6 ANALYSIS OF THE PROPOSED ACTION AND ITS ALTERNATIVES

Through this PEIS, the BLM is evaluating the proposed action to implement a Wind Energy Development Program specific to BLM-administered lands. The proposed action, discussed in Section 2.2, would establish programmatic policies and BMPs providing guidance on how to mitigate the potential impacts of wind energy development. The alternatives to the proposed action present options for the management of this development activity. Under the no action alternative, discussed in Section 2.3, the BLM would continue to develop wind energy resources under the terms and conditions of the Interim Wind Energy Development Policy (BLM 2002a) (Appendix A), but would not establish programmatic mitigation guidance. Under the limited wind energy development alternative, discussed in Section 2.4, the BLM would restrict wind energy development to a few specific locations and would establish mitigation measures for those locations on a project-by-project basis only.

Chapter 5 presents an evaluation of the potential impacts of wind energy development on BLM-administered lands under the MPDS and discusses relevant measures that could be implemented to mitigate those impacts. In this chapter, the effectiveness of the different management options (i.e., the proposed action and its alternatives) at mitigating these potential impacts is evaluated. In addition, how well each management option would support or facilitate wind energy development on BLM-administered lands is analyzed. This discussion addresses the question of whether the proposed action presents the best management approach for the BLM to adopt (Section 2.4).

Sections 6.1 through 6.3 discuss the potential impacts of each of the management alternatives being evaluated. Section 6.4 discusses the cumulative impacts of the proposed action. Cumulative impacts include those effects that could result from incremental impacts of development in accordance with the terms and conditions of the proposed Wind Energy Development Program when added to other past, present, and reasonably foreseeable future actions. Section 6.5 discusses other NEPA considerations related to the proposed action, including unavoidable adverse impacts, short-term uses of the environment and long-term productivity, irreversible and irretrievable commitment of resources, and mitigation of adverse impacts.

6.1 IMPACTS OF THE PROPOSED ACTION

As discussed in Section 2.2, under the proposed action, the BLM is seeking to develop a Wind Energy Development Program that would establish comprehensive policies and BMPs addressing wind energy development on BLM-administered lands in 11 western states, excluding Alaska. The magnitude of potential development under the proposed action is defined by the MPDS and WinDS model results (Section 2.2.1). The proposed program includes policies and BMPs addressing the administration of wind energy development ROW authorizations and establishing programmatic level mitigation guidance (Section 2.2.3). The proposed action also includes the amendment of many BLM land use plans (Section 2.2.4).

Chapter 5 presents an analysis of the potential impacts associated with wind energy development on BLM-administered lands under the MPDS. It also presents information about relevant mitigation measures that could be applied to reduce those impacts. As discussed in Section 5.15, the BLM reviewed the impact analysis and mitigation measures to identify appropriate policies and BMPs that could be applied to all wind energy development projects on BLM-administered lands. Site-specific and species-specific mitigation measures are not included in the programmatic policies and BMPs. Rather, as required by the proposed policies and BMPs, the site-specific and species-specific issues would be addressed at the project level to ensure that potential impacts of a project would be minimized. These types of project-specific mitigation measures would be incorporated into the POD and ROW authorization stipulations. Information presented in Chapter 5 may be useful for identifying appropriate project-specific mitigation requirements.

The following sections discuss the impacts of the proposed action on the pace of wind energy development, the environment, and the economy. Cumulative impacts and other NEPA considerations of the proposed action are discussed in Sections 6.4 and 6.5, respectively.

6.1.1 Pace and Cost of Wind Energy Development on BLM-Administered Lands

Implementation of the proposed Wind Energy Development Program, including the establishment of programmatic policies and BMPs and amendment of land use plans, would be expected to minimize some of the delays that currently occur for wind energy development projects and reduce costs.[1] In addition, the proposed program would ensure consistency in the way ROW applications and grants for wind energy development are managed.

The proposed programmatic policies and BMPs would not eliminate the need for detailed analyses at the project level; they would, however, bring focus to the efforts. Decisions and debate regarding what actions must be undertaken at the project level and what mitigation measures must be addressed in the POD would be resolved by the programmatic policies and BMPs. The universe of issues that must be evaluated in detail at the project level would be reduced to site-specific and species-specific issues and concerns.

Proposed wind energy development activities must be reviewed and approved in accordance with local land use plan requirements. Such review and approval would be better supported by land use plans that specifically address wind energy development. The proposed amendment of selected BLM land use plans through this PEIS would facilitate specific project review and approval. Additional land use plans for those areas where developable wind energy resources would be located are expected to be amended or revised in the future to address wind energy development.

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[1] A number of other factors also would affect the pace of wind energy development within the region, including (1) the presence or absence and structure of national PTCs and national and state RPSs; (2) access to and the cost of electricity transmission; (3) the cost of other fuels for electricity supply, including natural gas and coal; and (4) public support or opposition to wind power development. Because these factors are beyond the influence or control of the BLM, they are not considered in the PEIS analysis.

As a result of the proposed action, the time necessary to obtain BLM approval of a ROW authorization application could be reduced, along with the associated costs to both the BLM and industry, without compromising the level of protection to natural and cultural resources. To the extent that decisions about future wind energy projects could be tiered off of the analyses in this PEIS or decisions in the resultant ROD, there would be even further time and cost savings. In summary, the proposed action would facilitate wind energy development on BLM-administered lands while ensuring that the adverse environmental, sociocultural, and economic impacts would be minimized.

6.1.2 Environmental Impacts

The proposed Wind Energy Development Program would incorporate policies and BMPs that establish mitigation requirements for all projects. The proposed policies identify specific lands on which wind energy development would not be allowed; establish requirements for public involvement, consultation with other federal and state agencies, and government-to-government consultation; define the need for project-level environmental review; establish requirements for the scope and content of the project POD; and incorporate adaptive management strategies. The proposed BMPs would establish environmentally sound and economically feasible mechanisms to protect and enhance natural and cultural resources. They would identify the issues and concerns that must be addressed by project-specific plans, programs, and stipulations during each phase of development. Specifically, they would address issues associated with the project location, project footprint and area of disturbance, sensitive or critical habitats, habitat fragmentation, threatened and endangered and other protected species, avian and bat impacts, habitat restoration, environmental monitoring and adaptive management strategies, visual resources, road construction and maintenance, transportation planning and traffic management, air emissions, noise, noxious weeds, pesticide use, cultural and paleontological resources, hazardous materials and waste management, storm water management and erosion control, and human health and safety. The land use plan amendments are being proposed to (1) adopt the programmatic policies and BMPs and (2) exclude specific areas from development. These proposed amendments would further ensure that potential impacts would be mitigated to the maximum extent possible.

Implementation of the proposed policies and BMPs would ensure that potential adverse impacts to most of the natural and cultural resources present at wind energy development sites, except wildlife and visual resources, would be minimal to negligible. This would include potential impacts to soils and geologic resources, paleontological resources, water resources, air quality, noise, land use, and cultural resources not having a visual component. The proposed policies and BMPs would require that mitigation measures protecting these resources be incorporated into project PODs; this would include the incorporation of specific programmatic BMPs as well as the incorporation of additional mitigation measures contained in other existing and relevant BLM guidance (Section 3.6.2) or developed to address site-specific or species-specific concerns. Information presented in Chapter 5 may be useful for identifying appropriate project-specific mitigation requirements.

The proposed policies and BMPs would considerably reduce potential impacts to wildlife by requiring that these issues be addressed comprehensively and by providing some minimum standards for mitigation. For example, under the proposed program, operators would be required to collect and review information regarding protected species and sensitive habitats at the project site and to design the project to avoid (if possible), minimize, or mitigate impacts to these resources. The specific measures needed to address these site-specific and species-specific issues, however, would be addressed at the project level. While it is possible that adverse impacts to wildlife could occur at some of the future wind energy development sites, the magnitude of these impacts and the degree to which they could be successfully mitigated would vary from site to site.

Similarly, the proposed policies and BMPs would reduce potential impacts to visual resources, although the degree to which this could be achieved would be site-specific. These resources would include cultural resources that have a visual component (e.g., sacred landscapes). The proposed program would require that the public be involved in and informed about potential visual impacts of a specific project during the project approval process. Minimum requirements regarding project design (e.g., BMPs regarding commercial logos and lighting) would be incorporated into individual project plans. Ultimately, determinations regarding the magnitude of potential visual impacts would be made by local stakeholders.

The proposed program would require the BLM and operators to adopt adaptive management strategies regarding wind energy development, which would further ensure that potential environmental impacts were kept to a minimum. Programmatic policies and BMPs would be reviewed and revised to strengthen mitigation measures as new data regarding the impacts of wind energy projects become available. At the project level, operators would be required to develop monitoring programs to evaluate the environmental conditions at the site through all phases of development, to establish metrics against which monitoring observations could be measured, to identify potential mitigation measures, and to establish protocols for incorporating monitoring observations and new mitigation measures into standard operating procedures and project-specific BMPs.

6.1.3 Economic Impacts

The potential economic impacts of the proposed action, which are discussed in detail in Section 5.13, would generally be beneficial to local and regional economies. The projected development defined by the WinDS model would result in new jobs and increased income, GSP, sales tax, and income tax in each of the 11 states during both construction and operation. These economic benefits would be realized to varying degrees in each state by the year 2005 and would increase over the 20-year study period.

The proposed policy to exclude certain lands from wind energy development (Section 2.2.3.1), as well as the corresponding land use plan amendments to exclude certain lands, would limit potential economic benefits to local communities. However, the economic impact of these exclusions at a regional level would likely be minimal.

The BLM would incur costs associated with developing, implementing, and managing wind energy development on BLM-administered lands. However, under the BLM's ROW program, which is a cost-recovery program, a substantial portion of the costs for processing ROW applications, including NEPA requirements, would be paid by industry. In addition, by the year 2025, the federal government is projected to earn as much as $7.9 million per year in ROW rental receipts for new wind energy development over what it currently earns from existing wind projects (Table 5.13.1-3).

6.2 IMPACTS OF THE NO ACTION ALTERNATIVE

As described in Section 2.3, under the no action alternative wind energy development would continue on BLM-administered lands in accordance with the terms and conditions of the Interim Wind Energy Development Policy (BLM 2002a) (Appendix A). Under the no action alternative, the BLM would not establish a Wind Energy Development Program to provide guidance to industry and BLM field staff in the 11-state study area. The policies, BMPs, and land use plan amendments of the proposed Wind Energy Development Program would not be implemented. Future wind energy projects and land use plan amendments would continue to be evaluated solely on an individual, case-by-case basis, and there would be no comprehensive program for moving the projects forward and ensuring consistency.

The MPDS developed for the proposed action (see Section 2.2.1 and Appendix B) is assumed to also represent the development scenario for the no action alternative and to define the extent and distribution of BLM-administered lands that would be potentially subject to wind energy development over the next 20 years. However, it is acknowledged that the absence of a BLM Wind Energy Development Program would be likely to adversely impact the pace at which wind energy resources would be developed on public lands and the cost of future projects (discussed below). An assessment of the potential impacts associated with the no action alternative on the pace of development, the environment, and the economy is described in the following sections.

6.2.1 Pace and Cost of Wind Energy Development on BLM-Administered Lands

The absence of a BLM Wind Energy Development Program would likely cause wind energy development on BLM-administered lands to occur at a slower pace than under the proposed action. The anticipated benefits of the proposed Wind Energy Development Program (Section 2.2), in terms of land use plan amendments, tiered NEPA analyses, and the availability of comprehensive BMP guidance, would not be realized under the no action alternative. One can predict that without these benefits, the length of time needed to review, process, and approve ROW applications for wind energy projects would increase. This would be particularly true for commercial project applications but would also likely be true for site monitoring and testing applications.

Extended time lines for application and approval processes usually translate into increased costs, and the cost per unit of wind energy developed would likely be greater under the no action alternative than under the proposed action. This could result in delays in establishing necessary project financing and power market contracts. Furthermore, developers could elect to avoid delay and uncertainty by shifting their projects to state, Tribal, and private land with potentially less federal environmental oversight (Section 6.2.2). If this shift were to occur, resulting in less development of wind energy on BLM-administered lands, this outcome would be in conflict with the intent of the National Energy Policy recommendation that encourages the development of renewable energy resources on public lands, and with the requirements of E.O. 13212 to expedite energy-related projects (U.S. President 2001a).

6.2.2 Environmental Impacts

The potential adverse impacts to natural and cultural resources on BLM-administered lands associated with the no action alternative could be greater than those described in Section 6.1 for the proposed action if effective mitigation measures are not applied to individual projects. In all likelihood, however, effective mitigation measures would be developed for individual wind energy projects by virtue of the environmental analyses required by the Interim Wind Energy Development Policy (BLM 2002a) (Appendix A). In that event, potential adverse impacts to natural and cultural resources would be similar to those of the proposed action. The absence of a Wind Energy Development Program, however, could result in inconsistencies in the type and degree of mitigation required for individual projects.

Although it is beyond the scope of the BLM's jurisdiction or responsibility, it is important to note that potential adverse impacts to natural and cultural resources on non-BLM-administered lands under the no action alternative could increase. If the absence of a BLM Wind Energy Development Program were to result in delays in processing wind project applications on BLM-administered lands or increases in the cost of developing wind power on BLM-administered lands, developers could respond by focusing their wind energy development efforts on state-owned, Tribal, and private lands. While wind energy development on nonfederal lands is subject to a wide array of environmental reviews and approvals by virtue of state and local permitting processes (see Appendix E), it may not be subject to NEPA requirements if federal funding or permitting is not required for the project.

6.2.3 Economic Impacts

Because it is difficult to estimate the degree to which the absence of the Wind Energy Development Program would impact the pace and amount of development, it is difficult to estimate the extent to which economic impacts under the no action alternative would vary from those estimated for the proposed action (Section 5.13). While the economic impact of specific projects on BLM-administered lands in a host state would likely be similar regardless of whether a Wind Energy Development Program is in place, uncertainties surrounding the time required for permitting and the consequent impact on project cost would likely delay the development of any given project. The consequent postponement of the various economic (employment, income and output) and fiscal (taxes and ROW rental receipts) benefits of specific projects would hinder the economic development of the region. Many of the potential host locations do not have other potential sources of economic growth.

In addition, even though it can be assumed that there would be an increased demand for wind energy as wind generation technology becomes more economically viable, it is difficult to predict where this development would occur. Although there is the potential for wind energy development to shift to nonfederal lands, as discussed in Section 6.2.1, it is also possible that economic factors would stifle development elsewhere. For example, sites on non-BLM-administered land within the 11 states may not necessarily be chosen for development if wind availability at these sites is inferior to that of sites on BLM-administered land, and if higher land costs undermine the economic viability of wind energy development. Consequently, the overall level of wind development in these states might be less in the absence of a BLM Wind Energy Development Program. Whether the focus for wind energy development would shift to potential locations outside the 11-state area is unknown. Given the remote location of much of the BLM-administered land and rural nature of surrounding communities, it is likely that the economic development prospects of communities located near potential wind development projects on BLM-administered land would be poorer than elsewhere in the 11-state area. The absence of a BLM Wind Energy Development Program may represent a lost economic development opportunity for rural communities.

The BLM would incur costs associated with developing, implementing, and managing wind energy development on BLM-administered lands. However, under the BLM's ROW program, which is a cost-recovery program, a substantial portion of the costs for processing ROWs, including NEPA requirements, would be paid by industry. In addition, the federal government earns money from ROW rental receipts.

6.3 IMPACTS OF THE LIMITED WIND ENERGY DEVELOPMENT ALTERNATIVE

As discussed in Section 2.4, under the limited wind energy development alternative, additional future wind energy development on BLM-administered lands would be limited to those locations where it currently exists (including future expansion at those facilities), is under review, or has been approved for development at the time the ROD for this PEIS is published. For the purposes of establishing an upper bound on the potential impacts of this alternative, it was assumed that all proposed wind energy projects on BLM-administered lands currently under review would be approved for development by the time the ROD is published. If this is not the case, there would be fewer environmental and economic impacts than described in this section. Under these limitations, the assumption used in the preparation of this PEIS is that wind energy development would be restricted to six locations:

- Existing wind energy development
    1. Palm Springs, California
    2. Ridgecrest, California
    3. Wyoming Wind Project, Arlington, Wyoming

- Proposed wind energy projects currently under review
    4. Table Mountain Wind Generating Facility, Nevada
    5. Cotterel Mountain Wind Farm Project, Idaho
    6. Walker Ridge, California

Under this alternative, wind energy development would be managed in accordance with the terms and conditions of the Interim Wind Energy Development Policy (BLM 2002a) (Appendix A).

6.3.1 Environmental Impacts

Environmental analyses for future expansions at existing wind projects would be conducted under the direction of the relevant BLM Field Office at such time that applications for expansion or repowering are submitted. The appropriate level of analysis would be determined on the basis of the nature and scale of the proposed activity, in accordance with NEPA requirements. Of the three proposed wind project applications currently being processed, an EIS has been completed for the Table Mountain Project in Nevada (PBS&J 2002), and EISs are being prepared at this time for the Cotterel Mountain Wind Farm Project and the proposed development at Walker Ridge.

Detailed project-specific analyses are not within the scope of this PEIS and would be redundant to on-going evaluations. As a result, site-specific environmental analyses associated with the limited wind energy development alternative have not been prepared for this PEIS. It can be concluded, however, that under this alternative, potential environmental impacts to BLM-administered lands associated with wind energy development would be less on a regional level than those discussed in the proposed action and the no action alternative because development would be restricted. Environmental impacts would occur at the local level and would need to be mitigated through project-specific stipulations. In turn, it might also be concluded that the decreased opportunities for wind energy development effected by limiting development on BLM-administered lands could result in the need to develop other traditional sources of electricity, such as natural gas or coal, which could translate into greater environmental impacts regionally. A multitude of factors would determine the balance between wind energy development on other federal, state, and private lands and increased development of fossil fuel sources, the analysis of which is beyond the scope of this PEIS. The limited wind energy development alternative could also cause increased development on state, Tribal, and private lands with potentially less federal environmental oversight.

6.3.2 Economic Impacts

Under the limited wind energy development alternative, only three new wind energy projects would be developed on BLM-administered land, and expansion of capacity would occur at two existing sites over the period 2005 to 2015.[2] The time line for development of the new wind energy projects, if they are approved, is expected to be 2 years (i.e., by 2007); the time line for expansion of capacity at the two existing sites is expected to be 10 years (i.e., by 2015). The projected capacity varies by project: Walker Ridge (120 MW), Ridgecrest (150 MW), and Palm Springs (40 MW), all in California; Cotterel Mountain, Idaho (200 MW); and Table Mountain, Nevada (205 MW). The impacts in the host state of constructing and operating these projects in 2015 are shown in Table 6.3.2-1. The year 2015 was selected for analysis because by that time, all new capacity projected under this alternative is expected to be developed.

Construction activities associated with these projects would produce 360 direct and 1,040 overall jobs in California, $46.5 million in income, and $164.0 million in GSP. The state would collect $11.3 million in sales taxes and $2.9 million in income taxes. Impacts in Idaho in 2015 would be slightly less than those in California, with 430 jobs created, $15.2 million in income, and almost $60 million in GSP generated. The state would collect $4.2 million in sales taxes and $1.0 million in income taxes. Impacts would also occur in Nevada, with 370 jobs created, producing almost $16 million in income.

Operational activities in 2015 would produce 140 direct and 180 total jobs in California, $7.0 million in income, $16.4 million in GSP, $1.7 million in sales taxes, and $3.0 million in income taxes (Table 6.3.2-1). Wind operations in California would also generate $1.2 million in ROW rental receipts to the federal government. In Idaho, wind project operation would create 50 direct and 90 total jobs, $2.4 million in income and $5.8 million in GSP. Sales taxes in the amount of $0.6 million would be generated, together with $1.2 million in income taxes. ROW rental receipts to the federal government would amount to $0.5 million in Idaho. Impacts would also occur in Nevada, with 60 jobs created, $2.4 million in income generated, and $0.5 million in ROW rental receipts to the federal government.

While the BLM incurs costs associated with managing wind energy development on these BLM-administered lands, the BLM's ROW program is a cost-recovery program, and a substantial portion of the costs for processing ROW applications, including NEPA requirements, is paid by industry. In addition, the federal government earns money from ROW rental receipts.

6.4 CUMULATIVE IMPACTS

The purpose of this cumulative impact assessment is to determine how the environmental, sociocultural, and economic conditions within the 11-state study area may be incrementally impacted over the next 20 years by wind energy development that would occur on BLM-administered lands in accordance with the proposed Wind Energy Development Program. The CEQ, in its regulations (CEQ 1997a) implementing the procedural provisions of NEPA (40 CFR 1500-1508), defines cumulative effects as follows:

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2 As discussed in Section 2.4.1, expansion of production capacity is not anticipated at the Wyoming Wind Project located on BLM-administered lands in Arlington, Wyoming.

TABLE 6.3.2-1 Economic Impacts of the Limited Wind Energy Development Alternative in 2015 ($ millions 2003, except jobs)[a]

Impact Area	Arizona	California	Colorado	Idaho	Montana	Nevada	New Mexico	Oregon	Utah	Washington	Wyoming
Construction											
Employment											
Direct	0.0	360	0.0	140	0.0	150	0.0	0.0	0.0	0.0	0.0
Total	0.0	1,040	0.0	430	0.0	370	0.0	0.0	0.0	0.0	0.0
Income											
Direct	0.0	11.9	0.0	4.7	0.0	4.8	0.0	0.0	0.0	0.0	0.0
Total	0.0	46.5	0.0	15.2	0.0	15.5	0.0	0.0	0.0	0.0	0.0
Gross state product	0.0	164.0	0.0	59.6	0.0	59.1	0.0	0.0	0.0	0.0	0.0
Taxes											
Sales	0.0	11.3	0.0	4.2	0.0	4.2	0.0	0.0	0.0	0.0	0.0
Income	0.0	2.9	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operations											
Employment											
Direct	0.0	140	0.0	50	0.0	50	0.0	0.0	0.0	0.0	0.0
Total	0.0	180	0.0	90	0.0	60	0.0	0.0	0.0	0.0	0.0
Income											
Direct	0.0	3.9	0.0	1.5	0.0	1.6	0.0	0.0	0.0	0.0	0.0
Total	0.0	7.0	0.0	2.4	0.0	2.4	0.0	0.0	0.0	0.0	0.0
Gross state product	0.0	16.4	0.0	5.8	0.0	5.7	0.0	0.0	0.0	0.0	0.0
Taxes											
Sales	0.0	1.7	0.0	0.6	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Income	0.0	3.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ROW rental receipts[b]	0.0	1.2	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0

Footnotes on next page.

TABLE 6.3.2-1 (Cont.)

[a] The estimated impacts presented in this table cannot be compared with the impacts presented in Table 5.13.1-2 for this same time period under the proposed action. The estimates in that table were made on the basis of projections generated by the WinDS model, and, therefore, were constrained by the model's assumptions about development (see Section 2.2.1 and Appendix B).

[b] ROW rental receipts to the federal government include annual minimum rent only, as based on installed capacity (in MW). The BLM may also charge additional production rents, depending on electricity production. These are not included, given the uncertainty over projected electricity output from wind developments.

> "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7).

The discussion of cumulative impacts in this programmatic analysis describes the impacts of wind energy development in the context of other activities that also could impact environmental resources. Specifically, the analysis considers the impacts of wind energy development on BLM-administered lands in the context of the impacts of (1) other commercial uses of BLM-administered lands, and (2) wind energy development on non-BLM-administered lands.

Section 6.4.1 presents the cumulative impact analysis for the proposed action. The analysis encompasses the same resources analyzed in Chapter 5 and considers the impacts that could occur as a result of wind energy development under the terms and conditions of the proposed Wind Energy Development Program, assuming that the proposed policies and BMPs are adopted (Section 2.2.3). In particular, it is assumed that the requirements for adaptive management incorporated into the proposed policies and BMPs would be met. These proposed policies and BMPs would require comprehensive, on-going environmental monitoring programs to evaluate environmental conditions and adjust impact mitigation requirements, as necessary. As a result, the proposed Wind Energy Development Program would continue to provide needed impact mitigation over time.

The scope of the cumulative impact analysis in this PEIS includes wind energy projects that are consistent with the pace of development projected for the next 20 years in the MPDS and the WinDS models (Table 2.2.1-1), projects that are consistent with the policies and BMPs contained in the proposed action, and projects that are proposed where land use plans have been amended to incorporate considerations of wind energy development. Individual site-specific wind energy projects on BLM-administered lands that are within the scope of this cumulative analysis and in accordance with the Wind Energy Development Program as described under the proposed action are considered to have been adequately addressed by this PEIS. These individual wind energy projects provide an incremental continuation to the overall scope of the cumulative analysis of wind energy development on BLM-administered lands.

Section 6.4.2 presents a comparison of the impacts associated with the development of wind energy versus other sources of electric power, including natural gas, coal, nuclear, solar, and geothermal energy. This comparison considers land area disturbance, air quality impacts, water use, and waste generation. Section 6.4.3 presents a discussion of considerations related to transmission line construction as a separate but related activity.

6.4.1 Cumulative Impacts of Wind Energy Development under the Proposed Action

To address the contributions of wind energy development to cumulative impacts, an understanding and knowledge of existing and reasonably foreseeable future activities are essential. For planning purposes, this PEIS assumes that activities on BLM-administered lands would continue into the future at current levels. Commercial activities include livestock grazing; forestry; mining; oil and gas development; construction of new gas, electric, and communication transmission lines; road construction; and outdoor recreation. Wind energy development on BLM-administered lands as described under the proposed action and analyzed in this PEIS would be in addition to those activities.

To support the cumulative impact assessment, the magnitude of wind energy development on BLM-administered lands under the proposed action was compared with other commercial uses of BLM-administered lands and with wind energy development on non-BLM-administered lands. Table 6.4.1-1 shows the amount of BLM-administered lands considered to be economically developable for wind energy over the next 20 years compared with total BLM-administered lands involved in various other commercial activities as of 2002 (data for 2003 on commercial uses of BLM-administered land were not available in time for incorporation into this PEIS). This comparison shows that the amount of BLM-administered land with economically developable wind resources is generally much smaller than lands involved in other commercial uses in each of the 11 states except California.

Table 6.4.1-2 shows the amount of BLM-administered lands considered to be economically developable over the next 20 years compared with all lands in each state (including BLM-administered lands and all other lands) expected to be involved in wind energy development over the same time period. In most states, the percentage of development expected to occur on BLM-administered lands compared with all lands is less than 20%, and in three of these states, it is less than 5%. In Utah and Nevada, the percentage of development on BLM-administered lands compared with all lands is higher, at 35% and 54%, respectively.

Tables 6.4.1-1 and 6.4.1-2, in combination with Table 2.2.2-1, show that the potential for wind energy development on BLM-administered lands is relatively small when compared with the total amount of BLM-administered lands and when compared with other uses of BLM-administered lands. To the extent that wind energy development projects on BLM-administered lands occur at the rates and in the amounts projected, as well as to the extent that the policies and BMPs described under the proposed action are applied, the impacts attributable to wind energy development would be marginal when compared with other anticipated ongoing activities.

6.4.1.1 Physiography, Geology, Soils, Sands, Gravel, and Seismicity

Cumulative impacts to geologic resources or seismic characteristics from wind energy projects are not expected to be significant. The proposed program includes many BMPs to mitigate impacts from blasting, excavation, or earthmoving activities. Any impacts that might occur would be minimal and largely limited to the project site.

The construction of new access roads, improvements to existing roads and bridges, and installation of turbines and ancillary structures at a project site would involve cut and fill operations. If large amounts of fill material would be necessary, increased demands could occur

TABLE 6.4.1-1 Comparison of Amount of BLM-Administered Lands with Projected Economically Developable Wind Resources Compared with Amount of BLM-Administered Lands Involved in Other Commercial Uses

State	BLM-Administered Lands with Economically Developable Wind Resources (acres)[a,b]	BLM-Administered Lands with Other Commercial Uses (acres)[c,d]	Percentage Wind versus Other Commercial Uses
Arizona	1,500	315,500	0.5
California	72,300	338,600	21.4
Colorado	4,200	1,616,000	0.3
Idaho	9,100	330,300	2.8
Montana	1,800	1,326,200	0.1
Nevada	34,700	658,400	5.3
New Mexico	9,800	4,659,700	0.2
Oregon/Washington[e]	10,300	2,528,700	0.4
Utah	12,700	1,495,300	0.8
Wyoming	3,700	4,172,800	0.1
Total	160,100	17,441,600	0.9

[a] To convert acres to hectares, multiply by 0.4047.

[b] Acreage estimates generated by the WinDS model. Projections include additional new capacity; existing capacity is excluded.

[c] Sources: Stamm (2004); (see Section 4.7 and Table 4.7.1-2). Other commercial uses include timber sales; oil and gas, geothermal, and coal production; nonenergy leasables; and ROW authorizations.

[d] Acres do not include existing wind energy projects, livestock grazing use, or mining activities. Grazing is a designated use that encompasses nearly all BLM-administered lands in the 11 western states. Data describing acreage involved in mining activities were not available.

[e] The acreage data describing other commercial uses in these two states were combined because Oregon and Washington are managed as a single administrative unit.

to off-site supplies of sand, gravel, and crushed rock. If multiple construction projects were developed within a single area, local supplies of required fill material, particularly gravel or crushed rock, could be reduced to the point of impacting the needs of roadways and other construction projects. For example, the Kittitas Valley Wind Project in Washington State is projected to require 145,000 yd^3 (110,860 m^3) of off-site gravel resources to support improvements to 7 mi (11 km) of existing roads; to construct 19 mi (30 km) of new road; and to build two substations, nine permanent meteorological towers, an operations center building, and

TABLE 6.4.1-2 Comparison of Amount of BLM-Administered Lands with Projected Economically Developable Wind Resources Compared with Amount of Total Lands with Projected Economically Developable Wind Resources

State	BLM-Administered Lands with Economically Developable Wind Resources (acres)[a,b]	Total Lands in State with Economically Developable Wind Resources (acres)[a,b]	Percentage BLM-Administered Wind
Arizona	1,500	11,000	14
California	72,300	450,400	16
Colorado	4,200	95,600	4
Idaho	9,100	54,400	17
Montana	1,800	65,500	3
Nevada	34,700	64,500	54
New Mexico	9,800	76,300	13
Oregon	9,700	86,900	11
Utah	12,700	36,600	35
Washington	600	65,500	1
Wyoming	3,700	21,400	17
Total	160,100	1,028,100	16

[a] To convert acres to hectares, multiply by 0.4047.

[b] Acreage estimates generated by the WinDS model. Projections include additional new capacity; existing capacity is excluded.

150 turbines (EFSEC 2003). This demand could impact resource availability for other local or regional projects.

6.4.1.2 Paleontology

Disturbances from wind energy development, combined with other surface-disturbing development activities, could uncover or destroy fossils on BLM-administered land. However, the proposed programmatic BMPs addressing paleontological resources and the proposed policy for excluding NLCS lands and ACECs from wind energy development would limit the potential impacts at a wind energy project site so that any cumulative impacts would be negligible.

6.4.1.3 Water Resources

Cumulative impacts to water resources are not expected to be significant. The proposed program includes many BMPs to mitigate impacts to both surface water and groundwater quality. On-site mixing of concrete during construction would require water as would some of the dust abatement activities, but these uses would be temporary. Operation of a wind energy project would use very small amounts of water and would not result in discharges to surface water.

6.4.1.4 Land Use

Appropriate planning and evaluation to address cumulative impacts of all permitted activities on BLM-administered lands would be needed at the Field Office level to ensure that proposed wind energy development projects are compatible with ongoing activities and land uses in the project region. The contribution to cumulative impacts of wind energy projects on BLM-administered lands likely would be small or negligible unless a significant permanent, uncompensated loss of the current productive use of a site occurred, or if future uses were precluded. However, wind energy development would generally be compatible with many other land uses, including livestock grazing; recreation; wildlife habitat conservation; and oil, gas, and geothermal production activities. The small number of workers at a wind energy project at any given time (e.g., about 150 during the peak construction period for a 180-MW capacity facility with about 150 turbines, and 10 to 20 workers during operations) would not likely add to cumulative impacts to land use or land disturbance that are occurring or have occurred from ongoing and past activities.

6.4.1.5 Air Quality

Wind energy development on BLM-administered lands would be unlikely to result in air pollutant concentrations that would exceed NAAQS. Multiple construction projects at the same time could contribute to regional pollutant emission loads from construction and worker vehicle exhaust emissions. Localized incidences of fugitive dust emissions along unpaved roads could occur if multiple construction projects occurred simultaneously. For example, transportation of the projected 145,000 yd^3 (110,860 m^3) of off-site gravel needed for the Kittitas Valley Wind Project in Washington State would require about 7,380 round-trips by medium-sized dump trucks (i.e., 23-ton [21-t] capacity per truck), or 5,300 round-trips by larger dump trucks of 32-ton (29-ton) capacity. Fugitive dust emissions from this volume of truck traffic, together with other sources of particulate emissions, would cause particulate concentrations to increase substantially above normal background levels, causing localized dust problems. However, the proposed programmatic BMPs include mitigation measures to reduce airborne dust at the project site. Dust emissions would not contribute to cumulative impacts to regional air quality because they would be localized and temporary. Air emissions from vehicles involved in operational activities at wind energy projects would be minimal because of the small number of employees needed on site at any one time. The small number of employees and associated trips during project operations would not have a noticeable effect on cumulative regional air quality. The use of wind-generated electrical power would avoid cumulative pollutant emissions from fossil-fired facilities that would be necessary to generate equivalent amounts of power (Section 6.4.2).

6.4.1.6 Noise

Noise levels generated by construction equipment would be variable and depend on the type, size, and condition of equipment used and the equipment operating schedule. Most locations of wind energy projects on BLM-administered land would likely be at distances far enough away from receptors that noise levels would not increase above existing background levels at the receptor location. Construction equipment at a wind turbine site could generate noise levels of 80 to 90 dB(A) at a distance of about 50 ft (15 m), as shown in Table 5.5.2-1. Because the estimated noise level of the two noisiest pieces of equipment operating simultaneously would not exceed the EPA noise guideline level of 55 dB(A) at a distance of about 1,640 ft (500 m) from the source, cumulative impacts would not be expected to occur to local residents living near BLM-administered land. Local residents near construction roads and turbine sites could experience intermittent noise from construction vehicles during the daytime period. Noise generated by turbines, substations, transmission lines, and maintenance activities during the operational phase would approach typical background levels for rural areas at distances of 2,000 ft (600 m) or less and, therefore, would not be expected to result in cumulative impacts to local residents.

6.4.1.7 Transportation

Localized impacts to traffic volume could occur on roads during construction and decommissioning, especially during peak periods; however, these impacts would be temporary. Multiple construction projects on the same or overlapping schedules could collectively contribute to congestion on local roads and highways. The vehicles of 100 to 150 workers and vehicles used to transport construction equipment, turbine components, and fill material to the respective wind energy projects would add to traffic volumes if common roads are used. Once wind energy projects were constructed, traffic volumes on nearby roads could increase by tourists wanting to drive by the turbines or visit the operations center.

6.4.1.8 Hazardous Materials and Waste Management

All wind energy projects would require shipment, storage, use, and disposal of hazardous materials and generation of solid and hazardous wastes; however, the proposed programmatic BMPs addressing these activities would effectively mitigate potential impacts. Waste volumes would likely be limited compared with other wastes generated regionally, particularly, if wastes generated during decommissioning of turbines and ancillary structures were recycled for other uses. As a result, cumulative impacts resulting from hazardous material use and waste generation would be negligible.

6.4.1.9 Human Health and Safety

Increased risk to human health and safety could occur during wind energy development and operation on the basis of the inherent hazards associated with construction activities and maintenance of turbines; however, these risks would be minimized by the proposed programmatic BMPs requiring a safety assessment, development of a comprehensive health and safety program and fire management strategy, safety setbacks to nearest residences, mitigation for EMI, and compliance with FAA regulations. In addition, EMF from transmission lines would decrease to background levels at distances of about 200 to 300 ft (60 to 90 m) from the edge of the ROW of a 115-kV and 230-kV line (BPA 1993). Cumulative impacts to human health and safety, therefore, would be negligible.

6.4.1.10 Ecological Resources

Ecological resources would be impacted by wind energy development as a result of vegetation clearing, wildlife habitat modification (e.g., reduction or fragmentation), increased noise levels generated during construction, and human intrusion into previously undisturbed areas. In addition, some biota may permanently abandon areas adjacent to the wind energy facility and could experience population-level effects. New access roads could create indirect impacts to vegetation and wildlife from increased use of previously remote areas. Off-road vehicle use, hunting intensity, and other activities would likely increase in the proximity of new wind energy projects where new access roads are built.

The number of bird collisions at wind energy projects is relatively small, when compared with collisions with other human-made structures. The effects of bird collisions on local populations would be a function of the number of animals killed relative to the size of the total population of the species in the region (NWCC 2002). It has been estimated that from 100 million to well over 1 billion birds are killed annually in the United States due to collisions with man-made structures (Erickson et al. 2001). These estimates include 60 million to 80 million birds from highway vehicle collisions, 28,500 birds from aircraft collisions, up to 174 million birds from power line collisions, 4 million to 50 million from collisions with communication towers, and 98 million to 980 million birds from colliding with buildings. In addition, an estimated 67 million birds die annually from exposures to agricultural pesticides, 1 million to 2 million birds from oil and gas extraction operations, and more than 100 million birds from legal hunting harvests (Curry and Kerlinger 2004a,b; Dunn 1993: Erickson et al. 2001; Klem 1990).

Other sources of avian mortality for which estimates are lacking include barbed-wire fences, commercial fishing (e.g., from being caught in nets), land development, oil spills, oil and gas open pits, logging, collisions with trains, strip mining, stock tank drowning, and exposure to mercury pollution from power plants (Allen and Ramirez 1990; Curry and Kerlinger 2004a,b; Erickson et al. 2001; Kleekamp 2004). Cats probably kill hundreds of millions of birds yearly (Kleekamp 2004). In Wisconsin alone, cats may kill as many as 217 million birds per year (Coleman and Temple 1996). Avian collision deaths for all existing wind energy projects are estimated at 10,000 to 40,000 each year (Erickson et al. 2001). Even as the number of wind turbines in the United States increases, wind turbine-related bird fatalities would still cause no more than a few percent of all collision deaths related to other non-wind-power related structures (Erickson et al. 2001). However, depending on the species involved, population-level effects could be increased as a result of such collisions.

Noise during construction would likely result in temporary impacts to wildlife at a wind energy site. Cumulative impacts to wildlife populations would be negligible for more mobile species, or species with relatively large home ranges. Operating wind energy projects could generate turbine noise levels that would adversely impact wildlife.

Depending on the turbine height, type, and location, and the locations of meteorological towers at existing wind energy projects or areas being monitored in pilot studies for future development, songbird mortality could occur from collisions with structures during migration. On the basis of bird and bat monitoring studies at existing wind energy projects, the contribution of wind projects to cumulative impacts on birds and bats would likely be minimal in comparison with population declines from other causes (e.g., habitat loss or fragmentation). However, some species could incur population-level effects.

Vegetation losses or disturbance would occur from wind energy project construction. The small amount of vegetation clearing at each turbine site would not be significant when compared with the amount of available similar habitat on large wind energy sites that cover several hundred acres.

6.4.1.11 Visual Resources

Visual resources could be impacted by wind energy projects. The heights, type, and color of turbines, together with their placement with respect to local topography (i.e., on a ridge or mesa), are factors that would contribute to visual intrusion on the landscape. Also, the need for additional transmission lines to connect wind energy projects to the regional power grid could contribute to cumulative impacts. The level of public acceptance of visual impacts may vary considerably from project to project.

Flexibility in locating turbines to avoid cumulative impacts to important (e.g., VRM Class I or II) viewsheds should be considered both by the wind energy developer and by the BLM on a project-specific basis. Depending on the number and height of turbines and transmission line towers in these viewsheds, wind farms could result in cumulative impacts on visual resources.

6.4.1.12 Cultural Resources

Disturbances from wind energy development, combined with other surface-disturbing development activities, could uncover or destroy cultural resources on BLM-administered land. However, the proposed programmatic BMPs addressing cultural resources and the proposed policy for excluding NLCS lands and ACECs would limit the potential impacts at a wind energy project site. The proposed programmatic policies and BMPs also require consultation under Section 106 of the NHPA, which includes consultation with SHPOs and with Native American governments as early in the planning process as appropriate to identify issues and concerns. Cumulative impacts to some cultural resources, predominantly archaeological sites, would, therefore, be negligible. However, cumulative impacts to cultural resources with a visual component (i.e., sacred landscapes) could occur.

6.4.1.13 Economics

Wind power developments on BLM-administered lands could potentially produce adverse cumulative impacts on other commercial uses of these lands and adjacent lands, including agriculture, forestry, mining, oil and gas development, electric power generation and transmission line facilities, recreation, and residential development. Quantification of these impacts requires specific information about the location and economic variables (e.g., the price of renewable [forest products] and nonrenewable [fossil energy] natural resources) and policy variables, such as federal and state legislation of natural resources. In general, however, the relatively small amount of land required for wind energy projects and their typically isolated locations means that the cumulative impact on other commercial uses of BLM-administered lands would likely be small. Consequently, potential conflicts with other traditional uses of BLM-administered lands, such as mining, oil and gas development, and agriculture, would likely be minimized. In addition, many of the activities associated with traditional uses of BLM-administered lands have either existed for long periods of time, or the location of any potential new developments would be predictable given the distribution of natural resources and areas of scenic beauty. Conflicts with forestry and recreation could therefore also be minimized.

Beneficial cumulative impacts associated with wind energy development on BLM-administered lands would be likely (Section 5.13). These benefits would include the creation of new jobs and increased regional income, GSP, sales and income tax revenues, and ROW authorization income to the federal government.

6.4.1.14 Environmental Justice

Potential cumulative impacts on environmental justice as a result of wind development could occur if wind energy projects produced environmental and health impacts similar to those that result from other activities on BLM-administered lands and adjacent lands in the project vicinity. If these combined impacts were to result in impacts that would be high and adverse, environmental justice issues would arise if minority and low-income populations were affected disproportionately. Proposed programmatic policies and BMPs, however, should ensure that adverse impacts to populations are minimized. Therefore, cumulative impacts on environmental justice issues should be negligible.

6.4.2 Impacts of Wind Energy Development versus Other Sources of Energy

This section provides a comparison of the environmental impacts of wind energy development with impacts associated with other energy sources. This comparison considers the amount of land area disturbed, air emissions, water use, and waste generation for the entire fuel cycle of different energy technologies.

6.4.2.1 Land Area Disturbance

Wind energy projects vary in land area requirements, depending on wind project size, terrain, turbine size, and the type of turbine array (e.g., linear pattern along a ridge line or grid-type distribution). Lease arrangements between the developer and landowner are also variable and depend on specific agreements between the parties. For example, the Nine Canyon Wind Project, a 69-MW capacity wind project located southeast of Kennewick, Washington, consists of 49 turbines that require 47 acres (19 ha) for towers, access roads, and maintenance buildings (Energy-Northwest 2004) over a leased area of 5,120 acres (2,073 ha). Similarly, the proposed Wild Horse Wind Project in Washington, a 312-MW wind energy project, would involve disturbance of 165 acres (67 ha) for 158 turbines and associated access roads on a leased area of 8,600 acres (3,482 ha) (EFSEC 2004). Land disturbance at these two projects is equal to about 1 acre per turbine or 0.52 and 0.68 acres per MW of installed capacity; at both projects, less than 2% of the total leased area is disturbed.

Land area disturbance for wind energy facilities is minimal compared with the amount of land disturbed by a coal surface mine or a new oil or gas field to produce an equivalent amount of electrical power by a conventional fossil-fueled power plant. For example, mining and disposal of waste from a 1,000-MW coal-fired power plant over its operational life is estimated to disturb 22,000 acres (8,900 ha) of land (NRC 1996). The coal-fired plant itself would require 1,300 to 1,700 acres of land (526 to 688 ha) (DOE/BPA 2003; NRC 1996). As another example, photovoltaic cells and solar thermal conversion power systems also disturb large land areas. Construction of a solar thermal generating station with a capacity of 1,000 MW would disturb about 5,000 acres (2,000 ha) of land in one or more locations (Sargent & Lundy LLC 2003), and thus affect land use and wildlife habitat in a relatively large area compared with land disturbed by an equivalent-sized wind energy project. Table 6.4.2-1 gives a comparison of land area disturbance for a 1,000-MW generation facility using different fuel sources. No information was available on the energy consumption and associated land disturbance to produce raw materials (i.e., the front-end fuel cycle) needed to make turbines, solar collectors, or piping and other hardware for geothermal facilities.

6.4.2.2 Air Quality

Air emissions from alternative energy sources are often compared when evaluating the advantages and disadvantages of new power generation capacity. Energy offsets from renewable energy sources, such as photovoltaic systems, wind energy, and solar thermal plants, are

TABLE 6.4.2-1 Land Disturbance for 1,000-MW Power Generation from Alternative Energy Sources

	Disturbed Land Area (acres)	
Energy Type	Front-End Fuel Cycle	Generation Facility
Wind	Unknown	520 to 680[a]
Solar thermal	Unknown	5,000[b]
Photovoltaic cell	Unknown	2,000[c]
Geothermal	Unknown	7,000[d]
Hydroelectric	Variable	Variable
Coal	22,000[b]	1,700[d], 1,300[e]
Oil	1,600[b]	120[d]
Natural gas	3,600[b]	110[d]
Nuclear	1,000[b]	500–1,000[d]

Sources: [a]EFSEC (2004) and Energy Northwest (2004), [b]Sargent & Lundy (2003), [c]Hansen (2003), [d]NRC (1996), and [e]DOE/BPA (2003).

compared with coal-, oil- or natural-gas-fired power plants both with respect to homes served and emissions generated. Gipe (1995) examines energy offsets for wind energy that includes both power generation and the fuel cycle for nuclear-, coal-, oil-, and natural-gas-fired plants. Table 6.4.2-2 gives a comparison of emissions from different generation technologies during facility operations.

Emission factors for the fuel cycle have been prepared by DOE for conventional coal plants, and nuclear power and photovoltaic plants (Meridian Corporation 1989 as cited in Gipe 1995). The emissions during the fuel cycle of these three technologies are shown in Table 6.4.2-3. A portion of the emissions for the nuclear fuel cycle are probably based on open pit mining, a type of uranium mining replaced by in situ mining in the western United States during the past two decades, and are thus higher than actual levels that would occur from current mining practices. No information was found that compared the fuel cycle emissions attributable to production of raw material used to manufacture components for wind turbines, solar power, and geothermal power plants. Kaygusuz (2004) provided estimates of SO_2, NO_2, and CO_2 emissions (in kg/GWh) for the manufacture of wind turbines on the basis of wind speed classes (in m/s), as follows:

- Wind speed = 4.5 m/s: SO_2 = 18–32 kg/GWh, NO_2 = 26–43 kg/GWh, CO_2 = 19–34 kg/GWh
- Wind speed = 5.5 m/s: SO_2 = 13–20 kg/GWh, NO_2 = 18–27 kg/GWh, CO_2 = 13–22 kg/GWh
- Wind speed = 6.5 m/s: SO_2 = 10–16 kg/GWh, NO_2 = 14–22 kg/GWh, CO_2 = 10–17 kg/GWh

TABLE 6.4.2-2 Comparison of Annual Air Emissions from Wind Energy Generation with Different Generation Methods[a] per Average Megawatt

	Air Emissions (tons/MW)					
Type of Energy Generation	SO_2	NO_x	CO_2	Particulates	CO	PAHs[b]
Wind[c]	0	0	0	0	0	0
Solar	0	0	0	0	0	0
Geothermal	0.8	0	700.8[d]	0	0	0
Coal	8.6	21.6	8,843	1.3	1.5	+[e]
Natural gas combined-cycle	0.05	0.7	3,542–5,142	0.03[d]	0.7–3.8	+
Oil combined-cycle	2.4[f]	1.8[f]	6,220[e]	1.4[e]	NA[g]	+
Nuclear	0	0	0	0	0	0
Wood-fired	0.5	9.0	11,959	1.7	17	+
Solid-waste-fired	13.6	70.2	13,256	3.0	2.7	+

[a] Information modified from DOE/BPA (2003), unless otherwise noted.

[b] PAHs = polycyclic aromatic hydrocarbons.

[c] Minor amounts of particulates and NO_x emissions would occur at wind energy projects from construction equipment and vehicles, and during O&M activities.

[d] Source DOE/BPA (1993).

[e] Present in emissions from incomplete fuel combustion.

[f] Source Gipe (1995).

[g] NA = not available.

TABLE 6.4.2-3 Estimated Emissions (g/MWh) from the Fuel Cycle for Coal, Natural Gas, Nuclear, and Photovoltaic Power Plants[a]

Emission	Natural Gas (combined cycle)	Coal	Nuclear	Photovoltaics
NO_x	277	2,700	30	10
SO_x	4	2,700	30	20
CO_2	389,000	962,000	7,800	5,350
Particulates	10	1,500	2.7	20
Trace metals	NA[b]	110	0	0
Solid waste	NA	213,000	30	10

[a] Sources: Table modified from information presented in Gipe (1995) and NEI (2004).

[b] NA = not available.

The extraction of raw materials and manufacture of wind turbines would not be expected to generate as much particulate matter as would be generated by a large coal surface mine.

Offsets can be calculated with information on wind turbine size, wind speed, and emissions generated by a typical coal-fired power plant. A 25-m (87-ft) diameter turbine at a wind energy site with an average wind speed of 7 m/s (16 mph) capturing about 30% of the wind energy, would generate about 1,000 kWh/m^2 of rotor area. During 1 year, the wind turbine would generate 500,000 kWh and offset about 500,000 kg (1 million lb) of CO_2 emitted by a new coal-fired power plant (Gipe 1995). In a 1992 report, the California Energy Commission indicated that the average household in California consumed about 6,450 kWh based on 1989 data. The power consumed by about 80 homes (the equivalent of 500,000 kWh), if generated by wind turbines, would offset 500,000 kg (1 million lb) of CO_2 emissions.

Many factors influence how power from wind energy production will affect production at other power production facilities. It is reasonably certain that producing a kWh of wind energy might correspond to a reduction of less than a kWh at other power facilities. Recognizing this limitation, upper bound offsets for coal and natural gas combined-cycle plants are presented below. In the mid-1990s, the State of California generated about 2 TWh/yr of electricity from wind energy projects. If this amount of power had been offset by a reduction in power generated by coal-fired plants, emissions up to the following could have been prevented:

- SO_x 14 million kg (15,428 tons)
- NO_x 14 million kg (15,428 tons)
- CO_2 2,600 million kg (2,860,000 tons)
- Particulates 4 million kg (4,200 tons)
- Trace metals 300,000 kg (330 tons)
- Solid waste 580,000 kg (638 tons)

Had the power been offset by a reduction in power generated by natural gas combined-cycle plants, emissions up to the following could have been prevented:

- SO_x 1.2 million kg (1,300 tons)
- NO_x 0.021 million kg (23 tons)
- CO_2 1,100 million kg (1,200,000 tons)
- Particulates 0.027 million kg (29 tons)
- Trace metals not available
- Solid waste not available

For perspective, in 2000, the most recent data available (EPA 2004c) indicated that total nonrenewable power plant emissions in the United States for SO_2, NO_2, and CO_2 were 11,513,034, 5,644,354, and 2,652,901,442 tons (10,444,449, 5,120,472, and 2,406,671,701 t), respectively.

6.4.2.3 Water Use

Wind energy projects require far less water than do other energy technologies. During construction, water is required for mixing of concrete and dust control along access roads and other areas of temporary disturbance around the turbines. Once a wind energy project is operating, minimal quantities of water are needed. Coal and nuclear fuel cycles can use 30 to 40 times more water than needed for periodic washing of photovoltaic panels (Gipe 1995). Fuel cycle water use by coal is about 3.12 ac-ft (1.017 million gal)/GWh, compared with 4.12 ac-ft (1.343 million gal) for nuclear and 0.1 ac-ft (32,590 gal) for photovoltaics (washing) (Gipe 1995). Consumptive water use (i.e., water lost to evaporation) ranges from 1.5 to 3.0 ac-ft (488,850 gal to 977,700 gal)/GWh for coal, compared with 2.5 to 4.0 ac-ft (814,750 gal to 1.304 million gal) for nuclear.

6.4.2.4 Waste Generation

Wastes generated by the coal and nuclear fuel cycles are very large compared with wastes associated with wind energy. Small waste quantities would be produced by operating wind energy projects mainly in the form of sanitary waste, and wastes produced from periodic servicing of the wind turbines. Preparation of coal before combustion in western U.S. power plants typically generates wastes that are about 10% of the coal mined. On the basis of coal extraction data from the early 1980s (DOE 1983), about 970,000 tons (879,969 t) of solid waste was produced each year during coal preparation (crushing and washing) before combustion in power plants. Coal combustion produces additional solid waste in the form of boiler slag, fly ash, and scrubber sludge produced by SO_2 removal equipment, which requires land for appropriate disposal. Nuclear power also generates solid wastes during power plant operations that require storage in underground water pools or dry casks in aboveground facilities. Relative to coal or nuclear plants, oil combined-cycle, and natural-gas-fired power plants generate very small amounts of solid waste during operation.

Gipe (1995) estimated that a wind turbine 25 m (82 ft) in diameter, if it was producing power to replace the same quantity of power generated by coal, would have a reduction of 234,000 lb (106,5000 kg) of solid waste.

6.4.3 Related Transmission Line Construction

In some portions of BLM-administered lands within the 11 western states, new transmission lines would be constructed to meet future power demands. This constitutes a separate but related activity to wind energy development. Planning for new transmission would require interagency coordination and cooperation following the protocol established between federal agencies and members of the Western Governors' Association on the siting and permitting of interstate electric transmission lines in the western United States signed in 2002 (Western Governors' Association 2002). This protocol is intended to carry out the goals set forth in the *Memorandum of Understanding among the U.S. Department of Energy, U.S. Department of the Interior, U.S. Department of Agriculture, U.S. Environmental Protection Agency, Council* *on Environmental Quality, and the Members of the Western Governors' Association, Regarding Energy Development and Conservation in the Western United States,* signed in 2001.

The protocol calls for an efficient mechanism for information sharing among entities having jurisdiction in siting and permitting new transmission systems. Feeder lines to connect wind energy facilities to larger transmission lines would require assessments by the BLM Field Offices to determine where best to site new feeder lines. Decisions on where to site the lines would require a coordinated, multidisciplinary environmental review that takes into account the project-specific location and design of the proposed wind energy project, line length, tower types, heights, construction methods, and access roads needed for line construction and maintenance. In addition, the BLM should gather information from state energy offices and wind energy associations on a regular and ongoing basis to stay abreast of future plans for wind energy and other energy generation facilities that would require new transmission systems.

An ongoing information database of current and future activities in the vicinity of proposed wind energy development projects that could affect siting of feeder and transmission lines should be maintained by BLM Field Office staff. Proximity of feeder lines to designated utility corridors on BLM-administered lands and the possible use of these corridors for the feeder lines would reduce the potential for additional cumulative impacts to wildlife and prevent human access into areas that are remote or with limited access.

To mitigate potential cumulative impacts of building new transmission and feeder lines to connect wind power facilities to the electrical grid, the following concerns and issues should be addressed before approval of new line routes:

- *Local and regional power supply needs.* Evaluate future transmission capacity and power demands.

- *Current and future land use.* Consider effects of ongoing oil and gas activities, mining, livestock grazing, and important wildlife use areas; land uses on private parcels adjacent to BLM-administered lands should not be ignored when determining how transmission lines might affect land use.

- *Potential for visual effects.* Evaluate how lines would fit into the visual character of the landscape collectively with the wind turbines and other structures; transmission tower height, type, and color are important factors in evaluating visual effects to local residents or motorists having a view of the lines.

- *Impacts to federal- and state-protected species.* Consider impacts of tower construction and conductor stringing, and increased access by individuals using transmission line access roads; evaluate how other activities in the vicinity of the lines have fragmented habitat or reduced the number of protected species.

- *Effects of access roads on human access to remote areas*. Consider the use that may be affected by ongoing projects on BLM-administered lands that could be further impacted by new access roads for transmission line construction.

- *Habitat fragmentation.* Determine how biodiversity and habitat have been affected by other activities in the area; evaluate line routes requiring minimal vegetation clearing.

- *Cultural resources.* Consider what potential impacts could occur from transmission line access roads opening remote areas or areas of significant cultural use; determine the impacts of other activities on BLM-administered lands and adjacent lands that have altered Native American use and values in the project area.

6.4.3.1 Rules and Regulations Governing Wind Project Grid Interconnections

A wind energy development project needs an outlet for the wind energy through the transmission system grid. In July 2003, the Federal Energy Regulatory Commission (FERC) issued Order 2003, *Standardization of Generator Interconnection Agreements and Procedures*, to establish a set of procedures and agreements to govern the process of interconnecting generators (i.e., generating facilities capable of producing more than 20 MW of power) to a transmission provider's transmission system. (Revised Order 2003-A was issued in March 2004.) Order 2003 applies to any new wind energy development larger than 20 MW in capacity that wants to interconnect to a transmission system that has a FERC-approved transmission tariff. It applies to independent transmission providers, such as Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs), as well as nonindependent transmission providers that provide tariff service.

Order 2003 establishes standard interconnection procedures, including a standard application form and procedures for studies that would be conducted to assess the proposed interconnection's effect on the transmission system. It also establishes a standard interconnection agreement and sets out the legal rights and obligations of the parties, including cost responsibility, milestones for the project's completion, and a process for resolving disputes.

In Order 2003, FERC also clarifies who should pay for interconnection costs when the transmission provider is not independent. The wind developer will pay for facilities on its side of the point of interconnection to the transmission system. Initially, the wind developer also will cover the cost of upgrades to the transmission provider's transmission system required to accommodate the new generator and the delivery of the output over the transmission grid to the point of delivery. The transmission provider may give credits back to the developer to offset a portion of the facility costs of the interconnection and transmission system improvements that can be included in the provider’s tariff.

Also, on January 24, 2005, FERC proposed regulations that would remove barriers to wind-generated electricity while helping to ensure continued reliability of the national power grid. Wind-generated power is a growing source of electricity generation in the United States; however, unique technical characteristics may impede the interconnection of wind facilities with the nation's grid system. The proposed regulations would include certain technical requirements that transmission providers must apply to interconnection service for wind generation plants. Once enacted, these requirements would be applied in addition to the standard interconnection procedures adopted in Order 2003.

6.4.3.2 Transmission System Additions for Wind Development

Order 2003 and subsequent filings by public utilities have standardized the procedures by which transmission providers and wind developers assess the need for transmission system additions to support a wind developer's request for interconnection. The standardized procedures require the development and review of an Interconnection Feasibility Study, Interconnection System Impact Study, and Interconnection Facilities Study. Each study is funded by the interconnection requestor; follow-on studies may be required on the basis of the status of other interconnection requests and/or changes in the points of interconnection.

The Interconnection Feasibility Study preliminarily evaluates the feasibility of the proposed interconnection to the transmission system. The study should consist of a power flow and short-circuit analysis and provide a list of facilities, a nonbinding good-faith estimate of cost responsibility, and a nonbinding good-faith estimated time to construct.

The Interconnection System Impact Study evaluates the impact of the proposed interconnection on the reliability of the transmission system, and coordinates the Interconnection System Impact Study with any adjacent system that may be impacted by the project. The Interconnection System Impact Study should consist of a short-circuit analysis, a stability analysis, and a power flow analysis. It should state the assumptions upon which it is based, state the results of the analyses, and identify the requirements or potential impediments to providing the requested interconnection service, including a preliminary indication of the cost and length of time that would be necessary to correct any problems identified in those analyses and implement the interconnection.

The Interconnection Facilities Study should identify the work needed to implement the conclusions of the Interconnection System Impact. It should also identify the electrical switching configuration of the connection equipment and necessary network upgrades, and provide an estimate of the time required to complete the construction and installation of such facilities.

Upon completion of a final Interconnection Facility Study, and any operational studies requested by the wind developer, an interconnection agreement would be negotiated and executed. For interconnects with federal power marketing administrations (e.g., Western Area Power Administration and Bonneville Power Administration), the appropriate level of NEPA review would need to have been completed before the interconnection agreement could be executed. The environmental impacts, including cumulative effects, of site-specific interconnection facilities and network upgrades would be assessed under site-specific environmental reviews.

6.5 OTHER NEPA CONSIDERATIONS

6.5.1 Unavoidable Adverse Impacts

The impacts associated with the proposed action are discussed in Section 6.1.1. In general, with the exception of potential impacts to wildlife and visual resources, these impacts would be negligible because of the comprehensive approach to mitigation provided in the proposed programmatic policies and BMPs. Unavoidable adverse impacts to wildlife and visual resources would likely occur at some of the future wind energy development sites; however, the magnitude of these impacts and the degree to which they can be successfully mitigated would vary from site to site. These site-specific and species-specific issues would be addressed at the project level in order to maximize opportunities to mitigate impacts.

6.5.2 Relationship between Local Short-Term Uses of the Environment and Long-Term Productivity

Activities associated with wind energy development that could be considered to be short-term uses of the environment would include those limited activities that would occur during the site monitoring and testing phase and the short-term disturbance associated with construction and decommissioning activities (e.g., use of lay-down areas and parking lots). The impacts associated with short-term use of the environment during the site monitoring and testing phase would be negligible, provided new access roads are not constructed and surface disturbance activities are kept to a minimum. Environmental impacts during construction would be relatively short term (about 1 to 2 years) and would be largely mitigated by programmatic BMPs and stipulations, including requirements for habitat restoration. The impacts to the environment during operations would constitute a long-term use of the environment; however, it would not conflict with most other land uses. The impacts of short-term use during decommissioning also would be mitigated by required habitat restoration activities, thereby rendering the land suitable for other uses.

The proposed action would result in favorable short-term and long-term effects for the local and regional economies where wind energy projects are located (Section 5.13). These benefits include the creation of new jobs and increased regional income, GSP, sales and income tax revenues, and ROW rental receipts to the federal government.

6.5.3 Irreversible and Irretrievable Commitment of Resources

The development of wind energy projects on BLM-administered lands would result in the consumption of sands, gravels, and other geologic resources, as well as fuel, structural steel, and other materials. Upon decommissioning, some of these materials would be available for reuse. Water resources also would be consumed during the construction and, to a lesser extent, decommissioning phases. These would be temporary uses and would be largely limited to on-site mixing of concrete and dust abatement activities.

In general, the impact to biological resources would not constitute an irreversible and irretrievable commitment of resources. During construction, operation, and decommissioning, individual animals would be impacted. For most species, population-level effects would be unlikely; however, population-level effects are possible for some species. Site-specific and species-specific analyses conducted at the project level for all project phases would help ensure that the potential for such impacts would be minimized to the fullest extent possible. While habitat would be impacted during construction and decommissioning, the restoration of habitat required by the programmatic policies and BMPs would reduce these impacts over time.

Cultural and paleontological resources are nonrenewable. Impacts to these resources would constitute an irreversible and irretrievable commitment of resources; however, the programmatic policies and BMPs are designed to minimize the potential for these impacts to the extent possible.

Impacts to visual resources in specific locations could constitute an irreversible and irretrievable commitment of resources. Efforts to mitigate these impacts would be undertaken at the project level with stakeholder input.

6.5.4 Mitigation of Adverse Effects

The proposed Wind Energy Development Program would establish programmatic policies and BMPs to ensure that potential adverse effects resulting from wind energy development on BLM-administered lands would be mitigated to the fullest extent possible. Any potential adverse impacts that cannot be addressed at the programmatic level would be addressed at the project level where resolution of site-specific and species-specific concerns is more readily achievable.

The proposed program would require that the BLM adopt adaptive management strategies regarding wind energy development. Programmatic policies and BMPs would be reviewed and revised to strengthen mitigation measures as new data regarding the impacts of wind power projects become available. At the project level, operators would be required to develop monitoring programs to evaluate the environmental conditions at the site through all phases of development, to establish metrics against which monitoring observations can be measured, to identify potential mitigation measures, and to establish protocols for incorporating monitoring observations and new mitigation measures into standard operating procedures and project-specific BMPs.