Navajo Hopi Land Commission Office
U.S. Department of Energy Tribal Energy Program

Feasibility Study for Paragon-Bisti Solar Ranch

on the Navajo Nation in New Mexico

DE-FOA-0000424, CFDA Number: 81.087

TETRA TECH

June 2015

NAVAJO HOPI LAND COMMISSION, NAVAJO NATION

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Feasibility Study

for Paragon-Bisti Solar Ranch

U.S. Department of Energy

Tribal Energy Program, Golden, Colorado

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EXECUTIVE SUMMARY

DESCRIPTION OF PROPOSED PROJECT AND ORGANIZATION OF FEASIBLITY STUDY

The Navajo Hopi Land Commission Office (NHLCO) and Navajo Nation (NN) plan to develop renewable energy (RE) projects on the Paragon-Bisti Ranch (PBR) lands, set aside under the Navajo Hopi Land Settlement Act (NHLSA) for the benefit of Relocatees. This feasibility study (FS), which was funded under a grant from DOE's Tribal Energy Program (TEP), was prepared in order to explore the development of the 22,000-acre PBR in northwestern New Mexico for solar energy facilities. Topics covered include:

- Site Selection
- Analysis of RE, and a Preliminary Design
- Transmission, Interconnection Concerns and Export Markets
- Financial and Economic Analysis
- Environmental Study
- Socioeconomic and Cultural Factors
- Next Steps.

SITE SELECTION AND RENEWABLE ENERGY TECHNOLOGIES

Site-specific Renewable Resource Assessment. The area assessed consisted principally of lands controlled by the NHLCO as well as a few sections controlled by the Eastern Land Commission, all inside the boundary or vicinity of the PBR. The PBR enjoys ample sunshine, over 7 thermal kilowatt-hours (kWh_t). In addition, a deep hot geothermal zone underlays the entire PBR and there are surface manifestations of some shallower hydrothermal resource. The groundwater aquifer under the PBR is said to be capable of producing up to 25,000 acre-feet of warm brine per year. The PBR has little reliable wind energy, and virtually no biomass. In this Feasibility Study, four basic forms of RE (solar, geothermal, wind, and biomass), in various types of each, were assessed over the entire PBR study area. After visiting the lands and screening with GIS tools, approximately 10,000 acres of the 22,000 acres were selected for development, and the selected portion of the PBR subdivided into five sites. According to the preliminary design herein, these sites could provide 2.1 billion watts (gigawatts, or GW) of peak power.

Technology Analysis. Solar and geothermal power generating technologies were then screened for five sites. Only photovoltaic (PV) is technically and economically viable for a utility-scale project on the PBR Fixed flat-plate PV tilted to summertime bias was selected for all five sites.

Preliminary System Design(s). Preliminary designs for five solar ranches have been created. See Figure ES-2 for one example. Each ranch is built up from self-sufficient 1.4-MW & 2.8-MW power blocks.

Long-term O&M Planning. A fully built-out PBR would contain about 9 million PV panels occupying 200 million square feet of glass. Monitoring the performance of solar arrays and making system repairs are operations and maintenance (O&M) functions, critical for assuring peak performance and power output. These activities can last from 25-40 years. Depending on the size of the plant, monitoring may be performed by onsite staff or may be performed with automation, summoning help if a fault is detected or some other problem occurs. Although the O&M charge for a utility-scale photovoltaic facility amounts to a mere 0.9¢/kWh, the sheer scale of the PBR magnifies the O&M task. 0.9¢/kWh translates to about one (1) full-time-equivalent (FTE) for every 3 to 6 MW_e of PV generating capacity, or about 15-30 FTEs per 100-megawatt (MW) ranch.

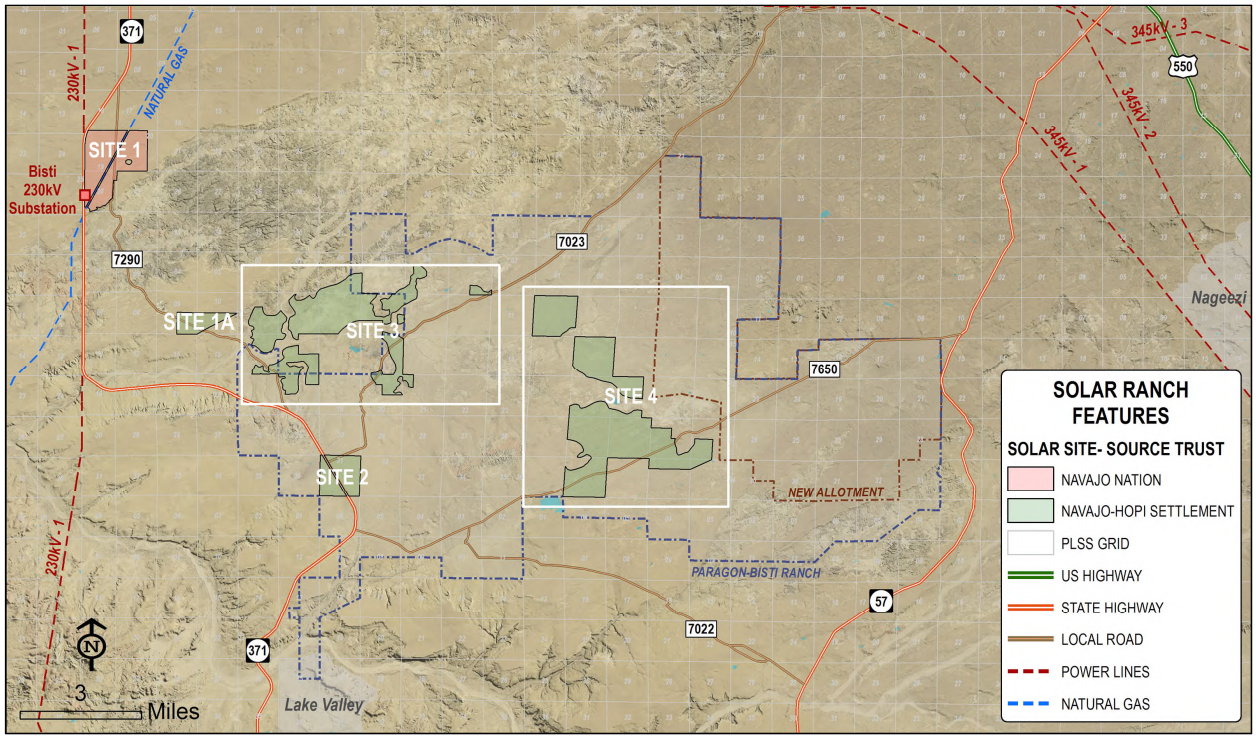

Figure ES-1. Topographic Map Depicting Five Sites Suitable for Solar Development

Source: Tetra Tech. Note: The Bisti substation (square red-filled icon) is in the upper left. Red fill (Site 1 only) denotes non-Settlement Act, but still Navajo Trust land. Green fill denotes developable land remaining after initial screening.

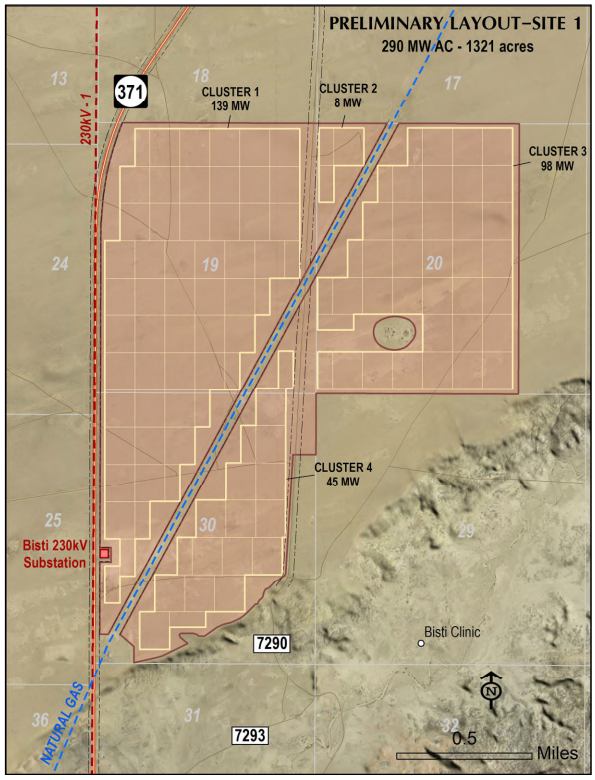

Figure ES-2. Preliminary Design for a Site 1 Solar Ranch Adjoining the Bisti Substation.

Source: Tetra Tech

TRANSMISSION & INTER-CONNECTION

Export Markets and Transmission, and Inter-connection Considerations. Potential export markets were evaluated, and 15 utilities and possible off-takers with an RE component in their portfolio were interviewed. The dominant utility in this market is Public Service Company of New Mexico (PNM), whom the team met in September 2014. In order to sell power, three conditions must exist: (1) available transmission capacity, (2) a utility with an RE need, and (3) an agreement from an offtaker to buy that electricity through a Power Purchase Agreement (PPA). PNM controls the five major power transmission lines around the PBR and follows a formal process for interconnection. PNM also has goals for using RE and often conducts competitive calls for RE. Potential offtakers expressed price sensitivity as a major concern. In this market, solar energy must compete with cheap hydropower, coal, and natural gas. Assuming a PPA is signed, one positive aspect is that it would be for a very long term, 25 years plus. Possible agencies with a RE need that may be open to a PPA include: PNM, Farmington Electric Utility System, Navajo Tribal Utility Authority (NTUA), and Tri-State Generation & Transmission Association. One significant challenge is that several utilities (including PNM) satisfy their obligations under New Mexico's Renewable Portfolio Standard (RPS) exclusively with customer-owned rooftop PV. One possible approach for the NN RE program is to start modestly at Site 1, develop a solar offering in the 50- to 100-MW range that can be absorbed by the existing transmission system yet generate revenue, then let success breed success.

ECONOMIC ANALYSIS

Tetra Tech developed an economic model to evaluate a nominal 100-MW solar ranch on the PBR from the viewpoint of an owner/investor. *Bottom Line Up Front*: If a PV ranch was constructed for no more than $1.60 per DC-watt, was financed via a 20-year loan (debt) @ 5% with 20% down (investor equity), took full advantage of every federal incentive that now exists, and sold electricity under a long-term PPA for about $75 per megawatt-hour (MWh) pegged to the Producer Price Index (PPI), then this plant would earn for its owners a decent after-tax return of 6% or so. Income for the NN from both land lease fees and normal royalties on production is allowed for in this scenario. Not having to pay income taxes would either increase the return considerably (by +33%) or allow room for cost growth. Based on interviews with major RE developers, sensitivity analysis showed the four most dominant parameters are: (1) price for electricity, (2) cost of money, (3) capital expense (CapEx) in dollars per DC-watt, not AC, and (4) debt-to-equity (D:E) ratio. A $2.50 per watt PV project cannot work today, since that requires a wholesale price of $100/MWh, which has not been seen on the West Coast for several years. The $45-55/MWh PPAs that have been mooted to the NN are not acceptable either, since a dollar-per-watt CapEx is not credible yet.

ENVIRONMENTAL STUDY

An environmental study was conducted for the 22,000-acre PBR, evaluating its potential as a solar ranch. The study was conducted at a "desktop" level using relevant literature, previous studies, databases, aerial imagery, and other resources already in print or published on the internet. Personal observations of ground conditions and general characteristics of the PBR during site reconnaissance were also gathered, together with interviews of staff from the NNEPA and other agencies to refine and enhance the environmental study. Select topics are explored with more focus, zeroing in on critical issue areas and highlighting their main elements along with important items pertaining to permitting of the project and recommended actions. The topics are: biological resources; historic and cultural resources; geology and soils/mineral resources; water resources; land use/planning; and visual, scenic, or aesthetic resources. No major areas of concern were identified in the investigation to date. Field work is required, based on the specific site boundaries, for Cultural Resources/ Archaeological/ Paleontological/Historical, in order to ensure avoidance of sensitive tribal lands (e.g., grave sites/sacred sites); and biological resources - vegetation and wildlife, to reduce potential impacts. Results of the cultural and biological resources field work will be considered in the design phase, along with hydrology and flood potential; high susceptibility of PBR soils to erosion; suitability of available onsite water supply for solar panel washing; visibility and effect on visual resources;

and land use, ensuring compatibility of RE facilities with the traditional Navajo lifestyle and future. A detailed matrix identifying six major permits for the project has been prepared. The timeline to obtain environmental permits and approvals/decisions for the first solar ranch is estimated to span 9-12 months.

Preliminary Projection of Reduction in Fossil Fuel Usage. New Mexico's electricity sector is one of the most coal-intense in the country, with a signature over 1.2 kg of greenhouse gas (GHG) per kWh delivered. Site 1 by itself (290 MW, see Figure ES-2) which should produce 12-20 million MWh over its 25- to 40-year life, would avoid 7 to 24 megatons of GHG emission. If fully built out, the entire Paragon Project (2,100 MW) should generate 90 to 144 million MWh over its working life, which should avoid the emission of 52 to 176 megatons of GHGs. This in turn would displace the mining and burning of 14 to 48 million metric tonnes of fossil fuel (oil or coal), which would fill a train about 3,000-10,000 miles long.

SOCIAL ECONOMIC FACTORS

Ramifications of a commercial scale project of this magnitude are vast and extend beyond the Relocatees to include the entire Navajo Nation. RE development of the PBR would provide many positive impacts and could serve as a model for all tribal nations. The two most significant benefits from this program are the potential for many new jobs in diverse disciplines and technical skill areas, and the income derived from the sale of green power from this inexhaustible energy source. Short term jobs during the 1- to 3-year construction phase could employ 1,000 workers for each 100-MW photovoltaic power plant. Long-term jobs during the O&M phase could employ 15-30 personnel for 25 years, or more. Annual wages could well exceed $1 million for each 100-MW plant. Technical training to compete for these new jobs will be essential. Fortunately, at least four colleges and technical schools in the vicinity of the PBR offer related technical training and are available to fill this need. Many local colleges are also willing to work with a developer to help craft an academic program to meet their specific needs in the areas of planning, management, short-term construction, and long-term O&M of a solar ranch. The program has been presented to, and gained the support of, the highest level of the Navajo Nation, including the past president, committees, chapters and councils. However, the recent change in leadership at many levels of the NN government such as the President of the NN, as well as the executive director of the NHLCO in May of 2015, requires that this education and outreach be repeated.

STEPS FOR DEVELOPING A RENEWABLE ENERGY PROGRAM

Three phases of six-phase PBR RE program have been completed. The first three phases provide a roadmap and next steps leading to project execution and power generation. This FS provides a substantial foundation for launching the project into those next phases including: preconstruction, construction and long term operation & maintenance of the solar facility. Several potential barriers must be addressed. One of the most critical is regaining the tribal momentum necessary to move ahead. Key to this is a tribal decision to either (1) engage a developer and offer the land under a leasing agreement, or (2) own the project and develop the site. Given there are five sites, a combination of land lease and tribal ownership could work.

Assuming a developer is selected, a successful large scale solar project such as this must seek to reduce the risk for the development team, while at the same time providing the Navajo Nation with assurance that the project will be completed and produce at expected levels of power. Thorough planning and management must be applied to ensure this outcome. It is suggested that the NHLCO establish a formal organization to accomplish these management and planning tasks in an efficient manner.

Several sources of funding exist to sponsor the program moving into the next phase, including grants from: DOE, US Department of the Interior (DOI) and from a private developer. At this point, the federal sources of funding can require cost matching between the Navajo Nation and federal agency. The NHLCO has also opened discussion with several developers, who have provided positive feedback, demonstrating a recognition of the project's potential profile, value, and anticipated support in the solar community.

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ACRONYMS AND ABBREVIATIONS

AGX	ArcGIS Explorer
APS	Arizona Public Service
ATC	available transfer capacity
BFE	base flood elevation
BI	Bisti to Ambrosia line
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
CHAT	Crucial Habitat Assessment Tool
COD	commercial operation date
CONUS	continental United States
CPUC	California Public Utilities Commission
DISIS	Definitive Interconnection System Impact Study
DOE	U.S. Department of Energy
DOI	U.S. Department of Interior
DPU	Department of Public Utility
eCO_2	equivalent carbon dioxide
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPE	El Paso Electric
Esri/ESRI	Environmental Systems Research Institute
°F	degrees Fahrenheit
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FEUS	Farmington Electric Utility System
FiT	feed in tariff
FONSI	Finding of No Significant Impact
GHG	greenhouse gas
GIS	geographic information system
GJU	Gallup Joint Utilities
GSHP	ground-source heat pump
GWh	gigawatt hour
IOU	investor-owned utility
IRP	Integrated Resource Plan
IS	Indian Service
kV	kilovolt
kW	kilowatt
kWh	kilowatt hour
$kWh_t\ m^{-2}$	thermal kilowatts per square meter
$kWh_t\ m^{-2}\ d^{-1}$	thermal kilowatts per square meter per day
LANL	Los Alamos National Laboratory
LGIA	Large Generator Interconnection Agreement
LSE	load-serving entity

ACRONYMS AND ABBREVIATIONS

mph	miles per hour
MW	megawatt
MW_e	megawatt electric
MWh	megawatt hour
mW m^{-2}	milliwatts per square meter
NAPI	Navajo Agriculture Products Incorporated
NED	National Elevation Dataset
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NHD	National Hydrography Dataset
NHLCO	Navajo Hopi Land Commission Office
NHLSA	Navajo-Hopi Land Settlement Act
NNDNR	Navajo Nation Division of Natural Resources
NNEPA	Navajo Nation Environmental Protection Agency
NOA	Notice of Availability
NREL	National Renewable Energy Laboratory
NTP	Navajo Transmission Project
NTUA	Navajo Tribal Utility Authority
NVE	NV Energy
PBR	Paragon-Bisti Ranch
PDF	portable document format
PEIS	Programmatic Environmental Impact Statement
PG&E	Pacific Gas & Electric
PISIS	Preliminary Interconnection System Impact Study
PMF	Published Map File
PNM	Public Service Company of New Mexico
PPA	Power Purchase Agreement
PRC	Public Regulation Commission
PV	photovoltaic
PVNGS	Palo Verde Nuclear Generating Station
RCT	Reasonable Cost Threshold
REC	renewable energy credit
RES	Renewable Energy Standard
RETA	Renewable Energy Transmission Authority
RFP	request for proposal
ROW	Right of Way
RPS	renewable portfolio standard
SCE	Southern California Edison
SJGS	San Juan Generating Station
SRIC	Southwest Research & Information Center
SRP	Salt River Project
SWAT	South West Area Transmission
TEDI	To'Hajiilee Economic Development, Inc.
TEP	Tucson Electric Power
USACE	U.S. Army Corps of Engineers
VRM	Visual Resource Management
WAPA	Western Area Power Authority

ACRONYMS AND ABBREVIATIONS

WECC	Western Energy Coordinating Council
WGA	Western Governors' Association

ACRONYMS AND ABBREVIATIONS

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1. DESCRIPTION OF THE PROPOSED PROJECT

The Navajo Hopi Land Commission Office (NHLCO) and Navajo Nation plans to develop renewable energy (RE) projects on the Paragon-Bisti Ranch (PBR) lands, set aside under the Navajo Hopi Land Settlement Act (NHLSA) for the benefit of Relocatees. During this phase, a feasibility study (FS) is prepared to explore the development of the 22,000-acre PBR site in northwestern New Mexico for RE facilities. This Study, prepared under a grant from the Department of Energy, explores all necessary aspects to move into the pre-construction phase of the program and includes:

- Site Selection,
- Analysis of RE, and a Preliminary Design,
- Transmission, Interconnection Concerns and Export markets,
- Financial and Economic Analysis,
- Environmental Study,
- Socioeconomic and Cultural Factors, and
- Next Steps.

If all five Sites on the PBR were fully built out, their total capacity (2,100 MW) would be roughly equal in capacity to the entire state of New Mexico.

The overall ranch is divided into five sites and has the potential to produce over 2,000 MW of solar power when fully built-out. The concept is to develop the sites in a time phased sequence depending on available transmission capacity and power export market identification. It is the objective of the program to partner with investors or a private-sector developer, execute a large generation connection agreement and sign a Power Purchase Agreement (PPA).

Figure 1-1 depicts the potential for renewable energy in terms of megawatt hours of tribal generation, of which the Navajo lands are a subset. The Navajo Nation and the private sector renewable energy developer can share a common goal: to establish significant amounts of large-scale renewable energy projects on tribal lands using private capital financing or Navajo funding. The scale of this effort is very large. The Navajo Nation has set a goal of developing up to 4 gigawatts of renewable energy. Thus, private financing must be obtained to achieve these goals. Meanwhile, developers and investors demand a return on their investments. Renewable energy projects have proven to be profitable, so investors may be interested in the opportunity provided by large-scale renewable energy projects on tribal lands.

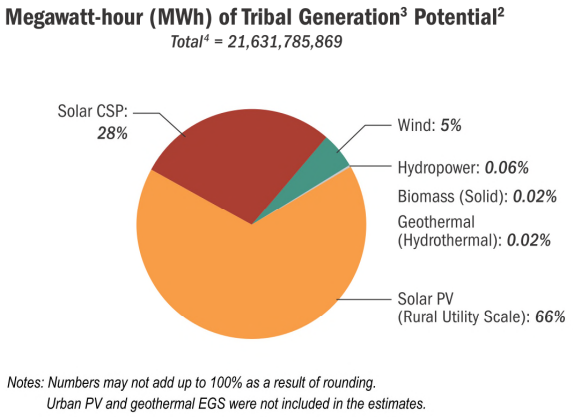


Figure 1-1. Summary of Tribal Renewable Energy Installed

Source: DOE, Developing Clean Energy Projects on Tribal Lands, Data and Resources for Tribes.

Recent data from the U.S. Department of Energy (DOE) Office of Indian Energy and Programs and from DOE's National Renewable Energy Laboratory were used to update and substantiate the estimated renewable energy technical potential on tribal lands. The purpose of the updated estimate is to provide tribal governments with data to make informed decisions about renewable development options for their communities. Key findings are as follows:

- American Indian land is approximately 3% of the U.S. area, but contains an estimated **5% of all renewable energy resources.**
- The total technical potential on tribal lands for photovoltaic generation from rural utility-scale solar resources is about **14 billion megawatt hours (MWh),** or **about 5%** of total U.S. photovoltaic potential of 281 billion MWh.
- The total RE potential on tribal lands for electricity generation from wind resources is about **1.1 billion MWh,** or **about 3%** of the total U.S. technical onshore wind power potential of 32.7 billion MWh.

Given that the Navajo Nation has one of the largest land holdings among all tribes, and the land conveyed under the Navajo-Hopi Land Settlement Act is very large, the potential for producing renewable energy from renewable sources is significant.

Figure 1-2. View of Developable Sect. 30, T24N R13W (Site 1 "Bisti Cornerstone")

North-Northeast from State Highway 371, Bisti Substation, and Bisti-Ambrosia 230-kV Transmission Line

Source: Tetra Tech, Site visit 24 Sep 2013.

2. SITE SELECTION & RENEWABLE ENERGY TECHNOLOGIES

This chapter discusses the inter-related processes of screening the lands of the PBR using advanced GIS tools and field reconnaissance as well as screening of the various RE technologies. In addition, each of the five sites are thoroughly described, with their attributes, advantages and disadvantages, and a preliminary design is presented.

Organization and flow of concepts in this chapter (2).

The first half of section 2.1, subsection 2.1.1, presents the GIS methods used to view and analyze lands of the PBR, the process to screen those lands for suitability, and results of that screening.

The second half of section 2.1, subsection 2.1.2, describes and evaluates existing renewable energy resources for the entire Study Area. As will be seen, only solar and geothermal energy passed this initial resource screening.

The section after that (2.2) discusses the technology to harvest those renewable energy resources which passed the initial screening. As will be seen, only solar technology, in particular fixed photovoltaic panels at summer bias, was deemed to be a viable cost-effective way to convert the available renewable energy resource into electricity.

The two sections after that (2.3 and 2.4) describe how the lands were screened for their suitability for hosting the selected solar power generating technology, and subdivided into developable groups.

The section after that (2.5) presents the preliminary designs and layouts for the five solar ranches.

The last section (2.6) discusses the long-term operations and maintenance of the five solar ranches.

Table 2-1. Summary of Site Selection Results

Group Name	Site #	Devel-opable Acres	Power [MWe] latitude tilt ***summer bias***	Access	Development Potential and Status
BISTI CORNERSTONE	1	1,321	207 ***290***	grid YES paved road YES	• Very high priority, goes 1st • Non-Settlement, but still Tribal
"the Wedge"	1A	333	36 ***50***	grid NO paved road YES	• Alternate to 1st if 1st not available • Settlement, Selected & Conveyed
"DOG-EYE SOLAR RANCH"	2	612	94 ***131***	grid NO paved road YES	• High, goes 2nd • Settlement, Selected & Conveyed
TANNER LAKE/COAL CREEK	3	3,161	456 ***638***	grid NO paved road NO	• Moderate, goes 3rd • Settlement, Selected & Conveyed
SPLIT LIP FLATS/BLACK LAKE	4	4,205	694 ***972***	grid NO paved road NO	• Medium-low, goes last • Settlement, Selected & Conveyed
TOTAL ALL SITES		9,632	1,487 ***2,081***		

The area assessed consisted principally of lands controlled by the NHLCO (green in the table above), as well as a few sections controlled by the Eastern Land Commission (salmon in the table), all inside the boundary of, or in the vicinity of, the PBR. The PBR enjoys ample sunshine (~7 kWh_t, equal to 26 million joules (J) per square meter per day). A deep hot geothermal zone underlays the entire PBR. In addition there are surface manifestations of some hydrothermal resource in the form of up to 25,000 acre-feet of warm brine per year. The PBR has little reliable wind energy, and virtually no biomass.

In this Feasibility Study, Tetra Tech, Inc. (Tetra Tech) has evaluated all forms of RE for development on and near the 22,000-acre PBR; approximately 10,000 of these acres were selected. According to the preliminary design, these sites are capable of generating about 1.5-2.1 gigawatts of peak daytime solar power to grid. As part of the effort, Tetra Tech has prepared a multi-layered geographic information system (GIS) rendering of the entire PBR to facilitate the screening process and identify smaller parcels for alternative energy development. The GIS product consists of approximately 1 gigabyte of public open-source data input incorporated with Navajo Nation data. The GIS rendering is provided on a CD inside the back cover of this report.

2.1 Site-Specific Renewable Resource Assessment

Given the vastness of the overall PBR and the impracticality of developing the entire property at one time, smaller sites within the PBR were identified. The following sections describe the methods used to select the RE sites and the parameters used to assess each site-specific RE resource.

2.1.1 Site Selection Background and Process

The following terms used throughout this document are defined as follows:

- Paragon-Bisti Ranch (PBR) or “Project Site” is the 22,000-acre site in San Juan County, New Mexico, composed of land conveyed to the Navajo Nation under NHLSA, also referred to as “Settlement Act lands.”
- “Study Area”, “Project Vicinity” and “Project Area” are general terms to describe the Project Site and broader area surrounding the Project Site. Figure 2-1 depicts the Study Area.
- NHLSA property is considered for siting solar ranches. Most but not all of these Settlement Act lands are inside the historical boundary of the Paragon Ranch, but the boundary itself is not a constraint.
- The exception to using only NHLSA land is presented for Site 1. Under this FS we have requested the NHLCO process a land swap to include this proposed site based on its ideal attributes.

2.1.1.1 GIS Tools and Databases Used to Screen PBR Lands for RE

To support the analysis of the PBR, an extensive mapping GIS database was developed. A project map in the ESRI Published Map File (PMF) format, was created to support the site selection for this project. The PMF and all GIS data support the following activities using the free ESRI ArcReader software.

- Map printing and exporting
- Viewing map and all data at full resolution
- Map content customization, including markup function
- System-generated and user definable area and distance measurement
- Direct overlay comparison of all layers for exploration and “what if” analysis

In addition, an integrated multilayered "2½-D" GIS product was created, which can be navigated in ESRI's free ArcGIS Explorer (AGX) application. These data support all the above listed activities as well as high-value data visualization with 3-dimensional "fly-through" using AGX (provided on CD inside the back cover of this report.) The National Hydrography Dataset (NHD) and National Elevation Dataset (NED) data for the project area are included for further analysis under ArcGIS if desired. Low and high-resolution portable document format (PDF) versions of the map are included for convenience, as well as PDF versions of the scanned maps. This data is provided to the Navajo Nation and DOE along with this FS.

The mapping data created includes:

- PBR Boundary
- New Allotment Boundary
- Proposed Solar Sites (major groupings consisting of multiple classes, filtered and screened by constraints such as slope over 3%, surface roughness, permanent drainage features, and intermittent and persistent water bodies)
- Substations (only the Bisti substation is shown in the Project Vicinity)
- Power Lines (one 230-kV line on the west side of the Project Site and three 345-kV lines on the northeast side)
- Major Roads (U.S. Highways, New Mexico State Highways, Indian Service Routes, and local roads)

GIS Rasters Created

- National Agriculture Improvement Program 2011 imagery draped over NED elevation
- Slope from NED
- Hillshade from NED

Existing Maps Scanned and Georeferenced

- Original Project Map
- Paragon Resource Ranch Map
- PNM Transmission System

Public Domain GIS Data Obtained/Processed

- Public Land Survey System Grid
- New Mexico Place Names
- New Mexico Unincorporated Places
- BLM Native American Areas
- BLM Reserves
- Tiger Roads
- National Hydrography Dataset (NHD)
- 1/3-arcsecond National Elevation Dataset (NED)
- 2011 National Agriculture Improvement Program orthoimagery
- ESRI Basemap high-resolution orthoimagery (Web-based)
- Wind maps from NREL
- Geothermal heat flux maps from NREL, Southern Methodist University Geothermal Lab, and the Bureau of Economic Geology at the University of Texas, Austin.

2.1.1.2 Land Screening Processes and Criteria

Candidate land was screened via multiple criteria such as size, land control, real estate encumbrances, and terrain features. Cultural, paleontological, and/or biological features as described in Section 5 would also limit development, but were not used to screen the five Sites described below, as field work has not been completed. The rationale for each screening criterion is presented next, in order of importance.

Size. In just the past 7 years, the definition of what constitutes "utility scale" has changed by an order of magnitude. When the 14-megawatt-electrical (MW_e) tracking PV farm was commissioned at Nellis Air Force Base in Nevada in 2007, it was not only the largest system in the federal government, it was the largest system in North America. Today, newly proposed systems are at least 10 times bigger, sometimes 20, especially in the Southwest. For example, the Agua Caliente band of Cahuilla Indians will ultimately generate almost 300 MW. Our objective in developing the sites within the PBR was to identify contiguous land holding 300-4,000 acres capable of producing 50 to 1,000 MW. The larger sites also provides the developer the flexibility to build out a site in an orderly manner as transmission capacity and PPAs expands. Given a surface density of 150-300 kW per acre, this puts a premium on larger sites with hundreds of contiguous acres.

Land Control/Lack of Encumbrances. Because the solar industry is changing so rapidly, as well as the energy landscape in general and governmental incentives in particular, there is a premium on fast-paced development. This means the host property must be unencumbered and ready for development.

Terrain. For developing land to host utility-scale solar power, the most desirable features are:

1. *Flatness* and a *lack of vegetation*, to avoid shading and minimize the cost of clearing, grading, earthmoving, and other site work. If a slope is unavoidable, the *slope* should *not exceed 3° or 5%* and should *face within ±45 degrees of due south* to minimize self-shading and maximize illumination in order to match production with peak demand on the grid. Aspect, which is the direction that a slope faces, was analyzed, but found to be an insignificant screening factor in this particular case due to the general flatness of the Project Vicinity.
2. *Soil* instead of rock, to minimize the cost of excavation and foundations, but with adequate *load-bearing capability* and *stability* to maximize life of the asset as well as minimize foundation cost.
3. *Outside the path of natural drainage channels/flood plains*, and as complete an absence of water features as possible: no boggy ground, no streams or waterbodies either permanent or intermittent.

Access. Two kinds of access are **critical** for solar power development:

1. Transmission
   a) *Access to the grid*, because electricity can neither be conveniently stored nor shipped, hence it must be delivered to an "offtaker" (paying customer) as soon as it is generated, or at least be "wheeled" through multiple utilities to the ultimate off-taker; as well as
   b) *Proximity to the grid*, because high-tension transmission lines cost between $1 to $5 million per mile depending on voltage, and take years to site and build, depending on neighbors
2. Surface Transportation Network (Roads), or at least a right-of-way, for temporary access with construction equipment and permanent access by maintenance personnel

Ground Rule. The one exception to the rule cited above (consider only lands controlled by NHLCO) is our proposed Site 1, consisting mostly of Navajo Trust lands plus some BLM leased land that could be swapped. Site 1 alone possesses all the required characteristics for the ideal "cornerstone" project.

2.1.1.3 Results of Land Screening Process for RE on the PBR

Based on information collected during the September 2013 public kickoff meeting and the site reconnaissance in 2013, 2014, and 2015, as well as updated and more accurate geographic information since the pre-feasibility study in 2010, the lands were organized into five groups of progressively increasing aggregate size. The first group is the primary site. The second is the alternate site if the first choice proves to be unavailable. The clusters of parcels are grouped as follows, and are recommended for development in this order, as shown in the following "waterfall" chart (Figure 2-1). (As presented below in Subsection 2.1.2, and explained in detail in Section 2.2, 2.3, and 2.4, solar energy is the most abundant, cost-effective, and sustainable energy resource on the PBR. The captions in Figure 2-2 reflect this decision.)

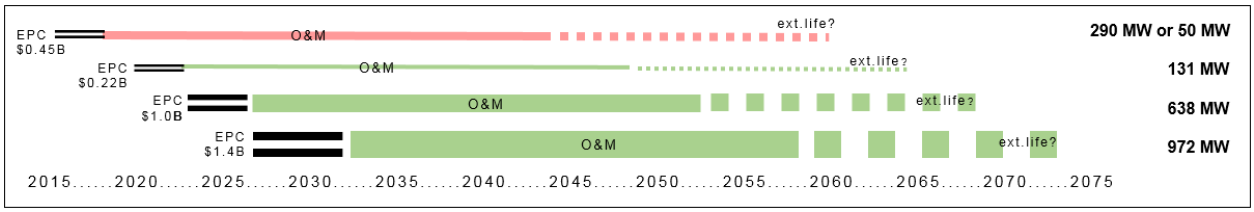


Figure 2-1. Waterfall Chart for Build-Out of the PBR.

- Site 1, the red "cornerstone" or "anchor tenant" at the Bisti substation, 290 MW potential
- Site 1A, the green wedge-shaped "alternate" starter location under control of the NHLCO if Site #1 proves to be unavailable, 50 MW potential
- Site 2, the green square mile straddling State Highway 371 near Dog Eye Pond, 131 MW potential
- Site 3, the green group surrounding Tanner Lake and Coal Creek, 638 MW potential
- Site 4, the green group between Split Lip Flats and Black Lake, 972 MW potential.

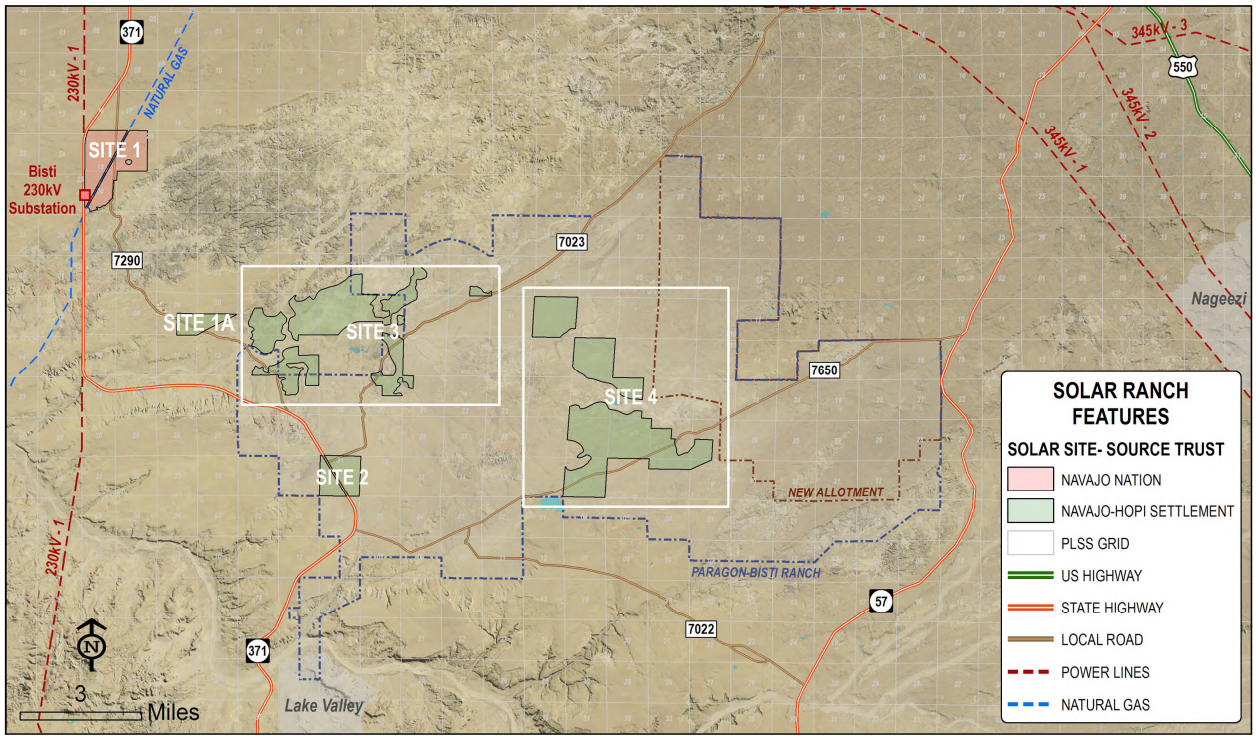


Figure 2-2. Topographic Map Depicting Five Sites Suitable for Solar Development

Source: Tetra Tech. Note: The Bisti substation (square red-filled icon) is in the upper left. Red fill (Site 1 only) denotes non-Settlement Act, but still Navajo Trust land. Green fill denotes developable land remaining after initial screening.

These five sites are within the PBR boundary and contain two classes of land, as shown on Figure 2-2 above. Land color-coded as red (Site 1 only, under control of the Eastern Land Commission) is Navajo Trust land. Land color-coded as light green (Sites 1A, 2, 3, and 4) is Settlement Act land that has already been "Selected & Conveyed," with Surface and Mineral rights, to the Navajo Nation under the terms of the NHLSA. This is according to the "Paragon Resource Ranch Map," dated February 2000, which was provided to Tetra Tech by the Navajo Hopi Land Commission Office (NHLCO). See also Figure 2-3.

The relevant portion of the February 2000 "Paragon Resource Ranch Map" is excerpted and reproduced on Figure 2-3. Settlement Act land is denoted by brown 45-degree diagonal hatching; see the key box "Navajo-Hopi Settlement Act-Trust," at the top of the Legend in Figure 2-3. To eliminate confusion due to "checker boarding," Tetra Tech has superimposed the five *developable* solar Sites, denoted by white borders that depict land after screening. Note that Sites 1A, 2, 3, and 4 contain only about half the available Settlement Act land. The other half was eliminated during geographic screening for development potential as described in the sections below. For convenient reference, power lines, pipelines, and numbered roads have also been layered on top to orient the reader.

What Comes Next. In the second half of section 2.1 (subsection 2.1.2), existing renewable energy resources for the entire Study Area will be identified, analyzed, and screened. As will be seen, only solar and geothermal energy passed this initial resource screening.

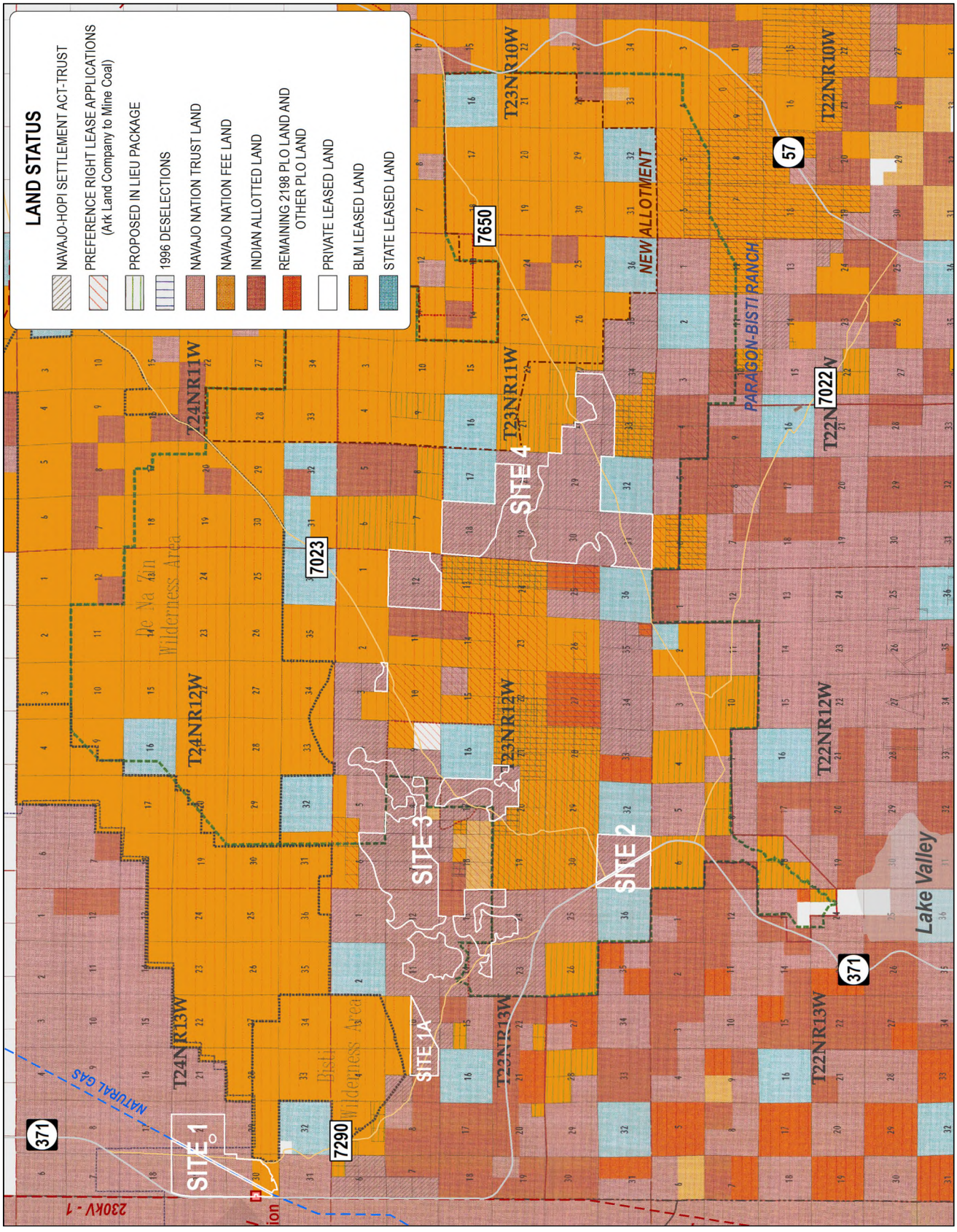
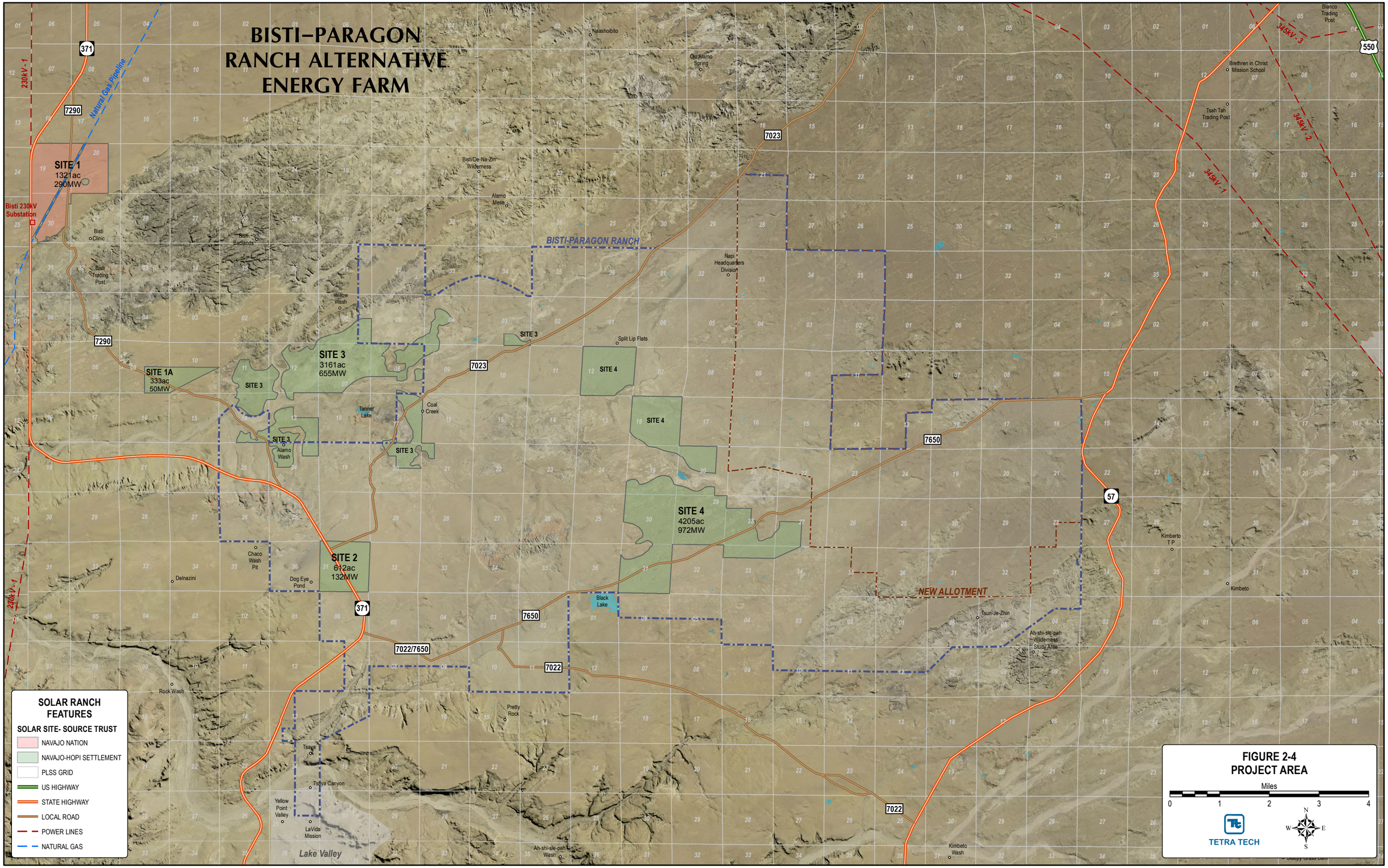


Figure 2-3. Paragon-Bisti Ranch Resource Map

Source: NHLCO, Feb 2000 version. Solar site and road layers added by Tetra Tech

BISTI–PARAGON RANCH ALTERNATIVE ENERGY FARM



2.1.2 Renewable Resource Assessment for Solar Geothermal Wind and Biomass Energy

2.1.2.1 Solar Energy on the PBR

As described in Sections 2.2 - 2.4, solar is the best renewable energy option for the PBR. Although the PBR does not have the very highest insolation on the North American continent, the quality of the resource is still very good, about 6-7 thermal kilowatts per square meter per day ($kW_t\ m^{-2}\ d^{-1}$). Figures 2-5 and 2-6 depict solar resources for the country as a whole, while Figure 2-7 shows the state of New Mexico only.

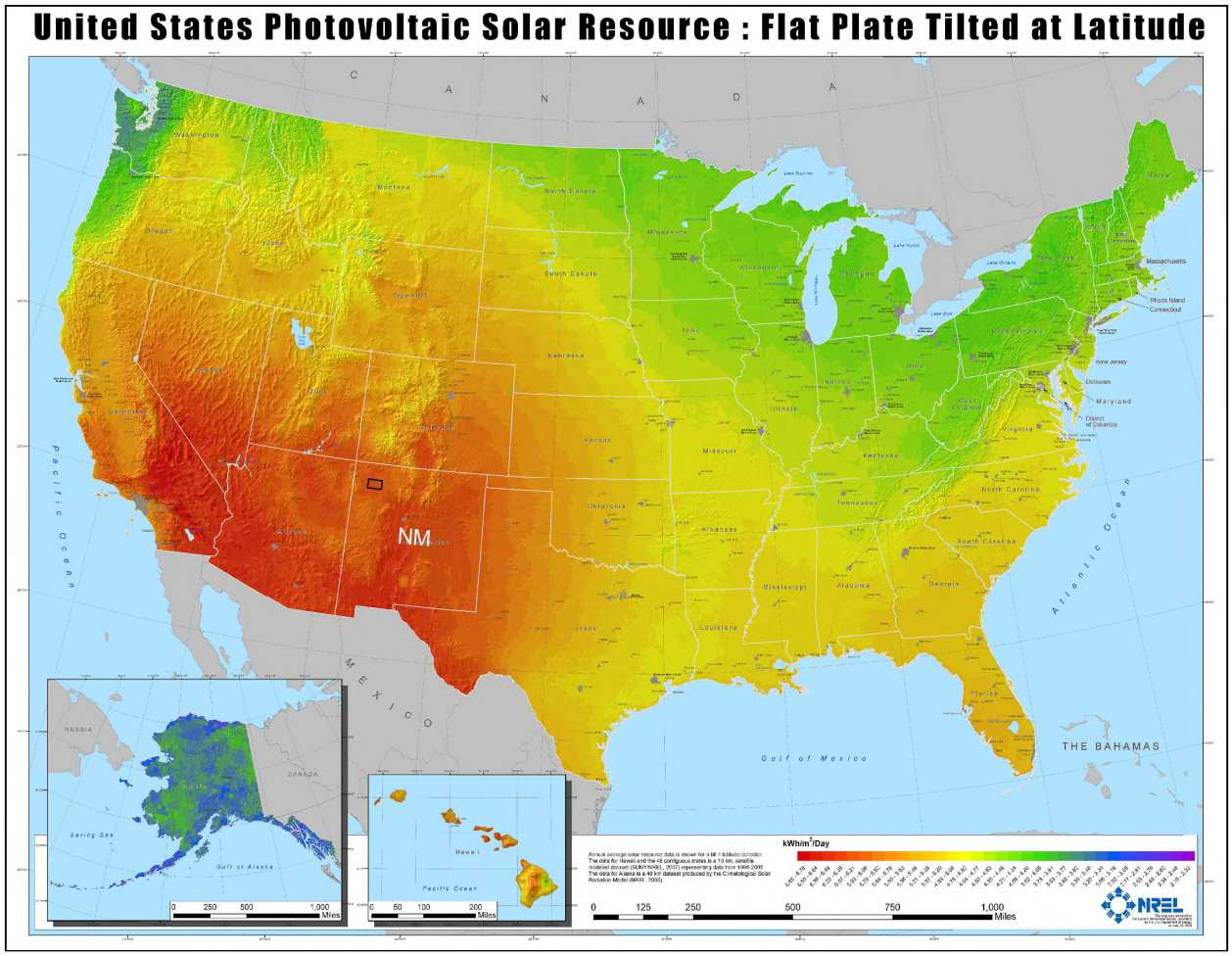


Figure 2-5. Solar Resource for United States for Flat-fixed Plate Technology

Source: NREL, 2008. Red end of range represents nearly 7 thermal-kilowatt-hours per square meter per day ($kW_t\ m^{-2}\ d^{-1}$); violet about 2 $kW_t\ m^{-2}\ d^{-1}$. Location of Project Area with about 6-7 $kW_t\ m^{-2}\ d^{-1}$ shown by black rectangle.

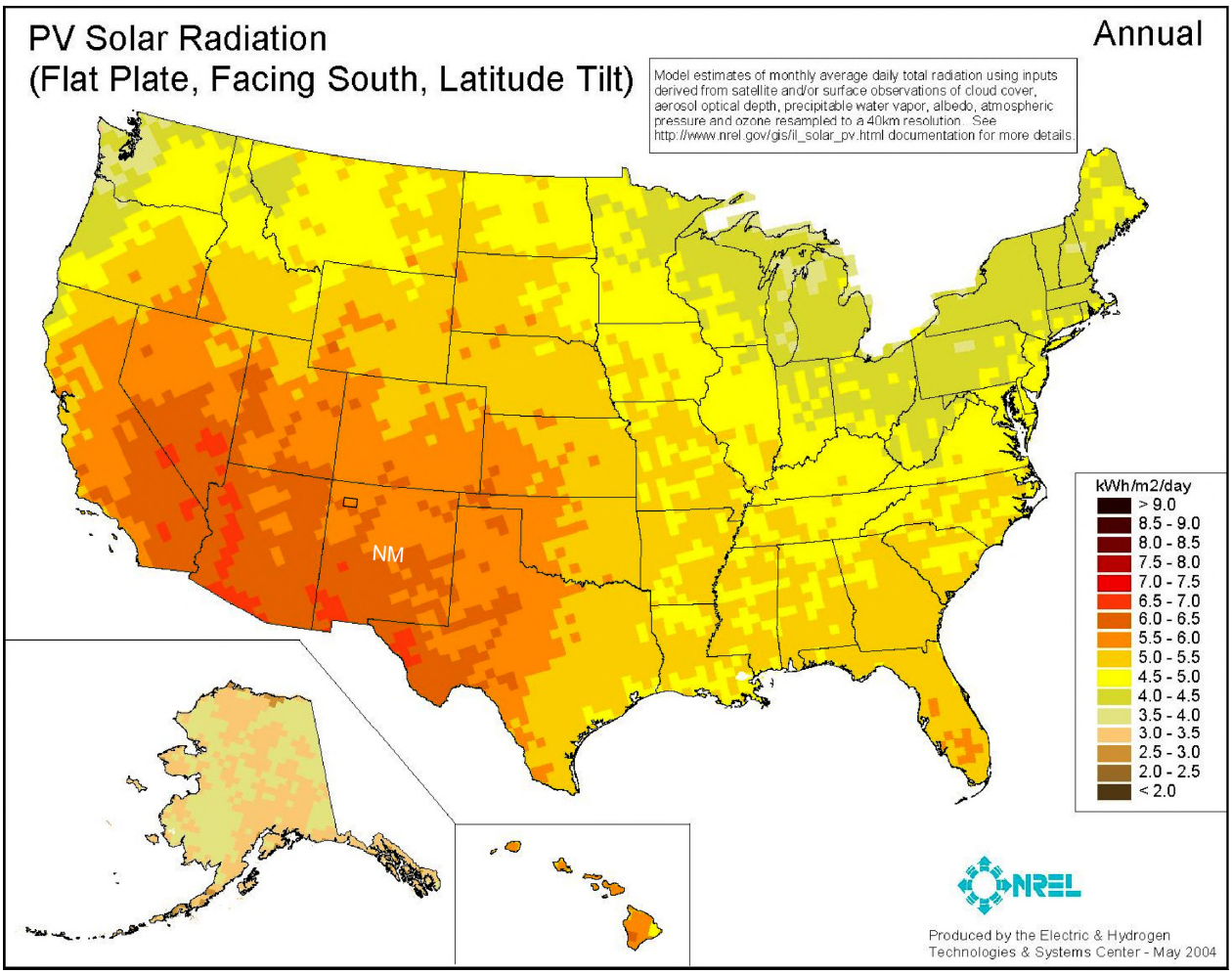


Figure 2-6. Solar Resource for United States for Flat-fixed Plate Technology in 40x40-km Grid

Source: NREL, 2004. Red is ~8+ kWh$_t$ m^{-2} d^{-1}; light green about 3-4 kWh$_t$ m^{-2} d^{-1}. Project Area is small black rectangle.

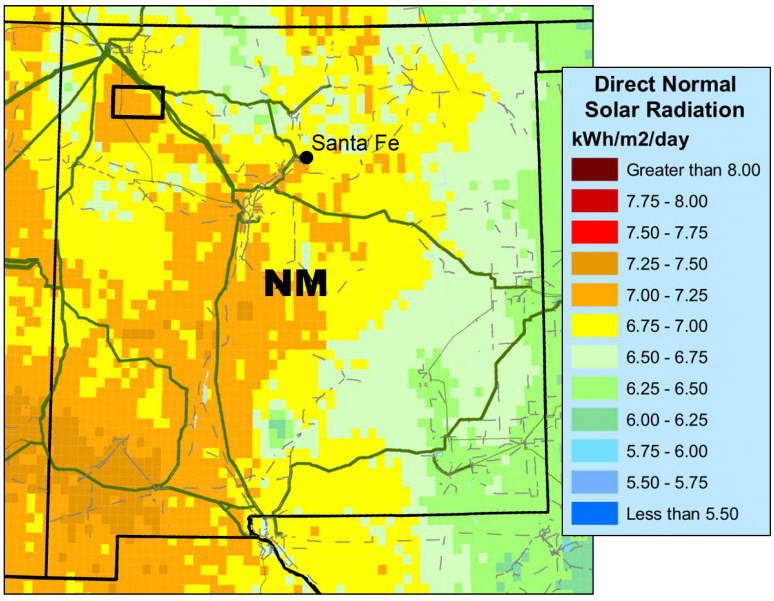


Figure 2-7. Solar Resource for New Mexico

Source: NREL, 2007. Orange and yellow indicates 6.75 to 7.25 kWh$_t$ m^{-2} d^{-1}. Project Area shown by black rectangle (to scale).

2.1.2.2 Geothermal Energy on the PBR

Deep Hot Dry Geothermal Resource. Figure 2-8 shows known hydrothermal spots and the distribution of deep geothermal heat for the U.S. Figure 2-9 shows the geothermal surface heat flux in New Mexico, which is considered by geothermal experts to represent the distribution of deep heat, though not necessarily deep hot water (i.e., hydrothermal resource). The Study Area does not have any hot hydrothermal vents, only a few warm surface outflows.

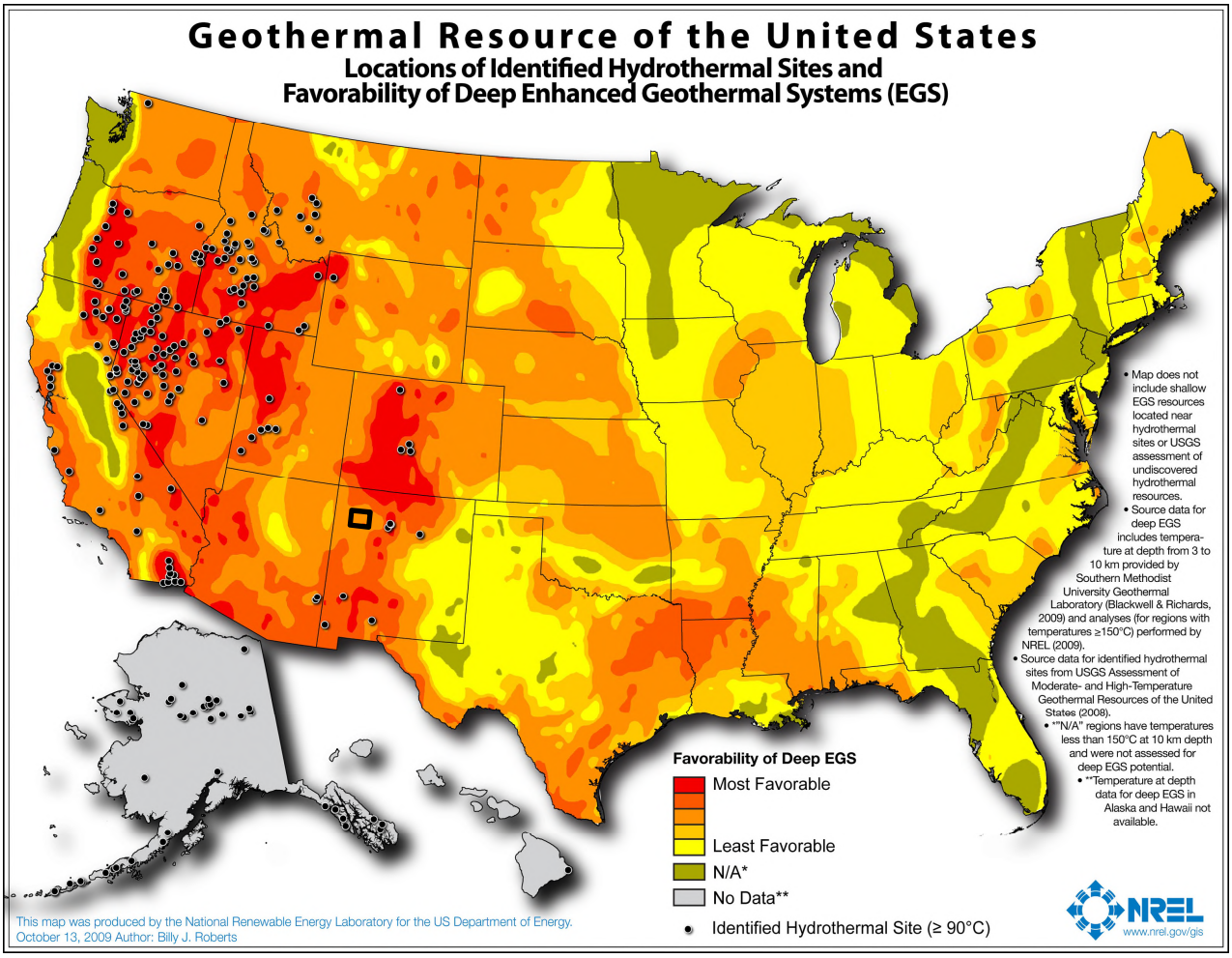


Figure 2-8. Hydrothermal Sites and Deep Geothermal Resource of the US

Source: Southern Methodist University Geothermal Lab & NREL, 2009. Courtesy Bureau of Economic Geology, University of Texas at Austin. Project Area shown by black rectangle.

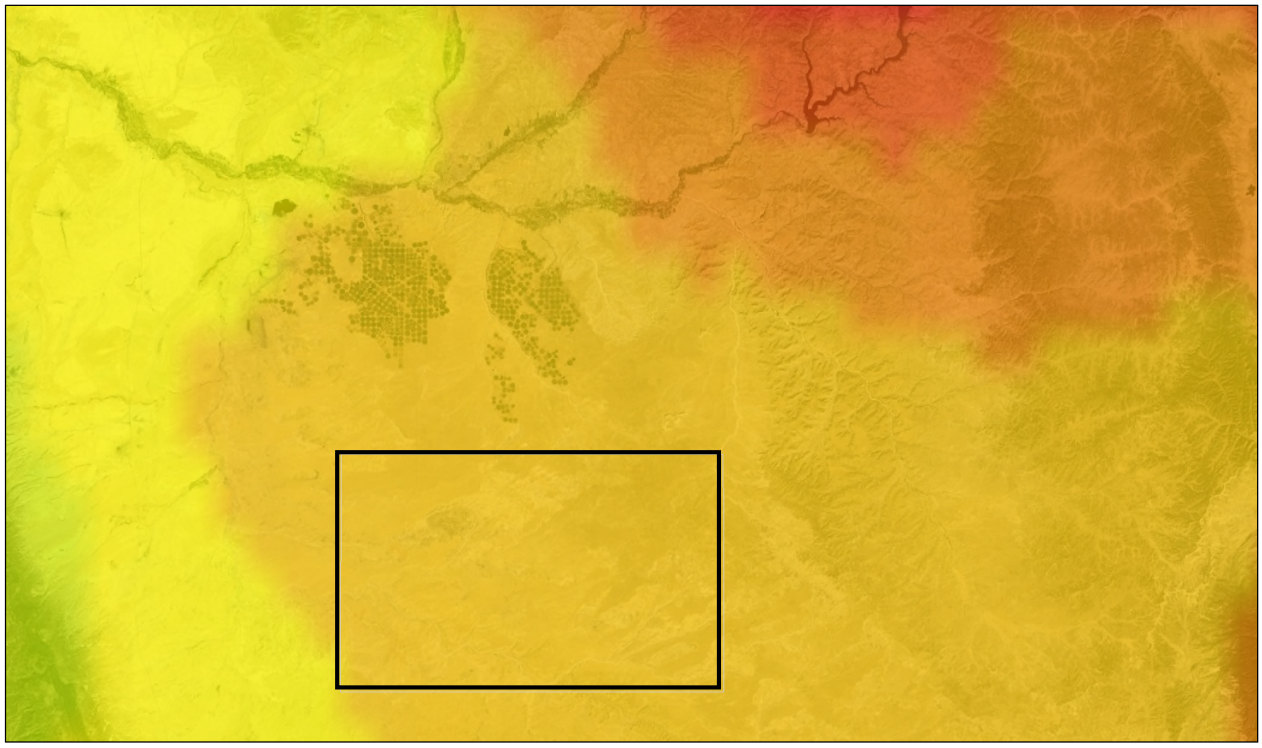


Figure 2-9. Geothermal Surface Heat Flux in NW New Mexico, Layered on Google Earth Imagery

Source: NREL, 2007, Google Earth 2014, Tetra Tech. Project Area to scale shown by black rectangle.

On Figure 2-23, red represents a heat flux of about 80 to 90 milliwatts per square meter (mW m^{-2}), and yellow-green about 55 to 60 mW m^{-2}. The black rectangle is the Project Vicinity containing the PBR. The slightly darker patch in the upper left quadrant of the rectangle is the Bisti/De-Na-Zin Wilderness Area. It is evident from the uniform color inside the box in Figure 2-9 that the distribution of deep geothermal energy is essentially uniform across the Project Site at ~75 mW m^{-2}. This can be compared with the maximum daytime solar flux at latitude tilt of ~1,000 watts per square meter (W m^{-2}), ten thousand times greater. Because the distribution is uniform, geothermal production wells could be located anywhere in the Project Vicinity without conflicting with other activities. However, there is much more to developing geothermal energy than just the surface heat flux, which is only a general indicator of a resource. Geopower (electricity from geothermal energy) is as critically sensitive to location as hydroelectric dams are, and is absolutely reliant on an accurate conceptual hydrogeologic model and thorough understanding of subsurface conditions. For utilization of deep geothermal at utility-scale, the hydrothermal resource must to be verified with a proper geothermal exploration program. About a third of the total project cost, and most of the financial risk, is up front at the exploration and drilling phase, as shown on Figure 2-22. Therefore, in comparison to solar electricity at utility scale, geopower is far more uncertain on the PBR.

Therefore, although geothermal energy might ultimately be an option for generating electricity, at this time, it could be implemented no more than at distributed residential and commercial/small industrial scales, not utility-scale, and even then only in limited applications.

Shallow Warm Hydrothermal Resource. It is unclear whether the reported 25,000 acre-feet-per-year (~8 billion gallons) of water reported to exist on the PBR is all warm, briny geofluid or some combination of geofluid and groundwater. During one site walk in December 2012, several miles off State Highway 371 on the west side of the Project area, a hydrothermal outflow was observed at the surface from a well of approximately 8” bore, with a malfunctioning cap, estimated at less than 100 degrees Fahrenheit (°F) and

a flow rate of 50 to 100 gallons per minute. See Figure 2-10 below. These have now been have been located on overhead imagery. It should be emphasized that but for this malfunctioning well, the surface manifestation might not exist. The geofluid was briny and obviously non-potable by odor (a taste test was not attempted since the temperature was insufficient to kill possible pathogens). The geofluid contained high dissolved solids, enough to form a thick crunchy white crust several inches thick on the otherwise rather soft soil. The geofluid outflow had formed a small lake roughly 100 feet across, and was said by residents to have been running for decades. Navajo guides attending the December 2012 site walk indicate that several such outflows exist. However, even several such wells flowing constantly would only produce a few percent—several hundred million gallons per year—of the reported ~8 billion gallon per year productive capacity of the aquifer. They are not viable for utility-scale applications either in terms of flow rate or temperature.

Figure 2-10. Geothermal Surface Manifestations: Warm Springs and Salt Flats

Source: Google Earth Pro

2.1.2.3 Wind Energy Resource on the PBR

Wind Energy. Figure 2-11 shows wind energy for the U.S. and Figure 2-12 shows the wind energy in New Mexico. Less than 1% of the Project Area contains any wind resources at all, and these are only rated "Marginal" (Class 2) by NREL, a mere 12 to 14 miles per hour (mph), principally along ridgelines. See Figure 1-14 below. In fact, none of the Marginal wind resource areas corresponds to any Settlement Act lands. Only one slightly windy ridgeline is even inside the BPR boundary. It is approximately 2 miles long, runs diagonally southwest-northeast across Section 34 in Township 23 North, Range 12 West, paralleling but not accessed by Indian Service (IS) Route 7650. This ridge is located about 3 miles northwest of Black Lake, and is separated by several miles in any direction from any parcel suitable for solar; therefore, shadow interference from the pylons would not be a problem. However, the ridge is also over a mile from any load-bearing road or track, therefore exploiting even this minimal resource would require construction of a dedicated road. In any case, the issue of development cost is moot, since this particular section of land does not fall under the scope of the NHLSA. Due to the absence of suitable wind energy resource, wind power generation is thus excluded from further consideration.

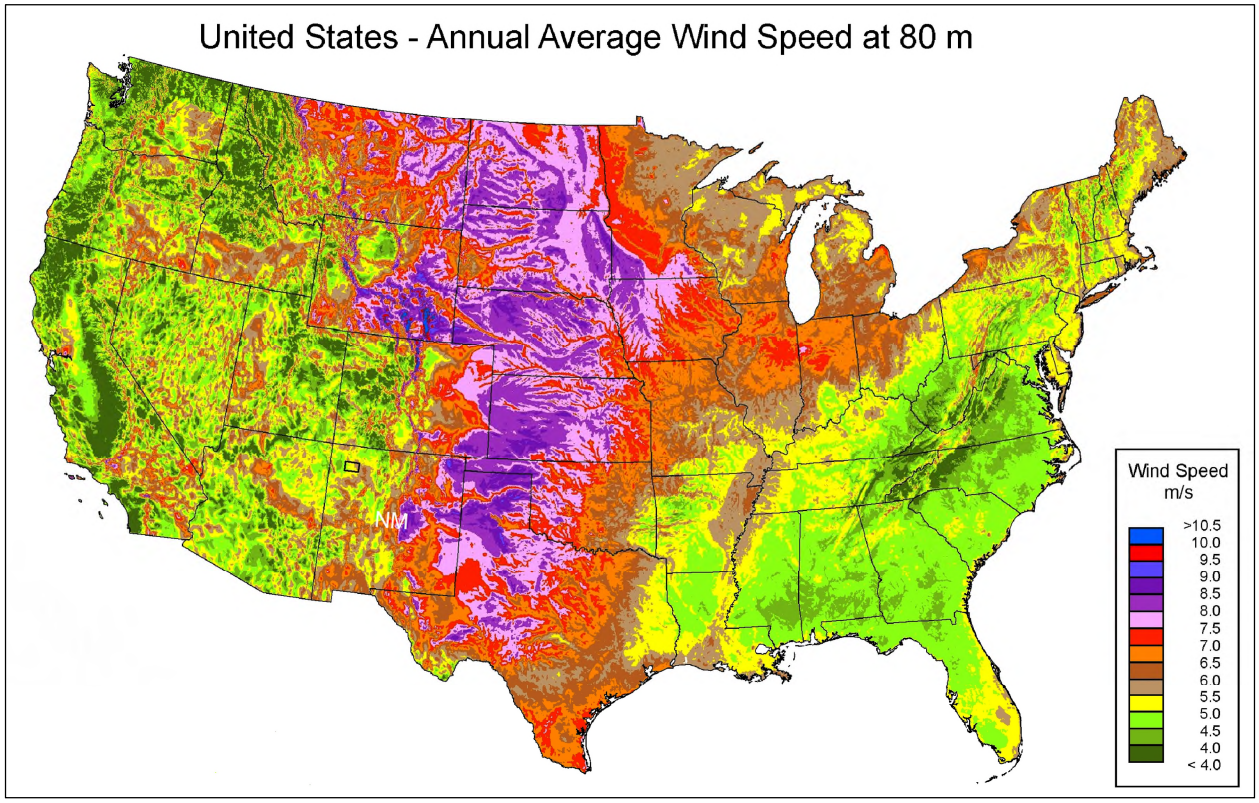


Figure 2-11. Wind Resource in the Continental US

Note: Project Area shown by small black rectangle. 80 m is meters above ground surface. Source: Public domain (NREL, 2007).

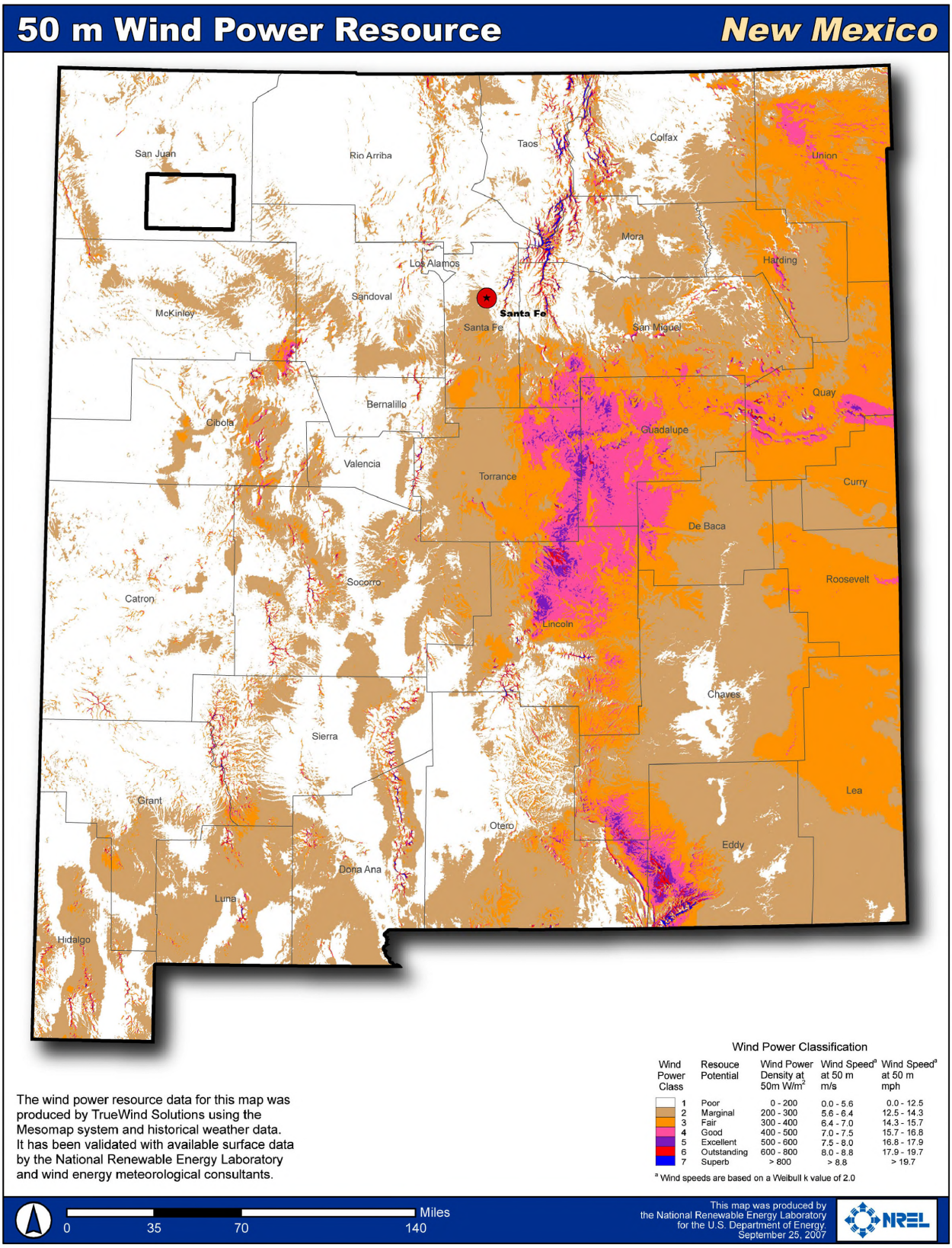


Figure 2-12. Wind Resource in New Mexico According to NREL, 2007

Note: Project Area shown at upper left by small black rectangle. Source: Public domain, (NREL, 2007).

2.1.2.4 Biomass Resource on the PBR

Biopower and bioenergy are not applicable due to complete lack of biomass in economically viable concentrations and economically sustainable growing rates in the Project Site. Biomass formation depends on sun but even more on water. Two simple charts, for annual rainfall (Figure 2 13) and biomass (Figure 2-14), illustrate the situation in this parched spot, among the driest in the U.S.

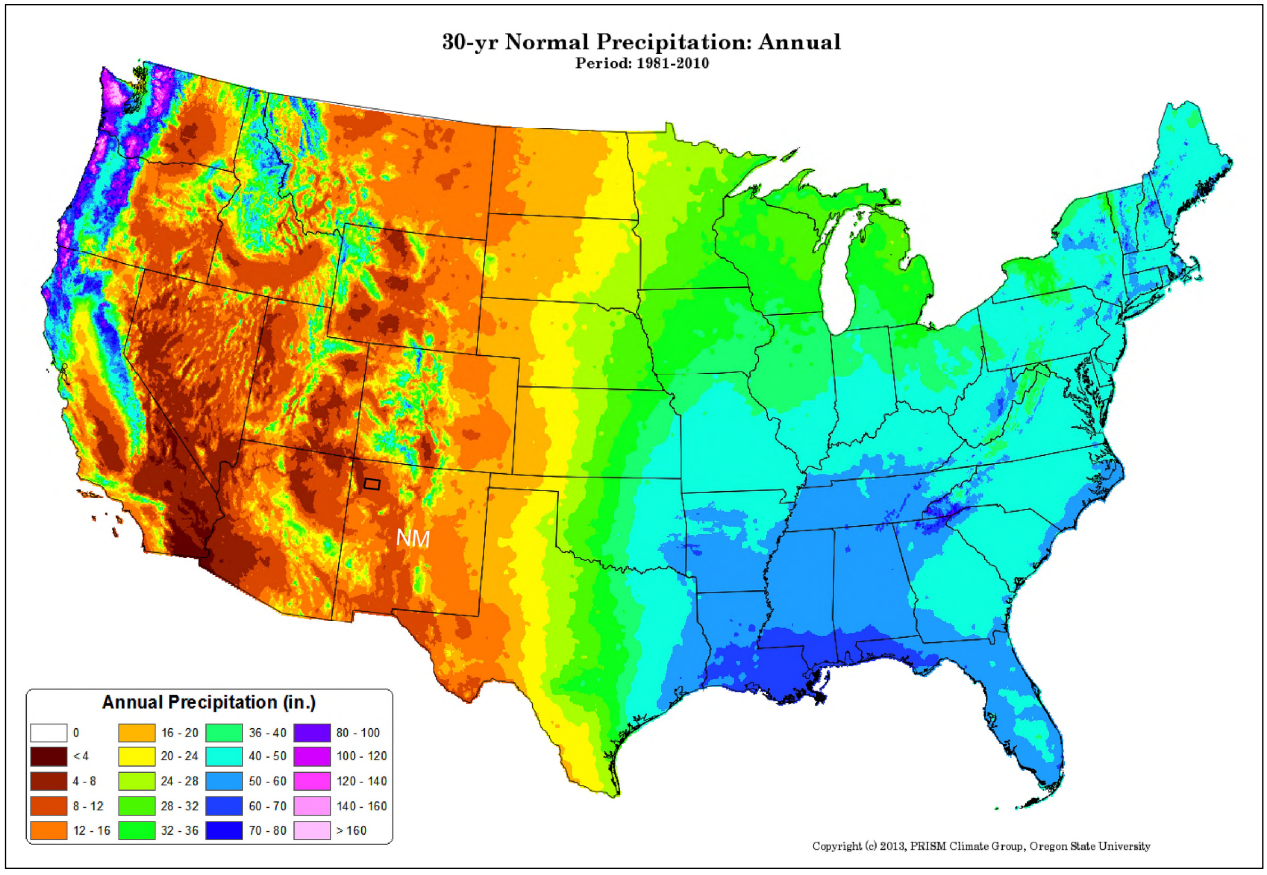


Figure 2-13. Approximate Average Rainfall Distribution in the Lower 48 U.S. States, 1981-2000

Source: Public domain, (Oregon Climate Service). Note: Project Area indicated by small black rectangle.

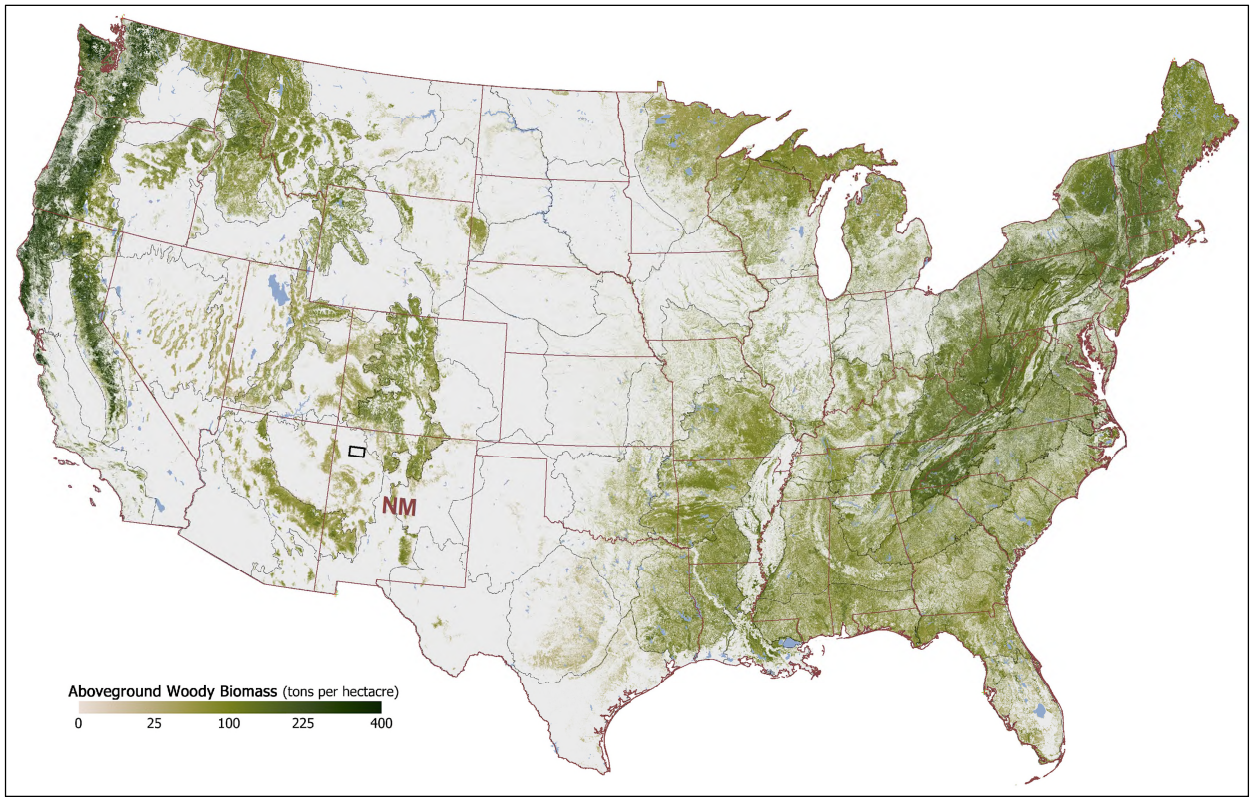


Figure 2-14. Biomass Formation in CONUS

Source: NASA 2011. Note: Dark green denotes maximum rate of formation; gray/brown minimum rate. Project Area shown by small black rectangle.

What Comes Next. In the next section, 2.2, the technology to harvest those renewable energy resources which passed the initial screening will be discussed. As will be seen, only solar technology, in particular fixed photovoltaic panels at summer bias, was eventually deemed to be a viable cost-effective way to convert the available renewable energy resource into electricity.

2.2 Renewable Power-Generating Technology Analysis

Within the 22,000-acre PBR, two basic types of **solar power generation** were thoroughly evaluated: fixed flat-plate photovoltaic (PV), as well as tracking PV and solar-thermal (which also means tracking). Of these, only the first, *fixed-flat-plate at summer bias*, was selected as technically and economically viable for a utility-scale project on the PBR. Three types of **geothermal energy** were also evaluated: deep and shallow geothermal electric power generation (various cycles), geothermal direct-use-heating, and geoexchange heating with ground-source heat pumps (GSHP). None of the geothermal technologies were selected, either due to too great a depth to exploit with current technology, lack of sufficient temperature for efficient electricity generation, or high salinity, or lack of potential off-takers of the thermal resource, or prevailing low prices for electricity. **Wind power** has been effectively eliminated in subsection 2.1.2.3 above, while **Biomass** was eliminated from further consideration in subsection 2.1.2.4.

2.2.1 Solar Power Generating Technologies

As stated in section 2.1.2 and above, solar is the strongest renewable energy option for the PBR. Various technologies for transforming solar energy into electricity are discussed in detail in this section.

2.2.1.1 Photovoltaic Generation

As solar is the best renewable energy resource suited to this location over the long term, photovoltaic (PV) is the best of the solar technologies. Figure 2-15 illustrates why this is true: "Swanson's Law" is conceptually similar to the much more famous Moore's Law (which governs the relationship between the growth on power and cost of integrated circuits). The behavior of the cost vs. time curve for PV modules is in a class by itself compared to any other power generation technology today. Most of this dramatic cost reduction is due to economies of scale and benefits of a strong learning curve as worldwide manufacturing capacity ramps up. Per-watt cost drops by about 20% for each doubling ("octave") of total manufacturing capacity, which is presently occurring every 20 months. In addition, the basic PV conversion efficiency of sunlight to electricity for both crystalline silicon and thin-film materials is improving by about 1% absolute (i.e., 100 basis points) per year. As of this writing (June 2015), commercial modules can be purchased in bulk quantity (utility-scale procurements) for a little over 60 cents per watt. Finally, the cost of inverters (which convert the DC output to AC electricity for the grid) is dropping dramatically, again as industry scales up and as inverters are bundled with or mounted on "plug and play" panels.

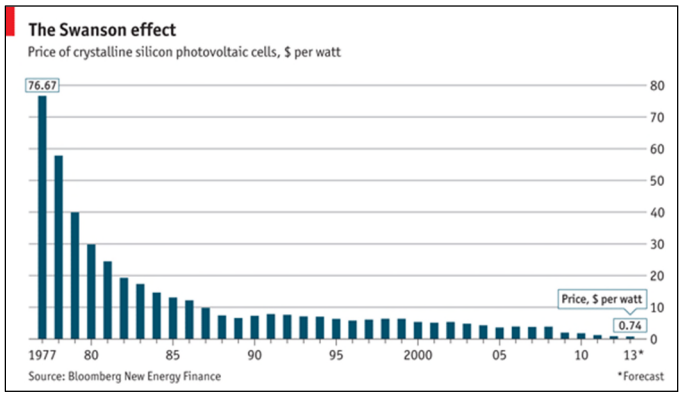


Figure 2-15. Swanson's Law

Source: The Economist, 28 Dec 2012.

As PV becomes off-the-shelf mainstream technology, the "soft costs" (financing, professional services, permitting) are expected to keep declining by 85% from now through 2030. Barring some revolution in dexterous robotics, on site assembly labor (which does not scale) and "balance of plant" (abbreviated BoP,

means everything else, e.g., land, site work, switchgear, inverters, transformers, racking) are expected to comprise an increasing share of the PV cost partition. As of this writing (June 2015), BoP without electrical hardware is 30 cents per watt. While utility-scale projects will always enjoy their economy of scale over smaller commercial and residential projects, estimated by Tetra Tech to be -10% per order-of-magnitude in project size, Tetra Tech does not have a technological roadmap for the "all-in" cost of a solar power plant to fall much below $1.00 per watt by 2030.

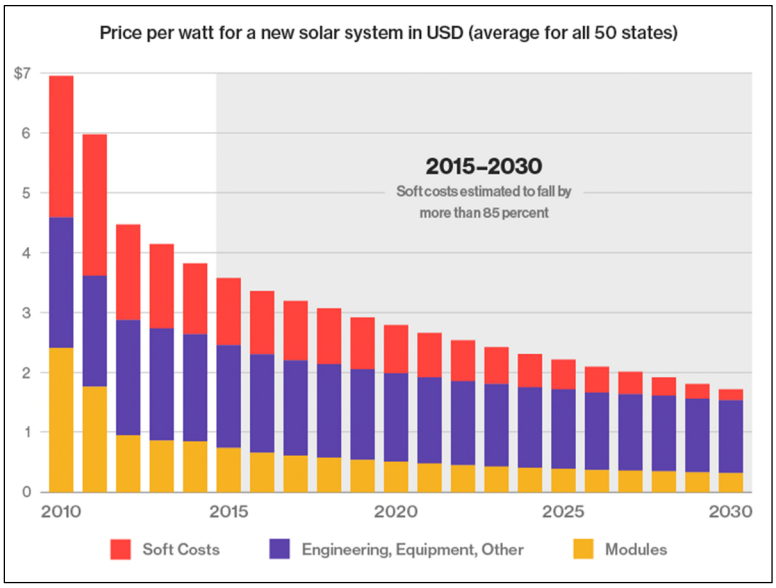


Figure 2-16. Forecast PV Cost Partition (50-US-state average price-per-watt)

Source: Bloomberg New Energy Finance, 25 Feb 2015.

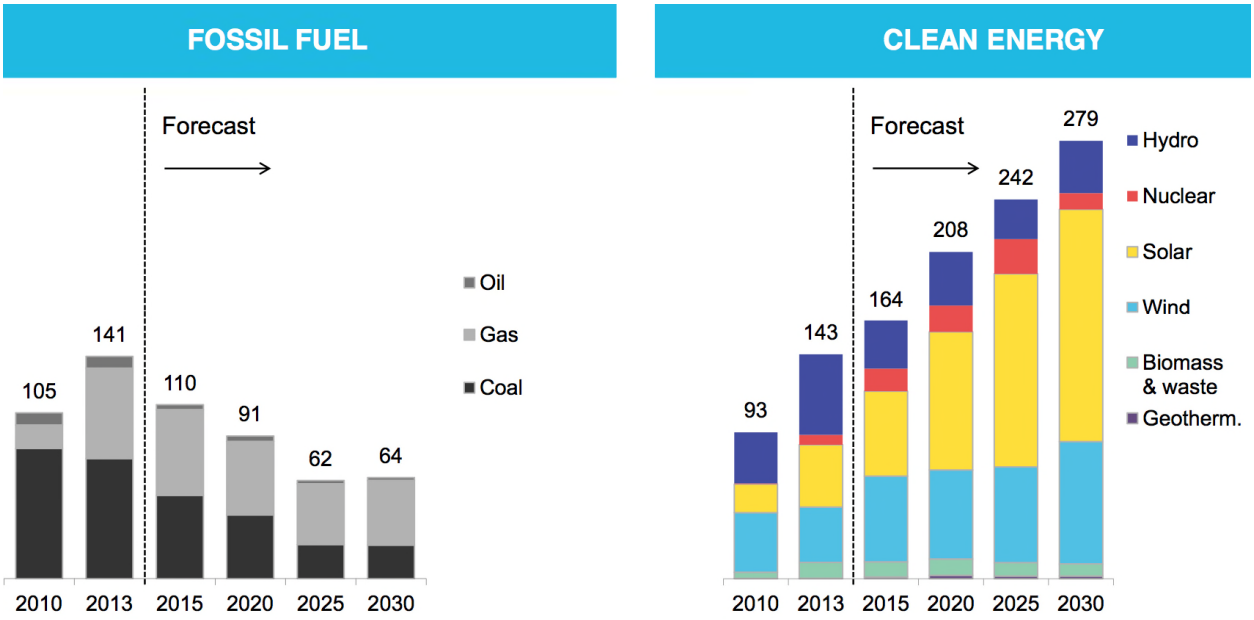


Figure 2-17. By 2030, solar will dominate global capacity additions at expense of fossil-fired power.

Source: Bloomberg New Energy Finance, 25 Feb 2015.

It is worth mentioning that, unlike a traditional thermal method to generate electricity, the water signature per kilowatt hour (kWh) of PV is virtually zero, an important benefit in the parched Southwest. Furthermore, while gigawatt-class nuclear-fired or coal-fired power stations both occupy about one square mile of ground,

the additional annual land consumption of the nuke is virtually zero, whereas keeping them supplied with fuel despoils about one square mile of land per year for *each* coal-fired plant.

- *Fixed flat plate PV* is by far the most likely to be cost-competitive with all other renewable electricity generating technologies, not to mention other solar technologies, given current price trends. Thanks to the completely unintended consequence of generous European FiTs, which in turn stimulated the creation of a gigantic PV production capacity in China, fixed flat-plate PV is on track to achieve grid parity before 2020, at which point subsidies (such as investment tax credit or production tax credits) would theoretically not be necessary.
- *Summer bias is better than winter bias.* See Figure 2-18 below. A panel inclined at latitude minus axial tilt is nearly flat (36.3°N minus 23.5° = 12.8°) thus it can be separated from its neighbor by as little as 6% of the panel width, yet still avoid shading that neighboring panel at local noon. Self-shading of one panel by another greatly impairs generating efficiency and can cause more harm to the system than one might expect. Therefore, it must be strictly avoided by proper design. However, some shading at sunup and sundown when the sun is low on the horizon would be unavoidable with such close spacing. About half a panel width of separation is required to avoid self-shading at latitude tilt (36.3°). For wintertime bias at the PBR's latitude, panels would have to be titled quite steeply, about 60 degrees above horizontal, which in turn would call for at least one-and-a-half-panel separation. Summertime bias uses the land much more efficiently than wintertime bias, and is better matched to peak demand in the Southwest, which is in the summer, not winter. Moreover, the two seasons of change, spring and fall, typically have the lowest demand on the grid due to their mild character. Nevertheless, some spacing must still be provided for maintenance, therefore Tetra Tech has provided a space-efficient configuration for a summertime-biased power block.

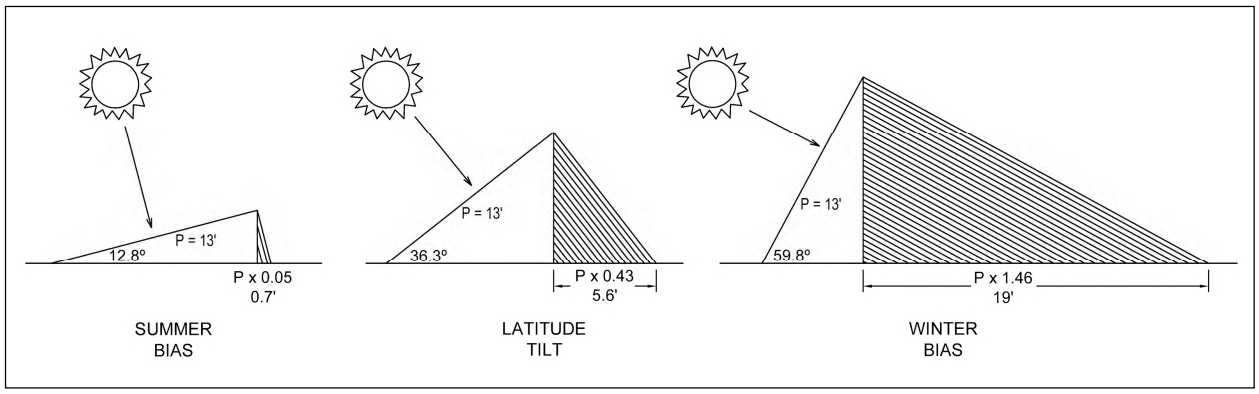


Figure 2-18. Illustration of summertime versus wintertime bias on land use

Source: Tetra Tech.

- *Tracking and/or concentrating PV* is no longer cost-competitive with fixed-flat-plate PV in electricity markets in the developed world. Tracking the sun increases the amount of time that a system works during the day ("capacity factor") from about 18% to about 26%, a 40% relative improvement. However, the extra hardware add more than 40% to the Capex. In addition, the extra complexity and parts count increases maintenance cost, spare parts inventory, and the chance for failure. Already a number of utility-scale PV projects in the Southwest, originally permitted for tracking PV technology, have been converted to fixed flat-plate PV projects due to increasing marginal disadvantage at the typically low land values at utility-scale sites. Tetra Tech has witnessed a prototype of state-of-the-art low-cost tracking/concentrating PV technology in the 10-kilowatt (kW) size range per individual station, and a cost premium for the tracking of $1 per watt, which represents +40% to +100% depending on the scale of the system. Furthermore, this technology is still years away from mass market. Therefore, the marginal benefit of tracking does not justify the marginal cost in a mature competitive electricity market in the developed world.

2.2.1.2 Electricity Generation with Solar Thermal Technologies

Virtually all solar-thermal-electric systems rely on tracking, and thus suffer from the same economic and operational disadvantages described above relative to fixed flat-plate PV. The 25,000 acre-feet-per-year of warm, briny groundwater said to exist on the PBR might be utilized for cooling various thermal power processes, including solar thermal (ST). However the brine that was observed during site reconnaissance in December 2012 would need considerable perhaps expensive treatment (filtering, desalination) before it could be used for this purpose.

Certain proprietary non-imaging parabolic trough technology, which Tetra Tech is supporting, could be applicable and may be available and cost-competitive within 2 years (delivering heat to the end-user at $4 per million British thermal units), especially if combined with water purification. On-site freshwater would be valuable for cleaning large arrays of flat-plate PV or parabolic mirrors modules, maintaining collector efficiency in avoiding the expense of trucking in water. This technology should be reviewed again in 2017.

Traditional parabolic troughs (Figure 2-19) at $4.50 to $6.50 per rated watt, even with +8 hours of thermal storage, will not be cost-competitive with the expected cost of flat-plate PV, about $1.50-2.50 per rated watt (and falling) at utility scale, due to the likely lack of sufficient incentives in New Mexico by the time a new trough project would come online. (See Sections 2 and 3 of this report.) It is true that the largest trough installations in California do compete in that power market at a levelized cost of 10 to 12 cents per kWh, but only because of generous incentives prevailing in California, plus the fact that the capital assets of the biggest plants (Solar Energy Generating Station [SEGS] I through IX at Kramer Junction/Harper Lake) were acquired by the current operator for pennies on the dollar during the previous owner's bankruptcy.

Figure 2-19. Concentrating Solar Thermal Power: 80-MW Solar Energy Generating Station (SEGS-IX) in Kramer Junction/Harper Lake, California

Source: Public domain (Ultra Systems, 2014).

Power towers (Figure 2-20) at $6.00 to $10.00 per rated watt, even with +8 hours of thermal storage, will not be cost-competitive with the expected cost of flat-plate PV (about $1.50-2.50 per rated watt and still falling at utility scale), due to the likely lack of sufficient incentives in New Mexico by the time a new power tower project would come online, which could be over 5 years from time of application.

Figure 2-20. Concentrating Solar Thermal Power: The Just Commissioned (Feb 2014) Solar-Thermal Power Towers at Ivanpah, California, 392-MW Total Capacity

Source: Public domain (www.ecoticias.us, 2014).

Two-axis tracking systems such as Stirling dishes (Figure 2-21), at an estimated $6.50 to $9.50 per rated watt without storage, are certainly not cost-competitive now, with PV or any other generating technology, and will be even less competitive in the future. The capital expense equates to a levelized cost in excess of 30 cents per kWh.

Figure 2-21. Concentrating Solar Thermal Power in Mojave, California: 10m-diameter 2-axis Tracking Dish with Stirling Engine at Focal Point

Source: Public domain (North American Renewable Energy Directory, 2014)

2.2.2 Geopower (Electricity Generation) and Geothermal Heat Technologies

Unlike most forms of solar power, or intermittent wind power, which are only good for meeting peak demands absent cheap effective electricity storage, electricity from geothermal plants can meet true baseload demand.

2.2.2.1 Major Types of Geopower

Electricity generation from hydrothermal resource via dry steam, flash steam, binary processes is not feasible at any scale on the PBR due to the lack of sufficient temperature (must be over 350°F) in the hydrothermal water which was observed, as well as lack of sufficient flow (must be thousands of gallons per minute [GPM] at utility-scale). It may be that a drilling program would reveal much hotter hydrothermal resources at depth. This investigation would require drilling an exploratory well(s). A "thermal gradient well" several km deep would cost about US$1M, and "slim hole" would cost as much as $3M, and a full-size "geothermal exploration well" (which can be converted into a full production well) would cost at least $5M. These are all far beyond the scope of this study and such a geothermal exploration program would require several years to execute.

Electricity generation from a low-temperature or very-low-temperature hydrothermal resource via advanced geothermal cycles such as organic Rankine cycle (ORC) or the Kalina cycle might be barely achievable in a technical sense but likely not economically feasible because of low reservoir temperature, very low conversion efficiency, likely high parasitic load consuming all the output, strong diseconomy of scale in small commercial-sized systems, low prevailing electricity prices from traditional sources, lack of guaranteed offtakers, and insufficient local incentives.

As noted in Figure 2-9 in subsection 2.1.2.2 above, the distribution of deep geothermal heat across the PBR is uniform, therefore geothermal production wells have no favored location and could be drilled anywhere in the Project Vicinity without conflicting with other activities. However, there is much more to developing geothermal energy than just the surface heat flux, which is only a general indicator of a resource. Geopower (electricity from geothermal energy) is as critically sensitive to location as hydroelectric dams are, and is absolutely reliant on an accurate conceptual hydrogeologic model and thorough understanding of subsurface conditions. For successful development at utility-scale, the hydrothermal resource must be verified with a proper geothermal exploration program. About a third of the total project cost, and most of the financial risk, is up front at the exploration and drilling phase, as shown on Figure 2-22. Also, compared to solar power which has lots of "headroom", geothermal energy has the slowest rate of technological progress over the past few decades. Therefore, in comparison to solar electricity at utility scale, geopower is far more uncertain on the PBR.

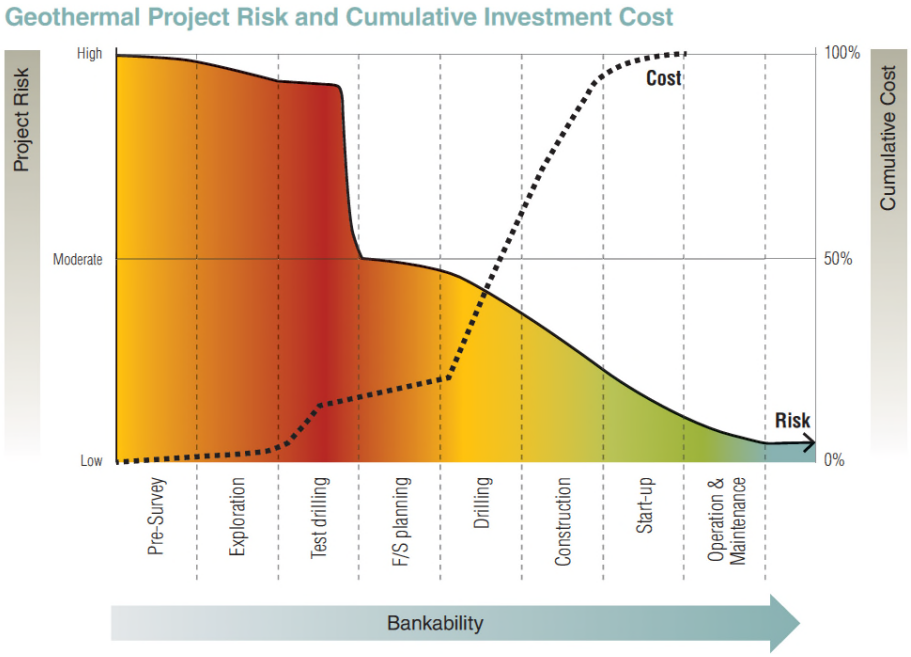


Figure 2-22. Typical Geothermal Project Profile Illustrating Risk and Cumulative Investment/Completion over Project Timeline

Source: Executive Summary of Handbook on Planning and Financing Geothermal Power Generation (2012), Energy Sector Management Assistance Program (ESMAP), World Bank.

2.2.2.2 Direct Use District Heating

It is unclear whether the reported 25,000 acre-feet-per-year (~8 billion gallons) of water said to exist on the PBR is all warm, briny geofluid or some combination of geofluid and groundwater. It is again emphasized that but for this malfunctioning well now located on overhead imagery (Figure 2-10) and described in subsection 2.1.2.2 above, the surface manifestation of a warm shallow geothermal resource might not exist. The geofluid was briny and obviously non-potable by odor (a taste test was not attempted since the temperature was insufficient to kill possible pathogens). The geofluid contained high dissolved solids, enough to form a thick crunchy white crust several inches thick on the otherwise rather soft soil. However, even several such wells, each flowing constantly at 50 to 100 gallons per minute, would only produce a few percent—several hundred million gallons per year—of the reported ~8 billion gallon per year productive capacity of the aquifer. This is not enough for utility-scale applications either in terms of flow rate or temperature.

Given the remoteness of these possible geothermal wells from any significant commercial or resident facilities and the low density of facilities, it is unlikely that the warm/hot water could be transported in an economical and useful manner. Hydronic pipelines typically cost hundreds of thousands of dollars per thermal megawatt per mile. (Steam pipelines cost even more, but cannot exist in this case.) It is possible that the 25,000 acre-feet of warm, briny groundwater could be put to use for space-heating facilities in the wintertime, hence "direct use." Any such application would have to be localized—the relatively mild temperature of the geofluid makes it unlikely to be worth transporting any long distance via pipeline as a heat source. Moreover, its briny quality and high dissolved solids would cause severe maintenance issues in all but the simplest distribution systems. Since the locations of all hydrothermal wells reported to exist have not been determined at this point and have not been geo-referenced with respect to the solar ranches described in the next section, direct-use geothermal heat will not be explored further in this report.

2.2.2.3 Geoexchange Heating and Cooling *via* Ground-Source Heat Pump

Compared to the simplicity of direct-use, space heating of isolated facilities in the wintertime with Ground-Source Heat Pump (GSHP) might not be cost-effective, given the additional capital expense of the heat pumps and heat exchangers, even with the low local cost of the electricity input for the motors. The warm/hot is unlikely to be worth transporting via pipeline as a heat source even after boosting its temperature with GSHP.

2.2.3 Wind Power and Biopower Already Ruled Out

Due to lack of a reliable wind, and the near complete absence of standing biomass or biomass formation, any discussion of power generation technologies based on these resources would be moot.

What Comes Next. In the next sections (2.3 and 2.4), the lands are screened for their suitability for hosting the selected solar power generating technology, and subdivided into developable groups.

2.3 Availability and Sustainability of the Renewable Energy Resource(s)

Sunlight is the only resource on the PBR that is both sufficiently available for economical electricity generation, and is sustainable in the sense that it will never run out, unlike the briny warm groundwater perhaps. Wind energy is not available in any economic quantity, period. While it might be possible to cultivate biofuel crops on this large area of light soil, the soil is light, highly erodible, and poor. Natural rainfall is utterly insufficient for commercial cultivation. The amount of fossil water that would have to be pumped from aquifers to irrigate such crops would be totally unsustainable. Therefore, as discussed above, solar is the renewable energy resource best suited to the PBR location, and non-tracking PV is the most suitable solar technology because the marginal cost:benefit of tracking is not justifiable. This finding in turn imposed a number of constraints for screening land within the PBR for this purpose, as described in detail in Section 2.1 above.

2.4 Renewable Energy Resource Quantified with Site-specific Resource Assessments

Sunlight is highly abundant on the PBR, amounting to 6-7 equivalent full-sun-hours per day, more than enough basis for year-round economic power generation. With the exception of a few steep and/or very rough areas that are unsuitable for solar ranches anyway, the distribution of solar power is virtually uniform across the PBR: ~7 kWh_t per square meter per day. See Figures 2-5, -6, -7 above. The distribution of deep geothermal energy is also uniform across the PBR, which means there is no particular hot spot to shoot for. However, the deep geothermal resource is too deep (~6 km) to develop economically with current technology, while the shallow hydrothermal resource (up to 25,000 acre-feet per year of warm briny pressurized groundwater) is not hot enough for power generation. Therefore, solar energy is the only form of RE which was quantified in this Feasibility Study. The contents of Table 2-1 are repeated here in Table 2-2 for the reader's convenience, but technical features of the solar ranches added in the last column.

Table 2-2. Summary of Solar Sites (repeat of Table 2-1)

Group Name	Site #	Devel-opable Acres	Power [MWe] latitude tilt *summer bias*	Access	Development Potential and Status
BISTI CORNERSTONE	1	1,321	207 ***290***	grid YES paved road YES	• Very high priority, goes 1st • Non-Settlement, but still Tribal
"the Wedge"	1A	333	36 ***50***	grid NO paved road YES	• Alternate to 1st if 1st not available • Settlement, Selected & Conveyed
"DOG-EYE SOLAR RANCH"	2	612	94 ***131***	grid NO paved road YES	• High, goes 2nd • Settlement, Selected & Conveyed
TANNER LAKE/COAL CREEK	3	3,161	456 ***638***	grid NO paved road NO	• Moderate, goes 3rd • Settlement, Selected & Conveyed
SPLIT LIP FLATS/BLACK LAKE	4	4,205	694 ***972***	grid NO paved road NO	• Medium-low, goes last • Settlement, Selected & Conveyed
TOTAL ALL SITES		9,632	1,487 ***2,081***		

2.4.1.1 Site 1-The "Paragon-Bisti Cornerstone" and Site 1A Alternate "The Wedge"

Site 1 (Figures 2-23 and 2-24) would be the cornerstone or "anchor tenant" of the entire renewable energy program at the PBR. The red color denotes that it is the only site not under the direct control of the NHLCO and outside of the NHLSA boundary. Nevertheless, because of its near-perfect attributes for solar development it is the best place to start, as will be seen. The land for this site is under Navajo control, part of the Eastern Chapter and currently designated for grazing. This concept has been elevated through the NHLCO to the NHLCO oversight committee. This Site's characteristics and potential issues are discussed below.

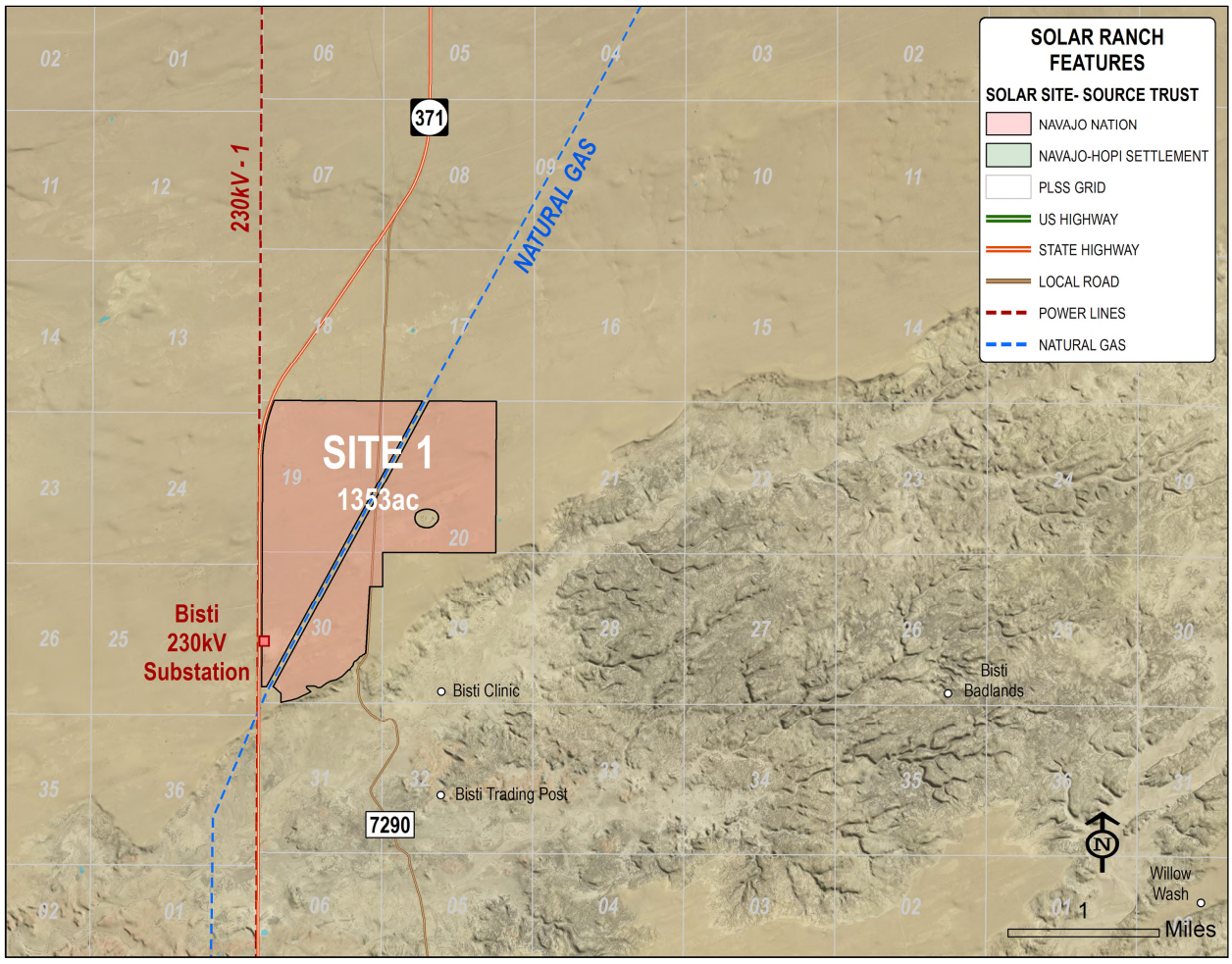


Figure 2-23. Site 1 Plan View, 1321 Developable Acres (with 290 MW solar power potential)

Source: Tetra Tech. For context, see Study Area Map on page 2-10. For detail, see full-size layouts starting on page 2-54.

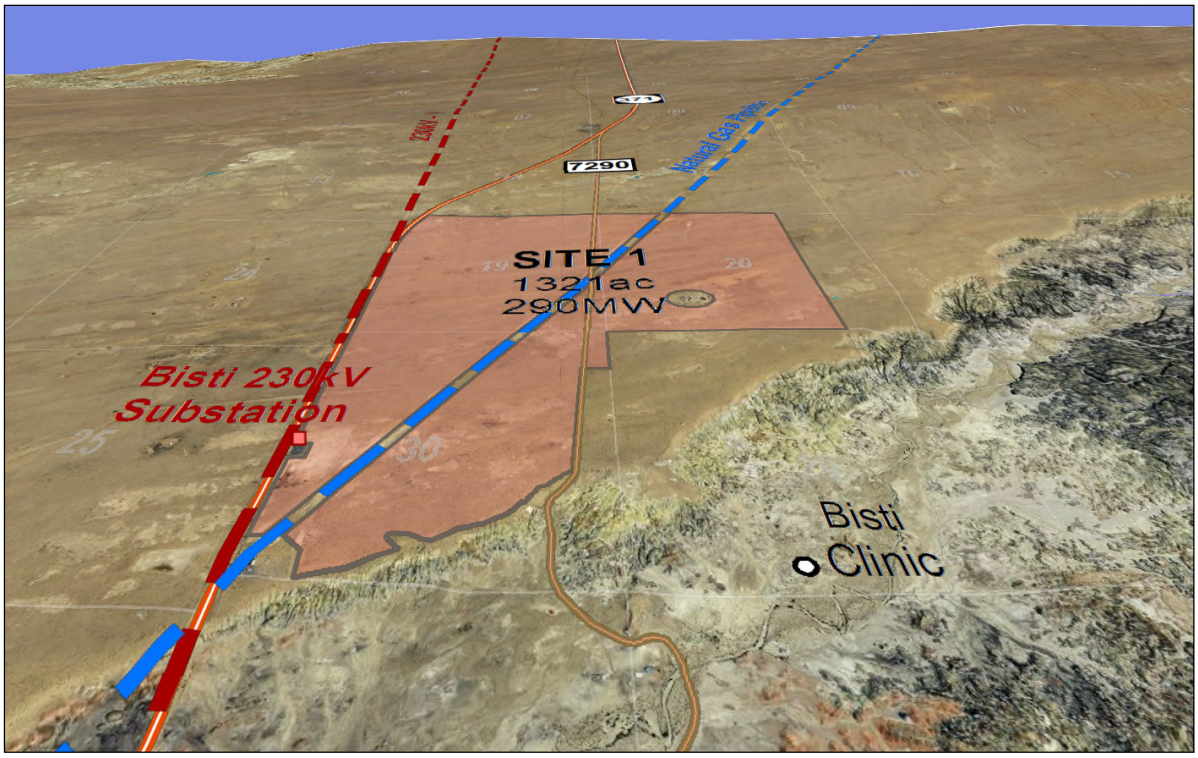


Figure 2-24. Perspective View of Site 1 during computer flyover

Source: Tetra Tech, data fusion with ArcGIS Explorer.

- **Location and Attributes**. Sections 19, 20, and 30, in Township 24 North, Range 13 West, on the mesa overlooking the badlands to the south, contain almost three square miles of very flat land, as well as both the Bisti substation and a compressor station for natural gas pipelines. The right of way for the buried pipelines was assumed to be 50 feet wide for the purpose of calculating the site area, which removes less than a dozen acres from development. The fenced footprint of the substation, compressor station, as well as an industrial area in the middle were cordoned off, leaving a net 1321 acres for solar development. Investigation of the natural gas networks in this area has revealed the presence of at least seven natural gas pipelines clustered around the single path illustrated on Figures 2-23 and 2-24, as well as a natural gas liquids pipeline. There has also proven to be a crude oil pipeline running approximately parallel to the illustrated pipeline run. The crude oil pipeline lies slightly to the east of the tightly-clustered natural gas pipelines lines and will further reduce the net area of Site 1 slightly once its boundaries are revised to respect the associated right of way. Presently Sections 19, 20, and the upper half of Section 30 are Navajo Trust lands used for grazing. The southern half of Section 30 is BLM leased land, which may be available for a land swap. Sections immediately to the east are off-limits to developers with a "Federal Protected" boundary. Developing all of Section 30 by itself would fill up the 150 MW available capacity on the existing line. Sections 19 and 20 would be the most convenient for expansion of the cornerstone solar ranch to potentially 290 MW at the least cost.

- **Access.**
  - *Transmission grid*. A solar ranch at Site 1 would surround the substation, which is almost perfectly matched to the Section 30's potential output, while the 230-kilovolt (kV) Bisti to Ambrosia power line has spare capacity to deliver about 150 MW of power to offtakers.
  - *Road network*. Sections 19, 20, and 30 are sandwiched between two paved roads, State Highway 371 on the west and IS Route 7290 going thru the middle. IS Route 7290 continues southward and serves Site 3 before reconnecting with the paved Highway 371. Therefore, it is

likely that IS Route 7290 would be upgraded to a fully paved road in the course of full development of the PBR solar complex.

- **Advantages**. The oversized Bisti substation provides the all-important point of connection to the public grid. Since the sole purpose of the substation is to power the pipeline compressor, it has approximately 150 megavolt-amperes (MVA, physical units equal to watts) of spare capacity. There appears to be the same amount of spare capacity on the 230-kV power line along the road. Multiple road access for construction could not be closer, and leveraging the pre-existing Bisti substation and Bisti to Ambrosia power line to their design capacity avoids millions of dollar of capital that would normally be expended on these necessary major items. This is an ideal place to begin the PBR project. No part of Site 1 is more than two miles from the substation, which minimizes the cost of internal feeder lines.
- **Issues**. The upper half of Section 30 is color-coded as "Navajo Nation Trust" on the NN's maps (both v.29Feb2000 and v.09Aug2011). The lower half of this section is coded as "BLM Leased" land on the same map. It is assumed that the Bureau of Land Management (BLM) might be inclined to do a simple land swap to make such a deal work, since a solar land auction held in late 2013 did not attract any developers, causing BLM to rethink its approach to date. PNM's grid-tie policies are discussed in Section 3 and apply to all possible renewable energy projects in the State of New Mexico, not just Site 1.

Alternate to Site 1

Site 1A pictured in Figure 2-25 below is the alternative to the preferred Site 1. Unlike Site 1 which is under the control of the ELC, the smaller Site 1A is under control of the NHLCO.

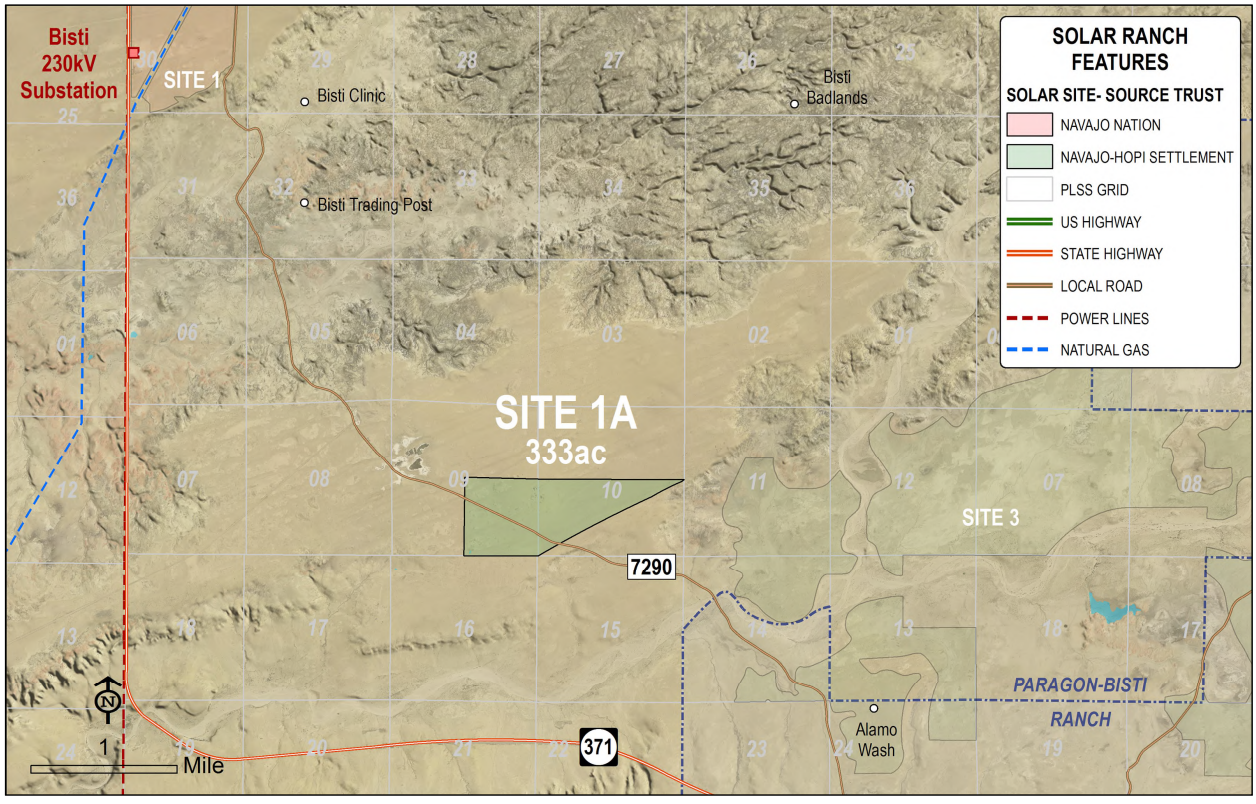


Figure 2-25. Plan View of Alternate Site 1A, about 333 Developable Acres, 50 MW potential

Source: Tetra Tech. For context, see Study Area Map on page 2-10. For detail, see full-size layouts starting on page 2-54.

- **Location and Attributes**. This wedge-shaped alternative to Site 1 is on Route 7290 about 5 road miles southeast of Site 1. It straddles Sections 9 and 10 of Township 23 North, Range 13 West. It is about 1.5 miles wide by ½ mile high and, after screening out steep slopes, water courses, drainage features, and rough ground, a net 333 acres suitable for solar development remains. However, an active ranching operation exists which is served by a number of tracks off Route 7290. Excluding these also from development leaves a mere 50 MW of solar potential, as shown in Figure 2-25.
- **Access.**
  - *Transmission grid*. Neither a substation nor a transmission line exist at Site 1A. A power line would have to extend about 5 miles along Route 7290 to connect with the existing 230-kV north-south Bisti to Ambrosia line, the likeliest link-up. Given the relatively small amount of generation (50 MW), even a 69-kV line should be sufficient to carry that much power to a step-up transformer at the substation. Such a line might cost about $100,000 per mile, exclusive of substations and switchgear. During the field reconnaissance, Tetra Tech noted that other distribution lines of lesser but unknown voltage run parallel to both the 230-kV line and Highway 371 for several miles. Therefore a direct connection to the distribution system may be possible, given the modest amount of power.
  - *Road network*. The Wedge is served by IS Route 7290, which cuts directly across it on the long axis. (IS Route 7290 also serves Site 1 to the northwest.) IS Routes in this part of the PBR are graded and graveled, but generally not paved. About 2.5 miles of ISR7290 cuts across the badlands, hence might have to be upgraded for a year-round, all-weather level-of-service. The scope and cost of such an upgrade has not been estimated.
- **Advantages**. Site 1A is not large; in fact, it is the smallest of all the sites. Its prime advantage is indicated by its green color—meaning that it is Selected and Conveyed therefore unambiguously under the control of the NHLCO. Nevertheless, it is large enough and its advantages of flatness, serviceable road access, and extensibility of the transmission grid at modest cost serve to make "The Wedge" a reasonable alternative for development should Site 1 prove to be unavailable. Site 1A could also be a viable link in the chain of extending infrastructure further east to connect the three bigger sites east to the grid.
- **Issues**. Proximity to an operating or intermittent ranch operation could present conflict, but none is expected.

2.4.1.2 Site 2-Dog Eye Pond Group

Site 2 is a single flat "section" of land (1 square mile) - Section 31 in Township 23 North, Range 12 West that straddles Highway 371 about half a mile east of Dog Eye Pond, and 13 road miles southeast of Site 1 (Figure 2-26). Although the so-called "Dog Eye Solar Ranch" (if the solar ranches are ultimately named after pre-existing local features) is about twice as far from Site 1 as the crow flies, Site 2's location on a paved State highway with existing rights-of-way (ROW) for extension of transmission lines makes it the next logical step in the timeline of the PBR development after Site 1 is fully built out.

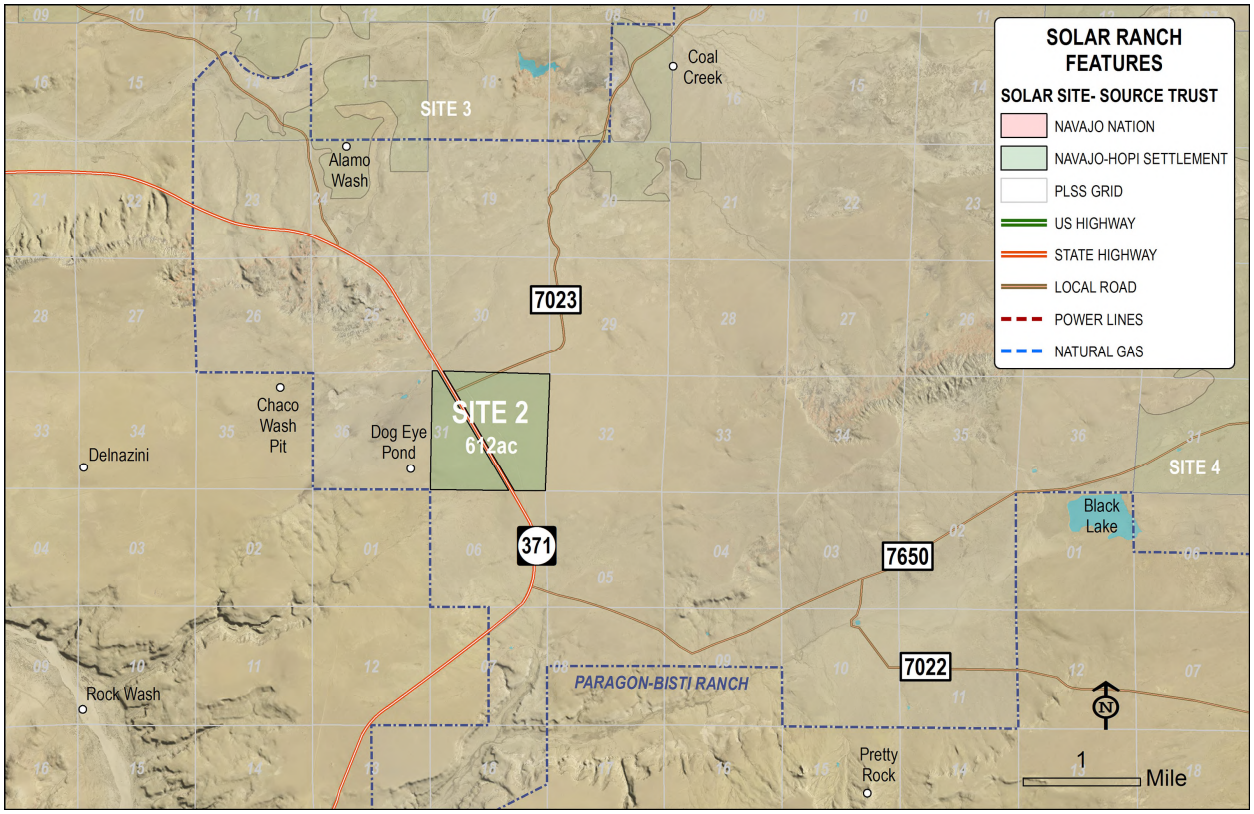


Figure 2-26. Site 2, Plan View, 612 Developable Acres, 131 MW Potential

Source: Tetra Tech. For context, see Study Area Map on page 2-10. For detail, see full-size layouts starting on page 2-54.

- **Location and Attributes**. Site 2 consists only of Section 31, in Township 23 North, Range 12 West, inside the boundary of the PBR. Similar the latter two sites, this land, color-coded green, is already "Selected & Conveyed" to the Navajo Nation, per the February 2000 NHLCO map. After the screening process described above, and excluding the ROW of Highway 371 indicated by visible fence lines, most of the square mile remains, translating into 612 developable acres.

- **Access.**

  – *Transmission grid*. Neither a substation nor a power line exists at Site 2. The 230-kV power line would have to extend a minimum of 13 miles northwest along Highway 371, at a cost of $400,000-500,000 per mile, to connect with the existing 230-kV north-south Bisti to Ambrosia line. A new dedicated substation costing millions of dollars would also have to be built at Site 2, and the existing 230-kV line would have to be significantly upgraded to carry the additional electrons to offtakers. Despite the additional distance compared to Site 3 to the north, the ease of power line and other electrical construction along an existing rural road compared to going over rough ground, provides enough advantage to offset the cost. Integrating Site 2's more modest output into the grid would also be easier. Therefore, Site 2 is the next logical step in the development timeline at PBR, after Site 1 is fully built out.

  – *Road network*. Site 2 is bisected by State Highway 371, and is also served by IS Route 7023, a graded, graveled road which intersects with the paved highway. (IS Route 7023 also serves Site 3 to the north and Site 4 to the northeast.) Therefore, it is likely that IS Route 7023 would be upgraded to a fully paved road in the course of full development of the PBR solar complex.

- **Advantages**. Site 2 is not large compared to the others; in fact, it is the smallest site after Site 1A. Nevertheless, it is sufficiently large and has the advantages of flatness, excellent road access, and extensibility of the transmission grid to serve it, making "Dog Eye Solar Ranch" the next logical

candidate for major development once Site 1 has been built out to its full capacity and is a going concern. Site 2 could be a viable link in the chain of extending infrastructure further east to connect the two bigger sites to the grid, especially if Site 1A is developed as well.

- **Issues**. Site 2 would require less effort than Site 1, but lacks one of the advantages of Site 1 (pre-existing transmission infrastructure).

2.4.1.3 Site 3-Tanner Lake Coal Creek Group

Site 3 is a group of half-dozen irregular parcels of land containing 3,161 developable acres surrounding Tanner Lake as shown on Figures 2-27 and 2-28 below, hence the working name. The blocks are spread over a 7-mile span from east to west and 4 miles north to south. Site 3 is less than half as far from Site 1 as Site 2. Site 3's much greater size, fragmentation, and isolation from both the road network and the electrical grid would make developing a so-called "Tanner Lake Solar Ranch" or "Coal Creek Solar Ranch" (if the solar ranches are ultimately named after pre-existing local features) a much more challenging project; hence, its third-place position in the PBR development timeline.

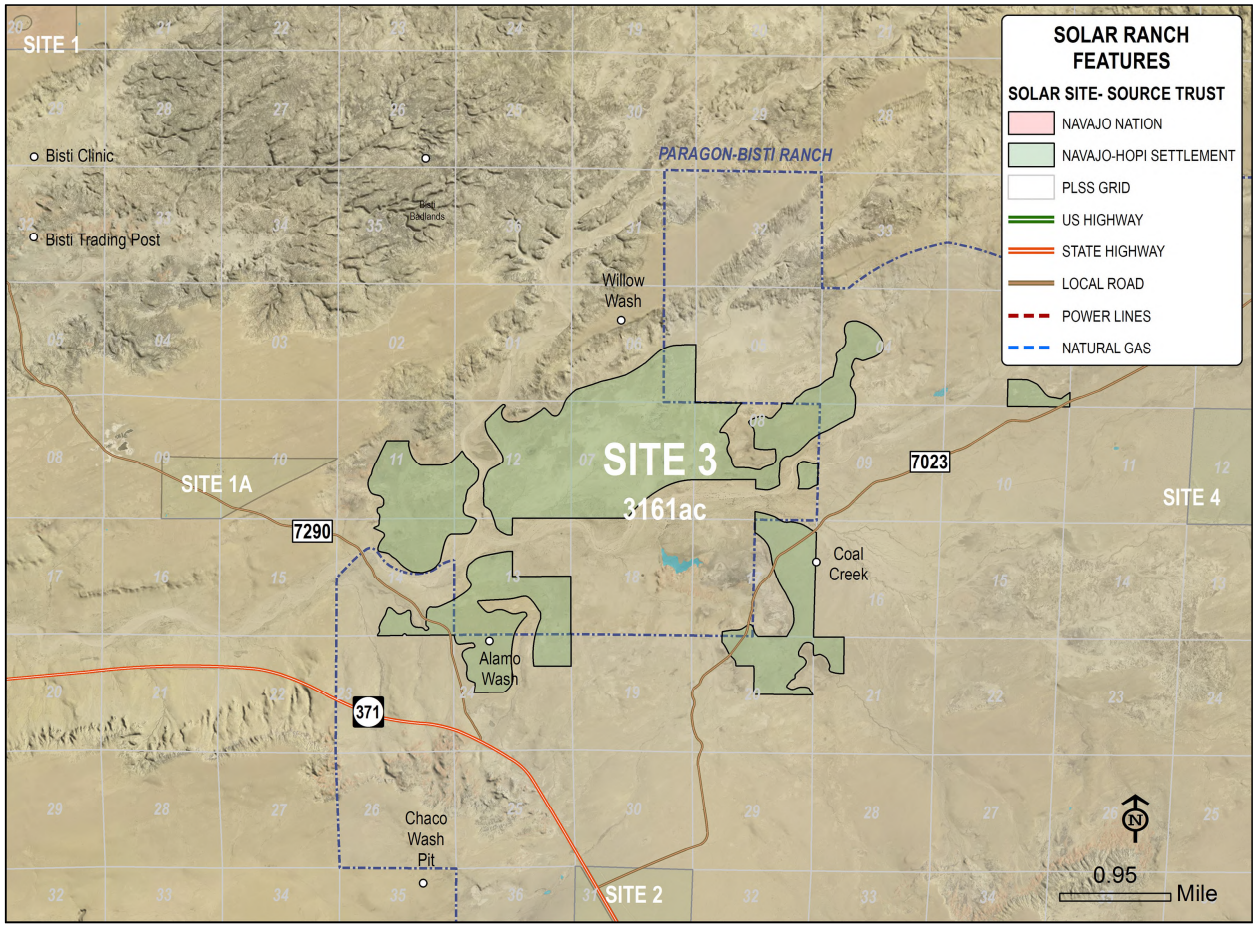


Figure 2-27. Plan View of Site 3, 3161 Developable Acres in Aggregate, 638 MW Potential

Source: Tetra Tech. For context, see Study Area Map on page 2-10. For detail, see full-size layouts starting on page 2-54.

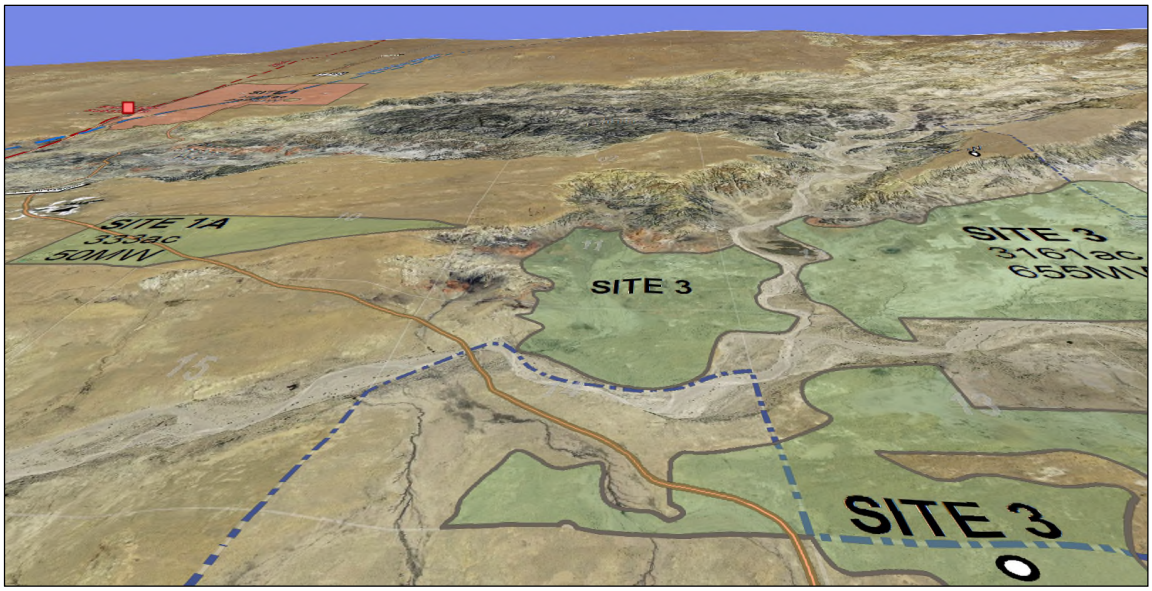


Figure 2-28. Flyover Perspective of Site 3 from Chaco Canyon to Bisti/De-Na-Zin Wilderness Area

Source: Tetra Tech, data fusion using ArcGIS Explorer. Note: Site 1 (red-filled) just barely visible in upper left.

- **Location and Attributes**. This group of half-dozen irregular parcels of land surrounds Tanner Lake and stretches 7 miles east to west, and 4 miles north to south. Site 3 contains Sections in both Township 23 North, Range 13 West as well as Township 23 North, Range 12 West. It is about 6 road miles southeast of Site 1, which is the red patch visible in the distance on the upper left of Figure 2-28. After screening out steep slopes, water courses, drainage features, and rough ground, only about half the candidate Settlement Act land in this area remains as suitable for solar power development. The reason for this is Site 3's proximity to the Bisti/De-Na-Zin Wilderness, which is also the cause of the irregular shaping and the fragmentation. The relatively rougher terrain is also visible on Figure 2-28 above. There are abutting land Sections to the north, which are much flatter, but they are excluded from consideration due to being a protected Federal Wilderness Area. At least one fragment of Site 3, flanking IS Route 7023 on the north (see upper right of Figure 2-27), is counted in the total land area, but is not worth developing due to its small size and isolation from the others by ownership constraints.

- **Access.**

  – *Transmission grid*. Neither a substation nor a transmission line exist at Site 3. A power line would have to extend a minimum of 5 to 6 miles directly to the west over rough bare ground to connect with the existing 230-kV north-south Bisti to Ambrosia line, the likeliest link-up. The existing line would have to be upgraded in capacity and perhaps voltage. Another transmission corridor could run perhaps 20 miles eastward along IS Route 7023, to connect with the triple 345-kV lines. However, the much greater distance would mean far greater cost (tens of millions of dollars, at least). If Site 3 were fully built out, at least three major new dedicated substations would have to be built. However, the potential generating capacity of Site 3 is so great due to its footprint (3,161 acres, 638 MW) that building a new dedicated line at higher voltage (345-kV) becomes justifiable.

  – *Road network*. Site 3 is about 6 road miles southeast of Site 1. The Tanner Lake/Coal Creek group is most directly served by IS Route 7290, crossing it in two places. (IS Route 7290 also serves Site 1 to the northwest.) This grouping can also be accessed by IS Route 7023 on its eastern edge, which goes on to connect to Highway 371. IS Routes in this part of the PBR are graded and graveled, but generally not paved. Since most of the fragments are not separated by

much, they can be connected by bridges across the washes and other drainage channels, but this adds cost.

- **Advantages**. Site 3 contains one of the largest contiguous groups of lands contemplated for solar development. They would provide a developer with the maximum possible economies of scale, and would be the next logical candidate for the next scale up of major development once Sites 1 and 2 have been built out to full capacity. Site 3's advantage over Site 4 is that it is about 10 miles closer to a grid connection, a $25 to 50 million benefit. Additionally, this site could be sub-divided, based on the needs and requirement of the offtaker or developed as a series of smaller parcels providing the developer with many options and flexibility.
- **Issues**. Site 3's much greater size, fragmentation, and isolation from both the road network and the electrical grid, would make developing "Coal Creek Solar Ranch" a much more challenging project; hence its third-place position in the timeline.

2.4.1.4 Site 4-Split Lips Flats–Black Lake Group

Site 4 is a group of three large and somewhat irregular blocks of land near the center of the PBR, spanning 6 miles east to west and 5 miles north to south. Site 4 lays between Split Lips Flats in the north and Black Lake in the south, as shown on Figure 2-29 below, hence the working name. Site 4's fragmentation, greater size, and even greater isolation from both the road network and the electrical grid, would make developing Site 4 a much more challenging project than even Site 3 would be; hence Site 4's last-place position in the PBR development timeline.

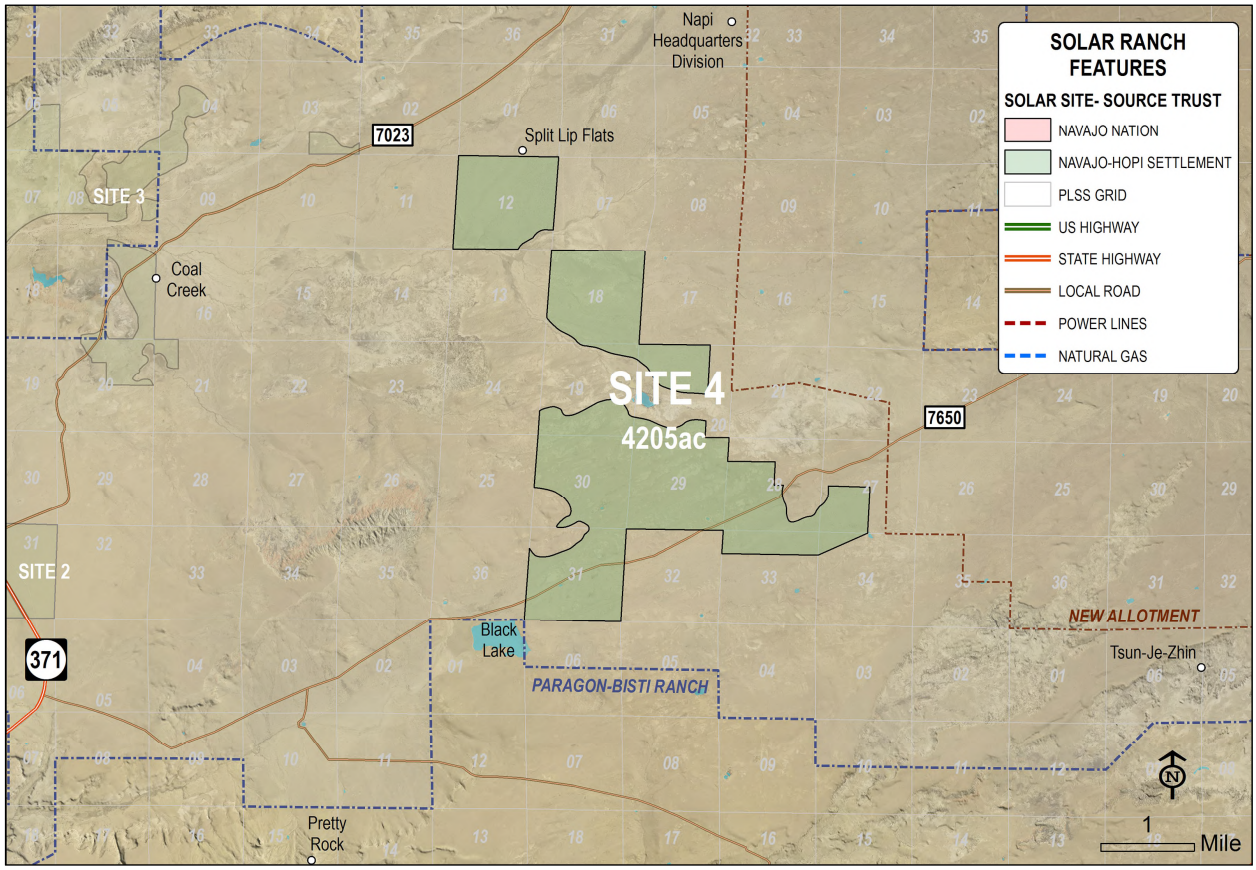


Figure 2-29. Plan View of Site 4, 4205 Developable Acres, 972 MW Potential

Source: Tetra Tech. For context, see Study Area Map on page 2-10. For detail, see full-size layouts starting on page 2-54.

- **Location and Attributes**. Site 4 lays mostly in Township 23 North, Range 11 West. It spans from the Split Lip Flats on the north to Black Lake on the south. At 4,205 acres, Site 4 contains some of the largest blocks of the flattest lands in the entire PBR for solar development, which is why it is less fragmented and has a higher proportion of developable land than Site 3. However, Site 4 is much more isolated from the grid than any other site: 12 to 14 miles away in either direction. It is also more isolated from the road network, being crossed by only one unpaved road, IS Route 7650. Settlement Act land blocks to the east of Site 4 were screened, but did not measure up well against the screening criteria due to steep slopes, water courses, drainage features, and rough or unstable ground.
- **Access**.
  - *Transmission grid*. Neither a substation nor power line exists at Site 4. It is equidistant (12 to 14 miles) from both the 230-kV north-south Bisti-Ambrosia line to the west of the PBR and the triple 345-kV lines to the east of the PBR. Therefore, roughly $50 million would have to be spent to tie in to the grid in either direction before a single kWh could be sold
  - *Road network*. Site 4 is served by only one road, the unpaved IS Route 7650, and only at the southernmost end of Site 4. At minimum, about 7 miles of new north-south road connecting Routes 7023 and 7650 would have to be built. Junctions with either of the paved two-lane State Highways, 371 to the west or 57 to the east, via Route 7650, are both 6 to 8 miles away. Several million dollars would have to be spent upgrading the roads to bear the large amount of construction traffic.
- **Advantages**. Site 4 is flatter and less fragmented than Site 3, but otherwise does not enjoy any of the advantages of the other sites. The greatest achievable economies of scale on the PBR would be here. Similar to site 3, the site could be sub-divided or developed in phases.
- **Issues**. Construction in such isolation would probably offset economy of scale. Fully building out a notional "Black Lake Solar Ranch" would consume at least $1.5 billion, perhaps $2B. Building the transmission line capacity alone would cost perhaps $50 million. Paving IS Route 7650 would cost millions more, without the mutually reinforcing benefits that the three sites to the west would enjoy. Being the closest to Chaco Canyon, the developer of this site would have the highest likelihood of encountering cultural resources.

Next. Preliminary designs and layouts for the five solar ranches are presented in Section 2.5.

2.5 Preliminary Designs and Layouts for the Five Solar Farms

Preliminary designs for five conceptual solar ranches have been created. These are just conceptual designs; the final design will be determined by an EPC contractor.

Each design is built up from self-sufficient power blocks in four basic styles: 1.4- and 2.8-MW_e (AC to grid), each block available in either east-west ("landscape") or north-south ("portrait") orientation. Power blocks are the smallest individual development units that the conceptual solar ranches of the PBR are "tiled" with. Think of them as LEGO™ blocks. The four styles exist so that the developable land can be efficiently covered with automated construction methods, yet not wasting too much land due to saw-tooth "aliasing". An individual commercial 225-watt(ac) panel is about the size of a door, measuring about 3.3 feet wide (i.e., 1 meter) by 6.5 feet tall (just about 2 meters). See Figure 2-30 below, a "cut sheet" for one such commercial panel made in the USA, courtesy of SunEdison.

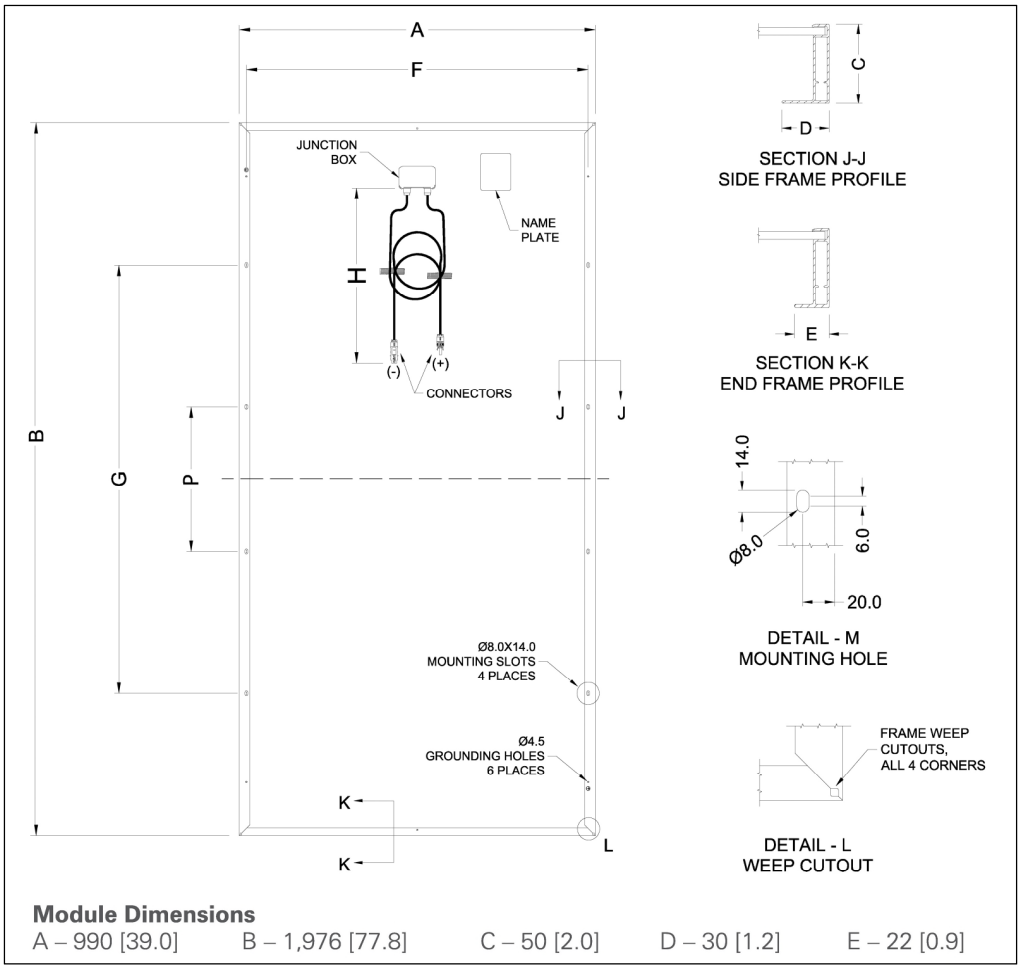


Figure 2-30. Cut sheet for a US-made SunEdison commercial panel

Source: SunEdison.

Traditionally, solar panels in farms are inclined at an angle equal to their latitude, in order that so that they face the sun as much as possible for good all-season performance. However, as the discussion of summer bias makes clear, at higher latitudes this is an inefficient use of land since a more steeply tilted panel casts a much longer shadow, and panels must not shade each other. Tetra Tech did better. The left side of figure 2-31 below is at latitude tilt; the right side is at "summertime bias", laying almost flat in order to maximize or capture as much sun as possible during the summer when it is high overhead.

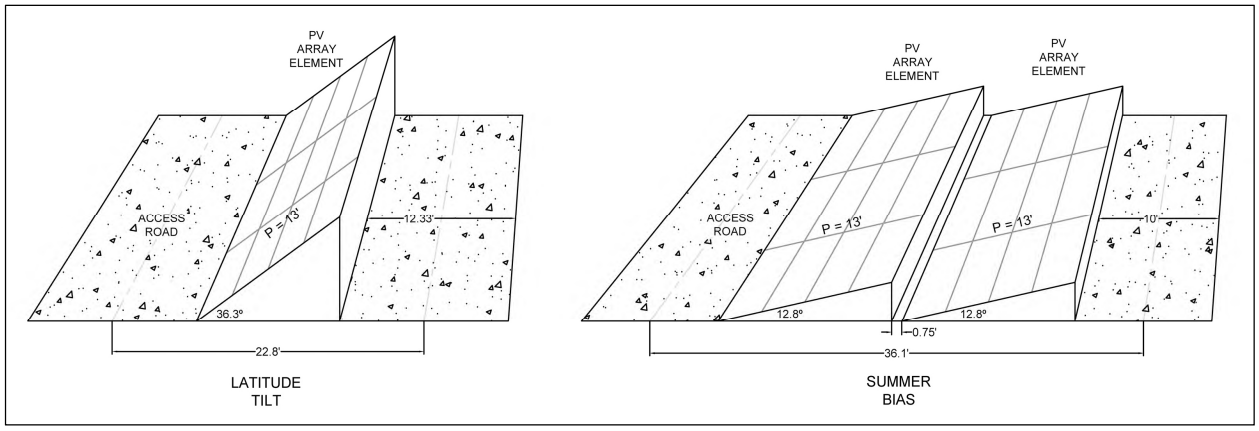


Figure 2-31. Latitude-tilt (left) versus summer-bias (right), and service lanes for each

Source: Tetra Tech.

Air conditioning during summer places by far the most demand on the grid in the southwest, while winters are mild with only a moderate demand for space heating, most of which is provided by natural gas anyway. Spring and fall have even less demand than winter, therefore Tetra Tech has provided a preliminary design optimized for summertime performance, "summer bias". It is true that the total production integrated over the entire year is about 10% less with summer bias that it would be at latitude tilt, but this way the peak output of an array in summer is 30% greater than it would be at latitude tilt, just when peak power is the most valuable.

Making the three simple optimizations illustrated in Figure 2-31 above:

- tilting panel at 12.8° "summer bias",
- This low angle allow two rows to be put down less than one foot from each other, without shading each other, instead of just one, thus eliminating one service aisle.
- reducing width of the service aisles to 10 feet.

increases the power output of a summer-bias block by 40% compared to a latitude-tilt block occupying the same amount of land. It also reduces the CapEx for civil site work somewhat. Compare the power, layout and packing density in Figures 2-32 and 2-33 on the next pages.

Remember, adjusting the panels' tilt angle up and down optimizes for time of *year* (season), while the adjusting the azimuth of the entire array from side to side optimizes for time of *day*.

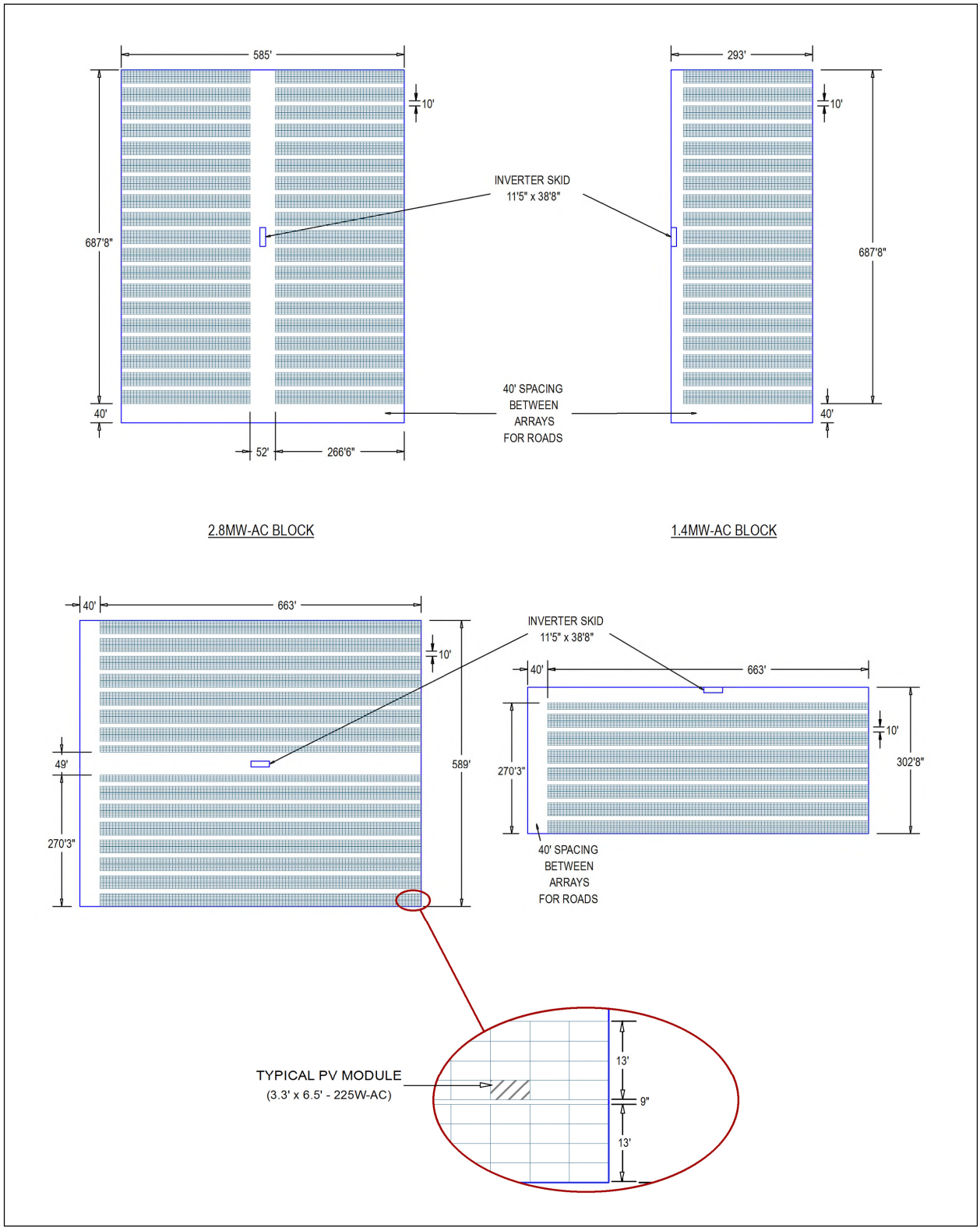


Figure 2-32. Four Styles of Power Blocks with Double Rows Optimized for Summer-Bias

Source: Tetra Tech.

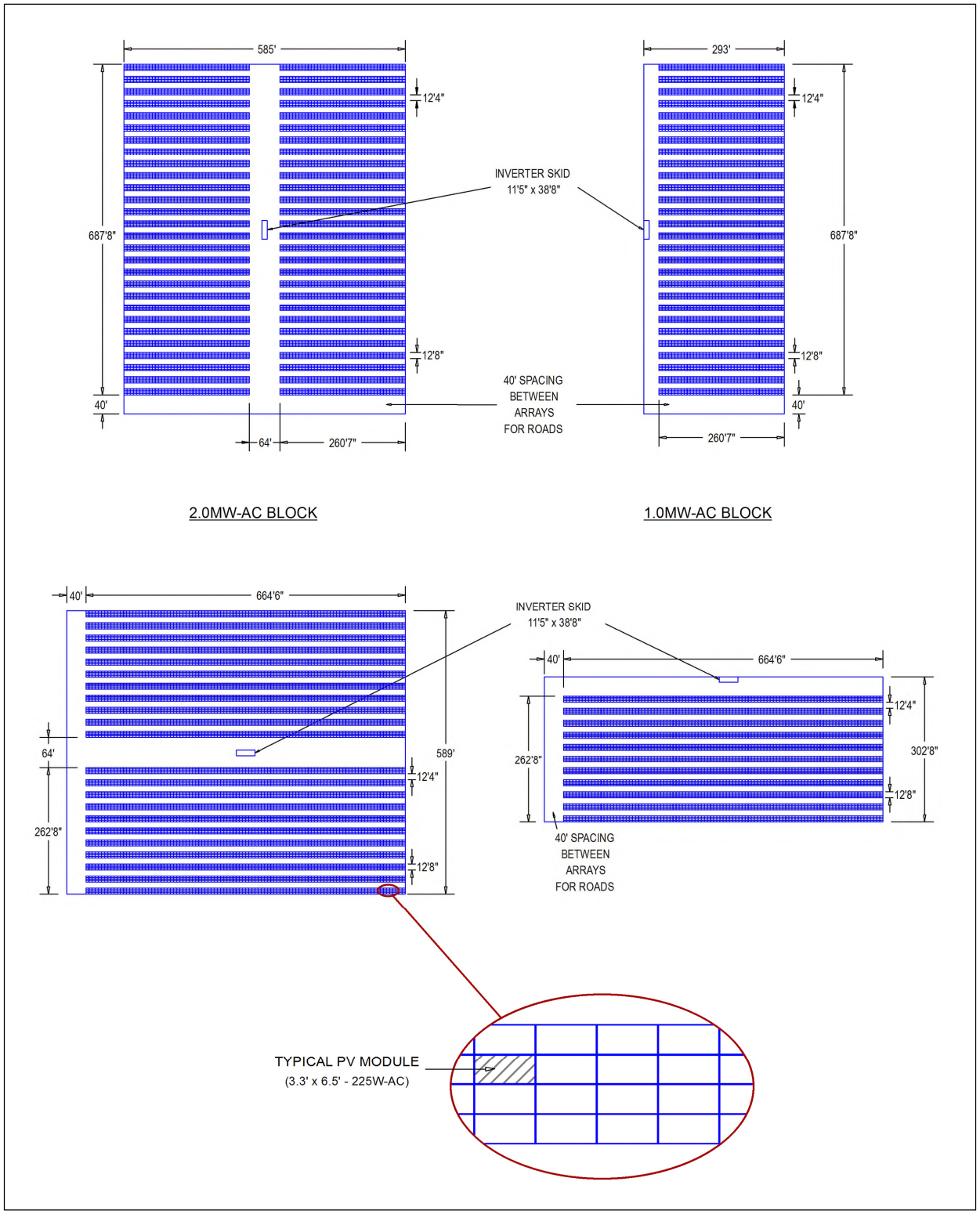


Figure 2-33. Four Power Blocks at Latitude-Tilt with Single Rows

Source: Tetra Tech.

In the layouts above, panels are laid on their long edge, and stacked four high. Depending on its tilt angle, each 12'8" wide stack of four covers from 6'6" to 12'8" of ground. Every row is oriented east-west, hence its normal axis has an azimuth due south.

Each of the long double rows in a landscape block is 102 units long (about 660 feet); each of the short double rows in a portrait block is 41 units long (about 290 feet). 816 modules per long double row generate about 184 net kW to grid, corrected for conversion from DC to AC. 328 modules per short row generate about 74 net kW to grid. 7.5 such long rows or 19 short rows make up a nominal 1.4-MW block. Regardless of length, each row is separated from its neighbor by a service lane that is about 10' wide. There is almost exactly 1 mile of service lanes in each 1.4-MW block, and each block in turn is separated from its neighbors by a clear buffer area 30 to 40 feet wide, which incorporates about a half-mile of wide perimeter road for security and fire-fighting access. A skid-mounted inverter that services each block sits in this buffer zone. A 2.8-MW block simply consists of two 1.4-MW blocks, with the skid-mounted inverter in the middle of a central aisle where the two blocks meet.

Reproduced here for convenience, Figure 2-34 is a "waterfall" chart depicting the build-out of the entire PBR over the next 20 years, providing clean power well into the latter half of this century, perhaps beyond the year 2075. Each step of the build-out and its preliminary design is presented in the sections below.

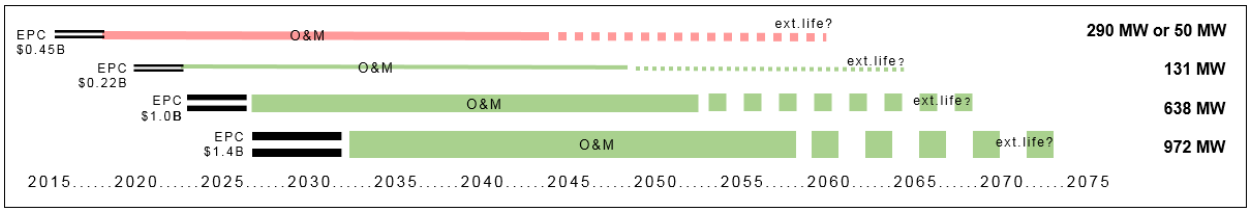


Figure 2-34. Preliminary Waterfall Chart for Build-out of the PBR.

Source: Tetra Tech

2.5.1 Preliminary Design for Site 1 Primary or Alternate Site 1A

2.5.1.1 Site 1-The "Bisti Cornerstone"

Site 1 would be the cornerstone or "anchor tenant" of the entire renewable energy program at the PBR. A preliminary design for a solar ranch on this site is presented in Figure 2-35 below.

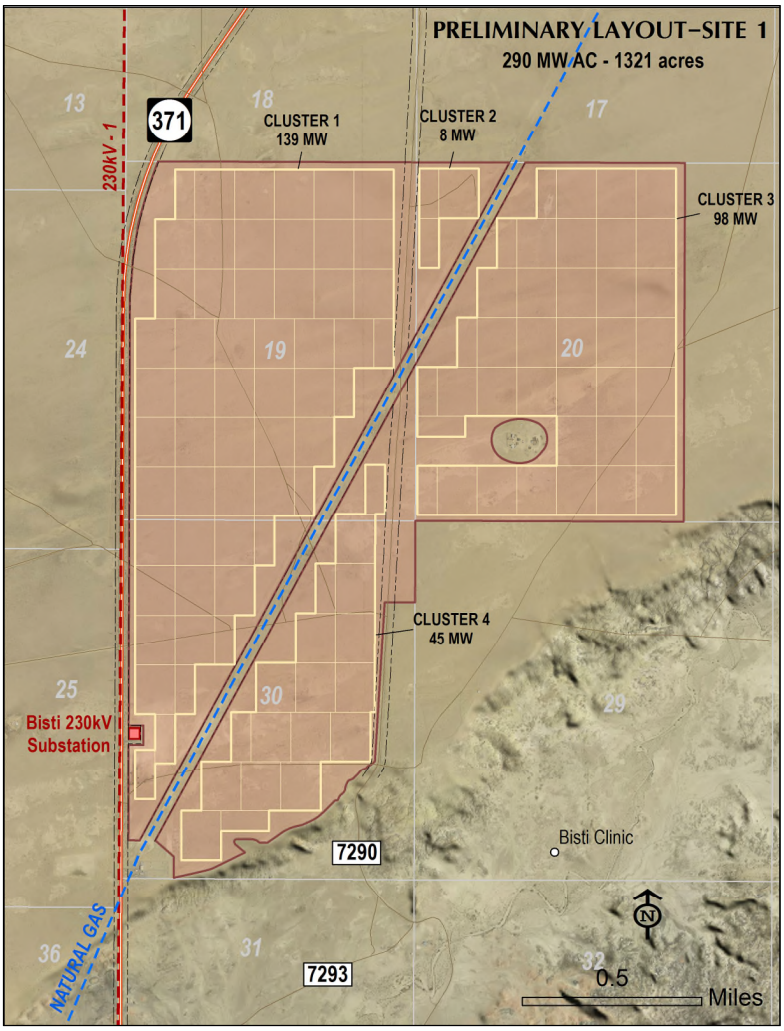


Figure 2-35. Preliminary Design for Site 1

Source: Tetra Tech. See also full-size map on page 2-55.

- **Design Features**.
  - *table of equipment (ToE) and itemized bill of materials*: ~1.3 million SunEdison Silvantis® F310BzC 225-watt PV modules @ 62¢/DC-watt; 290 skid-mounted inverters of 1000 kVA capacity; about ten (10) x 69/20 step-up transformers inc. assoc. switchgear of 30-MVA rating each @ $1.5M ea.
  - *optional capital equipment pending interconnection study by PNM*: one (1) to five (5) x 230/69 step-up transformer(s) inc. assoc. switchgear of 60-MVA rating @ $4M ea.
  - *civil site work*: 200 miles of graded, compacted, unsurfaced service lanes @ $100,000 per mile; 80 miles of graded, compacted, unsurfaced, graveled interior and perimeter roadway @ $250,000 per mile; 14 miles of site-wide security fencing and gates @ $200,000 per mile
  - *neither specified, enumerated, nor individually costed*; subsumed under "balance of plant" @ 30¢/DC-watt: poles or ballasts for ground mounts as required by surface conditions; racking;

miscellaneous switchgear and panels; breakers; reactive compensation if any; SCADA system; kcmil-age of overhead or underground conductors, and linear footage of overhead or underground cabling and conductors @ $70,000-100,000 per mile; linear footage of interior collector circuits; number of permanent equipment sheds and/or service vehicle garages; site office with comfort facilities; utilities such as site power, lighting, phone, potable water, sewerage; other civil site work such as water storage, culverts, drainage, detention as required.

- **Potential Solar Power Generation**. A solar ranch at Site 1 would surround the substation, which is almost perfectly matched to the Section 30's potential output, while the 230-kilovolt (kV) Bisti to Ambrosia power line has the technical capacity to deliver over a hundred MW of power to offtakers. Assuming fixed flat panels at summer bias (12.8° tilt), oriented due south, then the 1,321 acres could generate 290 MW_e of alternating current (AC) net to grid. 100+ MW_e of that could be generated by flat panels on Section 30 alone, closest to the substation. This happens to be almost exactly, and conveniently, equal to the 150 megavolt-ampere (MVA) spare capacity of both the 230-kV power line and the substation. No part of Site 1 is more than two miles from the substation, which minimizes the cost of internal feeder lines.

2.5.1.2 Alternate Site 1A-The "Wedge"

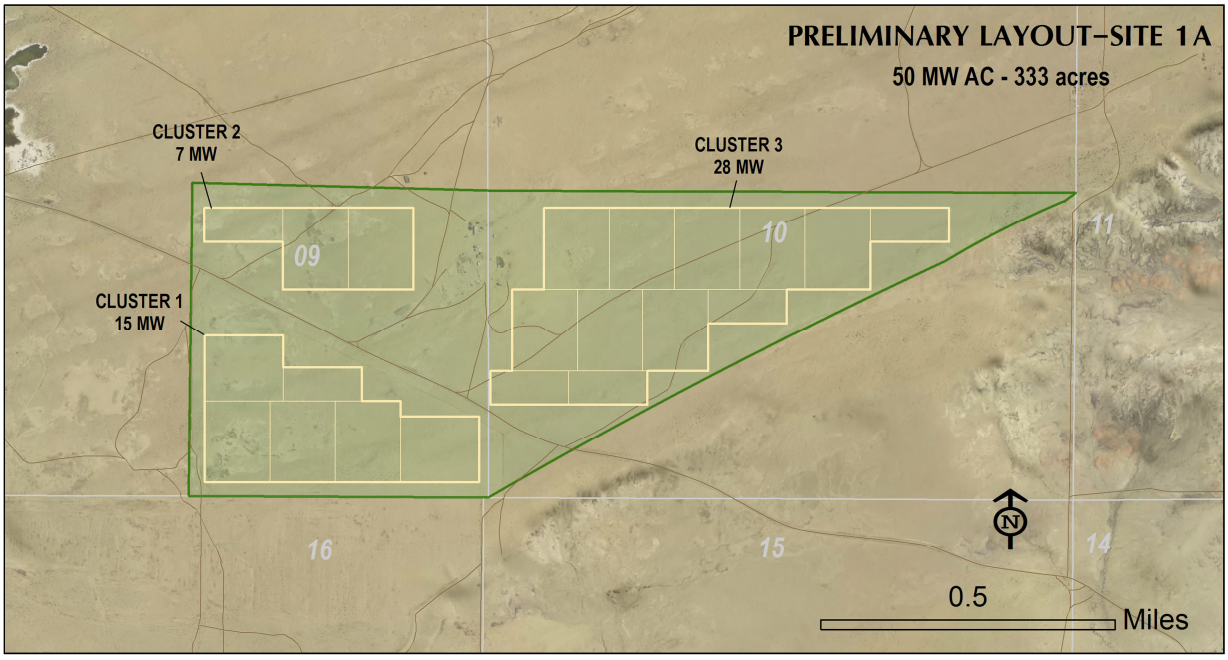


Figure 2-36. Preliminary Design for Site 1A, about 50 MW Potential

Source: Tetra Tech. See also full-size map on page 2-57.

- **Design Features**.
  - *table of equipment (ToE) and itemized bill of materials*: ~225,000 SunEdison Silvantis® F310BzC 225-watt PV modules @ 62¢/DC-watt; 50 skid-mounted inverters of 1000 kVA capacity; two (2) x 69/20 step-up transformers inc. assoc. switchgear of 30-MVA rating each @ $1.5M ea.; one (1) 230/69 step-up transformer(s) inc. assoc. switchgear of 60-MVA rating @ $4M ea.
  - *civil site work*: about 33 miles of graded, compacted, unsurfaced service lanes @ $100,000 per mile; ~15 miles of graded, compacted, unsurfaced, graveled interior and perimeter roadway @ $250,000 per mile; about 6 miles of site-wide security fencing and gates @ $200,000 per mile
  - *neither specified, enumerated, nor individually costed*; subsumed under "balance of plant" @ 30¢/DC-watt: poles or ballasts for ground mounts as required by surface conditions; racking; miscellaneous switchgear and panels; breakers; reactive compensation if any; SCADA system; kcmil-age of overhead or underground conductors, and linear footage of overhead or underground cabling and conductors @ $70,000-100,000 per mile; linear footage of interior collector circuits; number of permanent equipment sheds and/or service vehicle garages; site office with comfort facilities; utilities such as site power, lighting, phone, potable water, sewerage; other civil site work such as water storage, culverts, drainage, detention as required
- **Potential Solar Power Generation**. Assuming simple flat panels at latitude tilt, oriented due south, plus the other typical assumptions, the Wedge could host 50 MW_e of alternating current (AC) net to grid, which is similar to the projected output of the To'Hajiilee project. (In 2008, the To'Hajiilee Chapter of the Navajo Nation began planning for a 500-acre alternative energy park about 20 miles outside of Albuquerque, New Mexico, on Indian trust lands.) Neither a substation nor a transmission line exist at Site 1A. A power line would have to extend about 5 miles along Route 7290 to connect with the existing 230-kV north-south Bisti to Ambrosia line, the likeliest link-up. Given the modest amount of power (50 MW), a 69-kV line, costing about $100,000 per mile, should be sufficient to carry that power to a step-up transformer at the substation. Therefore a grid-tie to the 69-kV distribution system may be possible, especially given the modest amount of power.

2.5.2 Site 2: "Dog Eye Solar Ranch"

Site 2 is a single flat "section" of land (1 square mile) - Section 31 in Township 23 North, Range 12 West that straddles Highway 371 about half a mile east of Dog Eye Pond, and 13 road miles southeast of Site 1. Although the so-called "Dog Eye Solar Ranch" (if the solar ranches are ultimately named after pre-existing local features) is about twice as far from Site 1 as the crow flies, Site 2's location on a paved State highway with existing rights-of-way (ROW) for extension of transmission lines makes it the next logical step in the timeline of the PBR development after Site 1 is fully built out.

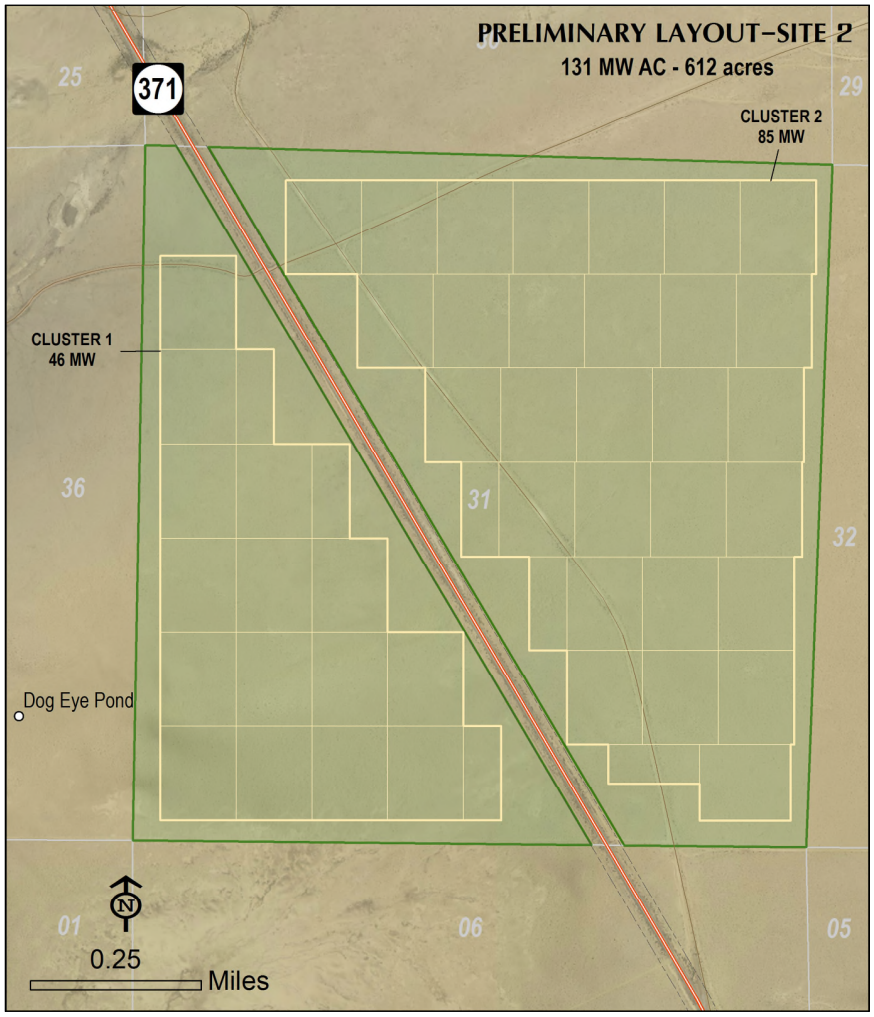


Figure 2-37. Preliminary Design for Site 2

Source: Tetra Tech. See also full-size map on page 2-59.

- **Design Features**.
  - *table of equipment (ToE) and itemized bill of materials*: ~600,000 SunEdison Silvantis® F310BzC 225-watt PV modules @ 62¢/DC-watt; 130 skid-mounted inverters of 1000 kVA capacity; about five (5) x 69/20 step-up transformers inc. assoc. switchgear of 30-MVA rating each @ $1.5M ea.; at least two (2) x 230/69 step-up transformer(s) inc. assoc. switchgear of 60-MVA rating @ $4M ea.
  - *civil site work*: 90 miles of graded, compacted, unsurfaced service lanes @ $100,000 per mile; 35 miles of graded, compacted, unsurfaced, graveled interior and perimeter roadway @ $250,000 per mile; 7 miles of site-wide security fencing and gates @ $200,000 per mile

- *neither specified, enumerated, nor individually costed*; subsumed under "balance of plant" @ 30¢/DC-watt: poles or ballasts for ground mounts as required by surface conditions; racking; miscellaneous switchgear and panels; breakers; reactive compensation if any; SCADA system; kcmil-age of overhead or underground conductors, and linear footage of overhead or underground cabling and conductors @ $70,000-100,000 per mile; linear footage of interior collector circuits; number of permanent equipment sheds and/or service vehicle garages; site office with comfort facilities; utilities such as site power, lighting, phone, potable water, sewerage; other civil site work such as water storage, culverts, drainage, detention as required

- **Potential Solar Power Generation**: Neither a substation nor a power line exists at Site 2. The power line would have to extend a minimum of 13 miles northwest along Highway 371 to connect with the existing 230-kV north-south Bisti to Ambrosia line. A new dedicated substation would also have to be built at Site 2, and the existing 230-kV line would have to be significantly upgraded to carry the additional electrons to offtakers. Despite the additional distance compared to Site 3 to the north, the ease of power line and other electrical construction along an existing rural road compared to going over rough ground, provides enough advantage to offset the cost. Integrating Site 2's more modest output into the grid would also be easier. Therefore, Site 2 is the next logical step in the development timeline at PBR, after Site 1 is fully built out. Under the reasonable assumption of one-quarter MW per acre net to grid for this part of the country, if fully developed, Site 2 could potentially host 131 MW of solar power, which also happens to match the available capacity on the line.

2.5.3 Site 3: "Coal Creek Solar Ranch"

A preliminary design of the putatively-named "Coal Creek Solar Ranch" is provided below.

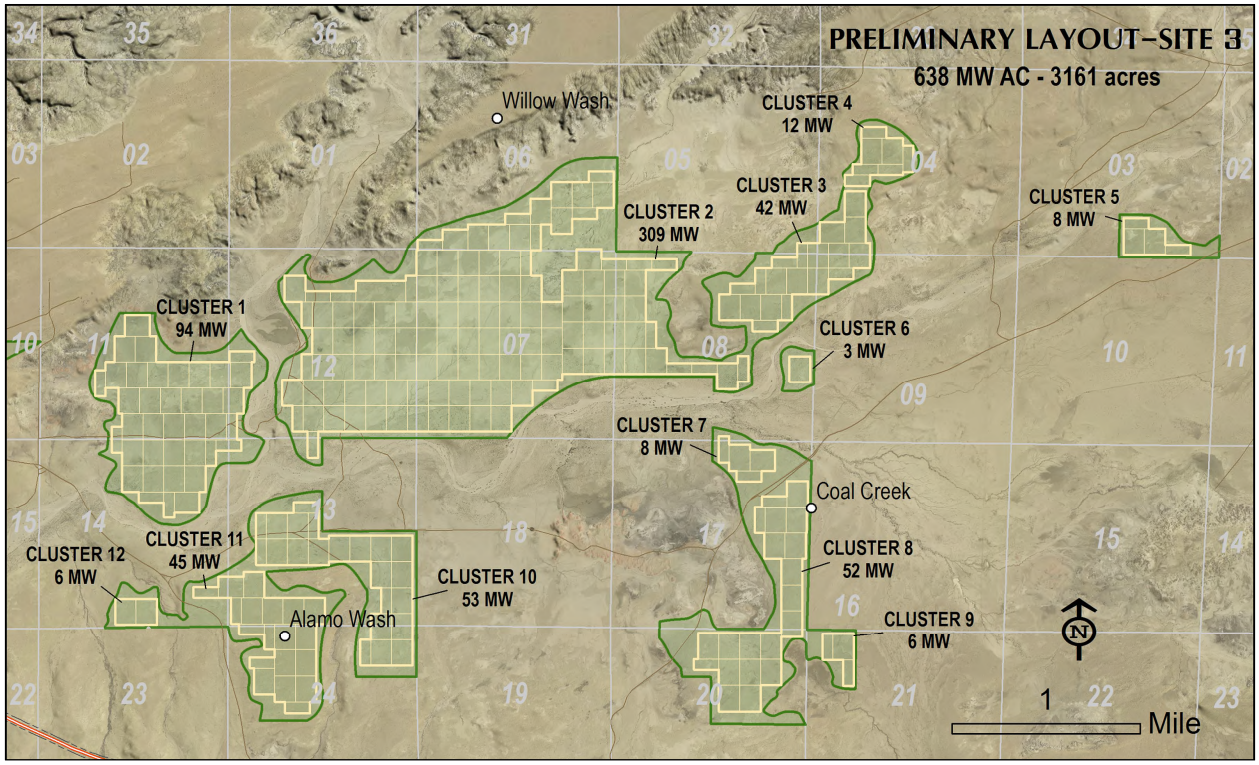


Figure 2-38. Preliminary Design for Site 3

Source: Tetra Tech. See also full-size foldout map on page 2-61.

- **Design Features**.
  - *table of equipment (ToE) and itemized bill of materials*: ~3 million SunEdison Silvantis® F310BzC 225-watt PV modules @ 62¢/DC-watt; 640 skid-mounted inverters of 1000 kVA capacity; about twenty two (22) x 69/20 step-up transformers inc. assoc. switchgear of 30-MVA rating each @ $1.5M ea.; at least ten (10) x 230/69 step-up transformer(s) inc. assoc. switchgear of 60-MVA rating @ $4M ea.
  - *civil site work*: 440 miles of graded, compacted, unsurfaced service lanes @ $100,000 per mile; 180 miles of graded, compacted, unsurfaced, graveled interior and perimeter roadway @ $250,000 per mile; at least 30 miles of site-wide security fencing and gates @ $200,000 per mile
  - *neither specified, enumerated, nor individually costed*; subsumed under "balance of plant" @ 30¢/DC-watt: poles or ballasts for ground mounts as required by surface conditions; racking; miscellaneous switchgear and panels; breakers; reactive compensation if any; SCADA system; kcmil-age of overhead or underground conductors, and linear footage of overhead or underground cabling and conductors @ $70,000-100,000 per mile; linear footage of interior collector circuits; number of permanent equipment sheds and/or service vehicle garages; site office with comfort facilities; utilities such as site power, lighting, phone, potable water, sewerage; other civil site work such as water storage, culverts, drainage, detention as required
- **Potential Solar Power Generation**: Neither a substation, transmission line, nor good roads exist at Site 3. A power line would have to extend a minimum of 5 to 6 miles directly to the west over rough bare ground to connect with the existing 230-kV north-south Bisti to Ambrosia line, the likeliest link-up. The existing line would have to be upgraded in capacity and perhaps voltage.

Another transmission corridor could run perhaps 20 miles eastward along IS Route 7023, to connect with the triple 345-kV lines. However, the much greater distance would mean far greater cost (tens of millions of dollars, at least). If Site 3 were fully built out, at least three major new dedicated substations would have to be built. However, the potential generating capacity of Site 3 is so great due to its footprint (3,161 acres, or 638 MW,) that building a new dedicated line at higher voltage (345-kV) becomes justifiable. Site 3, if fully built out, would be about half again the capacity (638 MW of solar power net to grid) of Sites 1, 1A, and Site 2 combined. This much land would also make the "Coal Creek Solar Ranch" by far the largest solar project on earth (until ground was broken for the Split Lip/Black Lake Solar Ranch). By the time a solar project of such scale is likely to be feasible by the end of the decade, unit costs for PV modules will have declined (if present trends continue) such that capital expense would be about $1 billion.

2.5.4 Site 4: "Black Lake Solar Ranch"

A preliminary layout of the more attractively-named "Black Lake Solar Ranch" is provided here:

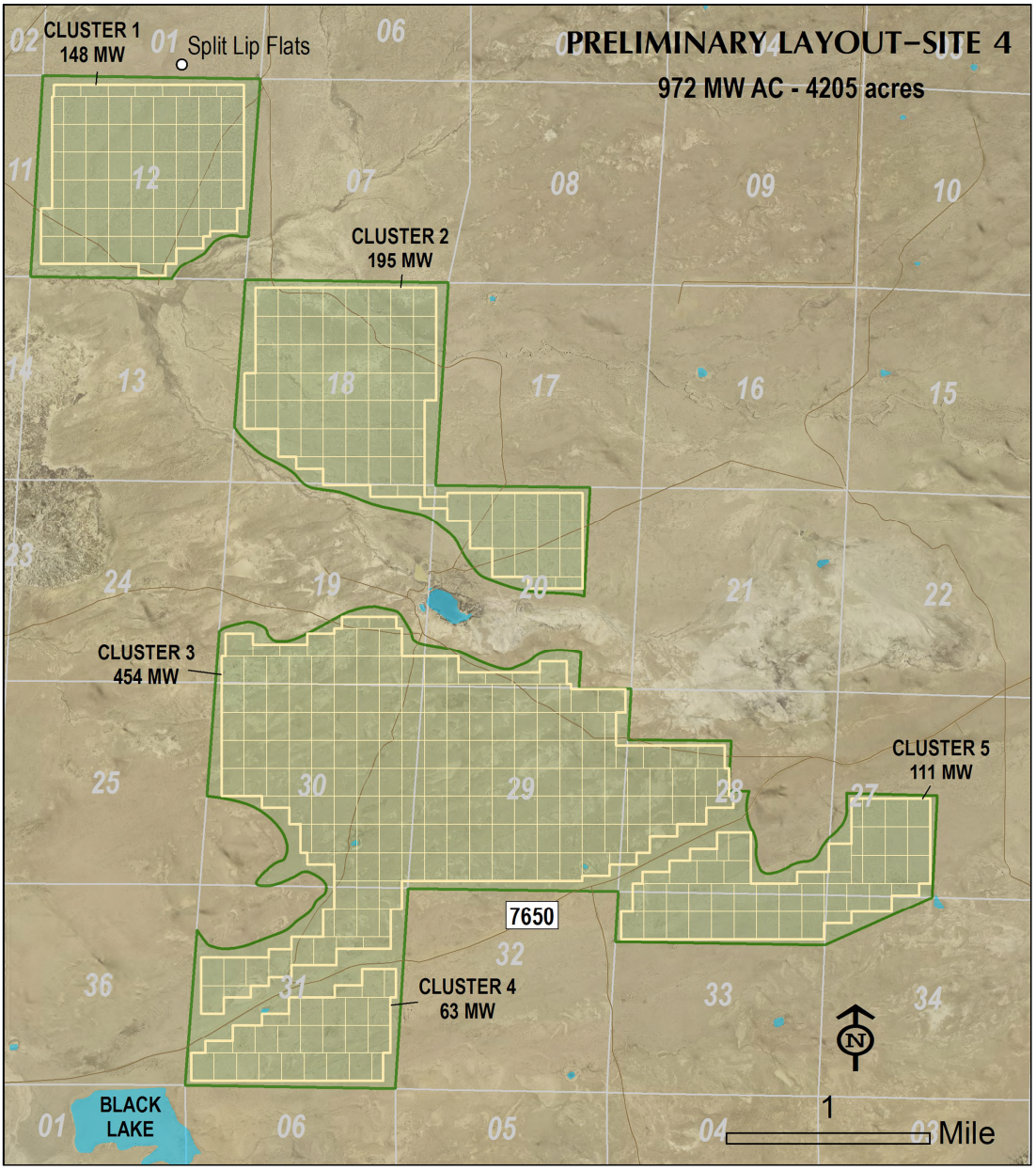


Figure 2-39. Preliminary Design for Site 4

Source: Tetra Tech. See also full-size foldout map on page 2-63.

- **Design Features**.
  - *table of equipment (ToE) and itemized bill of materials*: ~4.4 million SunEdison Silvantis® F310BzC 225-watt PV modules @ 62¢/DC-watt; almost a thousand skid-mounted inverters of 1000 kVA capacity; about thirty three (33) x 69/20 step-up transformers inc. assoc. switchgear of 30-MVA rating each @ $1.5M ea.; about fifteen (15) x 230/69 step-up transformer(s) inc. assoc. switchgear of 60-MVA rating @ $4M ea.
  - *civil site work*: 670 miles of graded, compacted, unsurfaced service lanes @ $100,000 per mile; 250 miles of graded, compacted, unsurfaced, graveled interior and perimeter roadway @ $250,000 per mile; ~50 miles of site-wide security fencing and gates @ $200,000 per mile

- *neither specified, enumerated, nor individually costed*; subsumed under "balance of plant" @ 30¢/DC-watt: poles or ballasts for ground mounts as required by surface conditions; racking; miscellaneous switchgear and panels; breakers; reactive compensation if any; SCADA system; kcmil-age of overhead or underground conductors, and linear footage of overhead or underground cabling and conductors @ $70,000-100,000 per mile; linear footage of interior collector circuits; number of permanent equipment sheds and/or service vehicle garages; site office with comfort facilities; utilities such as site power, lighting, phone, potable water, sewerage; other civil site work such as water storage, culverts, drainage, detention as required

- **Potential Solar Power Generation**: Neither a substation nor power line exists at Site 4. It is equidistant (12 to 14 miles) from both the 230-kV north-south Bisti-Ambrosia line to the west of the PBR and the triple 345-kV lines to the east of the PBR. Therefore, roughly $50 million would have to be spent to tie in to the grid in either direction before a single kWh could be sold. Due to its sheer size, this much flat land could potentially host almost a gigawatt of solar power, which is the size of a nuclear power plant. To put 972 MW into context, consider that the entire generating capacity of the state of New Mexico is about 2000 MW.

2.5.5 Summary of Preliminary Designs

The summary contents of Table 2-1 are again repeated here in Table 2-3 for the reader's convenience.

Table 2-3. Summary of Solar Sites, in Recommended Order (repeat of Table 2-1)

Group Name	Site #	Devel-opable Acres	Power [MWe] latitude tilt *summer bias*	Access	Development Potential and Status
BISTI CORNERSTONE	1	1,321	207 ***290***	grid YES paved road YES	• Very high priority, goes 1st • Non-Settlement, but still Tribal
"the Wedge"	1A	333	36 ***50***	grid NO paved road YES	• Alternate to 1st if 1st not available • Settlement, Selected & Conveyed
"DOG-EYE SOLAR RANCH"	2	612	94 ***132***	grid NO paved road YES	• High, goes 2nd • Settlement, Selected & Conveyed
TANNER LAKE/COAL CREEK	3	3,161	468 ***638***	grid NO paved road NO	• Moderate, goes 3rd • Settlement, Selected & Conveyed
SPLIT LIP FLATS/BLACK LAKE	4	4,205	694 ***972***	grid NO paved road NO	• Medium-low, goes last • Settlement, Selected & Conveyed
TOTAL ALL SITES		9,632	1,487 ***2,081***		

Five full-page high-resolution maps depicting the preliminary layouts of the five solar ranches described and referenced above in Sections 2.1 through 2.6 above:

Figure 2-40, Preliminary Solar Farm Layout-Site 1

Figure 2-41, Preliminary Solar Farm Layout-Site 1A

Figure 2-42, Preliminary Solar Farm Layout-Site 2

Figure 2-43, Preliminary Solar Farm Layout-Site 3

Figure 2-44, Preliminary Solar Farm Layout-Site 4

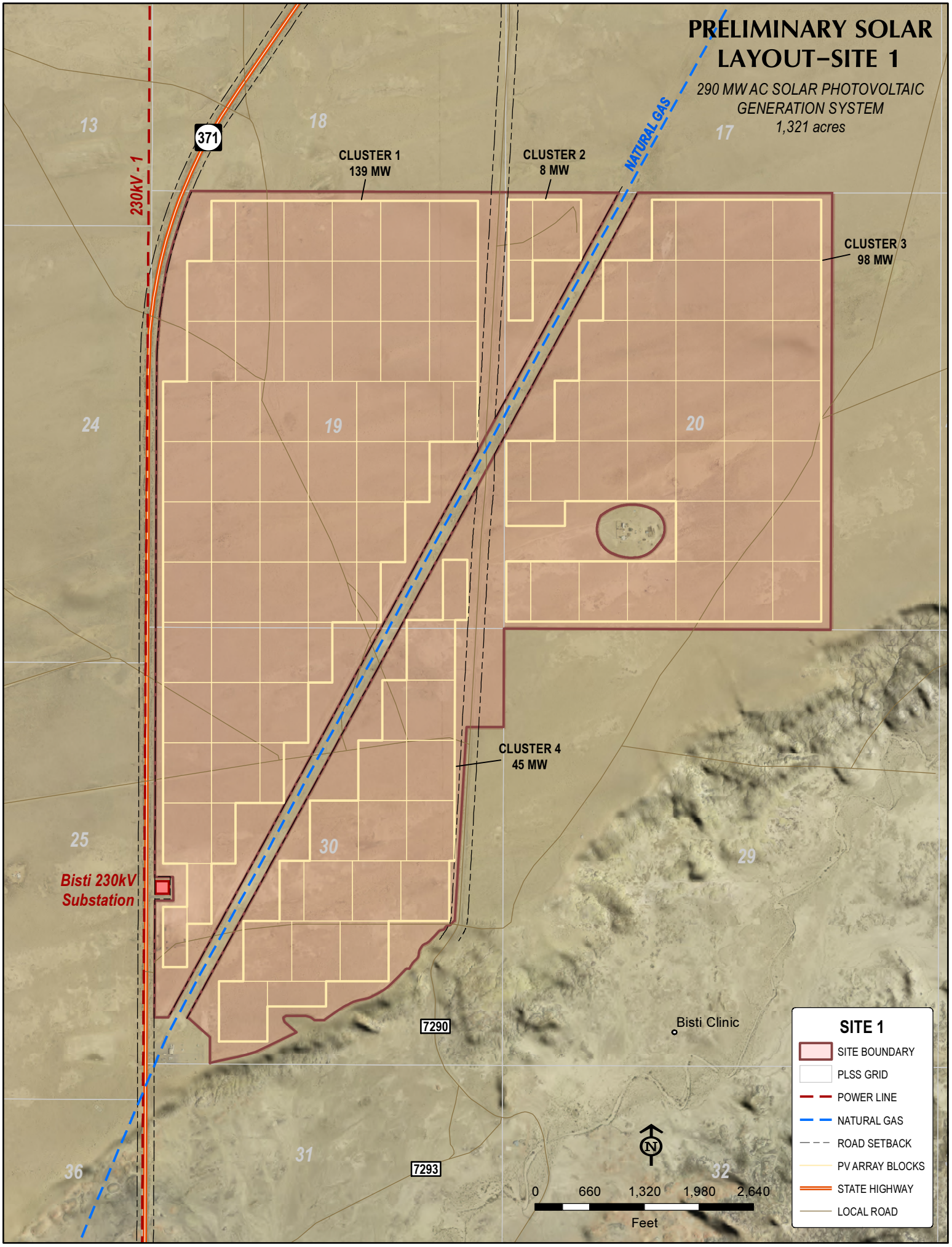
are now presented following this page.

What Comes Next. In the last section, 2.6, the long-term operations and maintenance (O&M) of the five solar ranches is discussed.

Figure 2-41. Preliminary Solar Ranch Layout-Site 1A

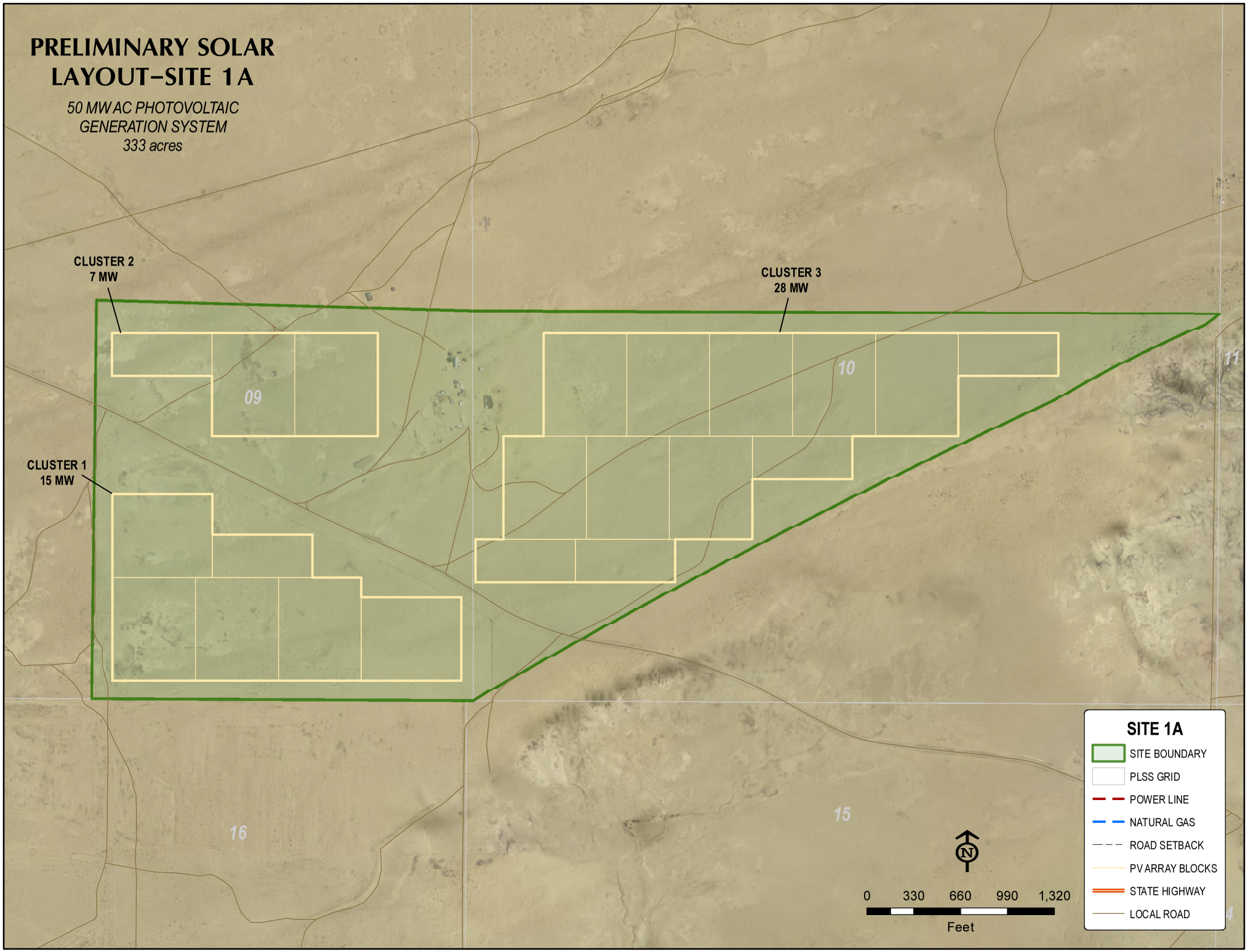
Source: Tetra Tech.

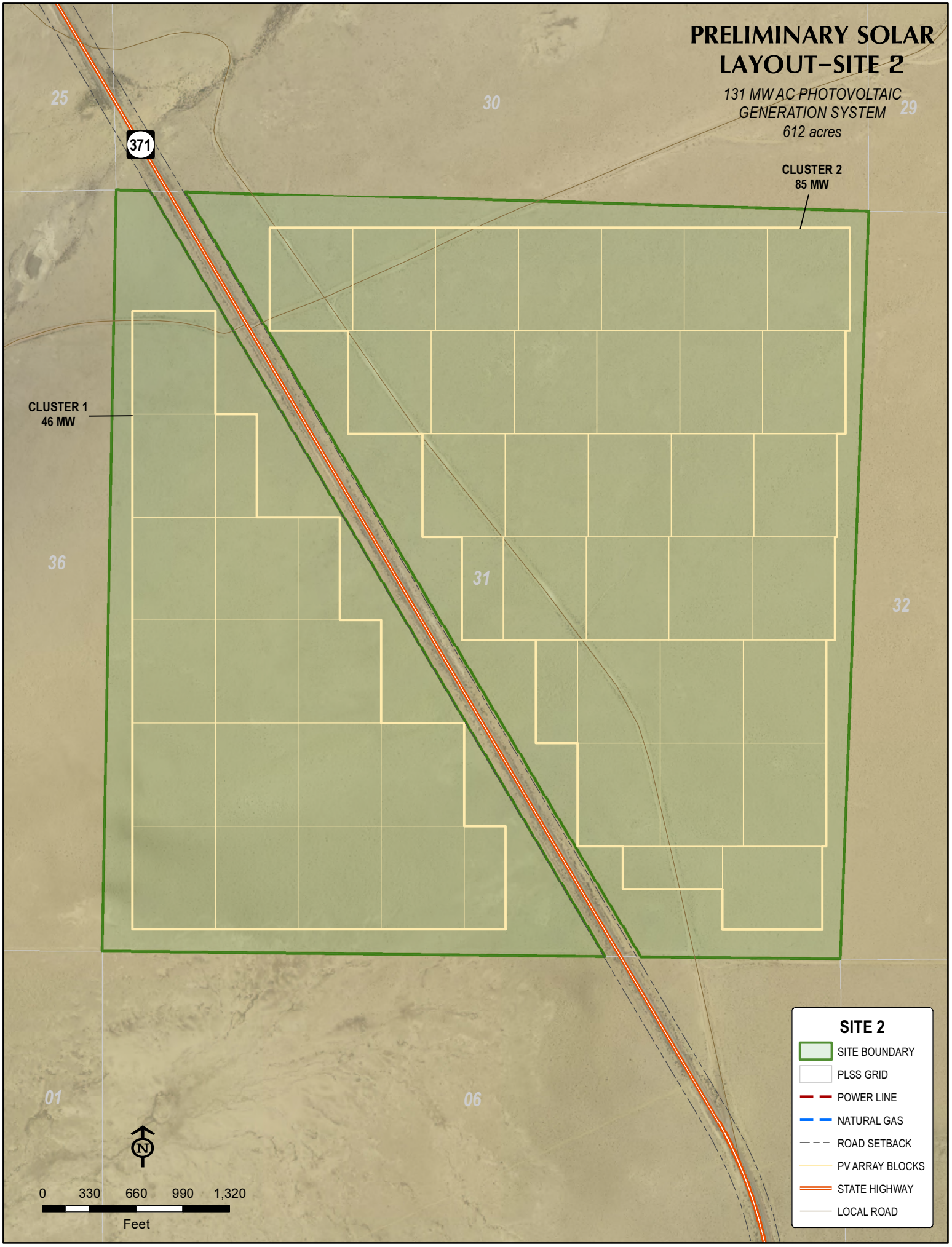
1-page placeholder for 8.5x11 or 11x17 printed map.


PRELIMINARY SOLAR LAYOUT–SITE 1
290 MW AC SOLAR PHOTOVOLTAIC GENERATION SYSTEM
1,321 acres
CLUSTER 1
139 MW
CLUSTER 2
8 MW
CLUSTER 3
98 MW
CLUSTER 4
45 MW
230kV - 1
NATURAL GAS
371
Bisti 230kV Substation
7290
7293
Bisti Clinic
13
18
17
24
19
20
25
30
29
31
36
32
SITE 1
SITE BOUNDARY
PLSS GRID
POWER LINE
NATURAL GAS
ROAD SETBACK
PV ARRAY BLOCKS
STATE HIGHWAY
LOCAL ROAD
N
0
660
1,320
1,980
2,640
Feet

PRELIMINARY SOLAR LAYOUT–SITE 1A

50 MW AC PHOTOVOLTAIC GENERATION SYSTEM
333 acres




PRELIMINARY SOLAR LAYOUT–SITE 2
131 MW AC PHOTOVOLTAIC GENERATION SYSTEM
612 acres
371
CLUSTER 2
85 MW
CLUSTER 1
46 MW
25
30
29
36
31
32
01
06
0
330
660
990
1,320
Feet
SITE 2
SITE BOUNDARY
PLSS GRID
POWER LINE
NATURAL GAS
ROAD SETBACK
PV ARRAY BLOCKS
STATE HIGHWAY
LOCAL ROAD

PRELIMINARY SOLAR LAYOUT–SITE 3

638 MW AC PHOTOVOLTAIC GENERATION SYSTEM
3,161 acres

CLUSTER 1
94 MW

CLUSTER 2
309 MW

CLUSTER 3
42 MW

CLUSTER 4
12 MW

CLUSTER 5
8 MW

CLUSTER 6
3 MW

CLUSTER 7
8 MW

CLUSTER 8
52 MW

CLUSTER 9
6 MW

CLUSTER 10
53 MW

CLUSTER 11
45 MW

CLUSTER 12
6 MW

Willow Wash

TANNER LAKE

Coal Creek

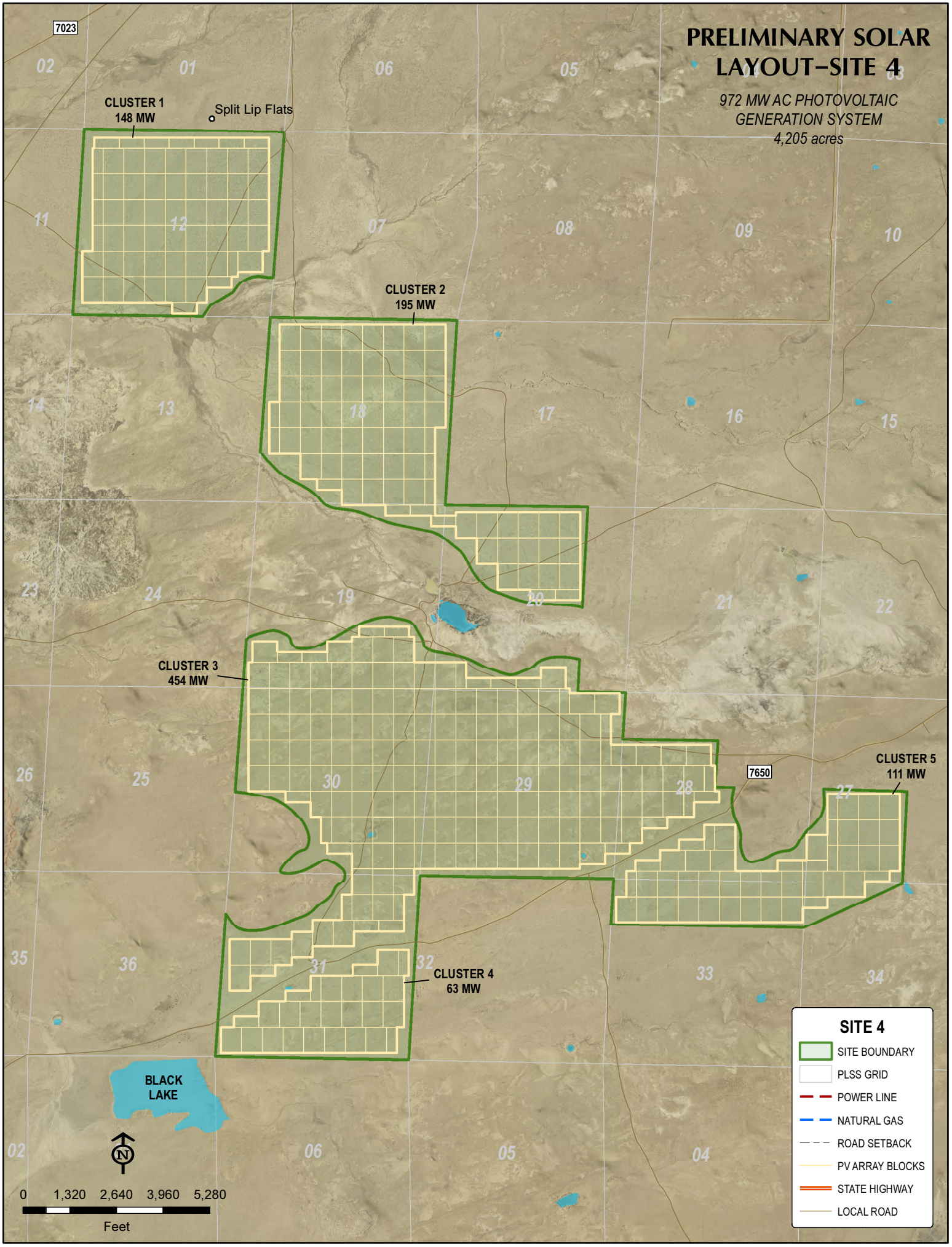
Alamo Wash

371

SITE 3

- SITE BOUNDARY
- PLSS GRID
- POWER LINE
- NATURAL GAS
- ROAD SETBACK
- PV ARRAY BLOCKS
- STATE HIGHWAY
- LOCAL ROAD

0 660 1,320 2,640 3,960 5,280
Feet


PRELIMINARY SOLAR LAYOUT–SITE 4
972 MW AC PHOTOVOLTAIC GENERATION SYSTEM
4,205 acres
CLUSTER 1
148 MW
Split Lip Flats
CLUSTER 2
195 MW
CLUSTER 3
454 MW
CLUSTER 4
63 MW
CLUSTER 5
111 MW
7023
7650
BLACK LAKE
0 1,320 2,640 3,960 5,280
Feet
SITE 4
SITE BOUNDARY
PLSS GRID
POWER LINE
NATURAL GAS
ROAD SETBACK
PV ARRAY BLOCKS
STATE HIGHWAY
LOCAL ROAD

2.6 Long-term O&M Planning for Photovoltaic Power Plants at PBR

The O&M phase of a solar RE project will be driven by two factors, the terms of the land-lease agreement and PPA duration, and the life expectancy of the panels and associated components. It is expected that the O&M phase could last from 25 to 40 years, or even longer. Labor-intensive activities associated with O&M for PV ranches on the PBR include:

- Administrative and Management – management, reporting, security and other office functions
- Monitoring performance of the facility. – Utility-scale plants smaller than 20 MW or so typically have no permanent on-site monitoring staff. Rather these smaller plants are monitored with automation from offsite using embedded SCADA ("supervisory control and data acquisition") systems. Help is summoned if a fault is detected or some other problem occurs that requires the attention of a human being. However, a fully built-out PBR would be 100 times greater in size, a scale which justifies permanent staff of specialty.
- Cleaning–performance is enhanced if dust and other debris does not accumulate on the panels.
- Repair damaged or failed components – items can include panels, inverters, mounting racks, as well as fixed facilities such as equipment sheds. This is obviously the most costly work performed during O&M.

System life expectancy. Although the industry-standard guarantee for a PV module is 25 years, absent catastrophic damage from storms and the like, they should last much longer. 40 years is commonly said. Furthermore, some results from the field suggest that certain hard monocrystalline cells may last a century in service. If the PBR were fully built out according to the waterfall chart shown on page 2-1 or 2-34, then the construction campaign would last well into the 2030s. Meanwhile, the system could be feeding clean power to the grid well beyond 2075.

Projected O&M Cost. The latest information from the industry indicates that a prudent overall O&M charge for a utility-scale photovoltaic facility amounts to 0.9¢/kWh. This includes labor and consumables. Depending on trades and rates, this 0.9¢/kWh charge translates to about one full-time-equivalent (FTE) for every 3 to 6 MW_e of generating capacity. Each 100-MW block then, should provide 15-30 FTEs across a variety of job descriptions. A fully built-out PBR of 2,100 MW capacity should provide 300-600 FTEs for the next few decades, not including ancillary indirect support jobs such as education and training. However, these FTEs may not be realized all at one time since the projects are spread over several decades.

Without tracking hardware, there are essentially no moving parts in a PV power plant, therefore reliability should be very high. Labor not only consists of the obvious replacement of the occasional whole panel, or panel-mounted inverter, but in addition includes maintenance and repair of major hardware such as the mounting racks, skid-mounted inverters, as well as fixed facilities such as equipment sheds, security fencing, and monitoring and surveillance systems. Given the PBR's remoteness combined with the potentially great size of the plant if fully built out, it may be wise to stockpile routine spare parts on site versus trucking them in every time. This problem is amenable to operations research, however, that will also be a decision for the developer and/or owner-operator to make.

PV panels must be kept clean since even a light coating of dust can rob a system of 20% of its designed performance. Washing ~9 million panels clean (200 million square feet of glass surface) would be a major chore. Given the friable soil on the PBR and occasional strong winds, the operators should expect at least two panel washings per year, possibly four. The principal consumable would be wash water. One washing of a megawatt of panels consumes about 10-20,000 gallons of water, enough to fill a few tanker trucks or one average swimming pool. In California, this is typically performed with water trucks just like those

used in road construction projects, but thriftier methods may be available. The aforementioned 25,000 acre-feet of groundwater that is reportedly available from the aquifer under the PBR would be sufficient to keep the 2 gigawatts of capacity clean. However, if all of this water is like the briny fluid observed on the 12 Dec 2012 reconnaissance near the salt flats, then this groundwater would have to be treated and perhaps even desalinated, which adds cost. At a minimum it must be filtered and stored. Therefore the occasional rainwater even on the bone-dry PBR may be a more cost-effective, greener choice. At 8" of rainfall per year, the 10,000 acres of the PBR can be expected to intercept about 7,000 acre-feet of water. Since storm water and runoff near each solar ranch must be managed anyway, perhaps catchments for rainwater, covered to limit evaporation, can be incorporated into the final design for a truly sustainable solution. Another alternative is to use compressed air or truck in water from Farmington.

Maintenance of the Site. Occasional perhaps annual grounds-keeping would be required to prevent weeds from growing tall enough to interfere with the arrays, but especially to limit the natural buildup of combustible fuel unintentionally irrigated with wash-water. Chemical methods to suppress weeds should be avoided, given that the whole point of the PBR solar ranches is to be green and sustainable.

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3. TRANSMISSION AND INTERCONNECTION

The purpose of this preliminary study was to evaluate the feasibility of developing a utility scale solar project at the PBR located on the Navajo reservation in New Mexico. Tetra Tech did an initial mapping and preliminary screening of sites on the Navajo reservation, which concluded that the Paragon-Bisti area had greatest potential for developing a solar generation project. This study is the next logical step in the site development process, which is to evaluate the site from market, economic, and transmission feasibility perspectives to see if developing a solar project at the PBR is commercially viable and would be successful in securing the necessary commercial agreements to develop the site.

There are multiple markets for electricity generated at the Paragon-Bisti Solar Energy Ranch (Ranch) in the Western Electricity Coordinating Council (WECC) region. The largest is California, which enacted a new 33-percent Renewable Portfolio Standard (RPS) requirement by the end of 2020 and is seriously considering increasing it to 50 percent. Closer to the Ranch, New Mexico established a 20 percent RPS for investor-owned utilities and a 10 percent RPS for rural electric cooperatives by 2020. Public Service of New Mexico (PNM) is the nearest utility market for the PBR project. Arizona also has a 15 percent RPS for its regulated utilities, which include Arizona Public Service (APS), Tucson Electric Power (TEP) and Salt River Project (SRP).

Transmission. The Ranch's location is proximate to several major transmission lines in northwest New Mexico that could provide access to these target markets, including lines owned by PNM, APS, TEP, and Tri-State Generation. The State of New Mexico further facilitates moving renewable energy generated in the State to markets through its Renewable Energy Transmission Authority, which is charged with establishing transmission corridors to move renewable energy generated in New Mexico to markets.

Specific transmission lines close to the Ranch include a PNM-owned 230-kV line that passes just west of the site, paralleling the north-south segment of Highway 371 for about 6 miles. This line connects the Four Corners Power Plant to Ambrosia Substation in McKinley County (identified by PNM as segments AF, BP, and BI). Bisti Substation is located along this line on Highway 371 not far from the Ranch. PNM also operates three 345-kV lines east of the site. One line connects Four Corners Power Plant to the Rio Puerco and West Mesa Substations near Albuquerque (line FW); another line, which mostly parallels the first, connects the San Juan Power Plant to Rio Puerco Substation (line WW); another line connects the San Juan Power Plant to Ojo Substation in Rio Arriba County (line OJ).

The Federal Energy Regulatory Commission (FERC) requires all public utility transmission tariffs to include a non-discriminatory process and agreements for interconnecting new generation to their systems. These processes and agreements are called Large Generator Interconnection Agreements (LGIA). The LGIA process requires generators requesting interconnection services to fund a System Impact Study and an Interconnection Facilities Study to determine the feasible interconnection options for a generator and its cost responsibilities for interconnecting. These studies include an evaluation of available transfer capacities, facilities required for interconnection, costs needed to implement the interconnection, and other projects already in the utility's interconnection queue. A preliminary assessment indicates there could be up to 150 MW of available transmission capacity on PNM's 230-kV system and some additional capacity on its 345 kV system. Securing a Power Purchase Agreement (PPA) from a utility buyer and having a Transmission Services Agreement (TSA) for transmission service are both necessary commercial agreements to develop a solar project at the Ranch. It is also important to be able to secure ROW to be able to get the power from the Ranch site to its interconnecting substation.

3.1 Export Markets

The Power Purchase Agreement (PPA) is a legal contract between an electricity generator (provider) and a power purchaser (buyer). Contractual terms may last anywhere between 5 and 20+ years, during which time the power purchaser buys energy, and sometimes capacity for ancillary services, from the electricity generator. Such agreements are crucial to financing of independently owned or merchant generating plants.

The PPA is often regarded as the central document in developing a merchant power project because it creates the revenue stream for the project and provides it with the necessary credit assurances for lenders to finance a generation project. It is key to obtaining non-recourse project financing. Without one or more PPAs, it is unlikely the Ranch project will be developed because the Navajo Tribe is unable to finance the costs to develop the Project without outside financing.

In this FS and analysis report, Tetra Tech conducted an investigation of the potential for securing a PPA by discussing the Ranch project with utilities that have the highest potential for securing a PPA for the project. These utilities included, PNM, El Paso Electric (EPE), Tri-State Generation & Transmission Association (Tri-State), and APS.

PNM serves population centers to the east and south of the Ranch project. Other utility load centers to the west and southwest would require power from the Ranch project to be transmitted north to the Four Corners market hub. NV Energy (NVE) and Southern California Edison (SCE) are also possible markets to the far west. Almost all of these potential utility customers secure their renewable PPAs though competitive bid processes, which will require the Ranch project to be able to sell at a competitive energy price in order to secure a PPA.

Tetra Tech also investigated several smaller local markets including Farmington, New Mexico; Gallup, New Mexico; Los Alamos, New Mexico; and the Navajo Nation itself. The Albuquerque and Central Rio Grande Valley were also investigated in terms of prior efforts by Navajo communities to sell PV power there. PNM, owner of the available power lines, has publicly advised that their ability to handle intermittent renewable resources in their balancing authority is very limited. Thus, PNM is filling its PV Renewable Portfolio Standard (RPS) in large measure by building its own PV generation immediately next to gas fired generation plants under its own control. This is done to ensure reliability, availability, dispatch ability, and deliverability with minimum system instability.

Generally, PNM and other load serving entities view the opportunity for independent generators to obtain a large PPA as dwindling because there are so many renewable energy developers already in the PNM's LGIA transmission queue. Currently, there are more proposed generators than demand for that power in PNM's system.

Based on interviews, technical research, and study of the published materials of a majority of potential power purchasers in the region, the following key findings are highlighted:

- There have been calls in the recent past for RE from PNM, however, it was not in our area. At this time, there is not an immediate purchase request for solar energy generated at the PBR that would enable interconnection or financing of the project.
- Target purchasers expressed price sensitivity as a major concern. As detailed below, in this marketplace, solar energy must be price competitive with hydropower, coal, and natural gas, unless significantly offset by incentives. Each potential purchaser has a unique mix of power sources, and each entity is successfully meeting long-term goals for renewables. Low-price purchasing is the norm in order to maintain lowest possible consumer prices.

- If solar PV generation from the PBR could be marketed at $45-55 per megawatt-hour (MWh) or less including transmission fees, Farmington, Navajo Tribal Utility Authority (NTUA), and possibly Tri-State may be willing to consider a bid when those entities open Requests for Proposals (RFPs). Some load-serving entities buy power on long-term contracts from PNM, which do not reopen for negotiation for a decade or more.
- Among the target customers who may not accept power from the PBR are APS, Salt River Project (SRP), Tucson Electric Power (TEP), Los Alamos Public Utility, EPE, etc. Similarly, PNM is filling its RPS from customer-installed rooftop PV and PNM-installed PV co-located with its natural gas generation facilities.
- If transmission and interconnection could be arranged, 50 to 100 MW of power might be offered by PBR in response to a competitive bid process. It appears unrealistic to market 2,000+ MW of solar power to the region from the PBR due to size of the potential purchasers, interconnection, and pricing. If transmission and interconnection can be secured over the long term, it may be possible to phase in some additional generation from PBR.
- Tetra Tech held discussion with PNM to investigate the interconnection process. Generally, potential purchaser who will negotiate a PPA want transmission and interconnection agreements with PNM in place.
- PNM relies on a policy is that all solar power in its distribution system will be either Distributed Generation or company-owned.

Potential Power Off-taker. In this study, Tetra Tech began the process of investigating potential PPAs by discussing power sales with regional load serving entities such as PNM, EPE, Tri-State, and APS currently managing regional transmission power lines. PNM serves population centers to the east and south of the site. Other lines serve load centers to the west and south west, although load centers to the west require transmission of power north to the Four Corners market hub. NVE and SCE are examples of large power purchasers to the far west. All PPAs, of course, are based on selling energy at competitive energy prices.

Markets. A summary of Tetra Tech's investigation of potential markets for exporting RE is presented below in Table 3-1:

• Export Market /Utility Company	• Factors / Assessment
Public Service Company of New Mexico (PNM)	• Owner of transmission line in the area. Largest consumer in the area. Periodic RFP calls for RE power. Meeting RPS from local distribution and rooftop units
Arizona Public Service (APS)	• Growth of RE portfolio, 15% RPS. Mainly using in-state RE sources
Tri-State Generation & Transmission Association (Tri-State)	Growing RE RPS, up to 10%. Buying out of state solar and wind energy. Would welcome bids from NN for RE from PBR
Salt River Project	Old service to AZ since 1903. 2020 RPS of 20%. Focus on rooftop solar and small diversified utility- projects. Unlikely for PPA
Tucson Electric Power (TEP)	1892 service to Tucson. Planned utility-scale generation projects 150 MW by 2019. Unlikely long-term PPA with NN, TEP will acquire power in the Tucson area.
El Paso Electric (EPE)	Covers TX, part of NM and Mexico. RPS grows to 20% by 2020. Meeting their goals with solar. Unlikely PPA
Los Alamos, New Mexico	County-wide service. Meeting RPS as high as 28%, looking for more RE opportunities. Not a good target based on location and service by PNM
Southern California Edison (SCE)	Primary electricity supply company for Southern California. SCE would not even hold negotiations with any company that did not have a transmission agreement. Difficult to establish a PPA
NV Energy (NVE)	Electrical service to parts of NV including Las Vegas. Early RE projects in 1983, RPS of 25% in 2025. Unlikely NVE would sign a PPA with NN, generating the power in-state instead.
Navajo Tribal Utility Authority (NTUA)	Service to 27,000 square miles of NN. Using remote standalone solar systems. Sale of PV to NTUA difficult due to energy pricing. NTUA purchases hydroelectric power at a very low cost.

Table 3-1. Summary of Potential Export Markets

The Albuquerque and central Rio Grande Valley are discussed in terms of prior efforts by Navajo communities to sell PV power there. It should also be remembered that PNM, owner of the available power lines, has publicly advised that their ability to handle intermittent renewable resources in their balancing authority is very limited. Thus, PNM is filling its PV RPS by building its own PV generation immediately next to gas fired generation plants under its own control. This is done to ensure reliability, availability, dispatch ability, and deliverability with minimum system instability. It also works keeps the utility franchise intact.

3.1.1 Public Service Company of New Mexico

PNM Resources, Inc. (NYSE: PNM) is an investor-owned energy holding company based in Albuquerque, New Mexico, with 2012 consolidated operating revenues of $1.3 billion. Through its regulated utilities—PNM and TNMP (Texas-New Mexico Power Co. & Subsidiaries)—PNM Resources Inc. has approximately 2,538 MW of generation capacity and serves electricity to more than 738,000 homes and businesses in New Mexico and Texas.

Out of the PNM total of 2,333 MW of electric generating capacity as of December 31, 2012 (0.22% of the U.S. total), PNM produced 79.2% from coal, 19.9% from natural gas, and 0.9% from oil. All of PNM's power plants are in New Mexico. PNM also obtains 204 MW of power under a long-term PPA with the New Mexico Wind Energy Center totaling 2,538 MW of generating power system wide. The following are some of the findings on PNM concerning the potential for cooperation from PNM on transmission leading to a PPA from PNM.

The total transfer capacity from the San Juan Generating Station (SJGS) to Albuquerque is approximately 1,312 MW, which is currently being met by PNM as “native load.” Very little excess capacity exists to add new generation from Western New Mexico. PNM asserts that there is no capacity to balance more than 200 MW of intermittent renewable energy generation in northwest New Mexico. There are no other transmission lines accessible from the PBR other than the PNM transmission lines. Some limited capacity may be available on the PNM 230 kV Bisti to Ambrosia line (BI) running adjacent to the BPS, if a non-PNM PPA can be secured prior to site engineering.

By the end of 2013, PNM had added more than 67 MW of solar from rooftop installations by customers and PNM-owned PV facilities. This places over 70% of the 2020 RPS in service by the end of 2013. The remaining 27 MW of solar to fulfill the 2020 RPS is being reserved for customer rooftop and perhaps some additional company-owned PV at scattered natural gas generation sites. Therefore, no PPA from PNM will be secured from the PBR.

3.1.2 PNM Renewable Portfolio Standards

In addition to and within the total portfolio requirements, utilities must design their public utility procurement plans to achieve a fully diversified renewable energy portfolio as follows. The New Mexico Renewable Energy Act of 2004 establishes a mandatory RPS requiring a RE portfolio equal to 10% by 2011, 15% by 2015, and 20% by 2020. Diversity requirements for investor-owned utilities (IOUs) as a percentage of total RPS (NMPRC 2014) requirements are:

- No less than *30% Wind*
- No less than *20% Solar*
- No less than 5% Other technologies
- No less than 1.5% Distributed Generation (2014) and 3% Distributed Generation by 2015

By the 2020 deadline, PNM will have a minimum of 467 MW of renewables, the breakdown of which has not yet been determined by PNM. However, it does mean that the solar component of the renewables is approximately 93.4 MW. According to Jeff Mechenbier, Director of Transmission/Distribution Planning and Contracts, as of October 30, 2013, Distributed Generation is generating 25.8 MW of solar PV power, which exceeds the distributed generation minimum for 2020. By 2020, this generation will have grown further and further exceeded its proportion of the renewables portfolio. PNM receives renewable energy credits (RECs) for this generation, thereby reducing the overall power needed to meet the RPS. Solar distributed generation beyond the RPS is transferred under the solar requirement. The breakdown of PNM renewables as of 2013 is shown on Figure 3-1.

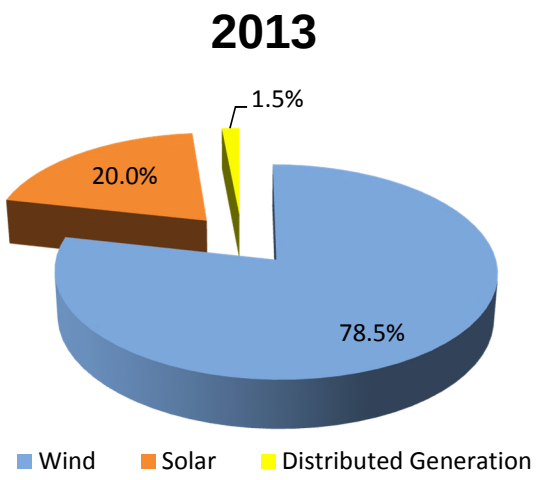


Figure 3-1. The Breakdown of PNM Renewables as of 2013

Source: PNM 2013a.

A public utility is not required to add renewable energy to its electric energy supply portfolio, pursuant to the renewable portfolio standard, above the reasonable cost threshold established by the Commission. The reasonable cost threshold in any plan year is 3% of plan year total revenues, beginning in 2013.

In August 2010, the Public Regulation Commission (PRC) partially approved PNM's revised 2010 procurement plan, including PNM's investment in 22 MW of solar PV facilities at various PNM sites and the construction of a solar-storage demonstration project. The PRC approved the estimated costs of $107.7 million. Under New Mexico's Renewable Energy Act of 2004, actual costs incurred pursuant to and consistent with an approved procurement plan are deemed to be reasonable and recoverable in the ratemaking process. Construction of these facilities was completed in 2011 at a total cost of approximately $95 million.

In July 2010, PNM filed its renewable energy procurement plan for 2011. PNM requested a variance from the diversity requirements for solar and certain "other resources" for 2011 based on the Reasonable Cost Threshold (RCT) and availability constraints, which the PRC granted. The PRC ultimately rejected a portion of PNM's proposal in an order that was appealed to the New Mexico Supreme Court. On June 7, 2012, the New Mexico Supreme Court dismissed the appeal.

In July 2011, PNM filed its renewable energy procurement plan for 2012. The plan requested a variance from the RPS due to RCT limitations. The plan was diversity-compliant based on the reduced RPS, except for non-wind/non-solar resources, which were not available. In December 2011, the PRC approved PNM's 2012 plan, but ordered PNM to spend an additional $0.9 million on renewable procurements in 2012. PNM

intends to recover the costs of the supplemental procurements in 2013 through a renewable rider. This order also required PNM to file its 2013 renewable energy procurement plan by April 30, 2012. The 2013 plan proposed procurements for 2013 and 2014 of 20 MW of PNM-owned solar PV facilities, at an estimated cost of $45.5 million, wind and solar REC purchases in 2013, and a purchased power agreement for the output of a new geothermal facility. The plan also included a supplemental procurement of 2 MW of PNM-owned solar PV facilities at an estimated cost of $4.5 million to supply the energy sold under PNM's voluntary renewable energy tariff. The plan will enable PNM to comply with the statutory RPS amount in 2013, but requires a variance from the PRC's diversity requirements in 2013 while the proposed geothermal facilities are being constructed. This plan is expected to achieve full RPS quantity and diversity compliance by 2014 without exceeding the RCT. The PRC approved the plan in December 2012, but reduced the supplemental solar PV procurement to 1.5 MW.

On October 30, 2013, Tetra Tech investigators conducted an interview with Dwight Lamberson, Utility Division Director of PRC, who indicated that solar diversity in 2012 represents 10.3% of the RPS requirement. As of November 2013, PNM is generating 60 MW of solar power, which represents 64% of its 2020 RPS requirements. In 2014, PNM is planning to bring online another 150 MW of investor-owned solar and wind power, thereby surpassing its 2020 RPS requirements. As stated, PNM policy is to provide 100% of the solar component of the RPS from customer rooftops and PNM-owned PV sites. There is little likelihood of selling any power at all from the PBR to PNM. The breakdown of PNM renewables as of 2014 is shown on Figure 3-2.

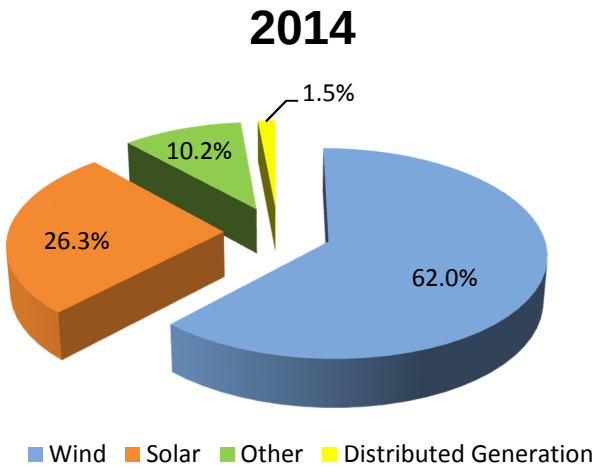


Figure 3-2. The Breakdown of PNM Renewables as of 2014

Source: PNM 2013a.

3.1.2.1 Integrated Resource Plan 2011 – 2030

PRC rules require that IOUs file an Integrated Resource Plan (IRP) every 3 years. The IRP is required to cover a 20-year planning period and contain an action plan covering the first 4 years of that period. In its most recent IRP, which was filed in July 2011, PNM indicated that it planned to meet its anticipated load growth through a combination of new natural gas-fired generating plants, renewable energy resources, load management, and energy efficiency programs.

Table 3-1 shows the renewables that PNM is planning to bring online now through 2030. The remainder of renewables to include in its RPS comes from RECs. These renewables mean that PNM surpasses all requirements of its RPS (PNM 2013a).

According to Table 3-2, PNM will have an additional 40 MW of new renewable generation online by 2030. Unless PNM changes its renewable strategy concerning solar, additional solar generation will come from customer rooftops and PNM-owned PV sites.

Table 3-2. PNM Resource Additions 2011 – 2030 (MW)

2011-2030	Mid-Forecast Energy Efficiency	17-127
2014	**Renewable Resources**	**150**
2015	Natural Gas Turbine	40
2016	Natural Gas Turbine	40
2017	Natural Gas Turbine	177
2017	Extend Load Management (LM)	115
2019	**Renewable Resources**	**200**
2022	**Renewable Resources**	**40**
2023	Natural Gas Turbine	177
2026	Natural Gas Turbine	177
Total renewables in the IRP to 2030		***390***

Source: PNM 2011.

3.1.2.2 PNM Incentive Program for Distributed Generation via Customer-Owned Solar Systems

In March 2006, PNM initiated a REC purchase program as part of its plan to comply with New Mexico's RPS. PNM purchases RECs from customers who install PV and solar thermal electric systems up to 10 kW for 8 years and >10 kW up to 1 MW for 20 years.

PNM will then be able to apply these RECs towards its obligations under the RPS for solar or distributed generation. As of June 2013, 3,300 customers are participating in the customer program, but it is still growing. As of October 2013, this distributed solar is generating 25.8 MW.

The PNM Solar Energy Customer Program is available to any PNM customer, residential or business, that installs a qualified solar energy system and has it interconnected to the PNM power grid. It applies to grid-tied solar PV systems and solar thermal electric technologies. Maximum system size is 1 MW_{AC}. Solar water heaters and other solar heated equipment are not eligible for incentives. This program is heavily promoted by PNM to create RECs for its renewables portfolio.

3.1.2.3 Incentives

Customers benefit in two ways when they install and interconnect qualified solar energy systems to the PNM power grid:

1. **REC purchase:** Because they are adding renewable-fueled power to the PNM system, PNM pays the customer for helping it meet its environmental goals.
2. **Net metering:** Since customer systems are producing energy, they only have to pay for electricity when they use more energy than their systems produce in a given billing period.

3.1.2.4 Conclusion

Current PNM policy is to provide 100% of the solar RPS from customer rooftops and PNM-owned PV sites. No PPAs for solar power will be awarded, although solar continues to be mentioned in periodic RFPs published by PNM to avoid a political challenge from the PRC. Additional discussions with the PNM should be scheduled regarding an initial project at the Bisti substation.

3.1.3 Arizona Public Service

APS was founded in 1884, nearly a quarter-century before Arizona became a state. Today, over 125 years later, APS generates safe, affordable, and reliable electricity for more than 1.1 million retail and residential customers in 11 of Arizona's 15 counties. The company serves approximately two-thirds of the Phoenix metropolitan area as well as Flagstaff, Prescott, Yuma, and Douglas. By 2030 APS expects to add approximately 700,000 new customers.

In 2012, the APS peak load requirement was 8,233 MW (APSC 2012) including:

- 1,100 MW of nuclear generation
- 1,700 MW of coal-fired generation
- 5,500 MW of natural gas resources and contracts

The company forecasts approximately 3 percent average annual growth in electricity requirements through 2027 when the peak load is projected to reach 13,167 MW. Customer-centric resources, such as energy efficiency and distributed energy (e.g., rooftop solar systems), are expected to help offset a portion of this forecasted growth; nonetheless, APS will need to add additional generating capacity to keep pace with demands.

3.1.3.1 APS RPS Portfolio

In November 2006, the Arizona Corporation Commission ruled to expand the state's Renewable Energy Standard (RES) to 15% by 2025, with 30% of the renewable energy to be derived from distributed energy technologies. Figure 3-3 shows the APS energy mix by resource in 2012 as well as the anticipated energy mix in 2027. It is important to note the RES created by the Arizona Corporation Commission includes renewable energy (RE) generation, distributed energy (DE) generation, and energy efficiency (EE) improvements.

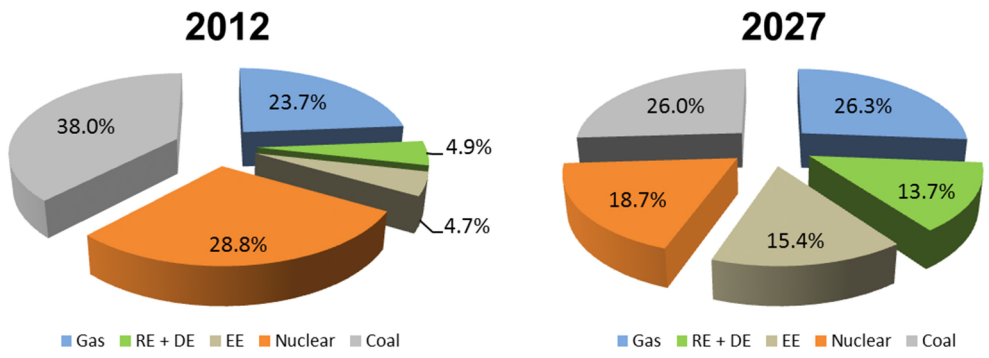


Figure 3-3. Composition of Energy Mix by Resource

Source: Arizona Public Service.

The APS renewable energy portfolio is expanding rapidly, growing from less than 1 MW in 2001 to over 650 MW of nameplate utility-scale capacity today. The current APS renewable portfolio consists of a mixture of APS-owned solar facilities and long-term purchased power contracts. It includes approximately 350 MW of solar generation, 289 MW of wind generation, 14.5 MW of biomass generation, 10 MW of geothermal generation, and 6 MW of biogas generation. To help meet 2027 customer demand and the Arizona RES requirements, APS anticipates developing and/or entering into long-term power purchase agreements for an additional 400 MW of utility-scale wind generation capacity, 300 MW of utility-scale

solar generation capacity, and 80 MW of utility-scale geothermal generation capacity between 2021 and 2027.

APS is committed to making Arizona the solar capital of America. In fact, due in large part to the company's work over the last decade, Arizona now has more solar generation per capita and more energy from large solar plants than any other state in the country. APS has also committed to spend approximately $1 billion on solar projects statewide that span from the Grand Canyon to Chase Field to Flagstaff and Yuma.

3.1.3.2 Conclusion

Every APS PV project providing energy has been sited within the boundaries of the State of Arizona. Tetra Tech investigators have been told informally that APS has no intention of siting projects outside Arizona and there is no transmission available from northwestern New Mexico to move power onto any APS line. Given the relatively limited amount of utility-scale solar (300 MW) that APS plans to develop and/or purchase between now and 2027 as well as the company's commitment to solar development within the state of Arizona, it is highly unlikely that APS would execute a long-term PPA with the Navajo Nation powered by the PBR.

3.1.4 Tri-State Transmission and Generation Association, Inc.

Tri-State is a wholesale electric power supplier owned by the 44 electric cooperatives that it serves. Tri-State generates and transmits electricity to its member systems throughout a 200,000 square-mile service territory across Colorado, Nebraska, New Mexico, and Wyoming. The company was founded in 1952 by its member system to provide a reliable, cost-based supply of electricity. Today, over 60 years later, Tri-State serves approximately 1.5 million consumers throughout its four-state service area.

In 2012, the Tri-State peak member demand was 2,798 MW (Tri-State 2012). That same year Tri-State had slightly more than 3,500 MW of generating capacity available in its diverse portfolio (Tri-State 2013). This power is generated through a combination of owned baseload and peaking power plants that use coal and natural gas as their primary fuels, supplemented by purchased power, federal hydroelectricity allocations, and renewable resource technologies. In 2012, less than 5% (4.9%) of the Tri-State generation capacity came from either wind or solar generation.

3.1.4.1 Renewable Portfolio Standard and the Tri-State Renewable Portfolio

Since Tri-State is a Rural Electric Cooperative, the New Mexico RPS requires 5% of retail energy sales come from renewable sources by 2015 with 10% from renewable sources by 2020. Tri-State's Member load peak demand is projected to grow at an average of 1.8% per year through the resource acquisition period. Therefore, the company has calculated a need for approximately 250 gigawatt hours (GWh) of REC by 2019 and approximately 2,700 GWh of REC by 2020.

In 2009, Tri-State signed agreements to purchase power generated by two renewable projects—the Kit Carson WindPower Project in east-central Colorado and the Cimarron Solar Project—located in northeastern New Mexico. The Kit Carson facility consists of 34 G.E. turbines, generating 51 MW of electricity, while the Cimarron Solar Project consists of 500,000 PV cells generating 30 MW of electricity at peak. In December 2012, Tri-State's Colorado Highlands Wind Project began commercial operation in northeastern Colorado and less than a year later it was expanded to increase the facility's total generating capacity to 91 MW. These three projects along with the individual renewable generation projects of Tri-State's 44 members will provide enough renewable energy to meet or exceed RPS requirements until 2019 as shown on Figure 3-5 (Tri-State 2013).

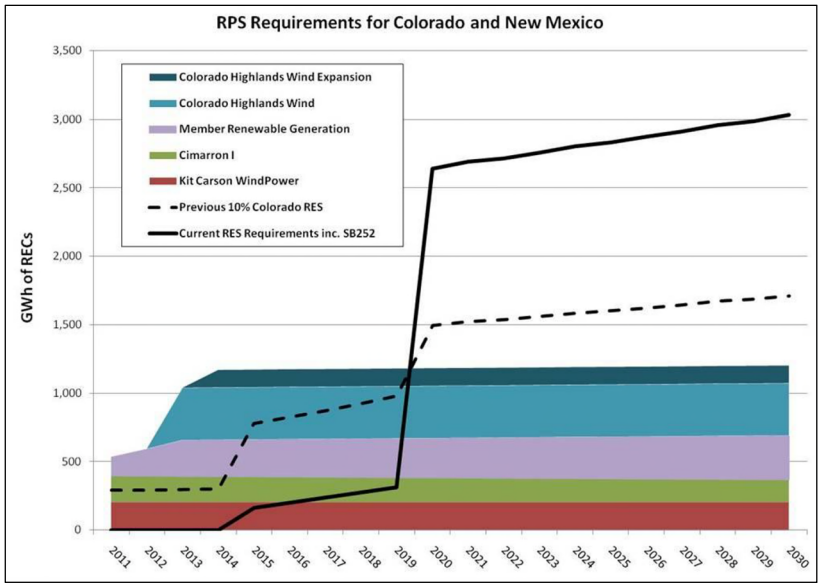


Figure 3-4. RPS Requirements for Colorado and New Mexico

Source: Tri-State, 2013.

By 2020, Tri-State will need to acquire additional renewable energy. If the company were to satisfy the renewable energy needs for 2020 with only wind generation, it would require approximately 400 MW of additional wind generation. However, if Tri-State were to use photovoltaic solar to supply the additional energy, it would require approximately 250 MW of photovoltaic solar. In reality, the generation will likely be split between these two resources.

Tri-State owns or has maintenance responsibilities for a vast multi-state interconnected transmission network consisting of more than 5,200 miles of high-voltage line across its service territory. With the existing transmission system reaching points of being fully subscribed, Tri-State's current efforts are focused on rebuilding and expanding portions of its critical infrastructure to enhance power reliability and stability to its member co-ops, while also creating opportunities for the development of new energy resources.

A phone interview was conducted with Rob Wolaver, Tri-State Senior Manager of Energy Resource, about the company's need for additional renewable generation in order to meet the 2020 RPS. When asked if he knew when a new RFP for renewable generating capacity would be issued, he explained that Tri-State had just completed a major RFP process initiated in early 2013. Therefore, it would be up to the Tri-State board of directors to determine when a new RFP will be issued based on market conditions and subsidies, but that will be some years in the future. He went on to state, "We would welcome RFP bids from the Navajo Nation, but there is no way we could purchase anything close to 250 MW." According to Mr. Wolaver, transmission constraints, available transmission capacity, and costs to interconnect to the Tri-State system are among the largest drivers in evaluating a project's feasibility and attractiveness. It is advantageous to purchase renewable resources near baseload generation to help with system balance from intermittent energy sources (Tri-State 2013). A projection of energy resources through the year 2033 is provided on Figure 3-6.

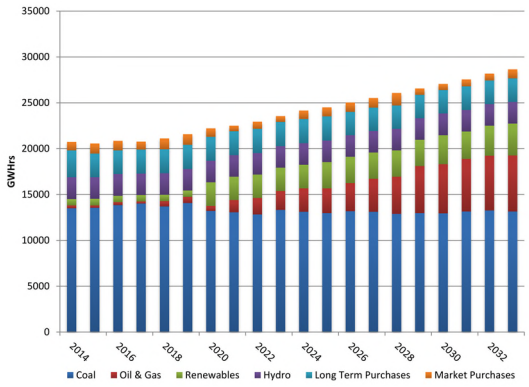


Figure 3-5. Tri-State Projection of Energy Sources Through 2033

Source: Tri-State, 2013.

3.1.4.2 Conclusion

Within a few years, Tri-State will issue another RFP. Tri-State has indicated a preference for wind energy, which they believe to be less expensive than solar PV. There is no opening with Tri-State to secure a guaranteed purchase agreement outside the RFP process. This presents a "chicken-and-egg" problem. If construction financing of the NHLCO demonstration site requires a PPA, waiting to bid for a PPA will not satisfy requirements for PNM interconnect. To win a competitive PPA may require a facility with transmission and interconnection agreements in place. Winning a PPA against wind energy by beating the wind energy price point is also a potential issue. Without a PPA, it will be nearly impossible to get an interconnection agreement with PNM under current PNM rules. This is the circular logic issue.

3.1.5 Salt River Project

Salt River Project (SRP) has been serving central Arizona since 1903, nearly 10 years before Arizona became the 48th state. Today, the SRP power district is one of the nation's largest public power utilities. The company provides electricity to more than 970,000 retail customers in a 2,900-square-mile service area that spans three Arizona counties, including the metropolitan Phoenix area. SRP offers an integrated utility, providing generation, transmission, and distribution services, as well as metering and billing services.

In 2013, the SRP annual peak demand was 7,195 MW. That same year the company had 8,155 MW of peak generating capacity available in its portfolio and total sales of approximately 32,500 GWh (SRP 2013a). SRP estimates that by 2023, annual peak customer demand will increase to approximately 8,403 MW with approximately 38,730 GWh of annual retail sales. To meet the growing power needs of metropolitan Phoenix and the entire SRP service area, the company is moving ahead with plans for additional generating facilities and transmission lines that will protect SRP customers from market fluctuations and power shortages.

3.1.5.1 Sustainable Portfolio Target and SRP Sustainable Energy Portfolio

SRP is not an IOU and therefore is not held to the RPS developed by the State of Arizona. However, in the spring of 2011, the SRP board of directors established that by 2020 the company will meet 20% of its retail energy requirements with sustainable resources. The SRP Sustainable Energy Portfolio combines renewable energy resources with energy conservation and demand response programs to reduce the impact of SRP's operation on the environment.

As of 2013, SRP's total current renewable capacity is 760 MW and includes the following resources (Table 3-2) (SRP 2013b):

Table 3-3. 2013 Renewable Resource Capacity Mix

Source	Size
Biomass	13 MW
Utility-scale solar	39 MW
Dry Lake Wind 1 and 2	127 MW
Geothermal	50 MW
Hydro	391 MW
Landfill gas	22 MW
Rooftop solar	68 MW
Wind purchase	50 MW
Total	**760 MW**

Source: Tri-State, 2013.

As highlighted above, SRP currently has an estimated 107 MW of solar generation capacity. However, only slightly more than a third of this capacity (39 MW) is produced by utility-scale solar facilities. SRP currently has a 20-year PPA with SPEG Solar Source for the 19 MW of energy generated by the Queen Creek Solar plant in Pinal County and a 25-year PPA with Iberdrola Renewables for the 20 MW of energy generated by the Copper Crossing Solar Ranch in Florence, Arizona. The remainder of the company's solar generating capacity (68 MW) comes from either rooftop installations on SRP-owned facilities and partnering community/business facilities, or customer-owned systems subsidized by SRP through the company's EarthWise Solar program. SRP is dedicated to generating solar power in this way as part of the company's best practices model and to test feasibility for customer and shareholder use.

In February 2013, a phone interview was conducted with Barry Petrey, SRP Manager of Resource Acquisition Analysis, about the company's need for additional utility-scale renewable generation. According to Mr. Petrey, SRP currently purchases out-of-state energy for a few of the products in its renewable portfolio. However, he explained this is usually only done when a specific type of power is not readily available within Arizona. "We buy geothermal energy from out-of-state because there really isn't any geothermal resource here in Arizona." He went on to say Arizona is well-situated for solar generation with over 300 sunny days a year. "We took off with solar right away and we're actually ahead of our goal at this point, so we're not actively out there procuring additional solar resources." Still, Mr. Petrey did acknowledge that SRP will eventually need to increase its solar generating capacity in order to keep up with the company's self-determined goals.

When asked if SRP would consider entering into a PPA for solar energy generated by the proposed PBR, Mr. Petrey stated, "There's limited transmission in that area. So even if you could get it to us, that's a long way to move it; which would probably make it too expensive for us to buy." When asked what SRP is currently paying for PV solar, he said, "I can't tell you what we're paying right now. What I can tell you though is that price has changed over time. It's about half of what it was." Mr. Petrey went on to say, "We do have a couple of utility-scale projects within the state, but they're around 20 MW. We really like smaller projects close to our load, for tie-in purposes."

3.1.5.2 Conclusion

Given the SRP focus on rooftop solar installation and small diversified utility-scale projects as well as the company's commitment to solar development close to their load for tie in purposes, it is highly unlikely that SRP would execute a long-term PPA with the Navajo Nation powered by the PBR.

3.1.6 Tucson Electric Power

Electric power was first used in Tucson in the 1880s. In 1892 a company was formed that became TEP. TEP is now the second-largest investor-owned utility in Arizona and the largest corporation headquartered in southern Arizona. The company provides power to more than 400,000 in the Tucson metropolitan area through traditional resources and green power projects.

In 2012, TEP experienced peak demand of 2,576 MW. That same year the company owned or leased 2,267 MW of generating capacity with an additional 683 MW supplied through PPAs with other sources (UNS 2012). Total sales in 2012 (excluding mining) were approximately 8,150 GWh. TEP anticipates peak hourly loads will reach approximately 2,800 MW by 2025 with total retail sales (excluding mining) projected to reach 9,500 GWh that same year (TEP 2013a).

3.1.6.1 Renewable Energy Standard and the TEP Renewable Portfolio

In November 2006, the Arizona Corporation Commission ruled to expand the state's RES to 15% by 2025, with 30% of the renewable energy to be derived from distributed energy technologies. Based on these requirements, TEP has created the following timetable for the development of renewable resources (Figure 3-6) (TEP 2013b).

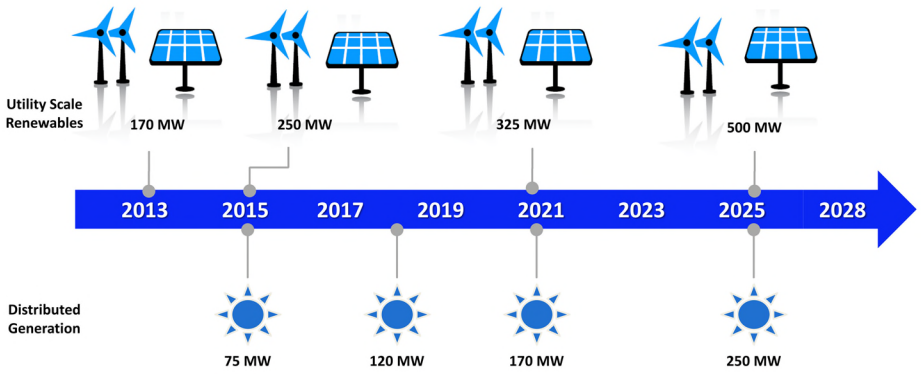


Figure 3-6. TEP Timetable for Renewable Generation Development

Source: TEP 2013b

As of December 2013, TEP had 161 MW of utility-scale renewable generation capacity in place with plans to develop and/or secure an additional 100 MW of capacity by 2015. Table 3-4 details the company's 2013 and 2015 renewable generation capacity by project.

Table 3-4. TEP Utility-Scale Generation

Project	Capacity MW (DC)	Annual MWh	Technology	Expected In-Service Date	TEP Owned
Existing Renewable Generation					
Sundt –Los Reales	4	21,100	Biogas	Operational	Yes
SGS	6.4	7,573	Fixed PV	Operational	Yes
UASTP I -Solon	1.6	3,041	SAT PV	Operational	Yes
UASTP II -Amonix	2	4,111	CPV	Operational	No
UASTP III -Solon	5	7,914	Fixed PV	Operational	Yes
UASTP IV -AstroSol	6	10,407	Fixed PV	Operational	No
SunPower	0.5	875	Fixed PV	Operational	Yes
Prairie Fire	5	7,954	Fixed PV	Operational	Yes
NRG Solar	35	78,010	Fixed PV	Operational	No
SunEdison	25	57,950	SAT PV	Operational	No

Project	Capacity MW (DC)	Annual MWh	Technology	Expected In-Service Date	TEP Owned
E.ON	6.2	14,518	SAT PV	Operational	No
E.ON	14	32,782	SAT PV	Operational	No
Macho Springs	50.4	130,244	Wind	Operational	No
Total Existing	**161**	**376,480**			
Bright Tucson Solar Buildout Plan (BTSBP)					
SunPower	10	19,947	Fixed/LCPV	1-Oct	Yes
Areva	5	14,310	PV/Thermal	1-Feb	Yes
Total Future -BTSBP	**15**	**34,257**			
Future Renewable Generation					
Cogenra	1	1,968	LCPV	1-Jun	No
Avalon Solar	35	66,532	Fixed PV	1-Jul	No
Red Horse Wind	50	129,560	Wind	2015	No
Total Future –Pending (Contracts)	**86**	**198,061**			
Total Planned Generation (Contracts)	**262**	**608,798**			
Total Planned Generation through 2014	**212**	**479,237**			

Once the BTSBP and future renewable generation detailed in the table above have been developed or secured, its utility-scale renewable generation capacity will be sufficient to meet the RPS until 2019 based on current demand forecasts. TEP anticipates it will be necessary to develop and/or secure an additional 238 MW of capacity between 2019 and 2025 in order to meet the 2025 requirements. If the company maintains the wind to solar ratio in the table above, it is anticipated that no more than 150 MW of additional solar capacity will be needed by TEP between now and 2025. TEP believes all 150 MW of additional solar capacity will be generated in Arizona, based on the abundance of the solar resource.

3.1.6.2 Conclusion

Given TEP's current and planned utility-scale generation projects and the need for only an additional 150 MW of solar generation capacity between 2019 and 2025, it is highly unlikely that TEP would execute a long-term PPA with the Navajo Nation for power generated by the PBR. It is more likely that TEP will acquire new solar generation in the Tucson area as it has done with other projects. Because Tucson has abundant sunshine, transmission costs are reduced, making local plants more cost competitive.

3.1.7 El Paso Electric

EPE first began servicing its customers on August 30, 1901. EPE is a regional electric utility providing generation, transmission, and distribution services to approximately 392,000 retail and wholesale customers in a 10,000-square-mile area of the Rio Grande Valley in west Texas and southern New Mexico. The company's service territory extends from Hatch, New Mexico, to Van Horn, Texas, and includes two connections to Juarez, Mexico, and the Comisión Federal de Electricidad, Mexico's national utility.

In 2012, EPE's Native System (the portion of the larger EPE system that serves New Mexico and Texas) experienced peak demand of 1,688 MW. During that same year, EPE had Net Dependable Generating Capability (generating capacity owned or leased by EPE) of 1,765 MW and total retail sales of 7,715 GWh (EPE 2012). Table 3-5 summarizes the contribution of nuclear fuel, natural gas, coal, and purchased power to the company's total energy mix in 2012.

Table 3-5. 2012 El Paso Electric Energy Mix

GENERATING CAPACITY			
Plant	**Net Dependable Generating Capability**	**Fuel Source**	**Energy Mix**
Palo Verde	633 MW	Nuclear	46%
Newman	732 MW	Natural Gas	
Rio Grande	229 MW	Natural Gas	32%
Copper	62 MW	Natural Gas	
Four Corners	108 MW	Coal	6%
		Purchased Power	16%
Hueco Mountain Wind Ranch	1 MW	Wind	
Total	**1,765 MW**		**100%**

Source: EPE, 2012.

EPE anticipates that by 2020, peak demand within the Native System will reach 2,188 MW with total sales of approximately 9,679 GWh (EPE 2011).

3.1.7.1 Renewable Energy Standard and the EPE Renewable Portfolio

In August 2007, the New Mexico PRC issued an order and rules requiring IOUs meet the 15% by 2015 and 20% by 2020 targets through a "fully diversified renewable energy portfolio." This is defined as a minimum of 20% solar power, 30% wind power, and 5% from either biomass, geothermal energy, or hydroelectric power brought into service after July 1, 2007. In 2015, EPE's total New Mexico retail jurisdictional energy sales are forecasted to be approximately 1,838 GWh, resulting in a 2015 RPS requirement of approximately 275,605 MWh (EPE 2013). Based on these numbers, the company estimates its renewable portfolio would need to include the following minimum amounts from the identified resource types to meet the New Mexico specified diversity requirements:

Resource	**2015**
Solar	55,120 MWh
Wind	82,681 MWh
Biomass/Other	13,780 MWh
Distributed Generation	8,268 MWh

EPE obtains the vast majority of its relatively limited renewable generation capacity through long-term PPAs for solar power. Table 3-6 below details the company's current and anticipated renewable energy generation capacity as of May 2013.

Table 3-6. Current and Anticipated Renewable Energy Capacity as of May 2013

Project	Technology	Location	Size
Hueco Mountain Wind Ranch	Wind	East of Horizon, TX	1.32 MW
Newman Solar PV #1	Solar Photovoltaic	El Paso, TX	0.064 MW
Rio Grande Solar PV	Solar Photovoltaic	Sunland Park, NM	0.064 MW
Wrangler Substation PV	Concentrated Photovoltaic	East El Paso	0.048 MW
Stanton Tower Building PV	Mono-Crystalline	Downtown El Paso	0.031 MW

El Paso Community College PV	Solar Polycrystalline	EPCC Valle Verde	0.014 MW
Van Horn PV (2013)	Solar Photovoltaic	Van Horn, TX	0.020 MW
		Sub-Total EPE Owned	**1.56 MW**
Southwest Environmental Center PV	Solar Photovoltaic	Las Cruces, NM	0.006 MW
Camino Real Landfill Methane Gas	Biomass	Sunland Park, NM	1.2 MW
Hatch Solar Energy Center	Concentrated Photovoltaic	Hatch, NM	5 MW
NRG Solar Roadrunner	Thin-film Photovoltaic	Santa Teresa, NM	20 MW
Las Cruces Centennial Solar Farm	Solar Polycrystalline	Las Cruces, NM	12 MW
El Chaparral Solar Farm	Solar Polycrystalline	Chaparral, NM	10 MW
Macho Springs Solar (2014)	Thin-film Photovoltaic	Deming, NM	50 MW
		Sub-Total PPA	**98.20 MW**
		Customer-Owned Renewable DG	**5.00 MW**
		Total Renewables	**104.76 MW**

Source: Derived from EPE data, 2013.

As noted above, EPE must meet the RES of 15% from 2015 through 2019, and 20% beginning in 2020. However, the company is not obligated to meet the RES (or individual diversity requirements) if the cost to acquire additional renewable generating capacity would exceed the Reasonable Cost Threshold (RCT) of 3% of total revenues in a given year. EPE has determined that any additional cost for new wind procurements would exceed the RCT for 2015. Therefore, the company is not proposing any additional procurement for 2015.

In an article titled *El Paso Electric Adds 25MW of Solar to Renewable Portfolio*, Ricardo Acosta, El Paso Electric Director of Resource and Delivery Planning said, "We're pretty full as far as solar." He went on to say, "At this point the company doesn't have any immediate plans to add in more solar…When we need new generation we'll look at issuing a RFP" (Meehan 2011).

3.1.7.2 Conclusion

Given that EPE's current utility-scale solar projects are capable of exceeding RES requirements until 2019 and the relatively small amount of solar that would be needed to meet 2020 requirements, it is highly unlikely that EPE would execute a long-term PPA for any significant portion of power generated by the PBR. The company will likely build or buy a locally generated source of solar PV. Investigators are unaware of any point of interconnection that can be made with lines carrying EPE power.

3.1.8 Los Alamos County Department of Public Utility

The Los Alamos Department of Public Utility (DPU) operates the county-owned electric, gas, water and wastewater systems servicing the residents, businesses, schools, and local government facilities for the communities of Los Alamos and White Rock. The DPU is funded by rates paid for electric, gas, water, wastewater services, and auxiliary fees and has provided the community with these services for more than 45 years. Because the utility is publicly held, it is accountable directly to the citizens of Los Alamos County through the local Board of Public Utilities.

The Los Alamos DPU and the U.S. Department of Energy (DOE) are joined in an Electric Coordination Agreement to combine their resources for the Los Alamos Power Pool. The Power Pool purchases, sells, and schedules the power requirements for Los Alamos County and Los Alamos National Laboratory (LANL).

PNM provides the transmission service into Los Alamos and the DOE owns the transmission system within Los Alamos County that serve both Los Alamos County and LANL. The Los Alamos County distribution system consists of the town site substation, which provides power to Los Alamos to approximately 6,100 customers and the White Rock substation, which provides power to the White Rock Community to approximately 2,400 customers.

According to the 2013 draft resource plan of the DPU, renewable energy for Los Alamos County fluctuates between 20 to 28% of the total power used. Los Alamos County and LANL/DOE are increasingly seeking opportunities to add renewable energy to its supply portfolio through the coordination of DPU and County Council-adopted goals as well as federal mandates on LANL/DOE to increase renewable energy use (DPU 2013).

DPU resources include:

- SJGS Unit 4 (coal, 36 MW)
- Laramie River Station entitlement (coal, 10 MW)
- El Vado hydroelectric facility (hydropower, 8 MW)
- Abiquiu hydroelectric facility (hydropower, 17 MW)
- Los Alamos Western Area Power Administration entitlement (hydropower, 1 MW)
- County transmission agreements
- County purchased power contracts (Western Area Power Authority [WAPA])
- PV array on the East Jemez landfill site (1 MW)

As this list shows, Los Alamos County has significant investment in renewables. In 2008, the DPU oversaw preparation of a Renewable Energy Feasibility Study under the coordinated efforts of LANL/DOE and the DPU. The purpose of the study was to explore the potential of renewable energy projects for the Power Pool that would meet LANL/DOE requirements and that would stabilize the future cost of energy.

In addition, in 2005, DPU implemented a “green” program called LA Green. RECs are purchased on behalf of locals consisting of residential or commercial customers who receive electricity from the DPU. Blocks of 100 kWh can be purchased at a premium of $0.50 over the existing rate. In 2005, the DPU purchased 200 MWh of RECs generated at the New Mexico Wind Energy Center located in eastern New Mexico. An additional 15,000 MWh of RECs were purchased that were made from a wind energy facility in Texas. Proceeds from the RECs support electric energy generated from renewable sources such as wind, solar, and qualifying hydroelectric plants.

The DPU along with the Conservation Advisory Group established a conservation goal to improve electric efficiencies by 3% for all customer classes per year. This goal should be achieved by a combined effort of reduced electrical energy consumption and a continuing acquisition of renewable energy sources.

In an interview with the Utility Manager of DPU, Mr. John Arrowsmith, he stated that, “We do our own generation and do not purchase power; we rely on our hydroelectric plants, our local PV, and our coal-fired investments.” As a municipal load-serving entity (LSE), it is not held to the state RPS; but DPU has incorporated significant renewables in its mix to satisfy LANL—both its largest customer and its only customer that has renewable requirements. He explained that DPU has a small solar PV site on top of a closed landfill as a demonstration, and this facility incorporated a battery system to distribute the power whenever it is needed. It produces about 22,000 MWh per year for them. That and the low-flow turbine hydroelectric facilities meet all their requirements for renewables.

As far as cost of energy is concerned, Arrowsmith added that DPU expanded one of the hydroelectric plants with an American Recovery and Reinvestment Act grant to add a third unit and the net cost of generation is 4.5 cents per kWh—an excellent cost for renewables (ARRA 2009). The other hydroelectric plant debt will be paid off in 2015 and that will leave the net cost of generation after the debt is retired at 2 to 3 cents per kWh. DPU produces about 70,000 MWh a year with hydropower.

Arrowsmith concluded that DPU owns a share of the coal-fired SJGS. The part of that plant that will be shutting down in about 2017 is not DPU's unit. DPU will continue to use DPUs power from SJGS well into the 2030s at minimum. When DPU adds to that their WAPA allocation, DPU will have all the generating capabilities needed. Given their generating capability as well as providing LANL with all the renewables it needs, Mr. Arrowsmith asked, "Why would we buy solar from anyone?"

3.1.8.1 Conclusion

Los Alamos DPU is not a good target to purchase power from the PBR. It was made clear that the DPU would not do so under any foreseeable circumstance.

3.1.9 Southern California Edison

SCE is the largest subsidiary of Edison International (NYSE: EIX) and is the primary electricity supply company for much of Southern California. It provides 14 million people with electricity across a service territory of approximately 50,000 square miles. However, the Los Angeles Department of Water and Power, San Diego Gas & Electric, Imperial Irrigation District, and some smaller municipal utilities serve large portions of the Southern California territory. The northern part of California is generally served by the Pacific Gas & Electric Company (PG&E) of San Francisco.

SCE still owns all of its electrical transmission facilities and equipment, but the deregulation of California's electricity market in the late 1990s forced the company to sell many of its power plants. In California, SCE retained:

- Hydroelectric plants, totaling about 1,200 MW
- 75% share of the 2,150-MW San Onofre Nuclear Generating Station, which has been shut down since January 2012; SCE plans to decommission and permanently close the nuclear plant (SCE 2013)
- About half of the 1,580-MW coal-fired Mohave Generating Station in Laughlin, Nevada, which supplied electricity to California, Nevada, and Arizona

Mohave closed in 2005 due to concerns regarding water rights and coal supplies. The utility lost all of its natural gas-fired plants, which provided most of its electrical generation. The large, aging plants were bought by out-of-state companies (FERC 2000).

SCE's power grid is linked to PG&E's by the Path 26 wires that generally follow Interstate 5 over the Tejon Pass. The interconnection takes place at a massive substation at Buttonwillow. PG&E's and WAPA's Path 15 and Path 66, respectively, from Buttonwillow north, eventually connect to Bonneville Power Administration's grid in the Pacific Northwest. There are several other interconnections with local and out-of-state utilities not cited here.

3.1.9.1 Where California's Power Comes From

California uses 265,000 GWh of electricity per year and consumption is growing at a rate of 2% annually. In the last decade, between 29% and 42% of California's in-state generation used natural gas. Another 10% to 20% was provided by hydroelectric power that is subject to significant annual variations. Almost one-

third of California's entire in-state generation base is more than 40 years old. Fifteen percent to 30% of statewide electricity demand is served from sources outside state borders. Peak electricity demands occur on hot summer days. Residential and commercial air conditioning represent at least 30% of summer peak electricity loads. Privately owned electric utilities serve approximately 80% of the load in California.

In 2009, SCE entered into a contract with Solar Millennium to purchase solar thermal power up to 726 MW (Solar Millennium 2009). In 2006, SCE planned to secure 1,500 MW or more of power generated from new projects to be built in the Tehachapi Pass Wind Farm area. The contract, which more than doubles SCE's wind energy portfolio, envisions more than 50 square miles (130 square kilometers) of wind parks in the Tehachapi region and is triple the size of any existing U.S. wind farm. In March 2008, SCE announced an $875 million project to build a network of 250 MW of PV solar power generation, making it the biggest solar cell project in the nation. The PV cells will cover 65 million square feet (6,000,000 square meters [m^2]) of rooftops in Southern California and will generate enough power to serve 162,000 homes (SCE 2008).

SCE's Solar Photovoltaic Program is a 5-year utility procurement program adopted by the California Public Utilities Commission (CPUC) to advance the development of distributed solar PV projects in SCE's service territory. This program requests offers from solar generating facilities with gross power ratings of not less than 500 kilowatts direct current and not greater than 10 MW direct current. This program consists of a series of Requests for Offer. The most recent one ended in February 2014, with an executed PPA going to CPUC for approval. The next has not been announced.

To be eligible to submit an offer, a project must have received a complete System Impact Study or Phase I Interconnection Study, or have passed the Wholesale Distribution Open Access Tariff Fast Track screens. Facilities that are not or will not be interconnected to a transmission network within the Western Energy Coordinating Council (WECC) service area are not eligible for the RPS.

3.1.9.2 General Requirements for California RPS

Electrical generation from a renewable facility with its first point of interconnection to a non-California-Balancing Authority outside the state can qualify for the RPS if it meets the RPS general eligibility requirements described and satisfies all of the following criteria:

- Facility has its first point of interconnection to an out-of-state transmission network within the WECC service area.
- Facility commences initial commercial operations on or after January 1, 2005.
- Facility does not cause or contribute to any violation of a California environmental quality standard or requirement within California.

3.1.9.3 Conclusion

Both Nevada and Arizona believe they have the land base, solar resource, and proximity available to serve the California market for solar PV. However, in the last few years several attempts by Arizona and Nevada have been rejected by California out of hand. An example of this was the proposed ENN Mojave Energy project in the 2010 time frame. This proposed project was a $5 billion offer from China (ENN) to build a PV cell manufacturing plant near Laughlin, Nevada, and a massive PV generating plant near the Marketplace Substation south of Las Vegas. No PPA could be secured by ENN Mojave Energy from California despite substantial political pressure from Senator Harry Reid (ENN 2013). Members of the South West Area Transmission (SWAT) group discussed below believe that California has adopted a policy to become a major exporter of renewable energy, not a major importer. California rightly believes that they have enough potential solar generation sites to supply the entire western U.S. with power.

Tetra Tech investigators found it difficult to get firm answers about a potential PPA with SCE. However, the subtext of conversations is that SCE would not even hold negotiations with any company that did not have a written transmission agreement and a FERC registered interconnection agreement in hand. The likelihood of securing these prerequisites appears extremely difficult given PNM queuing rules (see a more detailed discussion of PNM in the PNM LGIA in this Section).

3.1.10 NV Energy

NV Energy is a public utility that generates, transmits, and distributes electric service in northern and southern Nevada, including the Las Vegas Valley; and provides natural gas service in the Reno-Sparks metropolitan area of northern Nevada. Based in Las Vegas, it serves about 1.3 million customers and over 40 million tourists annually. NV Energy charges the highest rates of any mountain energy company.

Figure 3-7. NV Energy Corporate Headquarters in Las Vegas

Source: NV Energy.

MidAmerican Energy Holdings Company, a subsidiary of Berkshire Hathaway, acquired NV Energy in a transaction completed on December 19, 2013. NV Energy will continue to be based in Las Vegas under its current name (Figure 3-7). Prior to the acquisition by MidAmerican, the company's common stock was listed on the New York Stock Exchange under the ticker symbol NVE.

The company obtains the majority of its electricity from natural gas-fired sources. Coal-fired power plants provide about 10% of electricity sources (NV Energy 2013). Eight of the company's nine coal-fired generating units have flue gas desulfurization equipment (scrubbers) installed to control sulfur dioxide emissions.

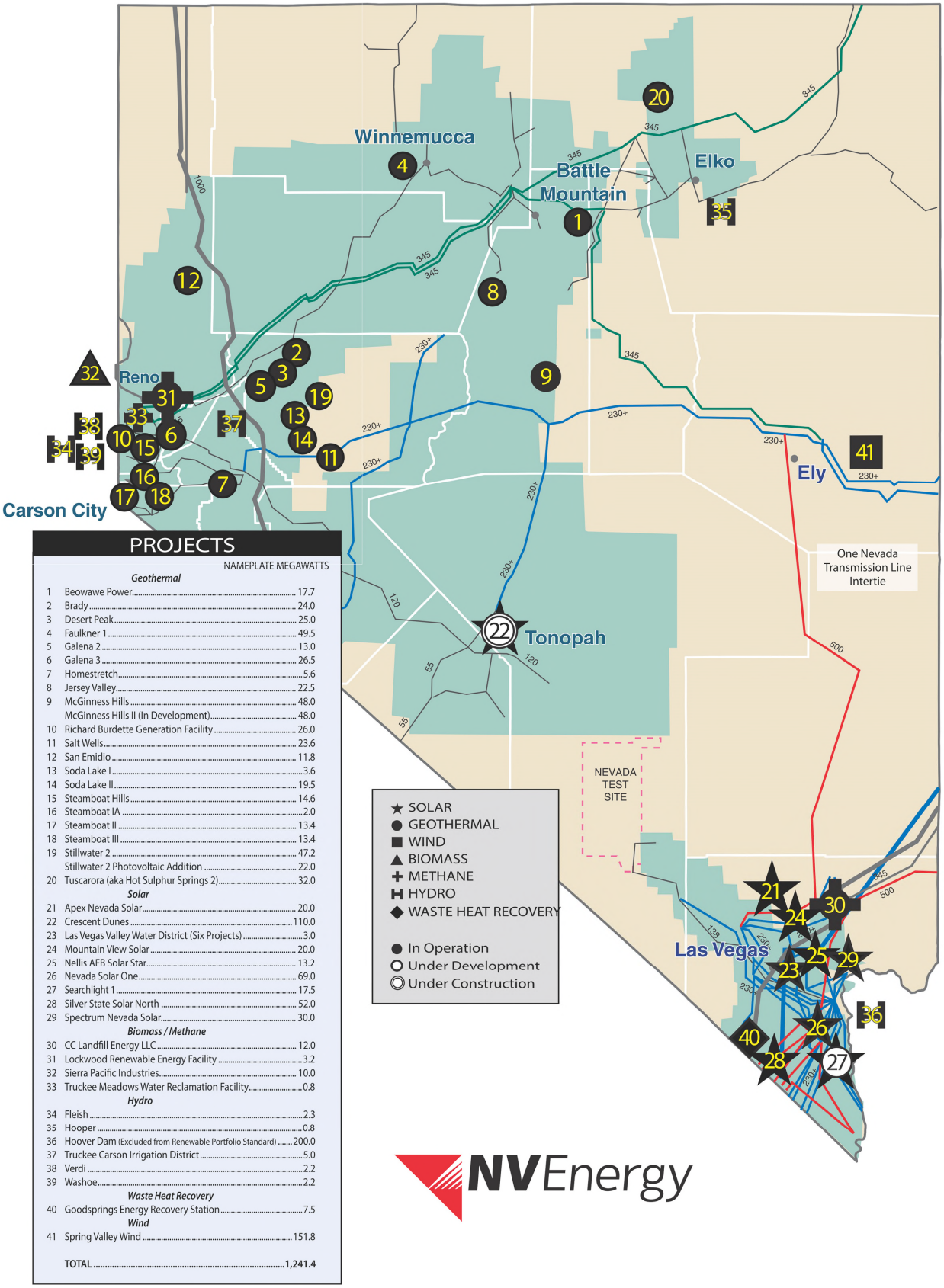
Renewable energy is not a new phenomenon for NV Energy. The company signed its first contract for geothermal power in 1983. Just this past year, it surpassed the renewable energy threshold of 1 GW (1,000 MW) under contract. NV Energy’s long-standing renewable energy commitment has resulted in one of the most diverse and extensive renewable energy portfolios in the U.S.

Additionally, Nevada’s Portfolio Standard is one of the most aggressive in the nation, with a requirement that at least 25% of the company’s retail energy sales be derived from renewable energy resources by 2025. Noteworthy are innovative provisions of the standard allowing up to 25% of sales from energy efficiency and a minimum requirement of 6% of the standard to come from solar resources.

NV Energy also is actively involved in promoting customer-installed facilities through a Renewable Generations program offering rebates for solar, wind, and hydroelectric power projects. To date, over 1,400 projects totaling more than 38 MW are installed at homes, businesses, public buildings, and schools. NV Energy is committed to renewable energy, and continues to develop its resources for the benefit of the State of Nevada and its customers (Figure 3-9).

3.1.10.1.1 Conclusion

Given the reality that NV Energy is currently generating 1,200 MW of renewable energy from within the state and has a commitment to purchase renewable PV power only from within Nevada, it is unlikely that NV Energy could be contracted for power purchase from the PBR.



PROJECTS

		NAMEPLATE MEGAWATTS
	Geothermal	
1	Beowawe Power	17.7
2	Brady	24.0
3	Desert Peak	25.0
4	Faulkner 1	49.5
5	Galena 2	13.0
6	Galena 3	26.5
7	Homestretch	5.6
8	Jersey Valley	22.5
9	McGinness Hills	48.0
	McGinness Hills II (In Development)	48.0
10	Richard Burdette Generation Facility	26.0
11	Salt Wells	23.6
12	San Emidio	11.8
13	Soda Lake I	3.6
14	Soda Lake II	19.5
15	Steamboat Hills	14.6
16	Steamboat IA	2.0
17	Steamboat II	13.4
18	Steamboat III	13.4
19	Stillwater 2	47.2
	Stillwater 2 Photovoltaic Addition	22.0
20	Tuscarora (aka Hot Sulphur Springs 2)	32.0
	Solar	
21	Apex Nevada Solar	20.0
22	Crescent Dunes	110.0
23	Las Vegas Valley Water District (Six Projects)	3.0
24	Mountain View Solar	20.0
25	Nellis AFB Solar Star	13.2
26	Nevada Solar One	69.0
27	Searchlight 1	17.5
28	Silver State Solar North	52.0
29	Spectrum Nevada Solar	30.0
	Biomass / Methane	
30	CC Landfill Energy LLC	12.0
31	Lockwood Renewable Energy Facility	3.2
32	Sierra Pacific Industries	10.0
33	Truckee Meadows Water Reclamation Facility	0.8
	Hydro	
34	Fleish	2.3
35	Hooper	0.8
36	Hoover Dam (Excluded from Renewable Portfolio Standard)	200.0
37	Truckee Carson Irrigation District	5.0
38	Verdi	2.2
39	Washoe	2.2
	Waste Heat Recovery	
40	Goodsprings Energy Recovery Station	7.5
	Wind	
41	Spring Valley Wind	151.8
	TOTAL	1,241.4

Figure 3-8. NV Energy Projects

Source: NV Energy, 2014.

3.1.11 Navajo Tribal Utility Authority

NTUA, established in 1959, supplies electricity, water, natural gas, wastewater treatment, and PV (solar power) services to residents throughout the 27,000 square-mile Navajo Nation. NTUA serves approximately:

- 39,400 electric customers
- 36,600 water customers
- 13,600 wastewater customers
- 7,900 natural gas customers
- 193 off-grid PV customers

NTUA provides electrification to the reservation through the resale of purchased power via its distribution network. NTUA is the sole utility for most of the reservation, though other utility service providers exist along the fringe of the reservation boundaries.

NTUA is a non-profit business enterprise of the Navajo Nation, and operates under a tariff rate established by the Tribal Council. Significant grassroots pressure exists to keep tariff rates as low as possible. NTUA prides itself as operating using a very conservative approach to its customer rate policy and takes pride in having one of the lowest electricity rates throughout the western U.S. NTUA reports that they employ a workforce of 589 regular employees and 30 temporary employees. Of these numbers, 97.7% are of Navajo Descent, meaning that out of 619 employees, 605 are Navajo. NTUA is one of the larger employers on the Navajo Nation.

Since 1999, in collaboration with Sandia National Laboratories Solar Program, NTUA has developed an off-grid residential PV program. Today, the Solar Program consists of almost 200 PV systems (hybrid units, hereafter noted as PV systems) available in two offerings: 640-watt systems and 880-watt systems enhanced with small wind turbines.

The PV systems owned by NTUA are designed as stand-alone systems; as such they do not intertie with the electricity utility grid. The systems include the following components: PV modules, frame for modules, battery bank, inverter, load center, and battery capacity meter.

The 880-watt PV systems were designed to generate 2 kWh of energy per day. These systems, however, are augmented by AirX 220-watt wind turbines to take advantage of the frequent wind that blows throughout the reservation. Fortunately for these hybrid systems winds are more prevalent at night, when electricity use is lessened so the battery banks are able to be recharged. Customers who have the hybrid systems demonstrate a clear preference for the hybrid systems over those that are PV only.

In an interview with Terry Battiest (since departed), Renewable Energy Specialist for NTUA, he was of the opinion that commercial sale of PV to NTUA through a large PPA is difficult due to several issues including wholesale energy pricing. Currently, NTUA purchases most of its hydroelectric power from WAPA and coal fired energy from the SJGS. Wholesale purchase price of this power is very low.

Although specific prices were not confirmed in the conversation, research indicates WAPA hydropower may be selling wholesale at approximately $25 per MWh. Four Corners coal-fired power is selling around $45 per MWh. Wholesale prices must include wheeling charges and possibly a PNM surcharge for lack of firmness. If PBR could produce power at $80 per MWh, PBR could likely deliver power at approximately

$100 per MWh. NTUA will not enter into a large scale PPA, which substantially raises rates to consumers/customers/contracts resulting in a substantial increase in retail cost because the Navajo Nation has many low-income customers. Battiest is skeptical that PV prices can compete right now against hydroelectric power or coal.

NTUA did pursue wind power as an adjunct to existing power suppliers for the last 8 to 10 years. However, the proposed wind projects never materialized. Generally, wind energy is still perceived by many Navajo policy makers as less expensive than solar PV. Battiest believes there will be no quick or easy PPA agreement in the offing from NTUA.

3.1.11.1.1 Conclusion

NTUA expressed skepticism that it would be willing or able to purchase solar PV electricity even from a Navajo project due to strict controls on wholesale pricing and Tribal Council pressure to keep consumer prices very low. NTUA has a very low cost of electricity derived from hydro power sources relative to the cost of solar power from PV. NTUA policy makers believe that wind power is still substantially cheaper than solar PV. Low cost is critical right now. NTUA further believes that it may not be possible to secure transmission and interconnection from PNM. Terry Battiest, formerly with NTUA, directed Tetra Tech to its engineering department for specifications of the Bisti substation. NTUA would be willing to work with a PBR team on the joint use of the substation, but would prefer that the project secure PNM transmission and interconnection access first.

3.1.12 City of Farmington, New Mexico

The Farmington Electric Utility System (FEUS), which is owned and operated by the City of Farmington, is located in northwest New Mexico. Farmington's service territory of 1,718 square miles encompasses the City of Farmington, most of the populated area of San Juan County, including the City of Bloomfield and the San Juan River Valley west from the City to the Navajo reservation, and a portion of Rio Arriba County northeast of the City. FEUS also provides transmission services for the City of Aztec, which owns its own substation and distribution facilities to Williams Field Services. Williams Field Services wheels the generation output of its Milagro facility to the Shiprock Substation for sale in the western markets. Finally, FEUS provides transmission services to Tri-State Generation and Transmission Association.

FEUS is an LSE with an ownership share in the SJGS (coal). It also owns hydroelectric and natural gas-fired capacity. As of the fiscal year that ended June 30, 2012, the electric system was serving 34,795 customers.

In its 2012 Integrated Resource Plan (IRP), the City of Farmington identifies its preferred strategy for satisfying its electric power requirements over the 2012 – 2030 timeframe. The FEUS system presently has generation capacity of 170 MW. Its current peak requirements are approximately 200 MW. Farmington is currently a net purchaser of 30 to 40 MW of power during peak periods. Farmington's power purchase contract covers capacity and energy allocations and will expire in 2024.

FEUS's IRP prepares for expansion and the addition of some renewables for customers that prefer it. Farmington is concerned with using a least-cost plan to meet its electric power requirements over the IRP study period to 2030, but also is concerned with rate stability, reliability, and system balance integrating future renewable generation.

Because Farmington is a municipal and not an investor-owned utility, it does not have to comply with the state's Renewable Portfolio Standards. According to Michael Sims, Utility Director, FEUS purchases a small amount of renewables from PNM for customers who request it. At this time they purchase less than

1 MW of renewables. To the best of his knowledge, PNM provides mostly wind power. Sims also explained that FEUS is planning to install in 2015 a small solar generation array that is not included in the IRP. It will be a test facility of less than 1 MW capacity.

Key elements of the incremental changes to Farmington's current portfolio during the IRP study period include:

- New Local Generation: A new 105 MW or 65 MW gas-fired combined-cycle facility in 2017 or 2018. This addition is for the most efficient means to ensure power reliability.
- Renewable Energy Additions: The plan could add between 20 and 60 MW of solar capacity to Farmington's existing portfolio in 2025 depending upon competitive pricing.

Sims reported that FEUS may be interested in purchasing additional solar power in the future depending upon price. The competitive price point that it feels is viable and that it will not exceed is 4.5 cents per kWh. Further, he said that as FEUS bring online new solar generating capacity, any PPA must be at or lower than their current generation cost.

3.1.12.1.1 Conclusion

FEUS expressed a specific willingness to purchase power from the Navajo Nation, but warned that the wholesale price point that they will not exceed must be in line with its other power purchases. The most they are willing to pay for wholesale power is $45 per MWh. It is unlikely that the PBR project could sell power at that price when transmission fees and wheeling charges must be added if PNM transmits power over its lines to Farmington.

3.1.13 City of Gallup, New Mexico

The City of Gallup, New Mexico, operates the Gallup Joint Utilities (GJU) as a non-generating, municipal-owned LSE utility that provides electricity to the City of Gallup, New Mexico. The electric point of delivery through which GJU receives wholesale power is at the secondary side of four distribution substations owned by PNM. The GJU electric department is responsible for maintaining the 13.8 kV medium voltage distribution system to provide service to its customers. The wholesale purchase price average for energy is approximately $24.30 per MWh ($2.4 cents/kWh) and demand rate of $15.75 per KW-month (GJU no date). The City of Gallup and GJU are the second largest firm-requirements wholesale customer of PNM (PNM 2013b).

Historically, GJU has met the electric needs of its customers through wholesale purchased power contracts with PNM and WAPA. GJU's allocation of power from WAPA's Colorado River Storage Project provides approximately 11% of GJU's demand and 7% of the utility's energy needs on an annual basis. The remaining portion of GJU power requirements are being supplied under contract with PNM. Power from both PNM and WAPA are delivered to Gallup over 115 kV transmission lines owned by PNM and Tri-State Generation and Transmission Association.

GJU takes delivery of its purchased power at the secondary sites of four PNM-owned 115-13.8 kV distribution substations. From these four distribution substations (Allison, Noe, Sunshine, and Wingate) GJU provides electrical service to its customers through a 215-mile primary distribution system of overhead and underground 13.8 kV lines. Most recently published data are shown in Table 3-6.

Table 3-7. Total GJU Energy Purchases (kWh)

Supply Resource	2002	2003	2004	2005	2006	2007
PNM	203,337,252	204,406,999	208,077,229	215,342,543	214,743,909	218,473,488
WAPA	17,600,145	17,954,287	15,436,484	14,321,039	15,189,470	15,392,659
TOTAL	220,937,397	222,361,286	223,513,713	229,663,582	229,933,379	233,866,147

Source: GJU

Planning realistic future supply-side options for a non-generating LSE-like GJU relies on analyzing the planning window from the same perspective as a power supplier in the Arizona-New Mexico-Southern Nevada power supply area would. By understanding the fuel supplies, new generation, and load growth uncertainties that affect the power suppliers in this area, GJU can be prepared to select future power suppliers or supply resource options that can provide reliable electrical service at a reasonable cost. GJU supply-side resource opportunities lie primarily within the WECC Arizona-New Mexico-Southern Nevada Power Area (AZ-NM-SNV) sub-region. GJU also has a supply-side resource opportunity through the City's membership in the Utah Associated Municipal Power Systems organization. The GJU load forecast is shown in Table 3-7.

Table 3-8. GJU Load Forecast

YEAR	MW	KW
2010	44	43,973
2011	45	45,121
2912	46	46,299
2013	48	47,507
2014	49	48,747
2015	50	50,020
2016	51	51,325
2017	53	52,665

Source: GJU

Gallup also offers as Customer-Owned Renewable Resource Generating System. It promotes interconnection with homes and businesses in its service area for net-metering. For residences it offers grid-tie to customer systems of up to 10 KW, and for commercial uses it offers grid-tie to customers up to 75 KW.

3.1.13.1.1 Conclusion

For GJU to purchase solar power from PBR, PNM would have to transmit power to GJU substations. GJU also would have to acquire additional capacity to balance the power load of PV for stability, which is not included in GJU planning. Since the only point of access is PNM power lines and PNM has no additional transmission capacity in this location, there is minimal opportunity to sell solar PV power to GJU. Pricing is a major issue with GJU. Their expectation is that solar PV could be purchased at an existing price of approximately $25 per MWh. NHLCO should not expect to secure a PPA with GJU prior to securing transmission and interconnect with PNM and being able to provide a price competitive with its existing power contract.

3.1.14 Albuquerque and Shá́ńdíín Solar

In 2008, the To'Hajiilee Chapter of the Navajo Nation began planning for a 500-acre alternative energy park about 20 miles outside of Albuquerque, New Mexico, on Indian trust lands. The To'Hajiilee Chapter of the Navajo Nation has a population of 2,500. The Chapter lead entity on the project was To'Hajiilee Economic Development, Inc. (TEDI).

A feasibility assessment was conducted on the PNM 115 kV transmission line (Blue Water line) indicating at least 30 MW of available capacity on the line supporting the creation of an 83 GWh/year PV utility-scale solar farm with proximity to Albuquerque/Santa Fe, the largest power market in New Mexico (approximately 850,000 population).

Pre-development expense was initially estimated at approximately $1 million. Funding was secure for pre-development from the DOE Tribal Energy Office and U.S. Department of Agriculture Rural Development. Approximately $600,000 in federal funding was secured and SunPower, the private sector development partner supplied approximately $400,000 in match for engineering design and for fees to PNM for a Definitive Interconnection System Impact Study (DISIS).

The project achieved the following milestones:

- Chapter resolution secured committing 500 acres of trust land and long-term lease signed by Bureau of Indian Affairs (BIA)
- Development team assembled including environmental, hydrologists, PV engineers, finance team, and pre-development specialists
- Preliminary transmission capacity study completed by WAPA
- Environmental assessment complete, approved by Navajo Nation, and a Finding of No Significant Impact issued by the BIA
- Site design and engineering completed by SunPower
- Financial modeling completed and finance partners secured
- Project development company established
- Large Generator Interconnection Agreement (LGIA) submitted and on file with PNM
- Definitive Interconnection System Impact Study paid for and completed by PNM
- Project financing committed
- PPA negotiations conducted for 2 years that ultimately failed

The DISIS completed by PNM showed no transmission upgrades were required to connect the 30 MW project from the point of injection to the West Mesa Substation 15 miles away. After failure to secure PPA commitments, TEDI proposed sale of energy to PNM under a 20-year PPA with a first year price of $60.00/MWh (at PNM transmission interconnect) and escalating by $1.00 per MWh on the commercial operation date (COD) anniversary date each year thereafter. PNM was offered an option to purchase the plant for a purchase price of approximately $96 million. All of these were rejected by PNM.

In summary, PNM explained informally that the PNM policy to meet the State of New Mexico RPS was to incentivize rooftop solar system installation by customers and to build its own PV next to gas generation assets. Negotiations took place with potential PPA customers included federal government agencies, municipal governments, major manufacturers, other investor-owned utilities, the Navajo Nation, etc. The major barrier for purchase of solar power was the low price for hydropower and coal power in New Mexico, ranging from $23 to $45 per MWh, and the inability of solar PV to compete at that price point. Many potential buyers were locked in to long-term purchase agreements with PNM and a few other generators. There is preference by many potential purchasers to reduce transmission costs to site PV solar near load demand when and if they decide to incorporate solar at all.

3.1.15 Access to Regional Markets and the Four Corners Cul-de-Sac

Tetra Tech investigators spoke with regional planning groups about transmission access to major load centers in Arizona, Nevada, and California. Without an ability to access transmission, there is no practical way to negotiate PPAs to the west of the PBR. Several planning agencies have spoken about the Four Corners transmission hub as a cul-de-sac. This term implies that New Mexico has the potential to generate massive amounts of alternative energy, but that there is no unused transmission capacity to carry that energy westward out of the Four Corners market hub. Below are some comments related to this problem as it affects PBR power sales.

3.1.15.1.1 Western Electricity Coordinating Council

WECC is the regional entity responsible for coordinating and promoting Bulk Electric System reliability in the Western Interconnection. In addition, WECC provides an environment for coordinating the operating and planning activities of its members as set forth in the WECC Bylaws. WECC is geographically the largest and most diverse of the eight Regional Entities that have Delegation Agreements with the North American Electric Reliability Corporation (NERC). The WECC service territory extends from Canada to Mexico. It includes the provinces of Alberta and British Columbia, the northern portion of Baja California, Mexico, and all or portions for the 14 western states between. WECC referred the Tetra Tech study team to SWAT referred to below. WECC also commented on the 10- to 20-year time frame for phase out of coal energy power generation and spoke about the challenge of maintaining grid stability in the transition period should coal energy generation ever be phased out completely in the 2030 time frame.

3.1.15.1.2 Western Area Power Administration

WAPA markets and delivers hydroelectric power and related services within a 15-state region of the central and western U.S. It is one of four power marketing administrations within the DOE having the role to market and transmit electricity from multi-use water projects to retail power distribution companies and public authorities. Its transmission system carries electricity from 55 hydropower plants operated by the Bureau of Reclamation, U.S. Army Corps of Engineers (USACE) and the International Boundary and Water Commission. Together, these plants have a capacity of 10,600 MW. WAPA is headquartered in the Denver, Colorado, suburb of Lakewood, Colorado. WAPA participates in regional transmission planning, but has no agency plan to provide transmission for new renewable generation out of the Four Corners area. They also referred this study to the SWAT Group. Randy Manion, Renewable Resource Program Manager for WAPA, has offered to assign engineers to study the Four Corners cul-de-sac problem if NHLCO will submit a feasibility request to the DOE Tribal Energy Program Office. This study would take several months to complete and will not involve anyone from WAPA actually negotiating with potential power purchasers.

3.1.15.1.3 New Mexico Renewable Energy Transmission Authority

The New Mexico legislature created the Renewable Energy Transmission Authority (RETA) by statute in 2007, with the objective of facilitating renewable energy development in New Mexico through the agency's authority to finance, plan, acquire, maintain, and operate transmission and energy storage facilities. In 2010, RETA commissioned studies by Los Alamos National Laboratory and identified the Western Spirit Clean Line project as a means of facilitating transmission from wind farms in eastern and central New Mexico to the Four Corners hub. Clean Line Energy Partners LLC is developer of the Western Spirit Clean Line project.

Clean Line and the New Mexico RETA are jointly developing the transmission project, which consists of a proposed 200-mile, 345 kV alternating current transmission line currently in planning. The Western Spirit Clean Line will collect 1,500 MW of wind power from east-central New Mexico with the idea to deliver that power to markets in the western U.S. At this time there is no planning for an on-ramp for solar power

in western New Mexico. New Mexico RETA has taken much public testimony on power line right-of-way and the New Mexico legislature has adopted a tentative route map for new transmission that avoids the western Navajo Nation. Clean Line hopes to negotiate the joint use of the PNM right-of-way. New Mexico RETA has officially designated 90% of planned new transmission capacity in New Mexico for wind energy transmission from eastern New Mexico. It appears that the Navajo Nation may have never officially engaged New Mexico RETA concerning the energy generation at the PBR.

3.1.15.1.4 South West Area Transmission Group

SWAT is a sub-regional voluntary study group that has been created to provide an open and collaborative forum where interested parties are encouraged to participate in the planning, coordination, and implementation of a robust transmission system in Arizona, New Mexico, and parts of Colorado, west Texas, southern Nevada, and the Imperial Valley area of California. The open stakeholder participation in this process is intended to result in transmission expansion plans that meet a variety of needs and have a broad basis of support. SWAT members that were interviewed wanted to emphasize the following current dynamic of their planning efforts:

- California, Nevada, Arizona, and New Mexico and a few other western states each and individually have the capacity to generate enough renewable energy to power the western U.S. Today all these states are making plans to become net energy exporters, including California. This is a big change from 5 years ago. Many planners have not yet caught up with current thinking in regional energy strategy.
- Transmission inefficiency may be the largest single barrier to renewable energy development on a large scale. Capital is not yet available to repair or augment old interstate transmission infrastructure. New Mexico RETA is very progressive in this area.
- The Four Corners cul-de-sac as a transmission barrier may not be able to be solved without the Navajo Transmission Project (NTP) being resurrected or some other new right-of-way for transmission through northern Arizona. Nevada is no longer as interested as a few years ago about interconnecting New Mexico power south of Las Vegas. Instead, Nevada is creating plans to interconnect large PV and wind energy installations being built inside the state.
- Potential closure of the Four Corners power plants, if it occurs, will be in phases over a 10- to 20-year time frame. Power generation from natural gas is the most likely replacement fuel source since stable base load power is required to further expand renewable development in New Mexico. PNM has significant problems with system stability. Their ability to balance non-firm renewables is a major limiting factor in transmitting renewable power over their system. Planning for coal transition is underway, but no final alternatives have been proposed.
- Due to the Four Corners cul-de-sac, there is no way to move anywhere near 4,000 MW of power out of the PBR or even a small fraction of that amount.

3.1.16 Diné Power Authority

Beginning in the late 1980s and for more than 25 years, the now-defunct Diné Power Authority of the Navajo Nation pursued the creation of a 462-mile, 500-kV high-voltage transmission line. That line was proposed to run from near the PBR in western New Mexico and terminating in Nevada, near Las Vegas. By 2002, the rights-of-way easements, environmental assessment, and preliminary engineering were substantially completed. However, there was no new generator of power on the horizon and therefore no PPA in the offing. Without a PPA there was no opportunity for financing the transmission line.

In 2003, the Diné Power Authority, created by the Navajo Nation Tribal Council to develop the Navajo Nation's energy resources, announced the 1,500 MW Desert Rock coal-fired generating station would be built very near the PBR. This $3.2 billion project was to utilize the vast coal deposits which underlie the

PBR. The plant was thought to incentivize more coal mining on Navajo tribal lands and lend economic sense to the transmission project. The coal fired generating station was to provide an energy source that made sense in a greater context.

But federal agencies under the newly elected administration in 2009 repeatedly denied power plant permits and in June 2010, Sithe Global, the power plant's developer, backed away from the project. Funding for the project was allowed to expire. Once the rationale for the NTP was eliminated, the transmission line project was not viable.

A great deal of the environmental opposition surrounding the power line in the decade after the millennium was fostered by opposition to the generation of electricity from new coal fired plants (Crane-Murdock 2011). Ironically, that opposition also eliminated the opportunity for a Native American-owned pathway for the transmission of renewable energy into the Arizona/Nevada/California markets. During the process of environmental approvals for the now-defunct Desert Rock coal-fired plant, a new legal challenge was posed against the NTP. That environmental challenge was accepted by the current administration, and BLM changed its prior ruling. Consequently, it appears very unlikely that the Navajo Transmission Project can be resurrected due to environmental opposition and changed market conditions.

3.1.17 Most Suitable Power Companies

If solar PV generation from the PBR can be marketed at $45-55 per MWh or less including transmission fees, Farmington, NTUA, and possibly Tri-State may be willing to consider a bid when those entities open RFPs. Some load-serving entities buy power on long-term contracts from PNM, which do not reopen for negotiation for a decade or more.

3.1.18 PNM Transmission

The PNM transmission system has been designed to transport electricity from base-load coal and nuclear-fueled plants constructed in the 1960s, 1970s, and 1980s in and around Four Corners, eastern Arizona, and Phoenix to the large load centers in central and south-central New Mexico; namely, the Albuquerque, Santa Fe, and El Paso metropolitan areas. The transmission system also serves to connect the large load centers together for emergency support purposes and interconnects to neighboring transmission systems for stability and economic interchange purposes (Mechenbier 2012).

Based on interviews, technical research, including IRPs, and study of the FERC-approved *Large Generation Interconnection Procedures of Public Service of New Mexico*, the following findings are highlighted:

- PNM has a total base load capacity of 2,333 GW. The total transfer capacity from the SJGS to Albuquerque is approximately 1,312 MW, which is currently being met by PNM as "native load." Very little excess capacity exists to add new generation from western New Mexico.
- Current PNM policy is to provide 100% of its solar RPS exclusively from customer rooftops and PNM-owned PV sites.
- There are no other transmission lines accessible from the PBR other than the PNM transmission lines. Some capacity may be available on the PNM 230 kV Bisti to Ambrosia line (BI) running adjacent to the PBR. To definitively determine available capacity, the project must file a Large Generation Interconnection Procedures application with PNM for a Preliminary Interconnection System Impact Study (PISIS) and DISIS—all costs of which are borne by the applicant.

- According to information from PNM professional staff, the PNM transmission system has very little Available Transfer Capacity (ATC) from the Four Corners Area to Central New Mexico. There may be limited capacity on the 230 kV line identified as the BI line running along Highway 371. It may be possible to build a demonstration project of 50 to 100 MW near the Bisti substation. Without building additional transmission lines near the PBR, which PNM is not currently planning, there may be no additional capacity for power transmission from the PBR. No generation project will be built without a signed PPA in place prior to site development.
- The Navajo Nation has very little leverage over PNM. Any solar generation site should be placed as close as possible to an interconnection site to reduce generation tie costs. PISIS and DISIS costs are substantial and must be paid directly to PNM in advance of any determination of ATC. Substantial engineering of each proposed site must include detailed equipment lists and must be submitted for engineering evaluation in the studies. Changes to a facility require re-study of the proposed facility including new study costs.
- PNM transmission lines run along the edges of Navajo tribal land from the SJGS to the Albuquerque area, PNM's major market. See Figure 3-9 and 3-10, the PNM transmission line map that follows:

3.1.18.1.1 Analysis of PNM Transmission Issues

Figures 3-9 and 3-10 are excerpted from the full PNM transmission system map. This portion shows all PNM lines in the vicinity of PBR onto which additional power could be interconnected should an interconnection agreement be reached. Following the map is the legend from the full map to indicate line capacity, etc. Line capacity does not equate to availability capacity.

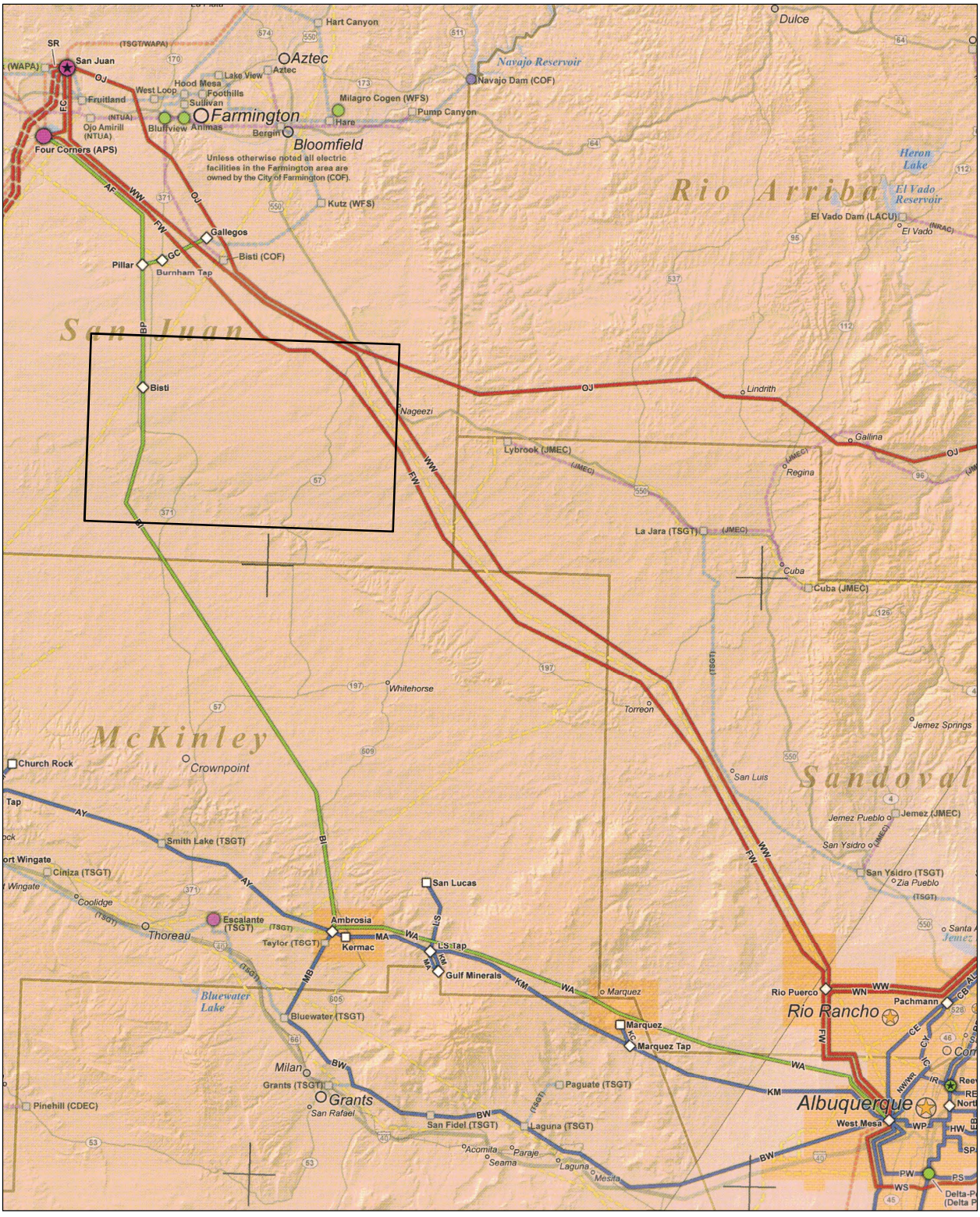


Figure 3-9. Excerpt from PNM Transmission Lines Map

Source: Public Service Company of New Mexico, 2009. Project Area shown by black rectangle.

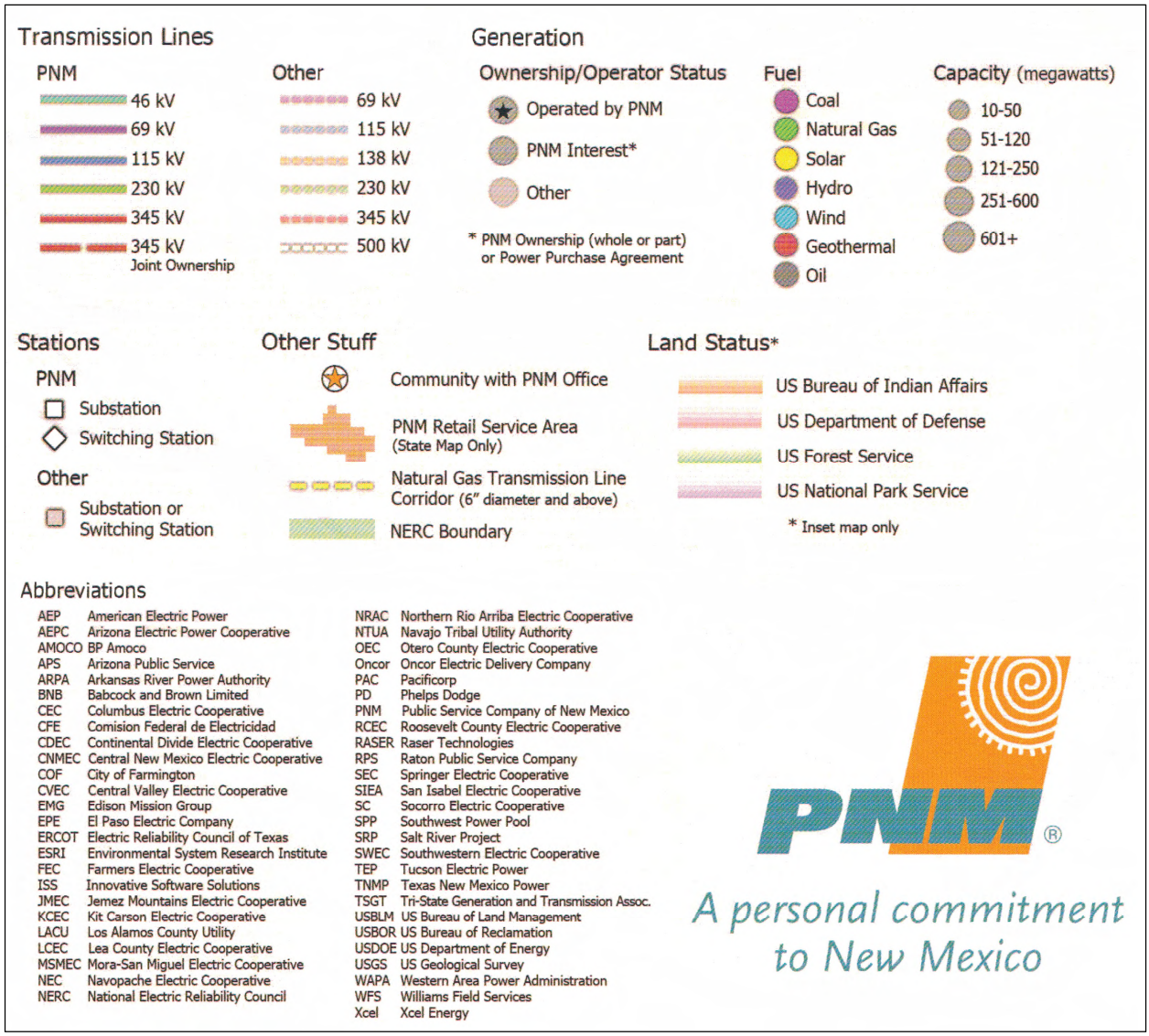


Figure 3-10. Legend from Full PNM Transmission Lines Map

Source: Public Service Company of New Mexico, 2009.

3.1.18.1.2 PNM Power Transmission Structure

PNM owns or leases 3,189 circuit miles of electric transmission lines that interconnect with other utilities in New Mexico, Arizona, Colorado, Texas, and Utah. Although there has been modest load growth in the utility's service territory in recent years, there has been little development of new transmission facilities. Therefore, most of the capacity on PNM's transmission system is fully committed during peak hours, with very little to no additional access available on a firm commitment basis. These factors result in physical constraints on the system and limit the ability to wheel power into PNM's service area from outside of New Mexico.

The backbone of the system consists of several long 345 kV lines and one 230 kV line that emanate from the Four Corners area in northwest New Mexico and run to the southeast and south. Power flow on these 345 kV and 230 kV lines is always from north to south due to the baseload of generation resources in the northwest area of Four Corners, New Mexico. (The transmission line through the Bisti substation is the 230 kV from the Pillar Substation [BP] to Ambrosia. This 230 kV line is generally rated at 200 to 250 MW and is the most likely path for injection of 100 to 150 MW from a demonstration project) (Charters and Percival

2010). New Mexico is also served by two 345 kV lines that run from eastern Arizona to the southeast and east towards El Paso, Texas (which sits on the southern New Mexico border with Texas). Historically, power has flowed in an easterly direction on these two lines. With the significant addition of new generation resources in southern New Mexico over the past several years, however, flow patterns have changed and power flows can be very light into southern New Mexico when the generation is online and running.

3.1.18.1.3 PNM System Facts

Line mileage, including jointly owned lines, is as follows (Figure 3-12):

- 165 miles of 500 kV (Outlet lines from Palo Verde Nuclear Generating Station [PVNGS])
- 1,556 miles of 345 kV
- 180 miles of 230 kV
- 1,000 miles of 115 kV

The majority of transmission lines were built in the late 1960s through the mid-1970s. PNM has not built any backbone transmission since 1984. PNM indicates that it owns 1,312 MW of total transfer capacity from the SJGS to Albuquerque, its major market area. The 345 kV lines are aging and virtually fully allocated to Western New Mexico/Albuquerque "native load."

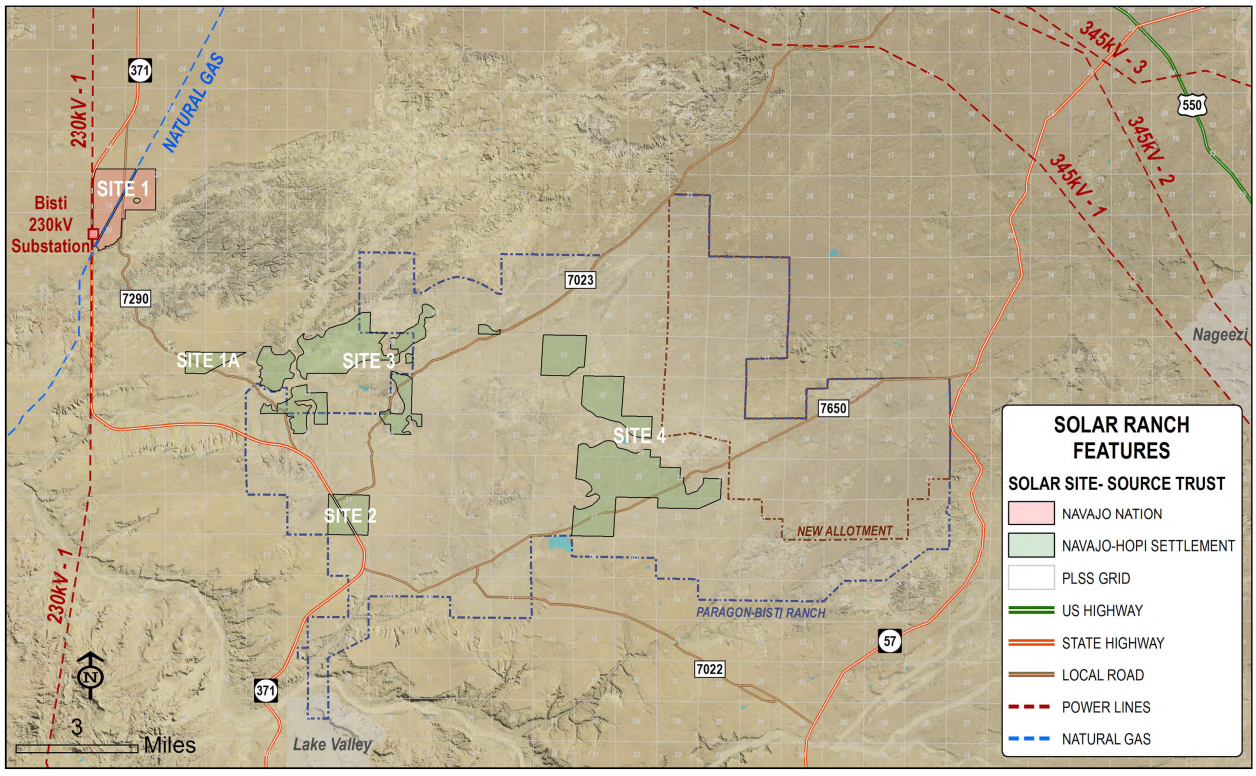


Figure 3-11. Transmission Lines in the PBR Area

Source: Tetra Tech and "PNM Transmission System, 2009".

Figure 3-12. 500 kV-Class Transmission Infrastructure of the Western U.S.

Source: Tetra Tech and ABB Enterprise Software, 2014.

3.2 Considerations for Interconnecting with PNM

There are markets for RE throughout the WECC, including California which in 2011 passed into law its 33-percent-by-2020 RPS requirement. There are several operators of transmission lines in northwest New Mexico, including PNM, Arizona Public Service, Tucson Electric Power, and Tri-State Generation, to get the electricity to the target markets. The State of New Mexico has created a Renewable Energy Transmission Authority to establish transmission corridors to move green electricity to market. New Mexico has also established an RPS of 20-percent renewable generation for investor-owned utilities (including PNM) by 2020 and of 10 percent for rural electric cooperatives by 2020. This should help develop the market for green power.

PNM Interconnection

PNM is the local transmission provider in the area and operates a FERC-compliant transmission service and interconnection queue via the OASIS web portal. The interconnection queue is opened twice a year to developers of potential generation projects that may inject power into the PNM-operated transmission system. Based on input received, PNM batches the information into a cluster of projects for study. PNM transitioned to the clustered-queue approach several years ago to clear congestion and provide better service to those seeking interconnection.

As options were considered for connecting renewable power from the PBR to the grid, it made sense to look at connecting to PNM's electric system. PNM operates a 230-kV line that passes just west of the site, paralleling the north-south segment of Highway 371 for about 6 miles. This line connects the Four Corners Power Plant to Ambrosia Substation in McKinley County (identified by PNM as segments AF, BP, and BI). Bisti Substation is located along this line on Highway 371 not far from PBR. PNM also operates three 345-kV lines east of the site. One line connects Four Corners Power Plant to the Rio Puerco and West Mesa Substations near Albuquerque (line FW); another line, which mostly parallels the first, connects San Juan Power Plant to Rio Puerco Substation (line WW); the final line connects San Juan Power Plant to Ojo Substation in Rio Arriba County (line OJ). Additional facilities include local 12.5kV distribution lines in the area. A more complete study process for interconnection is provided at Appendix F.

3.2.1 Open Access

The US Federal Energy Regulatory Commission (FERC) previously issued two landmark orders which opened up the US energy market to competition.

FERC Order 888 mandated the unbundling of electrical services for power generation and delivery and separated marketing functions for these newly-disaggregated services, required utilities to provide open access to their energy rate schedules (also called tariffs), and gave existing utilities who may have made substantial investments based on older regulations the right to recover their stranded costs from energy customers. One of the most important points in Order 888 was the requirement that owners of transmission facilities to make transmission services available on the open market.

Soon afterward, FERC Order 889 set standards regarding information that utilities must make available to the marketplace and established an Open Access Same-time Information System (OASIS), a web-based bulletin board system for sharing this information. OASIS allows energy customers on the wholesale market to schedule and reserve capacity on the US' regional energy grids to insure that energy can be delivered to customers in a fair and transparent manner. FERC order 889 prohibits utilities from sharing market information in any way that prevents access to this information by potential competitors, and requires all such information to be posted on OASIS for all to see.

Additional regulations including FERC Order 890 and Order 1000 further strengthened rules for regional coordination and power system planning and ensuring that transmission alternatives are considered in regional transmission plans.

Like all utilities under these Federal orders, PNM is required to have a fair and open process for those desiring access to the PNM-owned transmission network.

Every two years, PNM prepares an Integrated Resource Plan (IRP) which evaluates needs for generation and transmission resources looking ahead 20 years and including variables such as fuel mix costs, regulatory trends, anticipated load and other factors. The latest IRP, published in July, 2014, states that the most cost effective mix of resources to serve PNM's growing customer energy needs after 2018 is a mixture of renewable energy and natural gas resources. The timing, type and quantity of these additions are dependent upon customer demand for energy, greenhouse gas regulations, and future prices of natural gas and renewable resources. The fact that renewable energy, including wind and solar will be sought by PNM to meet their anticipated resource needs means that the PBR could explore options for supplying a portion of that expected need.

3.2.2 PNM Interconnection Process

On 25 September 2014, the NHLCO and Tetra Tech team met with the PNM staff, led by Mr. George Nail to discuss the inter-connection process. This was a very through meeting and involved many members of the PNM staff, including their tribal coordinator. In order to consider the options for connecting to PNM's electric system, an understanding of the technical feasibility and commercial requirements is necessary. Under the requirements of FERC, PNM has implemented an interconnection request process which is further described in this Section.

As an Interconnection Customer, PBR must follow the general steps below. Refer to "Open Access Transmission Tariff of Public Service Company of New Mexico, for additional details.

a). Determine if the request will be in the form of either a:
   i. Preliminary System Interconnection Study (PSIS), or
   ii. Definitive Interconnection System Impact Study Agreement (DSIS)

b). Determine if the request will be a:
   i. Small Generator Interconnection (less than 20 MW), or a
   ii. Large Generator Interconnection (greater than 20 MW)

c). Designate the type of interconnection service desired:
   i. Energy Resource Interconnection Service - to connect the Generating Facility to the Transmission System and be eligible to deliver the Facility's output using the existing firm or non-firm capacity of the Transmission System on an "as available" basis.
   ii. Network Resource Interconnection Service - to serve native load customers; or into an Independent System Operator or Regional Transmission Operator with market based congestion management, in the same manner as Network Resources.

d). Submit an Interconnection Request and a deposit of:
   i. $75,000 for request less than 50 MW, or
   ii. $150,000 for requests of 50 MW and greater, but less than 200 MW, or
   iii. $250,000 for requests of 200 MW and greater

e). Provide evidence that Applicant has "Site Control". Site control may be demonstrated through:
   i. Ownership of, a leasehold interest in, or a right to develop a site for the purpose of constructing the Generating Facility;
   ii. An option to purchase or acquire a leasehold site for such purpose; or;
   iii. An exclusivity or other business relationship between the Applicant and the entity having the right to sell, lease, or grant the Applicant the right to possess or occupy a site for such purpose

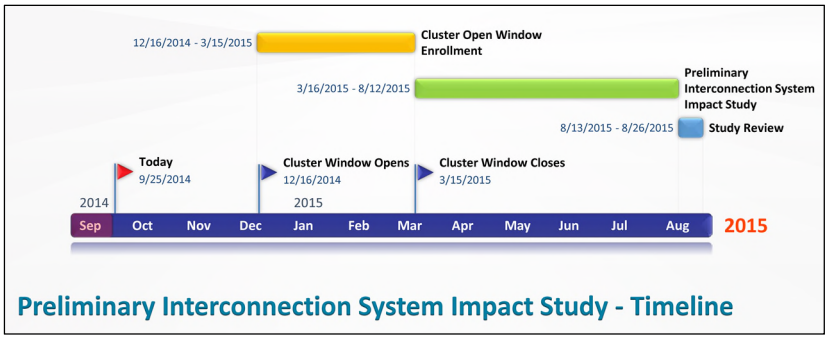


Figure 3-13. Timeline of PNM's Preliminary Interconnection Study

Source: PNM.

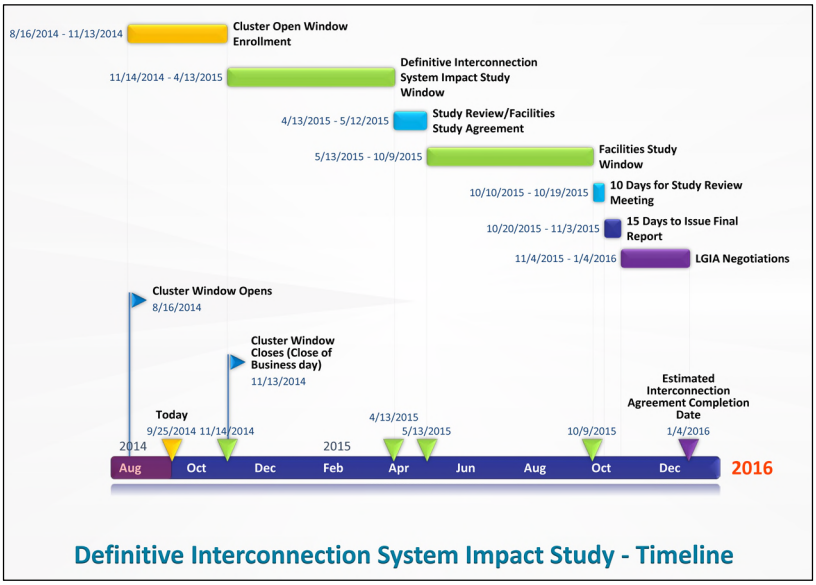


Figure 3-14. Timeline of PNM's Definitive Interconnection Study

Source: PNM.

Following application acceptance, the Transmission Provider (in this case, PNM) will assign a "Queue Position" to the Request. The Queue Position of each Interconnection Request will be one factor used to determine the cost responsibility for any facility upgrades necessary to accommodate the interconnection. Interconnection Requests are submitted during specific time windows published by the host utility, and may be studied along with other requests as part of a "Cluster Study. Typically, these windows are open for 90 days and occur about every 14 months, with PSIS and DSIS windows open at different times during the year.

3.2.3 System Impact Study

There are two types of system impact studies. A Preliminary System Impact Study (PSIS) is a feasibility study which evaluates the technical effects of interconnecting a generation source on PNM's system. A Definitive System Impact Study (DSIS) studies the same effects, but has the expectation that the Applicant will continue further in the process to a Facilities Study to evaluate estimated costs of new or upgrades facilities. Since there is an opt-out provision at each step or the process, there is really no advantage in pursuing a PSIS, unless the Applicant only wants a pass/fail result.

Within thirty (30) days of receipt of a Completed Application, the Transmission Provider will provide the Applicant a System Impact Study Agreement pursuant to which the applicant agrees to reimburse the Transmission Provider for performing the required System Impact Study. For a service request to remain a Completed Application, the Applicant should execute the System Impact Study Agreement and return it to the Transmission Provider within fifteen (15) days. If the applicant elects not to execute the System Impact Study Agreement, the Application is deemed withdrawn and its deposit, (less a non-refundable fee of $5,000) is to be returned with interest.

Once a decision is made to proceed with the System Impact Study, the Application is signed by both parties and the Transmission Provider will use due diligence to complete the Study within 60 days. The System Impact Study includes the following.

- identification of any circuit breaker short circuit capability limits exceeded as a result of the interconnection
- identification of any thermal overload or voltage limit violations resulting from the interconnection
- identification of any instability or inadequately damped response to system disturbances resulting from the interconnection, and
- description and non-binding, good faith estimated cost of facilities required to interconnect the Generating Facility to the Transmission System and to address the identified short circuit, instability, and power flow issues.

3.2.4 Facilities Study

If a System Impact Study indicates that additions or upgrades to the Transmission System are needed to supply the Applicant's service request, the Transmission Provider, within thirty (30) days of the completion of the System Impact Study, will prepare a Facilities Study Agreement pursuant to which the Eligible Customer shall agree to reimburse the Transmission Provider for performing the required Facilities Study.

When completed, the Facilities Study will include a good faith estimate of.

- the cost of Direct Assignment Facilities to be charged to the Transmission Customer
- the Transmission Customer's appropriate share of the cost of any required Network Upgrades, and
- the time required to complete such construction and initiate the requested service.

The Applicant next has a choice to either agree to reimburse the transmission provider for the cost of new facilities as defined by the Facilities Study, or opt out of the process

3.2.5 Transmission Service Request

Up until this point, facility improvements to interconnect have been limited to the point of insertion of any proposed generation source. Additional technical and commercial requirements must be further evaluated to determine if the transmission network beyond the insertion point (substation) has capacity to carry the additional generation either by point-to-point service under a commercial Power Purchase Agreement (PPA) to a third party user, or as a network resource for PNM's own internal system needs.

Depending upon whether the service will be firm or non-firm, point-to-point, or network service, the Applicant and PNM will enter into an agreement (or agreements) specifying the appropriate tariffs that will be paid to PNM by the Applicant as a fee for transferring the power to the ultimate user.

3.2.6 Generation Requests for Proposals

According to PNM's Integrated Resource Plan (IRP), the amount of generation capacity from existing resources can change over time due to events such as the expiration of leases and PPAs. PNM's resource plan takes these developments into account and assumes that the resource availability will either be extended or replaced with a more cost-effective resource through a Request for Proposal (RFP) process. From time to time, PNM will issue a Request for Proposals to satisfy needs for new generation, including solar, wind and other renewable sources.

3.2.7 Summary

A LGIA interconnection system impact study and an interconnection facilities study must be performed to determine the available interconnection options for the Ranch project. These studies will include evaluation of available transfer capacities, facilities required for interconnection, costs the utility will assign to the generator. It will also identify other projects already in the queue for interconnection. Tetra Tech's preliminary, cursory assessment indicated there could be up to 150 MW of capacity on the PNM's 230-kV system and additional capacity on its 345-kV FW system.

Other options to consider include connecting smaller generation blocks (usually less than 10 MW) at the 12.5kV distribution level, which would typically require significantly lower facilities costs than connecting at the 230 kV transmission voltage level, and also be consistent with PNM's current IRP.

As there are potentially significant infrastructure costs associated with connecting third party generation to a utility system, the full range of options and complete costs should be well understood prior to signing an interconnection agreement or tariff. The process begins with up front feasibility studies that must be committed to before the ultimate costs can be quantified. There are opportunities to "opt-out" of the process at several points, and receive a refund of unspent study funds (less a non-refundable $5,000 fee).

A signed PPA and LGIA are necessary agreements that the Ranch project must have in hand in order to build the project. If the generation output is not sold at the point of interconnection (POI), a TSA is necessary to be able to move the power to the point of delivery (POD).

Next Step. It is recommend that additional transmission studies be undertaken following the FERC process, moving ahead with the PNM process

3.3 Plan to Quantify Local or Export Markets

Given the remote nature of this site, there are no immediate local markets for distributive power systems. The nearest significant market would be Farmington NM, however, this is over 30 miles from the site. Export market are presented extensively in section 3.1 above, as a part of our review of the possible markets. For each utility and possible export market, we have quantified their current and expected future demand, sources of power in term of fossil fuels and RE growth. The RPS for each utility is also presented, which is the driver for future RE requirements. The most critical portion of our analysis includes the strategy each discrete market will pursue in achieving their RPS goals. This factor defines whether a utility is buying from out of state sources, using small scale or large scale project or favoring solar verses wind.

4. ECONOMIC ANALYSIS SECTION

Bottom Line Up Front. If a PV ranch on the PBR is constructed for no more than $1.60 per DC watt, is mainly financed via a 20-year loan (debt) @ 5% with 20% down (investor equity), takes full advantage of every federal incentive that exists, and sells electricity under a long-term PPA for about $75 per megawatt-hour (MWh) pegged to the Producer Price Index (PPI), then this plant will earn for its owners a decent after-tax return of 6% or so. Income for the NN from both COLA-adjusted land lease fees and royalties on production is allowed for in this model. Not having to pay business income taxes would allow the capital budget or the cost of money to be increased considerably (by +33%) yet still provide that decent 6% return for the owners.

Background. Energy-economic analysis is performed today against a background of profound social, economic, and technical change: the revolution of fracking natural gas with geopolitical ramifications, diverging inflationary and deflationary pressures even in developed economies, divergence between rates of increase in the price indices of petroleum and electricity, and decoupling of oil from economic growth in the most advanced societies.

Summary. Tetra Tech conceptually designed and then evaluated a nominal 100-MW solar ranch on the PBR, using a custom-developed investment-grade economic model to perform the main analysis. The production and capacity factor of the PV ranch were verified with NREL's "PVWatts" online tool. Using current data from leading developers in the industry, supported by our model, for a project to have an overall reasonable after-tax IRR of 6%, the following conditions must be met:

- PPA must sell electricity for at least 7.5 cents per kWh, or $75 per MWh
- Capital cost for the plant NTE $1.60/W
- Cost of money at 5%, term = 20 years
- Debt-to-Equity ratio of 4 to 1
- A federal investment tax credit (ITC) equal to 30% of the qualifying CapEx, plus Bonus MACRS.

A Basic Primer on Finance

A dollar tomorrow is not worth as much as a dollar today, and a dollar in someone else's hand is not worth as much as a dollar in your own pocket. For one thing, your dollar is not as useful to you if you have to wait until tomorrow before you can get it back and spend it. This is the time value of money. For another thing, you might not get your dollar back even if you do wait. This is risk. A lender gets compensated for time and risk by charging interest to the borrower. The reciprocal of interest is discount rate, which makes tomorrow's dollar smaller than today's dollar in constant terms. In most societies, prices in nominal terms tend to increase over time as productivity and wealth increase, which is called inflation. In rare cases, the opposite, deflation, happens, but its cause is never good. A constant dollar is adjusted for inflation; a nominal dollar isn't.

Interest can be tricky because all the action is in the exponent, which can lead to startling or counterintuitive results if the time factor goes out long enough. At low interest rates, small changes can have dramatic effects in terms of the time required to pay off an investment; conversely modest changes in a high interest rate seem to affect the time intercept hardly at all.

To perform an economic analysis of a prospective investment, each annual cash flow over the life of the investment is discounted by a given discount rate, for example the rate of general monetary inflation, according to that cash flow's position on the time-axis. Then all the discounted cash flows are summed together to make a single Present Value (PV, don't confuse with acronym for photovoltaic). From this PV, the principal (capital cost of the investment) is subtracted, thus yielding the "net present value" (NPV).

NPV indicates a project's fitness in an external environment. Alternatives can be compared to one another by stipulating a single discount rate and then calculating the NPVs of the alternatives -- the higher NPV wins.

Sometimes, we want to know a project's fitness in terms of itself. Even without alternatives to compare against one another, a specific investment's economic merit can still be assessed against general metrics such as long-term bond interest, via the technique of internal rate of return (IRR). To solve for the IRR, which is usually unknown, the known nominal cash flows of a specific project are discounted by an assumed interest rate, then summed as above, generating an NPV. The process is iterated with higher or lower discount rates until the NPV approaches zero, yielding the IRR. This approach works so long as the cash flows don't change sign more than once. Note that at higher IRRs over the long-term, say 30 years, out-year cash flows almost disappear. This is why investing for the very long term (beyond a human generation) is so difficult to justify on purely economic grounds.

At present, and this is subject to change, the aforementioned values for these parameters are prudent and reasonable based on our discussions with developers and investors.

4.1 Economic Analysis & Cost:Benefit subsection

4.1.1 Custom/Proprietary Scenario-Based Parametric Model

The Tetra Tech Model. Tetra Tech has developed a custom economic model to evaluate a nominal 100-MW solar ranch on the PBR from the viewpoint of a commonly expected owner/investor. The source code for the former is provided on the DVD-ROM enclosed with this report. The 100-MW number was chosen for ease of scaling to other size ranches, as the PBR is fully built out. The model produces 50 scenarios or investment-grade "*pro formas*", each of which is a complete schedule of income (e.g., sales, incentives, and deductible write-offs) and expenses (e.g., CapEx, OpEx, taxes, depreciation) over the life of the project, reporting a single figure of merit: internal rate of return (IRR). A sensitivity analysis showed that the four dominant parameters, in order, and their range, are:

- Sales price of electricity per net kWh delivered to grid, varied over a broad range of 4 to 14 cents. 7.5 cents was satisfactory.
- Cost of money (debt), in percent, ranged from 4% to 8%. 5% / 20-year money is available to projects in the USA with good long-term offtakers that have good credit.
- Capital expenditure (CapEx) of the power plant, ranged from $1.50 to $2.50 dollars per $watt_{ac}$. Start-of-the-art in the Southwest is about $1.60 per watt.
- Percentage of equity versus debt financing, range from 100% to 5%. Debt (D) is a loan or a bond which must be repaid with interest. Equity (E) is ownership of a project with no recourse. Maximizing this D:E parameter means leveraging other peoples' money (OPM) while retaining ownership and control.

The following general conclusions result from the sensitivity analysis:

- **A $2.50 per watt PV project cannot work today**, since it **relies on a "dime PPA"** (sales price of 10¢/kWh, or $100/MWh) or better, which has not been seen on the West Coast for several years.
- **A CapEx of $1.00 per watt is required to make a "nickel PPA" work**. Therefore, since dollar-per-watt power plants are not credible yet, the **$45-55 per MWh PPAs** that have been raised for discussion with the NN **are not acceptable**.
- **Each reduction of 100 basis points (i.e., 1% nominal) in the cost of debt offsets an increase of $0.25 per watt in CapEx**. Therefore, the team must find debt financing in the range of 5% in order to have a credible capital budget in the range of $1.50 to $2.00 per watt.

Financial Model for the Economic Feasibility Assesment of Power Plants

Total Cost of Ownership - TCO

Date: 7/10/2015

Title: Navajo Paragon-Bisti Solar Site #1, Proformae w/up to 5 cases 4 D:E & 10 PPA Variations, & BEST / LIKELY / REASONABLY WORST CASES

Version: 2.2

Assumptions & Data Entry

Performance

System Size (kW DC)	100,000
Yearly fuel consumption (tons)	-
Net Output after House Load	88.00%
Adjusted System Size (kWac)	88,000
Capacity Factor	19.50%
Performance degradation, %/year	0.50%
Capital Cost per nameplate watt	$ 1.60

Key Rates

Internal Utility Electricity Price ($/kWh)	0.075
Fuel Receipt Fee ($/per ton)	$ -
O & M ($/kWh)	$ 0.009
General Monetary Inflation Rate Americas est. (%/ye	3.90%
Electricity Price Inflation, US PPI 1950-2005 (%/year,	2.20%
Discount Rate est. for WestHem.	4.90%
Assumed Nevis Corporate Tax Rate (%)	35.00%
State Income Tax Rate (%)	0.00%
Local Jurisdiction Income Tax Rate (%)	0.00%
Property Tax (%)	0.00%
REC Current Rate ($/1000Kwh)	$ -
REC Value Change (%/year)	0.00%
Current Electricity Usage (kwh)	-
Land Rate Escalation (%/year)	2.90%
Fuel / Feedstock Escalation (%/year)	0.00%
Feedstock Receipt Fee Escalation (%/year)	0.00%
Royalty (annual)	$ 675,000

Capital Costs

EPC Costs	$ 160,000,000
Development & Equity Fees, Loan Points & C	$ 2,880,000
Total Qualifying Costs for Grant	$ 162,880,000
Total Unqualified Costs for Grant	$ -
System Gross Price	$ 162,880,000
Less: Net Federal Incentive	$ 48,864,000
Less: State/Local Incentives	$ -
Net Capital Cost	**$ 114,016,000**

Other Operating Costs

O&M ($/year)	see proforma
Property Tax ($/year)	$ -
Land Lease (annual), ($/year)	$ 9,960
Annual fuel cost ($/year)	$ -
Other/Misc Cost ($/year)	$ -
Royalties (annual), ($/year)	$ 675,000

Financing

Equity %	20%
Interest Rate/Cost of Capital	5.0000%
Loan Term Years	20
Down Payment	$ 22,803,200
Loan	$ 91,212,800
Yearly Payment	$ 7,319,151
Monthly Payment	$ 609,929

Incentives

Federal ITC or Grant	30.00%
State/Local Rebates	$0.000
Production Tax Credit ($/kwh)	$0.000
Sales Tax Exemption	
Waiver of Local Fees	
Net Federal Incentive	$ 48,864,000
State/Local Incentives	$ -

Bonus MACRS Depreciation Schedule (to 85% of

Year	Depreciation Factor
1	60.00%
2	16.00%
3	12.00%
4	8.00%
5	4.00%
6	0.00%

Analysis

to set IOC year value in this column, see cell D12 on GlobalParamsIns&Outs tab

Rates

	Total	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25
Utility Electric Price ($/kWh)			0.0750	0.0767	0.0783	0.0801	0.0818	0.0836	0.0855	0.0873	0.0893	0.0912	0.0932	0.0953	0.0974	0.0995	0.1017	0.1040	0.1062	0.1086	0.1110	0.1134	0.1159	0.1184	0.1211	0.1237	0.1264
REC Price ($/1000Kwh)			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Annual Electrical Production (kWh)	3,543,393,626		150,424,560	149,672,437	148,924,075	148,179,455	147,438,557	146,701,365	145,967,858	145,238,018	144,511,828	143,789,269	143,070,323	142,354,971	141,643,196	140,934,980	140,230,306	139,529,154	138,831,508	138,137,351	137,446,664	136,759,431	136,075,633	135,395,255	134,718,279	134,044,688	133,374,464

Operating Revenue Sources

	Total	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25
Fuel/Feedstock Receipt Fees ($)	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity Sales ($)	347,352,746		11,281,842	11,472,392	11,666,161	11,863,202	12,063,572	12,267,326	12,474,521	12,685,215	12,899,469	13,117,341	13,338,893	13,564,187	13,793,286	14,026,254	14,263,158	14,504,062	14,749,036	14,998,147	15,251,466	15,509,063	15,771,011	16,037,384	16,308,255	16,583,702	16,863,800
Renewable Energy Credit ($)	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capacity Sales ($)	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Operating Revenue	**347,352,746**		**11,281,842**	**11,472,392**	**11,666,161**	**11,863,202**	**12,063,572**	**12,267,326**	**12,474,521**	**12,685,215**	**12,899,469**	**13,117,341**	**13,338,893**	**13,564,187**	**13,793,286**	**14,026,254**	**14,263,158**	**14,504,062**	**14,749,036**	**14,998,147**	**15,251,466**	**15,509,063**	**15,771,011**	**16,037,384**	**16,308,255**	**16,583,702**	**16,863,800**

Operating Costs

	Total	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25
Land Rental Fees (annually)	(358,404)		(9,960)	(10,249)	(10,546)	(10,852)	(11,167)	(11,490)	(11,824)	(12,167)	(12,519)	(12,882)	(13,256)	(13,640)	(14,036)	(14,443)	(14,862)	(15,293)	(15,736)	(16,193)	(16,662)	(17,146)	(17,643)	(18,154)	(18,681)	(19,223)	(19,780)
O&M	(55,627,733)		(1,353,821)	(1,406,620)	(1,461,478)	(1,518,476)	(1,577,696)	(1,639,227)	(1,703,156)	(1,769,580)	(1,838,593)	(1,910,298)	(1,984,800)	(2,062,207)	(2,142,633)	(2,226,196)	(2,313,018)	(2,403,225)	(2,496,951)	(2,594,332)	(2,695,511)	(2,800,636)	(2,909,861)	(3,023,345)	(3,141,256)	(3,263,765)	(3,391,052)
Fuel / Feedstock Costs	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Property Tax	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Royalties	(24,289,427)		(675,000)	(694,575)	(714,718)	(735,444)	(756,772)	(778,719)	(801,302)	(824,539)	(848,451)	(873,056)	(898,375)	(924,428)	(951,236)	(978,822)	(1,007,208)	(1,036,417)	(1,066,473)	(1,097,400)	(1,129,225)	(1,161,973)	(1,195,670)	(1,230,344)	(1,266,024)	(1,302,739)	(1,340,518)
Other/Misc Costs	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Operating Cost	**(80,275,565)**		**(2,038,781)**	**(2,111,444)**	**(2,186,742)**	**(2,264,772)**	**(2,345,635)**	**(2,429,436)**	**(2,516,282)**	**(2,606,285)**	**(2,699,564)**	**(2,796,237)**	**(2,896,431)**	**(3,000,275)**	**(3,107,905)**	**(3,219,461)**	**(3,335,087)**	**(3,454,935)**	**(3,579,160)**	**(3,707,925)**	**(3,841,398)**	**(3,979,754)**	**(4,123,173)**	**(4,271,844)**	**(4,425,961)**	**(4,585,726)**	**(4,751,350)**
EBITDA	**267,077,181**		**$9,243,061**	**$9,360,948**	**$9,479,419**	**$9,598,430**	**$9,717,937**	**$9,837,890**	**$9,958,239**	**$10,078,930**	**$10,199,905**	**$10,321,104**	**$10,442,462**	**$10,563,911**	**$10,685,380**	**$10,806,794**	**$10,928,071**	**$11,049,128**	**$11,169,876**	**$11,290,222**	**$11,410,068**	**$11,529,309**	**$11,647,838**	**$11,765,540**	**$11,882,294**	**$11,997,975**	**$12,112,450**

Financing

	Total	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25
Initial Capital Cost (Down Payment)	(22,803,200)	(22,803,200)																									
Equipment Loan Principal Payments	(91,212,800)		(2,758,511)	(2,896,437)	(3,041,258)	(3,193,321)	(3,352,987)	(3,520,637)	(3,696,669)	(3,881,502)	(4,075,577)	(4,279,356)	(4,493,324)	(4,717,990)	(4,953,890)	(5,201,584)	(5,461,663)	(5,734,746)	(6,021,484)	(6,322,558)	(6,638,686)	(6,970,620)	0	0	0	0	0
Equipment Loan Interest Payments	(55,170,221)		(4,560,640)	(4,422,714)	(4,277,893)	(4,125,830)	(3,966,164)	(3,798,514)	(3,622,482)	(3,437,649)	(3,243,574)	(3,039,795)	(2,825,827)	(2,601,161)	(2,365,262)	(2,117,567)	(1,857,488)	(1,584,405)	(1,297,667)	(996,593)	(680,465)	(348,531)	0	0	0	0	0
Total Annual Capital Expense	**169,186,221**	**(22,803,200)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**(7,319,151)**	**0**	**0**	**0**	**0**	**0**

Depreciation Schedule

	Total	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25
Bonus MACRS Depreciation	(138,448,000)		(83,068,800)	(22,151,680)	(16,613,760)	(11,075,840)	(5,537,920)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Financial Analysis

Before Tax Analysis

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25
Operating Revenue	347,352,746 -	11,281,842	11,472,392	11,666,161	11,863,202	12,063,572	12,267,326	12,474,521	12,685,215	12,899,469	13,117,341	13,338,893	13,564,187	13,793,286	14,026,254	14,263,158	14,504,062	14,749,036	14,998,147	15,251,466	15,509,063	15,771,011	16,037,384	16,308,255	16,583,702	16,863,800
Depreciable Capital	(114,016,000) (114,016,000)																									
Non-Depreciable Capital (Land)	- -																									
Loan Proceeds	91,212,800 91,212,800																									
Operating Expenses	(80,275,565)	(2,038,781)	(2,111,444)	(2,186,742)	(2,264,772)	(2,345,635)	(2,429,436)	(2,516,282)	(2,606,285)	(2,699,564)	(2,796,237)	(2,896,431)	(3,000,275)	(3,107,905)	(3,219,461)	(3,335,087)	(3,454,935)	(3,579,160)	(3,707,925)	(3,841,398)	(3,979,754)	(4,123,173)	(4,271,844)	(4,425,961)	(4,585,726)	(4,751,350)
Interest on Loan Expense	(55,170,221) -	(4,560,640)	(4,422,714)	(4,277,893)	(4,125,830)	(3,966,164)	(3,798,514)	(3,622,482)	(3,437,649)	(3,243,574)	(3,039,795)	(2,825,827)	(2,601,161)	(2,365,262)	(2,117,567)	(1,857,488)	(1,584,405)	(1,297,667)	(996,593)	(680,465)	(348,531)	-	-	-	-	-
Principal Repayment of Loan	(91,212,800) -	(2,758,511)	(2,896,437)	(3,041,258)	(3,193,321)	(3,352,987)	(3,520,637)	(3,696,669)	(3,881,502)	(4,075,577)	(4,279,356)	(4,493,324)	(4,717,990)	(4,953,890)	(5,201,584)	(5,461,663)	(5,734,746)	(6,021,484)	(6,322,558)	(6,638,686)	(6,970,620)	-	-	-	-	-
Working Capital																										
Depreciation Expense (Excluded)																										
Net Before Tax Cash Flow from Operation	**97,890,960 (22,803,200)**	**1,923,910**	**2,041,797**	**2,160,268**	**2,279,279**	**2,398,785**	**2,518,739**	**2,639,088**	**2,759,779**	**2,880,754**	**3,001,953**	**3,123,311**	**3,244,760**	**3,366,229**	**3,487,642**	**3,608,920**	**3,729,977**	**3,850,725**	**3,971,071**	**4,090,916**	**4,210,158**	**11,647,838**	**11,765,540**	**11,882,294**	**11,997,975**	**12,112,450**
Discount Factor	1.0000	0.9533	0.9088	0.8663	0.8258	0.7873	0.7505	0.7154	0.6820	0.6502	0.6198	0.5908	0.5632	0.5369	0.5119	0.4879	0.4651	0.4434	0.4227	0.4030	0.3841	0.3662	0.3491	0.3328	0.3172	0.3024
Net present value	33,132,351 (22,803,200)	1,834,042	1,855,503	1,871,463	1,882,329	1,888,487	1,890,298	1,888,102	1,882,220	1,872,953	1,860,583	1,845,376	1,827,582	1,807,434	1,785,152	1,760,941	1,734,995	1,707,494	1,678,606	1,648,490	1,617,293	4,265,403	4,107,250	3,954,250	3,806,241	3,663,066
Cumulative NPV	33,132,351 (22,803,200)	(20,969,158)	(19,113,655)	(17,242,192)	(15,359,863)	(13,471,376)	(11,581,079)	(9,692,977)	(7,810,757)	(5,937,804)	(4,077,221)	(2,231,845)	(404,264)	1,403,170	3,188,322	4,949,263	6,684,258	8,391,752	10,070,359	11,718,849	13,336,141	17,601,544	21,708,794	25,663,044	29,469,284	33,132,351
Project IRR	**12.62%**																									

After Tax Analysis

	Total	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25
Est. Effective Income Tax Rate (%)	***35.0%***																										
Operating Revenue	347,352,746		11,281,842	11,472,392	11,666,161	11,863,202	12,063,572	12,267,326	12,474,521	12,685,215	12,899,469	13,117,341	13,338,893	13,564,187	13,793,286	14,026,254	14,263,158	14,504,062	14,749,036	14,998,147	15,251,466	15,509,063	15,771,011	16,037,384	16,308,255	16,583,702	16,863,800
Operating Expenses	(80,275,565)		(2,038,781)	(2,111,444)	(2,186,742)	(2,264,772)	(2,345,635)	(2,429,436)	(2,516,282)	(2,606,285)	(2,699,564)	(2,796,237)	(2,896,431)	(3,000,275)	(3,107,905)	(3,219,461)	(3,335,087)	(3,454,935)	(3,579,160)	(3,707,925)	(3,841,398)	(3,979,754)	(4,123,173)	(4,271,844)	(4,425,961)	(4,585,726)	(4,751,350)
Operating Income	267,077,181		9,243,061	9,360,948	9,479,419	9,598,430	9,717,937	9,837,890	9,958,239	10,078,930	10,199,905	10,321,104	10,442,462	10,563,911	10,685,380	10,806,794	10,928,071	11,049,128	11,169,876	11,290,222	11,410,068	11,529,309	11,647,838	11,765,540	11,882,294	11,997,975	12,112,450
Depreciation Expense	(138,448,000)		(83,068,800)	(22,151,680)	(16,613,760)	(11,075,840)	(5,537,920)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Operating Income	128,629,181		(73,825,739)	(12,790,732)	(7,134,341)	(1,477,410)	4,180,017	9,837,890	9,958,239	10,078,930	10,199,905	10,321,104	10,442,462	10,563,911	10,685,380	10,806,794	10,928,071	11,049,128	11,169,876	11,290,222	11,410,068	11,529,309	11,647,838	11,765,540	11,882,294	11,997,975	12,112,450
Interest expense	(55,170,221)		(4,560,640)	(4,422,714)	(4,277,893)	(4,125,830)	(3,966,164)	(3,798,514)	(3,622,482)	(3,437,649)	(3,243,574)	(3,039,795)	(2,825,827)	(2,601,161)	(2,365,262)	(2,117,567)	(1,857,488)	(1,584,405)	(1,297,667)	(996,593)	(680,465)	(348,531)	-	-	-	-	-
Pretax Net Income	73,458,960		(78,386,379)	(17,213,446)	(11,412,234)	(5,603,239)	213,853	6,039,376	6,335,757	6,641,281	6,956,331	7,281,309	7,616,635	7,962,750	8,320,119	8,689,226	9,070,583	9,464,723	9,872,209	10,293,629	10,729,602	11,180,778	11,647,838	11,765,540	11,882,294	11,997,975	12,112,450
Income taxes	(65,125,990)		-	-	-	-	(74,849)	(2,113,781)	(2,217,515)	(2,324,448)	(2,434,716)	(2,548,458)	(2,665,822)	(2,786,963)	(2,912,042)	(3,041,229)	(3,174,704)	(3,312,653)	(3,455,273)	(3,602,770)	(3,755,361)	(3,913,272)	(4,076,743)	(4,117,939)	(4,158,803)	(4,199,291)	(4,239,358)
Investment Tax Credit (alread factored in to CapEx)																											
Net Income AT (Not cash inflow)	8,332,970		(78,386,379)	(17,213,446)	(11,412,234)	(5,603,239)	139,004	3,925,594	4,118,242	4,316,833	4,521,615	4,732,851	4,950,813	5,175,788	5,408,077	5,647,997	5,895,879	6,152,070	6,416,936	6,690,859	6,974,241	7,267,506	7,571,095	7,647,601	7,723,491	7,798,684	7,873,093
Depreciation (Added back as a non cash transa	138,448,000		83,068,800	22,151,680	16,613,760	11,075,840	5,537,920	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Cash Flow from Operation			**4,682,421**	**4,938,234**	**5,201,526**	**5,472,601**	**5,676,924**	**3,925,594**	**4,118,242**	**4,316,833**	**4,521,615**	**4,732,851**	**4,950,813**	**5,175,788**	**5,408,077**	**5,647,997**	**5,895,879**	**6,152,070**	**6,416,936**	**6,690,859**	**6,974,241**	**7,267,506**	**7,571,095**	**7,647,601**	**7,723,491**	**7,798,684**	**7,873,093**
Principal Repayment	(91,212,800)		(2,758,511)	(2,896,437)	(3,041,258)	(3,193,321)	(3,352,987)	(3,520,637)	(3,696,669)	(3,881,502)	(4,075,577)	(4,279,356)	(4,493,324)	(4,717,990)	(4,953,890)	(5,201,584)	(5,461,663)	(5,734,746)	(6,021,484)	(6,322,558)	(6,638,686)	(6,970,620)	-	-	-	-	-
Depreciable Capital	(114,016,000) (114,016,000)		-																								
Non-depreciable capital	-		-																								
Loan Proceeds	91,212,800 91,212,800		-																								
Capital Gains/Losses	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Working Capital	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Capital Cash Flow	**(114,016,000)**	**(22,803,200)**	**(2,758,511)**	**(2,896,437)**	**(3,041,258)**	**(3,193,321)**	**(3,352,987)**	**(3,520,637)**	**(3,696,669)**	**(3,881,502)**	**(4,075,577)**	**(4,279,356)**	**(4,493,324)**	**(4,717,990)**	**(4,953,890)**	**(5,201,584)**	**(5,461,663)**	**(5,734,746)**	**(6,021,484)**	**(6,322,558)**	**(6,638,686)**	**(6,970,620)**	**-**	**-**	**-**	**-**	**-**
Total Cash Flow	**32,764,970**	**(22,803,200)**	**1,923,910**	**2,041,797**	**2,160,268**	**2,279,279**	**2,323,937**	**404,957**	**421,573**	**435,331**	**446,038**	**453,495**	**457,489**	**457,798**	**454,188**	**446,413**	**434,216**	**417,324**	**395,452**	**368,301**	**335,556**	**296,886**	**7,571,095**	**7,647,601**	**7,723,491**	**7,798,684**	**7,873,093**
Discount Factor		1.0000	0.9533	0.9088	0.8663	0.8258	0.7873	0.7505	0.7154	0.6820	0.6502	0.6198	0.5908	0.5632	0.5369	0.5119	0.4879	0.4651	0.4434	0.4227	0.4030	0.3841	0.3662	0.3491	0.3328	0.3172	0.3024
Net present value	**2,797,538**	**(22,803,200)**	**1,834,042**	**1,855,503**	**1,871,463**	**1,882,329**	**1,829,561**	**303,918**	**301,609**	**296,903**	**289,996**	**281,072**	**270,303**	**257,850**	**243,868**	**228,497**	**211,872**	**194,118**	**175,352**	**155,684**	**135,217**	**114,046**	**2,772,512**	**2,669,712**	**2,570,262**	**2,474,056**	**2,380,993**
Cumulative NPV		**(22,803,200)**	**(20,969,158)**	**(19,113,655)**	**(17,242,192)**	**(15,359,863)**	**(13,530,302)**	**(13,226,384)**	**(12,924,775)**	**(12,627,872)**	**(12,337,875)**	**(12,056,803)**	**(11,786,501)**	**(11,528,650)**	**(11,284,783)**	**(11,056,286)**	**(10,844,414)**	**(10,650,297)**	**(10,474,945)**	**(10,319,261)**	**(10,184,044)**	**(10,069,998)**	**(7,297,486)**	**(4,627,774)**	**(2,057,512)**	**416,545**	**2,797,538**
Project IRR	**5.78%**																										

Financial Results

Baseline Cost per kWh - TCO

	Total	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25
Rent per kWh	0.0001		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
O&M	0.0157		0.0090	0.0094	0.0098	0.0102	0.0107	0.0112	0.0117	0.0122	0.0127	0.0133	0.0139	0.0145	0.0151	0.0158	0.0165	0.0172	0.0180	0.0188	0.0196	0.0205	0.0214	0.0223	0.0233	0.0243	0.0254
Fuel / Feedstock Costs	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Property Tax	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other/Misc Costs	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Capital Expense per kWh	0.0257		0.0183	0.0194	0.0204	0.0216	0.0227	0.0240	0.0253	0.0267	0.0282	0.0298	0.0314	0.0331	0.0350	0.0369	0.0389	0.0411	0.0434	0.0458	0.0483	0.0510	-	-	-	-	-
Cost of Capital (per kWh)	0.0156		0.0303	0.0295	0.0287	0.0278	0.0269	0.0259	0.0248	0.0237	0.0224	0.0211	0.0198	0.0183	0.0167	0.0150	0.0132	0.0114	0.0093	0.0072	0.0050	0.0025	-	-	-	-	-
Total Cost per kWh	**$ 0.0571**		**0.0577**	**0.0584**	**0.0590**	**0.0597**	**0.0604**	**0.0611**	**0.0619**	**0.0627**	**0.0635**	**0.0643**	**0.0651**	**0.0660**	**0.0669**	**0.0678**	**0.0688**	**0.0698**	**0.0708**	**0.0719**	**0.0730**	**0.0741**	**0.0215**	**0.0225**	**0.0235**	**0.0245**	**0.0256**

Normalized Cost per kWh - TCO

Rent per kWh	0.18%
O&M	27.49%
Fuel / Feedstock Costs	0.00%
Property Tax	0.00%
Other/Misc Costs	0.00%
Capital Expense per kWh	45.07%
Cost of Capital (per kWh)	27.26%
Total Cost per kWh	**100%**

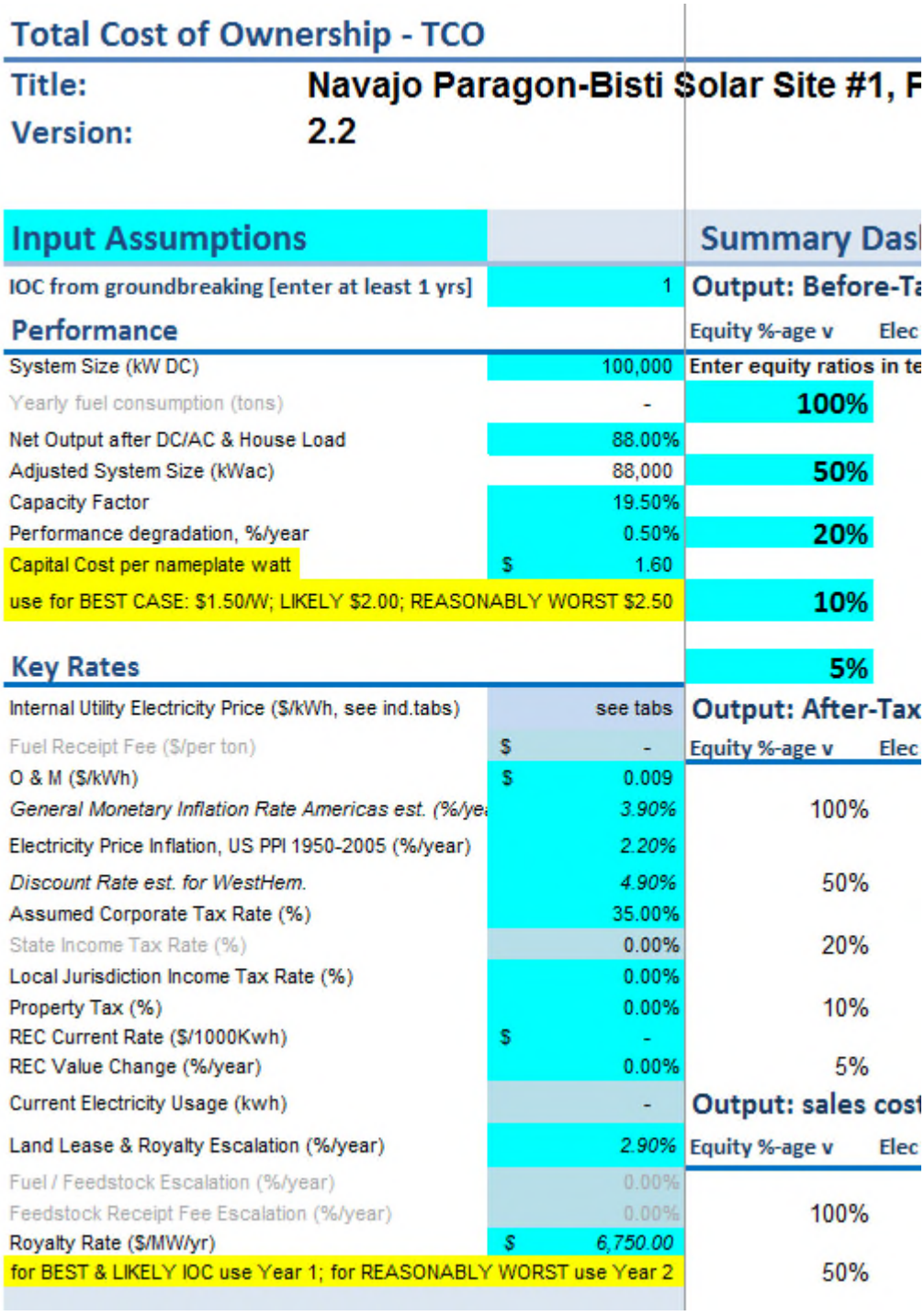
Summary of Financial Results - Before Tax

		5 Years	10 Years	15 Years	20 Years	25 Years
Net Present Value	$	$ (13,471,376)	$ (4,077,221)	$ 4,949,263	$ 13,336,141	$ 33,132,351
Before Tax Internal Rate of Return	%	-20.10%	1.31%	7.61%	10.12%	12.62%
Life Cycle Costs - Equivalent Uniform Annual Cost (EUAC)	$/Yr	$ (3,102,952)	$ (525,458)	$ 473,606	$ 1,061,072	$ 2,327,316

Summary of Financial Results - After Tax

		5 Years	10 Years	15 Years	20 Years	25 Years
Net Present Value	$	$ (13,530,302)	$ (12,056,803)	$ (10,844,414)	$ (10,069,998)	$ 2,797,538
After Tax Internal Rate of Return	%	-20.33%	-12.37%	-6.75%	-4.01%	5.78%
Life Cycle Costs - Equivalent Uniform Annual Cost (EUAC)	$/Yr	$ (3,116,525)	$ (1,553,838)	$ (1,037,726)	$ (801,205)	$ 196,507

Inputs. The Tetra Tech model contains several dozen input parameters which can be adjusted by the user. Each of these parameters is listed and briefly discussed below. The model provides immediate feedback via a summary "dashboard" wherein the 50 scenarios are tabulated, before- and after-tax, in two tables, reporting a single output figure of merit: internal rate of return (IRR).



Total Cost of Ownership - TCO

Title:	**Navajo Paragon-Bisti Solar Site #1, F**
Version:	**2.2**

Input Assumptions			**Summary Das**
IOC from groundbreaking [enter at least 1 yrs]		1	**Output: Before-Ta**
Performance			Equity %-age v Elec
System Size (kW DC)		100,000	Enter equity ratios in te
Yearly fuel consumption (tons)		-	**100%**
Net Output after DC/AC & House Load		88.00%	
Adjusted System Size (kWac)		88,000	**50%**
Capacity Factor		19.50%	
Performance degradation, %/year		0.50%	**20%**
Capital Cost per nameplate watt	$	1.60	
use for BEST CASE: $1.50/W; LIKELY $2.00; REASONABLY WORST $2.50			**10%**
Key Rates			**5%**
Internal Utility Electricity Price ($/kWh, see ind.tabs)		see tabs	**Output: After-Tax**
Fuel Receipt Fee ($/per ton)	$	-	Equity %-age v Elec
O & M ($/kWh)	$	0.009	
General Monetary Inflation Rate Americas est. (%/ye		*3.90%*	100%
Electricity Price Inflation, US PPI 1950-2005 (%/year)		2.20%	
Discount Rate est. for WestHem.		*4.90%*	50%
Assumed Corporate Tax Rate (%)		35.00%	
State Income Tax Rate (%)		0.00%	20%
Local Jurisdiction Income Tax Rate (%)		0.00%	
Property Tax (%)		0.00%	10%
REC Current Rate ($/1000Kwh)	$	-	
REC Value Change (%/year)		0.00%	5%
Current Electricity Usage (kwh)		-	**Output: sales cost**
Land Lease & Royalty Escalation (%/year)		2.90%	Equity %-age v Elec
Fuel / Feedstock Escalation (%/year)		0.00%	
Feedstock Receipt Fee Escalation (%/year)		0.00%	100%
Royalty Rate ($/MW/yr)	$	*6,750.00*	
for BEST & LIKELY IOC use Year 1; for REASONABLY WORST use Year 2			50%

Figure 4-1. Screen Shot of User Interface – Some Inputs to Economic Model

Source: Tetra Tech. All Rights Reserved.

The sales price of electricity is a function of the cost of capital, i.e. debt service. The model assumes a 20-year loan at 5%. With 0% debt (ostensibly zero debt service) and 100% equity, direct cost of sales equals land lease costs and O&M, which comes to 1.6 cents per kWh. At 50/50 debt/equity, cost of sales more than doubles to 4 cents per kWh. At virtually all debt/zero equity, cost of sales per kWh approaches 6 cents. Therefore the proportion of debt places a floor on the PPA that can be accepted. Cutting the interest rate on the loan in half removes 2 pennies from the total cost of sales, as seen in Table 4-2 below.

Table 4-2. Cost of Sales (pennies per kWh) versus D:E Ratio at two interest rates

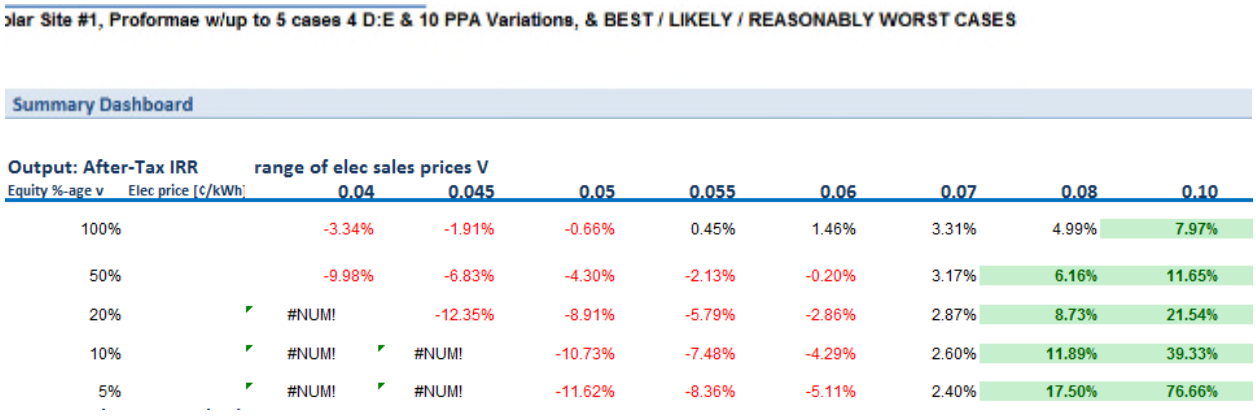
Equity	100%	50%	20%	10%	5%
Cost of Sales (¢/kWh) @ i=10%	1.6	5.4	7.6	8.4	8.7
Cost of Sales (¢/kWh) @ i=5%	1.6	4.2	5.7	6.2	6.5

At low PPA and low D:E ratio (lots of debt, hence interest payments) cash flow never goes positive, and the IRR algorithm blows up due to a mathematical singularity (dividing by zero). This is simply a mathematical way of saying that borrowing a lot of money to sell a commodity cheaply is not a good idea.

All the parameters used in the model are presented below, in the same order they appear in the model:

- **Net power output** of 99,000 kWe ; net = 100,000 kWe gross minus 1% "house" load.
- **Capacity factor** of fixed flat-plate summer-bias system comes to 1712 kWh per kW, divided by 8766 hours in a year, or 19.5%. With proper planning, "availability" (accounting for maintenance outages) should be equal to capacity factor.
- **Performance degradation** of 0.5% (relative, not absolute) per year
- Best Case initial operational capability (**IOC**) after groundbreaking = Year 1; Likely Case IOC = Year 2, Reasonably Worst Case IOC = Year 3. Aka commissioning operation date (COD).
- Best Case **CapEx** $1.50 per watt, Likely = $2.00, Reasonably Worst = $2.50.
- **Electricity Sales Price** ($/kWh), from $0.04 (4 cents) to $0.14 (14 cents)
- **O & M** ($/kWh) = $0.009 (0.9 cents)
- General **Monetary Inflation Rate** Americas est. = 3.90% per year
- **Electricity Price Inflation**, US PPI 1950-2005 (%/year) = 2.20%
- **Discount Rate** est. for Western Hemisphere = 3.70% (Figure derived using the "Social-Time-Preference Rate" method.
- **US Corporate Tax Rate** (%) = 35.00%
- State Income Tax Rate (%) = 0.00%, since it is assumed that the State taxes do not apply on the Navajo Reservation.
- **Local Jurisdiction Income Tax Rate** (%) = 0.00% , since it is assumed that the NN will either be a partner in the project overseeing the developer, or own it outright.
- **Property Tax** (%) = 0.00%
- **REC Current Rate** ($/1000kWh) = 0.00 (The REC market has collapsed.)
- **REC Value Change** (%/year) = 0.00%
- **Land Rate Escalation** (%/year) = 2.00%

- **Royalty Rate** (%/kWh) = 4.00%
- **Development and Other Costs** = 7% surcharge on equity, and 2 points on debt.
- No Misc Costs identified at this stage of the analysis.
- **Debt:Equity ratios** vary from 0%debt/100% equity, to almost the other way 'round.
- **Cost of Capital** was set at 5%. Note that for a commercial system type, loan interest payments are tax deductible. Tax-exempt municipal bonds typically carry 2-3 points less interest than commercial paper in exchange for the tax benefit. Even lower interest rates are available in the USA for certain environmentally-conscious infrastructure projects. For example, there is a revolving loan fund with a rate of 1% (less than inflation) for water quality improvements. Every state has these funds, provided by the EPA to encourage compliance with the Clean Water Act.
- **Loan Term** of 20 years. This is less than the guaranteed 25-year life of PV modules because the lender does not want to loan money against an asset that retires before the loan does.
- **Incentives**
  - Federal **Investment Tax Credit** or Grant = 30.00%
  - State/Local Rebates = $0.000
  - PTC **Production Tax Credit** ($/kwh) = $0.000 (either PTC or ITC can be chosen, but not both)
  - **Sales Tax Exemption** = 0
  - **Bonus MACRS** Depreciation Schedule (applied to 85% of CapEx, not 70%)
    - Year Depreciation Factor
    - 1 60.00%
    - 2 16.00%
    - 3 12.00%
    - 4 8.00%
    - 5 4.00%
    - 6 0.00%



olar Site #1, Proformae w/up to 5 cases 4 D:E & 10 PPA Variations, & BEST / LIKELY / REASONABLY WORST CASES

Summary Dashboard

Output: After-Tax IRR range of elec sales prices V

Equity %-age v	Elec price [¢/kWh]	0.04	0.045	0.05	0.055	0.06	0.07	0.08	0.10
100%		-3.34%	-1.91%	-0.66%	0.45%	1.46%	3.31%	4.99%	7.97%
50%		-9.98%	-6.83%	-4.30%	-2.13%	-0.20%	3.17%	6.16%	11.65%
20%		#NUM!	-12.35%	-8.91%	-5.79%	-2.86%	2.87%	8.73%	21.54%
10%		#NUM!	#NUM!	-10.73%	-7.48%	-4.29%	2.60%	11.89%	39.33%
5%		#NUM!	#NUM!	-11.62%	-8.36%	-5.11%	2.40%	17.50%	76.66%

Figure 4-2. Screen Shot of User Interface – Outputs from Economic Model

Source: Tetra Tech. All Rights Reserved.

Outputs. Only one output is produced by the model: internal rate of return. However, by varying all of the other parameters, this yardstick can produce useful general conclusions:

- **At a CapEx of $2.50 per watt**, even taking full advantage of all incentives, not even a "dime PPA" (sales price of 10¢/kWh, or $100/MWh) would produce positive returns across all D:E scenarios. A 10-cent PPA yields only inflation or less, even outright negative returns for the investors. The IRR curve becomes flat with respect to D:E ("saddle point") at 12¢/kWh. The financial benefits of D:E leveraging do not appear until 14¢/kWh, a PPA price that has not been seen on the West Coast for several years, and even then they are weak. In other words, a $2.50-per-watt project cannot work any longer.
- **A CapEx of $1.00 per watt** is required to make a 5-cent-PPA work at ordinary interest rates, and even that would be barely positive. The IRR "saddle point" with respect to D:E moves to 6¢/kWh. In other words, the $45-55 per MWh PPAs that have been mooted to the NN will not work, since a dollar-per-watt-all-in utility-scale power plant is not credible yet, and might not ever be. (4% money and very high D:E ratio would make a "nickel PPA" work, but such low-priced money is typically not available in the commercial investment world.)
- *Reducing* the cost of capital by 100 basis points (i.e., 1% nominal) nearly balances or offsets an *increase* of $0.15 per watt in CapEx. Therefore, the team must find debt financing in the range of 5% (typically available to municipalities with good credit) in order to have a credible capital budget.

4.1.2 Land Lease Analysis

In the event the tribe partners with a developer; the developer assumes all risks under the land lease agreement to raise the capital, obtains all permits, then builds and operates the plant. Under this situation the agreement can be structured in various manners based on the lease value of the land, reaching development milestones such as completing NEPA documentation and production of power. In a modular fashion, which can be scaled up based on the size of the site, a possible schedule of fees informed by old BLM figures might look like this:

- Initial land lease: $19 per acre per year now, (equivalent to $61 per MW per year using a summer bias design), escalating at the same rate of the CPI
- Land lease after NEPA milestones achieved: $30 per acre per year now (equivalent to $97 per MW per year), escalating at the same rate of the CPI
- Severance fee or royalty after commissioning / during power production: $6750 per MW per year, escalating at the same rate of the CPI

Using the sites defined in table 4-1 below, the land could generate the following revenues from leases and during full energy production. Although the value of land leasing before power production is slight, it is more than zero, and as the projects mature and the sites move into production, the returns are significant. The key is to move the project into the construction and commissioning phase. It must also be realized that all sites will not be developed simultaneously, therefore the cash flow will be staggered.

Table 4-3. Summary of Revenue from Land Lease and Electricity Generation

Group Name	Site #	Devel-opable Acres	Power [MW]	Initial Annual Revenue Land-Lease	Annual Revenue After NEPA	Annual Revenue Electricity Generation
BISTI CORNERSTONE	1	1,321	***290***	$25,000	$40,000	$1,960,000
"the Wedge"	1A	333	***50***	$6,000	$10,000	$340,000 M
"DOG-EYE SOLAR RANCH"	2	612	***132***	$12,000	$18,000	$890,00 M
TANNER LAKE/COAL CREEK	3	3,161	***638***	$60,000	$95,000	$4,420,000 M
SPLIT LIP FLATS/BLACK LAKE	4	4,205	***972***	$80,000	$126,000	$6,560,000 M
TOTAL ALL SITES		9,632	***2,081***	$183,000	$289,000	$14,200,000 M

4.2 Technical and Economic Viability of Commercial RE Technology Options

A nominal 100-MW PV ranch on the PBR will be viable from the viewpoint of an owner/investor, earning a decent after-tax return of 6% or so, if and only if:

It is built for no more than $1.60 per DC-watt,

It is financed via a 20-year loan (debt) @ 5% with 20% down (investor equity)

It takes full advantage of every federal incentive that now exists

It sells electricity under a long-term PPA for about $75 per megawatt-hour (MWh) pegged to the Producer Price Index (PPI).

Income for the NN from both land lease fees and normal royalties on production is allowed for in this model. Not having to pay income taxes would parameters to increase considerably (by +33%) yet still provide that return.

A $2.50 per watt PV project cannot work today, since that requires a wholesale price of $100/MWh, which has not been seen on the West Coast for several years. The $45-55/MWh PPAs that have been mooted to the NN are not acceptable either, since a dollar-per-watt CapEx is not credible yet

4.3 Business Planning for Implementing a Sustainable RE Development Project

A sound business plan will provide the Navajo Nation with a roadmap to help unlock the value of this land. Business planning for this potentially very diverse, geographically expansive and complex RE project at the PBR would be organized around a series of progressive projects at the sites described in Section 2. The key business planning factors in developing the plan include:

- *Transmission Capacity* –Development plan for the project will be based on the connection to grid.
- *PPA* - Securing a PPA is critical as discussed in Section 3.
- *Funding* – Engaging a developer will present the most efficient path for initial site development. The smallest solar ranch may cost over $600 million to develop. Developers have access to major funding sources, and solar developers have investment capital of their own. The alternative course would be for the Navajo Nation to take a leadership role as the owner of the project and the RE resource.

The course the Navajo Nation wishes to pursue, will to a very large extent, determine the direction of the Business Plan. Discussions with Navajo stakeholders, staff at NHLCO and the Office of Navajo and Hopi Indian Relocation (ONHIR) indicate clear interest in Navajo ownership (partially-owned to wholly-owned) and financing of prospective RE development ("Development"). The Navajo stakeholders, are interested in exploring their options whereby the Nation may offer the land for development or participate in a more invested, structured manner to obtain great benefits. The options for developing RE at PBR include:

- Ownership gained through capital investment by Navajo Nation
- Ownership gained through the "flip" or conversion to Navajo Nation after a number of years from a developer.

The Navajo stakeholders wish to fully explore their options for participation and perform the due diligence before committing to a simple land lease arrangement. It must be understood that a project can require $2.5-3M/ MW or $300M for 100MW.

4.3.1 Business Plan for Implementing a RE Project at PBR

The following provides and outline for implementing a RE Business Plan. This is not a complete business plan as there are many factor unavailable at this junction and the time of execution is uncertain as it relates to tax credits and the details from the LGIA.

4.3.1.1 Vision

The evolving world of RE offers huge potential for America. The merger of the resource assets of the Navajo Nation and evolving RE technology offers solutions and compensation opportunity for the Relocatees, putting the Nation on the map as one of the largest solar projects in the country. Part of Tetra Tech's plan is to promote economic activity that helps the NHLCO realize their objective and unlock the potential of solar production on PBR lands.

4.3.1.2 Goals and Objectives

The goals of the Paragon project is to form an efficient organization to implement a commercial scale RE project on the lands allocated under the NHLSA. The project should:

- Develop a series of solar RE projects which are financially profitable and sustainable for the benefit of Relocatees

- Provide maximum information for developers and interested investors, yielding a low risk and safe opportunity for all partners
- Partner with PNM and leverage tribal connections to gain interconnection agreement and complete the study
- Move the program into the pre-construction phase
- Advertise the opportunity to engage developers and/or investor to assess level of interest and qualify potential partners
- Prepare the Navajo Nation to get a good outcome and have a positive impact on our country's development of RE resource.

4.3.1.3 The Investment Opportunity

The energy industry is a major area for investment, and policy makers in the US and elsewhere are looking to this sector to be the driver of future prosperity. The basic economics of energy and developments in technology are making the area of Solar Energy positioned to grow in this segment of the energy market.

Economic indicator show the vast potential of the solar energy segment of the RE market. Many well-known investors have made long term investments in the sector. Financial analysis does suggests that this sector may be slowing or becoming more deliberate, trying to better match production capacity with a specific need in a geographic area and establishing smaller more manageable projects that do not represent a potential surge impact to balancing the reliability of the grid.

4.3.1.4 Strategy

Tetra Tech's strategy is to build out the PBR to the maximum extent possible, tempered by an understanding of the realities of the remoteness of the lands and transmission capacity to export power. Our desire is to employ tribal members in the construction, long term operations, and maintenance phases where practical. This strategy also responds to the possible lack of a contracting market in the area and play to the unique strengths of the Navajo Nation to respond, including the role that local business plays in strengthening the local community.

At the same time, the project delivery team must organize so that the major issues of contracting, financing, negotiating, land control, and ensuring good design and quality control are handled with units that address these matters of selecting the right partner developer and a project management and oversight entity.

4.3.1.5 Financing Plan

Assuming today's utility-scale cost of about $1.60 per watt of capacity, the nominal CapEx for the example 100-MW solar plant would be $160M. Assuming a 4:1 D:E ratio (80% debt:20% equity), then the total financing cost (front-end fees such as underwriting and points on debt, plus the sum of interest payments over the 20-year term of the loan) would be half again as much, amounting to another $80M. The economic analysis of these solar ranch projects is presented in Section 4 above. For a reasonable investment scenario, a developer or the Navajo Nation could see a return in the range of 6 to 7%, which could be a good investment and a profitable project.

4.3.1.6 Risk

The possible risk to the Navajo Nation as the project owner are considerable and includes: business management, financing and economics, environmental permitting, engineering, procurement and construction (EPC), schedule management, health & safety, quality control, meeting project production expectations – mission, vision and values (MV&V), satisfying investors and managing the solar projects

into long term O&M for up to 30+ years. Much of this risk can be shifted to a developer if the tribe initially leases the land and enjoys the lease payments based on project phase and energy production.

4.3.1.7 Keys to Success

The keys to the program success will be in the following:

- *A Full Bench*. Building a competent project delivery team capable of working with the utilities, off takers, developers, regulatory agencies, investors and contractors.
- *Best Foot Forward*. Work the land swap for Site 1 to offer the most attractive site to an initial developer
- *Don't Delay*. Qualify a developer and form a partnership to kick off a cornerstone project
- *Success Breeds Success*. Use the initial project as a springboard with stable reliable cash flow to launch subsequent projects

4.3.1.8 Energy History

United States. The United States developed its industry and infrastructure over the past century with the assumption that there would be an unlimited and enduring supply of exceptionally low cost energy. This assumption was valid until the 1970s when countries like the United States had to face the OPEC 'oil shock' when global energy prices reset at levels much higher than had prevailed.

Because of the history of low cost energy, US industry and US infrastructure were built in ways that were extremely energy inefficient whether it was industrial processes, transportation equipment, residential housing or commercial and industrial buildings. Much of this infrastructure still exists. A large proportion of the buildings in the United States were designed and built more than 30 years ago when energy costs were much lower than they have been in recent years. Now policy makers in Washington at the federal level and around the country understand the need to provide incentives to encourage the growth of the energy retrofit industry and are moving on a multitude of initiatives

Technology and economics are now driving investment towards RE sustainable projects – for example:

- Gasoline sold for 27 cents a gallon in 1973. In 2015 the price is almost 10 times as much, $2.50 a gallon. It has been 20 times as much in recent memory (2008).
- Crude oil was $3.50 a barrel before 1973 but hit $140.00 a barrel (40 times as much) in 2008.

Navajo. The Navajo Nation has a long history of energy related contracts and projects ranging from fossil fuels (coal and natural gas) to RE (solar and wind). Some of these projects have not resulted in the best situation for the Nation in terms of protecting their lands, air quality, and population. The PBR project has importance because of history and the intersection of this type of project with the cultural values of the Navajo Nation.

4.3.1.9 Market

Solar Energy System Installations. The global market for solar systems has been growing fast as shown in the following.

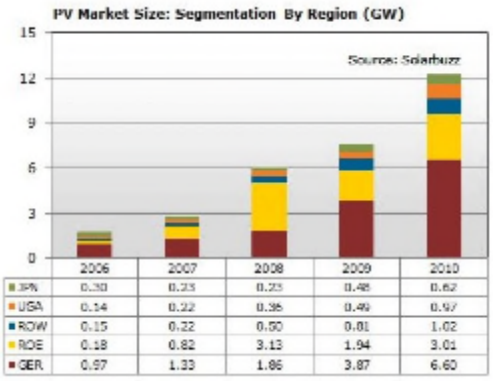


Figure 4-3. US markets are gaining in solar systems development

Source: SolarBuzz. All Rights Reserved.

According to the solar industry observer SolarBuzz, in 2009 solar (PV) installations were 7,300 MW and predicted to rise in capacity to 15,400-37,000 MW in 2015, more than five times the size of the 2009 market. In the past five years the generation of energy from solar in the United States increased from 140 MW to 970 MW, about a 7 fold increase.

SolarBuzz reported that in 2009, the photovoltaic solar industry generated $38.5 billion in revenues globally, which includes the sale of solar modules and associated equipment, and the installation of solar systems. Their forecast scenarios, depending on their assumptions, project growth in the world PV market from $56.3 billion to $96.8 billion in 2015.

In 2014, according to the Solar Energy Industries Association (SEIA), there were 297 MW of residential PV installations in the United States. As a planning factor, commercial installations are approaching 1,000 MW per year at an average installed price of $2.00 /$W_{dc}$ the commercial market size is about $4 billion annually.

The SEIA projects the growth of installed capacity through 2016. The combined residential and commercial segment is projected to almost triple in four years from 1,400 MW installed in 2012 to about 4,200 MW installed in 2016. An estimate of the installed cost would therefore be $5.6 billion in 2012 increasing to $16.8 billion in 2016, and increase of $11.2 billion or $3 billion a year.

Though the specific size of the market is difficult to determine, the trend towards a bigger market is clear. More important, is whether or not the market will be profitable. The profitability of the solar energy system installation business will be determined in large part by the way the business is structured and managed. There is a definite opportunity in the segment for a well-managed and properly planned solar projects to grow at PBR.

The following graphic shows the potential for all forms of RE on tribal lands.

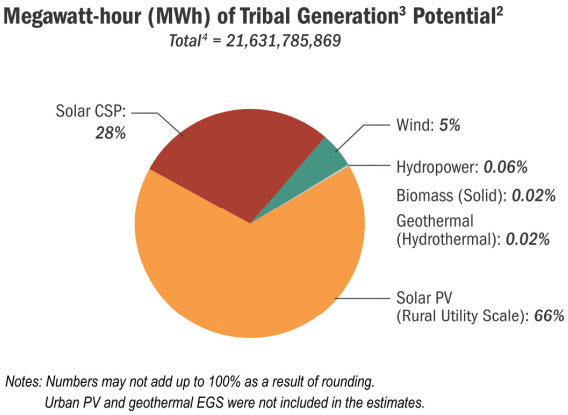


Figure 4-4. Summary of Tribal Renewable Energy Installed

4.3.1.10 Revenues

The revenues from PBR will come from the payment for the lease value of the lands, provided to a developer. A developer would assume the risk and generate their income from the sale of power to a utility or agency. If the NHLCO elects to prosecute the project and take a more active role as an owner of a PBR site, producing energy, they would assume the risk and be responsible for all aspects of the project through to long-term O&M and of course earn the biggest reward, depending on the terms of the PPA.

4.3.1.11 Prices

Prices are a function of permitting, EPC and desired rated of return for investors and servicing debt. The largest cost component is the installed prices for solar systems, which have been going down; averages installed costs are shown in the following graphic.

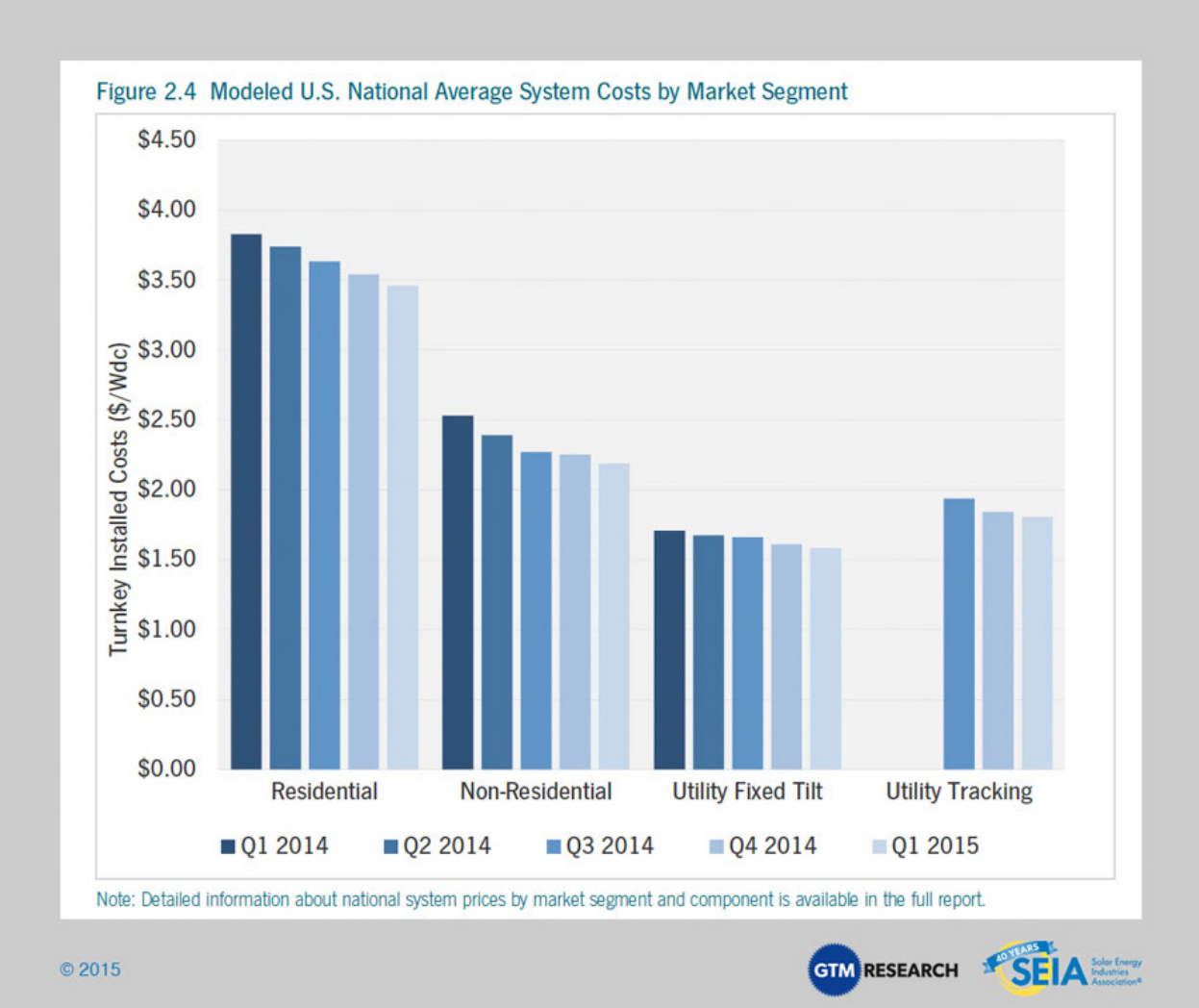


Figure 4-5. Price Spectrum of PV from Residential to Utility-Scale

Source: SEIA/GTM Research U.S. Solar Market Insight.

4.3.1.12 Government Incentives

The role of government incentives is often critical in the determining the viability of a RE project. The current generous ITC of 30% is set to drop to 10% at the end of 2016. PTCs of about 2 cents for wind and solar tend to get renewed every year, and also go up a little every year. However the PTC is much less lucrative for owners. Even if current tax credits expire, it is likely that there will be other government incentives in the immediate future both from the Federal and State Governments.

The PBR solar complex should take advantage of these incentives to the maximum extent possible. The developer will, most certainly, explore all the incentive possibilities and design working procedures that will enable them to make use of these incentives efficiently.

4.3.1.13 Profit & Benefits

The profit potential for this program is substantial given the longevity of an RE project. A commercial scale solar array has the advantage of offering long term income for the Navajo Nation and Relocatees. Given the duration of an RE contract, 30+ years, it is critical that upfront activities be accomplished with great care and diligence and that the management team clearly defines requirements, expectations and long term objectives and goals.

Social and cultural benefits are also important and should be serious evaluated as the projects evolve. These features can include training and employment for tribal members and developing a project which is congruent with Navajo values. The added social value of more work opportunities is that every new job helps to support a family and a community and enables both individuals and society to satisfy needs. This environmentally clean solar power program would displace carbon emitting fossil fuel and not pollute.

The technological trend continues to drive down the commodity price of solar, which is good for the developer and makes the energy cost more competitive. On the other hand low prices could reduce profit for the investor. As the cost and price of fossil-fuels goes up, the benefit of having a solar ranch also goes up.

4.3.1.14 Organization and Management

The following are the key positions and partners needed to execute a commercial scale power project of this magnitude. These five items comprise the proposed structure for the organization:

1. Holding / Major Financing Component
2. Project management and oversight
3. Marketing
4. Contractor Teams
5. Suppliers

Holding / Financing Unit. The holding entity obtains financing for the project on the best possible terms. The legal structure and its specific structure are to be determined based on the respective interests of investors and lending institutions. The funds available in this project would be loaned to the projects to finance project implementation and the associated systems. The funds would be reimbursed from the cash flow from the implemented projects:

- For solar RE projects the norm for cash recovery is 5 years.
- The life of a typical solar installation is 25 years.
- These results may change substantially depending on the assumptions being made in the projections for inflation and other factors.
- In some cases funds are used to provide construction financing to fund the acquisition of equipment and pay contractors prior to payment by the owner.

Project Management and Oversight Team. The project management and oversight team has responsibility for project implementation, costs and performance. This team is the link between what the customer wants and what the system suppliers and the installation contractors do to deliver, install and commission the system. This entity has an important role in collaborating with contractors so that they are able to operate efficiently and do their work to a high quality standard in a safe manner.

Marketing. This unit will perform much of their work in advance of project execution, and is critical to all subsequent tasks. The Marketing team will identify markets to export power and gain a PPA. The team will work with local and distant utilities to continue to expand the project beyond the initial site.

Contractor Team. Depending on how a project will be executed, a well-integrated and diverse set of performance based contractor must be engaged and synchronized to deliver an RE project in an efficient manner. Partner contractors may include:

- EPC
- Construction Management
- Environmental
- Permitting
- Transmission
- Long Term O&M

This contractor team should include qualified tribal members from the Navajo Nation.

Suppliers. Supplier and vendors will provide the critical items needed to complete the project. The largest commodity item required for the project will be the solar array panels and associated system components to include racking systems. Equipment of this type is manufactured in volume by a limited number of large companies. The pricing, reliability, efficiency, warranty terms and delivery will be the major project driver in terms of meeting budget objectives and schedule. In the event an EPC contractor is utilized, this contractor will generally select the suppliers and assumes responsibility for the suppliers' performance and delivery.

4.3.1.15 Financial Analysis

A base case financial scenario is prepared and presented above supports developing the program. The financial model has been prepared for several energy cost and D:E ratios. At this point, there are too many unknowns to fully develop the financial model. The responsibility to complete this model resides with the developer. When complete the model should include:

- Solar Energy Balance Sheet
- Solar Energy Profit and Loss Statement
- Solar Energy Cash Flow
- Land Lease Values

5. ENVIRONMENTAL STUDY

5.1 Overview

The environmental study conducted for the 22,000-acre PBR, evaluated potential use of the PBR as an RE site. Select topics are addressed, focusing on critical issue areas and highlighting the main elements of those issues together with important items pertaining to permitting of the project and recommended actions. The overview and analysis was conducted using

- relevant literature,
- previous studies,
- existing databases,
- aerial imagery,
- reconnaissance of the 22,000-acre property,
- interviews of NN Staff with the NNEPA and other agencies (see Section 8 References for listing of persons interviewed), and
- other miscellaneous resources.

Figures 5-5 to 5-11, which were developed to support the environmental study portion of this Feasibility Study, are provided at page 5-26, *et seq.* following Section 5.5.

There is a vast amount of prior environmental documentation on the PBR, the regional area, and energy generation in the Southwestern U.S (which has been collected and archived within Tetra Tech offices). The intent of the environmental study was not to restate or repackage the abundance of information already published, but to focus on the critical environmental areas, highlighting key considerations and then, as possible, offering a path forward to guide and direct preparation of future environmental documentation and required regulatory permit applications. A summary of the key environmental findings follows:

5.1.1 Biological Resources

- Using the Western Governors' Association (WGA) Crucial Habitat Assessment Tool (CHAT), habitat within the PBR boundary is primarily Rank 4 with limited Rank 3 and Rank 5. Of the six CHAT habitat rankings, Rank 1 is the Most Crucial.
- After conducting a literature review, Tetra Tech was able to identify three special-status wildlife species with a potential to occur within the PBR based on the presence of suitable habitat, species range, and recorded occurrence within the Project Vicinity. Species identified based on the literature review that have a moderate or high potential to occur within the PBR are:
  - Loggerhead Shrike (*Lanius ludovicianus*) – State Sensitive, BLM Sensitive Species
  - Gray Vireo (*Vireo vicinior*) – State Endangered
  - Burrowing Owl (*Athene cunicularia*) – Federal Species of Concern, BLM Sensitive Species
- None of these three species are contained within the higher priority Groups 1, 2 or 3 of the Navajo Endangered Species List (see Appendix H).
- Discussion with the Wildlife Manager of the Navajo Nation Heritage Program (Diswood 2015) indicates that only pre-construction surveys for the burrowing owl would likely be required. The owl has the potential to occur in open areas where activity of burrowing animals (e.g., like prairie dogs) is prevalent.
- For the burrowing owl, New Mexico Fish and Game has prepared guidelines and recommendations for burrowing owl surveys and mitigation. Best times to survey are March to June. A simple

transect walk (without audio calls) to determine presence/absence of any burrows in suitable areas would be sufficient. Any burrows found should be inspected for potential burrowing owl activity. Surveys should not be conducted in certain weather conditions when owls are more likely to be in their burrows and not visible, such as temperatures above 30°C (86°F) and winds exceeding 20 kilometers per hour (approximately 12 miles per hour [mph]). Surveys also should be restricted to the early morning and evening hours, because above-ground activity is often higher during these times. If any burrowing owl activity is detected, additional follow-up surveys could be needed to determine abundance and locations of all active burrows in order to mitigate properly.

- All special-status plant species identified in a literature review as having potential to occur on the PBR were identified as having a low potential to occur within the Project Vicinity based on the presence of suitable habitat, species range, and recorded occurrence within the Project Vicinity. The plants require no focused surveys as all have a low probability of occurring within the PBR. In particular, Brack cactus, a special status plant (Federal Species of Concern, State Endangered, and BLM Sensitive Species), found elsewhere on the NN, has a low potential to occur within the PBR, and no focused surveys for Brack cactus would be expected to be required.

5.1.1 Cultural Resources

- Cultural resources expected to occur within the PBR include archaeological sites ranging from archaic to modern; Chacoan Roads (up to 400 miles); graves (modern graves, as well as historic and prehistoric graves); and Sacred Sites. A comprehensive cultural resources investigation will need to be performed for the individual solar sites as they are proposed for development.

- Fossil occurrences in the PBR area were identified and ranked by category of importance in the 1983 BLM Final Environmental Impact Statement (EIS) (Class I – Critical, Class II – Highly Important, Class III – Important, and Class IV – Not Important). Based on the record of Class I, II and III fossil occurrences, it is possible that significant paleontological resources could be uncovered during earthmoving and grading associated with RE facility construction. A comprehensive cultural resources investigation, to be performed for the individual solar sites as they are proposed for development, will need to include a site-specific Paleontological Resource Assessment.

5.1.2 Geology and Soils

- The soils that are present in the area have resulted primarily from weathering and erosion of sedimentary parent materials (e.g., shale, sandstone, and siltstone).

- A site-specific geology and soils investigation will need to be performed for the individual solar sites as they are proposed for development. Recommendations would be provided as part of the final environmental documentation, adherence to which would result in project design suited to geologic and soil characteristics, and compliance with applicable building codes.

5.1.3 Hydrology and Water Quality

- Flood peaks are the most important feature of stream flow as the channels and washes are normally dry for much of the year. All streams in the area drain from east to west and only periodically contain surface water flows. Localized short-duration, high-intensity thunderstorms, usually occurring during the late spring and summer, generate flows in the channels and washes.

- Surface water quality is generally poor in the area due to high concentrations of suspended sediment due to high erodibility of many soils in the area. More detailed analysis and study are planned for the individual solar sites as they are proposed for development. A Hydrology Feasibility Report will need to be completed, either for the individual solar sites, or in groupings. Sites 3 and 4 contain some channels and/or washes that would need to be considered in the design and engineering phases. Engineering solutions to maximize solar power generation can be utilized (e.g., pole mounts well above grade, underground culvert to convey flows).

5.1.4 Visual Resources

- While there are expected occurrences of BLM-rated Class A (Distinctive) and Class B (Common) areas, most of the Project area is expected to be rated as Class C (Minimal, defined as areas in which the features are fairly common to the physiographic region [BLM 1983]).
- More detailed analysis and study planned for the individual solar sites as they are proposed for development will need to identify visual resources of the PBR and vicinity, identify key viewpoints and views available from those viewpoints, and address the changes in these views that would be experienced from project implementation. Glint and glare from solar panels associated with solar project development would also need to be addressed in future analysis and documentation. A future assessment of glint and glare impacts, and the necessary orientation of the solar panels to track the sun's rays, would allay any concerns that glare could impact the Bisti/De-Na-Zin Wilderness area proximate to the PBR.

5.1.5 Data Sources

The following existing documents were reviewed as part of the work effort supporting Section 5 (see Section 8 for a complete list of references):

1. Paragon Resources Ranch and Related Lands Resource Inventory, Roman Bitsuie & Associates, Southwest Research & Information Center (SRIC), 2006.
2. Final Environmental Impact Statement (FEIS) on Public Service Company of New Mexico's Proposed New Mexico Generating Station and Other Possible End Uses of the Ute Mountain Land Exchange, BLM,1983.
3. Final Programmatic Environmental Impact Statement (PEIS) for Solar Energy Development in Six Southwestern States, Bureau of Land Management (BLM), U.S. Department of Energy (DOE), 2012.
4. Feasibility Assessment of Renewable Generation Applications, for NHLCO Paragon Ranch Solar, prepared for U.S. Department of Energy, Tribal Energy Program and the Western Area Power Administration by James H. Charters and Milton F. Percival, 2010.
5. West-Wide Energy Corridor Final Programmatic Environmental Impact Statement, DOE, BLM, Forest Service, Department of Defense, 2008.

Documents 1 and 2 above provided much useful information for the PBR and immediate vicinity, and were used most extensively in the environmental review provided herein. The Resource Inventory (Bitsuie, SRIC 2006) focused on the resources of the PBR "Ranch and Related Lands" and their value for alternative energy production. The 1983 BLM FEIS evaluated a proposed 2,000 MW coal-fired steam electric generating station on the "Bisti lands" in San Juan County, then controlled by BLM. Issues identified during public scoping and in the FEIS were:

- Aesthetics/Visual Resources
- Air Quality
- Biological Resources
- Cultural Resources
- Project Need
- Recreation
- Social and Economic Concerns
- Traffic (Construction phase)
- Water Quality and Supply

5.2 Environmental Study Results

Review of the existing documents, and consideration of the issues identified during the BLM FEIS public scoping process and in the FEIS itself led to a natural division among the environmental topics to be considered. Six topics, as listed below beginning with Biological Resources, emerged as the top priority grouping where emphasis and focus was merited. General information highlighting critical issues for these topics is provided, as well as important items pertaining to: considerations to be addressed during the refined siting and design phase, permitting of the project, potential concerns, and recommended actions. The top-priority topics are as follows:

- Biological Resources - general information is provided, highlighting special status species considerations; a comprehensive biological resources assessment for the solar sites (and likely focused surveys for certain special status species) will be needed once boundaries are finalized;
- Historic and Cultural Resources – general information is provided; a comprehensive cultural resources investigation for the solar sites will be needed once boundaries are finalized;
- Geology and Soils/Mineral Resources –including discussion of terrain and high susceptibility of soil to erosion;
- Water Resources – addressing hydrology, water quality, and water supply, and including discussion of potential for flooding, and supply of water for solar panel washing of suitable quality;
- Land Use/Planning – including discussion of compatibility of solar power generation facilities with the traditional Navajo lifestyle and future; and
- Visual, Scenic, or Aesthetic Resources – addressing visibility of solar power generation facilities and effect on visual resources.

Remaining topics are listed below beginning with Agricultural Resources. They comprise a lower priority grouping associated mostly with the manmade, built environment. They are addressed in a limited manner below, but are planned for further discussion and analysis in the environmental documentation to be prepared for solar site development (in addition to the topical areas cited above):

- Agricultural Resources – Sheep grazing occurs in the project area. Center-pivot irrigation systems operated by Navajo Agriculture Products Incorporated (NAPI) on agricultural lands have been identified approximately 12 miles to the north of Site 1. No impacts on agricultural resources and activities are expected from establishment of the solar generation facilities on the PBR.
- Air Quality and Greenhouse Gas Emissions – Short-term construction air quality impacts will be experienced due to:
    - fugitive dust emissions resulting from soil disturbance activity;
    - emissions of air pollutants from fuel combustion in construction equipment; and
    - emissions of air pollutants from fuel combustion in vehicles used for worker commute, material hauling, and construction debris disposal.

  Establishment of solar generation facilities on the PBR will result in greenhouse gas (GHG) emissions from the combustion of fuel in construction equipment, in vehicles used to haul materials, and in vehicles used by commuting workers. Long-term beneficial air quality and GHG impacts will be experienced, however, due to the reduced use of fossil fuels for future energy production (quantified in Section 5.4 below).
- Hazards and Hazardous Materials – A discussion of hazards and hazardous materials in environmental documentation allows the assessment of risk regarding exposure to hazardous

materials, wastes, and activities. Hazardous materials include, but are not limited to hazardous substances, hazardous waste, and any material that would be injurious to the health and safety of persons or harmful to the environment if released into the workplace or the environment. Any potential hazards associated with airports and wildfires are commonly addressed under this heading as well. Hazardous materials use associated with establishment of solar generation facilities is not expected to result in any potential impacts. Some information relative to the PBR regarding Hazards and Hazardous Materials is as follows:

- A collinear group of natural gas / natural gas produced liquids (NGPL)/other pipelines bisect Site 1 and are identified in Figures 5-5 through 5-11.
- The closest Department of Defense facilities to the PBR are:
  - Kirtland Air Force Base, Albuquerque, New Mexico (approx.. 105 miles to the southeast)
  - U. S. Army White Sands Missile Range, White Sands, New Mexico (approx. 175 miles to the southeast

  Albuquerque and Santa Fe, New Mexico, also have commercial airports.

No conflict with the existing gas pipelines or military or commercial air traffic is expected. The PBR is not considered to be hazardous from the standpoint of wildfires due to the lack of significant vegetation to act as fuel. Subsurface soil contamination is often discovered at locations formerly occupied by trading posts where underground storage tanks for gasoline were established. Soils underlying the site of the former Bisti Trading Post (see Figures 5-5 through 5-11), outside the boundaries of the proposed solar sites, are not expected to pose a risk to development of solar generation facilities on the PBR.

- Noise – Ambient noise levels in the project area, typical of rural areas, are generally low. The dominant source of noise in the project area is traffic. Traffic volume on Highway 371 is relatively light, and does not represent a significant source of noise. The PBR is primarily composed of and surrounded by undeveloped open space, with the exception of the unmanned Bisti 230 kV Substation located on Highway 371 within the current Site 1 boundary, and a place of worship in the PBR interior and a limited number of residents engaged in pastoral and subsistence agriculture on the PBR. Noise-sensitive receptors and land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals and places where quiet is an essential element of the intended purpose. Residential dwellings, hospitals, school, places of worship, libraries, and other places where low interior noise levels are essential are considered noise-sensitive land uses, which do not exist on these sites. Noise will be generated during project construction, but is considered a short-term impact, and can be limited to avoid nighttime and early morning hours, and Sundays or holidays. The limited presence of noise-sensitive receptors and land uses on the PBR suggest that construction noise will have minimal effect and is not expected to increase noise levels to the degree and duration that would be considered problematic.
- Population and Housing –As noted, the PBR contains a limited number of residents engaged in pastoral and subsistence agriculture. The locations of the few residences, ranches, and associated facilities has been considered in the siting of the solar sites. Establishment of solar generation facilities on the PBR would not induce substantial population growth, nor would it lead to any significant extension of roads or infrastructure. Short-term construction jobs and jobs associated with operations and maintenance are expected to be locally sourced and filled mostly by the existing workforce. Establishment of solar generation facilities on the PBR is not expected to alter existing population and housing conditions.
- Recreation – The project area is primarily undeveloped open space that, for the most part, does not support recreational activities other than off-road travel, riding and exploring. The Bisti/De-Na-Zin Wilderness Area does extend to the area in which the PBR is located. The Wilderness Area comprises over 41,000 acres. According to the BLM website:

(http://www.blm.gov/nm/st/en/prog/blm_special_areas/wilderness_and_wsas/wilderness_areas/bisti.html),

> "*The Bisti/De-Na-Zin Wilderness is a rolling landscape of badlands which offers some of the most unusual scenery found in the Four Corners Region. Time and natural elements have etched a fantasy world of strange rock formations made of interbedded sandstone, shale, mudstone, coal, and silt. The weathering of the sandstone forms hoodoos - weathered rock in the form of pinnacles, spires, cap rocks, and other unusual forms. Fossils occur in this sedimentary landform*."

Parking and access for walking and camping is provided in two locations off Indian Service Routes in the vicinity of the PBR. As a Wilderness Area, it is closed to motorized vehicles and mechanical forms of transportation (including mountain bikes). Siting and development of solar generation facilities on the PBR would protect recreational access and would not be expected to affect access to this recreational facility.

- Economic and Social Considerations - Establishment of solar generation facilities on the PBR is expected to result in benefits to the NN in terms of economic development, job creation, training and professional development leading to increased tribal employment, and increase in income of the local workforce benefiting NN businesses. Additional benefits would be experienced from a cultural and social standpoint, such as compatibility of power generation facilities from renewable sources with the traditional Navajo lifestyle and cultural. These economic and social considerations, addressed in part in Section 6 of this Feasibility Study, will be further analyzed within the framework of the future environmental documentation.
- Traffic and Transportation - Access to the PBR is provided by State Highway 371. When construction is at its peak, typical activities would include the movement of heavy equipment, and the transportation of materials and workers. Impacts associated with traffic volume increases due to construction traffic would be considered temporary and likely would not be substantial. Long-term operation of the solar generation facilities, including trips by water trucks to wash the solar panels, would be expected to generate limited maintenance vehicle trips per year. Future environmental documentation would address actual construction- and operational-traffic levels for the individual solar sites.
- Utilities and Public Services - There are no water, sewer, or solid waste disposal services currently provided at the PBR. Drainage and water supply are two high-priority topics to be addressed in the paragraphs that follow. Provision of adequate fire and police protection services would be addressed for the solar sites in future environmental documentation. The nearest services at present would come from Farmington NM or other state resources.

The following discussion addresses the six environmental topics listed previously that emerged as the top priority grouping where emphasis and focus was needed, beginning with Biological Resources:

5.2.1 Biological Resources

The biological resources addressed in the following paragraphs include plant communities, vegetation, wildlife, and jurisdictional waters potentially present within the PBR. Figures 5-5 and 5-6 contain mapping of biological resources. Figure 5-5 reflects broad mapping of three vegetation communities, obtained from the Earth Data Analysis Center in New Mexico. Figure 5-6 displays Crucial Habitat Areas mapped using the WGA CHAT. CHAT ranks habitat within six categories, but only five categories are reflected in the area shown on Figure 5-6. As indicated, habitat within the PBR boundary is primarily Rank 4 with limited Rank 3 and Rank 5. Rank 1 is the Most Crucial.

5.2.1.1 Plant Communities

Focused more on the PBR, the Paragon Resources Ranch and Related Lands Resource Inventory (Bitsuie, SRIC 2006) identifies and defines five vegetation types or habitats within the PBR vicinity. The five vegetation types are as follows:

- **Loamy-sagebrush:** Occurs in the middle and eastern portions of the property in areas that are level to moderately sloping (0 to 9%), with occasional swales. The vegetation is typically a sagebrush-grassland. Big sagebrush dominates the overstory except in small areas containing alkaline soils where four-wing saltbush is the dominant. Russian thistle, scarlet globemallow, and wooly Indian-wheat are forbs commonly occurring on this site.
- **Loamy bottom-sagebrush:** Occurs in nearly level to gently sloping areas in wide upland valley bottoms, and is dominated by big sagebrush and black greasewood. The big sagebrush plant community is located on gentle slopes of upland valleys. The black greasewood plant community is located in the valley bottoms associated with sodium-affected soils.
- **Deep sand-grassland-saltbrush:** Occurs mainly in the western portion of the PBR, in terrain ranging from nearly level to gently sloping (0 to 8 per cent). Shrub species mixed with short and mid-grasses characterize this vegetation type. Species common to these areas are fourwing saltbush, black greasewood, shadscale, mound saltbush, broom snakeweed, alkali sacaton, galleta, western wheatgrass, and wild buckwheat.
- **Sodic slopes-grassland:** Occurs in the level to gently sloping mesas and valleys existing throughout the property. Grassland-shrub is the general vegetation aspect. Sodium-affected soils limit the density and productivity of the vegetation on the property, however. The dominant species of grass varies with locale, but include alkali sacaton, galleta, Indian rice grass, sand dropseed, bottlebrush squirreltail, needleandthread, and red threeawn. The common shrubs are black greasewood, fourwing saltbush, rabbit brush, winterfat, broom snakeweed, shadscale, and mound saltbush.
- **Badlands:** Very sparse and generally restricted to flat areas along intermittent channels which dissect badland areas within the property. The Badlands within the PBR are characterized by rolling to very steep, non-stony barren hills, breaks, canyons, and valleys where shale is exposed or lies close to the surface. The soils, high in clay content, are highly resistant to water infiltration. Shrubs found here are black greasewood, shadscale, mound saltbush, four-wing saltbush, broom snakeweed, rabbit brush, and Mormon-tea. The principal forbs are Russian thistle, wild buckwheat, annual saltbush species, four-o'clock, and various composite species.

5.2.1.2 Special-Status Plants

After conducting a literature review, Tetra Tech has identified the special-status plant species with a potential to occur within the PBR based on the presence of suitable habitat, species range, and recorded occurrence within the project vicinity (see Table 5-1).

Table 5-1. Special-Status Plants with a Potential to Occur within the Project Area

Scientific Name	Common Name	Status	Blooming Period	Potential Plant Community Association	Potential to Occur within Project Area
Astragalus humillimus	Mancos milk-vetch	FE, SE, BLM, NE	late April – early May	Badlands Loamy-sagebrush Loamy bottom-sagebrush	Low
Pediocactus knowltonii	Knowlton's cactus	FE, SE, BLM	mid April – early May. Flowers for 2-3 days	Loamy-sagebrush Loamy bottom-sagebrush Sodic slopes-grassland	Low
Sclerocactus mesae-verdae	Mesa Verde cactus	FT, SE, BLM	late April – early May. Flowers for 2-3 days	Loamy-sagebrush Loamy bottom-sagebrush	Low

Scientific Name	Common Name	Status	Blooming Period	Potential Plant Community Association	Potential to Occur within Project Area
				Sodic slopes-grassland	
Erigeron rhizomatus	Zuni fleabane	FT, SE, BLM, NE	mid May – late May	Loamy-sagebrush Loamy bottom-sagebrush Sodic slopes-grassland	Low
Sclerocactus cloverae	Brack hardwall cactus	FSC, SE, BLM	late April – mid June	Loamy-sagebrush Loamy bottom-sagebrush Sodic slopes-grassland	Low
Aliciella formosa	Aztec gilia	FSC, SE, BLM	April – May	Loamy-sagebrush Loamy bottom-sagebrush Sodic slopes-grassland	Low
Puccinellia parishii	Parish's alkali grass	FSC, SE, BLM	May – June	Loamy-sagebrush, Sodic slopes-grassland Deep sand-grassland-saltbrush	Low

Legend

Federal Endangered Species Act (ESA) Listing Codes: Federal listing is pursuant to the Federal ESA of 1973, as amended. The official federal listing of Endangered and Threatened Animals is published in the Federal Register, 50 CFR 17.11 (USFWS 2014).

- **FE = federally listed as endangered:** any species, subspecies, or variety of plant or animal that is considered endangered throughout all or a significant portion of its range within the foreseeable future.
- **FT = federally listed as threatened:** any species, subspecies, or variety of plant or animal that is considered likely to become endangered throughout all or a significant portion of its range within the foreseeable future.
- **FPE = federally proposed as endangered:** Species for which a proposed rule has been published in the Federal Register to list the species as endangered.
- **FPT = federally proposed as threatened:** Species for which a proposed rule has been published in the Federal Register to list the species as threatened.
- **FC = federal candidate species:** Substantial information exists in USFWS files on biological vulnerability to support proposals to list as endangered or threatened.
- **FSC = federal species of concern:** The terms "Species of Concern" or "Species at Risk" should be considered as terms-of-art that describe the entire realm of taxa whose conservation status may be of concern to USFWS, but neither term has official status.

The Forestry Division of the Energy, Minerals and Natural Resources Department (EMNRD) of New Mexico administers the **Endangered Plant Species Act**, passed in 1985 (NMSA 1978 § 75-6-1). This Act acknowledges only one status, "Endangered." Species of Concern List and Taxa Considered But Not Listed List (NHNM 2014).

- **SE = state endangered:** Any species or subspecies whose prospects of survival or recruitment in New Mexico are in jeopardy.

Bureau of Land Management (BLM): The BLM conserves habitat for **"special status" species** that occur on BLM-managed lands. Special status species include species that are Federally listed as "threatened" or "endangered" under the ESA and other non-listed wildlife considered sensitive (BLM 2009).

- **BLM = Sensitive Species:** BLM Special status species and sensitive species, which are non-listed wildlife, fish and plants that require special management consideration to reduce the need for listing as well as all Federal candidate species, proposed species, and delisted species in the 5 years following delisting. BLM "sensitive" plant and animal species include fish, amphibians, mollusks, insects and macroinvertebrates.

Navajo Endangered Species List Codes: Resources Committee Resolution No. RCS-41-08 September 10, 2008. Division of Natural Resources, Department of Fish and Wildlife (NNDFW 2008).

- **NE = Navaho Nation listed as endangered:** Any species or subspecies whose prospects of survival or recruitment are in jeopardy.
- **NT = Navajo Nation listed as threatened:** A species or subspecies whose prospects of survival or recruitment are likely to be in jeopardy in the foreseeable future.
- **NC = Navaho Nation listed as candidate.** Any species or subspecies for which the Navajo Nation Department of Fish and Wildlife (NNDFW) does not currently have sufficient information to support their being listed in G2 or G3 but has reason to consider them. The NNDFWL will actively seek information on these species to determine if they warrant inclusion in a different group or removal from the list.

Potential to Occur: **Unlikely** – no species range overlap with Project Area or unsuitable habitat in Project vicinity; **Low**– species range overlaps with Project Area and marginally suitable habitat in Project vicinity; **Moderate** – species range overlaps with Project Area and suitable habitat present in Project Area, or species known to occur in habitat similar to Project Area; **High** – highly suitable habitat present in Project Area, or known populations exist in Project vicinity.

All special-status plant species identified in the literature review as having potential to occur on the PBR PBR were identified as having a low potential to occur within the Project Vicinity based on the presence of suitable habitat, species range, and recorded occurrence within the Project Vicinity. No focused surveys for special-status plant species would be expected to be required as all species have a low probability of occurring within the PBR. In particular, Brack cactus, a special status plant (Federal Species of Concern, State Endangered, and BLM Sensitive Species), found elsewhere on the NN, has a low potential to occur within the PBR, and no focused surveys for Brack cactus would be expected to be required

5.2.1.3 Special-Status Wildlife

Based on a literature review, Tetra Tech has identified the special-status wildlife species with a potential to occur within the PBR based on the presence of suitable habitat, species range, and recorded occurrence within the Project Vicinity (see Table 5-2). Species that have a moderate or high potential to occur within the Project Area are further described in separate paragraphs that follow Table 5-2.

Table 5-2. Special-Status Wildlife with a Potential to Occur within the Project Area

Scientific Name	Common Name	Status	Potential to Occur within Project Area
Bird (in taxonomic order)			
Aechmophorus clarkii	Clark's Grebe	NC	Unlikely, Migrant
Pelecanus occidentalis	Brown Pelican	SE	Unlikely
Plegadis chihi	White-faced Ibis	BLM	Unlikely, Migrant
Haliaeetus leucocephalus	Bald Eagle	ST, NT	Low
Accipiter gentilis	Northern Goshawk	FSC, SS, BLM, NC	Low
Buteogallus anthracinus	Common Black-Hawk	FSC, ST	Low
Buteo regalis	Ferruginous Hawk	BLM	Low, Migrant
Falco peregrinus anatum	Peregrine Falcon	FSC, ST, NT	Low, Migrant
Porzana carolina	Sora	NC	Unlikely, Migrant
Charadrius montanus	Mountain Plover	SS	Low, Migrant
Chlidonias niger	Black Tern	FSC, BLM	Low, Migrant
Sternula antillarum	Least Tern (interior population)	FE	Low, Migrant
Coccyzus americanus	Yellow-Billed Cuckoo (western population)	FPT, SS, NC	Low, Migrant
Strix occidentalis lucida	Mexican Spotted Owl	FT, SS	Unlikely
Athene cunicularia	Burrowing Owl	FSC, BLM	Moderate
Cypseloides niger	Black Swift	SS	Low, Migrant
Cynanthus latirostris	Broad-billed Hummingbird	ST	Low, Migrant
Megaceryle alcyon	Belted Kingfisher	NC	Unlikely
Empidonax traillii extimus	Southwestern Willow flycatcher	FE, SE, NE	Low
Lanius ludovicianus	Loggerhead Shrike	SS, BLM	High
Vireo vicinior	Gray Vireo	ST	Moderate, Migrant
Anthus spragueii	Sprague's Pipit	FC	Unlikely, Migrant
Ammodramus bairdii	Baird's Sparrow	FSC, ST, BLM	Low, Migrant
Amphibian			
Lithobates pipiens	Northern Leopard Frog	NT	Unlikely
Reptile			
Lampropeltis getula californiae	California Kingsnake	SS	Low
Fish			
Catostomus latipinnis	Flannelmouth Sucker	NC	Unlikely
Catostomus discobolus yarrowi	Zuni Bluehead Sucker	FPE	Unlikely
Catostomus discobolus discobolus	Bluehead Sucker	NC	Unlikely
Ptychocheilus lucius	Colorado pikeminnow	FE, SE, NE	Unlikely
Xyrauchen texanus	Razorback sucker	FE, SS, NE	Unlikely
Gila robusta	Roundtail Chub	SE, BLM, NE	Unlikely
Bat			
Corynorhinus townsendii	Pale Townsend's Big-eared Bat	BLM	Low
Euderma maculatum	Spotted Bat	ST, BLM	Low
Nyctinomops macrotis	Big Free-tailed Bat	SS, BLM	Low
Myotis thysanodes	Fringed Myotis	SS, BLM	Low
Myotis evotis	Long-eared Myotis	SS, BLM	Low
Myotis volans	Long-legged Myotis	SS, BLM	Low
Myotis ciliolabrum	Western Small-footed Myotis	SS, BLM	Unlikely
Myotis yumanensis	Yuma Myotis	SS, BLM	Low
Mammal			
Lynx canadensis	Canada Lynx	FPE	Unlikely

Cynomys gunnisoni zuniensis	Gunnison's prairie dog	SS	Low
Vulpes vulpes	Red Fox	SS	Low
Marmota flaviventris	Yellow-bellied Marmot	SS	Low
Bassariscus astutus	Ringtail	SS	Low
Spilogale gracilis	Western Spotted Skunk	SS	Low
Microtus mogollonensis navaho	Navajo Mogollon Vole	NC	Unlikely
Insect			
Speyeria nokomis nokomis	Nokomis Fritillary Butterfly	NC	Low

Legend

Federal Endangered Species Act (ESA) Listing Codes: Federal listing is pursuant to the Federal ESA of 1973, as amended. The official federal listing of Endangered and Threatened Animals is published in the Federal Register, 50 CFR 17.11 (USFWS 2014).

- **FE = federally listed as endangered:** Any species, subspecies, or variety of plant or animal that is considered endangered throughout all or a significant portion of its range within the foreseeable future.
- **FT = federally listed as threatened:** Any species, subspecies, or variety of plant or animal that is considered likely to become endangered throughout all or a significant portion of its range within the foreseeable future.
- **FPE = federally proposed as endangered:** Species for which a proposed rule has been published in the Federal Register to list the species as endangered.
- **FPT = federally proposed as threatened:** Species for which a proposed rule has been published in the Federal Register to list the species as threatened.
- **FC = federal candidate species:** Substantial information exists in USFWS files on biological vulnerability to support proposals to list as endangered or threatened.
- **FSC = federal species of concern:** The terms "Species of Concern" or "Species at Risk" should be considered as terms-of-art that describe the entire realm of taxa whose conservation status may be of concern to the USFWS, but neither term has official status.

The New Mexico Department of Game and Fish (NMGF), through its Conservation Services Division, administer the **Wildlife Conservation Act. (NMSA 1978 § 17-2-37 et seq.)** The Act requires the listing of any species or subspecies of "wildlife indigenous to the state" as endangered or threatened (BISON-M 2014).

- **SE = state endangered:** Any species or subspecies whose prospects of survival or recruitment in New Mexico are in jeopardy.
- **ST = state threatened:** Any species or subspecies that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in New Mexico.
- **SS = state sensitive species:** Species that are monitored by the NMGF and Natural Heritage but have no regulatory or protection status.

Bureau of Land Management (BLM): The BLM conserves habitat for **"special status" species** that occur on BLM-managed lands. Special status species include species that are Federally listed as "threatened" or "endangered" under the ESA and other non-listed wildlife considered sensitive (BLM 2009).

- **BLM = Sensitive Species:**BLM Special status species and sensitive species, which are non-listed wildlife, fish and plants that require special management consideration to reduce the need for listing as well as all Federal candidate species, proposed species, and delisted species in the 5 years following delisting. BLM "sensitive" plant and animal species include fish, amphibians, mollusks, insects and macroinvertebrates.

Navajo Endangered Species List Codes: Resources Committee Resolution No. RCS-41-08 September 10, 2008. Division of Natural Resources, Department of Fish and Wildlife (NNDFW 2008).

- **NE = Navaho Nation listed as endangered (G2):** Any species or subspecies whose prospects of survival or recruitment are in jeopardy.
- **NT = Navajo Nation listed as threatened (G3):** A species or subspecies whose prospects of survival or recruitment are likely to be in jeopardy in the foreseeable future.
- **NC = Navaho Nation listed as candidate (G4).** Any species or subspecies for which the Navajo Nation Department of Fish and Wildlife (NNDFW) does not currently have sufficient information to support their being listed in G2 or G3 but has reason to consider them. The NNDFWL will actively seek information on these species to determine if they warrant inclusion in a different group or removal from the list.

Potential to Occur: **Unlikely** – no species range overlap with Project Area or unsuitable habitat in Project vicinity; **Low**– species range overlaps with Project Area and marginally suitable habitat in Project vicinity; **Moderate** – species range overlaps with Project Area and suitable habitat present in Project Area, or species known to occur in habitat similar to Project Area; **High** – highly suitable habitat present in Project Area, or known populations exist in Project vicinity. **Migrant** = Seasonal non-breeding bird species that may be encountered during spring and fall migration.

Loggerhead Shrike (*Lanius ludovicianus*) – State Sensitive, BLM Sensitive Species
The loggerhead shrike is found in as year-round resident in New Mexico (Yosef 1996). The species prefers open country with short vegetation including pastures with fence rows, old orchards, mowed roadsides, cemeteries, golf courses, agricultural fields, riparian areas, and open woodlands (Yosef 1996). The species is considered a sensitive species by the State and BLM due to population declines linked to pesticide contaminants from agriculture practices. The species has a high potential to occur within the Project Area due to habitat found throughout the Project Area and observational records from nearby Christmas Bird Count, Chaco Culture National Historical Park survey (NAS 2010) approximately 4 miles south of the Project Area, and from breeding bird surveys on the Nageezi survey route (Sauer et al. 2014) approximately 5 miles east of the Project Area.

Gray Vireo (*Vireo vicinior*) – State Endangered
The gray vireo is a small songbird species that prefers mixed juniper/piñon and oak scrub associations and/or chaparral in hot, arid mountains and high plains scrubland (Barlow et al. 1999). In Arizona and New Mexico, the species occurs in chaparral-juniper and dwarf conifer forests, as well as sites with Graves oak (*Quercus gravesii*), mixed piñon (*Pinus* sp), and madrone (*Arbutus* sp). The species is considered a short-distance migrant that winters in northern Mexico and southern Arizona. The species is threated with a loss of habitat due to invasive species, habitat alteration due to development, and forest logging. The species has a moderate potential to occur within the Project Area due to marginal habitat in the northeast section of the Project Area and observational records from breeding bird surveys on the Nageesi survey route (Sauer et al. 2014) approximately 5 miles east of the Project Area.

Burrowing Owl (*Athene cunicularia*) – Federal Species of Concern, BLM Sensitive Species
Burrowing owls are known to inhabit any open, treeless areas within grassland, steppe, and desert biomes (Poulin et al. 2011). They are often associated with high densities of burrowing mammals such as prairie dogs (*Cynomys* sp.). In addition to "natural" breeding habitats, areas such as agricultural fields, golf courses, cemeteries, road allowances, airports, vacant urban lots, and fairgrounds are regularly used. The species is threatened by habitat alteration due to development and agricultural practices, and is sensitive to disturbance of nesting sites. The species has a moderate potential to occur within the Project Area due to marginal habitat found throughout the Project Area and observational records from nearby Christmas Bird Count, Chaco Culture National Historical Park survey (NAS 2010) approximately 4 miles south of the Project Area.

None of these three species are contained within the higher priority Groups 1, 2 or 3 of the Navajo Endangered Species List (see Appendix H). Discussion with the Wildlife Manager of the Navajo Nation Heritage Program (Diswood 2015) indicates that only pre-construction surveys for the burrowing owl would likely be required.

5.2.1.4 Jurisdictional Waters

The discharge of dredged or fill material (temporarily or permanently) into areas delineated as waters of the U.S., including wetlands, typically requires prior authorization from the USACE, pursuant to Section 404 of the Clean Water Act. More detailed analysis planned for the solar sites as development is proposed will need to address the presence of any areas with the potential to be subject to the jurisdiction of USACE. A formal jurisdictional delineation would provide clarification as to whether there are USACE jurisdictional waters to be potentially affected by development of solar generation facilities on the PBR.

5.2.2 Cultural Resources

The PBR is located in the San Juan Basin, a geologic structural basin in the Four Corners region of the Southwestern U.S. The Basin's main portion encompasses much of northwestern New Mexico, southwest Colorado, and parts of Arizona and Utah, and covers around 4,600 square miles. The region's most striking features include Chaco Canyon (northwestern New Mexico, between Farmington and Santa Fe) and Chacra Mesa.

The San Juan Basin has been inhabited for at least the past 11,000 years. Extensive study has been conducted and considerable documentation compiled for cultural resources in the region surrounding the PBR, providing a basis for understanding the significance of those resources. The Final EIS for PNM's Proposed New Mexico Generating Station and Other Possible End Uses of the Ute Mountain Land Exchange (BLM 1983) addresses the complex record of the human occupation (p. 2-16):

> "*Archaeologically, the area is best known at present for its record of the Chacoans, a prehistoric Anasazi people who lived in the region from AD 500 to AD 1300. However, it also holds significant remains of earlier Paleo-Indian and Archaic cultures and later Navajo history. It is the traditional as well as present home of several Native American peoples, especially the Navajo, but also the Ute to the north, the Jicarilla Apache to the east, and the Puebloans to the south and southeast. Finally, it has a sparse but significant record of historic Euroamerican habitation of the area*."

The 2006 Inventory (Bitsuie, SRIC) addresses cultural resources in the region (pp. 40–42):

- Archaeological sites – ranging from archaic to modern, with a large number of sites from the Pueblo II to Pueblo III period (900 to 1300 AD);
- Chacoan Roads – approximately 400 miles have been identified on aerial imagery and many segments verified on the ground. The Chaco Canyon area was first declared a National Monument in 1907. Congress designated the monument as the Chaco Culture National Historical Park in 1980.
- Graves – modern graves, as well as historic and prehistoric graves.
- Sacred Sites – Native American sacred places generally include mountains, landmarks, areas where plants or minerals are gathered for ceremonial use, and places featured in origin stories. As detailed by Bitsuie, SRIC, Navajo sacred sites are:
  - Localities that play an important role in Navajo origin legends concerning the creation of the universe, the Holy People, the matrilineal clans, and various song ceremonials used primarily for healing and blessing
  - Localities that are utilized for ceremonial or ritualistic purposes, or that provide materials needed for sacred activities
  - Places to be avoided because they are considered dangerous
  - Shrines
  - Gathering areas

More detailed analysis and study in the form of a comprehensive cultural resources investigation, to be performed for the individual solar sites as they are proposed for development, will address cultural resources. Normal procedures for conducting a cultural resources investigation involve several steps, including an initial reconnaissance field visit, completion of a records search for the area being investigated and a 1-mile buffer, systematic pedestrian survey, site recordation, evaluation of findings, and eligibility determination for listing to the National Register of Historic Places if possible based on surface findings. The Navajo Nation Archaeology Department operates under Navajo Tribal Code (CRMP-19-88) and does

not require a permit to perform cultural resource services on Navajo lands. Utilization of outside firms would require a permit to perform cultural resource services on Navajo lands. The Navajo Nation Historic Preservation Department has compiled a list of currently permitted Cultural Resource Consultants/Permittees, available at http://www.hpd.navajo-nsn.gov .

Mitigation for cultural resources is avoidance, if at all possible. In many instances, a project can be designed to avoid impacts to cultural resources. If an archaeological site cannot be avoided and an eligibility determination cannot be made from surface findings, additional site testing to determine site extent and subsurface deposition to determine eligibility would need to be carried out.

Under NEPA, evaluation of the project also requires compliance with Section 106 of the National Historic Preservation Act of 1966 and 36 *Code of Federal Regulations* 800. Additional consultation with federally recognized Navajo Nations would be required.

5.2.2.1 Paleontology

A large amount of literature exists on the paleontology of the PBR regional area. Past paleontological studies have shown that the Fruitland and Kirtland Formations located here contain valuable remains of dinosaurs and other reptiles, and some of the earliest mammals, invertebrates, and plants (BLM 1983, Appendix J, p. 2-1). Paleontological sites (together with water and environmental restrictions) are addressed in P.L. 93-305.

Fossil occurrences in the PBR area were identified and ranked by category of importance in the 1983 BLM Final EIS (Class I – Critical, Class II – Highly Important, Class III – Important, and Class IV – Not Important). Based on the record of Class I, II and III fossil occurrences, it is possible that significant paleontological resources could be uncovered during earthmoving and grading associated with RE facility construction. The comprehensive cultural resources investigation would need to include a site-specific Paleontological Resource Assessment. Mitigation for paleontological resources would then be incorporated into a comprehensive mitigation monitoring plan for cultural resources.

5.2.3 Geology and Soils

The PBR is located in the central San Juan Basin of Northwestern New Mexico on the Chaco Plateau (Bitsuie, SRIC 2006). Figures 5-7 and 5-8 provide a map of regional geology and a terrain map, respectively. The 1983 BLM Final EIS provides a description of the geologic setting of the San Juan Basin (p.2-5):

> " *…[T]he San Juan Basin… is a structural depression underlain by Tertiary, Cretaceous, and older sedimentary rocks. A thin veneer of Late Quaternary deposits covers the bedrock units over much of the area. Volcanic necks and potentially active faults border the basin on the east. The surface of the San Juan Basin has been strongly eroded, creating badlands, buttes, mesas, and dissected plateaus…*
>
> *Landslide blocks border many of the buttes, mesas, and plateaus, and deposits of baked shale produced by spontaneous combustion of coal are widespread. Soils with a variety of engineering defects are present in the general region….*"

Badlands along Highway 371, shown below (Fig. 5-8), were photographed during a site visit in September 2013. Badlands are a type of dry terrain where softer sedimentary rocks and clay-rich soils have been extensively eroded by wind and water.

Figure 5-1. Typical Rock Formation in Badlands along Highway 371

Source: Tetra Tech.

The soils that are present in the area have resulted primarily from weathering and erosion of sedimentary parent materials (e.g., shale, sandstone, and siltstone). Area soils are generally not very productive because of low organic matter content, low available moisture, and undesirable chemical and physical characteristics. The interior of the San Juan Basin is relatively inactive tectonically, but may be subject to the effects of relatively distant earthquakes (BLM 1983).

Site-specific geology and soils investigations will need to be performed for the individual solar sites as they are proposed for development. Recommendations would be provided as part of the final documentation, adherence to which will result in Project design suited to geologic and soil characteristics, and compliance with applicable building codes and regulations. It is expected that impacts to downstream water quality and sedimentation issues will be minimized through use of erosion control devices and implementation of a Construction Stormwater Pollution Prevention Plan, referenced in the discussion of hydrology and water quality below.

Individual site grading would be expected to be relatively straightforward. Area soils, however, are considered moderately to highly susceptible to wind-induced erosion, and will contribute to dust generation during and post-construction. This will need to be addressed in a Project Air Quality and Greenhouse Gas (GHG) Emissions Analysis, to be prepared once the design process advances. A menu of mitigation measures are available to reduce impacts from fugitive dust, and would be employed, as appropriate, as part of the Air Quality and GHG technical analysis to assess impacts after mitigation.

5.2.3.1 Mineral Resources

Coal is the major mineral resource identified in the PBR (Bitsuie, SRIC 2006). Also identified are deposits of oil and gas (first discovered in the PBR regional area over 60 years ago), sand and gravel (found along most washes), and baked shale. Existing mineral resources are depicted on Figure 5-9.

The Fruitland Formation contains in excess of 200 billion tons of coal, the largest coal resources of the San Juan Basin. Of the 200 billion tons, 7 to 10 billion tons have been considered potentially recoverable by strip mining methods (BLM 1983; Bitsuie, SRIC 2006). Several coal mines – the BHP-Billiton-operated Navajo Mine and the San Juan Mine, which feed the mine-mouth Four Corners and San Juan Electric Generating Stations, are operating in the Fruitland Formation (Bitsuie, SRIC 2006). Figure 5-9 identifies the existence of a coal permit that includes the area within Site 1A.

Abandoned oil and gas wells could be encountered during project construction. A cluster of seven buried natural gas pipelines as well as a natural gas liquid and a crude oil pipeline also run diagonally through Site 1.

5.2.4 Hydrology and Water Quality

De-Na-Zin Wash and its tributary, Coal Creek, are the principal streams on the PBR (Bitsuie, SRIC 2006). On the south lie the Ah-Shi-Sle-Pah Wash, Tsaya Wash, and the Chaco River, the only major river in the area. Alamo Wash and Hunter Wash are on the north. Intermittent lakes and intermittent canals/streams are shown on Figure 5-10. Figure 5-10 also shows the location of Federal Emergency Management Agency (FEMA) Flood Zones A and X lying within the boundary of the PBR. Information below, obtained from the FEMA website, defines Flood Zones A and X (FEMA 2014).

Special Flood Hazard Areas – High Risk

Special Flood Hazard Areas (SFHAs) represent the area subject to inundation by 1-percent-annual chance flood. Areas located within SFHAs have a 26% chance of flooding over a 30-yearspan. Federal floodplain management regulations and mandatory flood insurance purchase requirements apply in these zones.

ZONE	DESCRIPTION
A	Areas subject to inundation by the 1-percent-annual-chance flood event. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown.

Moderate and Minimal Risk Areas

Areas of moderate or minimal hazard are studied based upon the principal source of flood in the area. However, buildings or other structures in these zones could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. Local stormwater drainage systems are not normally considered in a community's flood insurance study. The failure of a local drainage system can create areas of high flood risk within these zones. Flood insurance is available in participating communities, but is not required by regulation in these zones. Nearly 25% of all flood claims filed are for structures located within these zones.

ZONE	DESCRIPTION
B, X (shaded)	Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones. (Zone X [shaded] is used on new and revised maps in place of Zone B.)

All streams in the project area drain from east to west and only periodically contain surface water flows. Localized short-duration, high-intensity thunderstorms, usually occurring during the late spring and summer, generate flows in the channels and washes. Consequently, flood peaks are the most important feature of stream flow as the channels are normally dry for the remainder of the year. Surface water quality is generally poor in the area due to high concentrations of suspended sediment due to high erodibility of many soils in the area.

Mention has already been made of the existence of 25,000 acre feet of warm briny groundwater available for use by proposed PBR RE facilities. Dissolved solids in the groundwater have been historically noted; sodium, chloride and sulfate are the major ions found to exist in the groundwater (Bitsuie, SRIC 2006).

More detailed analysis and study are planned for the individual solar sites. A Hydrology Feasibility Report will need to be completed, either for the individual solar sites, or in groupings. This will involve use of

refined topographic information to improve the delineation of areas subject to flooding and ponding. Sites 3 and 4 contain some channels and/or washes that would need to be considered in the design and engineering phases. Engineering solutions to maximize solar power generation can be applied (e.g., pole mounts well above grade, underground culvert to convey flows).

Additional plans associated with hydrology and water quality (e.g., a Drainage Report, Water Quality Management Plan, Stormwater Pollution Prevention Plan) may need to be prepared in line with applicable Navajo Nation and federal requirements, addressed more specifically in Table 5-4 Permitting Matrix. Grading and drainage controls would be designed to minimize the effects of stormwater runoff.

Development of the PBR for solar power generation would involve limited operational water use, using water for periodic washing of solar panels only. As people in the Southwestern U.S. are well aware, the entire Southwestern U.S. is currently afflicted by drought. Northwestern New Mexico is categorized as an area of "Severe Drought" in the February 22, 2014, edition of *The Economist* magazine in an article entitled "The Drying of the West" (Economist 2014).

5.2.5 Land Use / Planning

The primary use of the PBR area has historically been livestock grazing. Surface ownership for the site and surrounding area is depicted on Figure 5-11. The property contained within the boundary of Site 1 is not entirely under NHLCO control at this point in time and will require a land swap. Referencing the Paragon Resource Ranch Map in Section 1.5.1 of this report, the upper half of Section 30 where Site 1 is plotted is color-coded as "Navajo Nation Trust" on the Navajo Nation's maps (v.29Feb2000, v.09Aug2011). The lower half of Section 30 is coded as "BLM Leased" land on the same map. The land is presently used for grazing. All other sites within PBR are under the control of the Navajo Nation through the NHLSA.

The Chaco Canyon National Monument lies just under 20 miles to the southeast of the PBR. The Bisti/De-Na-Zin Wilderness Area, shown on Figure 5-11, is within San Juan County and extends into the area near the PBR. This Wilderness Area comprises over 41,000 acres. Established in 1984, the Wilderness Area is a desolate area of steeply eroded badlands managed by the BLM, with the exception of three parcels of private Navajo land within its boundaries. (Additional discussion of the Bisti/De-Na-Zin Wilderness Area is provided in Section 5.2 under the Recreation subheading).

The Resource Inventory (Bitsuie, SRIC 2006) describes the Bisti/De-Na-Zin Wilderness Area as containing highly scenic badlands and good backcountry use values. Parking and access for walking and camping is provided in two locations off Indian Service Roads within and near the PBR. As a Wilderness Area, it is closed to motorized vehicles and mechanical forms of transportation (including mountain bikes). Siting and development of solar generation facilities on the PBR would protect recreational access and would not be expected to affect access to this recreational facility

The closest Department of Defense facilities to the PBR are:

- Kirtland Air Force Base, Albuquerque, New Mexico (approximately 105 miles to the southeast)
- U. S. Army White Sands Missile Range, White Sands, New Mexico (approximately 175 miles to the southeast)

Albuquerque and Santa Fe, New Mexico, also have commercial airports. . No impacts on either civilian or military aviation activities would be anticipated.

With encouragement and support from the federal government, the NN is trying to transition away from coal toward power generation from RE sources. Facilities for power generation from RE sources would promote activities and practices that support the well-being of the Navajo people.

From the standpoint of overall land use compatibility, establishment of solar power generation facilities on the PBR is considered compatible with existing land uses, and Navajo culture and lifestyle and respect for the natural environment. The Navajo lifestyle and culture respects natural resources and employs sustainable practices to minimize impacts on the land and natural environmental. Development of solar generation facilities is very much in keeping with the Navajo culture and lifestyle.

Development of solar generation facilities would require that grazing be excluded from the areas developed for solar energy production. Specific impacts would be addressed in future environmental documentation based on finalized solar site boundaries.

5.2.6 Visual Resources

The topic of visual resources encompasses the visual character of the region, visual resources of the PBR, and views of the site PBR from key viewpoints. The PBR is visible from New Mexico Highways 371 and 57.

BLM uses three Visual Resource Management (VRM) classes to identify the scenic quality of the natural landscape:

> Class A – Distinctive; areas that combine the most outstanding characteristics of each rating factor
> Class B – Common; areas in which there is a combination of some outstanding features and some that are fairly common to the physiographic region
> Class C – Minimal; areas in which the features are fairly common to the physiographic region (BLM 1983)

The Resource Inventory (Bitsuie, SRIC 2006) assigned BLM VRM class ratings to the visual resources for the Project area evaluated in the Resource Inventory. Classifications were assigned based on a combination of outstanding landforms or lack thereof, vegetation, and structural rating features in the landscape (Bitsuie, SRIC 2006). The Class A rating was assigned to a portion of their Project area within the Bisti/De-Na-Zin Wilderness Area to recognize the outstanding visual quality of the badland features. Badlands along Highway 371 were photographed during a PBR site visit in September 2013 (Photograph 5-1). An area within Tsaya Canyon received a B Rating in the Resource Inventory. Most of their Project area was identified as lying within Class C units.

More detailed analysis and study initially planned for the individual solar sites will need to identify visual resources of the PBR and vicinity, identify key viewpoints and views available from those viewpoints, and address the changes in these views that would be experienced from project implementation. It is anticipated that visibility of the solar generation facilities within an otherwise rural area and effect on existing visual resources can be minimized through project design features, and that significant visual/aesthetic impacts would not be experienced. No major concerns associated with visual resources resulting from establishment of solar generating facilities on the PBR would be expected.

Glint and glare from solar panels associated with solar project development will also need to be addressed in future analysis and documentation, however, in order to provide a complete analysis. Glint and glare have been identified as a potential source of impacts on airspace. The Department of Defense facilities closest to the PBR with air operations are:

- Kirtland Air Force Base, Albuquerque, New Mexico (approximately 105 miles to the southeast)
- U. S. Army White Sands Missile Range, White Sands, New Mexico (approximately 175 miles to the southeast)

Albuquerque, New Mexico, also has a commercial airport, as does Santa Fe.

Department of Defense consultation could be required for the proposed project to assess potential for impacts to long-range radar, weather surveillance radar, military training routes, and special airspace. Consultation with the Federal Aviation Administration could also be required, as well as an analysis to evaluate the horizontal and conical imaginary surfaces and facility height.

5.3 Environmental Impacts and Benefits of Future Proposed Project

Sections 5.1 and 5.2 review the high-priority environmental issue areas, beginning with Biological Resources, where environmental impacts could potentially be experienced from establishment of solar power generation facilities on the PBR. Critical items for further study on a site-specific basis have been identified. This future focused and detailed analysis will occur as solar site boundaries are finalized, in order to maximize opportunities and limit the effect of environmental constraints, thereby minimizing potential impacts.

There are numerous benefits to be derived from the establishment of solar power generation facilities on Navajo land. The benefits fall within three general categories:

Minimization of Environmental Impacts - Future energy use with reliance on fossil fuels is linked to acid precipitation, stratospheric ozone depletion, and the greenhouse effect. The greenhouse effect is where carbon dioxide and other GHGs act like a blanket, absorbing infrared radiation and preventing it from escaping and passing into the atmosphere and into space. Power generation from RE sources generates none of the carbon, methane, or particulate emissions emitted by fossil fuels (further addressed in Section 5.4 below). RE technologies offer benefits with respect to the environment, air pollution and health. Non-combustion-based RE power generation technologies have the potential to significantly reduce local and regional air pollution and lower associated health impacts compared to fossil-based power generation. Power generation from RE sources also doesn't require related drilling operations or large-scale mining, the impacts of which have been experienced by the Navajo people first hand.

Establishment of sustainable economic development - RE and sustainable development have a strong connection. Establishment of RE facilities offers the opportunity to contribute to a number of important sustainable development goals:

1. Economic and social development - creating employment opportunities (addressed in more detail in Section 6), and promoting activities and practices that support the well-being of the Navajo people;
2. energy access - RE development offers the opportunity to improve access to modern energy services for the Navajo people;
3. energy security – supporting the nation's goal of producing RE from sustainable sources, gaining energy independence; and
4. climate change mitigation and the reduction of environmental and health impacts - RE technologies can provide important benefits compared to fossil fuels, in particular in the reduction of greenhouse gas (GHG) emissions. GHG emissions from RE technologies are, in general, considerably lower than those associated with fossil fuels.

Geopolitical Benefits - Establishment of RE power generation facilities results in a long-term increase in the economic and physical security of every American citizen by reducing U.S. reliance on unstable or hostile countries to supply oil. The deployment of RE can contribute to energy security by diversifying energy sources and diminishing dependence on unstable or hostile countries.

5.4 Preliminary Projection of Reduction in Fossil Fuel Usage

5.4.1 Introduction and Background of EPA's Proposed Rule 111(d)

The public health cost of coal-fired electricity, primarily due to the "criteria air pollutants" (oxides of sulfur (SO_x), oxides of nitrogen (NO_x), and particulates (PM_{10} and especially $PM_{2.5}$), is reckoned by the EPA to be roughly half a penny, (0.5 cents or 5 mills) per kWh. In the US, the actuarial toll of coal is 15 deaths per terawatt-hour (TWh) consumed (primarily from air pollution effects). The corresponding weighted average for the world is 100; while China's figure is 170 (composed of occupational accidents in coal mining, plus the effect of very bad air pollution on public health). In contrast, all forms of solar power (PV, thermal, and hot water) amount to 0.4 deaths per TWh. In the US, cheap western coal is both part of the problem (carbon in an area where coal already has high market penetration) and part of the solution (it has a very low sulfur content). This quality gives western coal a unique value in the marketplace, since it allows power generators back East to mix low-sulfur western with high-sulfur eastern fuel, yet still make their emission targets. Without western coal to leaven the mix, much eastern coal could not be legally burnt.

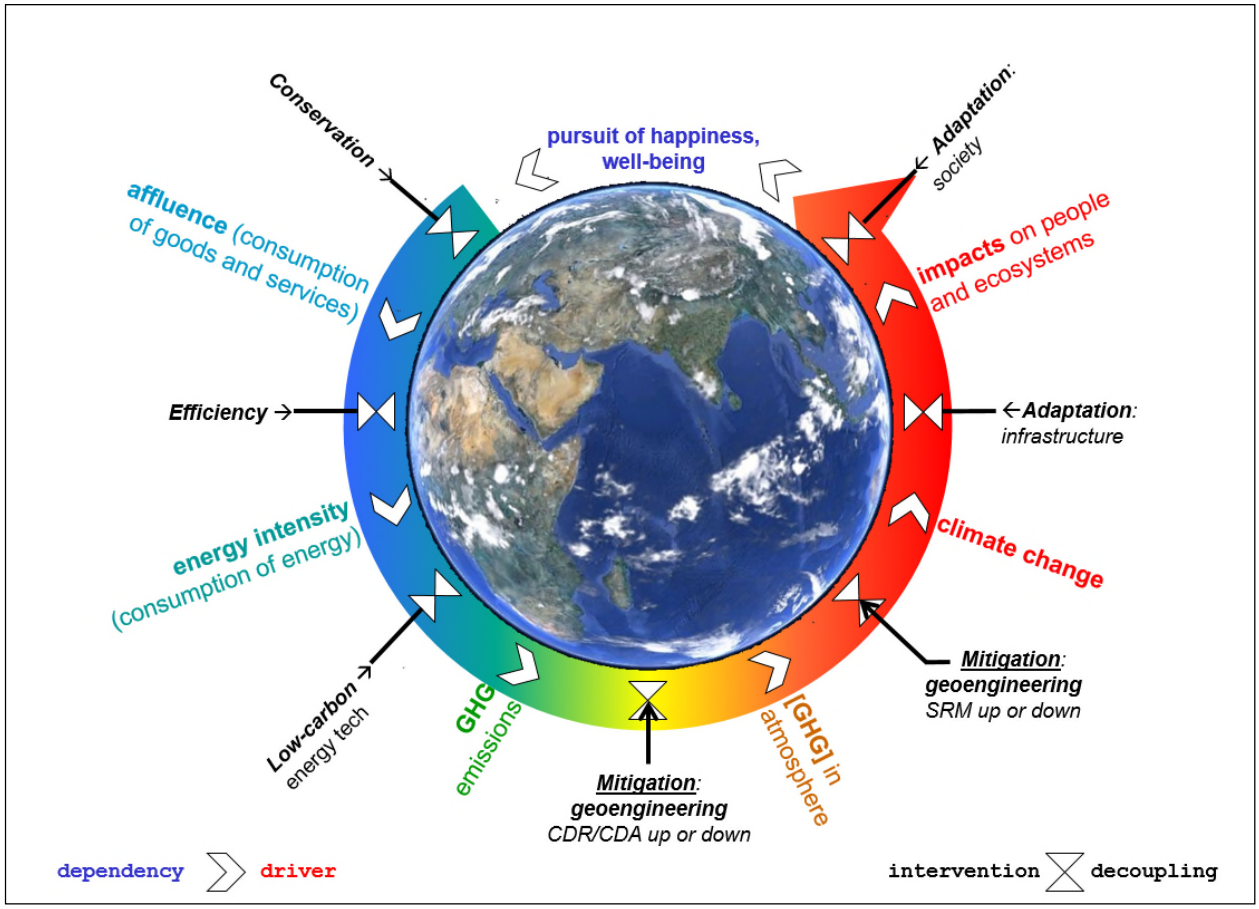


Figure 5-2. Cycle of anthropogenic climate change, with approaches and points of intervention

Source: R.Kennedy, K.Roy, E.Hughes, D.Fields in Johnson, Matloff, Bangs Harvesting Space for a Greener Earth (2014).

By contrast, the Intergovernmental Panel on Climate Change (IPCC) reckons the discounted present value of the sum of all climate change forecast over the coming century that can be attributed to fossil-fired electricity is ten times as great, roughly a nickel per kWh. Therefore, 5 cents per kWh, corresponding to a carbon tax of $42 per tonne of eCO_2, or $153 per tonne of coal burned, is considered to be the upper limit of a carbon tax or surcharge that would fully recapture these externalities. (Carbon markets in the US are presently far below this figure.) In the sparsely populated Four Corners area, the unaccounted-for impact ("externality") of any given kilowatt-hour is greatly diminished by being spread out over a very large area with few people in it.

Furthermore, the southwest being already in drought exacerbates the coal problem in two more ways: climate change such as droughts and temperature extremes become worse as atmospheric GHG concentrations increase, and the consumption of water in thermal power stations (the "carbon-water-energy nexus") increases with population and standard of living, putting yet more pressure on water supplies. See Figure 5-2 above.

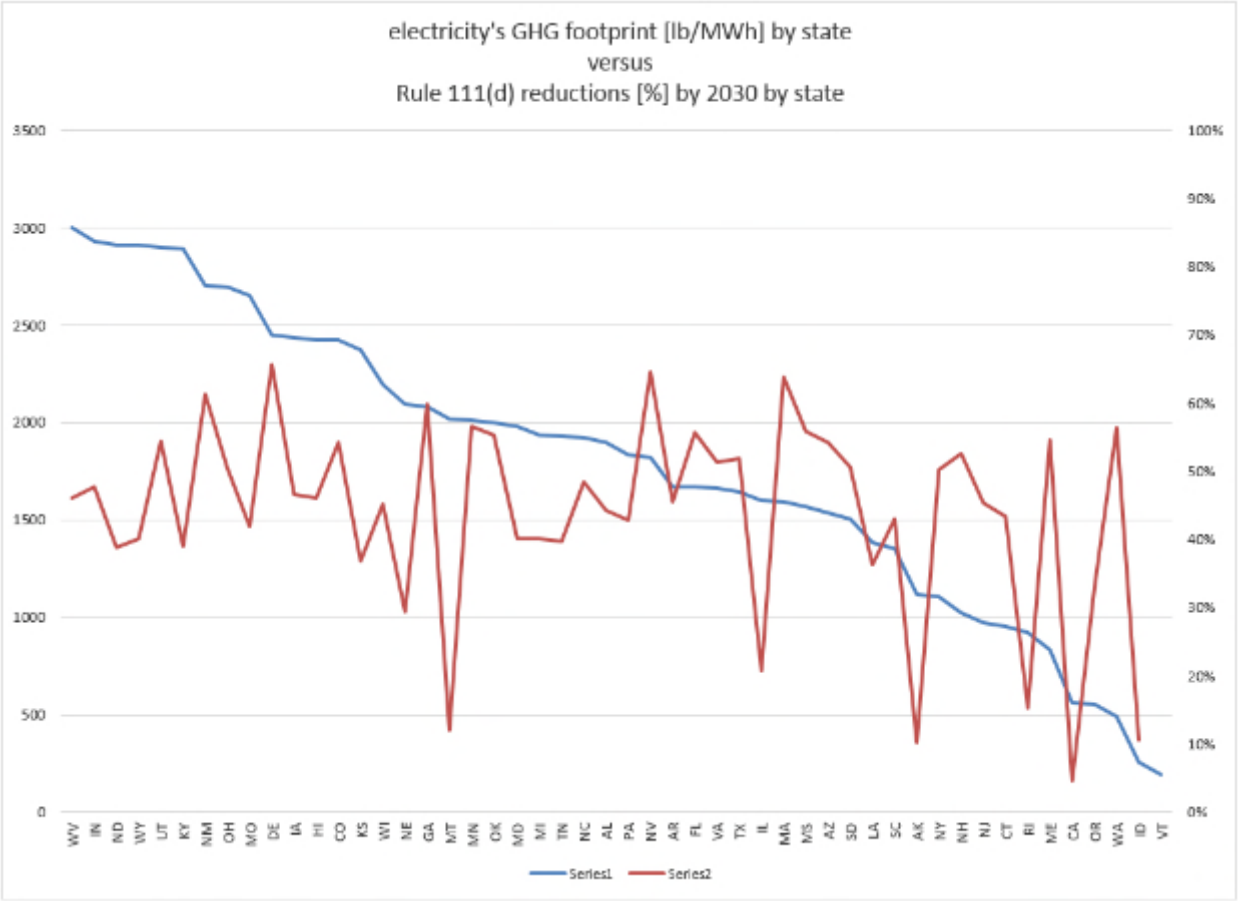


Figure 5-3. GHG footprints, by State, vs. %-age reductions by 2030, per proposed Rule 111(d)

Source: Tetra Tech. All Rights Reserved.

The "fuel mix" in the USA's electricity sector varies considerably by state, over two orders of magnitude from the cleanest (Vermont, 195 lbs per MWh) to the dirtiest (West Virginia, 3000 lbs per MWh). (2010 data.) See the blue line in Figure 5-3 above, in which each point was calculated using 2009-2010 data from the EIA, and the heating value of the coal fraction estimated by Dulong's Rule. In 2010, the average greenhouse gas (GHG) footprint in terms of CO_2-equivalents (eCO_2) for the USA as a whole right now is

about 1.3 lbs (0.58 kg) per kWh delivered, although this metric is improving all the time thanks to the ongoing rapid displacement of coal by natural gas in the electricity sector, especially combined cycle. However, New Mexico is among the carbon-intense states in the country due to its reliance on coal, with a GHG signature over 1.2 kg/kWh delivered.

Despite its laudable goals of reducing the footprint of the electricity sector of the economy, the EPA's proposed Rule 111(d) is based on a counterproductive top-down state-by-state approach, instead of a bottom-up producer-by-producer/worst-producers-first approach. See red line Figure 5-3 above. The reduction goals appear to be almost entirely uncorrelated with the existing footprints. Moreover, as measured by fraction of de-carbonization, it may surprise the reader to learn that the electricity sector is already the cleanest major sector in the American economy—the transport sector is the dirtiest. Alone among G8 economies, growth in the USA is de-coupling from growth in primary energy consumption. It remains to be seen whether Rule 111(d) will be put into practice, however the Navajo Nation should understand that it will not be immune from this proposed regulation forever. This puts a premium on long-term planning for clean energy developed from a limitless Navajo resource: sunlight falling upon land.

5.4.2 Estimates for Solar Electricity Generation and GHG Reductions on the PBR

PBR Site 1 by itself (290 MW) should produce from 12 to 20 million MWh over its 25- to 40-year working life, which in turn would avoid the emission of 7 to 24 megatons of GHGs. If fully built out, the entire Paragon Project (2,100 MW) would generate between 90 to 144 million MWh over its working life, avoiding the emission of 52 to 176 megatons of GHGs. Since one unit of carbon almost quadruples in weight when it is burned (3.67:1 daltons for stoichiometric combustion), and even oil is almost 90% carbon by weight, the reduced consumption of fuel is easily estimated, by dividing the GHG figures by 3.67. Therefore, the PBR is fully built out would displace 14 to 48 million metric tonnes of carbonaceous fuels. This many railcars (a third-million to a million) would make a train 3,000-10,000 miles long, stretching across the entire country at least once, and perhaps three times.

Table 5-3. Summary of Estimated GHG Avoidances, by Solar Sites

Group Name	Site	Power [MWe]	Lifetime Generation @ 25-40 years [MWh]	GHG avoidance (@USA avg fuel mix = 578 kg/MWh) GHG avoidance (@NM fuel mix = 1230 kg/MWh) [metric tonnes]
BISTI CORNERSTONE	1	***290***	12 – 20 million	7 – 24 million tonnes
"the Wedge"	1A	***50***	2 - 3 million	1 – 4 million tonnes
"DOG-EYE SOLAR RANCH"	2	***131***	6 - 9 million	3 – 11 million tonnes
TANNER LAKE/COAL CREEK	3	***638***	28 - 45 million	16 – 55 million tonnes
SPLIT LIP FLATS/BLACK LAKE	4	***972***	42 - 66 million	24 – 82 million tonnes
TOTAL ALL SITES		***2,081***	**90 - 144 million**	**52 – 176 million tonnes**

5.5 Permitting Requirements – Federal, State, Tribal

A matrix identifying potential permits and approvals for the project has been prepared. The matrix, provided in Table 5-4, Potential Permits and Approvals for the PBR Solar Project, summarizes Tribal requirements together with the major applicable federal, State and/or local laws, ordinances, regulations, and standards that may apply to the project. The matrix contains a brief description of the necessary permits/plans, the public process involved, and relevant comments. . Obtaining permits, clearances, and approvals, together with preparation of technical studies to support environmental documents and permit applications, is the responsibility of the Applicant/project proponent.

The matrix is all-inclusive and, from a permitting standpoint, should be considered a worst-case scenario. Opportunities for permit consolidation are offered in Appendix I, which contains NNEPA "Uniform Regulations for Permit Review, Administrative Enforcement Orders, Hearings, and Rulemakings under Navajo Nation Environmental Acts" (see p. 6, Section 203 Consolidation of Permit Processing).

The matrix addresses technical studies, with supporting field work, to be conducted to support the environmental documents and permit applications as development of the solar sites proceeds, expected to be funded by RE developers. Anticipated field work to be required, driven by specific site boundaries, includes Cultural Resources (Archaeological/Paleontological/Historical) to ensure avoidance of cultural resources such as sensitive tribal lands-grave sites/sacred sites; and Biological Resources, addressing vegetation and wildlife. Environmental issues related to the solar sites have been addressed throughout Section 5. Detail should be sufficient to plan the technical studies required to support environmental documentation under the NNEPA and the National Environmental Policy Act (NEPA).

Figure 2-2 Paragon Resource Ranch Map (February 2000 version) distinguishes between the various categories of Navajo and Indian land (e.g., Navajo Nation Trust Land, Navajo Nation Fee Land, Indian Allotted Land). The checkerboard nature of the PBR is apparent in Figure 2-2. The land category affects the permitting requirements that are imposed. (For example, New Mexico State requirements apply if fee lands are involved.) The NN Heritage Program is currently in discussions with the NN Department of Justice to determine what categories of biological resources need to be addressed for Tribal Ranches with checkerboard land status that contain fee lands (Diswood 2015). It is expected that special status species at the federal, State, and County level will need to be addressed for Tribal Ranches with checkerboard land status that contain fee lands (such as the PBR).

In Table 5-4, the first matrix entry for federal permitting is for review and compliance under NEPA. As a first step in the NEPA process, a federal agency is selected as the Lead Agency to administer the NEPA process and issue required documents. If it is determined that a federal agency will process the NEPA document (and not have it be processed solely by the Navajo Nation), it is expected that the Bureau of Indian Affairs (BIA) would be the federal Lead Agency.

Figure 5-4 identifies the steps required to complete an Environmental Assessment (EA) under NEPA. The Council on Environmental Quality (CEQ) NEPA regulations defines an EA as a concise public document prepared by a federal agency when a proposed action is not covered by a categorical exclusion or otherwise exempt from NEPA. An EA is used by federal agencies to determine whether a proposed action has the potential to cause significant environmental effects (Bass 2001). Contact with the Navajo Nation Environmental Protection Agency (Whitehorse-Larson 2014) indicates that Navajo Nation EAs follow the format and content set forth in the Department of Interior (DOI) Departmental Manual 516 (see Appendix C). The level of detail and depth of impact analysis contained in an EA should normally be limited to that needed to determine whether there are significant environmental effects. If the EA is adopted, the responsible official prepares his/her own Notice of Intent to prepare an EIS, or Finding of No Significant

Impact (FONSI), which also acknowledges the origin of the EA and takes full responsibility for its scope and content (DOI 1980).

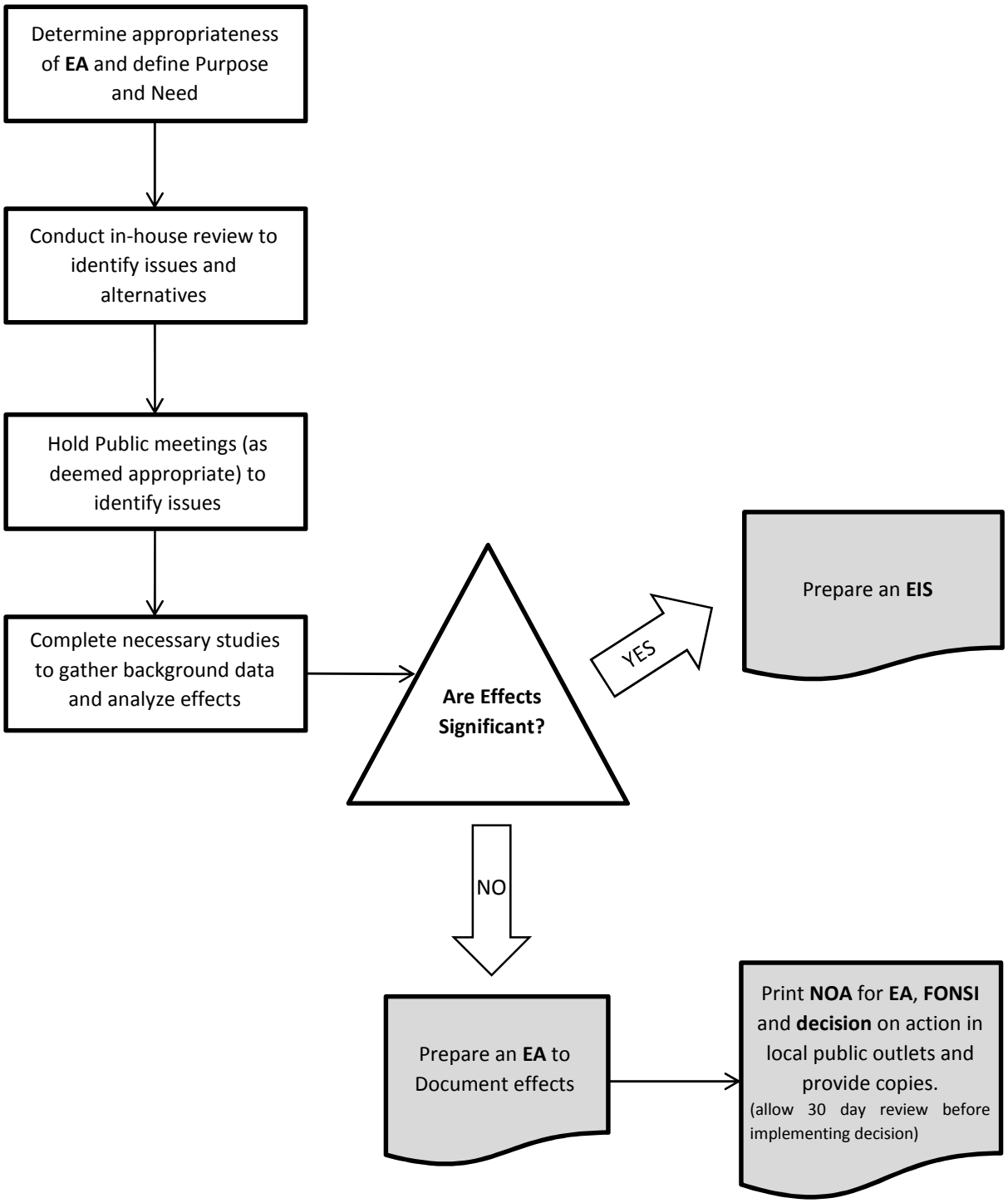


Figure 5-4. Steps in Completing an Environmental Assessment

Source: BIA 2012.

Also included in Appendix C of this Feasibility Study is an excerpt from the BIA NEPA Guidebook (BIA 2012), which also guides NN EA preparation. BIA NEPA Guidebook Section C.3 provides direction for EA preparation:

> "*An EA is not supposed to be a short EIS and CEQ regulations encourage agencies to write concise EAs (40 CFR 1508.9). The analysis in an EA need not go beyond that needed to determine whether impacts will or may be significant. This analysis should rely on existing data, but where appropriate, additional studies may be necessary to provide sufficient background information to determine if impacts will be significant.…The BIA encourages preparers to restrict the size of EAs to no more than 15 pages. … Larger documents may be appropriate for more complex actions or programmatic reviews.*" (BIA 2012)

Per NNEPA, any correspondence between the EA preparer and/or the project proponent and NN agencies is to be included in the appendices to the EA.

Typical timelines for NEPA environmental documents, as provided in the matrix, are 6 to 12 months for an Environmental Assessment (EA)/Finding of No Significant Impact (FONSI), and 18 to 24 months for an Environmental Impact Statement (EIS)/Record of Decision (ROD).

The seven environmental resource maps described and referenced above in Sections 5.1 through 5.5:

Figure 5-5, Existing Vegetation

Figure 5-6, Western Governors' Crucial Habitat Assessment

Figure 5-7, Regional Geology

Figure 5-8, Terrain Map

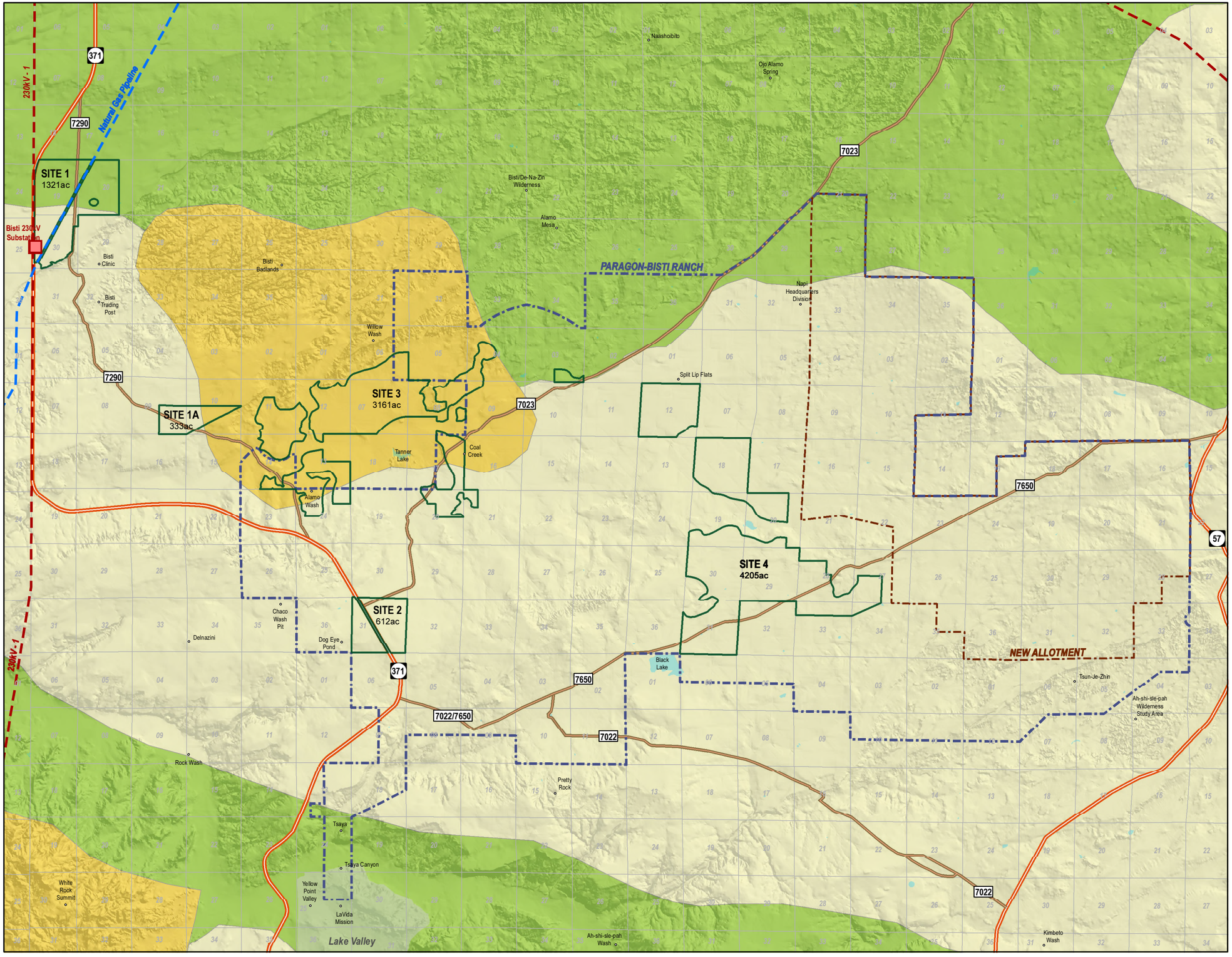
Figure 5-9, Existing Mineral Resources

Figure 5-10, FEMA Flood Zones

Figure 5-11, Surface Ownership

are now presented following this page.

PARAGON - BISTI RANCH ALTERNATIVE ENERGY FARM NAVAJO NATION, NEW MEXICO



FEATURES

- BISTI 230kV SUBSTATION
- PARAGON-BISTI RANCH
- NEW ALLOTMENT
- SOLAR SITE OUTLINE
- PLSS GRID
- US HIGHWAY
- STATE HIGHWAY
- LOCAL ROAD
- POWER LINES
- NATURAL GAS

VEGETATION

- CONIFEROUS AND MIXED WOODLAND
- DESERT GRASSLAND (ECOTONE)
- GREAT BASIN DESERT SCRUB

FIGURE 5-5
EXISTING VEGETATION

0 1 2 4
Miles

TETRA TECH

PARAGON - BISTI RANCH ALTERNATIVE ENERGY FARM NAVAJO NATION, NEW MEXICO

FEATURES

- BISTI 230kV SUBSTATION
- PARAGON-BISTI RANCH
- SOLAR SITE OUTLINE
- PLSS GRID
- US HIGHWAY
- STATE HIGHWAY
- LOCAL ROAD
- POWER LINES
- NATURAL GAS

WGA CRUCIAL HABITAT RANK

- 1 - MOST CRUCIAL
- 2
- 3
- 4
- 5 - LEAST CRUCIAL

FIGURE 5-6
WESTERN GOVERNORS' CRUCIAL HABITAT ASSESSMENT

0 1 2 4
Miles

TETRA TECH

PARAGON - BISTI RANCH ALTERNATIVE ENERGY FARM NAVAJO NATION, NEW MEXICO

FEATURES

- BISTI 230kV SUBSTATION
- PARAGON - BISTI RANCH
- NEW ALLOTMENT
- SOLAR SITE OUTLINE
- PLSS GRID
- US HIGHWAY
- STATE HIGHWAY
- LOCAL ROAD
- POWER LINES
- NATURAL GAS

USGS GEOLOGY

- Kch - CLIFF HOUSE SANDSTONE
- Kkf - KIRKLAND & FRUITLAND FORMATIONS
- Kls - LEWIS SHALE
- Kmf - MENEFEE FORMATION
- Kpc - PICTURED CLIFFS SANDSTONE
- Tn - NACIMIENTO FORMATION
- Toa - OJO ALAMO FORMATION

FIGURE 5-7
REGIONAL GEOLOGY

0 1 2 4
Miles

TETRA TECH

PARAGON - BISTI RANCH ALTERNATIVE ENERGY FARM NAVAJO NATION, NEW MEXICO

FEATURES

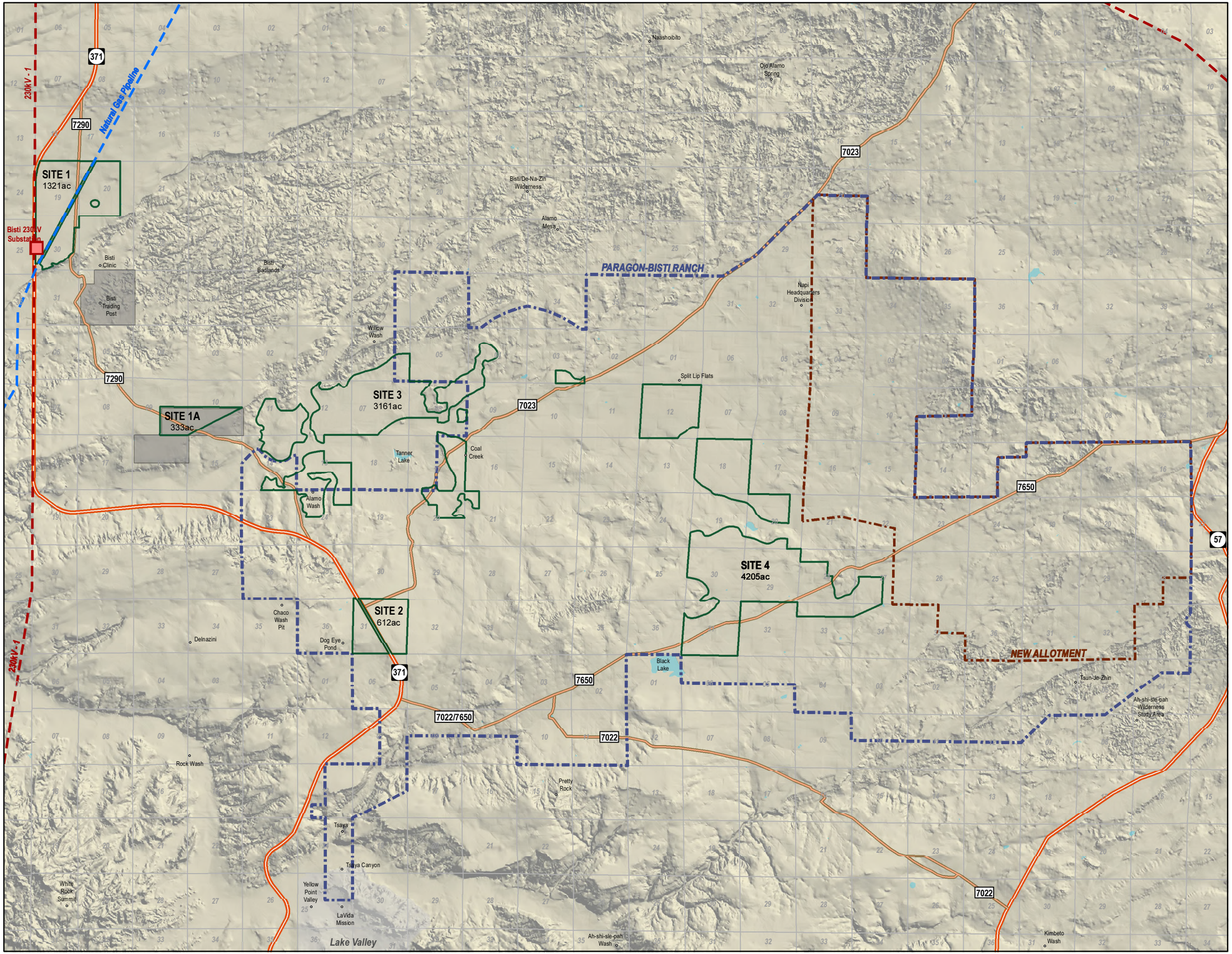
- BISTI 230kV SUBSTATION
- >5% SLOPE
- PARAGON - BISTI RANCH
- NEW ALLOTMENT
- SOLAR SITE OUTLINE
- PLSS GRID
- US HIGHWAY
- STATE HIGHWAY
- LOCAL ROAD
- POWER LINES
- NATURAL GAS

FIGURE 5-8
TERRAIN MAP

0 1 2 4
Miles

TETRA TECH

PARAGON - PARAGON RANCH ALTERNATIVE ENERGY FARM NAVAJO NATION, NEW MEXICO



FEATURES

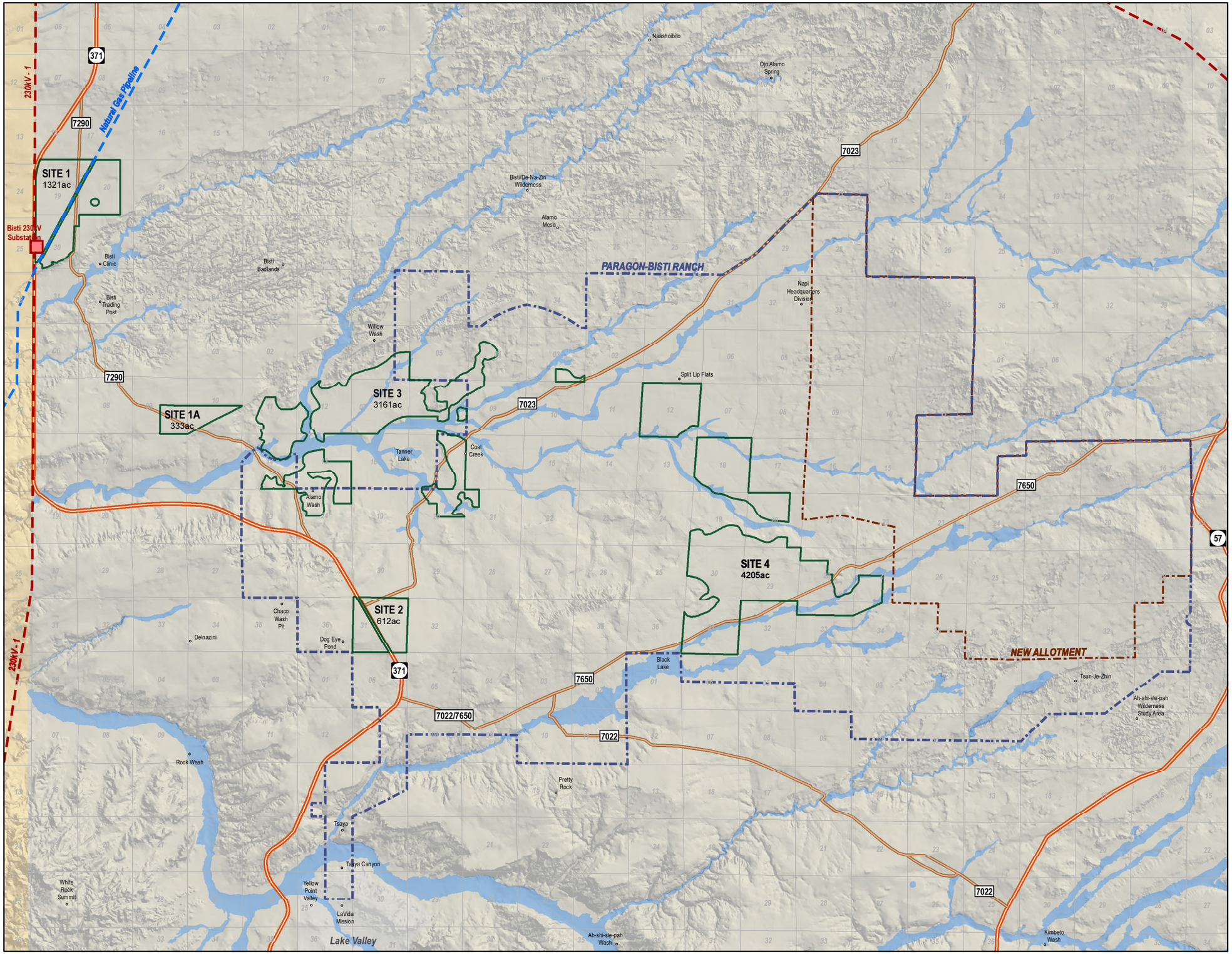
- BISTI 230kV SUBSTATION
- COAL MINE PERMIT
- PARAGON-BISTI RANCH
- NEW ALLOTMENT
- SOLAR SITE OUTLINE
- PLSS GRID
- US HIGHWAY
- STATE HIGHWAY
- LOCAL ROAD
- POWER LINES
- NATURAL GAS

FIGURE 5-9
EXISTING MINERAL RESOURCES

0 1 2 4
Miles

TETRA TECH

PARAGON - BISTI RANCH ALTERNATIVE ENERGY FARM NAVAJO NATION, NEW MEXICO



FEATURES

- BISTI 230kV SUBSTATION
- PARAGON - BISTI RANCH
- NEW ALLOTMENT
- SOLAR SITE OUTLINE
- PLSS GRID
- US HIGHWAY
- STATE HIGHWAY
- LOCAL ROAD
- POWER LINES
- NATURAL GAS

FEMA FLOOD ZONE

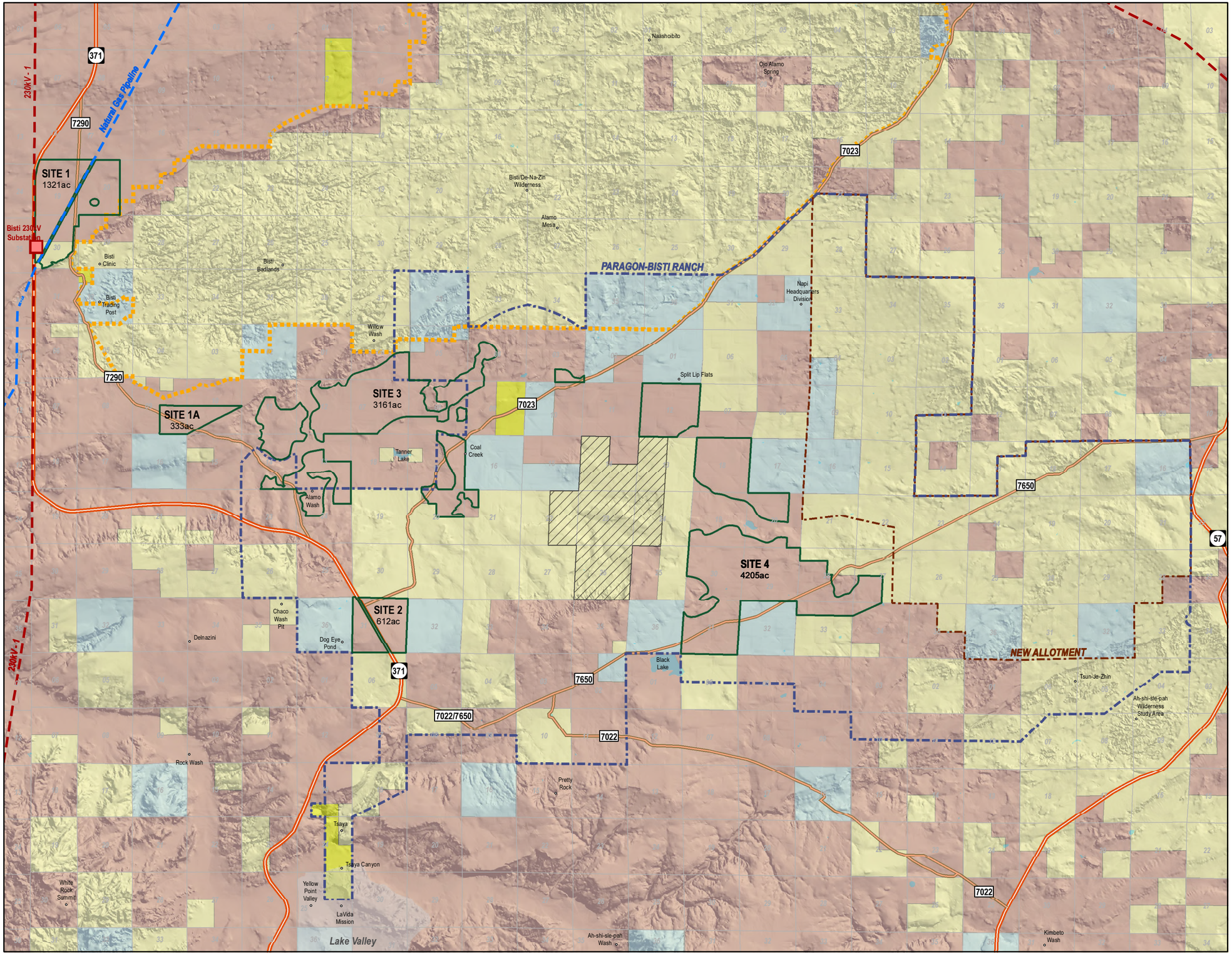
- A
- D
- X

FIGURE 5-10
FEMA FLOOD ZONES

0 1 2 4
Miles

TETRA TECH

PARAGON - BISTI RANCH ALTERNATIVE ENERGY FARM NAVAJO NATION, NEW MEXICO



FEATURES

- BISTI 230kV SUBSTATION
- FOSSIL FOREST RESEARCH NATIONAL AREA
- BISTI/DE-NA-ZIN WILDERNESS AREA
- PARAGON-BISTI RANCH
- NEW ALLOTMENT
- SOLAR SITE OUTLINE
- PLSS GRID
- US HIGHWAY
- STATE HIGHWAY
- LOCAL ROAD
- POWER LINES
- NATURAL GAS

SURFACE OWNERSHIP

- BLM
- TRIBAL LANDS
- PRIVATE LANDS
- STATE OWNED LANDS

FIGURE 5-11
SURFACE OWNERSHIP

0 1 2 4
Miles

TETRA TECH

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5.6 Plan for Obtaining Required Environmental Permits, Approvals, or Decisions

The Table 5-4 permit matrix, together with the timeline provided in Figure 5-12 that follows it, combine to provide a plan to obtain environmental permits and approvals or decisions. The estimated timeline to obtain environmental permits and approvals/decisions could be as quick as 9 months if an EA/FONSI is utilized. As noted above, a longer timeframe of 18 to 24 months could also be experienced if an EIS/ROD is required.

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Table 5-4. Permit Matrix

PERMITTING AGENCY	PERMIT	TRIGGER	APPLICATION TIMELINE	PUBLIC PROCESS	COMMENTS
FEDERAL					
As a first step in the federal National Environmental Policy Act (NEPA) process, a federal Lead Agency is selected to administer the NEPA process and issue required documents. If it is determined that a federal agency will process the NEPA document (and not have it be processed solely by the Navajo Nation), it is likely that the Bureau of Indian Affairs (BIA) would be the federal Lead Agency. Bureau of Indian Affairs (BIA), Gallup, New Mexico Harrilene J. Yazzie, Regional NEPA Coordinator Bureau of Indian Affairs (BIA) – Navajo Region Division of Environmental, Cultural, and Safety Management P.O. Box 1060 Gallup, New Mexico 87301 505-863-8287	**NEPA Review and Compliance - Categorical Exclusion, Finding of No Significant Impact (FONSI), or Record of Decision (ROD)**. Categorical Exclusion would not apply to the proposed project.	Submittal of applications for right-of-way (ROW) grants for access roads and transmission line	6 to 12 months to complete an initial Environmental Assessment (EA); if Lead Agency determines from EA and agency/public comments that significant impacts may result from project, then an Environmental Impact Statement (EIS) may be required, which may take 18 to 24 months to complete including studies, preparation of draft EIS, public comment, agency review, and issuance of a final EIS. A cost sharing agreement would be required to fund the federal Lead Agency's work related to preparation of NEPA documentation.	Public process varies with the type of NEPA document; for an EIS, the Lead Agency publishes a formal Notice of Intent and conducts public scoping (typically a 30-day comment period) prior to preparing the EIS, and a formal review period (typically 45 days) for the draft EIS; opportunities for public involvement are typically less for an EA.	Whenever a federal permit or approval or federal funds are required for a development, the federal agency involved in the action must comply with NEPA and document the compliance activity. NEPA requires preparation of an EIS for "major federal actions significantly affecting the quality of the human environment." Actions involving lesser levels of environmental impact are addressed through an EA or are categorically excluded from comprehensive review. An EA or EIS considers alternatives (no project alternative, alternative location, alternative technology, etc.), as well as socioeconomics, environmental, and cultural impacts. An EA would go to Navajo Nation EPA (NNEPA) for final review. If an EIS were to be prepared, U.S. EPA Region 9 would review the EIS. The Endangered Species Act (ESA) could apply, depending on the route for generation tie line(s), and whether non-tribal land is involved. For federal lands, federal agency involvement can be triggered by siting within the habitat of an endangered species, requiring consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the ESA. If a tribal action is funded or authorized by a federal agency, then that federal agency's decision is subject to Section 7 consultation. For private land where there are anticipated impacts to special status species, Section 10 of the ESA enters in, and preparation of a Habitat Conservation Plan (HCP) would be required. Any disturbance of wetlands is likely to require approval by the U.S. Army Corps of Engineers (USACE) under the Clean Water Act (CWA), which could require NEPA review if an Individual Permit is required. If a proposed solar PV facility would interconnect with the federal grid or if a DOE Loan Guarantee is applied for, creating a federal nexus, NEPA review would be required. Federal agencies must comply with NEPA in order to enter into a power purchase or interconnection agreement. More general information on the NEPA process is available online at http://www.epa.gov/oecaerth/basics/nepa.html. Format for an EA for a project proposed for Navajo lands traditionally follows the BIA 516 Department Manual, provided as an appendix to this report (Appendix _C_). Written correspondence between the EA preparer and the individual NN agencies is to be included as an appendix to the EA. NNEPA would issue a letter of recommendation regarding the EA (to either approve or deny). If NNEPA recommends approval of the EA, the letter would include a list of terms and conditions that need to be required.
U.S. Army Corps of Engineers (USACE) Regulatory Division Albuquerque District, USACE 4101 Jefferson Plaza NE Albuquerque, NM 87109 Marcy Leavitt Phone: 505-342-3678 marcy.l.leavitt@usace.army.mil (Tribal Liaison Ron Kneebone is also available at 505-342-3355 or ronald.r.kneebone@usace.army.mil. Mr. Kneebone handles USACE tribal matters with the exception of permitting)	**Nationwide Permit (NWP) or Individual Permit under Section 404 of the Clean Water Act (CWA)**	Discharges of dredged or fill material into waters of the United States, including their adjacent wetlands; construction, excavation, or filling activities encroaching upon floodplains; impacts less than 0.5 acres are eligible for NWP 12 (the NWP that typically applies to solar energy projects); impacts less than 0.1 do not require notification, except under certain circumstances; impacts greater than 0.5 acres require an Individual Permit	Allow 2 months for fieldwork and report and application preparation; allow 60 to 120 days for application review for an Individual Permit, but varies on degree of potential impacts to biological and cultural resources; 30-day public notice for an Individual Permit.	None for NWP; public comment period prior to issuance of an Individual Permit; mitigation of unavoidable impacts is negotiated with USACE to its satisfaction in order to obtain the permit; no appeal process.	Section 404 of the CWA requires approval from the USACE prior to undertaking an activity that affects the waters of the United States, which includes wetlands, rivers, and streams. The USACE issues general permits in the form of NWPs for certain activities, provided that the disturbance thresholds are met. Individual Permits are available for activities that do not qualify for coverage under a NWP. Typical activities in national waters regulated under this permit program include fill for development, water resource projects, infrastructure development, and mining projects. Section 404 requires a permit before dredged or fill material may be discharged into waters of the United States, unless the activity is exempt from Section 404 regulation. The clearing of the solar sites, construction of access roads, and trenching of collection lines could potentially impact wetlands or water bodies and require filing a permit to comply with Section 404. Activities that disturb less than 0.5 acre of wetlands can obtain coverage under a NWP. The NWP that typically applies to solar energy projects is NWP 12 for Utility Line Activities. This permit covers activities that include access roads, temporary staging areas, and trenching and backfilling activities. For NWPs, impacts over 0.1 acres require submittal of a Pre-Construction Notification

PERMITTING AGENCY	PERMIT	TRIGGER	APPLICATION TIMELINE	PUBLIC PROCESS	COMMENTS
					(PCN). Other PCN thresholds may apply depending on the nature of impacts and regional conditions (e.g., impacts to Threatened & Endangered [T&E] species or sensitive water resources). Impacts over 0.5 acres would require an Individual Permit. A Section 404 permit may be avoided altogether or the project may qualify for a NWP by carefully siting facilities in uplands, conducting a wetland delineation to confirm boundaries (as appropriate), and using horizontal drilling technology for crossing wetlands. Note that information regarding potential impacts to federally protected species and cultural resources is required for a USACE permit. Additional information is available at http://www.spl.usace.army.mil/regulatory/
United States Department of Interior Bureau of Land Management (BLM) – New Mexico BLM-New Mexico State Office 301 Dinosaur Trail Santa Fe, NM 87502-0115 (505) 954-2000 Contacts: Debby Lucero (505) 954-2196 Cynthia Sandoval (505) 954-2198	**Informal interaction**	Proximity to Bis-ti/De-na-zin Wilderness Area and potential for impact from solar development on PBR			Jurisdiction for the Bis-ti/De-na-zin Wilderness Area falls under the BLM: http://www.blm.gov/nm/st/en/prog/blm_special_areas/wilderness_and_wsas/faq_wilderness_areas.print.html Concerns regarding impacts, especially from Solar Site 3, on the Bis-ti/De-na-zin Wilderness Area will center on glare and reflection, and an interest in a low level of lighting at night.
US Environmental Protection Agency (US EPA), Region 9 75 Hawthorne St. San Francisco, CA 94105 NPDES Permits Office (WTR-5) Water Division Gary Sheth NN Permitting Lead 415-972-3516 sheth.gary@epa.gov (US EPA Region 9, San Francisco CA issues permits for activities on the Navajo Reservation in the area of the Bisti Paragon Ranch and not Region 6, Albuquerque, NM)	**Construction general permit, NPDES Permit for stormwater under Section 402 of the CWA**	Ground disturbance greater than 1 acre	Allow at least 2 months for preparing application, submitting application, and processing prior to construction	Water Quality Certification under Section 401 of the CWA on Navajo land requires a public hearing	USEPA delegated authority to the Navajo Nation for the National Pollutant Discharge Elimination System permits, and 401 certification within the Navajo Nation. A separate entry for NNEPA for NPDES permitting and 401 certifications is provided below under Tribal permits.
United States Department of Interior Bureau of Land Management (BLM) – New Mexico BLM-New Mexico State Office 301 Dinosaur Trail Santa Fe, NM 87502-0115 (505) 954-2000 Contacts: Debby Lucero (505) 954-2196 Cynthia Sandoval (505) 954-2198	**ROW grant**	NEPA review typically triggered by application for ROW grant application	Subject to completion of the NEPA review; 6 to 12 months for an EA, but may take up to 18 to 24 months if determined EIS is required	NEPA review is required for ROW application review; public process occurs pursuant to standard NEPA requirements	A ROW grant is an authorization to use a specific piece of public land for a certain project, such as roads, pipelines, transmission lines, and communication sites. Solar energy development projects on BLM-administered public lands are authorized as ROWs under Title V of the Federal Land Policy and Management Act if the proposed project is consistent with BLM land use planning. The applicant is required to pay the BLM's costs in processing the ROW grant application, and all projects require an environmental review underNEPA. Any entity that receives a solar energy ROW authorization must comply with the terms and conditions of the authorization and pay fair market value for use of the public lands. Additional information is available at: http://www.blm.gov/pgdata/content/wo/en/prog/energy/solar_energy.html It may also be necessary to obtain a ROW grant through BIA as well and not just BLM. BIA contact information is provided in the first federal entry in this table.
U.S. Fish and Wildlife Service – Southwest Region U.S. Fish & Wildlife Service 500 Gold Avenue SW, Albuquerque, NM 87102	**Courtesy Consultation**	Project development	N/A	N/A	The ESA could apply, depending on the route for generation tie line(s), and whether non-tribal land is involved. For federal lands, federal agency involvement can be triggered by siting within the habitat of an endangered species, requiring consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the ESA. For private land where there are anticipated impacts to special status species, Section 10 of the ESA enters in, and preparation of an HCP would be required. If required, consultation is recommended early in the development process to evaluate the potential for the project to impact federally listed species and to determine the need for permitting or mitigation measures. Consultation would occur as part of the overall project review under NEPA. Assessment by the USFWS of potential adverse impact to species or habitat could result in permitting delays as

PERMITTING AGENCY	PERMIT	TRIGGER	APPLICATION TIMELINE	PUBLIC PROCESS	COMMENTS
					NEPA decisions may not be issued until USFWS concerns are addressed. Additional information is available at: http://www.fws.gov/cno.
	Incidental Take Permit (ITP) under Sections 9 and 10 of the Endangered Species Act	Potential adverse impacts to federally- listed species and critical habitats (project with no federal nexus)	Preparation and approval of HCP and EA/EIS may take 1-5 years	A minimum of 60 days comment period for the ITP application; NEPA public comment period runs concurrently	Under Section 9 of the ESA, it is unlawful to knowingly or unknowingly perform an action that results in the "take" of a listed species or habitat. Agency correspondence and ecological assessments are recommended to evaluate whether a project may adversely affect federally-listed rare, threatened, or endangered species. A project proponent may choose to apply for coverage under an Incidental Take Permit (ITP) under Section 10 of the ESA if the USFWS determines that the project may result in "take." (NN would enter into Section 7 consultation with the USFWS if an incidental [or direct] take were anticipated to occur.) If the USFWS determines that the project may adversely affect a listed species, applying for an ITP and preparing an HCP should be considered to avoid penalties in the case of incidental take. In issuing an ITP, the USFWS must also comply with NEPA. Additional information is available online at: http://www.fws.gov/endangered/permits/index.html.
	Section 7 Consultation under the ESA	Likely adverse impacts to federally-listed species and critical habitats as a result of a project with a federal nexus (disturbance of land managed by a federal agency; federal permit or approval required)	Depends on whether informal or formal consultation is necessary; formal consultation can take 6 months to 1 year	Variable, depending on the type of consultation; public comment period prior to issuance of Biological Opinion if formal consultation required	Under Section 7 of the ESA, federal agencies involved in reviewing or approving a project must consult with the USFWS to evaluate whether any action they authorize, implement, or fund will not jeopardize the continued existence of a federally-listed species or result in the destruction or adverse modification of designated critical habitat. While Sections 9 and 10 apply to any action, private or agency, Section 7 consultation applies specifically to actions taken by a federal agency, such as issuing a permit or granting an approval for a development project. Most consultations are conducted informally to determine if a proposed action may adversely affect listed species or critical habitat. Informal consultation consists of meetings, conversations, and letters. Formal consultation is not required if the federal agency finds, with written concurrence from the USFWS, that the proposed action "may affect, but is not likely to adversely affect" listed species or critical habitat. Conversely, if the USFWS determines that the project may have adverse effects, a formal consultation and preparation of a Biological Assessment is required for further evaluation. The USFWS issues a Biological Opinion and an incidental take statement based on the formal consultation. The Section 7 Consultation Handbook is available online at: http://www.fws.gov/endangered/esa-library/pdf/esa_section7_handbook.pdf. Note: Pre-Construction Notification for U.S. Army Corps general permits requires documentation that the activity will not adversely affect listed species to satisfy the requirements of Section 7 of the ESA.
	Consultation and due diligence under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA)	Potential impacts to migratory birds and eagles	Consultation should be initiated early in project development process	None noted	The MBTA and BGEPA establish penalties for take of several bird species. An ITP is now available under the BGEPA, and the USFWS has released draft standards for review of solar energy projects under this act; however, no ITPs have been issued under the new standards. No ITPs are available under the MBTA. Correspondence with the USFWS and due diligence regarding impacts to migratory birds and eagles is recommended to reduce liability in the case of an incidental take under these two acts. Additional information is available at: http://www.fws.gov/migratorybirds/ Field surveys would determine the extent of use of the project area by bird species, especially pertaining to the spring (March – May) and fall (September – November) migrations. The NN Biological Clearance process addresses bird species protected under the MBTA and BGEPA. Additional surveys focusing on the presence/absence of

PERMITTING AGENCY	PERMIT	TRIGGER	APPLICATION TIMELINE	PUBLIC PROCESS	COMMENTS
					potentially occurring listed species could be required: burrowing owl, loggerhead shrike, and gray vireo, to be conducted during the breeding season from March to June. Contact with NN staff indicated that surveys for burrowing owl may be the only surveys out of these three species that would be required.
STATE					
New Mexico Department of Game and Fish 1 Wildlife Way, Santa Fe, NM 87507 Phone: (888) 248-6866 ispa@state.nm.us Conservation Services Matt Wunder Matthew.Wunder@state.nm.us 505-476-8101 Northwest Office Colin Duff, Captain 3841 Midway Place NE Albuquerque, NM 87109 Phone: (505) 222-4700 Fax: (505) 222-4720 colin.duff@state.nm.us	**No State permit required**	Wildlife Conservation Act does not apply to Tribal Trust lands.			The State of New Mexico has a State Endangered Species law - the Wildlife Conservation Act (NMSA 1978, §17-2-37 to 17-2-46). The State of New Mexico also has a voluntary guideline for surveying burrowing owl (BUOW). The NN Biological Clearance process addresses State special-status species. State special-status wildlife species are those that appear on any of the following lists: (1) the list of wildlife indigenous to the State determined to be endangered within the State as set forth by regulations of the State conservation commission; and (2) the United States lists of endangered native and foreign fish and wildlife as set forth in Section 4 of the Endangered Species Act of 1973 as endangered or threatened species, but only to the extent that those lists are adopted for this purpose by regulations of the State conservation commission.
TRIBAL					
Navajo Nation Environmental Protection Agency (NNEPA) Office of the Environmental Review/Office of the Executive Director-Admin. P.O. Box 339 Window Rock Blvd. #2695 Window Rock, AZ 86515 Rita Whitehorse-Larsen, Sr. Environmental Specialist Main Office: 928-871-7692 Office Direct: 928-871-7188 Mobile: 928-551-2058 rwhitehorsel@navajo-nsn. gov	**NEPA and NNEPA Environmental Review and Compliance**	Proposed use of Tribal Land for a Renewable Energy Facility	6 to 12 months to complete an initial EA; if it is determined from EA and agency/public comments that significant impacts may result from project, then an EIS may be required, which may take 18 to 24 months to complete including studies, preparation of draft EIS, public comment, agency review, and issuance of a final EIS.	Public process varies with the type of environmental document; for an EIS, the Lead Agency publishes a formal Notice of Intent and conducts public scoping (typically a 30-day comment period) prior to preparing the EIS, and a formal review period (typically 45 days) for the draft EIS; opportunities for public involvement are typically less for an EA.	NEPA requires preparation of an EIS for "major federal actions significantly affecting the quality of the human environment." Actions involving lesser levels of environmental impact are addressed through an EA or are categorically excluded from comprehensive review. An EA or EIS considers alternatives (no project alternative, alternative location, alternative technology, etc.), as well as socioeconomics, environmental, and cultural impacts. An EA would go to Navajo Nation EPA (NNEPA) for final review. If an EIS were to be prepared, U.S. EPA Region 9 would review the EIS. NNEPA, directly under the NN Executive Director's Office of Environmental Review, has approval authority for EAs. Consultation with BIA would be required, but authority for final review and approval of an EA may rest solely with the NNEPA. FONSI would still be issued by the BIA, however. Format for an EA for a project proposed for Navajo lands traditionally follows the BIA 516 Department Manual, provided as an appendix to this report (Appendix _C_).
Navajo Nation Eastern Navajo Agency, Real Estate Services Jerry Degrot Agency Realty Officer Telephone: (505) 786-6121 Fax: (505) 786-6115	**NEPA Review and Compliance**	Requirement for a federal permit (in this instance, Revocable Use Permit, and/or Solar Resource Permit and/or Lease))	6 to 12 months to complete an initial EA); if Lead Agency determines from EA and agency/public comments that significant impacts may result from project, then an EIS may be required, which may take 18 to 24 months to complete including studies, preparation of draft EIS, public comment, agency review, and issuance of a final EIS.	Public process varies with the type of NEPA document; for an EIS, the Lead Agency publishes a formal Notice of Intent and conducts public scoping (typically a 30-day comment period) prior to preparing the EIS, and a formal review period (typically 45 days) for the draft EIS; opportunities for public involvement are typically less for an EA.	NNEPA, directly under the NN Executive Director's Office of Environmental Review, has approval authority for environmental assessments. Consultation with BIA would be required, but authority for final review and approval of an EA may rest solely with the NNEPA. FONSI would still be issued by the BIA, however. Format for an EA for a project proposed for Navajo lands traditionally follows the BIA 516 Department Manual, provided as an appendix to this report (Appendix _C_). With certain exceptions, anyone seeking to conduct activities associated with the development of wind and/or solar resources on Indian trust or restricted lands must secure a Wind and Solar Resource lease. The lease application is required to contain environmental and cultural resource information. Revocable Use Permits, and Wind and Solar Resource Permits and Leases have historically been issued by the BIA. Responsibility for issuance of these permits and leases, however, is now being assumed by the Navajo Nations.
NNEPA P.O. Box 339 Window Rock, AZ 86515 Patrick Antonio Principal Hydrologist 928-871-7185 patrickantonio@navajo-nsn.gov	**NPDES Permit for stormwater under Section 402 of the CWA; Water Quality Certification under**	Ground disturbance greater than 1 acre	Generally requires 75 days to obtain permits.	Water Quality Certification on Navajo land under Section 401 of the CWA requires a public hearing.	NNEPA is an independent entity of the Executive Branch of the Navajo Nation. USEPA delegated authority to the Navajo Nation for the National Pollutant Discharge Elimination System permits within the Navajo Nation. One copy of the project Stormwater Pollution Prevention Plan (SWPPP) is to be submitted to the NNEPA. NNEPA has developed Uniform Regulations for Permit Review, Administrative Enforcement

PERMITTING AGENCY	PERMIT	TRIGGER	APPLICATION TIMELINE	PUBLIC PROCESS	COMMENTS
	Section 401 of the CWA				Orders, Hearings, and Rulemakings under Navajo Nation Environmental Acts. The Regulations are provided as an appendix to this report (Appendix _C_) and available at http://www.navajonationepa.org/Pdf%20files/Uniform.pdf The NNEPA does not have any specific wetland standards. There are guidelines regarding wetlands in the NN Forest Protection Manual that specifies buffer zone requirements regarding wetlands.
Navajo Nation EPA (NNEPA) – Air Quality Control/Operating Permit Program P.O. Box 529 Fort Defiance, AZ 86504 928-729-4096 (main no.) Tennile B. Begay Sr. Environmental Specialist 928-729-4248 tbbegay@navajo-nsn.gov Raju Bisht Environmental Engineer 928-729-4249 rbisht@navajo-nsn.gov	**Air and Air Toxics Permits** providing Authority to Construct/ Permit to Operate under the Clean Air Act (CAA)	Equipment (e.g., construction equipment) with the potential to emit air pollutants	Allow at least 3-4 weeks	None noted	USEPA delegated authority to the Navajo Nation for issuance of permits to emit air pollutants (including air toxics and hazardous air pollutants such as pesticides) within the Navajo Nation. The NNEPA-Air Quality Control/Operating Permit Program requires that all equipment with the potential to emit air pollutants (including air toxics and hazardous air pollutants) have a valid permit prior to commencing construction and/or operation. Project types listed in the Activity Application/Section 3 that could apply to the proposed project include road construction, land clearing, earthmoving, demolition, excavation and grading, repairing paved roads, and trenching.
Navajo Nation Dept. of Water Resources, Water Code Administration P.O. Box 678 Fort Defiance, AZ 86504 928-729-4132 Laurita Begay Water Code Compliance Officer 928-729-4147 begaylj@hotmail.com	**Water Code Permit**	Water Use	Permit is granted once signed application is submitted	None noted	The Water Code Administration is a program within the Dept. of Water Resources that is responsible for implementation of the NN's water code legislation, which governs all waters of the NN, both surface and groundwater. A permit application for use of NN water is available at: http://www.watercode.navajo-nsn.gov/links.html. A Provisional or Import Permit is also required in order to import water onto the NN. This application is one-page and is available at the same website above. Additional general water code information is available at: http://www.watercode.navajo-nsn.gov.
Navajo Nation EPA (NNEPA) – Public Water System Supervision Program P.O. Box 339 Window Rock, AZ 86515 Yolanda Barney Program Supervisor 928-871-7715 ybarney@navajopublicwater.org	**Public Water System Permit**	Water use by the proposed project	Not specified	None noted	The USEPA has delegated authority to administer the Safe Drinking Water Act and issue public water system permits on the Navajo Reservation to the NNEPA-Public Water System Supervision Program (PWSSP). The PWSSP ensures that regulations are met for each regulated pubic drinking water system on the Reservation. The PWSSP is under the Surface and Groundwater Protection Department, responsible for protecting the waters of the Navajo Nation. Further information is available at: www.navajopublicwater.org
Navajo Nation Dept. of Fish & Wildlife P.O. Box 1480 Window Rock, AZ 86515 Gloria Tom, Manager Navajo Nation Dept. of Fish & Wildlife 928-871-6450 Samuel Diswood Wildlife Manager Navajo Natural Heritage Program 928-871-7062 sdiswood@nndfw.org Other contacts within Natural Heritage Program: Botanist-Andrea Hazelton Zoologist-Chad Smith Environmental Reviewer-Pam Kyselka Environmental Tech-Sonja Detsoi	**Biological Clearance, wildlife coordination, Navajo Nation Endangered Species Act**	Potential wildlife impacts involved with construction of the proposed project	None noted	None noted	Navajo Nation Department of Fish & Wildlife (NNDFW) is within the Navajo Nation Division of Natural Resources. Letter can be sent to Sonja Detsoi, Environmental Technician and fee of $65 to obtain a list of federal- and Tribal-listed species. Tribal-listed species are on the Navajo Endangered Species List and have cultural significance. Letter should also identify the State species that Tetra Tech has identified in their BIA and DOE environmental documentation. Pam Kyselka, Environmental Reviewer deals with compliance issues regarding biological resources. A Data Request Form would need to be obtained from the NNDFW Natural Heritage Program. Website is: www.nndfw.org Mandatory items to support the Data Request Form are GPS Coordinates, and a 7.5 minute map. A list of approved biological resource companies (Navajo-owned companies or outside contractors) is available on the NNDFW website. Additional firms not yet approved can obtain permit to operate on Navajo lands through NNDFW. A Biological Land Use Clearance Map has been developed for the Navajo reservation. NNDFW and the NNDFW Natural Heritage Program have this information. The status of Tribal Lands (e.g., Trust; Tribal; Allotted - considered private to a certain extent; Fee Simple)

PERMITTING AGENCY	PERMIT	TRIGGER	APPLICATION TIMELINE	PUBLIC PROCESS	COMMENTS
					determines what categories of species are addressed. For example, for private/fee simple lands, no review for Navajo species (species having cultural significance for the Navajo) is conducted, only for federal T+E species. The Navajo Land Department/GIS Program has mapping information on land status within the Reservation.
Navajo Nation Dept. of Fish & Wildlife P.O. Box 1480 Window Rock, AZ 86515 Jeff Cole Project Manager, Research and Management Navajo Nation Department of Fish & Wildlife 928-871-6450 or 928-871-6451	**Permit for Biological Field Specialist(s) to survey on Navajo land**	Potential for wildlife impacts to be associated with construction of proposed project	Allow at least 2 weeks for permit to process	None noted	It is anticipated that a biological investigation will be necessary to evaluate potential biological impacts that may result from the project. In order to conduct a biological investigation, the NNDFW requires the procurement of a Scientific Collecting/Biological Investigation Permit. Biological resource field work can be performed by Tetra Tech or another approved subcontractor, but field personnel must first secure a permit to perform biological resource surveys. A completed application must be submitted to NNDFW along with a cover letter, study plan, and biological staff SOQs. The permit application can be accessed via the following link: http://www.nndfw.org/NNHP/bio_permit.pdf A list of currently-approved biological resource contractors for Navajo lands can be obtained at the NNDFW website: www.nndfw.org/bi_consult_list_2014.pdf
Tribal Historic Preservation Officer (THPO), Navajo Nation Historic Preservation Department, Division of Natural Resources, Navajo Nation Historic Preservation Department, Window Rock, AZ 86515 928-871-7134 928-871-7198 Cultural Resource Compliance Section Staff Ronald P. Maldonado Supervisory Archaeologist P.O. Box 4950 Window Rock, AZ 86515 928-871-7134 928-871-7198 ronpmaldonado@navajo-nsn.gov Tamara Billie Senior Archaeologist tamara_billie@yahoo.com	**Consultation under NEPA and Section 106 of the National Historic Preservation Act (NHPA) of 1966 (36 CFR 800)**; Cultural resources are also protected under the **Navajo Cultural Resources Protection Act (CRPA).**	Issuance of permit or license by federal agency, or expenditure of federal funds (excluding undertakings that do not have the potential to affect historically-significant properties)	Consultation process must be completed before construction begins. The Navajo process through the NN Historic Preservation Department (HPD) is to: engage approved contractor and obtain permit to perform cultural resource field surveys; perform the records search and field surveys; submit the Survey Report; receive comments and revise the Survey Report; complete a Compliance Form (form identifies resources) and provide to BIA for review; BIA generally approves the Compliance Form. Total amount of time required for consultation process is dependent on the scope and complexity of the project, and is typically 3 to 12 months, but can take longer	Extent of formal public involvement depends upon scope, complexity, and number of historic resources affected by the federal undertaking, and input from THPO	The NN Historic Preservation Department (NNHPD, within the Division of Natural Resources) is the NN agency responsible for the protection, preservation and management of the NN's cultural resources. The US Dept. of Interior, National Park Service has delegated certain responsibilities of the National Historic Preservation Act to the NN. The NN Tribal Historic Preservation Officer (THPO) assumes State Historic Preservation Officer (SHPO) functions for the NN and tribal lands. Federal and federally-sponsored programs and projects are reviewed pursuant to Section 106 of the National Historic Preservation Act (NHPA), which requires federal agencies to consider the effects of proposed federal undertakings on historic properties. Federal agencies must initiate consultation with the State Historic Preservation Officer (SHPO) as part of the Section 106 review process, which in this case is the THPO. The NHPA seeks to minimize adverse effects of federal undertakings on significant historic properties. Under Section 106, federal agencies must take into account the effects of their undertakings (including the issuance of licenses and permits) upon historically-significant districts, sites, buildings, structures, and objects. The NN CRPA also addresses the protection of cultural resources on the NN. Unlike federal and state laws that emphasize protection of ancient prehistoric sites and historic buildings, the CRPA focuses on Navajo sacred places and cultural landmarks as sites worthy of protection and conservation. Areas of modern cultural importance to the Navajo people are also addressed under the CRPA. Further information is available at: http://dnrnavajo.org/archaeology/cultural-resources-management/ The NNHPD is the regulatory agency addressing cultural resources on the Reservation. The project proponent pays for and conducts the necessary information gathering, evaluation, and related studies. Cultural survey field work can be performed by Tetra Tech or another approved subcontractor, but field personnel must first secure a permit to perform cultural surveys. A list of currently-approved cultural resource contractors for Navajo lands can be obtained at the NNHPD website: http://www.hpd.navajo-nsn.gov A permit from the NNHPD is required for archaeological investigations. The application for a B Permit (project-specific annual permit) is available at the above HPD website and is processed through the HPD.

PERMITTING AGENCY	PERMIT	TRIGGER	APPLICATION TIMELINE	PUBLIC PROCESS	COMMENTS
					As part of the cultural resource records search, the NNHPD requires that you review the non-electronic database of surveys done to date. The New Mexico State database must also be reviewed. NNHPD staff indicated that linear surveys (for oil/gas facilities and roads) have been performed in the eastern lands of the Navajo Reservation where the Bisti Paragon Ranch is located. It is assumed that archaeological field surveys for solar sites within the Bisti Paragon Ranch will be required.
Navajo Land Department P.O. Box 2249 Window Rock, AZ 86515 W. Mike Halona Land Department Manager 928-871-2523 m_halona@frontiernet.net Project Review Section Howard Draper, Program & Projects Specialist 928-871-6490 howarddraper@frontiernet.net Esther Kee ROW Agent 928-871-6490 estherkee@frontiernet.net	**ROW Permit**	Transmission line crossing of an Indian road, trench or bore within Indian road ROW, or alteration of existing intersection(s)	Not specified	None noted	The Navajo Land Department/GIS Program has mapping information on the transportation network within the Navajo Nation. Ms. Key performs site surveys, and deals with local chapter officials.
Navajo Division of Transportation (NDOT) P.O. Box 4620 Window Rock, AZ 86515 Phone:(505) 371-8300 Fax: (505) 371-8399 Karen B. Benally, Transportation Planning Department Manager 505-371-8389 kbenally@navajodot.org.	**ROW Encroachment Permit** **Transportation Permit**	If transmission lines are to cross NDOT roads or property, an encroachment permit is likely needed. Also, transportation of oversize and/or overweight vehicles on NDOT roads may require special permit, depending on the loads required for delivery of project components to site(s).	Not specified	None noted	Additional information is available at: http://www.navajodot.org/
NNEPA Pesticide Enforcement and Development P.O. Box 339 Window Rock, AZ 86515 Glenna Lee Environmental Program Supervisor Pesticide Enforcement and Development 928-871-7815 glennalee@navajo-nsn.gov	**Pesticides Permit** to control Invasive Species	Potential to introduce Invasive Species	Not specified	None noted	Pesticide Enforcement and Development Program is within the Air and Toxics Department that is part of the NNEPA.
Navajo Nation Division of Natural Resources Administration Minerals Department Oil and Gas Division P.O. Box 1910 Window Rock, AZ 86515 Steven L. Prince Principal Petroleum Engineer 928-871-7312 s_prince@frontier.com Other recommended contacts: Brad Neisemeyer, Contract Geologist Akhtar Zaman 928-871-6587	**Informal interaction**	Potential Impact on Minerals/Oil & Gas Leases			Oil/gas leases and gathering lines (small oil pipelines that carry crude oil) will need to be identified so that no conflict occurs. Several Navajo Nation staff have identified the existence of oil and gas activities within the PBR. The Navajo Minerals Department, Oil and Gas Division oversees leases on land within the Navajo reservation. The BLM/ Department of Interior has historically overseen leases on allotted lands. The BLM Federal Indian Minerals Office (FIMO) is located in Farmington, New Mexico. Mr. Neisemeyer has GIS data regarding oil and gas facility locations. Include township and range in GIS data request. Also provide project description and GPS coordinates of the solar site/sites (UTM or Latitude/Longitude).
Navajo Abandoned Mine Lands (AML) Reclamation/Uranium Mine Tailings Remedial Action (UMTRA) Department Madeline Roanhorse Department Manager	**Permit to perform reclamation work**, obtained by NN AML Reclamation	Potential to encounter abandoned (or active) mineral extraction sites	None noted	Individual NN chapters are consulted at regular monthly meetings to inform chapter of AML Reclamation/UMTRA Dept. plans to reclaim abandoned mine(s).	Existence of abandoned mines on Bisti Paragon Ranch have been identified by AML Reclamation/UMTRA Dept. as part of assessment of abandoned mines on Navajo Trust Lands. Priority for reclamation is established through this assessment. Abandoned mines (coal, uranium, other –

PERMITTING AGENCY	PERMIT	TRIGGER	APPLICATION TIMELINE	PUBLIC PROCESS	COMMENTS
P.O. Box 1875 Window Rock, AZ 86515 928-871-6982 mroanhorse@frontiernet.net Other Contacts (requested to be copied on letters to Madeleine Roanhorse): Gilbert Dayzie Civil Engineer 505-368-1409 gdayzie@frontier.com Joni Nofchissey Environmental Specialist 505-368-1220 jnofchissey@frontier.com website address: www.aml.navajo-nsn.org	/ UMTRA Dept. from US Department of Interior/Office of Surface Mining			Individual Chapter needs to pass resolution for work to be allowed. AML Reclamation/UMTRA staff visits residences of persons having grazing rights to obtain signatures approving reclamation work proposed to occur.	reclaimed or as is) may be encountered for Site 4 for southeast area by Highway 57. Joni Nofchissey will respond to environmental questions and requests. She can provide shape files of where the coal mines are located. AML Reclamation/UMTRA staff indicated that the coal seam is close to the surface (within 2'–3') in the area of the large wash just below Site 1. Limited surface mining has occurred here. Other mines cited were Black Mesa, Cayenta, McKinley, and Navajo. Current coal mining activity (within and outside tribal lands) funds the Office of Surface Mining within the Department of Interior. AML Reclamation/UMTRA staff indicate that there are up to 4 mine sites on either side of Highway 371, around Mile Marker 81. The Navajo tribe has responsibility for reclamation of these mines, but they are interested in collaborating if these abandoned mine sites overlap with any of the Bisti Paragon solar sites.
Resource Conservation Recovery Program P.O. Box 339 Window Rock, AZ 86515 Cassandra Bloedel Environmental Program Supervisor 928-871-7816 cbloedel@navajo-nsn.gov	**Informal interaction**	Discovery of illegal waste dumps during project construction			GPS coordinates of any illegal waste dumps encountered during project development would need to be recorded and provided to the NN Resource Conservation Recovery Program, who deals with illegal waste dumps. The new land user assumes responsibility for waste, and the new user is responsible for hauling off the waste.
Navajo Nation Division of Economic Development P.O. Box 663 Window Rock, AZ 86515 928-871-6544 srbp@navajoadvantage.com Anthony Perry Project Development Dept. Manager 928-871-6504 tperrynnded@gmail.com	**Business Lease**	Use of Tribal Land designated for grazing for Renewable Energy Facility	Not specified	None noted	Boundaries regarding grazing within the Navajo Nation are fluid. No fencing is in place. The individual applicable Navajo Chapter would need to provide boundaries.

ACRONYMS IN PERMITTING TABLE 5-4

AML Abandoned Mine Lands
AUM Abandoned Uranium Mine
BGEPA Bald and Golden Eagle Protection Act
BIA Bureau of Indian Affairs
BLM Bureau of Land Management
BUOW Burrowing Owl
CAA Clean Air Act
CRPA Cultural Resources Protection Act CWA Clean Water Act
DOE Department of Energy
EA Environmental Assessment
EIR Environmental Impact Report
EIS Environmental Impact Statement
ESA Endangered Species Act
FIMO Federal Indian Minerals Office
FONSI Finding of No Significant Impact
HCP Habitat Conservation Plan
ITP Incidental Take Permit
MBTA Migratory Bird Treaty Act
NAPI Navajo Agriculture Products Incorporated
NEPA National Environmental Policy Act
NDOT Navajo Department of Transportation
NHPA National Historic Preservation Act
NMSA New Mexico Statutes Annotated
NN Navajo Nation
NNDFW Navajo Nation Department of Fish and Wildlife
NNEPA Navajo Nation Environmental Protection Agency
NHLSA Navajo Hopi Land Settlement Act
NHPA National Historic Preservation Act
NNHPD Navajo Nation Historic Preservation Department
NWP Nationwide Permit
PBR Paragon Bisti Ranch
PCN Pre-Construction Notification
PWSSP Public Water System Supervision Program
ROD Record of Decision
ROW Right-of-Way
SHPO State Historic Preservation Officer
SWPPP Stormwater Pollution Prevention Plan
T&E Threatened and Endangered
THPO Tribal Historic Preservation Officer
UMTRA Uranium Mine Tailings Remedial Action
USACE U.S. Army Corps of Engineers
US EPA U.S. Environmental Protection Agency
USFWS US Fish and Wildlife Service

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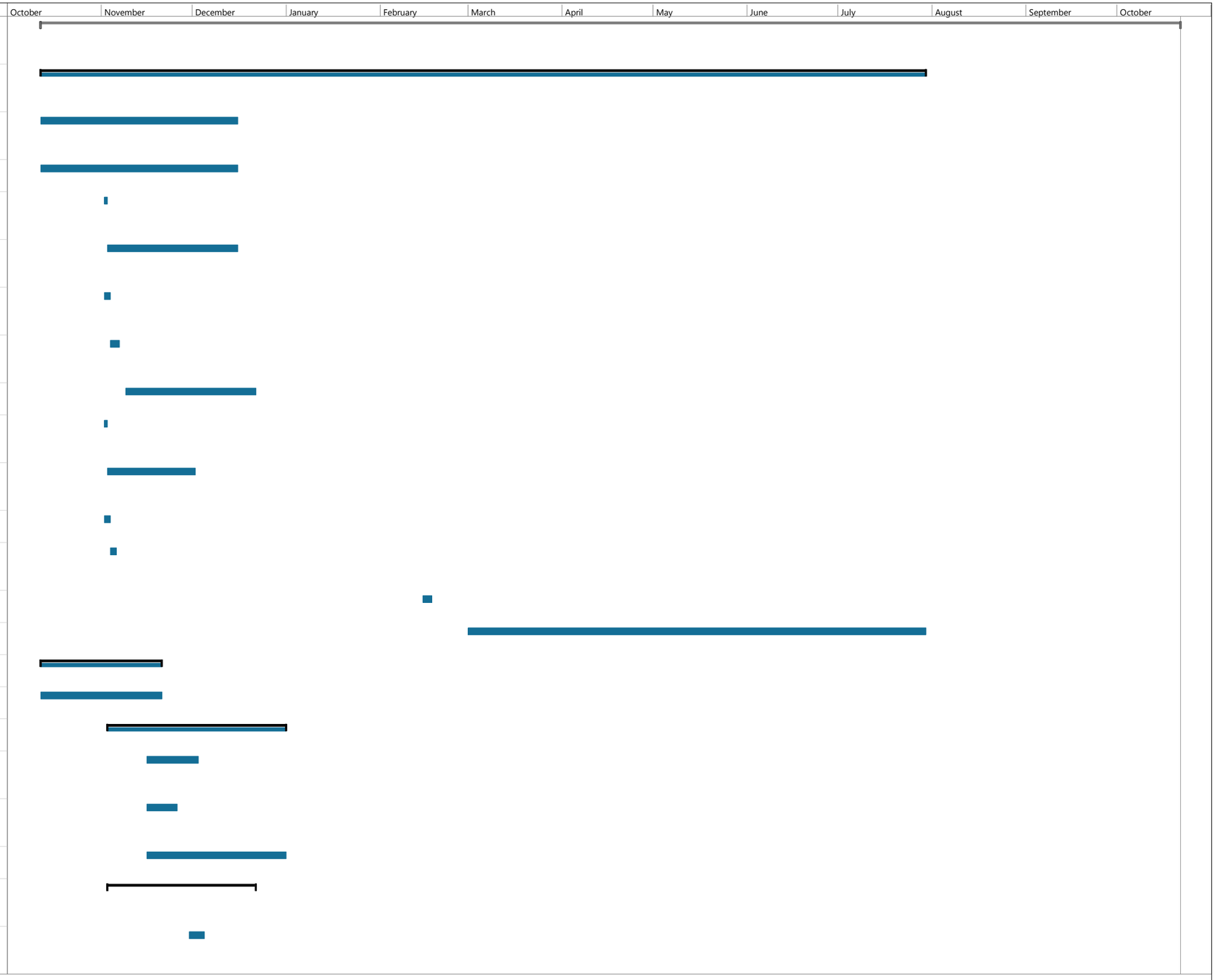
ID	Task Name	Duration	Start	Finish
0	**Project Schedule**	**270 days**	**Mon 10/12/15**	**Fri 10/21/16**
1	**1 Initial Site - Early Environmental Studies, Surveys and Agency Consultation (as necessary)**	**210 days**	**Mon 10/12/15**	**Fri 7/29/16**
2	1.1 USFWS Consultation	47 days	Mon 10/12/15	Tue 12/15/15
3	1.2 New Mexico Dept. of Game & Fish Consultation	47 days	Mon 10/12/15	Tue 12/15/15
4	1.3 Wetlands Field Work Prep.	1 day	Mon 11/2/15	Mon 11/2/15
5	1.4 Wetlands & Waters of the US	31 days	Tue 11/3/15	Tue 12/15/15
6	1.5 Cultural Survey Prep	2 days	Mon 11/2/15	Tue 11/3/15
7	1.6 Cultural Resources Surveys	3 days	Wed 11/4/15	Fri 11/6/15
8	1.7 Cultural Resources Phase I Assessment	31 days	Mon 11/9/15	Mon 12/21/15
9	1.8 Visual Impact Study Preparation	1 day	Mon 11/2/15	Mon 11/2/15
10	1.9 Visual Impact Assessment	21 days	Tue 11/3/15	Tue 12/1/15
11	1.10 Paleontology Survey Preparation	2 days	Mon 11/2/15	Tue 11/3/15
12	1.11 Paleontology Surveys	2 days	Wed 11/4/15	Thu 11/5/15
13	1.12 Biological Resource Field Work Prep	3 days	Mon 2/15/16	Wed 2/17/16
14	1.13 Biological Resource Surveys & Habitat Evaluation	109 days	Tue 3/1/16	Fri 7/29/16
15	**2 Initial Site - Pre-Construction Studies/Plans**	**30 days**	**Mon 10/12/15**	**Fri 11/20/15**
16	2.1 Phase I Environmental Site Assessment	30 days	Mon 10/12/15	Fri 11/20/15
17	**3 Initial Site - Environmental Assessment**	**43 days**	**Tue 11/3/15**	**Thu 12/31/15**
18	3.1 Project Description Details	13 days	Mon 11/16/15	Wed 12/2/15
19	3.2 Need for the Proposed Action	8 days	Mon 11/16/15	Wed 11/25/15
20	3.3 Environmental Setting & Impact Assessment	34 days	Mon 11/16/15	Thu 12/31/15
21	**3.4 Appendicies**	**35 days**	**Tue 11/3/15**	**Mon 12/21/15**
22	3.4.1 EA Checklist	5 days	Mon 11/30/15	Fri 12/4/15



PARAGON RANCH SOLAR PROJECT
Date: 6/1/15

Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Progress
Manual Progress

ID	Task Name	Duration	Start	Finish
23	3.4.2 Technical Reports	35 days	Tue 11/3/15	Mon 12/21/15
24	**4 Initial Site - Permitting**	**245 days**	**Mon 11/16/15**	**Fri 10/21/16**
25	**4.1 Federal Permits (as necessary)**	**100 days**	**Mon 2/29/16**	**Fri 7/15/16**
26	4.1.1 Section 404 Permit	45 days	Mon 5/16/16	Fri 7/15/16
27	4.1.2 FAA Hazard Determination	36 days	Mon 2/29/16	Sat 4/16/16
28	4.1.3 Right-of-Way Grant	22 days	Mon 5/2/16	Tue 5/31/16
29	**4.2 Tribal Permits (as applicable)**	**245 days**	**Mon 11/16/15**	**Fri 10/21/16**
30	4.2.1 Environmental Assessment	245 days	Mon 11/16/15	Fri 10/21/16
31	**4.2.2 Permits Delegated to NN by USEPA or DOI**	**110 days**	**Mon 1/18/16**	**Fri 6/17/16**
32	4.2.2.1 NPDES	45 days	Mon 2/29/16	Fri 4/29/16
33	4.2.2.2 Air & Air Toxics Permit	45 days	Mon 2/29/16	Fri 4/29/16
34	4.2.2.3 Public Water System Permit	45 days	Mon 2/29/16	Fri 4/29/16
35	4.2.2.4 Section 106	110 days	Mon 1/18/16	Fri 6/17/16
36	4.2.3 Biological Clearance	50 days	Mon 7/11/16	Fri 9/16/16
37	4.2.4 Revocable Use Permit	45 days	Mon 2/29/16	Fri 4/29/16
38	4.2.5 Business Lease	21 days	Fri 9/16/16	Fri 10/14/16
39	4.2.6 Right-of-Way/ Transportation Permit	45 days	Mon 2/29/16	Fri 4/29/16
40	4.2.7 Pesticides Permit	45 days	Mon 2/29/16	Fri 4/29/16
41	4.2.8 Minerals Dept. Permit	45 days	Mon 2/29/16	Fri 4/29/16
42	4.2.9 Abandoned Mine Reclamation Permit	45 days	Mon 2/29/16	Fri 4/29/16
43	4.2.10 Permit to Remove Illegal Waste	45 days	Mon 2/29/16	Fri 4/29/16

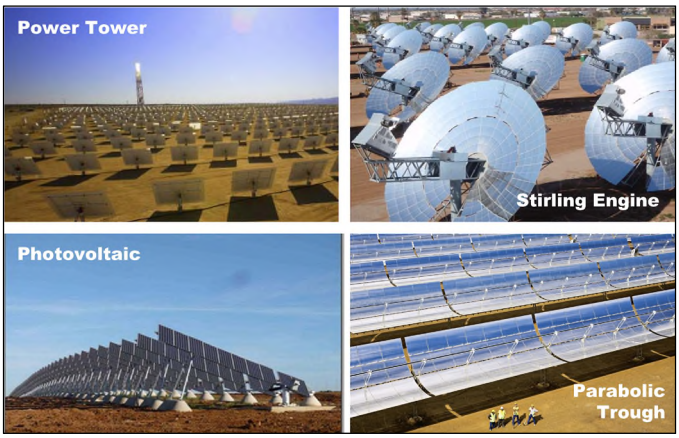
PARAGON RANCH SOLAR PROJECT
Date: 6/1/15

Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Progress
Manual Progress

6. SOCIOECONOMIC AND CULTURAL FACTORS

The socioeconomic ramifications of a commercial scale project of this magnitude are vast and extend well beyond the needs of the Relocatees, will have a positive impact on the NN and could serve as a model for all tribal nations, especially given the extensive land holding of many tribes in prime sustainable energy zones. This program, if fully developed at once, or even developed in phases would rank among the largest in the US and the world.

Benefits. There are clearly many obstacles as cited above which must be overcome to make this project a success, including: land control, grid interconnection and locating an off taker resulting in a PPA. These are all significant challenges, however, these are common with any program of this scope. To advance a program such as this, the same management team which is established to execute the program from a technical perspective, must also be ready to explore the social economic issues and move early to take full advantage of the many benefits this program will offer.



Gaining Support. The PBR solar program will also need strong leadership and support from the highest levels of the NN government, local chapters and community. To date, the existence and progress of this program has been presented on many fronts to the NN. However, given the recent and significant change in leadership at many levels of the government, inc. the President of the NN and executive director of the NHLCO, new leadership must be briefed on the program to gain support. Two-way communication with the community about the program's progress must happen often.

Figure 6-1. Four Solar Power Technologies

Source: Center for Energy Efficiency and Renewable Technology (CREET), 2010.

Training. A very important benefit of the program which must be considered and acted upon early is the education and training of a Navajo workforce, if they are to take part in the planning, construction, management and long term O&M of the site's solar assets. The upfront training could take 6 months to 2 years, the activities associated with construction could take several years, while the O&M could go on for as many decades, 25 years, maybe much more. Resources are available locally for education and training for workforce development. There are offerings from Federal agencies for RE leadership, training, technical support and grant funding and other assistance.

NHLCO and the Office of Navajo and Hopi Indian Relocation (ONHIR) are the primary agencies the team has coordinated their efforts with for successful project development and execution.

6.1 Benefit Assessment (employment, cultural, and social)

As this program moves from the FS phase into pre-construction and beyond, the NN will be positioned to realize both direct and indirect benefits from this solar program. The most tangible direct benefit will result from a viable program that produces long term jobs and results in clean energy for the nation.

6.1.1 Employment

As solar power continues to provide a larger share of our country's (and the world's) energy needs, there will be a growing need for more solar technicians and specialty personnel. This includes manufacturing workers to make solar panels, construction workers to build power plants, installers to install solar hot water and PV panels, and personnel for the O&M phase. Other solar energy jobs might include repairing solar energy systems or working with architects or engineers as they design and install solar projects. Regardless of where panels are manufactured, installation must be performed locally. That part cannot be "offshored".

With the current unemployment rate as high as 13% in the Window Rock area and 40-45% Navajo Nation-wide, a series of projects in the PBR at the sites defined in Section 2 could have tremendous benefit for the NN. The following assumptions and data were applied in developing a model for employment projection for the buildout of solar resources at PBR.

- Sites will be built out in phases based on revenue, growth in demand, demonstrated generating cost and transmission line capacity, present and future. As a result, a trained workforce can move from one project to its successor (the norm), while remaining local (rare).
- Sites can range in size from 50 to 500 MW
- Buildout of the entire PBR could occur over a 20+ year period
- Economic lifespan of a single site/ project could range from 25 – 40+ years

WASHINGTON, DC, Jan. 15, 2015 – *The Solar Foundation (TSF), an independent nonprofit solar research and education organization, today released its fifth annual* ***National Solar Jobs Census*** <*http://TheSolarFoundation.org*>.

The Census found that the U.S. solar industry employed 173,807 Americans in 2014, a figure that includes the addition of more than 31,000 solar jobs over the previous year, representing 21.8 percent growth in solar industry employment since November 2013. Solar employment grew nearly 20 times faster than the national average employment growth rate of 1.1 percent in the same period.

Applying the assumptions above and using the empirical data in Table 6.1 from other recent similar solar projects of comparable scale in the southwestern US, it is anticipated that a solar project on the PBR with a 100 MW nameplate capacity could yield the following in terms of employment.

- 150-1,000 jobs during the construction phase of ***each*** 100-MW campaign (the exact type of solar technology can vary and affect job types)
- Employment period ranging from 2-3 years during construction
- 15-30 jobs during the O&M phase
- Cumulative O&M over the life of one 100-MW ranch might be as much as 400 - 1,200 man years
- Assuming a rollover factor of 2.5, the cumulative impact of this payroll on the local economy over the life of each 100-MW ranch, could be as much as $150-450M.

LARGE-SCALE SOLAR CONSTRUCTION WORKFORCE NEEDS

DEVELOPER	TECHNOLOGY	PROJECT NAME	MW SIZE	AVG # JOBS FTEs PER MONTH	EMPLOYMENT LENGTH
ABENGOA	Parabolic Trough	Mojave Solar 1 Project	250	**830**	2 Years
SOLAR MILLENNIUM	Parabolic Trough	Blythe Solar Power Plant	1,000	**604**	~6 Years
SOLAR MILLENNIUM	Parabolic Trough	Palen Solar Power Plant	500	**566**	3.5 Years
SOLAR MILLENNIUM	Parabolic Trough	Ridgecrest Solar Power Plant	250	**405**	2.5 years
NEXTERA	Parabolic Trough	Beacon Solar Energy Project	250	**507**	3.5 years
NEXTERA	Parabolic Trough	Genesis Solar Energy Project	250	**507**	2.5 Years
TESSERA	Stirling Engine	Imperial Valley Solar	709	**360**	3.5 years
PERMACITY	Photovoltaics	Five 5 MW Systems	25	**500**	.5 year
SUNPOWER	Photovoltaics	California Valley Solar Ranch	250	**353**	~3 Years
TOTAL			**3,484 MW**	**4,632 JOBS/MONTH**	**~3 YEARS**

The survey is a sample, not a census, of all the projects being developed. Prepared by Center for Energy Efficiency & Renewable Technologies

Table 6-1. Large-Scale Solar construction Workforce Needs

Source: Center for Energy Efficiency and Renewable Technology (CREET) Jobs Survey, 2010.

Given that the overall capacity of the PBR is 2,100 MW, the employment benefits could be 21 times the values cited above. Again, the important aspect with regard to the Navajo Nation's planning horizon is the long term impact of a project with a locked-in 30-year future. Figure 6.2 highlights the job types expected and needed for a successful project, as the program grows beyond the first 100 MW. Table 6.3 presents the salary ranges by job type in the O&M phase.

CONSTRUCTION WORKFORCE NEEDS
250 MW PHOTOVOLTAIC SYSTEM
Construction Period Length: ~3 Years

Job Description Average	AVERAGE Monthly Workforce (FTEs)	PEAK Monthly Workforce (FTEs)
Administrators	2	4
Carpenters	12	15
Cement Masons	10	20
Construction Staff	3	6
Electricians	25	50
Engineers	2	2
Laborers	10	20
Operating Engineers	7	15
Operators	5	10
Project and Construction Managers	7	10
Solar Field Craft: Incl's Apprentices, Assistants and Helpers	90	133
Surveyors	4	8
Teamsters	20	30
Welders	15	30
TOTAL	212	353

Source: CEERT Renewable Powerplants Jobs Survey, 2010

Table 6-2. Solar Construction Workforce Skills Mix

Source: Center for Energy Efficiency and Renewable Technology (CREET) Jobs Survey, 2010.

OPERATIONS & MAINTENANCE JOBS EARNINGS
250 MW SOLAR THERMAL POWERPLANT

Job Description	Annual Workforce	Salary (Average)
General: Office Personnel, Administration, Managers	10	$ 126,500
Engineering: Controls, Electrical, Mechanical, Plant and Resource Engineers, Project Analyst, Chemical Technician, Engineering Technician, Operations Supervisors	6	$ 117,500
Maintenance: Mechanical Technicians, Electricians, Equipment Operators, Welders, Machinists, Planners, Equipment Washing Technicians, Auto Mechanics	25	$ 87,800
Operations: Shift Supervisor, Control Operator, Plant Operator, etc.	22	$ 91,100
Unskilled Labor	5	$ 25,000
TOTAL	**68**	**$ 92,600**

Table 6-3. Skills, Resource Loading, and Salaries for 250-MWe Solar-Thermal Power Plant in 2010

Source: Abengoa, and Center for Energy Efficiency and Renewable Technology (CREET), 2010.

6.1.2 Cultural and Social Benefits

RE is making a difference in the lives of people and communities in more ways than one. Most importantly, RE could benefit the individuals and the NN by providing, social, cultural, and environmental benefits that lead to a stronger, sovereign nation. In working with the NN and the NHLCO, the director Raymond Maxx clearly and concisely stated the benefits of the program.

- Doing the Right thing
- Clean and sustainable
- Relocatees benefits

More specifically, the director addressed these areas

- Culture – consistent with tribal goals
- Education & Employment - training and careers
- Economic – income derived from RE resources
- Environmental - Displace hydrocarbon-based fuels, reduce greenhouse gas
- Long-term - clean commercial power, profitable enterprise based on RE

Table 6.4 below details the many benefits of this program from a Native American perspective.

Cultural, Social, Economic & Environmental Aspects	Benefits
Doing the Right Thing - Promote environmental stewardship	• Supports cultural values and commitments to protect Mother Earth • Contributes to the well-being of society through Sustainable Development • Increases popularity of and interest in RE
Environmental	• Reduces use of and reliance on fossil fuel resources • Reduction of pollution and greenhouse gas emissions • Played major role in increasing the popularity of RE
Reducing reliance on foreign oil	• Less reliance on foreign resources for energy • Increases energy security for the nation • Reduces demand, offsetting the economic cost of a barrel of oil
Climate Change	• Concerns for climate change may not be the main reason that the Navajo Nation is developing RE
Secure New Jobs	• New skilled labor force in solar and RE industry – which are healthy • Direct, indirect and permanent job creation • Increases the education level of tribal members
Economic empowerment Revitalizing the Local Tribal Community	• Increases revenue generation • Millions of dollars in local economies • Support the development of financial incentives, such as green tags and tax credits • Provides for possibility of building a manufacturing plant on Navajo land using power from the PBR
Conserve and sustain natural resources	• Protects natural resources for future generations to develop with advanced technologies
Build infrastructure	• Provides long term infrastructure on NHLSA lands in remote location • Promotes self-sufficiency

Table 6-4. Social and Cultural Benefits

Source: Tetra Tech

Figure 6-2 depicts overall benefits of a RE project such as the PBR.

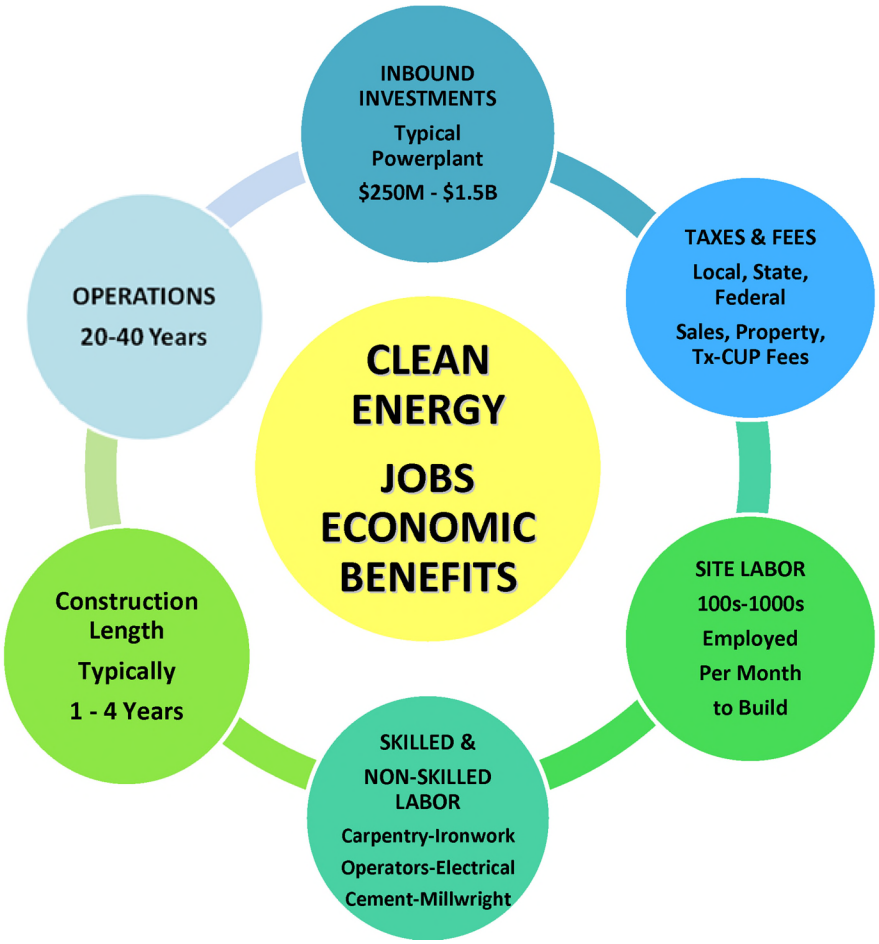


Figure 6-2. Overall Benefits of RE on the PBR

Source: Center for Energy Efficiency and Renewable Technology (CREET), 2010.

6.2 Training and other Tribal Professional Development Planning

The execution of a program of this scale will require specialty skills, training and education at all levels, as shown in Tables 6-2, 6-3, and 6-4. In preparing this report we discussed the needs of the NN with the Navajo Nation Human Resources Department and alerted them to the potential of this program in terms of the many opportunities for jobs and most importantly, the need for skilled labor to compete for these jobs.

> Navajo Nation Human Resources Department's Staffing Philosophy:
>
> "*The Navajo Nation will maintain staffing levels that are based on the objective, priorities and economic resources of the Nation and that result in reasonable workloads and an adequate workforce. The Nation will recruit qualified personnel from within and outside of the Nation in accordance with applicable laws. Applicants will be selected and place based on their qualification in a manner that is consistent with the Nation's preference laws. Qualified Navajos will be given preference in placement, promotion and reduction in force decisions.*"

Assuming the tribe leases the land to a RE developer, the lease agree could mandate the use of a tribal labor force. If the tribe develops a RE project, tribal resources could be applied. However, under either scenario, it is incumbent on the tribe to field qualified personnel in the maximum number of job categories. In general these job categories could be classified as:

- Planning – all aspects of project planning prior to execute
- Management – management of the actual project
- Engineering – all engineering skills to permit and design a project
- Construction – field skills to build the project
- Maintenance – field work for long term maintenance
- Operations – monitoring and controlling the project long term

Planning. An excellent source of training to support all aspects of project planning is the DOE- Tribal Energy Program (TEP) and through which NREL offers workshops on "Tribal Champions" roles, responsibilities and strategic planning. The NHLCO team has taken part in this session. Continued participation in the Annual Tribal Energy Review Conference to collaborate on energy development in Indian Country and share lessons learned by other tribes pursuing RE development is recommended. The TEP assists tribal leaders with the tools to realize their energy visions. This program offers financial and technical assistance to the Navajo Nation through government-to-government partnerships that offer the Nation's leaders opportunities that enable them to evaluate, develop RE resources and to make informed decisions. TEP has the staff experience and purpose to assist the Navajo Nation and other tribes with bringing RE to Indian Country.

TEP offers education and training opportunities through student internships, regional workshops, webinars and RE short courses for those interested in pursuing RE careers to those updating skills from working in coal-fired energy generation to RE generation.


U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Tribal Energy Program

June 24 Webinar to Discuss How Environmental Laws and Regulations Affect Tribal Energy Projects

The U.S. Department of Energy (DOE) Office of Indian Energy, in partnership with Western Area Power Administration (Western), will present the next Tribal Renewable Energy Series webinar, **Regulatory Impacts for Renewable Energy Projects on Indian Lands**, on Wednesday, June 24, 2015, from 11 a.m. to 12:30 p.m. Mountain time.

TEP also offers Grant monies to pay for technical assistance when developing an FS. The National Laboratory Technical Assistance for Tribal Professional Development Planning (offered by NREL) offers the

assistance in strategic energy planning, Grantee support, transmission and interconnection, project development, finance and lease agreements.

Education and training in RE development, engineering, and procurement, is available to Navajo Relocatees, local Navajo (from the five chapters surrounding the project) and unemployed Veterans seeking gainful employment from the project.

Engineering / Operations. There are several professional engineering degrees, registrations and other technical disciplines required to design and execute a large scale commercial RE project such as this. Engineering disciplines may include: mechanical, electrical, environmental, chemical, control systems and several others. In general, these are four year degrees, available at universities and colleges across the country. Given the growth of the RE market space, many colleges are offering specialized degrees related specifically to developing RE assets. Universities in New Mexico, Arizona, Colorado and California have specialized programs in these areas. Again, given the four year commitment required to achieve a bachelor's degree in one of these areas, tribal members interested in pursuing a career in the RE market, should start now.

Skill sets within the NTUA and other technical areas within the Navajo Nation are very well suited to move laterally into a RE technical field.

Construction and Maintenance. This is by far the highest density career field which will see the biggest and most long-term impacts from RE projects. On the positive side, many of the skill sets required are already inherent in the tribal work force. However, several specialized skills such as solar panels installer and maintenance of electrical systems will require additional training.

Local institutions that Tetra Tech examined offer training in the skills needed to participate in paying high-tech jobs in the RE field. Table 6.5 below provides an assessment of these local schools which have been effective in the past in educating Navajo members.

Table 6-5. Local Institutions examined which have been successful in the past in educating Navajo

Mesalands Community College, 911 Tenth Street, Tucumcari, NM 88401	
Associate Degree: 2-Year Programs Wind Energy Technology Applied Science in Building Trades Physical Science Pre-Engineering $2,270/ semester average 15-credit hours **Faculty:** Dr. Phillip Kaatz, Mathematics and Physical Science – 124A, Building A (575)461-4413, ext 128	Mesaland has potential however their main focus is on **Wind Research and Training**, operating a 1.5 MW Wind Turbine. Training experience is to qualify technician. Training is offered for technicians in the following: O&M, Traveling Technician, Commissioner, Sales, and Construction. **Building Trades** program is where students can gain entry-level job skills for employment in the construction field including: Carpentry, Construction Safety, Blueprint Reading, Job-site Etiquette, Applied Design (CAD) and Project Management. **Physical Science** Pre-Engineering concentration is designed for students interested in Renewable Energy, Computer Networks, Nanomaterials, Robotics, Sustainable Infrastructure and more. Program provides students with first two years of college work that can be completed later at four-year college or university for an engineering degree. It is understood that if a large scale Solar program was demanded, the school could focus on Solar specific education

Diné College (5 campuses),

Tsaile Campus, 1 Circle Dr. Route 2, Tsaile, AZ 86556	(928) 724-6600 ext. 6600
Chinle Center, PO Box 1997, Chinle, AZ 86503	(928) 674-3320 ext. 7100
Crownpoint Center, PO Box 57, Crownpoint, NM 87313	(505) 786-7391 ext. 7200
Shiprock Branch, 1228 Yucca St., PO Box 580, Shiprock, NM 87420	(505)368-3500 ext. 3500
Tuba City Center, PO Box 1716, Tuba City, AZ 86045	(928) 283-5113 ext. 7500

Associate Degree: 2-Year Programs

$805/yr. tuition/Fees:

Tsaile campus housing: $5,020/yr.

books and supplies: $1,400/yr.

Contacts:

Patrick Sandoval, Director Crownpoint Center; *psandoval@dinecollege.edu* (505) 786-7391 Ext. 7201

Abraham Bitok, Vice President of Student Success, *akbitok@dinecollege.edu* (928) 724-6623

Cathy L. Bahe, Director Chinle Center, *clbahe@dinecollege.edu* (928) 724-3319

Phyllis Begay, Director Tuba City Center, *ptbegay@dinecollege.edu* (928) 283-5113 Ext. 7501

Priscilla Weaver, Shiprock Campus Director, *pweaver@dinecollege.edu* (505) 368-3522 Ext. 3522

Diné College (offering in the Southwest the most affordable education and training with campuses throughout Navajo Nation:

Public Health; Environmental Public Health Option; Science: Biology Option; Science: Environmental Sciences Option; and Science: General Science Option; and others

Comments: Diné College is a proud pioneer in higher education serving the Navajo Nation since 1968. Diné College has campuses located across New Mexico and Arizona as well as distance learning program options. Diné College serves the needs of each community as a multi-campus institution throughout the Navajo Nation. The community focus is seen in each campus program along with its distinct and specialized faculty. Diné College campuses focus on offering high-quality educational programs, which prepare students for transfer into four-year colleges, universities and/or for entry into gainful employment. Diné College campus directors are ready to work with representatives from Navajo agencies (directors and staff), prospective RE developers and EPC companies, to plan curriculums that serve and educate prospective students and help them achieve their academic and employment goals. Diné College wants to expand their Energy Science and Technology curriculum aimed at supporting local gainful employment in renewable energy careers and other spin-off opportunities. Diné College offers a rich educational environment, known for quality, is accessible and has the most affordable classes

Navajo Technical College, P O Box 849, Crownpoint, NM 87313

2-Year Associate Applied Science Degree in Energy Systems

Bachelor of Applied Science Degree: 4-Year Programs

Bachelor of Science Degree: 4-Year Programs

Tuition/fees: $3820/year

Certificates: Building Information Modeling, Construction Technology, Electrical Trade, Environmental Science, Industrial Maintenance Operations

Lower Point Road State-Main Campus, Crownpoint, NM 87313 (505)786-4100

Chinle Campus, Chinle, AZ 86503 (928) 674-5764

Teec Nos Pos Campus, Teec Nos Pos, AZ 86514 (928) 656-3600

Navajo Technical University is committed to offering quality technical, vocational, and 2-year / 4-year academic degree programs. Degree programs in energy systems program teaches students the fundamentals of electricity, magnetism, photovoltaic electrical systems, and wind generation. Program emphasizes techniques to harness the earth's renewable energy sources. Students study energy related applications, design and installation, and renewable energy topics. Students learn residential and commercial wiring techniques, programming controls and electrical motors. Students also learn to apply the National Electrical Code (NEC) for safe and reliable electrical installations. Solar street lighting, photovoltaic electrical systems, wind turbine fabrication and installation, and collection of wind resources are covered in addition to stand-alone, grid-tied, and net-metering systems. Students explore science, mathematics, technology, and engineering while they study the transformation of mechanical energy to electrical energy. The degree programs offer hands-on training that will not only prepare students to compete for job opportunities in the traditional construction and service-related industries, but also meet the challenge for the growing demand in the development of eco-friendly renewable energy systems

San Juan College School of Energy, 800 S. Hutton Road, Farmington, NM 87401, (866) 426-1233	
Associate Degree: 2-Year Programs Technical Degree: 4-Year Programs	Programs: Lease Operator, Natural Gas Compression, Safety, Oil and Gas Industry Training courses
Contacts: Nancy L. Sisson, Workforce Development Director sissonn@sanjuancollege.edu (505) 566-3742 **AAS Occupational Safety Program** 3535 East 30th Street, Farmington, NM 87402 (505) 566-3892 **Renewable Energy Program**. Farmington, NM 87402 (505) 327-5705	San Juan College School of Energy is close to the Paragon-Bisti project site and considered one of the most qualified to support training needs. San Juan College School of Energy offers education and training that aligns with the rapidly evolving energy industry in New Mexico and the U.S. Offered are professional 2-year and 4-year degree and certificate programs. The School of Energy also offers CDL training and degrees in Solar Energy and Occupational Safety. The Center for Workforce Training (CWT), at San Juan College is structured to be a customer-guided, hands-on partner to provide professional and technical training needs of industry. CWT offers first-rate, cost effective courses, programs and consulting services which result in improved performances and outcomes for the participating individuals, organizations, and businesses. CWT welcomes suggestions so they may design programs that will meet your training needs

Source: Tetra Tech

It is very encouraging that many of these schools have established programs in the energy field and are focusing on RE classes and other related degree fields. It is recommend and was indicated from our interviews that these colleges have the flexibility, based on meeting with RE developers, to alter or create a program suited the needs of the industry and contractors in this area.

TEP and other educational opportunities and trainings strengthen the knowledge base of leaders and decision makers in RE development and supports the development of skills for a qualified workforce. Having developed a strong knowledge base in RE development helps the Navajo Nation play a large role in reducing project risk and thereby attract developers and private capital investment. Being trained and well informed, helps all members of the development Team understand the operating context, constraints, and language; and improves communication and collaboration. Education and training support work together to define a common goal that moves the project forward through an understanding of terminology and processes.

Navajo Nation Human Resources Department's Development and Training Philosophy:

"*The Navajo Nation will provide training and other developmental opportunities that ensure employees reach their full potential and provide the Nation with the maximum return on its investment in employees. Career management programs will be established and maintained. These programs will provide employees adequate growth opportunities and allow the Nation to ensure there is an adequate supply of qualified personnel. Adequate and timely job specific training will be provided to ensure employees have the necessary skills and knowledge to perform their jobs and to meet performance expectations.*"

6.3 Anticipated Benefits to Navajo Nation Members Resulting from the Project and Supply Plan for Assessing those Benefits

Benefits for the Navajo Nation Members. Benefits are potentially vast and have been described above from an employment, social and cultural perspective, in Section 6.2. Although all members of the NN will benefit from a series of RE projects, it must be remembered, that the primary focus and the reason these lands were allocated, is for the direct benefit of the Relocatees. This region was promised jobs from coal mining and development of coal electrical generating power plant. There were even plans for a new town. The benefits to the Navajos who were relocated from their ancestral lands in Arizona would benefit from the increased revenue stream in direct and indirect business spin-offs.

When the sites are developed and producing RE, millions of dollars in annual revenue for the Relocatees can be realized.

Plan to Assess the Benefits. The most tangible and direct manner in which to access the benefits derived from the NHLSA lands will be to measure the revenue generated from the projects as they evolve. It will be up to the NHLCO to determine the distribution within the relocate community. The revenues cannot mitigate the adverse impacts from their relocation but they can provide funds for education, health care, sanitation and other services for their children and grandchildren for years to come. The lands where development is planned was acquired is for the Relocatees' benefit.

The benefits will be assessed through an evaluation of employment statistics, new business enterprises, and completion of secondary education or RE training. Other benefits include significant revenue generation from the collection of taxes by the Navajo Nation.

6.4 Efforts Taken or to be Undertaken to Gain Tribal Community Support and Tribal Leadership Support

This program has been under consideration, review and study since 2009. Since that time the program has been presented and briefed at many levels at community meetings by the past two NHLCO directors, Raymond Maxx and Roman Bitsue. Using briefing material, handout and maps prepared by Tetra Tech, they have visited many Navajo Chapters and communities to discuss the benefits of RE on Navajo lands and this project in particular. This has been especially true in the eastern region where the PBR is located. There have also been three other minor studies of the RE potential of this property which have also resulted in community outreach and support of the project.

At this time, the immediate Chapters surrounding the RE project area have very little development and most of the jobs are in distant places in Crownpoint or Farmington. With this project comes the promise of potential jobs in the area. This was discussed with Larry Roger, East Lands Chapter President. Representing his chapter, he is in favor of the project and the opportunity for employment in the immediate areas.

Since the Tetra Tech contracts and modification describing this project have to be reviewed by the tribal council and ultimately signed by the president, it is assumed that education on the program and support of the program has been achieved with each new approval action. The recent challenge concerns the election of the new president and change of leadership in many committees and directorates. Introduction of new stakeholders requires a renewed focus on outreach and education process, which must start with the new NHLCO Executive Director Wenona Benally and extends from there. Gaining and maintaining project support will be accomplished by scheduling periodic project up-date sessions, meeting with community leaders and service providers and maintaining effective communication.

Presentations, Meetings and Discussions held to gain support:

- September 2013, Farmington, NM. The project Team presented and held discussion with over 75 Navajo members including: President Ben Shelley, Navajo Council delegates, Chapter representatives, Tribal elders, Tribal committee members, staff, and NHLCO Director Raymond Maxx, and many other leaders and stakeholders.
- From 2010 to 2014, project Team presented and held discussions at multiple locations: Albuquerque, NM; Window Rock, AZ; Phoenix, AZ; Farmington, NM and at the Project site in San Juan County, NM with the staff and Director from the Navajo Hopi Land Commission Office. At these meetings there were other Eastern Agency Tribal representatives and stakeholders present and contributing to the discussions.
- 2012-2015 Updates provided to the NHLCO team
- 24 September 2014. Briefing to NHLCO Oversight Committee under Chairman Walter Phelps – briefing conducted to provide an update on the FS. All comments were positive.
- then-Legislative Director Anthony Peterman / now Energy Advisor to Speaker of the Council – provided large-format maps, briefing book, and in-person overview of the program. Only positive comments were received and he offered to assist finding developers
- Meeting NNEPA – meeting held to discuss project requirement from an environmental perspective
- NN Energy Advisory Committee (EAC) acts as the president's advisor on energy policy – program updates provided. EAC holds key responsibility for the approval or granting of land leases, permits, rights-of-way, and water rights for energy developments that include wind and solar. We know and can direct others to work with the EAC who coordinates the review process by sharing information and resources. The EAC's key goal is to optimize the long-term benefits, economic and otherwise, realized by the Navajo Nation from RE developments on Tribal trust lands. The EAC sets policies regarding land lease terms and rental/royalty rates, allocation of development rights, and project ownership by the Navajo Nation and its agencies. The future selected developer will be directed to show the EAC their development plans in order for the EAC to use its comprehensive financial model to evaluate project ownership structure options and royalty/lease rates and to estimate the prospective economic benefits that will be realized by the Navajo Nation and its agencies. The EAC has experience since 2011, enhancing Navajo capacity for conducting business, attracting investment and planning options for future economic development
- Meeting with Office of the Navajo Hopi (ONHIR) providing program update and seeking direction
- Meeting with NTUA. Discussion of PPA and off-takers' options for selling RE.
- The Team has prepared written material, produced visual and audio materials, identified audiences and media, and presented and distributed educational materials. There have been and will need to continue to have follow-up activities with stakeholders from Eastern Agency and representatives from the five Chapters surrounding the Project.

6.5 Efforts to Implement the Resultant Project

The plan is to continue discussions, meetings and Grant application support for the Navajo-Hopi Land Commission playing the lead role in working with the five local Chapters, ONHIR, BIA, NTUA and others to develop the RE program on the Paragon-Bisti area for the benefit of the Navajo Nation and the Navajos relocated from their ancestral lands in Arizona. The two former Presidents -Joe Shirley and Ben Shelley have been present at some of the Project presentations with question/answer discussion sessions following. The newly elected President Russell Begaye must be briefed as soon as possible if this program is going to maintain the momentum earned over the last five years. With the completion of this FS, there is no future action planned to move into the next phase. A tribal champion must be appointed as discussed in the section on Next Steps.

"Solar energy project proposed for Paragon Ranch"

By Noel Lyn Smith, The Daily Times

UPDATED: 09/27/2013 10:39:44 PM MDT

From left, Scott Prosuch, senior program manager at Tetra Tech; Roman Bitsuie, senior program specialist with the Navajo-Hopi Land Commission Office; and Robert Kennedy, senior systems engineer at Tetra Tech; look on Tuesday at a map from the Navajo Land Department of Paragon Ranch during a visit to site one of the proposed Paragon-Bisti Renewable Energy Ranches off N.M. Highway 371. (Augusta Liddic/The Daily Times)

Figure 6-3. Local Press Coverage of the Public Kick Off, 24 September 2013

Source: Daily Times/Four Corners News

7. NEXT STEPS FOR DEVELOPING THE SOLAR ENERGY PROGRAM

The intent of this section is to provide the Navajo Nation and NHLCO with a guide for planning future steps in the execution of a large-scale RE project on tribal lands. This section provides a roadmap and common language for working between all stakeholders involved in a large-scale commercial energy project, to include the developer, capital investors, EPC contractors, environmental regulators, consultants, utilities/off takers, and other regulatory agencies. A successful project must seek to reduce the risk for the developer and investor.

Each phase in project development from defining the project through long-term operation and maintenance of the site is discussed and includes steps that must be taken by the Navajo Nation and NHLCO to complete the project.

The following information sources were used in the preparation of this section:

- U.S. Department of Energy, Office of Indian Energy. 2013. Developing Clean Energy Projects on Tribal Lands, Data and Resources for Tribes, Revised April 2013. DOE/IE-0015. Accessed online at indianenergy@hq.doe.gov in March 2014.
- U.S. Department of Energy, Federal Energy Management Program. 2013. Developing Renewable Energy Projects Larger Than 10 MWs at Federal Facilities – A Practical Guide to Getting Large-Scale Renewable Energy Projects Financed with Private Capital. DOE/GO-102013-3915. March 2013. Accessed online at: femp.energy.gov in March 2014.

7.1 Should the Tribe be a Passive or Active Player

One critical programmatic decision the tribe must make early in the process is the level of involvement they wish to commit to the project. The Navajo must assess tribal resources and willingness to engage the project. That decision is beyond the scope of this study and concerns a very long-term partnership potentially with non-Indian parties on Indian lands:

- EITHER Tribal-owned/operated: PPA's, investors, OR
- Not tribal owned/operated: long-term presence and partnership

The DOE Tribal Energy Program can help tribes evaluate this issue.

7.2 Defining Tribal Steps Necessary for Large-Scale Renewable Energy

This guide provides a project development framework to allow the Navajo Nation, private developers, and investors to work in a coordinated fashion on large-scale RE projects. The framework includes key elements that describe a successful, financially attractive project. This framework begins with the translation between the Navajo Nation and private sector operating environments. When viewing the overall effort of both parties in this framework, four key points are clear:

- The efforts of the Navajo Nation and their consultant, private developers, and financiers are inter-dependent.
- The Navajo Nation can play a large role in reducing project risk and thereby attract developers and private capital investment.
- Each party's operating context, constraints, and language must be acknowledged by the other.
- Partnering is critical to success and often the result of each party working together to define a common goal and an understanding of each other's terminology and processes.

7.3 Defining Success: A Common Goal

For the purpose of this discussion, we assume the Navajo tribe will partner with a developer – at least in the early development phases. The Navajo Tribal Government and the private sector RE developer share a common goal: to establish significant amounts of large-scale RE projects on tribal lands using private capital financing. Federal and tribal statutes set forth requirements and goals for RE; the scale of this effort is very large. The tribe has set a goal of developing up to 2 gigawatts of RE. Thus, private financing must be obtained to achieve these goals. Meanwhile, developers and investors demand a return on their investments. RE projects have proven to be profitable, so investors, eager to find new markets, may be interested in the opportunity of large-scale RE projects on tribal lands.

Figure 7-1 provides an overall view of some of the similarities of process and differences in language from three key perspectives: that of the Federal agencies, private developer, and financier. This translation between the three key parties involved in procuring and supplying privately financed RE projects is the starting point for the development of effective communication and a successful project.

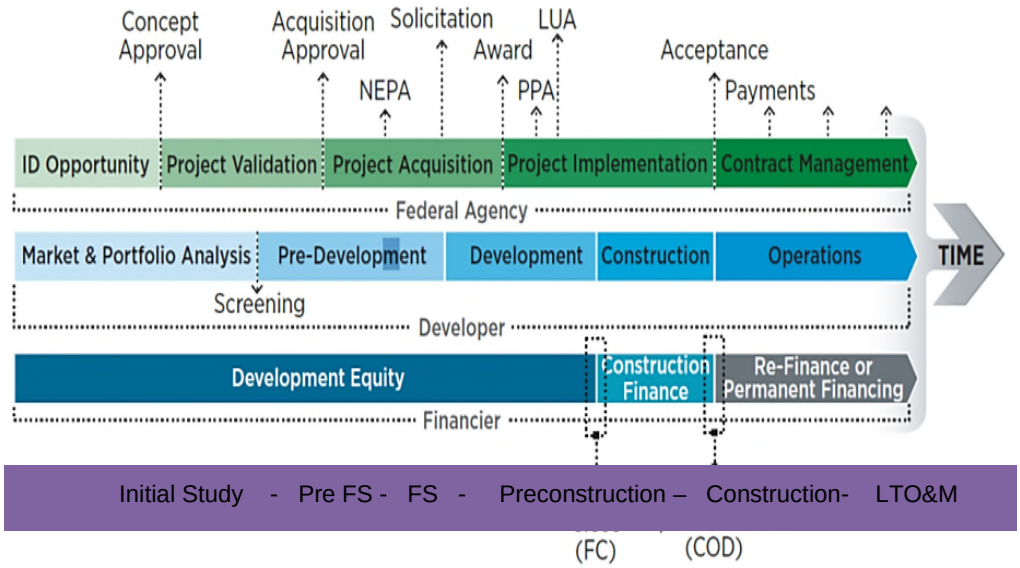


Figure 7-1. Process, Terminology Comparison and Phased Sequence for Project Development

Source: DOE Guide for Developing Clean Energy Projects over 10 Megawatts on Tribal Lands, 2013.

Defining the Opportunity. Given the recent turnover in the tribe's leadership, it is recommended that key personnel dedicate some time to reestablish the direction and goals of the project and use this section to develop a roadmap for the future. From a tribal perspective this would help to validate the requirement, identify internal resource needs (funding, staff, and land control) and assess what external assets are needed to prosecute the program and develop sites in the PBR.

7.4 Phases and Steps to Project Execution

The following discussion addressed the six phases of the project as portrayed in the Figure 7-1 following the Navajo Nation sequence of activities: Initial Study – Pre FS – FS – Preconstruction – Construction – LTO&M. These steps are fairly universal and are used by DOE and within the industry.

The four elements of the project—project identification, development, construction, and operation—are fairly universal, although the language within the industry context can differ somewhat from the generic commercial terms used here.

To successfully attract private financing, a project must be fully defined with risks and unknowns mitigated and allocated to appropriate parties. For developers and providers of capital, judging the success of any project at its earliest stages depends on having a market, a way to get to the market, and the ability to obtain all of the relevant permits. The project development process ends with either an active decision to abandon the effort or successfully securing project financing and the subsequent start of construction. The level of effort and investment required to fully define a project can be quite significant and in this case is being supported through grants and other financial sources.

For the purposes of this report, the project development phase is broken down into three stages:

1. Market and Portfolio Analysis
2. Pre-Development
3. Development

These are generic commercial terms; those working from the tribal or federal context may recognize terms such as:

1. Opportunity Identification
2. Project Validation
3. Project Acquisition

These represent roughly the same activities with different naming conventions than the commercial terms mentioned above. A translation between these sets of terms is shown on Figure 7-1.

7.4.1 Phase I. Market and Portfolio Analysis/Feasibility Study

The first phase of project development does not focus on a project, which may just be a concept at this stage. Phase 1 focuses instead on the market fundamentals that define or influence the project's operating environment. A project opportunity positioned in a market with supporting fundamentals has a strong economic business case, development and operational risks that are acceptable to all parties, acceptable technology or performance risk, site characteristics suitable for a given technology, supportive policies, and an execution pathway providing either access to markets or financing, or both.

Developers identify market opportunities at several levels, and some of these levels are related to their core business model. By focusing on a set of technologies, or renewable resources, or other areas where the company may have a market advantage, the developers often have a shorter timeline in assessing a particular set of project opportunities than federal agencies do. Some of the background work may have been done when setting up the company or developing the company business plan.

This also introduces unique risk, as a project may face difficulty when market conditions change during the planning process.

7.4.1.1 Elements of Project Fundamentals

The Federal Energy Management Program has adopted the following five elements or categories from an NREL-developed framework to help organize the information required to establish sound project fundamentals.

- Baseline. An objective analysis of the current energy market for the site that defines the market-based drivers supporting or motivating the development of the project.
- Economics. Fundamental energy economics must be established—both in terms of the market price of acquiring energy from existing sources and a premium for RE.

- Tribal Policy and Contracting. Policy, contracting accessibility, and function and execution authorities must be addressed prior to expending significant resources pursuing a project. The contracting authority and legal basis to issue the land lease and manage the construction and long term operations and maintenance are also requirements.
- Technology. Fundamental technology assessment and analysis may be the most straightforward part of establishing project fundamentals. This assessment should include a constructability review to establish fatal-flaw site constraints
- Consensus. Building from the technology aspects of this report, identifying key stakeholders (including tribal chapters, communities and non-governmental organizations) and then communicating with and consensus-building among those project stakeholders is vital. To generate buy-in, a common understanding of the project's objectives and fundamental characteristics, and a unification of purpose are essential.
- Portfolio Analysis with NTUA. In conjunction with an analysis of project fundamentals, or market analysis, a portfolio level view can be established. This Feasibility Study addresses not only each potential project on its own merits of technical feasibility and market environment, but also the project within the context of the agency's portfolio of opportunities to choose the most valuable, feasible projects.

7.4.2 Phase II. Pre-Development

The Pre-Development stage is meant to identify significant barriers to ultimate project execution prior to significant investment of time and money in the development stage. The goal of this stage is to uncover any fatal flaws with minimal investment of time and money and to confirm and establish project economics and the feasibility of obtaining all necessary agreements, approvals, permits, or contracts from third parties—without contracting or formally applying for them.

Depending on the method of financing, early project development stages may be conducted and led by the Navajo Nation with support from federal agencies and consultants firms such as Tetra Tech. Agency leadership in the Pre-Development stage is important because the project at this stage is likely to be too risky to command an economic energy price, or perhaps any interest from the private sector at all. By performing some early development activities for the project, the agency can reduce the project risk. Lower risk will reduce the returns necessary for the developer and may lower the price of power for the Navajo Nation.

Early development activities can consist of creating a financial model, or "pro forma," (previously addressed in Chapter 4) for the project to "run the numbers" and evaluate sectors. Developers use their own proprietary *pro forma* analysis to assess these elements, and they apply their own risk tolerance and professional judgment to a project. Other activities may include:

- Establishing that the site is available for development and transferrable to a private sector entity
- Producing a critical issues analysis (CIA) report
- Confirming the renewable resource with site-specific data collection
- Establishing a dialogue with potential off-takers or purchasers of the RE produced by the project
- Site-specific renewable resource assessment
- Export markets and transmission and inter-connection considerations
- Economic analysis
- Environmental assessment (i.e., environmental impacts anticipated from project development and possible mitigation measures to limit impacts)
- Benefit assessment (e.g., employment, cultural and social)

- Preliminary system design(s)
- Training and other tribal professional development planning

At the end of Phase II, the project is likely ready to be offered to the public through a competitive procurement. The data needed to create a government solicitation include a large amount of this information.

7.4.3 Phase III. Development

Once a potential project is found to have strong fundamentals in Phases I and II, it moves into Phase III, Development, in which the information needed to close a deal is generated, verified, and compiled as the basis of an executable transaction. In keeping with prior discussion, it can be expected that developers of large-scale projects would require an off-take agreement or PPA prior to investing in Phase III.

In Phase III, the investment required by the developer or Navajo Nation may increase dramatically as all the necessary documentation for the project is generated and negotiated by engineering, contract, and legal professionals preparing the project for financing and construction. This effort can entail significant resources (1% to 5% of total project costs), and can take from 9 months to 3 years (or more). In normal projects, this stage has two parts:

1. Detail developed by the *Navajo Nation* in order to issue a competitive process document and negotiate it through to acquisition award.
2. Detailed development work done by the *project developer* selected to implement the project.

Activities supporting this phase include:

- Developing the RFP or other acquisition agreement (instrument)
- Negotiations, awards, and ensuring compliance with the requirements of the contract
- Establish financing method to be employed
- PPA
- Land use agreement.

For planning, there are seven categories of information from an NREL developed framework that can be used to organize and evaluate the risks and investment decisions required. These categories form a framework of information on which an iterative process is conducted, supported by tools such as pro formas and development checklists or questionnaires. Project Development Framework Categories are:

- **Site**. An investor must be assured that he or she has access to the site for construction and operation of the facility for the term of the contract (Site Control). The Navajo Nation must also especially understand whether the site is affected by any restrictions or withdrawal terms, which affect terms of land use.
- **Resource**. The renewable resource under consideration (sun, wind, biomass, or geothermal) needs to be characterized and understood at a level of detail and confidence appropriate to the project's stage of development. Whether the government or developer is investing in this resource data is an important consideration and can impact the viability and marketability of a project.
- **Off-take**. The off-take agreement is a PPA or other agreement that includes the terms of sale of energy between the developer and the utility company. Other characteristics of output of the project (such as RECs) need to be addressed in this phase to help pay for the project. Also included are:
    - Transmission access and related agreements necessary to get the power to the ultimate power purchaser
    - Terms of the PPA and other agreements

  - Rates proposed for the sale of power and RECs
- **Permit**. All permits necessary for project construction and operation—including environmental regulations, such as compliance with the National Environmental Policy Act (NEPA) local electric utility interconnections, and necessary transmission rights or facilities.
- **Technology**. This begins with the technical design feasibility of a given technology that was developed in earlier project fundamentals work and becomes more detailed through the project development process. This work culminates in the final selection of all technology vendors and manufacturers, securing quotes from EPC contractors, selecting the team, and executing all supporting and related documentation such as warranties, guarantees, and performance requirements.
- **Team**. A qualified team would be assembled consisting of tribal and consultant services representing all aspects of the project including technical, financial, contracting, legal, real property, master planning, environmental, and operational. Investors will look for a qualified and committed tribal team with requisite experience and capability.
- **Capital**. Development capital is invested by developers to put all project development elements in place: Site, Resource, Off-Take, Permits, Technology, and Team. Raising and closing this financing is the final element in project development. It is important to note, however, that capital requirements do not begin at construction; they are required throughout the multi-year development process.

7.4.4 Phase IV. Project Construction

Once a developer is selected by competitive process award, the Navajo Nation's role changes to supporting and monitoring the developer's implementation plan. This is a significant change from the traditional role of reviewing and approving designs and managing construction. Generally, the NHLCO will be primarily concerned that the developer can deliver and operate the project within the standards defined in the contract. Key government elements in the process include execution of the land use agreement and completion of the terms of the PPA (contract execution). The rest is up to the developer.

During this stage, the developer completes the project financing, design, and permits for construction, thus completing the development. Once the developer completes the financial close milestone, construction begins. For tribal agencies, this implementation stage includes construction, which is a separate stage for the developers and financiers. All the stages converge again at the COD, which may coincide with any necessary Navajo Nation acceptance of the project.

7.4.5 Phase V. Contract Management/Long Term Operation & Maintenance (O&M)

The process moves from implementation into management once the power plant has been commissioned and is online. The commercial term for this is COD. At this point, the developer has met the requirement to build a power plant capable of operating at contract outputs. Thereafter, the developer operates and maintains the plant to continue to produce energy at the contracted levels. The government ensures that the quantity and quality of energy meet the specifications and pays for that energy. To minimize the risk of a project failing at a later stage, the Navajo Nation can require regular review of the operations, maintenance, and capital reinvestment plans of a project, but only to the extent that operational problems are affecting the generation and delivery of the contracted energy, and in line with project contracts and agreements.

7.5 Project Development Stages Possible Funding Options to Implement the Resultant Project

For all phases leading up to development, capital to support elements before construction are critical. Several sources such as DOE, Department of the Interior, BIA, and others are available to support the NHLCO.

Funding and Financing Opportunities

IEED Energy and Mineral Development Program Grants

Applications due: June 23, 2015
Eligible entities: Federally recognized tribes

The Secretary of the Interior, through the U.S. Department of the Interior's (DOI's) Office of lndian Energy and Economic Development (IEED), is soliciting grant proposals from federally recognized Indian tribes and tribal energy resource development organizations for projects that assess, evaluate, or otherwise promote the processing, use, or development of energy and mineral resources on Indian lands. Grant awards are subject to the availability of funds as appropriated by Congress and allotted to IEED.

Proposals must be used by an Indian tribe for the development of a tribal energy and mineral resource inventory, a tribal energy and mineral resource on Indian land, or for the preparation of a report necessary to develop energy and mineral resources on Indian lands. Evaluation of applications will promote community-scale energy development. Local-impact power generation promotes sovereignty, energy independence, security, reliability, diversification, environmental benefits, sustainability, and stronger Native economies.

The preferred method of submitting grant proposals is via email at IEEDGrants@bia.gov, Attention: Bernie Toyekoyah. Proposals can also be mailed to Bernie Toyekoyah at 1 Mile North on Highway 281, P.O. Box 368, Anadarko, OK 73005, but must be received by the June 23 deadline.

Learn more.

If you have questions about the application process, please contact Rebecca Naragon at 202-208-4401 or email Rebecca.Naragon@bia.gov.

7.6 Barriers that Could Impede the Project will be Identified, Documented, and Plans Developed to Overcome Barriers

From an administrative and management perspective, without focusing on the technical and off-takers issues addressed in the other sections, the following items present a significant challenge to successful project execution. It is highly encouraged that the NHLCO and the Navajo Nation take steps to overcome the following challenges and address the options:

Table 7-1. Challenges and Options

Barriers That Could Impede	Plans Developed to Overcome Barriers
Lack of a common office to manage RE projects	Appoint a Navajo Nation Renewable Energy (NNRE) Director (NNRED) and establish supporting office to coordinate and manage all RE projects over 10 MW across all Tribal Chapters.
Lack of incentive for buying tribal RE	In concert with other tribes and backing from the U.S. Department of Energy Indian Energy office, propose legislation to incentivize the development and associated tax credit for buying RE from tribal lands
Negotiations with PNM	Senior official from the Navajo Nation and the new NNRED to continue to meet with PNM to develop options for producing energy on tribal lands in New Mexico and transmission on PNM lines
Depth of technical expertise	Engage the service of a technical consulting firm to augment the NNRED and assist in planning and execution of projects
Contracting Timeliness	The NNRED would have the authority to enter into contracts and bind the NN in 45 days or less. There are obvious situations which may occur requiring a high authority level; nonetheless, a much more abridged and streamlined process is needed
Lack of a common interface to Industry	Conduct an Industry Day to explain the Navajo Nation's broad plan for developing RE on tribal lands and solicit input from developers on steps and language to help the project succeed
Obtaining additional funding beyond the Feasibility Study	Dedicated members of the NNRE office would work to identify and obtain additional funding to move into the next phases. This could be accomplished in concert with NREL and other federal agencies commissioned to provide this support and funding

It is understood that making these changes in themselves represent a significant commitment; however, without making many of these changes, it will be difficult to execute the program.

7.7 Partnering with Developers

As discussed in the business plan section above, a pathway to initiating the program and developing a site, is to partner with a RE developer to kick off the program. There are many advantages to this options that are also detailed above. Initial discussions have been conducted with three large RE developers. These discussion are all preliminary however, they do show potential in that commercial developers are interested in these tribal lands for RE energy production.

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APPENDIX A

ADDITIONAL ON-LINE RESOURCES

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APPENDIX A

ADDITIONAL ON-LINE RESOURCES

Foundational Courses – To augment the Navajo's progress in developing the PBR for renewable energy technologies, several courses are provided under the U.S. Department of Energy (DOE) Tribal Support program. A topical overview of foundational information on renewable energy technologies, strategic energy planning, and transmission grid include:

- Assessing Energy Resources
- Biomass
- Building Heat and Hot Water
- Electricity Grid Basics
- Geothermal
- Hydroelectric
- Solar
- Strategic Energy Planning
- Wind

Webinars are available at the National Training and Education Resource (NTER) website at *www.nterlearning.org*. Search for "Indian Energy."

Additional On-Line Resources

- DOE Office of Indian Energy Website *www.energy.gov/indianenergy*
- DOE Office of Indian Energy Resource Library *www.energy.gov/indianenergy/resources/energy-resource-library*
- DOE Office of Indian Energy Newsletter *www.energy.gov/indianenergy/resources/newsletter*
- DOE Office of Indian Energy Renewable Energy Curriculum *www.nterlearning.org*
- DOE Office of Indian Energy START Programs *www.energy.gov/indianenergy/resources/start-program*
- On-Demand Technical Assistance *www.energy.gov/indianenergy/technical-assistance*
- Tribal Leader Energy Forums *www.energy.gov/indianenergy/resources/education-and-training*
- Tribal Renewable Energy Webinar Series *www.wapa.gov*

Additional On-Line Resources-Environmental Study and Project Permitting

- NN Department of Fish and Wildlife-Biological Consultant List www.nndfw.org/bi_consult_list_2014.pdf
- NN Heritage Program-NN Department of Fish and Wildlife-Navajo Endangered Species List www.nnhp.nndfw.org/nnhp_nesl.pdf
- Tribal Energy and Environmental Information Clearinghouse http://teeic.indianaffairs.gov/am/assess/index.htm

APPENDIX B

SITE PHOTOGRAPHS

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Photograph 1. Bisti Substation from Highway 371, looking east/southeast.

Photograph 2. View of Site 1, as currently mapped, looking southeast.

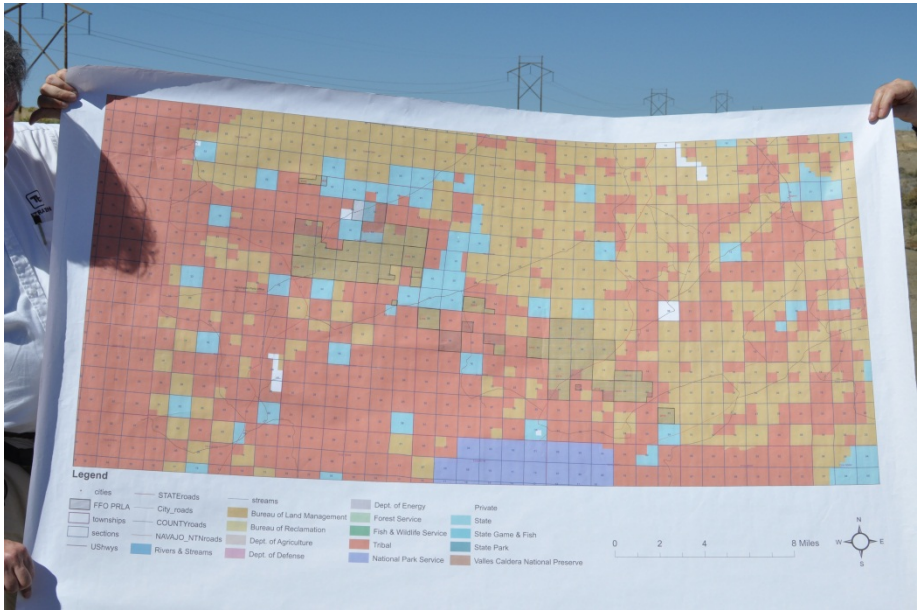
Photograph 3. View of Site 1, as currently mapped, looking further southeast.

Photograph 4. View of Site 1, as currently mapped, looking northeast.

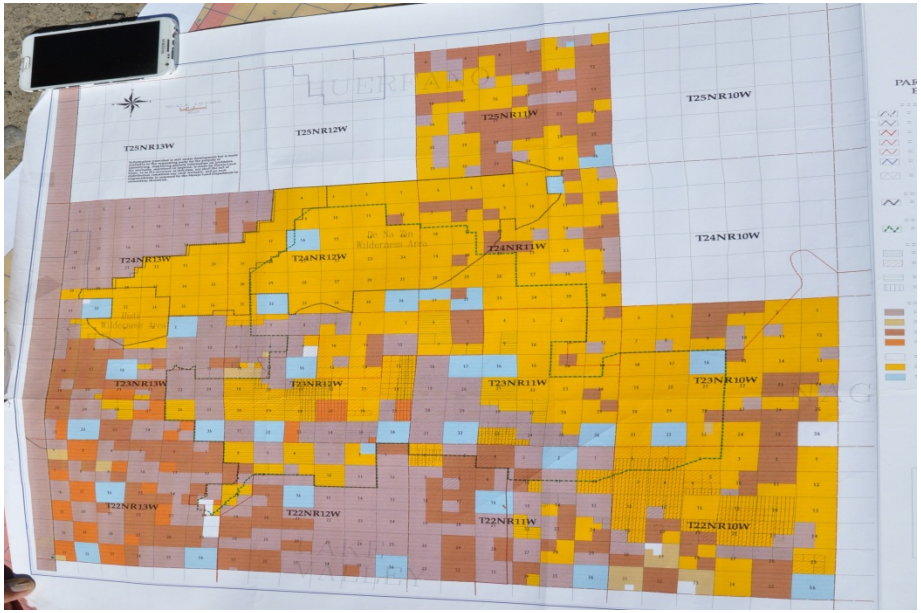
Photograph 5. View of Site 1, as currently mapped, looking east.

Photograph 7. View of Site 1, as currently mapped, looking south.

Photograph 6. View of Site 1, as currently mapped, looking southeast.



Photograph 8. Paragon Resource Inventory Map



Photograph 9. Paragon Resource Ranch Map, Eastern Navajo Agency Land Status.

Photograph 10. View from the road that accesses the Bistahi First United Methodist Church, looking north.

Photograph 11. Bistahi First United Methodist Church, on private property, looking south.

Photograph 12. View of Site 2, standing in the southernmost end of the western portion of Site 2 near Highway 371, looking west.

Photograph 13. View of Site 2, standing in the southernmost end of the western portion of Site 2 near Highway 371, looking northwest.

Photograph 14. View of Site 2, standing in the southernmost end of the western portion of Site 2 near Highway 371, looking north.

Photograph 15. View of Site 2, standing in the southernmost end of the western portion of Site 2 near Highway 371, looking northeast.

Photograph 16. View of Site 2, standing in the southernmost end of the western portion of Site 2 near Highway 371, looking east.

Photograph 17. View of Site 2, standing in the western portion of Site 2 that extends in a southerly direction, looking north.

Photograph 18. View of Site 2, standing in the western portion of Site 2 that extends in a southerly direction, looking northeast.

Photograph 19. View along County Road 7500 where the County Road crosses the eastern portion of Site 2 that extends in a southerly direction, looking north.

Photograph 20. View along County Road 7500 where the County Road crosses eastern portion of Site 2 that extends in a southerly direction, looking northwest.

Photograph 21. View of water tank along County Road 7500 where County Road crosses eastern portion of Site 2 that extends in a southerly direction, looking west.

Photograph 22. View of culvert along County Road 7500 where County Road crosses eastern portion of Site 2 that extends in a southerly direction.

Photograph 23. View of Site 2 from where County Road 7500 crosses eastern portion of Site 2 that extends in a southerly direction, looking southeast.

Photograph 24. View of Site 2 from where County Road 7500 crosses eastern portion of Site 2 that extends in a southerly direction, looking northwest.

Photograph 25. View from northernmost portion of Site 3, looking southwest across Site 3.

Photograph 26. View from northernmost portion of Site 3, looking south across Site 3.

Photograph 27. View from northernmost portion of Site 3, looking southeast across Site 3.

Photograph 28. View of Site 4 from County Road 7650 where the County Road borders Black Lake on the north, looking west.

Photograph 29. View of Site 4 in the background from County Road 7650 near Black Lake, looking southwest. Black Lake lies in the middleground zone (center of view but outside Site 4).

Photograph 30. View of Site 4 in the background from County Road 7650 near Black Lake, looking south. Black Lake lies in the middleground zone (center of view but outside Site 4).

Photograph 31. View of Site 4 in the background from County Road 7650 near Black Lake, looking southeast. Black Lake lies in the middleground zone (center of view but outside Site 4).

Photograph 32. View of Site 4 from County Road 7650 near Black Lake, looking east.

Photograph 33. View of Site 4 from County Road 7870 (that runs south off County Road 7650) where County Road 7870 intersects Site 4 in the northern/central portion, looking west.

Photograph 34. View of Site 4 from County Road 7870 (that runs south off County Road 7650) where County Road 7870 intersects Site 4 in the northern/central portion, looking southwest.

Photograph 35. View of Site 4 along County Road 7870 (that runs south off County Road 7650) where County Road 7870 intersects Site 4 in the northern/central portion, looking south.

Photograph 36. View of Site 4 from County Road 7870 (that runs south off County Road 7650) where County Road 7870 intersects Site 4 in the northern/central portion, looking southeast.

Photograph 37. View of Site 4 from County Road 7870 (that runs south off County Road 7650) where County Road 7870 intersects Site 4 in the northern/central portion, looking east.

Photograph 38. View of transmission line from area below the Bisti Natural Gas Compressor Station along Highway 371 (not pictured but to the east), looking north. Bisti Substation is shown in the distant background.

Photograph 39. View of the Natural Gas Compressor Station from area between the Bisti Substation and the Compressor Station along Highway 371, looking south/southeast.

Photograph 40. View of potential Site 1A from area between the Bisti Substation and the Natural Gas Compressor Station along Highway 371, looking southeast.

Photograph 41. View of potential Site 1A from area between the Bisti Substation and the Natural Gas Compressor Station along Highway 371, looking east.

Photograph 42. View of potential Site 1A from area between the Bisti Substation and the Natural Gas Compressor Station along Highway 371, looking northeast.

Photograph 43. View of potential Site 1A from area between the Bisti Substation and the Natural Gas compressor Station along Highway 371, looking north.

Photograph 44. View of potential Site 1A and Bisti Substation from area between the Substation and the Natural Gas Compressor Station along Highway 371, looking north.

Photograph 45. View of potential Site 1A at north end of Bisti Substation property (fencing shown), looking northeast from Highway 371.

APPENDIX C

BIA GUIDANCE FOR ENVIRONMENTAL DOCUMENTATION

Appendix C.1 BIA Department Manual 516

Appendix C.2 BIA NEPA Guidebook 59 IAM 3-H August 2012 (including Organization and Format for Environmental Assessment)

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Appendix C.1 BIA Department Manual 516

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Index to 516 DM 1-7

1.1 Purpose. This Chapter establishes the Department's policies complying with Title 1 of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321-4347) (NEPA); Section 2 of Executive Order 11514, Protection and Enhancement of Environmental Quality, as amended by Executive Order 11991; and the regulations of the Council on Environmental Quality (CEQ) implementing the procedural provisions of NEPA (40 CFR 1500-1508).

1.2 Policy. It is the policy of the Department:

A. To provide leadership in protecting and enhancing those aspects of the quality of the Nation's environment which relate to or may be affected by the Department's policies, goals, programs, plans, or functions in furtherance of national environmental policy;

B. To use all practicable means, consistent with other essential considerations of national policy, to improve, coordinate, and direct its policies, plans, functions, programs, and resources in furtherance of national environmental goals;

C. To interpret and administer, to the fullest extent possible, the policies, regulations, and public laws of the United States administered by the Department in accordance with the policies of NEPA;

D. To consider and give important weight to environmental factors, along with other essential considerations, in developing proposals and making decisions in order to achieve a proper balance between the development and utilization of natural, cultural, and human resources and the protection and enhancement of environmental quality;

E. To consult, coordinate, and cooperate with other Federal agencies and State, local, and Indian tribal governments in the development and implementation of the Department's plans and programs affecting environmental quality and, in turn, to provide to the fullest extent practicable, these entities with information concerning the environmental impacts of their own plans and programs;

3/18/80 #2244
Replaces 9/17/70 #1222 and 9/27/71 #1341

F. To provide, to the fullest extent practicable, timely information to the public to better assist in understanding Departmental plans and programs affecting environmental quality and to facilitate their involvement in the development of such plans and programs; and

G. To cooperate with and assist the CEQ.

1.3 General Responsibilities. The following responsibilities reflect the Secretary's decision that the officials responsible for making program decisions are also responsible for taking the requirements of NEPA into account in those decisions and will be held accountable for that responsibility:

A. Assistant Secretary--Policy, Budget and Administration.
(1) Is the Department's focal point on NEPA matters and is responsible for overseeing the Department's implementation of NEPA.
(2) Serves as the Department's principal contact with the CEQ.
(3) Assigns to the Director, Office of Environmental Project Review, the responsibilities outlined for that Office in this Part.

B. Solicitor. Is responsible for providing legal advice in the Department's compliance with NEPA.

C. Assistant Secretaries.
(1) Are responsible for compliance with NEPA, E.O. 11514, as amended, the CEQ regulations, and this Part for bureaus and offices under their jurisdiction.
(2) Will insure that, to the fullest extent possible, the policies, regulations, and public laws of the United States administered under their jurisdiction are interpreted and administered in accordance with the policies of NEPA.

C. Heads of Bureaus and Offices.

(1) Must comply with the provisions of NEPA, E.O. 11514, as amended, the CEQ regulations and this Part.

(2) Will interpret and administer, to the fullest extent possible, the policies, regulations, and public laws of the United States administered under their jurisdiction in accordance with the policies of NEPA.

(3) Will continue to review their statutory authorities, administrative regulations, policies, programs, and procedures, including those related to loans, grants, contracts, leases, licenses, or permits, in order to identify any deficiencies or inconsistencies therein which prohibit or limit full compliance with the intent, purpose, and provisions of NEPA and, in consultation with the Solicitor and the Legislative Counsel, shall take or recommend, as appropriate, corrective actions as may be necessary to bring these authorities and policies into conformance with the intent, purpose, and procedures of NEPA.

(4) Will monitor, evaluate, and control on a continuing basis their activities so as to protect and enhance the quality of the environment. Such activities will include those directed to controlling pollution and enhancing the environment and designed to accomplish other program objectives which may affect the quality of the environment. They will develop programs and measures to protect and enhance environmental quality and assess progress in meeting the specific objectives of such activities as they affect the quality of the environment.

1.4 Consideration of Environmental Values.

A. In Departmental Management.

(1) In the management of the natural, cultural, and human resources under its jurisdiction, the Department must consider and balance a wide range of economic, environmental, and social objectives at the local, regional, national, and international levels, not all of which are quantifiable in comparable terms. In considering and balancing these objectives, Departmental plans, proposals, and decisions often require recognition of complements and resolution of conflicts among interrelated uses of these natural, cultural, and human resources within technological, budgetary, and legal constraints.

(2) Departmental project reports, program proposals, issue papers, and other decision documents must carefully analyze the various objectives, resources, and constraints, and comprehensively and objectively evaluate the advantages and disadvantages of the proposed actions and their reasonable alternatives. Where appropriate, these documents will utilize and reference supporting and underlying economic, environmental, and other analyses,

(3) The underlying environmental analyses will factually, objectively, and comprehensively analyze the environmental effects of proposed actions and their reasonable alternatives. They will systematically analyze the environmental impacts of alternatives, and particularly those alternatives and measures which would reduce, mitigate or prevent adverse environmental impacts or which would enhance environmental quality. However, such an environmental analysis is not, in and of itself, a program proposal or the decision document, is not a justification of a proposal, and will not support or deprecate the overall merits of a proposal or its various alternatives.

B. In Internally Initiated Proposals. Officials responsible for development or conduct of planning and decision making systems within the Department shall incorporate to the maximum extent necessary environmental planning as an integral part of these systems in order to insure that environmental values and impacts are fully considered and in order to facilitate any necessary documentation of those considerations.

C. In Externally Initiated Proposals. Officials responsible for development or conduct of loan, grant, contract, lease, license, permit, or other externally initiated activities shall require applicants, to the extent necessary and practicable, to provide environmental information, analyses, and reports as an integral part of their applications. This will serve to encourage applicants to incorporate environmental considerations into their planning processes as well as provide the Department with necessary information to meet its own environmental responsibilities.

1.5 Consultation, Coordination, and Cooperation with Other Agencies and Organizations.

A. Departmental Plans and Programs.

(1) Officials responsible for planning or implementing Departmental plans and programs will develop and utilize procedures to consult, coordinate, and cooperate with relevant State, local, and Indian tribal governments; other bureaus and Federal agencies; and public and private organizations and individuals concerning the environmental effects of these plans and programs on their jurisdictions or interests.

(2) Bureaus and offices will utilize, to the maximum extent possible, existing notification, coordination and review mechanisms established by the Office of Management and Budget, the Water Resources Council, and CEQ. However, use of these mechanisms must not be a substitute for early and positive consultation, coordination, and cooperation with others, especially State, local, and Indian tribal governments.

B. Other Departmental Activities.

(1) Technical assistance, advice, data, and information useful in restoring, maintaining, and enhancing the quality of the environment will be made

available to other Federal agencies, State, local, and Indian tribal governments, institutions, and individuals as appropriate.

(2) Information regarding existing or potential environmental problems and control methods developed as a part of research, development, demonstration, test, or evaluation activities will be made available to other Federal agencies, State, local, and Indian tribal governments, institutions and other entities as appropriate.

(3) Recognizing the worldwide and long-range character of environmental problems, where consistent with the foreign policy of the United States appropriate support will be made available to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of the world environment.

C. Plans and Programs of Other Agencies and Organizations

(1) Officials responsible for protecting, conserving, developing, or managing resources under the Department's jurisdiction shall coordinate and cooperate with State, local, and Indian tribal governments, other bureaus and Federal agencies, and public and private organizations and individuals, and provide them with timely information concerning the environmental effects of these entities' plans and programs.

(2) Bureaus and offices are encouraged to participate early in the planning processes of other agencies and organizations in order to insure full cooperation with and understanding of the Department's programs and interests in natural, cultural, and human resources.

(3) Bureaus and offices will utilize to the fullest extent possible, existing Departmental review mechanisms to avoid unnecessary duplication of effort and to avoid confusion by other organizations.

1.6 Public Involvement. Bureaus and offices, in consultation with the Office of Public Affairs, will develop and utilize procedures to insure the fullest practicable provision of timely public information and understanding of their plans and programs with environmental impact including information on the environmental impacts of alternative courses of action. These procedures will include, wherever appropriate, provision for public meetings or hearings in order to obtain the views of interested parties. Bureaus and offices will also encourage State and local agencies and Indian tribal governments to adopt similar procedures for informing the public concerning their activities affecting the quality of the environment. (See also 301 DM 2.)

1.7 Mandate.

A. This Part provides Department-wide instructions for complying with NEPA and Executive Orders 11514, as amended by 11991 (Protection and Enhancement of Environmental Quality) and 12114 (Environmental Effects Abroad of Major Federal Actions).

B. The Department hereby adopts the regulations of the CEQ implementing the procedural provisions of NEPA (Sec. 102(2)(C) except where compliance would be inconsistent with other statutory requirements. In the

case of any apparent discrepancies between these procedures and the mandatory provisions of the CEQ regulations the regulations shall govern.

C. Instructions supplementing the CEQ regulations are provided in Chapters 2-7 of this Part. Citations in brackets refer to the CEQ regulations. Instructions specific to each bureau are appended to Chapter 6. In addition, bureaus may prepare a handbook(s) or other technical guidance for their personnel on how to apply this Part to principal programs.

D. Instructions implementing Executive Order 12114 will be provided in Chapter 8.

2.1 Purpose. This Chapter provides supplementary instructions for implementing those portions of the CEQ regulations pertaining to initiating the NEPA process.

2.2 Apply NEPA Early (1501.2).

A. Bureaus will initiate early consultation and coordination with other bureaus and any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved, and with appropriate Federal, State, local and Indian tribal agencies authorized to develop and enforce environmental standards.

B. Bureaus will also consult early with interested private parties and organizations, including when the Bureau's own involvement is reasonably foreseeable in a private or non-Federal application.

C. Bureaus will revise or amend program regulations or directives to insure that private or non-Federal applicants are informed of any environmental information required to be included in their applications and of any consultation with other Federal agencies, and State, local or Indian tribal governments required prior to making the application. A list of these regulations or directives will be included in each Bureau Appendix to Chapter 6.

2.3 Whether to Prepare an EIS (1501.4).

A. Categorical Exclusions (CX) (1508.4).

(1) The following criteria will be used to determine actions to be categorically excluded from the NEPA process: (a) The action or group of actions would have no significant effect on the quality of the human environment; and (b) The action or group of actions would not involve unresolved conflicts concerning alternative uses of available resources.

(2) Based on the above criteria, the classes of actions listed in Appendix 1 to this Chapter are categorically excluded, Department-wide, from the NEPA process. A list of CX specific to Bureau programs will be included in each Bureau Appendix to Chapter 6.

(3) The exceptions listed in Appendix 2 to this Chapter apply to individual actions within CX. Environmental documents must be prepared for any actions involving these exceptions.

(4) Notwithstanding the criteria, exclusions and exceptions above, extraordinary circumstances may dictate or a responsible Departmental or Bureau official may decide to prepare an environmental document.

B. Environmental Assessment (EA) (1508.9). See 516 DM 3.

C. Finding of No Significant Impact (FONSI) (1508.13). A FONSI will be prepared as separate covering document based upon a review of an EA. Accordingly, the words include(d) in Section 1508.13 should be interpreted as attach(ed).

D. Notice of Intent (NOI) (1508.22)'. A NOI will be prepared as soon as practicable after a decision to prepare an environmental impact statement and shall be published in the Federal Register, with a copy to the Office of Environmental Project Review, and made available to the affected public in accordance with Section 1506.6. Publication of a NOI may be delayed if there is proposed to be more than three (3) months between the decision to prepare an environmental impact statement and the time preparation is actually initiated. The Office of Environmental Project Review will periodically publish a consolidated list of these notices in the Federal Register.

E. Environmental impact Statement (EIS) (1508.11). See 516 DM 4. Decisions/actions which would normally require the preparation of an EIS will be identified in each Bureau Appendix to Chapter 6.

2.4 Lead Agencies (1501.5).

A. The Assistant Secretary-Policy, Budget and Administration will designate lead Bureaus within the Department when Bureaus under more than one Assistant Secretary are involved and will represent the Department in consultations with CEQ or other Federal agencies in the resolution of lead agency determinations.

B. Bureaus will inform the Office of Environmental Project Review of any agreements to assume lead agency status.

C. A non-Federal agency will not be designated as a joint lead agency unless it has a duty to comply with a local or State EIS requirement that is comparable to a NEPA statement. Any non-Federal agency may be a cooperating agency by agreement. Bureaus will consult with the Solicitor's Office in cases where such non-Federal agencies are also applicants before the Department to determine relative lead/cooperating agency responsibilities.

2.5 Cooperating Agencies (1501.6).

A. The Office of Environmental Project Review will assist Bureaus and coordinate requests from non-Interior agencies in determining cooperating agencies.

B. Bureaus will inform the Office of Environmental Project Review of any agreements to assume cooperating agency status or any declinations pursuant to Section 1501.6(c).

2.6 Scoping (1501.7).

A. The invitation requirement in Section 1501.7(a)(1) may be satisfied by including such an invitation in the NOI.
B. If a scoping meeting is held, consensus is desirable; however, the lead agency is ultimately responsible for the scope of an EIS.

2.7 Time Limits (1501.8). When time limits are established they should reflect the availability of personnel and funds.

3.1 Purpose. This Chapter provides supplementary instructions for implementing those portions of the CEQ regulations pertaining to environmental assessments (EA).

3.2 When to Prepare (1501.3).

A. An EA will be prepared for all actions, except those covered by a categorical exclusion, covered sufficiently by an earlier environmental document, or for those actions for which a decision has already been made to prepare an EIS. The purpose of such an EA is to allow the responsible official to determine whether to prepare an EIS.
B. In addition, an EA may be prepared on any action at any time in order to assist in planning and decision making.

3.3 Public Involvement.

A. Public notification must be provided and, where appropriate, the public involved in the EA process (1506.6).
B. The scoping process may be applied to an EA (1501.7).

3.4 Content.

A. At a minimum, an EA will include brief discussions of the need for the proposal, of alternatives as required by Section 102(2)(E) of NEPA, of the environmental impacts of the proposed action and such alternatives, and a listing of agencies and persons consulted (1508.9(b)).
B. In addition, an EA may be expanded to describe the proposal, a broader range of alternatives, and proposed mitigation measures if this facilitates planning and decision making.
C. The level of detail and depth of impact analysis should normally be limited to that needed to determine whether there are significant environmental effects.
D. An EA will contain objective analyses which support its environmental impact conclusions. It will not, in and of itself, conclude whether or not an EIS will be prepared. This conclusion will be made upon review of the EA by the responsible official and documented in either a NOI or FONSI.

9/26/84 #2596
Replaces 3/18/80 #2244

3.5 Format.

A. An EA may be prepared in any format useful to facilitate planning and decision making.
B. An EA may be combined with any other planning or decision making document; however, that portion which analyzes the environmental impacts of the proposal and alternatives will be clearly and separately identified and not spread throughout or interwoven into other sections of the document.

3.6 Adoption.

A. An EA prepared for a proposal before the Department by another agency, entity or person, including an applicant, may be adopted if, upon independent evaluation by the responsible official, it is found to comply with this Chapter and relevant provisions of the CEQ regulations.
B. When appropriate and efficient, a responsible official may augment such an EA when it is essentially but not entirely in compliance in order to make it so.
C. If such an EA or augmented EA is adopted, the responsible official must prepare his/her own N01 or FONSI which also acknowledges the origin of the EA and takes full responsibility for its scope and content.

4.1 Purpose. This Chapter provides supplementary instructions for implementing those portions of the CEQ regulations pertaining to environmental impact statements (EIS).

4.2 Statutory Requirements (1502.3). NEPA requires that an EIS be prepared by the responsible Federal official. This official is normally the lowest-level official who has overall responsibility for formulating, reviewing, or proposing an action or, alternatively, has been delegated the authority or responsibility to develop, approve, or adopt a proposal or action. Preparation at this level will insure that the NEPA process will be incorporated into the planning process and that the EIS will accompany the proposal through existing review processes.

4.3 Timing (1502.5).

A. The feasibility analysis (go/no-go) stage, at which time an EIS is to be completed, is to be interpreted as the stage prior to the first point of major commitment to the proposal. For example, this would normally be at the authorization stage for proposals requiring Congressional authorization, the location or corridor stage for transportation, transmission, and communication projects, and the leasing stage for mineral resources proposals.
B. An EIS need not be commenced until an application is essentially complete; e.g., any required environmental information is submitted, any consultation required with other agencies has been conducted, and any required advance funding is paid by the applicant.

4.4 Page Limits (1502.7). Where the text of an EIS for a complex proposal or group of proposals appears to require more than the normally prescribed limit of 300 pages, bureaus will insure that the length of such statements is no greater than necessary to comply with NEPA, the CEQ regulations, and this Chapter.

4.5 Supplemental Statements (1502.9).

A. Supplements are only required if such changes in the proposed action or alternatives, new circumstances, or resultant significant effects are not adequately analyzed in the previously prepared EIS.
B. A bureau and/or the appropriate program Assistant Secretary will consult with the Office of Environmental Project Review and the Office of the Solicitor

prior to proposing to CEQ to prepare a final supplement without preparing an intervening draft.

C. If, after a decision has been made based on a final EIS, a described proposal is further defined or modified and if its changed effects are minor or still within the scope of the earlier EIS, an EA and FONSI may be prepared for subsequent decisions rather than a supplement.

4.6 Format (1502.10).

A. Proposed departures from the standard format described in the CEQ regulations and this Chapter must be approved by the Office of Environmental Project Review.

B. The section listing the preparers of the EIS will also include other sources of information, including a bibliography or list of cited references, when appropriate.

C. The section listing the distribution of the EIS will also briefly describe the consultation and public involvement processes utilized in planning the proposal and in preparing the EIS, if this information is not discussed elsewhere in the document.

D. If CEQ's standard format is not used or if the EIS is combined with another planning or decision making document, the section which analyzes the environmental consequences of the proposal and its alternatives will be clearly and separately identified and not interwoven into other portions of or spread throughout the document.

4.7 Cover Sheet (1502.11). The cover sheet will also indicate whether the EIS is intended to serve any other environmental review or consultation requirements pursuant to Section 1502.25.

4.8 Summary (1502. 12). The emphasis in the summary should be on those considerations, controversies, and issues which significantly affect the quality of the human environment.

4.9 Purpose and Need (1502.13). This section may introduce a number of factors, including economic and technical considerations and Departmental or bureau statutory missions, which may be beyond the scope of the EIS. Care should be taken to insure an objective presentation and not a justification.

4.10 Alternatives Including the Proposed Action (1502.14).

A. As a general rule, the following guidance will apply:

(1) For internally initiated proposals; i.e., for those cases where the Department conducts or controls the planning process, both the draft and final EIS shall identify the bureaus' proposed action.

(2) For externally initiated proposals; i.e., for those cases where the Department is reacting to an application or similar request, the draft and final EIS shall identify the applicant's proposed action and the bureau's preferred alternative unless another law prohibits such an

expression (3) Proposed departures from this guidance must be approved by the Office of Environmental Project Review and the Office of the Solicitor.

B. Mitigation measures are not necessarily independent of the proposed action and its alternatives and should be incorporated into and analyzed as a part of the proposal and appropriate alternatives. Where appropriate, major mitigation measures may be identified and analyzed as separate alternatives in and of themselves where the environmental consequences are distinct and significant enough to warrant separate evaluation.

4.11 Appendix (1502.18). If an EIS is intended to serve other environmental review or consultation requirements pursuant to Section 1502.25, any more detailed information needed to comply with these requirements may be included as an appendix.

4.12 Incorporation by Reference (1502.21). Citations of specific topics will include the pertinent page numbers. All literature references win be listed in the bibliography.

4.13 Incomplete or Unavailable Information (1502.22). The references to overall costs in this section are not limited to market costs, but include other costs to society such as social costs due to delay.

4.14 Methodology and Scientific Accuracy (1502.24). Conclusions about environmental effects will be preceded by an analysis that supports that conclusion unless explicit reference by footnote is made to other supporting documentation that is readily available to the public.

4.15 Environmental Review and Consultation Requirements (1502.25).

A. A list of related environmental review and consultation requirements is available from the Office of Environmental Project Review.
B. If the EIS is intended to serve as the vehicle to fully or partially comply with any of these requirements, the associated analyses, studies, or surveys will be identified as such and discussed in the text of the EIS and the cover sheet will so indicate. Any supporting analyses or reports will be referenced or included as an appendix and shall be sent to reviewing agencies as appropriate in accordance with applicable regulations or procedures.

4.16 Inviting Comments (1503.1).

A. Comments from State agencies will be requested through procedures established by the Governor pursuant to Executive Order 12372, and may be requested from local agencies through these procedures to the extent that they include the affected local jurisdictions. See 511DM.
B. When the proposed action may affect the environment of an Indian reservation, comments will be requested from the Indian tribe through the tribal governing body, unless the tribal governing body has designated an alternate review process.

4.17 Response to Comments (1503.4).

A. Preparation of a final EIS need not be delayed in those cases where a Federal agency, from which comments are required to be obtained (1503.1(a)(1)), does not comment within the prescribed time period. Informal attempts will be made to determine the status of any such comments and every reasonable attempt should be made to include the comments and a response in the final EIS.
B. When other commentary are late, their comments should be included in the final EIS to the extent practicable.
C. For those ElSs requiring the approval of the Assistant Secretary - Policy, Budget and Administration pursuant to 516 DM 6.3, bureaus will consult with the Office of Environmental Project Review when they propose to prepare an abbreviated final EIS (1503.4(c)).

4.18 Elimination of Duplication with State and Local Procedures (1506.2). Bureaus will incorporate in their appropriate program regulations provisions for the preparation of an EIS by a State agency to the extent authorized in Section 102(2XD) of NEPA. Eligible programs are listed in Appendix I to this Chapter.

4.19 Combining Documents (1506.4). See 516 DM 4.6D.

4.20 Departmental Responsibility (1506.5). Following the responsible official's preparation or independent evaluation of and assumption of responsibility for an environmental document, an applicant may print it provided the applicant is bearing the cost of the document pursuant to other laws.

4.21 Public Involvement (1506.6). See 516 DM 1.6 and 301 DM 2.

4.22 Further Guidance (1506.7). The Office of Environmental Project Review may provide further guidance concerning NEPA pursuant to its organizational responsibilities (110 DM 22) and through supplemental directives (381 DM 4.5B).

4.23 Proposals for Legislation (1506.8). The Legislative Counsel in consultation with the Office of Environmental Project Review, shall:

A. Identify in the annual submittal to OMB of the Department's proposed legislative program any requirements for and the status of any environmental
B. When required, insure that a legislative EIS is included as a part of the formal transmittal of a legislative proposal to the Congress.

4.24 Time Periods (1506.10).

A. The minimum review period for a draft EIS will be sixty (60) days from the date of transmittal to the Environmental Protection Agency.

For those EISs requiring the approval of the Assistant Secretary - Policy, Budget and Administration pursuant to 516 DM 6.3, the Office of Environmental Project Review will be responsible for consulting with the Environmental Protection Agency and/or CEQ about any proposed reductions in time periods or any extensions of time periods proposed by those agencies

5.1 Purpose. This Chapter provides supplementary instructions for implementing those portions of the CEQ regulations pertaining to decision making..

5.2 Predecision Referrals to CEQ (1504.3).

A. Upon receipt of advice that another Federal agency intends to refer a Departmental matter to CEQ, the lead bureau will immediately meet with that Federal agency to attempt to resolve the issues raised and expeditiously notify its Assistant Secretary and the Office of Environmental Project Review.
B. Upon any referral of a Departmental matter to CEQ by another Federal agency, the Office of Environmental Project Review will be responsible for coordinating the Department's position.

5.3 Decision making Procedures (1505.1).

A. Procedures for decisions by the Secretary/Under Secretary are specified in 301 DM 1. Assistant Secretaries should follow a similar process when an environmental document accompanies a proposal for their decision.
B. Bureaus will incorporate in their formal decision making procedures and NEPA handbooks provisions for consideration of environmental factors and relevant environmental documents. The major decision points for principal programs likely to have significant environmental effects will be identified in the Bureau Appendix to Chapter 6.
C. Relevant environmental documents including supplements, will be included as part of the record in formal rulemaking or adjudicatory proceedings.
D. Relevant environmental documents comments, and responses will accompany proposals through existing review processes so that Departmental officials use them in making decisions.
E. The decision maker will consider the environmental impacts of the alternatives described in any relevant environmental document and the range of these alternatives must encompass the alternatives considered by the decision maker.

5.4 Record of Decision (1505-2).

A. Any decision documents prepared pursuant to 301 DM 1 for proposals

involving an EIS may incorporate all appropriate provisions of Section 1505.2(b) and (c).

B. If a decision document incorporating these provisions is made available to the public following a-decision, it will serve the purpose of a record of decision.

5.5 implementing the Decision (1505.3). The terms 11monitoring" and "conditions" will be interpreted as being related to factors affecting the quality of the human environment.

5.6 Limitations on Actions (1506.1). A bureau will notify its Assistant secretary, the Solicitor, and the Office of Environmental Project Review of any situations described in Section 1506.1(b).

5.7 Timing of Actions (1506.10). For those EISs requiring the approval of the Assistant Secretary--Policy, Budget and Administration pursuant to 516 DM 6.3, the responsible official will consult with the Office of Environmental Project Review before making any request for reducing the time period before a decision or action.

5.8 Emergencies (1506.11). In the event of an unanticipated emergency situation, a bureau will immediately take any necessary action to prevent or reduce risks to public health or safety or serious resource losses and then expeditiously consult with its Assistant Secretary, the Solicitor, and the Office of Environmental Project Review about compliance with NEPA. The Office of Environmental Project Review and the bureau will jointly be responsible for consulting with CEQ.

6.1 Purpose. This Chapter provides supplementary instructions for implementing those provisions of the CEQ regulations pertaining to procedures for implementing and managing the NEPA process.

6.2 Organization for Environmental Quality.

A. Office of Environmental Project Review. The Director, Office of Environmental Project Review, reporting to the Assistant Secretary--Policy, Budget and Administration (PBA), is responsible for providing advice and assistance to the Department on matters pertaining to environmental quality and for overseeing and coordinating the Departments compliance with NEPA, E.O. 11514, the CEQ regulations, and this Part. (See also 110 DM 22.)

B. Bureaus and Offices. Heads of bureaus and offices will designate organizational elements or individuals, as appropriate, at headquarters and regional levels to be responsible for overseeing matters pertaining to the environmental effects of the bureaus plans and programs. The individuals assigned these responsibilities should have management experience or potential, understand the bureau's planning and decision making processes, and be well trained in environmental matters, including the Department's policies and procedures so that their advice has significance in the bureau's planning and decisions. These organizational elements will be identified in the Bureau Appendix to this Chapter.

6.3 Approval of EISs.

A. A program Assistant Secretary is authorized to approve an EIS in those cases where the responsibility for the decision for which the EIS has been prepared rests with the Assistant Secretary or below. The Assistant Secretary may further assign the authority to approve the EIS if he or she chooses. The Assistant Secretary--PBA will make certain that each program Assistant Secretary has adequate safeguards to assure that the EISs comply with NEPA, the CEQ regulations, and the Departmental Manual.

B. The Assistant Secretary--PBA is authorized to approve an EIS in those cases where the decision-for which the EIS has been prepared will occur at a level in the Department above an individual program Assistant Secretary.

6.4 List of Specific Compliance Responsibilities.

3/18/80 #2244
Replaces 9/17/70 #1222 and 9/27/71 #1341

A. Bureaus and offices shall:
   (1) Prepare NEPA handbooks providing guidance on how to implement NEPA in principal program areas.
   (2) Prepare program regulations or directives for applicants.
   (3) Propose categorical exclusions.
   (4) Prepare and approve EAs.
   (5) Decide whether to prepare an EIS.
   (6) Prepare and publish NOIs and FONSI.
   (7) Prepare and, when assigned, approve EISs.

B. Assistant Secretaries shall:
   (1) Approve bureau handbooks.
   (2) Approve regulations or directives for applicants.
   (3) Approve categorical exclusions.
   (4) Approve EISs pursuant to 516 DM 6.3.

C. The Assistant Secretary--Policies Budget and Administration shall:
   (1) Concur with regulations or directives for applicants.
   (2) Concur with categorical exclusions.
   (3) Approve EISs pursuant to 516 DM 6.3.

6.5 Bureau Requirements.

A. Requirements specific to bureaus appear as appendices to this Chapter and include the following:
   (1) Identification of officials and organizational elements responsible for NEPA compliance (516 DM 6.2B).
   (2) List of program regulations or directives which provide information to applicants (516 DM 2.2B).
   (3) Identification of major decision points in principal programs (516 DM 5.3B) for which an EIS is normally prepared (516 DM 2.3E).
   (4) List of categorical exclusions (516 DM 2.3A).

B. Appendices are attached for the following bureaus:
   (1) Fish and Wildlife Service (Appendix 1).
   (2) Geological Survey (Appendix 2).
   (3) Heritage Conservation and Recreation Service (Appendix 3).
   (4) Bureau of Indian Affairs (Appendix 4).
   (5) Bureau of Land Management (Appendix 5).
   (6) Bureau of Mines (Appendix 6).
   (7) National Park Service (Appendix 7)
   (8) Office of Surface Mining (Appendix 8).
   (9) Water and Power Resources Service (Appendix 9).

C. The Office of the Secretary and other Departmental Offices do not have separate appendices, but must comply with this Part and will consult with the Office of Environmental Project Review about compliance activities

6.6 Information About the NEPA Process. The Office of Environmental Project Review

will publish periodically a Departmental list of contacts where information about the NEPA process and the status of EISs may be obtained.

7.1 Purpose. These procedures are to implement the policy and directives of Section 102(2)(C) of the National Environmental Policy Act of 1969 (P.L. 91-190, 83 Stat. 852, January 1, 1970); Section 2(f) of Executive Order No. 11514 (March 5, 1970); the Guidelines issued by the Council on Environmental Quality (36 F.R. 7724, April 23, 1971); Bulletin No. 72-6 of the Office of Management and Budget (September 14, 1971);.and provide guidance to bureaus and offices of the Department in the review of environmental statements prepared by and for other Federal agencies.

7.2 Policy. The Department considers it a priority responsibility to provide competent and timely review comments on environmental statements prepared by other Federal agencies for their major actions which significantly affect the quality of the human environment. These reviews are predicated on the Department's jurisdiction by law or special expertise with respect to the environmental impact involved and shall provide constructive comments to other Federal agencies to assist them in meeting their environmental responsibilities.

7.3 Responsibilities.

A. The Assistant Secretary - Program Policy:

(1) Shall be the Department's contact point for the receipt of requests for reviews of draft and final environmental statements prepared by or for other Federal agencies;

(2) Shall determine whether such review requests are to be answered by a Secretarial officer or by a Field Representative, and determine which bureaus and/or offices shall perform such reviews;

(3) Shall prepare, or where appropriate, shall designate a lead bureau responsible for preparing the Department's review comments. The lead bureau may be a bureau, Secretarial office, other Departmental office, or task force and shall be that organizational entity with the most significant jurisdiction or environmental expertise in regard to the requested review;

(4) Shall set review schedules and target dates for responding to review requests and monitor their compliance;

(5) Shall Review, sign, and transmit the Department's Review comments to the requesting agency and to the Council on Environmental Quality, unless he designates otherwise;

(6) Shall follow through on the Department is Review comments transmitted to the requesting agency to ensure resolution of the Department's concerns, unless he designates otherwise; and

(7) Shall consult with the Legislative Counsel and the Solicitor when environmental reviews pertain to legislative or legal matters, respectively.

B. The Legislative Counsel:

(1) Shall ensure that requests for reviews of environmental statements prepared by other Federal agencies that accompany or pertain to legislative proposals are immediately referred to the Assistant Secretary - Program Policy.

C. Field Representatives:

(1) When designated by the Assistant Secretary Program Policy, shall Review, sign, and transmit the Department's Review comments to the requesting agency and to the Council on Environmental Quality.

C. Assistant Secretaries andHeads of Bureaus and Offices:

(1) Shall designate officials and organizational elements responsible for the coordination and conduct of environmental reviews and report this information to the Assistant Secretary - Program Policy;

(2) Shall provide the Assistant Secretary - Program Policy with appropriate information and material concerning their delegated jurisdiction and special environmental expertise in order to assist him in assigning Review responsibilities;

(3) Shall conduct reviews based upon their areas of jurisdiction or special environmental expertise and provide comments to designated lead bureaus assigned responsibilities for preparing Departmental comments;

(4) When designated lead bureau by the Assistant Secretary - Program Policy, shall prepare and forward the Department's Review comments as instructed; and

(5) Shall assure that Review schedules for discharging assigned responsibilities are met, and promptly inform other concerned offices if established target dates cannot be met and when they will be met.

7.4 Types of Reviews

A. Descriptions of Proposed Actions:

(1) Descriptions of proposed actions are not substitutes for environmental statements. Federal agencies and applicants for Federal assistance may circulate such descriptions, for the purpose of soliciting information concerning environmental impact in order to determine whether or not to prepare environmental statements.

(2) Requests for reviews of descriptions of proposed actions are not required to be processed through the Assistant Secretary - Program Policy. Review comments may be handled independently by bureaus and offices, with the Field Representative and Assistant Secretary - Program Policy being advised of significant or highly controversial issues. Review

comments are for the purpose of providing technical assistance to the requesting agency and should reflect this fact.

B. Environmental Assessments or Reports:

(1) Environmental assessments or reports are not substitutes for environmental statements. These assessments or reports may be prepared by Federal agencies, their consultants, or applicants for Federal assistance. They are prepared either to provide information in order to determine whether or not an environmental statement should be prepared, or to provide input into an environmental statement. If they are separately circulated, it is generally for the purpose of soliciting additional information concerning environmental impact.

(2) Requests for reviews of environmental assessments or reports are not required to be processed through the Assistant Secretary - Program Policy. Review comments may be handled independently by bureaus and offices, with the Field Representative and Assistant Secretary - Program Policy being advised of significant or highly controversial issues. Review comments are for the purpose of providing technical assistance to the requesting agency and should reflect this fact.

C. Negative Declarations:

(1) Negative declarations are prepared in lieu of environmental statements by Federal agencies and, in some cases, by applicants for Federal assistance. A negative declaration is a statement for the record by the proponent Federal agency that it has reviewed the environmental impact of its proposed action, that it determines that the action will not significantly affect the quality of the human environment, and that an environmental statement is not required. Such declarations are not normally circulated.

(2) Requests for reviews of negative declarations are not required to be processed through the Assistant Secretary - Program Policy. Review comments may be handled independently by bureaus and offices and shall concur or not concur with the requesting agency. If a bureau or office does not concur, the Field Representative and Assistant Secretary - Program Policy will be advised promptly by copy of the comments with a copy of the negative declaration attached.

D. Preliminary, Proposed, or Working Draft Environmental Statements:

(1) Preliminary, proposed, or working draft environmental statements are sometimes prepared and circulated by Federal agencies and applicants for Federal assistance for consultative purposes.

(2) Requests for reviews of these types of draft environmental statements are not required to be processed through the Assistant Secretary - Program Policy. Review comments may be handled independently by bureaus and offices with the Field Representative and Assistant Secretary - Program Policy being advised of significant or highly controversial issues. Review comments are for the purpose of providing informal technical assistance to the requesting agency and

should state that they do not represent the Review comments of the Department on the draft environmental statement.

E. Draft Environmental Statements

(1) Draft environmental statements are prepared by Federal agencies under the provisions of Section 102(2)(C) of the National Environmental Policy Act and provisions of the Guidelines of the Council on Environmental Quality. They are officially circulated to other Federal agencies for Review from their Jurisdiction by law or special environmental expertise.

(2) All requests from other Federal agencies for' Review of draft environmental statements shall be made through the Assistant Secretary - Program Policy. Review comments shall be handled in accordance with his instructions and the provisions of this chapter.

F. Final Environmental Statements:

(1) Final environmental statements are prepared by Federal agencies following receipt and consideration of Review comments. They are filed with the Council on Environmental Quality and are generally circulated for information purposes and sometimes for comment.

(2) The Assistant Secretary - Program Policy shall Review final environmental statements to determine whether they reflect adequate consideration of the Department's comments. Bureaus and offices shall not comment independently on final environmental statements, but shall inform the Assistant Secretary - Program Policy of their views. Any Review comments shall be handled in accordance with his instructions.

7.5 Content of Review Comments on Draft Environmental Statements

A. Departmental Comments:

(1) Departmental comments on draft environmental statements prepared by other Federal agencies shall be based upon the Department's jurisdiction by law or special expertise with respect to the environmental impact of the proposed action or alternatives to the action. The adequacy of the statement in regard to the Act and the Council on Environmental Quality's Guidelines is the responsibility of the Federal agency that prepared the statement and any comments on its adequacy shall be limited to the Department's jurisdiction or environmental expertise.

(2) Reviews shall be conducted in sufficient detail to insure that both potentially beneficial and adverse environmental effects of the proposed action, including cumulative and secondary effects, are adequately identified. Wherever possible, and within the Department's competence and resources, other agencies will be advised on ways to avoid or minimize adverse impacts of the proposed action and on alternatives to the proposed action that may-have been overlooked or inadequately treated.

(3) Review comments should not capsulize or restate the environmental statement, but should provide clear, concise, substantive, and complete comments on the stated or unstated environmental impacts of the proposed action and, if appropriate, on alternatives to the action. Comments, either positive or negative, shall be objective and constructive.

(4) Departmental Review comments shall be organized as follows:

(a) Control Number The Departmental Review control number shall be typed in the upper lefthand corner below the Departmental seal on the letterhead page of the comments.

(b) Introduction The introductory paragraph shall reference the other Federal agency's Review request, including the date, the type of Review requested, the subject of the Review, and, where appropriate, the geographic location of the subject and the other agency's control number.

(c) General Comments, if any This section will include those comments of a general nature and those which occur throughout the Review which ought to be consolidated in order to avoid needless repetition.

(d) Detailed Comments The format of this section shall follow the organization of the other agency's statement. These comments shall not approve, disapprove, support, or object to proposed actions of other Federal agencies, but shall constructively and objectively comment on the environmental-impact of the proposed action, and on the adequacy of the statement in describing the environmental impacts of the action, the alternatives, and the impacts of the alternatives.

(e) Summary Comments, if any in general, the Department will not take a position on the proposed action of another Federal agency, but will limit its comments to those above. However, in those cases where the Department has jurisdiction by statute, executive order, memorandum of agreement, or other authority the Department may comment on the proposed action. These comments shall be provided in this section and may take the form of support for, concurrence with, concern over, or objection to the proposed action and/or the alternatives.

B. Bureau and Office Comments:

(1) Bureau and office reviews of environmental statements prepared by other Federal agencies are considered informal inputs to the Department's comments and their content will generally conform to paragraph 7.5A of this chapter with the substitution of the bureau's or office's delegated jurisdiction or special environmental expertise for that of the Department.

B. Relationship to Other Concurrent Reviews:

(1) Where the Department, because of other authority or agreement, is concurrently requested to Review a proposal as well as its environmental

statement, the Department's comments on the proposal shall be separately identified and precede the comments on the environmental statement. A summary of the Department's position, if any, on the proposal and its environmental impact shall be separately identified and following the Review comments on the environmental statement.

(2) Where another Federal agency elects to combine other related reviews into the review of the environmental statement by including additional or more specific information into the statement, the introduction to the Department's Review comments will acknowledge the additional Review request and the Review comments will be incorporated -into appropriate parts of the combined statement Review. A summary of the Department's position, if any, on the environmental impacts of the proposal and any alternatives shall be separately identified and follow the detailed Review comments on the - combined statement.

7.6 Availability of Review Comments

A. Prior to the public availability of another Federal agency's final environmental statement, the Department shall not independently release to the public its comments on that agency's draft environmental statement. In accordance with Section 10(f) of the Council on Environmental Quality's Guidelines [516 DM 2, App. A], the agency that prepared the statement is responsible for making the comments available to the public, and requests for copies of the Department's comments shall be referred to that agency. Exceptions to this procedure shall be made only by the Assistant Secretary - Program Policy in consultation with the Solicitor and the Director of Communications.

B. Various internal Departmental memoranda, such as the Review comments of bureaus, offices, task forces, and individuals, which are used as inputs to the Department's Review comments are generally available to the public in accordance with the Freedom of Information Act (5 U.S.C. Section 552) and the Departmental procedures established by 43 C.F.R. 2. Upon receipt of such requests and in addition to following the procedures above, the responsible bureau or office shall notify and consult the Assistant Secretary Program Policy.

7.7 Procedures for Processing Environmental Reviews

A. General Procedures:

(1) All requests for reviews of draft and final environmental statements prepared by or for other Federal agencies shall be received and controlled by the Assistant Secretary - Program Policy.

(2) If a bureau or office, whether: at headquarters or field level, should receive an environmental statement for Review directly from outside of the Department, it should ascertain whether the statement is a preliminary, proposed, or working draft circulated for technical assistance or input in order to prepare a draft statement or whether the statement is in fact a draft environmental statement, or in some cases, a final

statement circulated for official Review.

(a) If the document is a preliminary, proposed, or working draft, the bureau or office should handle independently and provide whatever technical assistance possible within the limits of their resources, to the requesting agency. The response should clearly indicate the type of assistance being provided and state that it does not represent the office's or the Department's review of the draft environmental statement. Each bureau or office should provide the Field Representative and the Assistant Secretary - Program Policy copies of any comments involving significant or controversial issues.

(b) If the document is a draft or final environmental statement circulated for official Review, the bureau or office should inform the requesting agency of the Department's procedures in subparagraph (1) above and promptly refer the-request and the statement to the Assistant Secretary Program Policy for processing.

(3) All bureaus and offices processing and reviewing environmental statements of other Federal agencies will do so within the time limits specified by the Assistant Secretary - Program Policy. From thirty (30) to forty-five (45) days are normally available for responding to other Federal agency Review requests. Whenever possible the Assistant Secretary - Program Policy shall seek a forty-five (45) day waiting period. Further extensions shall be handled in accordance with paragraph 7.7B(3) of this chapter.

(4) The Department's Review comments on other Federal agencies' environmental statements shall reflect the full and balanced interests of the Department in the protection and enhancement of the environment. Lead bureaus shall be responsible for resolving any intra-Departmental differences in bureau or office Review comments submitted to them. The Office of Environmental Project Review is available for guidance and assistance in this regard. In cases where agreement cannot be reached, the matter shall be referred through channels to the Assistant Secretary - Program Policy or to the Field Representative, if appropriate.

B. Processing Environmental Reviews:

(1) The Assistant Secretary - Program Policy has delegated to the Director, Office of Environmental Project Review, the responsibility for distributing and monitoring the Review of all environmental statements referred to the Department by other Federal agencies. In carrying out this responsibility, the Director, Office of Environmental Project Review, shall determine which bureaus and offices will Review the statements, shall designate lead bureaus which shall prepare the Department's comments, shall indicate the intended Signature of the comments, and shall set and monitor Review schedules.

(2) The Office of Environmental Project Review shall secure and distribute sufficient copies of environmental statements for Departmental Review. Bureaus and offices should keep the Office of

Environmental Project Review informed as to their needs for Review copies, which shall be kept to a minimum, and shall develop internal procedures to efficiently and expeditiously distribute environmental statements to reviewing offices.

(3) Reviewing bureaus and offices which cannot meet the Review schedule shall so inform the lead bureau and shall provide the date that the Review will be delivered. The lead bureau shall inform the Office of Environmental Project Review in cases of headquarters-level response, or the Field Representative in cases of field-level response, if it cannot meet the schedule, why it cannot, and when it will. The Office of Environmental Project Review or the Field Representative. shall be responsible for informing the other Federal agency of any changes in the Review schedule.

(4) Reviewing offices shall route their Review comments through channels to the lead bureau, with a copy to the Office of Environmental Project Review. When, in cases, of headquarters-level response, Review comments cannot reach the lead bureau within the established Review schedule, reviewing bureaus and offices shall send a copy marked "Advance Copy" directly to the lead bureau.

(5) In cases of headquarters-level response:

(a) The lead bureau shall route the completed comments through channels to the Office of Environmental Project Review. Copies shall be prepaid and attached for all bureaus and offices from whom Review comments were requested, for the Office of Environmental Project Review, and for the Field Representative when the Review pertains to a project within his geographic jurisdiction. In addition, legible copies of all Review comments received shall accompany the Department's comments through the clearance process and shall be retained by the Office of Environmental Project Review;

(b) The Office of Environmental Project Review shall Review, secure any necessary additional surnames, surname, and transmit the Department's comments to the Assistant Secretary - Program Policy for signature or for his forwarding to another appropriate Secretarial Officer for signature. Upon signature, the Office of Environmental Project Review shall transmit the comments to the requesting agency, and shall reproduce and send ten (10) copies of the signed original to the Council on Environmental Quality.

(6) In cases of field-level response:

(a) The lead bureau shall route the completed comments to the appropriate Field Representative. Copies shall be prepared and attached for all offices from whom review comments were requested and for the Office of Environmental Project Review. In addition legible copies of all review comments received shall be

attached to the Office of Environmental Project Review's copy and to the Field Representative's file copy;

(b) The Field Representative shall Review, sign, and transmit the Department's comments to the agency requesting the Review. In addition he shall reproduce and send ten (10) copies of the signed original to the Council on Environmental Quality and send a copy of the CEQ transmittal memorandum, the Department's comments, and the bureau Review comments to the Office of Environmental Project Review.

(c) If the Field Representative determines in the course of his review of the Department's comments that the Review involves policy matters of Secretarial significance, he shall not sign and transmit the comments as provided in subparagraph (b) above, but shall forward the Review to the Assistant Secretary - Program Policy.

Appendix C.2 BIA NEPA Guidebook 59 IAM 3-H August 2012 (including Organization and Format for Environmental Assessment)

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SECTION 6 ENVIRONMENTAL ASSESSMENTS (EA)

6.1 GENERAL

The DOI regulations (43 CFR 46.300(a)) specify that an EA must be prepared for any Federal action except those: (1) covered by a CE; (2) covered by an earlier environmental document; or (3) a decision has already been made to prepare an EIS. The EA is the document that provides sufficient analysis for determining whether a proposed action may or will have a significant impact on the quality of the human environment and therefore requiring the preparation of an EIS. If the EA does not reveal any significant impacts, a FONSI is prepared.

6.2 PUBLIC INVOLVEMENT

The CEQ and DOI regulations encourage agencies to facilitate public involvement in the NEPA process (40 CFR 1506.60), but the extent of public involvement in preparing an EA is at the discretion of the decision-maker (43 CFR 46.305(a)). Depending on the nature of the action the BIA may hold both internal and public scoping to define issues and appropriate alternatives.

The CEQ requires making a FONSI available for 30 day review if: (1) the proposed action is normally one that requires an EIS; or (2) the nature of the proposed action is one without precedent (40 CFR 1501.4(e)(2), also see Appendix 17). However, for most routine non-controversial actions the DOI regulations only require notifying the public of the availability of an EA and FONSI(43 CFR 46.305(c)). There is no minimum time period for this notification and there is no requirement to seek comments. A shorter review period may be used for most routine non-controversial actions, but in general the Notice of Availability (NOA) for the EA and FONSI should be published at the same time as the decision to proceed. The time between the NOA and the time when the action may be implemented will then correspond to the 30-day appeal period on the decision to proceed as required in 25 CFR. 2.7. This NOA should be published in a local newspaper, but NOAs for minor localized actions need only be posted at the agency and tribal offices.

Because of the unique government to government relationship and the sovereignty of tribes, the BIA should involve tribal governments and relevant tribal programs in the development and review of EAs, especially when NEPA actions affect lands within reservation boundaries. Tribes are not viewed as members of the public, but as partners in the NEPA process and should be invited to participate as cooperating agencies when developing EAs as well as EISs.

6.3 EA PREPARATION

An EA is not supposed to be a short EIS and CEQ regulations encourage agencies to write concise EAs (40 CFR 1508.9). The analysis in an EA need not go beyond that needed to determine whether impacts will or may be significant. This analysis should rely on existing data, but where appropriate, additional studies may be necessary to provide sufficient background information to determine if impacts will be significant. In following the guidance of CEQ, the

BIA encourages preparers to restrict the size of EAs to no more than 15 pages (See Appendix 17, Question 36a). Larger documents may be appropriate for more complex actions or programmatic reviews.

An EA can be prepared at any time, to facilitate the planning process and can be combined with planning documents (43 CFR 46.300(b)). When appropriate, the use of programmatic EAs is encouraged for actions that are identical and/or confined to a geographic location. Such analysis can programmatically address common environmental issues, and eliminate the need to replicate the review of those issues in subsequent projects.

6.4 CONTENTS AND FORMAT OF AN EA

The DOI regulations (43 CFR 46.310) define the minimal requirements of an EA to include: (1) the proposal; (2) the need for the proposal; (3) the environmental impacts of the proposed action; (4) the environmental impacts of the alternatives considered; and (5) a list of agencies and persons consulted. The BIA uses the following format.

6.4.1 Cover Sheet

This will include the title and location of the proposed action; date of issue of the EA; name of responsible Federal agency(s); and name(s) of the preparing entity(s). If the EA is to be circulated as a draft, this will be clearly marked on the cover sheet.

6.4.2 Table of Contents

This lists chapter and section headings, along with tables, figures and illustrations.

6.4.3 Proposal and Need for the Proposal

In this section, explain the proposal and why the BIA is considering the action. This should clearly answer the questions: What Federal action triggered NEPA? Why here? Why now? For many types of actions, the "need" can be described as the underlying issue the BIA is addressing with the action. Descriptions of proposed actions in EAs usually include four elements:

(1) "Who" is the Federal agency guiding the analysis and making the decision.
(2) "What" is the specific activity proposed. Sufficient detail must be provided, so the effects of the proposed action may be compared to the effects of the alternatives,
(3) "When" is the timeframe in which the project will be implemented and completed.
(4) "Where" is the location of the proposed action. This will be described as specifically as possible, with relevant maps.

6.4.4 Alternatives

For an EA where there are no unresolved conflicts with respect to alternative uses of available resources only the proposed action needs to be considered (43 CFR 46.310(b)).

Even if there are no unresolved conflicts, the No Action alternative may also be considered in EAs. This alternative provides a useful baseline for comparison of environmental effects (including cumulative effects) and demonstrates the consequences of not meeting the need for the action. The description of the No Action alternative depends on the type of action proposed. It can either be no change from the current management practices, or a description of what is reasonably foreseeable, if the proposed action does not take place.

If there are unresolved conflicts, other alternatives must be considered. If there are no conflicts, other alternatives may be considered, depending on the nature of the action (43 CFR 46.310 (b)). For some EAs, these can be described and eliminated in this section, with reasons given for not considering them further.

6.4.5 Environmental Impacts

The principle components of the environment to consider are listed in Figure 3. While all of these components should be considered, only those which will be affected by the proposed action need be described. For the remaining components, a brief statement of why the components will not be affected is sufficient.

Good analysis in this section is the key to a good EA. Since the purpose of preparing an EA is to determine whether or not the proposed action will or may significantly affect the human environment, analyze all potentially significant effects, beneficial and adverse. Analyze in this section the impacts on the components of the human environment as identified above. Discuss the consequences of each alternative on a component of the environment before moving on to the next component.

The effects analysis must demonstrate BIA took a "hard look" at the impacts of the action. The analysis will concentrate on those components of the affected environment that will truly be affected. The effects analyzed include direct, indirect, cumulative, and disproportionate (Environmental Justice). For each type of effect, consider those that are short term, long term, irreversible and irretrievable.

The significance of the effects is a critical analysis, because this determines if there will be a need to complete an EIS. The analysis of environmental effects and significance are discussed in more detail in Section 7.

The Human Environment

(1) Land Resources
- (a) Topography (land forms, drainage, gradients)
- (b) Soils (types, characteristics)
- (c) Geology, Mineral and Paleontological Resources

(2) Water Resources (surface and ground; quality, quantity, use, rights)

(3) Air (quality/achievement, visibility)

(4) Living Resources
- (a) Wildlife (terrestrial, aquatic, threatened/endangered)
- (b) Vegetation (terrestrial, aquatic, riparian, threatened/endangered)
- (c) Ecosystems and Biological Communities
- (d) Agriculture (livestock, crops, prime and unique farmland)

(5) Cultural Resources
- (a) Historic and Archeological Resources
- (b) Cultural, Sacred and Traditional Cultural Properties

(6) Socioeconomic Conditions
- (a) Employment and Income
- (b) Demographic Trends
- (c) Lifestyle and Cultural Values (rural, urban)
- (d) Community Infrastructure (public services, utilities)
- (e) Environmental Justice

(7) Resource Use Patterns
- (a) Hunting, Fishing, Gathering
- (b) Timber Harvesting
- (c) Agriculture
- (d) Mineral Extraction
- (e) Recreation
- (f) Transportation Networks
- (g) Land Use Plans

(8) Other Values
- (a) Wilderness
- (b) Noise and Light
- (c) Visual
- (d) Public Health and Safety
- (e) Climate Change (Greenhouse gases).
- (f) Indian Trust Assets
- (g) Hazardous materials

Figure 4 Components of the Human Environment

6.4.6 Mitigation Measures

Mitigation includes specific means, measures or practices that would reduce or eliminate effects of the proposed action or alternatives. Mitigation measures can be applied to reduce or eliminate adverse effects to biological, physical, or socioeconomic resources. Mitigation may be used to reduce or avoid adverse impacts, whether or not they are significant in nature.

As defined in the CEQ Regulations (40 CFR 1508.20) mitigation can include:

> (1) Avoiding the impact altogether by not taking a certain action or parts of an action.
> (2) Minimizing impact by limiting the degree of magnitude of the action and its implementation.
> (3) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
> (4) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
> (5) Compensating for the impact by replacing or providing substitute resources or environments.

Measures or practices will only be termed mitigation measures if they have not been incorporated into the proposed action or alternatives. If mitigation measures are incorporated into the proposed action or alternatives, they are design elements, not mitigation measures. Design elements are those specific means, measures or practices that make up the proposed action and alternatives. Standard operating procedures, stipulations, and best management practices are usually considered design elements (43 CFR 46.130(b)).

For an action analyzed in an EA, mitigation can be used to reduce the effects of an action below the threshold of significance, avoiding the need to prepare an EIS. Enforceable mitigation measures will result in a "mitigated FONSI" and will be clearly described in the FONSI.

Mitigation measures are critical elements for the decision maker to allow an action to move forward. The CEQ regulations (40 CFR 1505.3) require agencies to (a) include appropriate conditions in grants, permits or other approvals; (b) condition funding of actions on mitigation; (c) upon request, inform cooperating or commenting agencies on progress in carrying out mitigation measures which were adopted by the agency making the decision; and (d) upon request, make available to the public the results of relevant monitoring.

Any mitigation measure must be enforceable and it is important for BIA Regional and Agency Offices to establish monitoring programs to ensure that mitigation is carried out (See Section 9 and Appendix 21).

6.4.7 Consultation

In this section, include a list of agencies, organizations and individuals consulted, and coordination with applicable statutes, regulations, Secretarial Orders and Executive Orders. Affected tribes and appropriate tribal programs should always be included in this consultation.

Federal, tribal, state, and local agencies, such as those having jurisdiction by law or special expertise, and the interested public should be consulted in preparing the EA. This effort must involve all minority/low income communities that might be affected by the proposed action. List in this section the agencies, organizations and individuals consulted. Include appropriate correspondence in appendices.

Compliance with statutes, regulations and Executive Orders that apply to the proposed action should be addressed in the EA. A partial list is included in Appendix 20. Because of the time that may be required for compliance, this coordination should begin early in the EA process. If compliance cannot be achieved by the time the EA is completed, explain in the EA how compliance will ultimately be accomplished.

Analyses of the impacts to endangered species and historic properties are critical components of the EAs, and compliance with Section 7 of the ESA and Section 106 of the NHPA should be accomplished during EA development. Any formal consultation letters and formal agreements should be referenced or included in the EA to document this compliance.

6.4.8 List of Contributors

List all persons, with position title and area of expertise/discipline, who contributed to the development of the EA.

6.4.9 Appendices

Include correspondence and reports resulting from consultation and coordination, a list of references cited, and any other pertinent material.

6.5 EA PROCESSING

The EA, the FONSI and NOA will be prepared for the BIA Responsible Official, if appropriate along with recommendations for a finding. The Responsible Official may then:

(1) Sign a FONSI. A FONSI is appropriate if the Responsible Official determines that the proposed action will not have a significant impact on the quality of the human environment, or if sufficient mitigation measures have been included to reduce the environmental effects.
(2) Direct Further Work on the EA. The Responsible Official may decide that the EA is not sufficient to determine whether or not an EIS is required. In such a case, he or she may direct the preparer(s) to revise analyses, consider new alternatives or mitigation measures, seek public involvement, or take other measures to make the EA adequate for making a decision.
(3) Initiate an EIS. An EIS shall be prepared if the Responsible Official determines that the proposed action may or will have a significant impact on the quality of the human environment. (See Section 7).

REMINDER: An EIS may be initiated at any time during the EA process, without completing the EA, if it becomes apparent that the proposed action will have a significant impact on the quality of the human environment.

6.6 PUBLIC REVIEW

The EA will be made publically available by publishing or posting NOA of the FONSI (See Section 6.2).

6.7 CONTENTS OF THE NOTICE OF AVAILABILITY (NOA)

The NOA shall:

(1) Briefly describe the proposed action;
(2) State that based on an EA, it has been determined that the action will not result in significant impacts to the quality of the human environment, therefore, an EIS is not required;
(3) Identify a person to contact for further information or to obtain a copy of the FONSI and EA; and
(4) Include the following statement: "This FONSI is a finding on environmental effects, not a decision to proceed, therefore it cannot be appealed. 25 CFR 2.7 requires a 30 day appeal period after the decision to proceed with the action is made before the action may be implemented. Appeal information will be made publically available when the decision to proceed is made."

6.8. CONTENTS OF THE FINDING OF NO SIGNIFICANT IMPACT (FONSI)

The FONSI is the document that explains the reasons why an action will not have a significant effect on the human environment and, why, therefore, an EIS will not be required (40 CFR 1508.13). The basic contents of a FONSI include (See Appendix 3 for an example):

(1) The statement: "Based on the [title and date of EA], it has been determined that the proposed action will not have a significant impact on the quality of the human environment, therefore, an environmental impact statement is not required."
(2) A brief statement of the reasons, with references to pertinent portions of the EA; supporting the finding;
(3) Description of any mitigation measures proposed to reduce the level of impact.
(4) References to all other environmental documents related to the EA; and
(5) Signature line for decision maker.

The EA can be completed while consultation under other applicable laws is on-going. However, the FONSI must not be issued before consultation under Section 106 of the National Historic Preservation Act and Section 7 of the Endangered Species Act has been completed, when they are applicable.

APPENDIX D

PUBLIC SERVICE OF NEW MEXICO SOURCES OF POWER

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Public Service Company of New Mexico's owned and leased capacity in electric generating facilities in commercial service as of December 31, 2012 is as follows:

Type	Name	Location	Generation Capacity (MW)
Coal	San Juan Generating Station (SJGS)	Waterflow, New Mexico	783
Coal	Four Corners	Fruitland, New Mexico	200
Gas	Reeves Station	Albuquerque, New Mexico	154
Gas	Afton (combined cycle	La Mesa, New Mexico	230
Gas	Lordsburg	Lordsburg, New Mexico	80
Gas	Luna (Combined cycle)	Deming, New Mexico	185
Gas/Oil	Delta	Albuquerque, New Mexico	132
Gas	Valencia	Belen, New Mexico	145
Nuclear	PVNGS	Wintersburg, Arizona	402
Solar	PNM-OWNED SOLAR	Five sites in New Mexico	22
		Total	**2,333**

As noted above, PNM also obtains 204 MW of power under a long-term Power Purchase Agreement (PPA) with the New Mexico Wind Energy Center bringing its total capacity to 2.538 gigawatt (GW).

Fossil-Fueled Plants

- San Juan Generating Station (SJGS) consists of four units operated by PNM. Units 1, 2, 3, and 4 at SJGS have net-rated capacities of 340 MW, 340 MW, 496 MW and 507 MW respectively. SJGS Units 1 and 2 are owned on a 50% shared basis with Tucson. SJGS Unit 3 is owned 50% by PNM, 41.8% by Southern California Public Power Authority (SCPPA), and 8.2% by Tri-State. SJGS Unit 4 is owned 38.457% by PNM, 28.8% by MSR Energy Authority (MSR), 10.04% by the City of Anaheim, California; 8.475% by the City of Farmington, New Mexico; 7.2% by the County of Los Alamos, New Mexico; and 7.028% by Utah Associated Municipal Power System (UAMPS).

- Four Corners Power Plant (Four Corners) Units 4 and 5 are 13% owned by PNM. Units 4 and 5 at Four Corners are jointly owned with SCE, APS, SRP, Tucson Electric Power Company, and El Paso Electric (EPE) and are operated by APS. PNM has no ownership interest in Four Corners Units 1, 2, or 3. Four Corners and a portion of the facilities adjacent to SJGS are located on land held under easements from the U.S. and also under leases from the Navajo Nation. APS, on behalf of the Four Corners participants, has negotiated amendments to an existing facility lease with the Navajo Nation that would extend the leasehold interest in the plant to 2041. The amendments have been approved by the Navajo Nation Council and signed by the Nation's President. U.S. Dept. of Interior (DOI) must also approve the amendments as well as a related federal rights-of-way grant that the Four Corners participants will pursue. A federal environmental review will be conducted as part of the DOI review process.

- PNM owns 100% of the Reeves, Afton, and Lordsburg energy facilities and 33.3% of the Luna facility. The remaining interests in Luna are owned equally by Tucson and Freeport McMoran. PNM is entitled to the energy and capacity of Delta-Person Generating Station (Delta) under a PPA that is deemed to be an operating lease. PNM has a PPA that entitles it to the entire output of the Valencia Energy Facility (Valencia). Valencia is a variable interest entity and is consolidated by PNM as required by Generally Accepted Accounting Principles (GAAP). Therefore, Valencia is reflected in the above table as if it were owned. Reeves, Lordsburg, Delta, and Valencia are used

primarily for peaking power and transmission support. PNM is planning to purchase the Delta facility.

Solar

In 2011, PNM completed its first major utility-owned renewable energy project when five utility-scale solar facilities in New Mexico went online. The five solar sites are located in Alamogordo, Deming, Los Lunas, Las Vegas, and Albuquerque. In addition to these facilities generating 22 MW, PNM completed its solar-storage demonstration project in Albuquerque, which has a generation capacity of 0.5 MW that is not included in the above table. The New Mexico Public Regulation Commission (PRC) has approved PNM's 2013 renewable energy procurement strategy that includes an additional 21.5 MW of utility-owned solar capacity. As noted below under RPS, by the end of 2013 PNM was generating approximately 67 MW of solar power and exceeding its 2015 RPS requirements.

Joint Projects

PNM owns all or part of eight power plants, seven of which are in New Mexico. As described above, SJGS, PVNGS, Four Corners, and Luna are joint projects each owned or leased by several different utilities. Some participants in the joint projects are investor-owned utilities, while others are municipally or co-operatively owned. Furthermore, participants in SJGS and Four Corners may have varying percentage interests in different generating units within the project. The primary operating or participation agreements for the joint projects expire in 2016 for Four Corners, 2022 for SJGS, and 2027 for PVNGS.

In addition, SJGS and Four Corners are coal-fired generating plants that obtain their coal requirements from mines near the plants. The agreements for coal supply expire in 2016 for Four Corners and 2017 for SJGS. As described above, Four Corners is situated on land under a lease from the Navajo Nation. Portions of PNM's interests in PVNGS Units 1 and 2 are through leases that expire in 2015 and 2016, but contain certain fixed-rate renewal and fair market value purchase options. PNM gave notice to the lessors in 2013 that PNM would renew the PVNGS Unit 1 leases and would retain control of the assets subject to the PVNGS Unit 2 leases at the expiration of the leases. Several of the participants in the joint projects are located in California. There are legislative and regulatory mandates in California that prohibit utilities from entering into new arrangements, or extending existing arrangements for coal-fired generation. It is also possible that the participants in the joint projects have changed circumstances and objectives from those existing at the time of becoming participants. The status of these joint projects is further complicated by the uncertainty surrounding the form of potential legislation and/or regulation of greenhouse gas emissions (GHG), coal combustion byproducts (CCBs), and other air emissions, as well as the impacts of the costs of compliance and operational viability of all or certain units within the joint projects. It is unclear how these factors will enter into discussion and negotiations concerning the status of the joint projects as the expiration of basic operational agreements approaches. PNM can provide no assurance that its participation in the joint projects will continue in the manner that currently exists.

Power Purchase Agreements

In addition to generating its own power, PNM purchases power under long-term PPAs. PNM also purchases power in the forward, day-ahead, and real-time markets.

In 2002, PNM entered into an agreement with FPL (Florida Light & Power) to develop the New Mexico Wind Energy Center producing approximately 204 MW of non-base load renewable energy. PNM began receiving power from the project in June 2003. FPL owns and operates the New Mexico Wind Energy Center, which consists of 136 wind-powered turbines on a site in eastern New Mexico. PNM has a contract to purchase all the power and Renewable Energy Credits (RECs) generated by the New Mexico Wind Energy Center for 25 years. The PRC has approved a voluntary tariff that allows PNM retail customers to

buy wind-generated electricity for a small monthly premium. Power from the New Mexico Wind Energy Center is used to service load under the voluntary tariff and as part of PNM's electric supply mix for meeting retail load.

PNM's 2013 renewable energy procurement plan includes a 20-year agreement to purchase energy from a geothermal facility to be built near Lordsburg. The 10 MW facility will be the first geothermal project for the PNM system and is scheduled to be completed by December 31, 2013.

A summary of purchased power, excluding Delta and Valencia but including power purchased under long-term contracts, resulted in a total of $27.30 per MWh or 2.73 cents per kWh (Mechenbier 2012).

See Section 2 in the main report for details on potential purchase power partners.

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APPENDIX E

INTERVIEW RESPONDENTS FOR CHAPTER 3

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APPENDIX F

PNM FERC-APPROVED LARGE GENERATION INTERCONNECTION PROCEDURES (LGIP)

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PNM Large Generation Interconnection Procedures

The Federal Energy Regulatory Commission (FERC) has determined that Interconnection and Transmission services are different issues requiring separate consideration (FERC/PNM 2013). Therefore, the studies required for interconnection must have either a real or an assumed load for the energy. This then assumes paths or lines from the generation resource to the load in the power flow study. Thus an Integrated System Impact Study (ISIS) is performed to determine the impacts of the transmission facilities disclosed. Public Service Company New Mexico (PNM) as the Transmission Owner (TO) generally subcontracts ISIS studies to determine system impacts and requires payment from the applicant in advance of the study.

Posted 11/12/13 on oasis system at http://www.oatioasis.com/PNM/

"Pursuant to PNM's Revised Large Generation Interconnection Procedures, PNM's next Preliminary Interconnection System Impact Study ("PISIS") Queue Cluster Window will open for Application submittal beginning on March 21, 2014 and extends through June 18, 2014. Should you have any questions regarding the cluster process you may email them to LGIACluster@pnm.com"

3.4.1 Notable Sections of Requirements from Large Generation Interconnection Procedures to Participate in DISIS:

The following excerpts from the FERC-approved PNM Large Generation Interconnection Procedures (LGIP) indicate the costs and other requirements of any applicant for interconnection to the PNM system. There are additional details regarding interconnection requests not included here. A full copy of the LGIP and/or LGIA is available upon request.

Interconnection Requests

PNM LGIP Section 3 Interconnection Requests

3.1 General.

An Interconnection Customer shall submit to Transmission Provider an Interconnection Request in the form of Appendix 1 to this LGIP and a deposit of:

a. $75,000 for requests of less than 50 MW, or
b. $150,000 for requests of 50 MW and greater, but less than 200 MW, or
c. **$250,000 for requests of 200 MW and greater**. *[ed. Emphasis added]*

$5,000 of the deposit shall be nonrefundable. The remainder shall be refundable pursuant to the terms outlined herein.

Transmission Provider shall apply the refundable portion of the deposit toward the cost of the applicable Interconnection Study. Interconnection Customer shall submit **a separate Interconnection Request for each site and may submit multiple Interconnection Requests for a single site. Interconnection Customer must submit a deposit with each Interconnection Request even when more than one request is submitted for a single site. An Interconnection Request to evaluate one site at two different voltage levels shall be treated as two Interconnection Request.** *[ed. emphasis added]*

3.2 Identification of Types of Interconnection Services. At the time the Interconnection Request is submitted, Interconnection Customer must request either Energy Resource Interconnection Service or Network Resource Interconnection Service, as described below. An Interconnection Customer may designate only one type of Interconnection Service for each separate Interconnection Service request in either the Preliminary Interconnection System Impact Study

(PISIS) Queue or the DISIS Queue. The type of Interconnection Service must be finalized on submission of the appropriate executed System Impact Study Agreement and may not be changed after the start of the study process.

Section 6 Preliminary Interconnection System Impact Study

C.1 Preliminary Interconnection System Impact Study Agreement.

Unless otherwise agreed, pursuant to the Scoping Meeting provided in Section 3.3.4, or simultaneously with the acknowledgement of a valid Interconnection Request indicating that a PISIS is to be performed, Transmission Provider shall provide to Interconnection Customer a PISIS Agreement in the form of Appendix 2 to this LGIP. The PISIS Agreement shall provide that Interconnection Customer shall compensate Transmission Provider for the actual cost of the PISIS. Within seven (7) Calendar Days of the close of a Cluster Window, the Transmission Provider shall provide to Interconnection Customers a non-binding updated good faith estimate of the cost and timeframe for completing the PISIS.

Section 7 Definitive Planning Phase

7.1 Definitive Interconnection System Impact Study Agreement.

Unless otherwise agreed, pursuant to the Scoping Meeting provided in Section 3.3.4, simultaneously with the acknowledgement of a valid Interconnection Request indicating that a DISIS is to be performed, Transmission Provider shall provide to Interconnection Customer a DISIS Agreement in the form of Appendix 3 to this LGIP. The DISIS Agreement shall provide that Interconnection Customer shall compensate Transmission Provider for the actual cost of the DISIS. Within seven (7) Calendar Days of the close of a Cluster Window, the Transmission provider shall provide to Interconnection Customer a non-binding updated good faith estimate of the cost and timeframe for completing the DISIS.

7.2 Execution of Definitive Interconnection System Impact Study Agreement.

Interconnection Customer shall execute the DISIS Agreement and deliver the executed DISIS Agreement to Transmission Provider no later than the lesser of (i) thirty (30) Calendar Days following its receipt or (ii) ten (10) Calendar Days following the close of the DISIS Queue Cluster Window, along with:

a. demonstration of Site Control and site adequacy; and

b. definitive Point of Interconnection; and

c. if Transmission Provider has not been notified pursuant to Section 29.2 of Part III of the Open Access Transmission Tariff (OATT) that Interconnection Customer's proposed Generating Facility is to be designated as a Network Resource within Transmission Provider's Control Area, the point of delivery or the geographic area on PNM's system at which Interconnection Customer intends to deliver output out of Transmission Provider's Control Area; and

d. definitive plant size (MW); and

e. technical information required in Appendix 1 of this LGIP, if applicable; **and**

f. **one of the following:** *[ed. emphasis added]*

i. Security equal to $2000/MW of the plant size (refundable at commercial operation or if LGIA is not executed by Interconnection Customer); or

ii. An executed contract (or comparable evidence) for the sale of electric energy or capacity from the Generating Facility; or

iii. Statement signed by an officer or authorized agent of the Interconnection Customer attesting that the Large Generating Facility is included in an applicable state resource plan; or

iv. Other information that the Transmission Provider deems to be reasonable evidence that the Large Generating Facility will qualify as a designated Network Resource; or

v. Site-specific Purchase Order for generating equipment specific to Queue Position, or statement signed by an officer or authorized agent of the Interconnection Customer attesting that the Generating Facility included is to be supplied with turbines with a manufacturer's blanket purchase agreement to which Interconnection Customer is a party. This blanket purchase agreement shall be provided to Transmission Provider.

If the DISIS uncovers any unexpected result(s) not contemplated during the Scoping Meeting, a substitute Point of Interconnection identified by Transmission Provider may be substituted for the designated Point of Interconnection specified above without loss of Queue Position, and re-studies shall be completed pursuant to Section 7.6 as applicable.

7.6 Re-Study.

If Re-Study of the DISIS is required due to a higher or equal priority queued project dropping out of the queue, or a modification of a higher queued project subject to Section 4.4, or re-designation of the Point of Interconnection pursuant to Section 7.2, Transmission Provider shall notify Interconnection Customer in writing. Any cost of Re-Study, as reduced by deposit amounts retained under Section 7.4.c, shall be borne by the Interconnection Customer(s) being re-studied. To the extent possible, Transmission Provider will undertake reasonable efforts to reduce Re-Study work by modifying existing studies that may closely approximate the system load and conditions reflected by the withdrawal from the DISIS Queue or by advancing customers with equivalent technology and size from the PISIS Queue or the pending DISIS Queue.

7.7 Interconnection Facilities Study Agreement.

Simultaneously with the delivery of the DISIS report to Interconnection Customer, Transmission Provider shall provide to Interconnection Customer an Interconnection Facilities Study Agreement in the form of Appendix 4 to this LGIP. The Interconnection Facilities Study Agreement shall provide that Interconnection Customer shall compensate Transmission Provider for the actual cost of the Interconnection Facilities Study. Within three (3) Business Days following the DISIS results meeting, Transmission Provider shall provide to Interconnection Customer a non-binding good faith estimate of the cost and timeframe for completing the Interconnection Facilities Study. Interconnection Customer shall execute the Interconnection Facilities Study Agreement and deliver the executed Interconnection Facilities Study Agreement to Transmission Provider within thirty (30) Calendar Days after its receipt, together with the required technical data along with one of the following:

a. Letter of Credit or payment of Interconnection Customer's share of estimated Network Upgrades less any amounts provided under Section 7.2.f.i (refundable if LGIA is not executed by Interconnection Customer); or

b. An executed contract (or comparable evidence) for the sale of electric energy or capacity from the Generating Facility; or

c. Statement signed by an officer or authorized agent of the Interconnection Customer attesting that the Large Generating Facility is included in an applicable state resource plan; or

d. Other information that the Transmission Provider deems to be reasonable evidence that the Large Generating Facility will qualify as a designated Network Resource; or

e. Site Specific Purchase Order for generating equipment specific to Queue Position or statement signed by an officer or authorized agent of the Interconnection Customer attesting that the Generating Facility is to be supplied with turbines with a manufacturer's blanket purchase agreement to which Interconnection Customer is a party. This blanket purchase agreement shall be provided to Transmission Provider.

7.8 Scope of Interconnection Facilities Study.

The Interconnection Facilities Study shall specify and estimate the cost of the equipment, engineering, procurement and construction work needed to implement the conclusions of the DISIS in accordance with Good Utility Practice to physically and electrically connect the Large Generating Interconnection Facility to the Transmission System. The Interconnection Facilities Study shall also identify the electrical switching configuration of the connection equipment, including, without limitation: the transformer, switchgear, meters, and other station equipment; the nature and estimated cost of any Transmission Provider's Interconnection Facilities and Network Upgrades necessary to accomplish the interconnection; and an estimate of the time required to complete the construction and installation of such facilities.

Section 10 Standard Large Generator Interconnection Agreement (LGIA)

Section 10.3 Execution and Filing.

Within fifteen (15) Business Days after receipt of the final LGIA, Interconnection Customer shall provide Transmission Provider (A) reasonable evidence of continued Site Control or (B) posting of $250,000, non-refundable additional security, which shall be applied toward future construction costs. At the same time, Interconnection Customer also shall provide reasonable evidence that one or more of the following milestones in the development of the Large Generating Facility, at Interconnection Customer election, has been achieved: (i) the execution of a contract for the supply or transportation of fuel to the Large Generating Facility; (ii) the execution of a contract for the supply of cooling water to the Large Generating Facility; (iii) execution of a contract for the engineering for, procurement of major equipment for, or construction of, the Large Generating Facility; (iv) execution of a contract (or comparable evidence) for the sale of electric energy or capacity from the Large Generating Facility; (v) statement signed by an officer or authorized agent of the Interconnection Customer attesting the Large Generating Facility is included in an applicable state resource plan; (vi) other information that the Transmission Provider deems to be reasonable evidence that the Large Generating Facility will qualify as a designated Network Resource; or (vii) application for an air, water, or land use permit. The Transmission Provider will not execute the final LGIA unless the Interconnection Customer provides the information described in this paragraph.

APPENDIX G. GLOSSARY

Appendix G. GLOSSARY

Aquaculture. Farming of organisms that live in water, such as fish, shellfish, and algae.

Baseload Capacity. Generating equipment normally operated to serve loads on an around-the-clock basis.

Baseload Plant. Plant, usually housing high-efficiency steam-electric units, which is normally operated to take all or part of the minimum load of a system, and which consequently produces electricity at an essentially constant rate and runs continuously. These units are operated to maximize system mechanical and thermal efficiency and minimize system operating costs.

Baseload. Minimum amount of electric power delivered or required over a given period of time at a steady rate.

Binary-cycle Plant. Geothermal electricity generating plant employing a closed-loop heat exchange system in which the heat of the geothermal fluid (the "primary fluid") is transferred to a lower-boiling-point fluid (the "secondary" or "working" fluid), which is thereby vaporized and used to drive a turbine/generator set.

Biomass. Energy resources derived from organic matter. These include wood, agricultural waste, and other living-cell material that can be burned to produce heat energy. They also include algae, sewage, and other organic substances that may be used to make energy through chemical processes.

Capability. Maximum load that a generating unit, generating station, or other electrical apparatus can carry under specified conditions for a given period of time without exceeding approved limits of temperature and stress.

Capacity. Amount of electric power delivered or required for which a generator, turbine, transformer, transmission circuit, station, or system is rated by the manufacturer.

Capacity Factor. Measure of the amount of real time during which a facility is used.

Carbon Dioxide. Colorless, odorless, non-poisonous gas that is a normal part of the air. Carbon dioxide, also called CO_2, is exhaled by humans and animals and absorbed by green growing things and by the sea.

Coal. Readily combustible black or brownish-black rock whose composition, including inherent moisture, consists of more than 50 percent by weight and more than 70 percent by volume of carbonaceous material. It is formed from plant remains that have been compacted, hardened, chemically altered, and metamorphosed by heat and pressure over geologic time.

***Co*generation.** Generally used in industry to mean the production of electricity by two different methods in the same, or co-located, prime mover(s). An example of this is combined cycle gas turbines, in which the initial electricity is produced by the moving hot combustion gasses through a gas turbine and then using those still-hot exhaust gasses to make steam to drive a steam turbine. Cogeneration in effect increases thermodynamic efficiency beyond what would be theoretically possible in a single stage process. Combined-cycle plants, for example, can often exceed 50-percent efficiencies.

Combined Cycle. Electric generating technology in which electricity is produced from otherwise lost waste heat exiting from one or more gas (combustion) turbines. The exiting heat is routed to a conventional boiler

or to a heat recovery steam generator for utilization by a steam turbine in the production of electricity. This process increases the efficiency of the electric generating unit.

Combined Heat and Power. Term used to distinguish this process from cogeneration, when the explicit purpose of the prime mover is to generate both electricity and process heat. The energy conservation and environmental benefits of CHP are clear given that energy usually wasted to the environment can be utilized for beneficial purposes to offset other energy consumption. The question whether to implement CHP therefore is often reduced to one of technical practicability and cost effectiveness.

Condensate. Water formed by condensation of steam.

Consumption (fuel). Amount of fuel used for gross generation, providing standby service, startup, and/or flame stabilization.

Cooling tower. Structure associated with water-cooled heat extraction systems. Hot water is spayed from the top of the structure and cascades against an upwards airflow that cools the water (mainly through evaporation).

Cost. Amount paid to acquire resources, such as plant and equipment, fuel, or labor services.

Crust. Earth's outer layer of rock; also called the lithosphere.

Debt. Amount owed to a person or organization for funds borrowed. Debt can be represented by a loan note, bond, mortgage, or other form stating repayment terms and, if applicable, interest requirements. These different forms all imply intent to pay back an amount owed by a specific date, which is set forth in the repayment terms.

Demand (electric). Rate at which electric energy is delivered to or by a system, part of a system, or piece of equipment at a given instant or averaged over any designated period of time.

Demand (utility). Level at which electricity or natural gas is delivered to users at a given point in time. Electric demand is expressed in kilowatts.

Direct Impacts. All expenditures associated with construction and maintenance of geothermal power plants. During the construction phase, it corresponds to the total investment associated with the power plant construction. During the operation and maintenance (O&M) phase, it relates to all expenditures in goods and services associated with power plant O&M.

Direct Use. Use of geothermal heat without first converting it to electricity, such as for space heating and cooling, food preparation, industrial processes, etc.

Dispatch. Operating control of an integrated electric system to: assign generation to specific generating plants and other sources of supply to effect the most reliable and economical supply as the total of the significant area loads rises or falls; control O&M of high voltage lines, substations and equipment, including administration of safety procedures; operate the interconnection; and schedule energy transactions with other interconnected electric utilities.

Distribution. Delivery of electricity to retail customers (including homes, businesses, etc.).

Distributed Generation. Practice of generating electricity via a network of small prime movers rather than a large central power station. The cost is added complexity, but the benefit is improved redundancy and fault tolerance.

District Heating and/or Cooling (CHP). When heat rejected from power production (no matter what type) is circulated through nearby buildings for space heat. District, or zonal, heating has been common in Europe since WWII. District cooling, in which the cooling effect is produced by an absorption chiller, is conceptually no different but much rarer in practice.

Drilling. Boring into the Earth to access geothermal resources, usually with oil and gas drilling equipment that has been modified to meet geothermal requirements.

Dry Steam. Very hot steam that doesn't occur with liquid.

Economics. Study of how the forces of supply and demand allocate scarce resources. Subdivided into *microeconomics*, which examines the behavior of firms, consumers and the role of government; and *macroeconomics*, which looks at inflation, unemployment, industrial production, and the role of government.

Economy of Scale. Reduction in cost per unit resulting from increased production, realized through operational efficiencies. Economies of scale can be accomplished because as production increases, the cost of producing each additional unit falls.

Electric Plant (Physical). Facility containing prime movers, electric generators, and auxiliary equipment for converting mechanical, chemical, and/or fission energy into electric energy.

Electric Utility. Corporation, person, agency, authority, or other legal entity or instrumentality that owns and/or operates facilities within the United States, its territories, or Puerto Rico for the generation, transmission, distribution, or sale of electric energy primarily for use by the public and files forms listed in the Code of Federal Regulations, Title 18, Part 141. Facilities that qualify as cogenerators or small power producers under the Public Utility Regulatory Policies Act (PURPA) are not considered electric utilities.

Emissions Standard. Maximum amount of a pollutant legally permitted to be discharged from a single source.

Energy. Capacity for doing work as measured by the capability of doing work (potential energy) or the conversion of this capability to motion (kinetic energy). Energy has several forms, some of which are easily convertible and can be changed to another form useful for work. Most of the world's convertible energy comes from fossil fuels that are burned to produce heat that is then used as a transfer medium to mechanical or other means in order to accomplish tasks. Electrical energy is usually measured in kilowatt-hours, while heat energy is usually measured in British thermal units.

Energy Independence and Security Act of 2007 (EISA07). (Public Law 110-140) Statute passed by the United States Congress on June 21, 2007 and later signed into law on December 19, 2007. The Act was intended "to move the United States toward greater energy independence and security, to increase the production of clean renewable fuels, to protect consumers, to increase the efficiency of products, buildings, and vehicles, to promote research on and deploy greenhouse gas capture and storage options, and to improve the energy performance of the Federal Government." The bill originally sought to cut subsidies to the petroleum industry in order to promote petroleum independence and different forms of alternative energy. These tax changes were ultimately dropped after opposition in the Senate, and the final bill focused on automobile fuel economy, development of biofuels, and energy efficiency in public buildings and lighting.

Energy Policy Act of 2005 (EPAct05). (Public Law 109-58) Statute passed by the United States Congress on July 29, 2005 and signed into law on August 8, 2005 at Sandia National Laboratories in Albuquerque,

New Mexico. The Act, described by proponents as an attempt to combat growing energy problems, provides tax incentives and loan guarantees for energy production of various types.

Energy Source. Primary source that provides the power converted to electricity through chemical, mechanical, or other means. Energy sources include coal, petroleum and petroleum products, gas, water, uranium, wind, sunlight, geothermal, and other sources.

Environmental Impact Study. Document required by federal and state laws to accompany proposals for projects and programs that may have an impact on the surrounding area.

Equity. Ownership interest in a corporation in the form of common stock or preferred stock. It is the risk-bearing part of the company's capital and contrasts with debt capital which is usually secured and has priority over shareholders if the company becomes insolvent and its assets are distributed.

Facility. Existing or planned location or site at which prime movers, electric generators, and/or equipment for converting mechanical, chemical, and/or nuclear energy into electric energy are situated, or will be situated. A facility may contain more than one generator of either the same or different prime mover type. For a cogenerator, the facility includes the industrial or commercial process.

Flash Steam. Steam produced when the pressure on a geothermal liquid is reduced. Also called flashing.

Fossil Fuel. Any naturally occurring organic fuel, such as petroleum, coal, and natural gas.

Fossil-Fuel Plant. Plant using coal, petroleum, or gas as its source of energy.

Fuel. Any substance that can be burned to produce heat; also, materials that can be fissioned in a chain reaction to produce heat.

Generating Unit. Any combination of physically connected generator(s), reactor(s), boiler(s), combustion turbine(s), or other prime mover(s) operated together to produce electric power.

Generation (electricity). Process of producing electric energy by transforming other forms of primary energy from nature (e.g., mechanical, chemical, thermal, nuclear) in a *prime mover*. Generation also means the amount of electric energy produced, expressed in watt-hours. Thanks to entropy, this process is never 100-percent efficient and is usually far less. The maximum *Carnot* (theoretical) *efficiency* of thermal power production in a single step is 38 percent.

Geology. Study of the planet Earth, its composition, structure, natural processes, and history.

Geophysical Survey. Geophysical methodologies used during the exploration and drilling phases to locate the resource and identify the best suited sites to drill production wells. These may include gravity surveys, ground magnetic surveys, magnetotelluric surveys, electrical resistivity surveys, and seismic surveys.

Geothermal. Of or relating to the Earth's interior heat.

Geothermal Energy. Natural heat from within the Earth, captured for production of electric power, space heating, or industrial steam.

Geothermal Heat Pumps. Devices that take advantage of the relatively constant temperature of the Earth's interior, using it as a source and sink of heat for both heating and cooling – when cooling, heat is extracted from the space and dissipated into the Earth; when heating, heat is extracted from the Earth and pumped into the space.

Geothermal Plant. Plant in which the prime mover is a steam turbine. The turbine is driven either by steam produced from hot water or by natural steam that derives its energy from heat found in rocks or fluids at various depths beneath the surface of the Earth. The energy is extracted by drilling and/or pumping.

Geothermal Steam. Steam drawn from deep within the Earth.

Geyser. Spring that shoots jets of hot water and steam into the air.

Geysers, The (note: "The" of "The Geysers" is always capitalized). Large geothermal steam field located north of San Francisco.

Greenfield Project. As opposed to a project expansion, a project that is developed on a resource (area) that is not used by an existing power plant.

See also Brownfield

Greenhouse Effect. Increasing mean global surface temperature of the Earth caused by gases in the atmosphere (including carbon dioxide, methane, nitrous oxide, ozone, and chlorofluorocarbon). The greenhouse effect allows solar radiation to penetrate but absorbs the infrared radiation returning to space.

Grid. Layout of an electrical distribution system.

Gross Generation. Total amount of electric energy produced by the generating units at a generating station or stations, measured at the generator terminals.

Heat Exchanger. Device for transferring thermal energy from one fluid to another.

Heat Pumps. See Geothermal Heat Pumps

Hot Dry Rock. Geothermal resource created when impermeable, subsurface rock structures, typically granite rock 15,000 feet or more below the Earth's surface, are heated by geothermal energy. The resource is being investigated as a source of energy production.

Hydroelectric Plant. Plant in which the turbine generators are driven by falling water.

Independent Power Producers. Entities that are considered nonutility power producers in the United States. These facilities are wholesale electricity producers that operate within the franchised service territories of host utilities and are usually authorized to sell at market-based rates. Unlike traditional electric utilities, Independent Power Producers do not possess transmission

Indirect Impacts. Correspond to the economic impact that affects all industries that provides goods and services to the industries directly involved in power plant construction or O&M. Indirect impacts thus quantify the impact of changes in power plant construction or O&M activities on the industries that supplies it.

Induced Impacts. Industries that experience both direct and indirect impacts will often change their employment levels to meet the new level of demand. These employment changes induce changes in income that are spent in the region to purchase goods and services. This income effect is the source of induced impacts. Induced impacts lead to further rounds of indirect and induced impacts as the increased demand for goods and services purchased by workers leads to further increases in output in other industries.

Injection. Orocess of returning spent geothermal fluids to the subsurface. Sometimes referred to as reinjection.

Injection Well. Injects the brine back into the reservoir after using it in the power production process.

Kilowatt (kW). One thousand watts.

Kilowatt-hour (kWh). One thousand watt-hours.

Known Geothermal Resource Area. Region identified by the U.S. Geological Survey as containing geothermal resources.

Lead Time. Amount of time between placing of an order and receipt of the goods.

Lease. Contract between a lessor and a lessee for use of a vehicle or other property, subject to stated terms and limitations, for a specified period and at a specified payment.

Levelized Cost. Present value of the total cost of building and operating a generating plant over its economic life, converted to equal annual payments. Costs are levelized in real dollars (i.e., adjusted to remove the impact of inflation).

Lithologies. Properties of a rock formation.

Load (electric). Amount of electric power delivered or required at any specific point or points on a system. The requirement originates at the energy-consuming equipment of the consumers.

Magma. Molten rock and elements that lie below the Earth's crust. The heat energy can approach 1,000 degrees Fahrenheit and is generated directly from a shallow molten magma resource and stored in adjacent rock structures. To extract energy from magma resources requires drilling near or directly into a magma chamber and circulating water down the well in a convection- type system. California has two areas that may be magma resource sites: the Mono-Long Valley Caldera and Coso Hot Springs Known Geothermal Resource Areas.

Mantle. Earth's inner layer of molten rock, lying beneath the Earth's crust and above the Earth's core of liquid iron and nickel.

Megawatt (MW). One million watts.

Megawatt Hour (MWh), One million watt-hours.

Mitigation. Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation. and technological hazards

Municipal Utility. Water or electric company over which the state Department of Public Utility Control does not have jurisdiction to regulate.

Natural Gas. Naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in porous geological formations beneath the earth's surface, often in association with petroleum. The principal constituent is methane.

Natural Gas Combined-Cycle. Plants that generate electricity using two methods, the steam cycle and the gas cycle. In the steam cycle, fuel is burned to boil water and create steam which turns a steam turbine

driving a generator to create electricity. In the gas cycle, gas is burned in a gas turbine which directly turns a generator to create electricity. Combined cycle power plants operate by combining the gas cycle and the steam cycle for higher efficiency.

Net Capability. Maximum load-carrying ability of the equipment, exclusive of station use, under specified conditions for a given time interval, independent of the characteristics of the load capability is determined by design characteristics, physical conditions, adequacy of prime mover, energy supply, and operating limitations such as cooling and circulating water supply and temperature, headwater and tailwater elevations, and electrical use).

Net Generation. Gross generation less the electric energy consumed at the generating station for station use.

Nitrogen oxides (NOx. Oxides of nitrogen that are a chief component of air pollution that can be produced by the burning of fossil fuels.

Non-specular Conductors. Conductors treated to reduce the amount of light reflected, usually by dipping the conductor in an acid bath that takes the shine off thereby reducing visibility.

Nuclear Energy. Power obtained by splitting heavy atoms (fission) or joining light atoms (fusion). A nuclear energy plant uses a controlled atomic chain reaction to produce heat; the heat is used to make steam run conventional turbine generators.

Nuclear Power Plant. Facility in which heat produced in a reactor by the fissioning of nuclear fuel is used to drive a steam turbine.

Open-Loop Biomass. Any agricultural livestock waste nutrients or any solid, nonhazardous, cellulosic or lignin waste material or by product of wood or paper mill operations, including lignin in pulping liquors. See also Closed-Loop Biomass.

Outage. Period during which a generating unit, transmission line, or other facility is out of service.

Particulate Matter (PM). Unburned fuel particles that form smoke or soot and stick to lung tissue when inhaled; a chief component of exhaust emissions from heavy-duty diesel engines.

Peak Demand. Maximum load during a specified period of time.

Peaking Capacity. Capacity of generating equipment normally reserved for operation during the hours of highest daily, weekly, or seasonal loads. Some generating equipment may be operated at certain times as peaking capacity and at other times to serve loads on an around-the-clock basis.

Permeability. Relative ease with which a porous medium can transmit a liquid under a hydraulic gradient. In hydrology, the capacity of rock, soil, or sediment to allow the passage of water.

Plant. Facility at which are located prime movers, electric generators, and auxiliary equipment for converting mechanical, chemical, and/or nuclear energy into electric energy. A plant may contain more than one type of prime mover. Electric utility plants exclude facilities that satisfy the definition of a qualifying facility under the PURPA of 1978.

Pollution. Unwanted particles, mist, or gases put into the atmosphere as a result of motor vehicle exhaust; the operation of industrial facilities or other human activity.

Polygeneration. General term which includes district heating and/or cooling, combined heat and power, cogeneration, trigeneration, Tetrageneration™, and even higher orders of polygeneration. Tetrageneration™ is obtaining four different useful energy effects in a thermodynamic cascade from the same unit input of primary fuel. For example: electricity; live steam for more electricity, biofuel production, desalination, other process heat, or simple space heat; chilled water via an absorption cooling cycle; and dehumidification. Note these can occur in *any* order.

Power. Rate at which energy is transferred. Electrical energy is usually measured in watts. Also used for a measurement of capacity.

Power Purchase Agreement. Off-take contract from a large customer to buy the electricity generated by a power plant.

Price. Amount of money or consideration-in-kind for which a service is bought, sold, or offered for sale.

Production Well. Production well drilled through a geothermal resource that produces geothermal brine.

Profit. Income remaining after all business expenses are paid.

Qualifying Facility. Cogeneration or small power production facility that meets certain ownership, operating, and efficiency criteria established by the Federal Energy Regulatory Commission pursuant to the PURPA.

Rate of Return. Annual rate of return on an investment, expressed as a percentage of the total amount invested. Also called return.

Reconnaissance. Method of gathering data, often associated with surface surveys, in which archaeological remains are systematically identified and plotted on a map.

Regulation. Governmental function of controlling or directing economic entities through the process of rulemaking and adjudication.

Reliability. Electric system reliability has two components--adequacy and security. Adequacy is the ability of the electric system to supply to aggregate electrical demand and energy requirements of the customers at all times, taking into account scheduled and unscheduled outages of system facilities. Security is the ability of the electric system to withstand sudden disturbances, such as electric short circuits or unanticipated loss of system facilities. The degree of reliability may be measured by the frequency, duration, and magnitude of adverse effects on consumer services.

Renewable Energy. Resources that constantly renew themselves or that are regarded as practically inexhaustible. These include solar, wind, geothermal, hydro, and wood. Although particular geothermal formations can be depleted, the natural heat in the earth is a virtually inexhaustible reserve of potential energy. Renewable resources also include some experimental or less-developed sources such as tidal power, sea currents and ocean thermal gradients.

Renewable Resources. Naturally, but flow-limited resources that can be replenished. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Some (such as geothermal and biomass) may be limited in that stocks are depleted by use, but on a time scale of decades, or perhaps centuries, they can probably be replenished. Renewable energy resources include: biomass, hydro, geothermal, solar, and wind. In the future, they could also include the use of ocean thermal, wave, and tidal action technologies. Utility renewable resource applications include bulk electricity generation,

on-site electricity generation, distributed electricity generation, non-grid-connected generation, and demand-reduction (energy efficiency) technologies.

Reservoir. Natural underground container of liquids, such as water or steam (or, in the petroleum context, oil or gas).

Re-vegetation. Re-growing native plants, mainly trees and shrubs, by active restoration, natural process restoration, or both.

Revenue. Total amount of money received by a firm from sales of its products and/or services, gains from the sales or exchange of assets, interest and dividends earned on investments, and other increases in the owner's equity except those arising from capital adjustments.

Royalty. Payment made for the use of property, especially a patent, copyrighted work, franchise, or natural resource. The amount is usually a percentage of revenues obtained through its use.

Sales. Amount of kilowatt-hours sold in a given period of time; usually grouped by classes of service, such as residential, commercial, industrial, and other. Other sales include public street and highway lighting, other sales to public authorities and railways, and interdepartmental sales.

Silviculture. Farming of forests for fruits, nuts, and other products, either for food, fuel, or medicine, as opposed to timbering or agriculture with traditional row-crops.

Slim-hole. Small-diameter wells drilled during the exploration phase in order to verify the existence of a productive geothermal resource and provide information about the geologic structure of the site. Such holes are sometimes preferred to "full-diameter production wells" since they are significantly less expensive.

Socioeconomics. Research into the effects of both social and economic factors on individuals and communities. Socioeconomics begins with the assumption that economics is not a self contained system, but is embedded in society, polity, and culture.

Solar Energy. Heat and light radiated from the sun.

Stability. Property of a system or element by virtue of which its output will ultimately attain a steady state. The amount of power that can be transferred from one machine to another following a disturbance. The stability of a power system is its ability to develop restoring forces equal to or greater than the disturbing forces so as to maintain a state of equilibrium.

Standby Service. Support service that is available, as needed, to supplement a consumer, a utility system, or to another utility if a schedule or an agreement authorizes the transaction. The service is not regularly used.

Subsidence. Sinking of an area of the Earth's crust due to fluid withdrawal and pressure decline.

Sulfur oxides. Compounds containing sulfur and oxygen, such as sulfur dioxide (SO_2) and sulfur trioxide (SO_3). Often abbreviated SOx.

Sustainability. Economic development that takes full account of the environmental consequences of economic activity and is based on the use of resources that can be replaced or renewed and therefore are not depleted.

System (electric). Physically connected generation, transmission, and distribution facilities operated as an integrated unit under one central management, or operating supervision.

Temperature Gradient Hole: Relatively slim and shallow hole (50 to 600 feet deep) that attempts to estimate the rate of increase of ground temperature with depth.

Transmission. Movement or transfer of electric energy over an interconnected group of lines and associated equipment between points of supply and points at which it is transformed for delivery to consumers, or is delivered to other electric systems. Transmission is considered to end when the energy is transformed for distribution to the consumer.

Transmission System (electric). Interconnected group of electric transmission lines and associated equipment for moving or transferring electric energy in bulk between points of supply and points at which it is transformed for delivery over the distribution system lines to consumers, or is delivered to other electric systems.

Turbine. Machine for generating rotary mechanical power from the energy of a stream of fluid (such as water, steam, or hot gas). Turbines convert the kinetic energy of fluids to mechanical energy through the principles of impulse and reaction, or a mixture of the two.

Utility. Regulated entity which exhibits the characteristics of a natural monopoly. For the purposes of electric industry restructuring, "utility" refers to the regulated, vertically-integrated electric company. "Transmission utility" refers to the regulated owner/operator of the transmission system only. "Distribution utility" refers to the regulated owner/operator of the distribution system which serves retail customers.

Utility-grade. Geothermal or hydrothermal resource hot enough to generate electricity with a thermal power plant.

Watt. Electrical unit of power. The rate of energy transfer equivalent to one ampere flowing under a pressure of 1 volt at unity power factor.

Watt-hour (Wh). Electrical energy unit of measure equal to 1 watt of power supplied to, or taken from, an electric circuit steadily for one hour.

Note: All terms from the Energy Information Administration [EIA] (2002) Glossary of Electricity Terms, Retrieved August 1, 2006, from http://www.eia.doe.gov/cneaf/electricity/epav1/glossary.html ; California Energy Commission (2004); the Glossary of Energy Terms, Retrieved August 1, 2006; and from http://www.energy.ca.gov/glossary/.

APPENDIX H

NAVAJO ENDANGERED SPECIES LIST

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NAVAJO NATION
DIVISION OF NATURAL RESOURCES
DEPARTMENT OF FISH AND WILDLIFE

NAVAJO ENDANGERED SPECIES LIST

Resources Committee Resolution
No. RCS-41-08

September 10, 2008

GROUP 1: Those species or subspecies that no longer occur on the Navajo Nation.

GROUP 2 (G2) & GROUP 3 (G3): "Endangered" -- Any species or subspecies whose prospects of survival or recruitment within the Navajo Nation are in jeopardy or are likely within the foreseeable future to become so.

G2: A species or subspecies whose prospects of survival or recruitment are in jeopardy.

G3: A species or subspecies whose prospects of survival or recruitment are likely to be in jeopardy in the foreseeable future.

GROUP 4: Any species or subspecies for which the Navajo Nation Department of Fish and Wildlife NNDFW does not currently have sufficient information to support their being listed in G2 or G3 but has reason to consider them. The NNDFWL will actively seek information on these species to determine if they warrant inclusion in a different group or removal from the list.

The NNDFW shall determine the appropriate group for listing a species or subspecies due to any of the following factors:

1. The present or threatened destruction, modification, or curtailment of its habitat;

2. Over-utilization for commercial, sporting or scientific purposes;

3. The effect of disease or predation;

4. Other natural or man-made factors affecting its prospects of survival or recruitment within the Navajo Nation; or

5. Any combination of the foregoing factors.

NAVAJO ENDANGERED SPECIES LIST – May 2008

	Scientific name	Common name
GROUP 1:		
MAMMALS	*Canis lupus*	Gray Wolf
	Lontra canadensis	Northern River Otter
	Ursus arctos	Grizzly or Brown Bear
FISHES	*Gila elegans*	Bonytail
GROUP 2:		
MAMMALS	*Mustela nigripes*	Black-footed Ferret
BIRDS	*Coccyzus americanus*	Yellow-billed Cuckoo
	Empidonax traillii extimus	Southwestern Willow Flycatcher
	Haliaeetus leucocephalus	Bald Eagle
AMPHIBIANS	*Lithobates pipiens*	Northern Leopard Frog
FISHES	*Gila cypha*	Humpback Chub
	Gila robusta	Roundtail Chub
	Ptychocheilus lucius	Colorado Pikeminnow
	Xyrauchen texanus	Razorback Sucker
PLANTS	*Astragalus cutleri*	Cutler's Milk-vetch
	Astragalus humillimus	Mancos Milk-vetch
	Erigeron rhizomatus	Rhizome Fleabane
	Pediocactus bradyi	Brady Pincushion Cactus
	Sclerocactus mesae-verdae	Mesa Verde Cactus
GROUP 3:		
MAMMALS	*Antilocapra americana* [1]	Pronghorn [1]
	Ovis canadensis [2]	Bighorn Sheep [2]
BIRDS	*Aquila chrysaetos*	Golden Eagle
	Buteo regalis	Ferruginous Hawk
	Cinclus mexicanus	American Dipper
	Strix occidentalis lucida	Mexican Spotted Owl
INVERTEBRATES	*Speyeria nokomis*	Western Seep Fritillary
PLANTS	*Allium gooddingii*	Gooding's Onion
	Asclepias welshii	Welsh's Milkweed
	Astragulus cremnophylax var. *hevroni*	Marble Canyon Milk-vetch
	Astragalus cronquistii	Cronquist Milk-vetch
	Astragalus naturitensis	Naturita Milk-vetch
	Carex specuicola	Navajo Sedge
	Erigeron acomanus	Acoma Fleabane
	Errazurizia rotundata	Round Dunebroom
	Lesquerella navajoensis	Navajo Bladderpod
	Pediocactus peeblesianus ssp. *fickeiseniae*	Fickeisen Plains Cactus
	Penstemon navajoa	Navajo Penstemon
	Perityle specuicola	Alcove Rock Daisy
	Platanthera zothecina	Alcove Bog-orchid
	Zigadenus vaginatus	Alcove Death Camas

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GROUP 4:

	Scientific name	Common name
MAMMALS	*Corynorhinus townsendii*	Townsend's Big-eared Bat
	Dipodomys microps	Chisel-toothed Kangaroo Rat
	Dipodomys spectabilis [3]	Banner-tailed Kangaroo Rat [3]
	Microtus mogollonensis	Navajo Mountain Vole
	Perognathus amplus cineris	Wupatki [Arizona] Pocket Mouse
	Vulpes macrotis	Kit Fox
BIRDS	*Accipiter gentilis*	Northern Goshawk
	Aechmophorus clarkia	Clark's Grebe
	Aegolius acadicus	Northern Saw-whet Owl
	Athene cunicularia	Burrowing Owl
	Ceryle alcyon	Belted Kingfisher
	Charadrius montanus	Mountain Plover
	Dendragapus obscurus	Dusky Grouse
	Dendroica petechia	Yellow Warbler
	Empidonax hammondii	Hammond's Flycatcher
	Falco peregrinus	Peregrine Falcon
	Glaucidium gnoma	Northern Pygmy-Owl
	Gymnogyps californianus	California Condor
	Otus flammeolus	Flammulated Owl
	Patagioenas fasciata	Band-tailed Pigeon
	Picoides dorsalis	American Three-toed Woodpecker
	Porzana carolina	Sora
	Tachycineta bicolor	Tree Swallow
	Vireo vicinior	Gray Vireo
REPTILES	*Lampropeltis triangulum*	Milk Snake
	Sauromalus ater	Chuckwalla
FISHES	*Catostomus discobolus*	Bluehead Sucker
	Cottus bairdi	Mottled Sculpin
INVERTEBRATES	*Oreohelix strigosa*	Rocky Mountainsnail
	Oreohelix yavapai	Yavapai Mountainsnail
	Oxyloma kanabense	Kanab Ambersnail
PLANTS	*Aliciella formosa*	Aztec Gilia
	Amsonia peeblesii	Peebles Blue-star
	Asclepias sanjuanensis	San Juan Milkweed
	Astragalus beathii	Beath Milk-vetch
	Astragalus heilii	Heil's Milk-vetch
	Atriplex garrettii var. navajoensis	Navajo Saltbush
	Camissonia atwoodii	Atwood's Camissonia
	Cirsium rydbergii	Rydberg's Thistle
	Cypripedium parviflorum var. pubescens	Yellow Lady's Slipper
	Cystopteris utahensis	Utah Bladder-fern
	Ericameria arizonica	Grand Canyon Goldenweed
	Erigeron sivinskii	Sivinski's Fleabane
	Eriogonum lachnogynum var. sarahiae	Sarah's Buckwheat
	Phacelia indecora	Bluff Phacelia
	Primula specuicola	Cave Primrose
	Psorothamnus arborescens var. pubescens	Marble Canyon Dalea
	Puccinella parishii	Parish's Alkali Grass
	Salvia pachyphylla ssp. eremopictus	Arizona Rose Sage
	Sclerocactus cloveriae brackii	Brack Hardwall Cactus
	Symphyotrichum welshii	Welsh's American-aster

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Footnotes (Exclusions)

[1] G3 designation **excludes** NNDFW Management Unit 16 'New Lands', the boundaries of which are: From Sanders, AZ east along Unit 4 boundary to the Zuni boundary; south along the boundary past AZ Hwy 61 to the Navajo Nation/state boundary; west along the boundary past US Hwy 666 to the Navajo Nation/state boundary; north along Rd 2007 to Navajo, AZ; west to the north and south of Interstate 40 to the state/Petrified Forest National Park boundary; north along the boundary to the Unit 8 boundary; east along the boundary to US Hwy 191; south to Chambers and east to Sanders. For a Unit 16 map, contact NNDFW, P.O. Box 1480, Window Rock, AZ, 86515, 928 871-6451.

[2] Special hunts of *Ovis canadensis* may be conducted in Management Unit 11 for management purposes.

[3]Group 4 status for this species pertains only to the populations in Arizona and Utah; populations in the New Mexico portion of the Navajo Nation are not considered for this designation.

APPENDIX I

UNIFORM REGULATIONS FOR PERMIT REVIEW, ADMINISTRATIVE ENFORCEMENT ORDERS, HEARINGS, AND RULEMAKINGS UNDER NAVAJO NATION ENVIRONMENTAL ACTS

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UNIFORM REGULATIONS FOR PERMIT REVIEW, ADMINISTRATIVE ENFORCEMENT ORDERS, HEARINGS, AND RULEMAKINGS UNDER NAVAJO NATION ENVIRONMENTAL ACTS

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Subpart 1. General Provisions and Definitions.

101. Purpose, Applicability and Scope.

(a) These regulations provide uniform procedures under the Navajo Nation environmental statutes for review and hearings on permit applications; issuance of and hearings on administrative orders; and rulemakings. By providing uniform procedures, the Navajo Nation Environmental Protection Agency ("Navajo Nation EPA" or "NNEPA") intends to ease the burden on the public of compliance and provide consistency in the implementation of the environmental statutes. Except where otherwise indicated, this Part applies to all applications for permits issued under the Navajo Nation Air Pollution Prevention and Control Act ("NNAPPCA") (4 N.N.C. §§ 1101, et seq.), the Navajo Nation Clean Water Act ("NNCWA")(to be codified at 4 N.N.C.§§ _____, et seq.), the Navajo Nation Safe Drinking Water Act ("NNSDWA")(to be codified at 4 N.N.C.§§ _____, et seq.), and the Navajo Nation Solid Waste Act ("NNSWA") (to be codified at 4 N.N.C.§§ _____, et seq.); all administrative enforcement orders issued under any of the forgoing Acts, the Navajo Nation Hazardous Substances Act ("NNCERCLA") (to be codified at 4 N.N.C.§§ _____ et seq.), the Navajo Nation Pesticide Act ("NNPA") (4 N.N.C.§§ 301, et seq.), and the Navajo Nation Underground Storage Tank Act ("NNUSTA") (to be codified at 4 N.N.C.§§ _____, et seq.); and all rulemakings conducted under any of the forgoing Acts. In the event that additional environmental Acts are enacted by the Navajo Nation Council after promulgation of these regulations, these regulations shall apply to permits, administrative orders, hearings and rulemakings issued or conducted under those Acts unless specifically provided otherwise in those statutes or in regulations promulgated under those Acts. In the case of any conflict between a provision of this Part and a provision of the applicable Act or regulations governing a permit application, administrative enforcement order, hearing, or rulemaking, the provision of the applicable Act or regulations shall govern.

(b) Questions arising at any stage of a permit, enforcement, or rulemaking proceeding which are not addressed in these rules or the applicable Act and regulations shall be resolved at the discretion of the Director or Hearing Official as appropriate.

102. Authority.

The authority to promulgate regulations pertaining to permitting, administrative enforcement actions and rulemaking comes from the Navajo Nation environmental Acts and the corresponding federal environmental Acts. *See, e.g.,* NNAPPCA, 4 N.N.C. §§ 1103, 1134, 1152; NNCWA §§ 104, 504, 902, 904, 1001 (to be codified at 4 N.N.C. §§ ___); NNSDWA §§ 107, 701, 803 (to be codified at 4 N.N.C. §§ ___); NNSWA §§ 107, 402-403, 502, 504 (to be codified at 4 N.N.C. §§ ___); NNCERCLA §§ 510, 801 (to be codified at 4 N.N.C. §§ ___); NNPA, 4

N.N.C. §§ 305, 320, 322; NNUSTA §§ 106, 502, 504, 506 (to be codified at 4 N.N.C. §§ ___); CAA § 301(d), 42 U.S.C. § 7601(d); CWA § 518(e), 33 U.S.C. § 1377(e); SDWA § 1451, 42 U.S.C § 300j-11; CERCLA § 126, 42 U.S.C. § 9626.

103. Definitions.

The definitions below apply to this Part. Additional definitions applicable to Subpart 3 are set forth in § 303.

(a) *Administrator* means the Administrator of the United States Environmental Protection Agency.

(b) *Applicable Act* and (or) *regulations* means the NNAPPCA, NNCWA, NNCERCLA, NNSDWA, NNSWA, or NNUSTA, as the case may be, or any Navajo Nation environmental Act enacted by the Navajo Nation Council after promulgation of these regulations, as specified in § 101(a), and (or) applicable regulations promulgated under those Acts.

(c) *Application* means the EPA standard national forms for applying for a permit, including any additions, revisions or modifications to the forms, and forms developed by NNEPA and approved by EPA, including any approved modifications or revisions. "Application" also includes any information required by the Director under the applicable Act or regulations.

(d) *Director* means the Executive Director of NNEPA or his or her authorized delegate.

(e) *Draft permit* means a document prepared under § 205 indicating the Director's tentative decision to issue or deny, modify, revoke and reissue, terminate, or reissue a permit. A notice of intent to terminate a permit and a notice of intent to deny a permit are types of draft permits. A denial of a request for modification, revocation and reissuance or termination is not a draft permit. When no draft permit is required under the applicable Act and regulations, draft permit means the permit application.

(f) *EPA* means the United States Environmental Protection Agency.

(g) *Facility* or *activity* means any hazardous waste management facility, underground injection control injection well, national pollutant discharge elimination system point source, treatment works treating domestic sewage or 404 dredge or fill activity (including land or appurtenances thereto) that is subject to regulation by NNEPA, or other facility or activity that is subject to regulation by NNEPA under the applicable Act or regulations.

(h) *Hearing Moderator* means the person designated by the Director to moderate a public hearing under Subpart 2 or Subpart 4 of these regulations.

(i) *Hearing Official* means the person designated by the Director within the Navajo Nation Office of Hearings and Appeals to be in charge of and issue decisions at adjudicatory hearings on administrative actions. The Director may designate a Hearing Official outside of the Navajo Nation Office of Hearings and Appeals, but that person must be a State-licensed attorney.

(j) *Navajo Nation EPA* or *NNEPA* means the Navajo Nation Environmental Protection Agency.

(k) *Permit* means an authorization, license, or equivalent control document issued by NNEPA to implement the applicable Act and regulations. Any control document specifically exempted from these regulations by the applicable Act or regulations is not a permit.

(l) *Person* means an individual, public or private corporation, company, partnership, firm, association, the federal or state governments and any of their political subdivisions, agencies or programs, and the Navajo Nation or any other tribe and any of its political subdivisions, agencies, programs, enterprises or companies.

(m) *Regional Administrator* means the Regional Administrator of U.S. EPA Region 9 or the authorized representative of the Regional Administrator.

(n) *Schedule of compliance* means a schedule of remedial measures included in a permit, including an enforceable sequence of interim requirements (for example, actions, operations, or milestone events) leading to compliance with the applicable Act and regulations.

(o) *Site* means the land or water area where any facility or activity is physically located or conducted, including adjacent land used in connection with the facility or activity.

(p) *State* means one of the states of the United States.

104. Computation of Time.

In computing any period of time prescribed or allowed under these regulations, except as otherwise provided, the day of the event from which the designated period begins to run shall not be included. Saturdays, Sundays, and federal and Navajo Nation legal holidays shall be included. When a stated time expires on a Saturday, Sunday or federal or Navajo Nation legal holiday, the stated time period shall be extended to include the next business day.

105. Conflict of Interest.

(a) The Director, Hearing Moderator, or Hearing Official may not perform functions provided for in these regulations regarding any matter in which he or she:

(1) Has a financial interest; or

(2) Has any relationship with a party to or with the subject matter of the proceeding in question which would make it inappropriate for him or her to act.

(b) If the Director is disqualified pursuant to subsection (a) from performing a function under these regulations, the Director shall assign a Department Director or a program manager who has none of the infirmities listed in subsection (a) to replace him or her with regard to such functions.

Subpart 2. Uniform Permit Review Procedures.

201. Scope.

This Subpart establishes uniform procedures for processing permit applications and requests for permit modification, revocation and reissuance, and termination, including issuing draft permits, providing for public comment and hearings, and issuing final permit determinations under the Navajo Nation Air Pollution Prevention and Control Act, the Navajo Nation Clean Water Act, the Navajo Nation Safe Drinking Water Act, the Navajo Nation Solid Waste Act, and other applicable Acts.

202. Application for a Permit.

(a) Any person who requires a permit under the applicable Act and regulations shall complete, sign, and submit to the Director an application for the permit as required under this section, together with any fees required by specific program regulations.

(b) The Director shall not begin the processing of a permit until the applicant has fully complied with the application requirements for that permit.

(c) Permit applications (except for Prevention of Significant Deterioration permits) must comply with any signature and certification requirements of the applicable Act and regulations.

(d) Each application submitted should be reviewed for completeness by the Director within thirty (30) days of its receipt, or such longer time as the Director may deem necessary. Upon completing the review, the Director shall notify the applicant in writing whether the application is complete or incomplete. The Director may also request additional information from an applicant when necessary to clarify, modify, or supplement previously submitted material. Requests for such additional information will not render an application incomplete.

(e) If an applicant fails or refuses to correct deficiencies in the application, the permit may be denied and appropriate enforcement actions may be taken under the applicable Act and regulations.

(f) If the Director decides that a site visit is necessary for any reason in conjunction with the processing of an application, the applicant shall be notified and a date shall be scheduled.

(g) The effective date of an application is the date on which the Director notifies the

applicant that the application is complete as provided in subsection (d).

203. Consolidation of Permit Processing.

(a) Whenever a facility or activity requires a permit under more than one Act covered by these regulations, processing of two or more applications for those permits may be consolidated. In making the decision whether to coordinate the expiration dates of the existing permits, the Director may consider whether the burden on the permittee's environmental quality staff and the staff of the NNEPA may be more strained if all of the permits for a facility expire at the same time rather than having them considered on a staggered schedule. The first step in consolidation is to prepare each draft permit at the same time.

(b) Whenever draft permits are prepared at the same time, fact sheets, administrative records, public comment periods, and any public hearings on those permits should also be consolidated. The final permits may be issued together. They need not be issued together if, in the judgment of the Director, joint processing would result in unreasonable delay in the issuance of one or more permits.

(c) Whenever an existing facility or activity requires additional permits under one or more of the Acts covered by these regulations, the Director may coordinate the expiration dates of the existing permits so that all permits expire simultaneously. Processing of the subsequent applications for renewal permits may then be consolidated.

(d) The Director may agree with the Regional Administrator to consolidate draft permits whenever a facility or activity requires permits from both EPA and NNEPA.

204. Permit Modification, Revocation and Reissuance, or Termination.

(a) Permits (other than Prevention of Significant Deterioration permits) may be modified, revoked and reissued, or terminated either at the request of any interested person (including the permittee) or upon the Director's initiative. However, permits may only be modified, revoked and reissued, or terminated for the reasons specified in the applicable Act and regulations. All requests shall be in writing and shall contain facts or reasons supporting the request.

(b) If the Director decides that the request is not justified, he or she shall send the requester a brief written response giving a reason for the decision. Denials of requests for modification, revocation and reissuance, or termination are not subject to public notice, comment, or hearings.

(c) **(1)** If the Director tentatively decides to modify or revoke and reissue a permit, he

or she shall prepare a draft permit under § 205 incorporating the proposed changes. The Director may request additional information and, in the case of a modified permit, may require the submission of an updated application. In the case of revoked and reissued permits, the Director shall require the submission of a new application.

(2) In a permit modification under this section, only those conditions to be modified shall be reopened when a new draft permit is prepared. All other aspects of the existing permit shall remain in effect for the duration of the unmodified permit. When a permit is revoked and reissued under this section, the entire permit is reopened just as if the permit had expired and was being reissued. During any revocation and reissuance proceeding, the permittee shall comply with all conditions of the existing permit until a new final permit is reissued.

(d) If the Director tentatively decides to terminate a permit, he or she shall issue a notice of intent to terminate. A notice of intent to terminate is a type of draft permit which follows the same procedures as any draft permit prepared under § 205.

205. Draft Permits.

(a) Once an application is complete, the Director shall tentatively decide whether to prepare a draft permit (except in the case that the applicable Act and regulations do not require a draft permit) or to deny the application.

(b) If the Director tentatively decides to deny the permit application, then he or she shall issue a notice of intent to deny. A notice of intent to deny the permit application is a type of draft permit which follows the same procedure as any draft permit prepared under this section. If the Director's final decision is that the tentative decision to deny the permit application was incorrect, he or she shall withdraw the notice of intent to deny and proceed to prepare a draft permit.

(c) If the Director decides to prepare a draft permit he or she shall prepare a draft permit that contains the following information:

(1) All permit conditions under the applicable Act and regulations;

(2) All compliance schedules under the applicable Act and regulations;

(3) All monitoring requirements under the applicable Act and regulations; and

(4) All other information required to be in the permit under the applicable Act and regulations.

(d) All draft permits prepared under this section shall be accompanied by a fact sheet and shall be based on the administrative record and, pursuant to § 207, notice of the draft permit shall be given to the public and the draft permit shall be made available for public comment. The Director shall give notice of opportunity for a public hearing, issue a final decision and respond to comments, pursuant to § 208.

206. Fact Sheet.

(a) A fact sheet shall be prepared for every draft permit unless a fact sheet is not required under the applicable Act and regulations, in which case the Director shall prepare a fact sheet if the Director finds that the permit application is the subject of widespread public interest or raises major issues. The fact sheet shall briefly set forth the principal facts and the significant factual, legal, methodological and policy questions considered in preparing the draft permit. The Director shall send this fact sheet to the applicant and, on request, to any other person.

(b) The fact sheet shall include, when applicable:

(1) A brief description of the type of facility or activity which is the subject of the draft permit;

(2) The type and quantity of wastes, fluids or pollutants which are proposed to be or are being treated, stored, disposed of, injected, emitted, or discharged;

(3) A brief summary of the basis for the draft permit conditions, including references to applicable statutory or regulatory provisions and appropriate supporting references to the administrative record;

(4) Reasons why any requested variances, exemptions or alternatives to required standards do or do not appear justified;

(5) A description of the procedures for reaching a final decision on the draft permit including:

A. The beginning and ending dates of the comment period and the address where comments will be received;

B. Procedures for requesting a hearing and the nature of that hearing; and

C. Any other procedures by which the public may participate in the final decision;

(6) Name and telephone number of a person to contact for additional information;

(7) When appropriate, a sketch or detailed description of the location of the discharge or regulated activity described in the application; and

(8) Any other information required to be in the fact sheet under the applicable Act and regulations.

207. Public Notice of Permit Actions and Public Comment Period.

(a) Public Notice Required.

(1) The Director shall give public notice that the following actions have occurred:

A. A draft permit has been prepared;

B. When no draft permit is required by the applicable Act and regulations, a permit application has been received; or

C. A hearing has been scheduled.

(2) No public notice is required when a request for permit modification, revocation and reissuance, or termination is denied under § 204(b). Written notice of the denial shall be given to the requester and to the permittee.

(3) Public notices may describe more than one permit or permit action.

(b) Timing.

(1) Public notice of the preparation of a draft permit, including a notice of intent to deny a permit application, shall allow at least thirty (30) days for public comment. This comment period may be reopened pursuant to § 211(b) if the Director determines that issuance of the permit is reasonably likely to be contested and that applying the requirements of § 211(b) will substantially expedite the decision making process. The notice of the draft permit shall state whenever this has been done.

(2) Public notice of a public hearing shall be given at least thirty (30) days before the hearing. Public notice of the hearing may be given at the same time as public notice of the draft permit and the two notices may be combined.

(c) **Methods.** The public notice required under subsection (a) shall be given by each of the following methods:

(1) A notice by mail to each of the persons listed below. Persons otherwise entitled to receive notice under this paragraph may waive their rights to receive notice for any classes and categories of permits by expressly advising the Director in writing.

A. The applicant;

B. Federal and Navajo Nation agencies with jurisdiction over fish and wildlife resources, the Advisory Council on Historic Preservation, the Navajo Nation Historic Preservation Department, and other appropriate agencies of affected states or Tribes, including the State or Tribal Historic Preservation Officer;

C. Any Chapter or other unit of local government having jurisdiction over the area where the facility is proposed to be located and each Navajo Nation agency having any authority under Navajo Nation law with respect to construction or operation of such facility;

D. Any other agency which the Director knows has issued or is required to issue a permit for the same facility or activity;

E. Any user identified in the permit application; and

F. Persons on a mailing list developed by:

(i) Including those who request to be on the list;

(ii) Soliciting persons for area lists from participants in past permit proceedings in that area; and

(iii) Notifying the public of the opportunity to be put on the mailing list through periodic publication in the public press and in such publications as newsletters, environmental bulletins, and Tribal law journals. The Director may update the mailing list from time to time by requesting written indication of continued interest from those listed. The name of any person who fails to respond to such a request may be deleted from the list.

(2) A notice in a daily or weekly newspaper within the area affected by the

facility or activity;

(3) A notice broadcast over local radio stations in English and Navajo; and

(4) Any other method reasonably determined to give actual notice of the action in question to the persons potentially affected by it, including press releases or any other forum or medium to elicit public participation.

(d) Contents.

(1) All public notices issued under this part shall contain the following minimum information:

A. Name and address of the office processing the permit action for which notice is being given;

B. Name and address of the permittee or permit applicant and, if different, of the facility or activity regulated by the permit;

C. A brief description of the business conducted at the facility or activity described in the permit application or the draft permit;

D. Name, address and telephone number of a person from whom interested persons may obtain further information, including copies of the draft permit or draft general permit, as the case may be, the fact sheet, and the application;

E. A brief description of the comment procedures and the time and place of any hearing that will be held (including a statement of procedures to request a hearing, unless a hearing has already been scheduled), and other procedures by which the public may participate in the final permit decision;

F. The location of the administrative record, the times at which the record will be open for public inspection, and a statement that all data submitted by the applicant are available as part of the administrative record, except data found to be confidential business information pursuant to the applicable Act or regulations or other applicable law;

G. A map or description of the permit area;

H. Any additional information required by the applicable Act and regulations; and

I. Any additional information that the Director considers necessary or appropriate.

(2) **Public notices for hearings.** In addition to the contents of a general public notice described in subsection (d)(1), the public notice for a permit hearing shall contain the following information:

A. Reference to the date of previous public notices relating to the permit; and

B. A brief description of the nature and purpose of the hearing, including the applicable rules and procedures.

(3) In addition to the general public notice described in subsection (d)(1), all persons identified in subsection (c)(1) shall be mailed a copy of the fact sheet and the draft permit. When no draft permit is required under the applicable Act and regulations, a copy of the permit application shall be made available for copying. Upon request, any person shall be provided a copy of the fact sheet and the draft permit, if any, and a copy of the permit application, if any, shall be available for copying.

(4) The Administrator shall be mailed a copy of the notice and the permit application.

208. Public Comments and Requests for Public Hearings.

(a) During the public comment period for a draft permit, any interested person may submit written comments on the draft permit and may request a public hearing.

(b) A request for a public hearing shall be in writing and shall include the following information:

(1) The name, address and telephone number of the individual, organization or other entity requesting a hearing; and

(2) A brief statement of the interest of the person making the request in the permit action.

(c) All public comments received during the public comment period, including at any public hearing and during any reopening of the public comment period, shall be considered in making the final decision and all significant comments shall be answered as provided in § 213.

209. Public Hearings.

(a) The Director shall hold a public hearing no sooner than thirty (30) days after publication of the hearing notice when he or she receives a request for a hearing pursuant to § 208 or finds significant public interest in a draft permit. The Director also may hold a public hearing at his or her discretion whenever, for instance, a hearing might clarify one or more issues involved in the permit decision. No public hearing is required for a denial of a request for modification, revocation and reissuance, or termination of a permit.

(b) The Director shall designate a Hearing Moderator for the public hearing. The Hearing Moderator shall be responsible for the orderly conduct of the public hearing. Nothing in these regulations shall empower the Hearing Moderator to make any findings of fact, conclusions of law, or recommendations on permit issuance or denial. The Director, a member of the staff of the NNEPA, or any individual may serve as a Hearing Moderator, so long as the Hearing Moderator is not the applicant or an officer or employee of the applicant and does not have a financial interest or other conflict of interest, pursuant to § 105, in the outcome of the permit application.

(c) Hearings shall be held at a time and place which facilitates attendance by interested persons and the general public. Public notice of the hearing shall be given as specified in § 207.

(d) The Director, a member of the staff of NNEPA, or the Hearing Moderator shall inform the audience of the issues involved in the decision to be made, the considerations the agency will take into account, the agency's tentative determinations (if any), and the information which is particularly solicited from the public.

(e) Any person may submit oral or written statements and information concerning the draft permit in English or Navajo. The Hearing Moderator may set reasonable limits upon the time allowed for oral statements. The Director shall allow the submission of statements in writing at the hearing, but the Director or Hearing Moderator shall not require a written statement in lieu of or as a condition upon making an oral statement. The public comment period under § 207 shall automatically be extended to the close of any public hearing under this section. The Hearing Moderator may also extend the comment period by so stating at the hearing.

(f) The Hearing Moderator and NNEPA shall make reasonable efforts to accommodate requests for English to Navajo or Navajo to English oral translations during the hearing.

(g) A tape recording or written transcript shall be made of the hearing. At the conclusion of the hearing, the Hearing Moderator shall forward to the Director the record of the hearing, including the tape recording or written transcript and any materials submitted at the hearing. The hearing record shall be made available to the public.

210. Obligation to Raise Issues and Provide Information During the Public Comment Period.

(a) All persons, including applicants, who believe that a permit application should be granted or denied, or that any condition of a draft permit is inappropriate or inadequate, must raise all reasonably ascertainable issues and submit all reasonably available arguments and factual grounds supporting their position, including all supporting material, by the close of the public comment period.

(b) All supporting materials shall be submitted in full and may not be incorporated by reference, unless they are already part of the administrative record in the same proceeding or consist of Navajo or federal statutes and regulations, USEPA's or the Director's documents of general applicability, or other generally available reference materials.

(c) The Director may grant additional time to comment to any person to the extent that a person desiring to comment demonstrates need for such time.

211. Reopening of the Public Comment Period or Issuance of a New Draft Permit.

(a) Whenever any data, information or arguments submitted during the public comment period appear to raise substantial new questions concerning the draft permit or NNEPA becomes aware of significant new information, the Director may take one of the following actions:

(1) Prepare a new draft permit, appropriately modified, under the applicable Act and regulations and provide public notice and opportunity to comment on the new draft permit;

(2) Prepare a revised fact sheet under the applicable Act and regulations, and reopen the public comment period under this section; or

(3) Reopen or extend the comment period under this section to give interested persons an opportunity to comment on the information or arguments submitted.

(b) If the Director reopens the public comment period pursuant to subsection (a)(2) or (3), the scope of the reopening shall be limited to the substantial new questions or

significant new information that caused the reopening. All persons, including applicants, wanting to comment on an issue within the scope of the reopening must submit all reasonably available legal and factual grounds supporting their position, including all supporting material, by a date set by the Director no sooner than sixty (60) days after public notice under subsection (c). Thereafter, any person may file a written response to the material filed by any other person, by a date set by the Director no sooner than twenty (20) days after the date set for filing of the material. Persons desiring to comment may request longer comment periods and a longer comment period may be granted to the extent that the Director finds it necessary to effect the purpose of the reopening.

(c) Public notice of any action taken by the Director pursuant to subsection (a) shall be issued under § 207 of this Subpart. In addition to the requirements of § 207, the public notice for any action taken pursuant to subsection (a)(2) or (3) shall state the scope of the reopening.

212. Issuance and Effective Date of Permit.

(a) After the close of the public comment period on a draft permit under § 207, the Director shall issue a final permit decision within a reasonable amount of time. The Director shall notify the applicant and each person who has submitted written comments or requested notice of the final permit decision. The notice shall include reference to the procedures for appealing the decision. For the purpose of this section, a final permit decision shall mean a final decision to issue, deny, modify, revoke and reissue, or terminate a permit.

(b) A final permit decision shall become effective thirty (30) days after the service of notice of the decision unless:

(1) a later effective date is specified in the decision; or

(2) if no comments requested a change in the draft permit, the Director may make the permit effective immediately upon issuance.

213. Response to Comments and Administrative Record.

(a) Response to Comments. At the time that any final permit decision is issued, the Director shall issue a response to comments. The Director shall fully consider all comments resulting from the public comment period, including any hearing, conducted under this Subpart. The response shall:

(1) Specify which provisions, if any, of the draft permit have been changed in the final permit decision and the reasons for the change;

(2) Briefly describe and respond to all significant comments on the draft permit raised during the public comment period or during any hearing; and

(3) Be available to the public.

(b) Administrative Record. The Director shall base tentative and final permit decisions under these regulations on the administrative record defined below.

(1) For draft permits, the administrative record shall consist of:

A. The application, if required, and any supporting data furnished by the applicant;

B. The draft permit or notice of intent to deny the application or to terminate the permit;

C. The fact sheet;

D. The public notice;

E. All documents cited in the fact sheet; and

F. Other documents contained in the supporting file for the draft permit.

(2) For final permits, the administrative record shall consist of:

A. The administrative record for the draft permit;

B. All comments received during the public comment period provided (including any extension or reopening);

C. The tape or transcript and notes of any hearing(s) held and any

written materials submitted at such hearing(s);

D. The response to comments and any new material that the Director references in the response to comments;

E. Other documents contained in the supporting file for the permit; and

F. The final permit.

The additional documents required under this paragraph should be added to the record as soon as possible after their receipt or publication by the Director. The record shall be complete on the date the final permit is issued.

(3) Material readily available at the applicable program office or published material that is generally available, and that is included in the administrative record under these provisions, need not be physically included with the rest of the record as long as it is specifically referred to in the fact sheet or response to comments.

(4) The administrative record shall be available for public inspection commencing no later than the date of the notice of the draft permit or final permit decision, as the case may be.

214. Judicial Review.

(a) **Exhaustion.** Any person challenging the issuance, denial, modification, revocation and reissuance, termination or reissuance of a permit must follow the procedures set forth in this Subpart as a prerequisite to seeking judicial review of the final agency action.

(b) **Final agency action.** For purposes of judicial review, final agency action occurs when the permit decision becomes effective pursuant to § 212(b).

(c) **Filing the record.** Within 30 (thirty) days following the date that a petition for judicial review is filed pursuant to the applicable Act and regulations, the Director shall file in court a certified copy or certified index of the record on which the decision was based.

Subpart 3. Uniform Procedures for Issuing Administrative Enforcement Orders and Conducting Hearings on Administrative Enforcement Orders

A. General Provisions and Definitions

301. Scope.

This Subpart establishes uniform procedures for issuing administrative enforcement orders and conducting hearings on administrative enforcement orders, including compliance orders, emergency compliance orders, civil penalty orders, field citations, orders prohibiting a person from continuing to operate within the Navajo Nation, and any other orders issued by the Director. Part A of this Subpart contains general provisions and definitions specific to this Subpart. Part B contains procedures for the issuance of initial orders and requirements for requests for hearings. Part C contains procedures for conducting hearings on such orders. Part D contains procedures for field citations. Part E contains procedures for judicial review.

302. Other Rights and Remedies Not Affected.

Nothing contained in these regulations shall be construed to abridge or alter rights of action or remedies in equity under treaties, the common law or statutory law, nor shall any provisions of these regulations or any act done by virtue thereof be construed as preventing the Navajo Nation or individuals from the exercise of their rights under treaties, the common law or statutory law to suppress nuisances or to abate pollution.

303. Definitions.

The following definitions, in addition to the definitions in § 103, apply to this Subpart:

(a) *Respondent* means the person to whom the initial order is directed.

(b) *Consent Agreement* means any written document, signed by the parties, containing stipulations or conclusions of fact or law and a proposed penalty, proposed revocation or proposed suspension acceptable to all parties.

(c) *Decision* means the decision issued by the Hearing Official based upon the record of the hearing.

(d) *Hearing* means a hearing on the record open to the public and conducted pursuant to this Subpart.

(e) *Hearing Clerk* means the individual designated by the Director or the Hearing Official to act as such.

(f) *Initial Order* means any order or proposed order issued by the Director to any person pursuant to § 304 of this Subpart and the applicable Act and regulations. An order to comply, an emergency order to comply issued pursuant to § 502(C) of the NNSWA or § 502(C) of the NNUSTA, an administrative penalty order, and an order prohibiting a person from continuing to operate within the Navajo Nation are each an "initial order." A field citation is not an "initial order," nor is an emergency order to comply issued under § 403(b) of the NNCERCLA, § 802(A) of the NNSDWA, § 902(c) of the NNCWA or § 1105(B) of the NNAPPCA, or the corresponding provision of any other applicable Act.

(g) *Party* means NNEPA or the Respondent.

B. Authorities and Procedures for Issuing Initial Orders

304. Initial Orders.

(a) **Authority.** The Director may issue the following initial orders under the specified circumstances, and may combine two or more orders directed against a Respondent in a single initial order:

(1) **Order to comply or cease and desist order.** Whenever the Director finds that any person has violated, or is violating, any condition, schedule, or other requirement of the applicable Act and regulations or any permit issued thereunder, the Director may issue an order that requires the Respondent to comply with the requirement or to cease and desist from the activity that allegedly violates the requirement.

(2) **Emergency orders to comply under the NNSWA or the NNUSTA.** If the Director issues an order to comply or a cease and desist order upon a determination that there is immediate and substantial endangerment pursuant to § 502(C) of the NNSWA or § 502(C) of the NNUSTA, the order shall be deemed an emergency order to comply.

(3) **Administrative penalty order.**

A. Whenever the Director finds that any person has violated, or is violating, any requirement of the applicable Act and regulations or any permit or order issued thereunder, the Director may issue an order that assesses a civil penalty upon the Respondent of up to $10,000 per day per violation, or such other amount authorized by the applicable Act.

B. The Director's authority under this section shall be limited to matters where the total penalty sought does not exceed $100,000

and the first alleged date of violation occurred no more than one (1) year prior to the initiation of administrative action, or such other limitations as may be established by the applicable Act, except where the Director and Attorney General of the Navajo Nation jointly determine that a matter involving a larger penalty or longer period of violation is appropriate for administrative penalty action. The communications required to make such a joint determination shall not be subject to judicial review.

C. In determining the proposed amount of a civil penalty, the Director shall consider:

(i) the history, severity, and duration of the violation;

(ii) any good faith efforts to comply with the applicable requirements;

(iii) the Respondent's full compliance history, including the severity and duration of past violations, if any;

(iv) the economic impact of the penalty on the Respondent;

(v) as an aggravating factor only, the economic benefit, if any, resulting from the violation; and

(vi) any other factors that the Director deems relevant.

D. For purposes of determining the number of days of violation for which a civil penalty may be assessed, if the Director has notified the Respondent in writing of the alleged violation and a prima facie showing is made that the conduct or events giving rise to the alleged violation are likely to have continued or recurred past the date of notice, the days of violation shall be presumed to include the date of such notice and each day thereafter until the Respondent establishes that continuous compliance has been achieved, except to the extent that the Respondent can prove by a preponderance of the evidence that there were intervening days during which no violation occurred or that the violation was not continuing in nature. A written notice of violation, a written order to comply, or a complaint filed in the Navajo Nation District Court in Window Rock that alleges any violation described in subsection (a)(3)(A) shall constitute notice under this section.

(4) Order prohibiting a person from continuing to operate within the

Navajo Nation. When any person has repeatedly violated any requirements of the NNAPPCA, NNSDWA, NNSWA or NNUSTA or regulations, permits or orders issued thereunder, or refused to comply with any such requirements, the Director may issue an order prohibiting such Respondent from:

A. continuing to operate any facility or engage in any activity governed by the applicable Act or regulations which the Respondent has repeatedly violated or has refused to comply with or under which the permit or order that the Respondent has repeatedly violated or has refused to comply with was issued; and/or

B. entering into any new contracts (including leases) that would permit such person to engage in any activity within the Navajo Nation governed by the applicable Act or regulations which the Respondent has repeatedly violated or has refused to comply with or under which the permit or order that the Respondent has repeatedly violated or has refused to comply with was issued.

(b) **Contents.** Every initial order shall:

(1) state with reasonable specificity the nature of each violation, including the location and factual circumstances surrounding the violation, and the provision of the applicable Act and regulations allegedly violated;

(2) state that the Respondent is entitled to a hearing pursuant to these regulations and the applicable Act;

(3) specify a schedule for compliance with the applicable Act and regulations that the Director determines is as expeditious as practicable, taking into account the seriousness of the violation and any good faith efforts to comply with applicable requirements;

(4) if the order is a proposed order, state that the order is a proposed order; and

(5) if the order is an emergency order to comply issued upon the Director's determination that there is immediate and substantial endangerment pursuant to subsection (a)(2), state that the order is an emergency order and is effective immediately.

In addition, a copy of this Subpart and a copy of the applicable Act or regulations that Respondent allegedly violated shall accompany every initial order. The

initial order will contain the address to send a request for a hearing.

(c) **Additional contents for civil penalty orders.** In addition to the information required by subsection (b), civil penalty orders shall state the amount of the civil penalty which is proposed to be assessed and briefly state the basis for that amount.

(d) **Optional requirement.** The initial order may be conditional and may require a person to refrain from particular acts unless certain conditions are met.

(e) **Service.** The Director shall serve the initial order upon the Respondent or his authorized representative either by personal service or by certified mail, return receipt requested. If the order is issued to a corporation, the Director shall serve the registered agent of the corporation and send a copy to the appropriate corporate officers. Service of the initial order is complete when the return receipt is signed or when the initial order is delivered by personal service. The Director shall send a copy of the initial order to the appropriate USEPA region.

(f) **Effective date.**

(1) Every initial order, except emergency orders to comply, shall become final and effective immediately upon the expiration of thirty (30) days after it is issued if the Respondent does not timely request a hearing pursuant to § 305. If the Respondent timely requests a hearing pursuant to § 305, then the Hearing Official shall issue a final decision pursuant to § 327.

(2) An emergency order to comply issued under § 304(a)(2) shall become effective immediately upon issuance, and shall remain in effect unless overturned or modified after a hearing, if a hearing is requested.

(g) **Effect.** The issuance of an initial order shall not prevent the Navajo Nation (including the Director) from assessing any penalties nor otherwise affect or limit the Navajo Nation's authority to enforce under other provisions of the applicable Act and regulations or under other applicable law, including but not limited to the Navajo Nation Business and Procurement Act, nor affect any person's obligations to comply with any section or requirement of the applicable Act and regulations or with a term or condition of any permit or order issued thereunder.

305. Request for Hearing.

(a) **Availability.** The Respondent may request a hearing on an initial order.

(b) **Timing.** The hearing shall be requested in writing within thirty (30) days after the date of issuance of the initial order.

(c) **Disposition.** Requests for hearings shall be acted upon pursuant to § 308(a).

(d) A request for a hearing will be made to the Director. Upon receiving a request for a hearing, the Director shall designate a Hearing Official and a Hearing Clerk within (15) days of receiving a request for a hearing and shall file a copy of the initial order with the Hearing Clerk.

306. Request for Stay of an Emergency Order to Comply.

(a) **Availability.** Any Respondent issued an emergency order to comply pursuant to § 304(a)(2) may request in writing that the Director stay the emergency order pending the outcome of a hearing under this Subpart.

(b) **Timing.** The stay shall be requested in writing within 30 days after the date of issuance of the emergency order to comply.

(c) **Contents.** Any request for a stay shall state the circumstances that justify the stay.

(d) **Disposition.** The Director shall grant or deny the stay within five days of the receipt of the request for stay. If the Director denies the stay, the denial shall be deemed final agency action for purposes of judicial review.

307. Subpoena Authority.

(a) In connection with any administrative enforcement action under this Subpart, the Director or the Hearing Official, as the case may be, may issue subpoenas for the attendance and testimony of witnesses and the production of relevant papers, books and documents, and may administer oaths.

(b) Upon a showing satisfactory to the Director or the Hearing Official, as the case may be, by the Respondent that it would divulge confidential information or trade secrets protected under the applicable Act or regulations or other applicable law to make public any papers, books, documents or information or any portion thereof subpoenaed pursuant to subsection (a), the Director shall consider this information confidential. Notwithstanding the foregoing, the Director or Hearing

Official may disclose such information to other officers, employees or authorized representatives of the Navajo Nation concerned with carrying out this Part or the applicable Act and regulations or when relevant in any proceeding thereunder.

(c) Witnesses summoned pursuant to this section may be paid the same fees and mileage that are paid by the courts of the Navajo Nation. The fees and milage paid to witnesses pursuant to this subsection shall be paid by the party requiring the testimony of that witness.

C. Procedures for Hearings on Initial Orders.

308. Timing, Location and Public Access.

(a) **Timing.** Within fifteen (15) days of being designated by the Director to preside at an administrative hearing, the Hearing Official shall issue an order setting the hearing date and location of the hearing. The date set for the hearing shall be at least thirty (30) days after the date the order is issued. The Director may grant a continuance of the hearing upon motion and for good cause shown or sua sponte.

(b) **Location**. The hearing shall be held in Window Rock, unless the Director determines that there is good cause to hold it at another location.

309. Purpose and Scope.

(a) **Purpose.** The purpose of the hearing shall be to determine whether the initial order:

(1) Has correctly stated the extent and nature of a Respondent's violation of any condition, schedule, or other requirement of the Respondent's permit or the applicable Act and regulations under which the order is issued, including the factual basis of the violation;

(2) Has provided, where appropriate, a reasonable and expeditious time for the Respondent to comply with the relevant requirements of the applicable Act and regulations; and

(3) Where the initial order assesses a civil penalty, has assessed an appropriate civil penalty.

(b) **Scope.** The Respondent and NNEPA may present information to the Hearing Official at the hearing, or to the Hearing Official in writing before the date set for the hearing, relevant to whether:

(1) The Respondent has violated a condition, schedule, or other requirement

of his or her permit or the applicable Act and regulations, as referenced in the initial order;

(2) The initial order, where appropriate, provides a reasonable and expeditious time for the Respondent to comply with the relevant requirements of the applicable Act and regulations; and

(3) Where the initial order assesses a civil penalty, the amount of the civil penalty is appropriate.

310. Answer to the Initial Order.

(a) Filing. Whenever the Respondent requests a hearing, he or she shall file an answer to the initial order with the Hearing Official, or with the Hearing Clerk if one has been designated, within thirty (30) days after service of the initial order.

(b) Contents. The answer shall clearly and directly admit, deny or explain each of the factual allegations contained in the initial order with regard to which Respondent has any knowledge. Where the Respondent has no knowledge of a particular factual allegation and so states, the allegation is deemed denied. The answer shall also briefly state the facts which the Respondent intends to place at issue and the arguments which constitute his defense. Failure of the Respondent to admit, deny, or explain any material factual allegation contained in the initial order constitutes an admission of the allegation.

311. Powers and Duties of the Hearing Official; Disqualification.

(a) Hearing Official. The Hearing Official shall conduct a fair and impartial proceeding and shall avoid delay. The Hearing Official shall have the powers and duties to:

(1) Conduct administrative hearings under this subpart;

(2) Rule upon motions, requests, and offers of proof, dispose of procedural requests, and issue all necessary orders;

(3) Administer oaths and affirmations and take affidavits;

(4) Examine witnesses and receive documentary or other evidence;

(5) For good cause, upon motion or sua sponte, order a party, or an officer or agent thereof, to produce testimony, documents, or other nonprivileged evidence, and failing the production thereof without good cause being shown, draw adverse inferences against that party;

(6) Admit or exclude evidence;

(7) Hear and decide questions of fact, law or discretion;

(8) Require parties to attend conferences for the settlement or simplification of the issues, or the expedition of the proceedings;

(9) Issue subpoenas authorized by the applicable Act or regulations; and

(10) Do all other acts and take all measures necessary for the maintenance of order and for the efficient, fair and impartial adjudication of issues arising in proceedings under this Part.

(b) Designation. The Director shall designate the Hearing Official.

(c) Disqualification and withdrawal.

(1) The Hearing Official may not perform functions provided for in these rules of practice regarding any matter in which he or she:

A. has a financial interest; or

B. has any relationship with a party or with the subject matter which would make it inappropriate for him or her to act.

(2) Any party may at any time by written request to the Director request that the Hearing Official be disqualified on the grounds set forth in subsection (c)(1). The Hearing Official may at any time withdraw from any proceeding in which he or she deems him or herself disqualified or unable to act for any reason.

(3) If the Hearing Official is disqualified or withdraws from the proceeding, a qualified individual who has none of the infirmities listed in paragraph (b)(1) shall be assigned by the Director to replace him or her.

(d) Separation of functions. The NNEPA or other Navajo Nation official(s) presenting the case against the Respondent at the hearing may not also participate in or otherwise advise in the decision issued by the Hearing Official.

312. Ex Parte Discussion of Proceeding.

(a) Prohibition. At no time after a hearing is requested shall the Director, the Hearing Official, or any other person who is likely to advise these officials in the decision on the case, discuss ex parte the merits of the proceeding with any interested person outside NNEPA, with any Navajo Nation staff member who performs a prosecutorial or investigative function in such proceeding or a factually related proceeding, or with any representative of such person.

(b) Service and reply. Any ex parte memorandum or other communication addressed to the Director or the Hearing Official during the pendency of the proceeding and relating to the merits thereof, by or on behalf of any party, shall be regarded as argument made in the proceeding and shall be served upon all other parties. The other parties shall be given an opportunity to reply to such memorandum or communication.

313. Motions.

(a) General. At any time after the Respondent has requested a hearing, either party may file a motion which shall:

(1) be in writing;

(2) state the grounds therefor with particularity;

(3) set forth the relief or order sought; and

(4) be accompanied by any affidavit, certificate, other evidence, or legal memorandum relied upon.

All motions shall meet these requirements, except motions made orally on the record during the hearing, and shall be served as provided by § 314.

(b) Response to motions. A party's response to any written motion must be filed within ten (10) days after service of such motion, unless the Hearing Official sets a shorter time or allows additional time for such response. The response shall:

(1) be in writing;

(2) respond to the grounds alleged by the opposing party;

(3) respond to the relief or order sought by the opposing party; and

(4) be accompanied by any affidavit, certificate, other evidence, or legal memorandum relied upon.

If no response is filed within the designated period, the parties may be deemed to have waived any objection to the granting of the motion. The Hearing Official may make such orders concerning the disposition of motions as he or she deems appropriate.

(c) Disposition. The Hearing Official shall rule on all motions. Oral argument on motions will be permitted where the Hearing Official considers it necessary or desirable.

314. Filing, Service, and Form of Pleadings and Documents.

(a) Filing of pleadings and documents. Except as otherwise provided, the original and one copy of all documents served in the proceeding shall be filed with the Hearing Official, or if a Hearing Clerk is designated, with the Hearing Clerk. A certificate of service shall accompany each document filed or served.

(b) Service of pleadings and documents. Every document filed in the proceeding shall be served on all parties by the party filing the document. All documents may be served personally or by certified or first-class mail. The Hearing Official shall serve all parties to the proceeding with every order or decision issued.

(c) Form of pleadings and documents.

(1) Unless otherwise ordered by the Hearing Official, the first page of every pleading, letter, or other document shall contain a caption identifying the Respondent and the docket number which is assigned by the Hearing Official or Hearing Clerk.

(2) The original of any pleading, letter, or other document (other than exhibits) shall be signed by the party filing or by counsel or other representative. The signature constitutes a representation by the signer that he or she has read the pleading, letter or other document, that to the best of his or her knowledge, information and belief, the statements made therein are true, and that it is not interposed for delay.

(3) All documents filed by any party shall contain his or her name, address and telephone number or, if the party is represented by counsel, counsel's name, address and telephone number. Any changes to this information shall be communicated promptly to the Hearing Clerk, Hearing Official, and all parties to the proceeding. A party who fails to furnish such information and any changes thereto shall be deemed to have waived the right to notice and service under these rules.

(4) The Hearing Official or Hearing Clerk may refuse to file any document which does not comply with this section.

315. Computation and Extension of Time.

(a) **Computation of time.** All time limits specified in this subpart refer to calendar days.

(b) **Extensions of time.** The Hearing Official may grant an extension of time for the filing of any pleading, document, or motion upon timely motion of a party to the proceeding, for good cause shown, and after consideration of prejudice to the other parties.

(c) **Service by mail.** Service of all pleadings and documents (other than the initial order) is complete upon mailing. Where a pleading or document is served by mail, five (5) days shall be added to the time allowed by these rules for the filing of a responsive pleading or document.

(d) **Personal service.** Personal service is complete when the document is delivered.

316. Appearances.

Any party may appear in person or by counsel or other representative and in a manner consistent with the laws of the Navajo Nation. Persons who appear as counsel or other representative must conform to the standards of conduct and ethics required of practitioners before the courts of the Navajo Nation.

317. Prehearing Conference.

(a) **Purpose of prehearing conference.** The Hearing Official may at his or her discretion at any time before the hearing begins direct the parties and their counsel or other representatives to appear at a conference before him or her to consider:

(1) The simplification of issues and stipulation of facts not in dispute;

(2) The necessity or desirability of amendments to pleadings;

(3) The exchange of exhibits, documents, prepared testimony, and admissions or stipulations of fact which will avoid unnecessary proof;

(4) The limitation of the number of expert or other witnesses;

(5) The need for a change in the time and/or place for the hearing; and

(6) Any other matters which may expedite the disposition of the proceeding.

(b) **Location of prehearing conference.** The prehearing conference shall be held in Window Rock, unless the Hearing Official determines that there is good cause to hold it at another location or by telephone.

(c) **Correspondence.** The Hearing Official, on motion or sua sponte, may direct the parties to correspond with him or her to accomplish any of the objectives set forth in subsection (a). Any such correspondence shall be filed and served upon all parties.

318. Exchange of Witness Lists and Documents.

(a) Each party shall make available to the other party at least fifteen (15) days prior to the hearing or within such other time ordered by the Hearing Official:

(1) The names of the expert and other witnesses he or she intends to call, together with a brief narrative summary of their expected testimony; and

(2) copies of all documents and exhibits which each party intends to introduce into evidence.

(b) Documents that have not been exchanged pursuant to subsection (a) shall not be introduced into evidence and witnesses whose names have not been exchanged shall not be allowed to testify without the permission of the Hearing Official. The Hearing Official shall allow the parties reasonable opportunity to review any new evidence.

319. Discovery.

(a) **Discovery orders.** Except as provided by § 320(a), discovery shall be permitted only upon motion and a determination by the Hearing Official:

(1) That such discovery will not in any way unreasonably delay the proceeding;

(2) That the information to be obtained is not otherwise obtainable;

(3) That such information has significant probative value; and

(4) If a deposition upon oral questions is sought, that there is a substantial reason to believe that relevant and probative evidence may otherwise not

be preserved for presentation by a witness at the hearing.

If the Hearing Official determines that the motion should be granted, the Hearing Official shall issue an order for the taking of such discovery together with the conditions and terms thereof.

(b) **Failure to comply.** When a party fails to comply with an order issued pursuant to this section and the information sought is within his or her control, the Hearing Official may:

(1) infer that the information to be discovered would be adverse to the party who failed to comply with the discovery order; or

(2) issue a default order under § 323.

320. Evidence.

(a) **General.** The Hearing Official shall admit all evidence which is not irrelevant, immaterial, unduly repetitious, or otherwise unreliable or of little probative value. Any evidence relating to settlement which would be excluded in the Navajo Nation courts shall not be admissible in these procceedings.

(b) **Confidential information.** In the presentation, admission, disposition, and use of evidence, the Hearing Official shall preserve the confidentiality of information or trade secrets protected under the applicable Act and regulations or other applicable law. The confidential or trade secret status of any information shall not, however, preclude its being introduced into evidence. The Hearing Official may make such orders as may be necessary to consider such evidence in camera, including the preparation of a supplemental decision to address questions of law, fact, or discretion which arise out of that portion of the evidence which is confidential or which includes trade secrets.

(c) **Examination of witnesses.** Witnesses shall be examined orally, under oath or affirmation, except as otherwise provided in these rules of practice or by the Hearing Official. Parties shall have the right to cross-examine a witness who appears at the hearing provided that such cross-examination is not unduly repetitious.

(d) **Verified statements.** The Hearing Official may admit into the record as evidence, in lieu of oral testimony, statements of fact or opinion prepared by a witness. The admissibility of the evidence contained in the statement shall be subject to the same rules as if the testimony were produced under oral examination. Before any such statement is read or admitted into evidence, the offering party shall deliver a copy of the statement to the Hearing Official and the

opposing party. The witness presenting the statement shall swear to or affirm the statement and shall be subject to appropriate oral cross-examination upon the contents thereof, unless the Hearing Official finds that the witness is unavailable.

(e) **Exhibits.** Where practicable, an original and one copy of each exhibit shall be filed with the Hearing Official for the record and a copy shall be furnished to the opposing party. A true copy of any exhibit may be substituted for the original.

(f) **Official notice.** Official notice may be taken of any matter judicially noticed in the Navajo Nation courts and of other facts within the specialized knowledge and experience of NNEPA. Opposing parties shall be given adequate opportunity to show that such facts are erroneously noticed.

321. Burden of Proof.

(a) The NNEPA has the burden of going forward with and of proving that the violation occurred as set forth in the initial order and that the proposed civil penalty is appropriate.

(b) Following the establishment of a prima facie case, the Respondent shall have the burden of presenting and of going forward with any defense to the allegations set forth in the initial order.

(c) Each matter of controversy shall be determined by the Hearing Official upon a preponderance of the evidence.

322. Interpreters.

The parties may arrange for interpreters at the proceedings at their own expense. The Hearing Official shall administer an interpreter's oath to such persons.

323. Default Order.

(a) **Grounds.** When a hearing has been set and due notice has been given and the Respondent fails to appear, the Hearing Official shall enter a default order against the Respondent. A party may also be found to be in default for failure to comply with a discovery order under § 319. If NNEPA fails to appear, the Hearing Official shall dismiss the initial order.

(b) **Procedures and effect.** When the Hearing Official finds a default has occurred, he or she shall issue a default order against the defaulting party. This order shall constitute the decision of the Hearing Official.

(c) **Contents.** A default order shall include findings of fact showing the grounds for

the order and conclusions regarding all material issues of law.

(d) **Set aside.** The Hearing Official may at the request of either party set aside any order issued under this section if good cause is shown. A request to set-aside a default order must be filed within 30 days from the date the default order is entered by the Hearing Official.

324. Accelerated Decision; Decision to Dismiss.

(a) **General.** The Hearing Official, upon motion of any party or sua sponte, may at any time render an accelerated decision in favor of the NNEPA or the Respondent as to all or any part of the proceeding, without further hearing or upon such limited additional evidence, such as affidavits, as he or she may require, if no genuine issue of material fact exists and a party is entitled to judgment as a matter of law, as to all or any part of the proceeding. In addition, the Hearing Official, upon motion of the Respondent, may at any time dismiss an action without further hearing or upon such limited additional evidence as he or she requires, on the basis of failure to establish a prima facie case or other grounds which show no right to relief on the part of the NNEPA.

(b) **Effect.**

(1) If an accelerated decision or a decision to dismiss is issued as to all the issues and claims in the proceeding, the decision constitutes the decision of the Hearing Official.

(2) If an accelerated decision or a decision to dismiss is rendered on fewer than all issues or claims in the proceeding, the Hearing Official shall determine what material facts exist without substantial controversy and what material facts remain controverted in good faith. The Hearing Official shall thereupon issue an interlocutory order specifying the facts which appear substantially uncontroverted, and the issues and claims upon which the hearing will proceed.

325. Decision.

(a) **General.** As promptly as possible after the conclusion of the hearing, the Hearing Official shall issue a decision in which the Hearing Official may affirm, modify, or reverse the initial order based upon the evidence presented at the hearing. In rendering the decision, the Hearing Official shall consider only information in the record or officially noticed. The decision shall contain findings of fact, conclusions regarding all material issues of law, as well as reasons therefor, and a final order. Where the initial order is a civil penalty order, the decision shall set forth the amount of the penalty and information required by

subsection (b). The Hearing Official shall serve all parties with a copy of the decision.

(b) Amount of civil penalty. Where the initial order is a civil penalty order and the Hearing Official determines that a violation has occurred, the Hearing Official shall determine the dollar amount of the civil penalty to be assessed in accordance with § 304(a)(3) and any criteria set forth in the applicable Act and regulations relating to the proper amount of a civil penalty. If the Hearing Official determines that a penalty different in amount from the penalty stated in the initial order should be assessed, the Hearing Official shall set forth in the decision the specific reasons for the increase or decrease. The Hearing Official shall not raise a penalty from that recommended to be assessed in the initial order if the Respondent has defaulted.

(c) Payment of a civil penalty. The Respondent shall pay the full amount of the civil penalty assessed in the final order within thirty (30) days after receipt of the order. Payment shall be made as specified in the final order.

326. Record of the Proceeding.

(a) Record. The Director shall maintain a complete and accurate record of the initial order. If a hearing is held, the Director shall promptly forward a copy of the record to the Hearing Official. The Hearing Official shall maintain a complete and accurate record of the hearing. A tape recording or written transcript shall be made of the hearing.

(b) Public inspection. The record shall be made available for public inspection by the Hearing Official, or for proceedings in which a Hearing Clerk is assigned, by the Hearing Clerk, commencing no later than the date of the public notice of the initial order, except for documents and other parts of the record that the Director or Hearing Official has determined would divulge confidential information or trade secrets protected by the applicable Act or regulations or other applicable law, which documents shall be kept under seal. Any person may, during NNEPA business hours, inspect and copy any document in the record of the proceeding, with the exception of such confidential information or trade secrets.

(c) Cost of duplication. The cost of duplicating documents in the record shall be borne by the person seeking copies of such documents. The Director or the Hearing Official may waive this cost in appropriate cases of financial hardship.

327. Informal Settlement; Consent Agreement and Order.

(a) Settlement policy. NNEPA encourages settlement of a proceeding at any time if the settlement is consistent with the provisions and objectives of the applicable

Act and regulations. The Director may compromise, modify or remit, with or without any conditions, any administrative penalty imposed under this Subpart. The pendency of settlement shall not affect the Respondent's obligation to timely comply with the requirements of this Subpart or the applicable Act and regulations, or any permit or order issued thereunder.

(b) **Consent agreement.** If the parties agree upon a settlement or compromise, the parties shall forward a written consent agreement and a proposed consent order to the Hearing Official. The consent agreement shall include any and all terms of the agreement, and shall be signed by all parties or their counsel or representatives.

(c) **Consent order.** No settlement or consent agreement shall dispose of any proceeding under this subpart without a consent order from the Hearing Official. In preparing such an order, the Hearing Official may require that the parties to the settlement appear before him or her to answer inquiries relating to the consent agreement or order.

D. Field Citations

328. Authority.

If the applicable Act authorizes the Director to implement a field citation program and if the Director has promulgated regulations establishing minor violations of the applicable Act or regulations or permits or orders issued thereunder for which a field citation may be issued, officers or employees of NNEPA designated by the Director may issue a field citation for any minor violation established in the regulations and for an amount permitted by such regulations.

329. Contents of Field Citation.

(a) A field citation is the equivalent of an expedited enforcement compliance order and settlement agreement.

(b) A field citation shall:

(1) state with reasonable specificity the nature of each violation, including the location and factual basis of the violation, and the provision(s) of the applicable Act and regulations violated;

(2) state the amount of the civil penalty that is proposed to be assessed and the applicable regulation providing for the penalty;

(3) specify a schedule for compliance with the applicable Act and regulations that is as expeditious as practicable; and

(4) state that the Respondent may either agree to comply with the field citation within the time specified therein or request a hearing, pursuant to the procedure set forth in § 330.

330. Procedure.

(a) The Respondent may sign the field citation and, by doing so, agree to pay the civil penalty stated in the field citation and agree to correct the violation within the time provided therein. By signing the field citation, the Respondent has agreed to a settlement and has waived its right to a hearing and to judicial review.

(b) Alternatively, the Respondent may request a hearing within thirty (30) days. If a hearing is requested, the field citation will automatically be withdrawn and will be replaced with a compliance order, administrative penalty order or other order(s) authorized under § 304. The penalty amount may increase from that in the field citation in order to cover the time and expense that will be incurred by NNEPA in pursuing more formal enforcement proceedings. Once the new initial order(s) is issued, pursuant to § 304, the provisions of § 304(C) shall apply.

331. Final Decision.

If a hearing is not requested within thirty (30) days of issuance of the field citation, the field citation becomes a final decision for purposes of § 332(b).

E. Judicial Review

332. Judicial Review.

(a) **Exhaustion.** Any person challenging an order issued under this Subpart must request a hearing under the procedures set forth in this Subpart as a prerequisite to the seeking of judicial review of the final agency action.

(b) **Final agency action.** For purposes of judicial review, a decision of the Hearing Official under § 324, § 325 or § 331 constitutes final agency action. An initial order, except an emergency order, and a field citation constitute final agency action thirty (30) days after they are issued if the Respondent does not request a hearing pursuant to § 305 or § 330, as the case may be, but are not reviewable because of the failure to request a hearing. An emergency order to comply issued under the NNSWA or the NNUSTA pursuant to § 304(a)(2) constitutes final agency action upon issuance unless the Respondent timely requests a hearing pursuant to § 305, but again is not reviewable. A default order against a Respondent for failure of the Respondent to appear is also an unreviewable final agency action.

(c) **Filing the record.** Within 30 (thirty) days following the date that a petition for judicial review is filed pursuant to the applicable Act and regulations, the Director shall file in the court a certified copy or certified index of the record on which the final agency action was based.

Subpart 4. Uniform Procedures for Rulemaking.

401. Scope.

This Subpart establishes uniform procedures for the promulgation of regulations under the NNAPPCA, NNCWA, NNCERCLA, NNPA, NNSDWA, NNSWA, and NNUSTA and other applicable Acts.

402. Public Notice of Proposed Regulations and Public Comment Period.

(a) Public notice required.

(1) The Director shall give public notice of any proposed regulation.

(2) Public notices may describe more than one proposed regulation or set of regulations.

(b) Timing.

(1) Public notice of a proposed regulation shall allow at least thirty (30) days for public comment.

(2) Public notice of a public hearing shall be given at least twenty (20) days before the hearing. Public notice of the hearing may be given at the same time as public notice of the proposed regulation and the two notices may be combined.

(c) Methods. The public notice required under subsection (a) shall be given by each of the following methods:

(1) A notice by mail to each of the persons listed below. Persons otherwise entitled to receive notice under this paragraph may waive their rights to receive notice for any classes and categories of regulations by expressly advising the Director in writing.

A. Federal and Navajo agencies and agencies of affected states or Tribes with an interest in the rulemaking, such as agencies with jurisdiction over fish and wildlife and other natural resources, the Advisory Council on Historic Preservation and the Navajo Nation Historic Preservation Department;

B. Persons on a mailing list developed by:

(i) Including those who request to be on the list;

(ii) Soliciting persons from participants in past proceedings related to the subject of the proposed regulation; and

(iii) Notifying the public of the opportunity to be put on the mailing list through periodic publication in the public press and in such publications as newsletters, environmental bulletins, and Tribal law journals. The Director may update the mailing list from time to time by requesting written indication of continued interest from those listed. The name of any person who fails to respond to such a request may be deleted from the list.

(2) A notice in a daily or weekly newspaper of general circulation in the areas of the Navajo Nation that may be affected;

(3) A notice broadcast over local radio stations in English and Navajo; and

(4) Such other methods as may be appropriate, including press releases, web pages or any other forum or medium to elicit public participation.

(d) Contents.

(1) All public notices issued under this part shall contain the following minimum information:

A. Name and address of the office proposing the regulation;

B. A brief description of the proposed regulation;

C. Name, address and telephone number of a person from whom interested persons may obtain further information, including copies of the proposed regulation;

D. A brief description of the comment procedures and the time and place of any hearing that will be held (including a statement of procedures to request a hearing, unless a hearing has already been scheduled), and other procedures by which the public may participate in the decision on the proposed regulation;

E. The location of the administrative record, the times at which the record will be open for public inspection, and a statement that all comments submitted are available as part of the administrative

record;

F. Any additional information required by the applicable Act and regulations; and

G. Any additional information that the Director considers necessary or appropriate.

(2) **Public notices for hearings.** If the public notice for a hearing is issued separately from the public notice of the proposed regulation, it shall contain the following information in addition to the contents of a general public notice described in subsection (d)(1):

A. Reference to the date of previous public notices relating to the proposed regulation; and

B. A brief description of the nature and purpose of the hearing, including the applicable rules and procedures.

(3) Upon request, any person shall be provided a copy of the proposed regulation.

403. Public Comments and Requests for Public Hearings.

During the public comment period for a proposed regulation, any person may submit written comments on the proposed regulation.

404. Public Hearings.

(a) The Director shall, if requested or if deemed appropriate by the Director, hold a public hearing on a proposed regulation to allow any person the opportunity to present orally their views, data or arguments in Navajo or English.

(b) The Director shall designate a Hearing Moderator for the public hearing. The Hearing Moderator shall be responsible for the orderly conduct of the public hearing. Nothing in these regulations shall empower the Hearing Moderator to make any findings of fact, conclusions of law, or recommendations on the issuance of the proposed regulations. The Director, a member of the staff of the NNEPA, or any individual may serve as a Hearing Moderator, so long as the Hearing Moderator does not have a financial interest in the outcome of the proposed regulation

(c) Hearings shall be held at a time and place which facilitates attendance by interested persons and the general public. Public notice of a hearing shall be

given as specified in § 402.

(d) The Director, a member of the staff of the NNEPA, or the Hearing Moderator, shall inform the audience of the issues involved in the proposed rulemaking, the considerations the agency will take into account, the agency's tentative determinations (if any), and the information which is particularly solicited from the public.

(e) Any person may submit, in English or Navajo, oral or written statements and information concerning the proposed regulation. The Hearing Moderator may set reasonable limits upon the time allowed for oral statements. The Director shall allow the submission of statements in writing at the hearing, but the Director or Hearing Moderator shall not require a written statement in lieu of or as a condition for making an oral statement.

(f) The Hearing Moderator and NNEPA shall make reasonable efforts to accommodate requests for English to Navajo or Navajo to English oral translations during the hearing.

(g) A tape recording or written transcript shall be made of the hearing. At the conclusion of the hearing, the Hearing Moderator shall forward to the Director the record of the hearing, including the tape recording or written transcript and any materials submitted at the hearing. The hearing record shall be made available to the public.

(h) Unless specified otherwise in the appropriate Act or regulations, the public comment period under § 402 shall be extended if necessary to allow the record to remain open for 20 days after the close of any public hearing under this section to provide an opportunity for submission of rebuttal and supplementary information. The Director may further extend the comment period at his or her discretion to effectuate this purpose.

405. Obligation to Raise Issues and Provide Information During the Public Comment Period.

(a) All persons, who believe that a proposed regulation should be issued, modified, or withdrawn must raise all reasonably ascertainable issues and submit all reasonably available arguments and factual grounds supporting their position, including all supporting material, by the close of the public comment period.

(b) All supporting materials shall be submitted in full and may not be incorporated by reference, unless they are already part of the administrative record in the same proceeding or consist of Navajo or federal statutes and regulations, USEPA's or the Director's documents of general applicability, or other generally available

reference materials.

(c) The Director may extend the public comment period on his or her own initiative or on request if the Director determines that such extension is necessary to obtain full public participation, and may grant additional time to comment to any person to the extent that a person desiring to comment demonstrates need for such time.

406. Reopening of the Public Comment Period.

(a) Whenever any data, information or arguments submitted during the public comment period appear to raise substantial new questions concerning the draft permit or NNEPA becomes aware of significant new information, the Director may take one of the following actions:

(1) Withdraw the proposed regulation;

(2) Prepare a revised proposed regulation under the applicable Act and regulations, and reopen the public comment period under this section; or

(3) Reopen or extend the comment period to give interested persons an opportunity to comment on the information or arguments submitted.

(b) If the Director reopens the public comment period pursuant to subsection (a)(2) or (3), the scope of the reopening shall be limited to the substantial new questions or significant new information that caused the reopening. All persons who believe any provision of the proposed regulation is inappropriate must submit all reasonably available legal and factual grounds supporting their position, including all supporting material, by a date not less than forty-five (45) days after public notice under subsection (c) set by the Director. Thereafter, any person may file a written response to the material filed by any other person, by a date not less than twenty (20) days after the date set for filing of the material, set by the Director. Persons desiring to comment may request longer comment periods and a longer comment period may be granted to the extent that the Director finds it necessary to effect the purpose of the reopening.

(c) Public notice of any action taken by the Director pursuant to subsection (a) shall be issued under § 402. In addition to the requirements of § 402, the public notice for any action taken pursuant to subsection (a)(2) or (3) shall state the scope of the reopening.

407. Issuance and Effective Date of Final Regulation.

(a) The final regulation shall be based on the record of the proceeding contained in the docket.

(b) The Director shall give public notice of the adoption of the final regulation as soon as possible pursuant to § 402(c)(2) and (3) and shall mail a notice to the same persons as were mailed notice of the proposed regulation pursuant to § 402(c)(1) as well as to any persons who commented on the proposed regulation and any others who request to receive such notice.

(c) Every final regulation shall be effective in accordance with its terms after approval by the Resources Committee.

408. Response to Comments and Administrative Record.

(a) Response to Comments. The final regulation shall be accompanied by a response to comments. The response shall fully consider all comments resulting from the public comment period, including any hearing, conducted under this Subpart. This response shall:

(1) Specify which provisions, if any, of the draft regulation have been changed in the final regulation and the reasons for the change;

(2) Briefly describe and respond to all significant comments on the proposed regulation raised during the public comment period or during any hearing; and

(3) Be available to the public.

(b) **Administrative Record.** The Director shall base the regulation on the administrative record.

(1) The administrative record shall consist of:

A. The proposed regulation;

B. The public notice;

C. All comments received during the public comment period (including any extension or reopening thereof);

D. The tape, transcript or notes of any hearing(s) held and any written materials submitted at such hearing(s);

E. The response to comments and any new material that the Director references in the response to comments;

F. Other documents contained in the supporting file for the regulation; and

G. The final regulation.

The documents required under this paragraph should be added to the record as soon as possible after their receipt or publication by the Director. The record shall be complete on the date the final regulation is issued.

(2) Material readily available at the applicable program office or published material that is generally available and that is included in the administrative record under these provisions need not be physically included with the rest of the record as long as it is specifically referred to in the fact sheet or response to comments.

(3) The administrative record shall be available for public inspection commencing no later than the date of the public notice.

409. Reconsideration of the Regulation after Issuance.

(a) Whenever a person can demonstrate to the Director that it was impracticable to raise an objection within the public comment period or if the grounds for the objection arose after the public comment period but within the time allowed for judicial review, and if the objection is of central relevance to the outcome of the regulation, the Director shall convene a proceeding for reconsideration of the regulation and provide the same procedural rights as would have been afforded had the information been available at the time the regulation was proposed. Whenever the Director determines that a reconsideration proceeding shall be convened, the Director may stay the effectiveness of the final regulation if necessary and for the time required to allow the reconsideration to occur. Such proceeding for reconsideration shall include a new public comment period which shall be limited in scope to the objection(s) that prompted the proceeding.

(b) All persons, including the person(s) whose objection(s) prompted the reconsideration, who believe that the final regulation is inappropriate for any of the grounds raised by the objection(s) that prompted the reconsideration, must submit all reasonably available legal and factual grounds supporting their position, including all supporting material, by a date no sooner than thirty (30) days after public notice under subsection (c) set by the Director. Thereafter, any person may file a written response to the material filed by any other person, by a date no sooner than twenty (20) days after the date set for filing of the material, set by the Director. Persons desiring to comment may request longer comment periods and a longer comment period may be granted to the extent that the Director finds it necessary to effect the purpose of the reconsideration.

(c) Public notice of a reconsideration proceeding shall be issued under § 402. In addition to the requirements of § 402, the public notice shall describe the objection that prompted the reconsideration proceeding, shall state the scope of the reconsideration and shall state whether the effectiveness of the final regulation has been stayed.

(d) The Director shall hold a public hearing on the reconsideration pursuant to § 404.

(e) The Director shall maintain the administrative record of the reconsideration proceeding pursuant to § 408(b).

(f) Within a reasonable time after the close of the public comment period under subsection (b), the Director shall issue a final decision on reconsideration pursuant to § 407, including a response to comments pursuant to § 408(a) and revisions to the final regulation, if any.

410. Judicial Review.

(a) Exhaustion. Any person challenging a final regulation or the refusal of the Director to convene a proceeding for reconsideration of a final regulation must follow the procedures set forth in this Subpart as a prerequisite to the seeking of judicial review of the final agency action.

(b) Final agency action. For purposes of judicial review, final agency action occurs when notice is first given of the final regulation.

(c) Filing the record. Within 30 (thirty) days following the date that a petition for judicial review is filed pursuant to the applicable Act and regulations, the Director shall file in the court a certified copy or certified index of the record on which the rulemaking was based.

APPENDIX J

MEETING MINUTES WITH PNM

Attendees

George Nail - PNM Transmission Planning

Thomas Duane – Manger of Transmission Planning

Kathy Maddux – PNM Transmission Contracts

Manuel Sanchez – Manger of Transmission Contracts

Cathy Newby – PNM Tribal Coordinator

Raymond Maxx – Director Navajo Hopi Land Commission

Christina Lewis PM NHLCO

Tom Benally Technical Support, NHLCO

Scott Prosuch (Tetra Tech PM)

George Culbertson (Tetra Tech)

Robert Kennedy, (Tetra Tech)

Agenda

1. Introductions

2. Project background – Paragon Bisti Alternative Energy Ranch – Raymond –

Raymond provided a short narrative about the history of the Navajo – Hopi Land dispute. The Navajo-Hopi Land Settlement Act of 1974 which created the Bisti – Paragon Ranch which has been designated for Renewable Energy. Their hopes are to develop some kind of solar Project that would help them provide electricity to the grid. BIA has estimated that this 20,000 acre land trust has the potential of 4,000 MW of energy.

3. Program Objectives - Scott

Scott- explained that Tetra Tech has teamed up with the Navajo Hopi Land Commission to explore developing a PV project at Site 1 that is right next to PNM's Bisti Station. See Appendix A : Map of Project Area

4. Overview of PNM working with Tribes – George N/Cathy Newby

Cathy – introduced her shelf to the audience and described her function here at PNM.

5. Overview of PNM FERC generation interconnect process (Large Generation Interconnect Process - LGIP) - George N.

PNM's open access transmission tariff (OATT) - (confidentiality, queue position, etc.)

LGIP Application?

Timeline for next cluster window

Perfection of application

Describe studies to be performed

Preliminary Interconnection System Impact Study

Definitive Interconnection System Impact Study

Interconnection Facilities Study

Interconnection Agreement (IA or Large Generator Interconnection Agreement)

Allocation of directed assigned costs and network upgrades?

George discussed the past history of the PNM interconnection queue and how congested the queue was prior to the September 30, 2011 restructuring. PNM had 44 large interconnection requests totaling 14,918 MW of generation that had a 5 year wait for studies to get completed.

George covered the Preliminary and Definitive Cluster Study Time lines as seen in Appendix B. George and Kathy covered the differences between the two study processes (Preliminary Interconnection System Impact Study and the Definitive Interconnection System Impact Study).

Discussion of the interconnection application was discussed and a copy of the interconnection application (Appendix 1 to LGIP) was given out. It is contained in the PNM Open Access Transmission Tariff – (OATT) http://www.oatioasis.com/PNM/PNMdocs/1-8-13_PNM_Conformed_OATT_Attach_R_and_TX_Rate_Settlement_ER11-1915.pdf page 329 of the pdf.

Discussed costs associated with filing a request. (page 296 of OATT pdf)

Discussed Definitive cluster requirements that differ from the Preliminary requirements (page 310 of the OATT pdf)

Study work is posted at http://www.oatioasis.com/pnm/index.html - Which is where past study work is posted.

Transmission Service Requests (Wheeling) was discussed because it is a separate request and study process than the Interconnection process. TSR are made through OATI Web Oasis portal.

http://www.oatioasis.com/cgi-bin/webplus.dll?script=/woa/woa-login.wml

Transmission Service request flow chart is attached in Appendix C

Finally the meeting was wrapped up with a short question addressing special PNM tribal programs for funding renewable projects. PNM has no special tribal programs for funding renewable projects.

Meeting adjourned at 3:15 pm.