintops) or incompatible land uses (e.g., the Yakima Firing Range). Based on wind measurements collected in the mid-1990s and from late 2001 to the present, the proposed project site has a proven wind resource suitable for producing electricity at competitive prices.

Another factor in identifying a viable site for a wind power project is access to existing transmission lines with adequate outlet capacity. Wind power projects generally cannot absorb the capital cost of constructing tens of miles of new transmission lines to interconnect with the grid because of their generally smaller size and higher overall capital costs per MW of installed capacity. The project site is crisscrossed by six sets of high voltage transmission lines, several of which have adequate capacity and are of an appropriate voltage (230 to 287 kV) for a project of this size (181.5 to 246 MW).

To address scoping comments regarding the viability of other sites suitable for wind project development, Section 2.7 below addresses other potential sites in Kittitas County, and whether such sites are reasonably available to Sagebrush Power Partners LLC.

Alternative Project Layout

In siting the individual turbines within strings at the project site, the same factors that were used in choosing the study area were considered. The turbines have been sited to minimize environmental effects to the greatest extent possible while maintaining the commercial viability of the project. Mitigation is identified in this EIS to further reduce and avoid potential impacts.

An alternative layout of individual turbines and turbine strings in the project area (referred to as Alternative A) was evaluated during the early stages of project development and was subsequently refined to reduce potential impacts; the resulting layout defines the proposed action. Alternative A was rejected for further consideration by the Applicant because of its higher environmental impacts. A summary of Alternative A is presented below (Sagebrush Power Partners LLC 2003b). The discussion below is limited to the "most likely" choice of turbine size.

Alternative A is composed of 174 wind turbine generators that would disrupt an approximate footprint of 105 acres (compared to approximately 93 acres for the proposed action) (Figure 2-7). Alternative A would extend several miles to the west of the proposed project area, across Swauk Creek to the western edge of Lookout Mountain. Alternative A would require constructing approximately 28 miles of new and upgraded access roads (2 miles greater than under the proposed action) and about 5 miles of overhead electrical power lines (more than double the amount compared to the proposed action).

The larger permanent footprint covered by Alternative A would result in a greater magnitude of impacts on footprint-driven environmental resources, including land use conversion, area of visual disturbance, habitat loss, cultural resources disturbance, and construction truck trips. For example, Alternative A would generate 2,200 more construction truck trips than the proposed action. Alternative A also would result in potential interference to directional microwave telecommunication systems such as television and radio signals caused by eight turbines located on the edge of Lookout Mountain.

Compared to the proposed action, the additional turbines considered under Alternative A would likely result in additional wildlife impacts in terms of overall avian and bat mortality. Nine of the 174 turbines proposed under Alternative A would be located within three-quarters of a mile of the Yakima River. The proximity of turbines to the Yakima River could cause higher (per turbine) waterfowl and eagle mortality.

For example, compared to the proposed action, bird and bat mortality impacts would be greater by approximately 40%. A range of approximately zero to seven raptor fatalities per year could occur if 174 turbines were constructed, an increase of approximately two raptor fatalities per year over predictions under the proposed action. It is also estimated that approximately 70 to 430 birds may be killed annually, an increase of 20 to 130 passerine fatalities each year compared to the proposed action. It is further estimated that approximately 350 bats may be killed annually, an increase of approximately 110 bat fatalities each year compared to the proposed action .

Impacts such as bird and big game displacement would also increase as the number of turbines and roads increases. Furthermore, the impacts in the western portion of the study area near the nine turbines under Alternative A may be higher on a per turbine basis than most other areas of the wind plant because of the current low levels of human disturbance in that area. More elk and mule deer were observed in the western portion of the wildlife baseline study area, probably because of the lower levels of human disturbance.

2.7 CONSIDERATION OF OFFSITE ALTERNATIVES

Through the scoping process for this project, EFSEC received requests that alternative offsite locations be considered in the EIS. EFSEC has coordinated the evaluation of alternative sites with Kittitas County, allowing both agencies and the public to benefit from the information provided regarding other potential sites. The analysis discussed in additional detail below concludes that although other sites for wind power generation may exist in Kittitas County, none would satisfy the test for availability or practicability for the Sagebrush Power Partners LLC proposal.

2.7.1 Process for Identifying Offsite Alternatives

This section describes the approach used for defining offsite alternatives for evaluation in the EIS. The approach includes the following steps: (1) consideration of SEPA requirements for alternatives; (2) definition of site selection/suitability criteria, which are based on the physical, technological and practical requirements of wind power generation facilities; (3) site screening, which involved application of the site selection/suitability criteria to the characteristics of numerous potential sites; and (4) identification of sites which could meet the criteria for suitability. Kittitas County and its EIS consultants developed the criteria and site screening process in coordination with EFSEC. Information regarding potential sites was provided by enXco and Desert Claim Wind Power LLC, the proponent for the Desert Claim Wind Power Project, and by Sagebrush Power Partners LLC and Wind Ridge Power Partners LLC, the applicants for the Kittitas Valley and Wild Horse Wind Power Projects, respectively.

SEPA Requirements

The State Environmental Policy Act requires that “reasonable alternatives” be considered by the lead agency under certain circumstances. When a proposal is made for a private project on a specific site, the lead agency is required only to evaluate the no action alternative plus other reasonable alternatives for achieving the proposal’s objective on the same site (WAC 197-11-440 (5) (d). The same SEPA requirements however requires that an analysis of reasonable alternatives be conducted when the proposal includes a rezone, unless the rezone is for a use allowed in an existing comprehensive plan that was adopted after review under SEPA.

In general, alternatives considered under SEPA must be “reasonable,” which is defined to mean that they can feasibly attain or approximate a proposal’s objectives at lower environmental cost (WAC 197-11-440 [5][b]). The word reasonable also limits the number and range of alternatives, and the amount of detailed analysis required under SEPA (WAC 197-11-440 [b] [i-ii]). The lead agency may also limit alternatives to sites on which it has the authority to control impacts through the imposition of mitigation measures (WAC 197-11-440 [b] [iii]).

The Applicant's objectives for the KVWPP are identified in Section 1.4.1 of the Draft EIS. They include developing a commercially viable wind energy facility with a total nameplate capacity between 181.5 and 246 MW using between 82 and 150 turbines, with associated project support facilities. To achieve this objective, the project site should be on large parcels and be free of significant environmental constraints, such as parks and recreation areas, and land owners must be willing to enter into long-term leases. The Applicant must also meet the applicable certification requirements set out in EFSEC laws and rules.

Consideration of alternatives has been limited to sites within Kittitas County, based on the County's authority to impose its adopted review process and to control direct and indirect environmental impacts (WAC 197-11-440 [b] [iii]), and the focus of EFSEC's SEPA review on the local county environment that could be most likely affected.

Site Selection and Suitability Criteria

Site selection criteria were developed based on information provided by wind energy developers (enXco and Zilkha Renewable Energy), and a review of published information regarding siting wind energy facilities (e.g., *Wind Energy – How Does It Work*, AWEA 2002a; *10 Steps in Building a Wind Farm*, AWEA 2002b; Patrick Mazza, *Wind: A New Economic Opportunity for Rural Communities*, 2002; *Basic Principles of Wind Energy Evaluation*, AWEA 1998; and *Wind Energy Resources*, National Wind Coordinating Committee 1997). The objective of the research was to identify the actual, not hypothetical, criteria that are typically used by developers to identify and investigate potential sites and to determine their suitability for wind facilities. The following five key criteria were identified: (1) sufficient wind resource (the most important); (2) proximate/adequate transmission facilities; (3) large land area; (4) absence of significant environmental constraints; and (5) property owner interest. Each criterion is considered essential, and failure of a site with respect to any one criterion is considered to be a "fatal flaw" that would make a wind power facility unfeasible at that site. The criteria are discussed further below; the experience of the Desert Claim and Kittitas Valley Wind Power Project proposals is used to provide context where appropriate.

(1) Sufficient wind resource. The most important criterion for siting a wind power facility is, of course, sufficient commercially viable wind. Sites that do not possess sufficient wind are not considered further by prospective developers, regardless of other characteristics. In Washington, sites with a minimum average wind speed of 13 to 17 mph (Wind Classes 3-4) are desired to support a commercially viable wind energy facility. Given the current energy market conditions in the Northwest and the characteristics of current wind energy proposals, an average wind speed of 15 to 17 mph appears to be the lower range of economic viability for a site. Sites with average speeds greater than 17 mph (Wind Classes 5 and above) are most desirable, but such sites in Washington are generally found in areas not conducive to wind power development, including mountain peaks and off-shore in the Pacific Ocean. Since the energy that can be derived for power generation from the wind is proportional to the cube of the wind speed, even a slight increase in wind results in a large increase in energy production; this also results in a reduction in

the production cost of electricity (AWEA 2002a). Developers typically rely on published wind energy maps to initially identify regions or large areas with sufficient wind resources. They then conduct more detailed site-specific meteorological (and environmental) studies, typically over 1 to 2 years. The *Wind Energy Resource Atlas of the United States* (U.S. Department of Energy 1986) identifies the Ellensburg corridor as having Class 3, 4 and 5 winds. (Also see www.windpowermaps.org).

Both enXco and Sagebrush Power Partners LLC conducted additional meteorological studies and site visual surveys to further narrow their search for potential wind energy facility sites in Kittitas County to between four and five areas/sites with sufficient wind resources. Once a potential site/area was identified, meteorological data were used, along with information on natural conditions and environmental features, to determine an optimal configuration of wind turbines. A computer model aids in this siting process for each individual turbine (referred to as “micro-siting”) for a specific potential project site.

(2) *Proximity to existing transmission facilities with adequate capacity.* Wind energy projects must connect to an electric transmission line to deliver power to the regional power system. The most important transmission-related factors considered by developers in project location decisions are the adequacy of existing transmission facilities (i.e., the availability of unused capacity on existing lines), and the distance from the project site to a transmission line. The need to either upgrade a regional transmission facility or to build an offsite project transmission line more than about 10 miles (or less, depending upon the capacity of the project) to interconnect to an existing line can make a site financially infeasible. An interconnection agreement with the utility that owns the transmission line(s) is typically negotiated during development of the wind project and after the land is secured.

Existing transmission facilities located in the northern portion of the Kittitas Valley are owned and operated by Bonneville (five 230 kV to 500 kV lines, and one 115 kV line) and PSE (one 230 kV line and one 115 kV line). Transmission lines at voltages below 115 kV are not adequate for connection of wind energy projects generating over 100 MW of electricity.

(3) Large land area. Some of the factors that bear on the size of a site needed for wind energy facilities include the size of the project (in terms of power output and the size and number of turbines); separation between turbines to ensure safety and efficient operation; dispersed population; a prevalence of rural/agricultural activities (to minimize potential land use conflicts); sufficient setbacks from nearby residences, structures and public roads (to minimize potential environmental impacts); and large undivided parcels of land (greater than 100 acres). These criteria generally translate into project sites encompassing approximately 5,000 +/- acres of land for a 180 MW wind project. However, developers typically begin their search by investigating very large study areas covering many thousands of acres (e.g., 20,000-50,000 acres or larger), and gradually focus in on a more defined area. In practice, a developer may be actively and simultaneously considering, and applying the criteria to, several potential sites within the larger area.

The Desert Claim (enXco) and Kittitas Valley (Sagebrush Power Partners LLC) proposals each involve approximately 120 turbines producing roughly 180 MW of electric power. Each developer independently defined an initial study area that included the entire Kittitas Valley (extending generally from Lookout Mountain on the west to the Columbia River on the east, and between the National Forest lands to the north and approximately Interstate 90 to the south). Each developer also conducted the studies necessary to determine desirable sites within this search area, then began to focus on smaller areas.

(4) Absence of significant environmental constraints. Wind energy developers try to avoid sites with significant environmental constraints. The presence of constrained areas can increase construction costs and make permitting more complex, time consuming, and uncertain. At the level of determining general site suitability and feasibility studies, characteristics taken into account include the presence of parks or designated recreational lands, wildlife refuges, prevalent wetlands and/or sensitive habitat/species, significant cultural and archaeological resources, and conflicting land uses. Qualified developer personnel and consultants identify these resources through research of published sources, onsite investigations, and discussions with resource agency staff.

(5) *Property owner interest/property availability*. Wind energy facilities are typically constructed on lands leased from property owners. As a practical matter, property owner support, responsiveness and willingness to enter into long-term leases are essential preconditions to gaining the ability to propose a wind facility on a particular site. As to a particular private applicant (whether enXco or Sagebrush Power Partners LLC in an individual case), a site that is not actually available for use would not meet that proposal's objectives and would not, therefore, be a real or "reasonable alternative" (as defined in the SEPA Rules) as to that applicant.

Site Screening Process

The criteria identified above were applied to areas/sites within the Kittitas Valley. Sites located outside Kittitas County were not considered to be "reasonable alternatives" per WAC 197-11-440 (b)(iii), and were not considered for evaluation in the EIS.

Four broad geographic areas, shown in Figure 2-8, were defined for investigation: west of US 97, east of US 97, Whiskey Dick Mountain, and south of Whiskey Dick/Boylston Mountains. These areas coincide with those identified in published information (e.g., the U.S. Department of Energy's *Wind Energy Resource Atlas*) as having potentially viable wind resources. These areas were explored by both enXco and Sagebrush Power Partners LLC to identify the sites of their respective proposals. Characteristics of each area relative to the site selection and suitability criteria are summarized below.

<u>West of US 97</u>

The area west of US 97 contains four potential sites of interest for wind energy development – Springwood Ranch, the land south of Lookout Mountain, Manastash Ridge, and the site being proposed for the Kittitas Valley Wind Power Project.

Figure 2-7

Figure 2-8

Springwood Ranch

The Springwood Ranch is an approximately 3,600-acre property that has been proposed or considered for development several times over the past 15 years. A conceptual master plan for a resort on this site was developed in the late 1980s, but an application for development was never submitted. The site was considered as an offsite alternative for the MountainStar Master Planned Resort and was evaluated in the EIS for that proposal (Kittitas County 1999).

For a wind energy facility, the Springwood Ranch site satisfied some, but not all of the site selection criteria and thus does not qualify as a "reasonable alternative." Sufficient wind resource is present, the site is in single ownership, and environmental constraints are not extreme. However, transmission facilities are not currently accessible to the site. Site size, configuration, and terrain would also likely limit the number of turbines that could be sited and, consequently, the amount of power that could be produced falls well short of the proponent's objective. The property owner, a foreign corporation, did not support wind power and was not interested in discussing leasing to accommodate a wind power facility. The site would not, therefore, meet the proponent's project objectives. Nevertheless, this site is discussed in more detail in Section 2.7.3.

South of Lookout Mountain

The area south of Lookout Mountain includes approximately 2,600 acres of the Swauk Valley Ranch. Sufficient wind resource is present and environmental constraints are not extreme. In 2001, enXco evaluated this area and met with a group of local property owners. This site failed the site selection criteria because the property owners were not interested in participating in a wind energy project.

Manastash Ridge

The Manastash Ridge area, south of I-90 and west of the Yakima River, also has sufficient wind resource to be of interest for development. Much of this area consists of the L.T. Murray Wildlife Recreation Area, however, which encompasses approximately 106,000 acres and is managed by WDFW. Adjacent lands include the Wenatchee National Forest on the west and the Oak Creek Wildlife Area (also managed by WDFW) on the south. The significant wildlife values and recreational use of this area would not satisfy the siting criteria related to environmental constraints. Also, this area is not adjacent to adequate transmission lines, and any project located in this area would require construction of a relatively long offsite project transmission line to reach existing transmission lines.

Kittitas Valley Site

The Kittitas Valley site is located both west and east of US 97. It is the subject of in-depth study in this EIS. Given that the Kittitas Valley site is the subject of the active application by Sagebrush Power Partners LLC (who has exclusive rights to wind energy development on the site through agreements with landowners), the site is not available to enXco, does not meet their proposal's objectives, and is not a practical or reasonable alternative to the Desert Claim project.

East of US 97

The area east of US 97 generally satisfied all suitability criteria for wind energy development. Both enXco and Sagebrush Power Partners LLC identified respective sites (or portions of sites) within this area, and developed wind power proposals based on those sites.

A portion of the Kittitas Valley site, discussed previously, is located east of US 97. The Desert Claim site, proposed by Desert Claim Wind Power LLC, a Washington company wholly owned and managed by enXco, is located approximately 8 miles northwest of Ellensburg. Desert Claim Wind Power LLC submitted an application for development of a wind energy facility on this site to Kittitas County in January 2003. The proposal is for a maximum of 120 wind turbines (at 1.5 MW each) producing a total of at least 180 MW of power, located on approximately 5,237 acres of privately-owned land in eight parcels.

Given that the Desert Claim site is the subject of an active application before Kittitas County by Desert Claim Wind Power LLC (who has exclusive rights to wind energy development on the site through agreements with landowners), the site is not available to Sagebrush Power Partners LLC, does not meet their proposal's objectives, and is not a practical or reasonable alternative to the project. The Draft EIS for the Desert Claim project is expected to be published and available for review contemporaneous with the Kittitas Valley Wind Power Project EIS. Decision makers and the public will, therefore, have the ability to review environmental information about the Kittitas Valley site and compare it to the Desert Claim site, albeit in a separate document. The cumulative effects of the Desert Claim project are considered (along with those of the Wild Horse proposal) later in this EIS.

Whiskey Dick Mountain

This is a large area east of Ellensburg and north of I-90, centered on Whiskey Dick Mountain. The area east and northeast of Whiskey Dick Mountain contains the Schaake, Quilomene, and Colockum Wildlife Areas. The ownership of these lands by WDFW and potential conflicts with wildlife and recreational values of these lands could make them unsuitable for wind energy development. The area west of Whiskey Dick, which quickly drops to the Valley floor, shows a poor wind resource, making it not commercially viable based on historic meteorological data for this area.

An area of approximately 26,000 acres centered on Whiskey Dick Mountain is owned by two parties controlled by the same group. This area contains sufficient wind resource, has adequate transmission facilities near the site, and is not characterized by wildlife area lands or readily apparent major environmental constraints. Zilkha Renewable Energy executed an agreement with owners of approximately 8,000 acres within this area and, through its wholly owned company, Wind Ridge Power Partners LLC, submitted a request for a Potential Site Study to EFSEC in July 2003. The proposal would include approximately 110 to 120 wind turbines and would generate approximately 180 MW of power. Because Wind Ridge Power Partners LLC has already indicated to EFSEC that an application for site certification would be brought forward to the Council for this site, the Wild Horse Wind Power Project site would not meet the test of a reasonable alternative for Sagebrush Power Partners LLC. A brief description of the Wild Horse project is given below in Section 2.7.2. Additional specific information about the impacts of this proposal are also available in Section 3.14, Cumulative Impacts, of this EIS.

South of Whiskey Dick/Boylston Mountains

The Boylston Mountains area, which is south of Whiskey Dick Mountain and east of the Yakima River, has sufficient wind resource but is comprised of lands that do not satisfy criteria related to land use or environmental constraints. The large area between the Yakima River and the Columbia River consists primarily of the Yakima Training Center, a federal military reservation administered by the U.S. Department of Defense and actively used for military training. Construction and operation of a wind farm in the Boylston Mountains would conflict with ongoing military operations on these lands and would not be allowed by the Defense Department.

2.7.2 Wild Horse Site

As stated above, because Wind Ridge Power Partners LLC has indicated to EFSEC that an application for site certification would be brought forward to the Council for the Wild Horse Wind Power Project site, this site would not meet the test of a reasonable alternative for Sagebrush Power Partners LLC. A brief description of the Wild Horse project is provided below.

Location and Site Characteristics

The Wild Horse Wind Power Project is proposed on an approximately 5,000-acre site located about 10 miles east of the town of Kittitas, on the eastern slopes of Whiskey Dick Mountain. With the exception of Whiskey Dick Mountain, much of the site consists of a relatively flat plateau with steep-sided drainages. Several creeks originate on the project site (Whiskey Dick, Skookumchuck, and Whiskey Jim); several other creeks and their tributaries are located on or near the project site. The majority of the site consists of shrub-steppe habitat. No wetlands occur on the site, according to National Wetland Inventory (NWI) maps.

The proposed project area is zoned Forest and Range. It consists of open range land that is currently used for grazing. There are no residences on the project site, and none within 2 miles of any proposed turbine location. The area surrounding the Wild Horse site is sparsely populated. The proposed route for the transmission feeder line passes near a few residences.

The Wild Horse project area (as proposed by Wind Ridge Power Partners LLC) includes three parcels of State-owned land administered by DNR and totaling approximately 1,900 acres. Wind turbines and associated facilities would be developed on these lands, through a lease agreement with DNR.

Vehicle access to the site is via private road from Old Vantage Highway, at a point approximately 2 miles south of the project boundary and 10 miles east from Kittitas.

Wind Power Facilities

The proposed configuration of wind turbines on the Wild Horse site is shown in Figure 2-9. The proposal would be comprised of between 83 to 125 wind turbines and associated facilities. The proposal would generate between 125 and 249 MW of power depending on the size of turbine ultimately chosen. Figure 2-9 presents a layout for a middle scenario of 1.5 MW nameplate capacity turbines. Facilities and construction techniques would generally be as described in Section 2.2 for the proposed action. The project would interconnect to either the existing Bonneville transmission line located approximately 4 miles west of the project site, or to the existing PSE transmission line located approximately 5 miles southwest of the project site. (If the interconnection were to the Bonneville system, the actual point of connection would be at the Schultz Substation farther to the northwest, although the Bonneville would build and operate the new section of line that would run parallel to the existing Bonneville lines.)

The location of the project substation would depend upon the transmission system selected for interconnection, pursuant to an agreement with Bonneville or PSE. Figure 2-9 shows two potential substation locations. A location near the northwestern corner of the project site would be used for the substation if interconnection were to the Bonneville transmission system, while a substation location in the southwestern quadrant of the site would be used for a PSE interconnection. An operations and maintenance facility would be constructed near the center of the project area.

A network of graveled project access roads would be constructed to provide vehicle access to all of the turbine locations, as described for the proposed action. Minor or major improvements to existing primitive roads on the site would be implemented where possible, to minimize construction of new roads. Figure 2-9 shows the configuration of the project road system in relation to the turbines and other project facilities. Power collection cables (primarily underground) would generally follow the routes of the project access roads. Five permanent meteorological towers and a communications tower would be constructed at various locations on the project site.

Construction for the proposed Wild Horse project would occur over a 9-to-12 month period and is expected to be completed by the end of 2005. Gravel and other material needed for project construction (for roads, pads, etc.) would be obtained from three quarries developed on the site. Figure 2-9 shows the location of a temporary batch plant that would be built to provide concrete for the project. Five construction laydown areas would be developed for temporary use.

The total area occupied by the turbines and associated permanent facilities would be approximately 153 acres. The total area cleared/temporarily disturbed by construction activities would be approximately 309 acres. Once construction was completed, an estimated 10 to 14 local workers would be employed to operate and maintain the facility.

The cumulative effects of the Wild Horse project are considered (along with those of the Desert Claim proposal) later in this EIS.

2.7.3 Springwood Ranch Site

As noted previously, this site is not a practical, reasonable alternative that is available to Sagebrush Power Partners LLC. The Springwood Ranch site lacks accessible, adequate transmission facilities and it does not meet the proponent's objectives because it will not support a 180 MW project due to site size, configuration, and terrain constraints that limit the number of turbines that could be located on this property. Also, the owner of the Springwood Ranch expressed lack of interest in discussing wind power development.

Although wind energy companies have investigated the prospects for wind energy development in the Springwood Ranch area, there has been no specific proposal for a wind energy project on this site. The following project description is based on a conceptual layout for a wind power project on the Springwood Ranch site that was prepared by enXco, at Kittitas County's request, specifically for their use in the Desert Claim EIS. A graphic of this conceptual layout is included as Figure 2-10. Because this site would not represent a viable or reasonable alternative to the Desert Claim site for enXco, Kittitas County has not requested enXco to prepare complete plans for a hypothetical project on this site. Therefore, Figure 2-10 identifies wind turbine and meteorological tower locations, but does not include locations for access roads, power collection cables, a substation, an operations and maintenance facility, or a transmission interconnection. These facilities would be required for a wind power project at this site, and their characteristics would likely be similar to those defined in Section 2.2 for the same components of the proposed action.

Location and Site Characteristics

Springwood Ranch is an approximately 3,610-acre site located approximately one-half mile northwest from the town of Thorp and 10 miles northwest of Ellensburg. Springwood Ranch is bounded by I-90 (or Thorp Prairie Road) on the south and the Yakima River on the north. The western end of the property abuts the Sunlight Waters community, in the Elk Heights area. The Iron Horse State Park/John Wayne Trail runs adjacent to or through the northern and eastern edge of the site. The northern boundary of the L.T. Murray Wildlife Recreation Area, managed by WDFW, is located near the site but south of I-90.

The surrounding area is primarily rural/agricultural (designated Forest Multiple Use and Agriculture in the Kittitas County Comprehensive Plan, and zoned Agriculture-20 and Forest and Range). A small cluster of commercial uses is located at Thorp (designated an Urban Growth Node [UGN] in the Kittitas County Comprehensive Plan). A ranch house and several accessory structures and outbuildings are located onsite.

Figure 2-9

Figure 2-10

The topography of most of the site is gently rolling, but gives way to steep bluffs along a narrow canyon that contains the Yakima River in this location. Taneum Creek runs in a southwest/northeast direction through the eastern one-third of the site. The predominantly upland terrain on the site drops approximately 200 feet to the valley along Taneum Creek, causing a wind shadow over the eastern third of the property. Vegetation is predominantly shrub-steppe and grazed grasslands. Alfalfa and hay are grown on the site. NWI maps identify 20 wetlands on the site, ranging in size from less than 3 acres to 8 acres. Most are associated with irrigation channels or excavated ponds.

Habitat on the site would support animals adapted to open grasslands or the ecotone between forest and grasslands. The Yakima River in this vicinity supports one run of spring chinook salmon. Several species of trout, including bull and steelhead, have been reported. Lower Taneum Creek has been historically used by resident trout and anadromous fish for spawning and rearing. Taneum Creek is listed as "water quality limited" surface waters (for temperature and instream flow) under section 303 (d) of the federal Clean Water Act.

Wind Power Facilities

An approximate configuration for wind turbines is shown in Figure 2-10. Based on site size, meteorological conditions, and topography, and assuming the same sized turbines and approximate spacing between turbines as for the proposed action, the Springwood Ranch site could accommodate approximately 40 to 45 turbines; Figure 2-10 shows locations for 43 turbines. A smaller or greater number of turbines could potentially be accommodated based on micro-siting. Using a 1.5 MW turbine, this number of turbines would generate approximately 64.5 MW of electric power, which is less than half of the capacity of the proposed action under the middle scenario. This reduced scale raises questions whether this could be a commercially viable site; in any case, it is below the Applicant's objectives for a wind power facility (i.e., at least 180 MW) and less than the quantity of wind energy that is currently being sought by regional utilities (e.g., in September 2003, PSE issued a draft request for proposals to acquire approximately 150 MW of capacity from wind power). Connection to transmission facilities (for the Bonneville lines) would require building a transmission line approximately 5 miles long, including crossing the Yakima River. Easements would also need to be acquired to travel across private properties located between the project site and the transmission line.

Other project facilities and construction techniques would be the same as described for the proposed action. The project substation would be located on the property, while a switchyard would be located at the interconnect point. Project access roads would be similar in design to the proposed action, but would be proportionally less in terms of total distance and disturbance. Based on corresponding unit factors for the various project components, the total area disturbed by construction activities for this alternative site would be approximately 125 acres. The total area permanently occupied by project facilities in this case would be approximately 30 acres. The labor force required for construction and for long-term operation and maintenance of a 65-MW wind project on the Springwood Ranch site would be less than for the proposed action, but the specific numbers or differences have not been estimated. The development of a project on this site could also have greater impacts on wetlands and endangered fish species. Avian impacts cannot be assessed without the support of a detailed study, however, they could be lower, since less turbines would be constructed. Socioeconomic impacts on the County would be lower because of both the smaller size of construction force required, and the lower capital cost of the project as a whole.

2.8 BENEFITS OR DISADVANTAGES OF RESERVING PROJECT APPROVAL FOR A LATER DATE

The disadvantages of reserving project approval for a later date would be continued reliance on a constrained regional energy and capacity system. Delays in addressing the need for additional power resources in the region would do nothing to solve current supply shortfalls for electrical power. Reserving project approval for a later date would delay all impacts of the project, including direct, indirect, and cumulative impacts. Delays might also result in construction and operation of new gas-fired power plants to meet demand growth, which would involve additional environmental impacts. Advantages of reserving project approval to a later date may include a better understanding of its energy benefits and its potential environmental consequences, particularly related to issues of controversy such as the project's effects on property values and its overall benefits to the local economy.