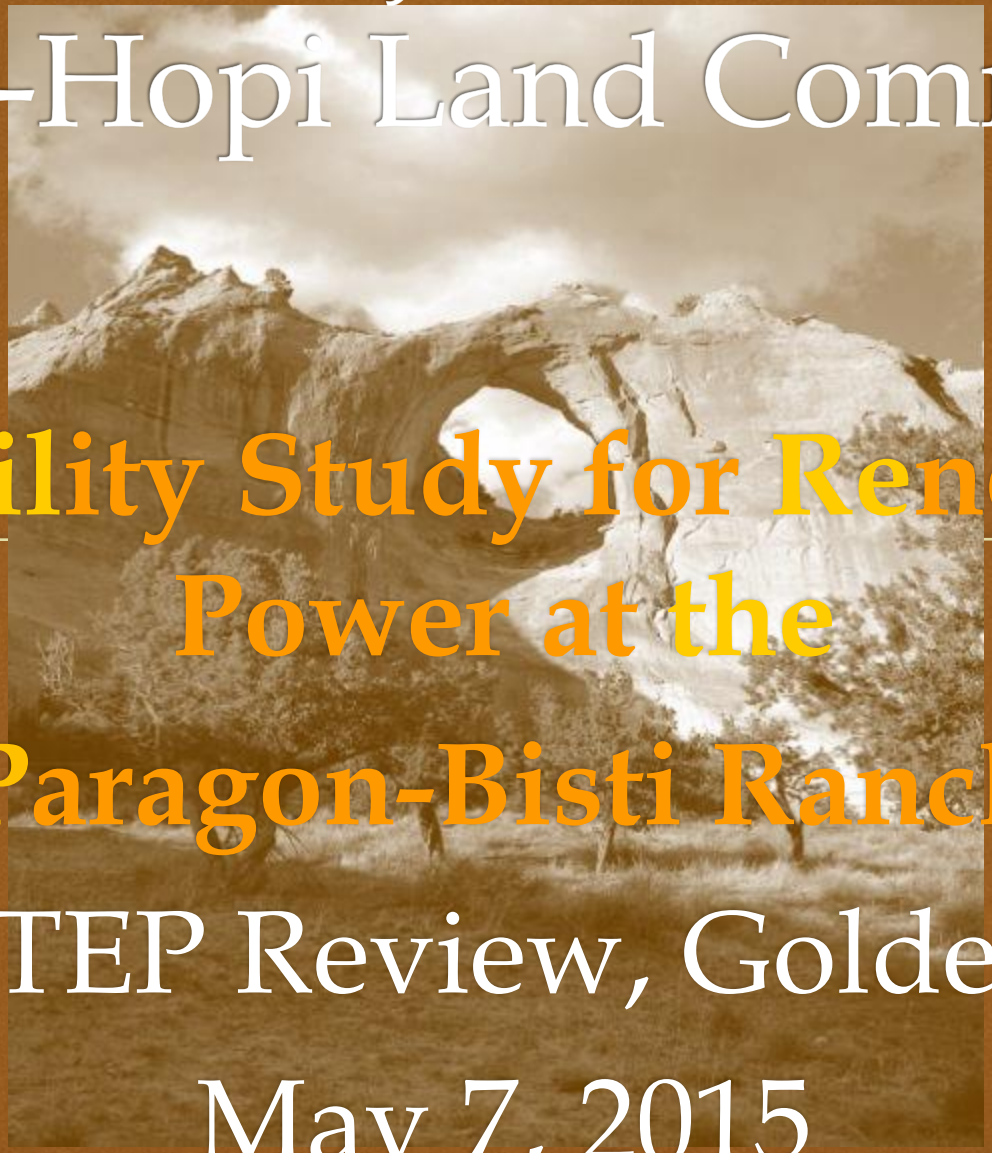
Navajo Nation
Navajo-Hopi Land Commission



Feasibility Study for Renewable Power at the Paragon-Bisti Ranch

DOE TEP Review, Golden, CO

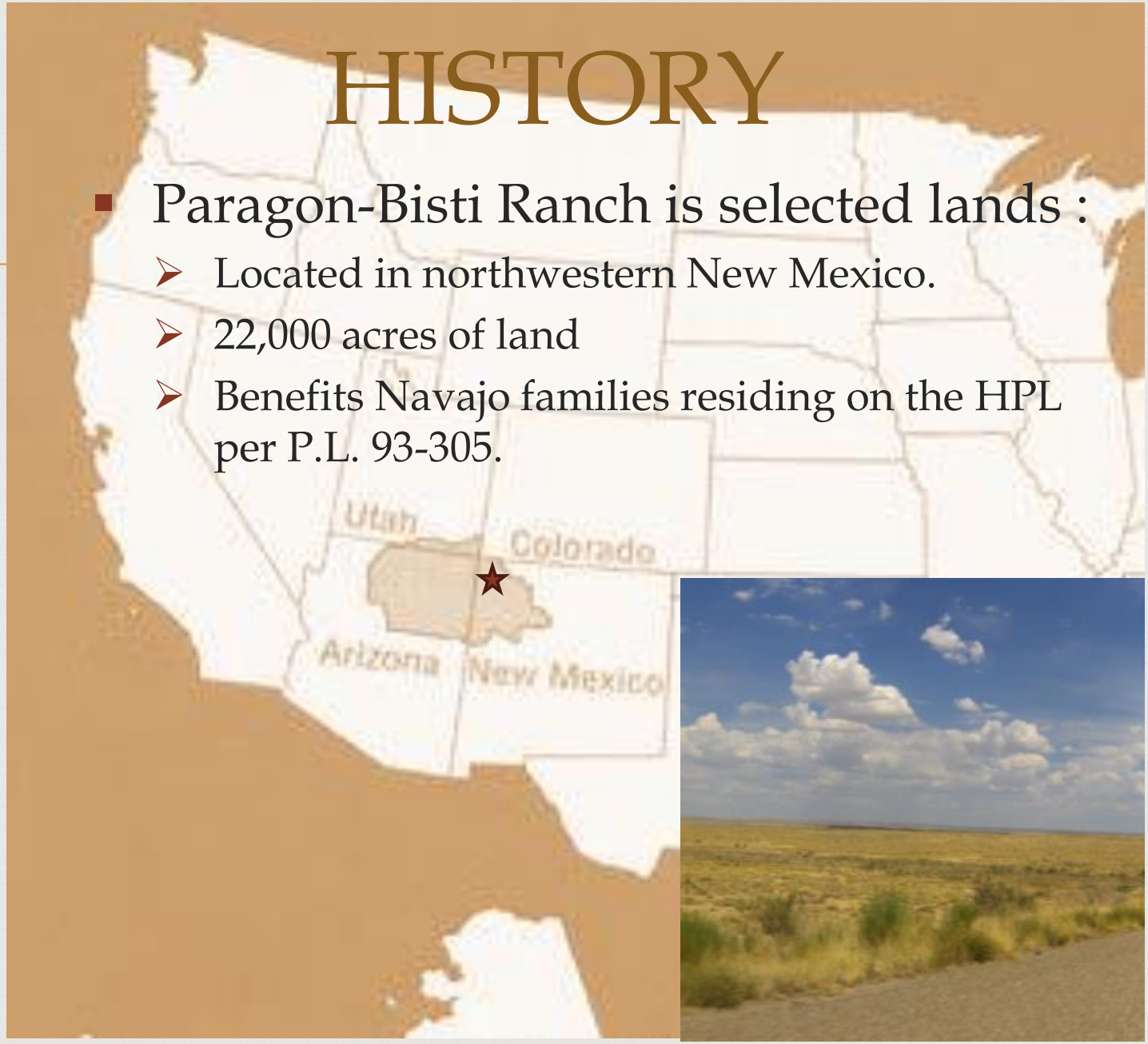
May 7, 2015

Project Background

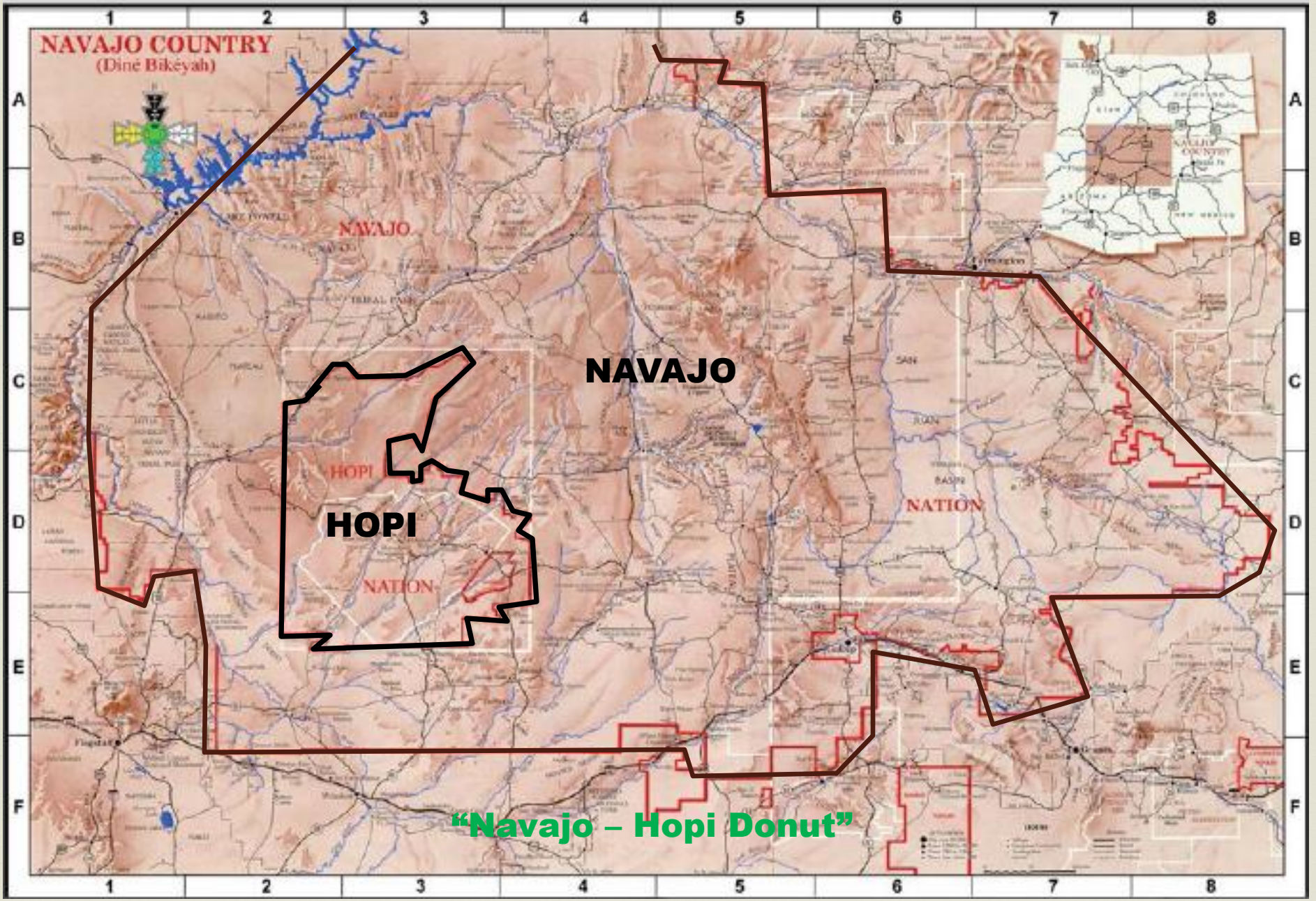
- THE NAVAJO-HOPI LAND SETTLEMENT ACT
  - Navajo-Hopi Land Settlement Act passed 1974
  - Required relocation of Navajo and Hopi families living on land partitioned to other tribe.
  - Set aside lands for the benefit of relocates
  - **Proceeds from RE development for Relocatee**

HISTORY

- Paragon-Bisti Ranch is selected lands :
  - Located in northwestern New Mexico.
  - 22,000 acres of land
  - Benefits Navajo families residing on the HPL per P.L. 93-305.



HISTORY

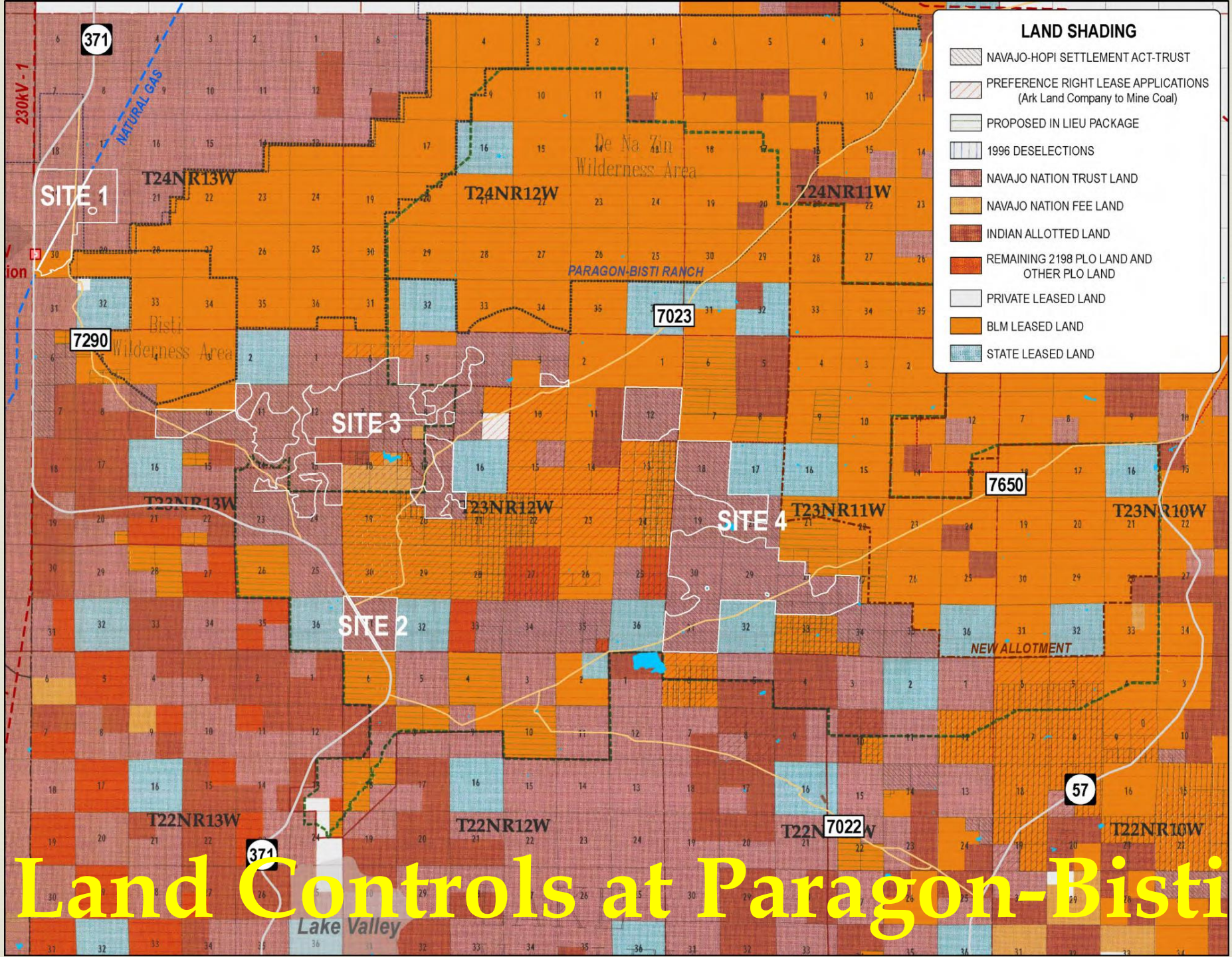

NAVAJO COUNTRY
(Diné Bikéyah)
NAVAJO
NATION
HOPI
NATION
NAVAJO
HOPI
NATION
"Navajo – Hopi Donut"

Feasibility Study Renewable Energy Development @ Paragon-Bisti

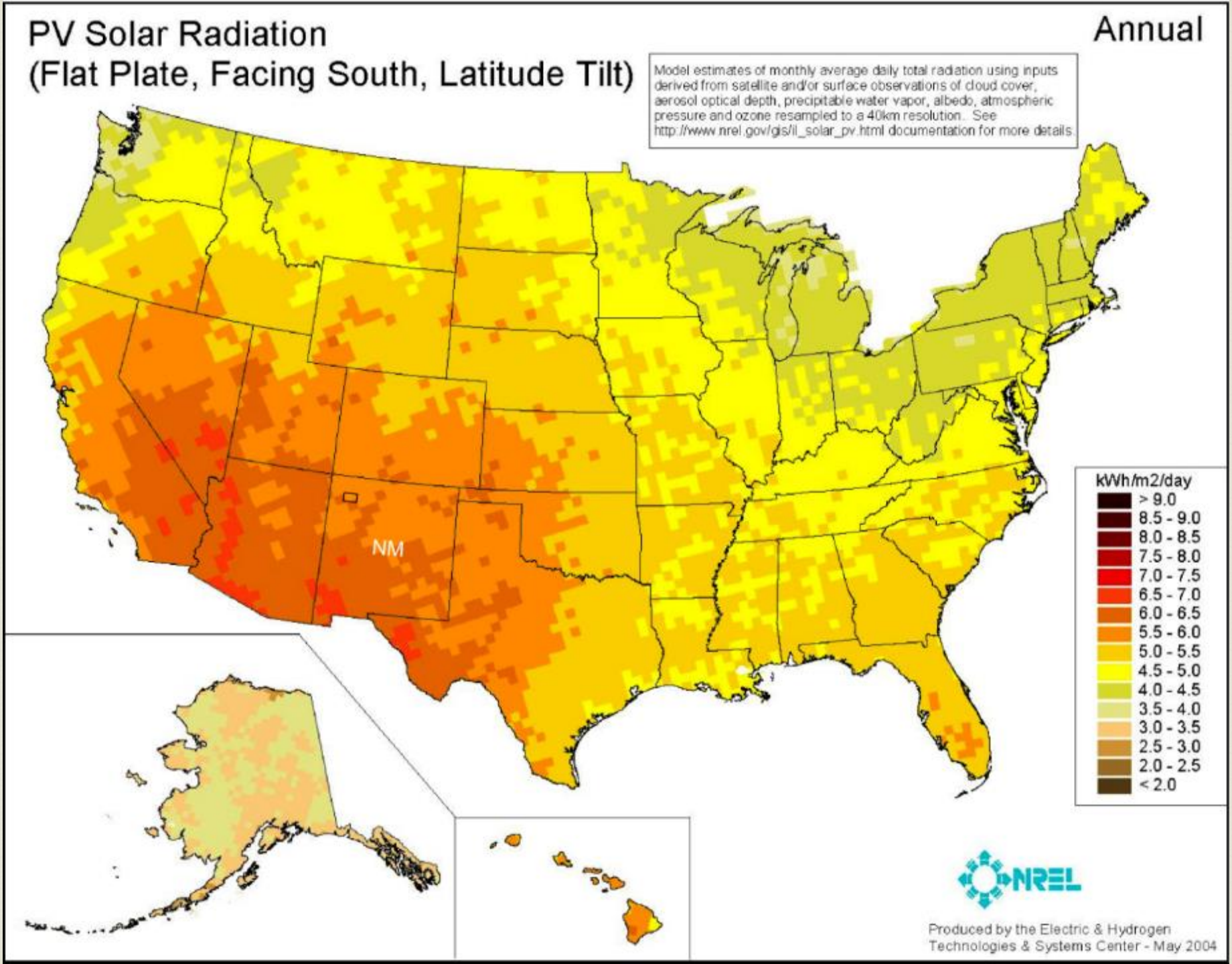
- Site Selection
- RE Technologies
- Preliminary Design
- Transmission and Interconnection
- Business Plan for Implementation
- Environmental Study
- Economic Viability
- Social Economic Factors
- Next Steps

Site Selection Process

at Paragon-Bisti

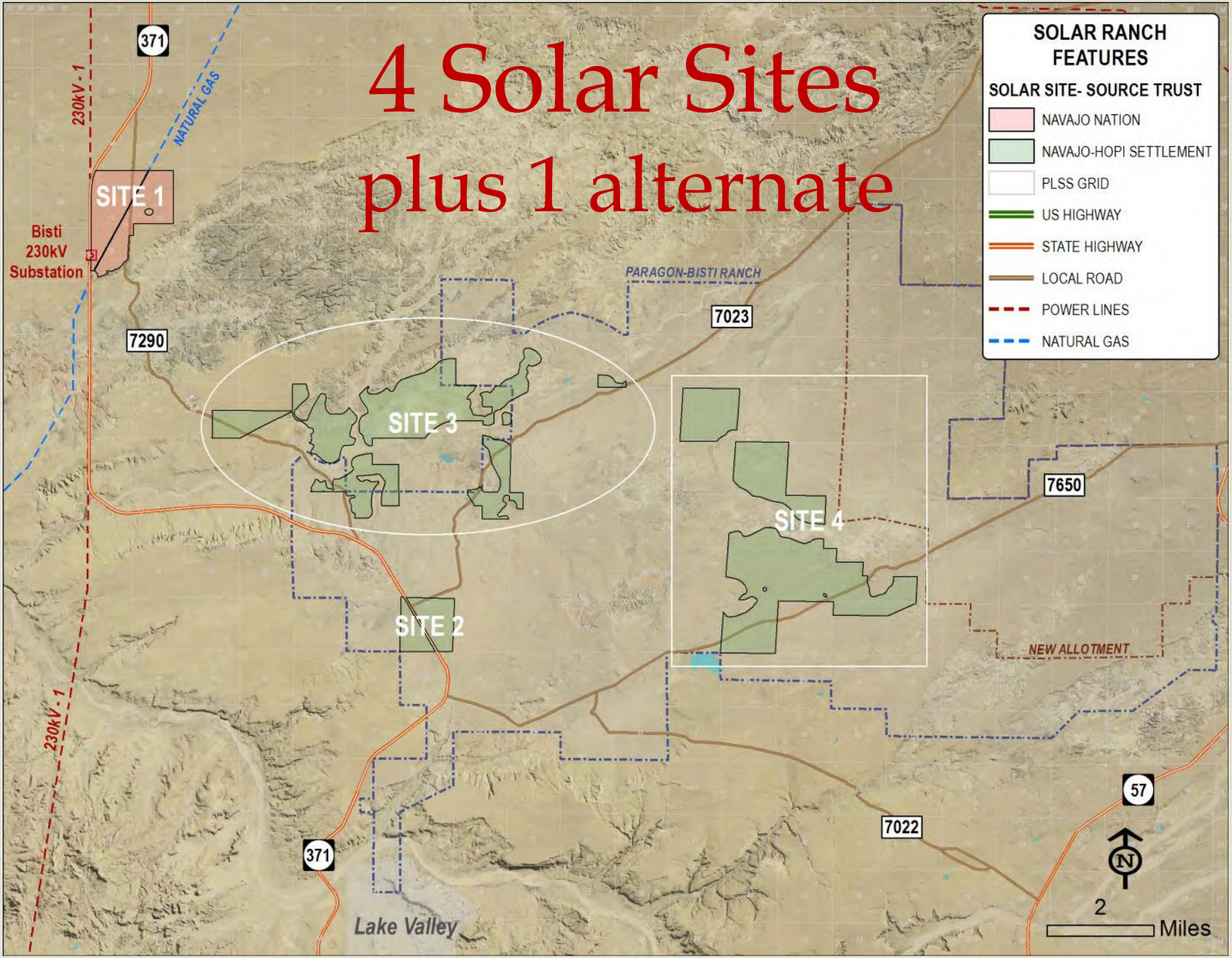


Land Controls at Paragon-Bisti

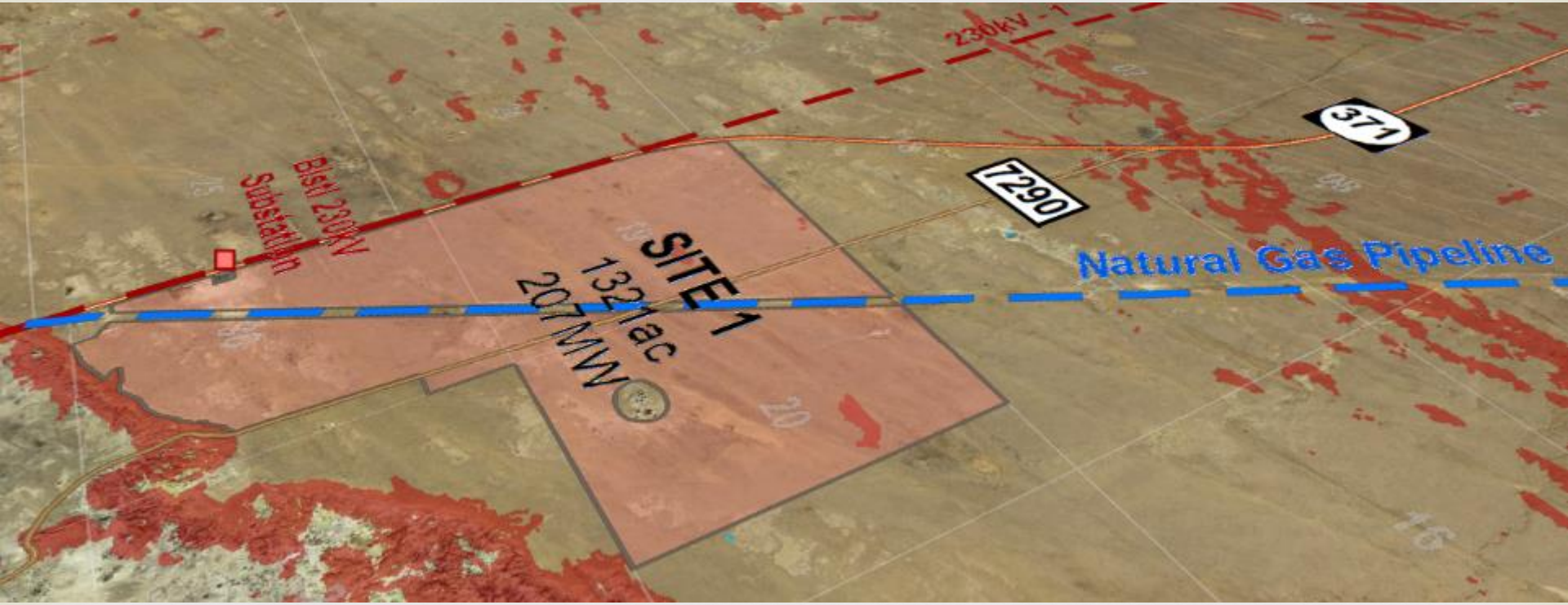

PV Solar Radiation
(Flat Plate, Facing South, Latitude Tilt)
Annual
Model estimates of monthly average daily total radiation using inputs derived from satellite and/or surface observations of cloud cover, aerosol optical depth, precipitable water vapor, albedo, atmospheric pressure and ozone resampled to a 40km resolution. See http://www.nrel.gov/gis/il_solar_pv.html documentation for more details
NM
kWh/m2/day
> 9.0
8.5 - 9.0
8.0 - 8.5
7.5 - 8.0
7.0 - 7.5
6.5 - 7.0
6.0 - 6.5
5.5 - 6.0
5.0 - 5.5
4.5 - 5.0
4.0 - 4.5
3.5 - 4.0
3.0 - 3.5
2.5 - 3.0
2.0 - 2.5
< 2.0
NREL
Produced by the Electric & Hydrogen Technologies & Systems Center - May 2004

RE Technology Screening

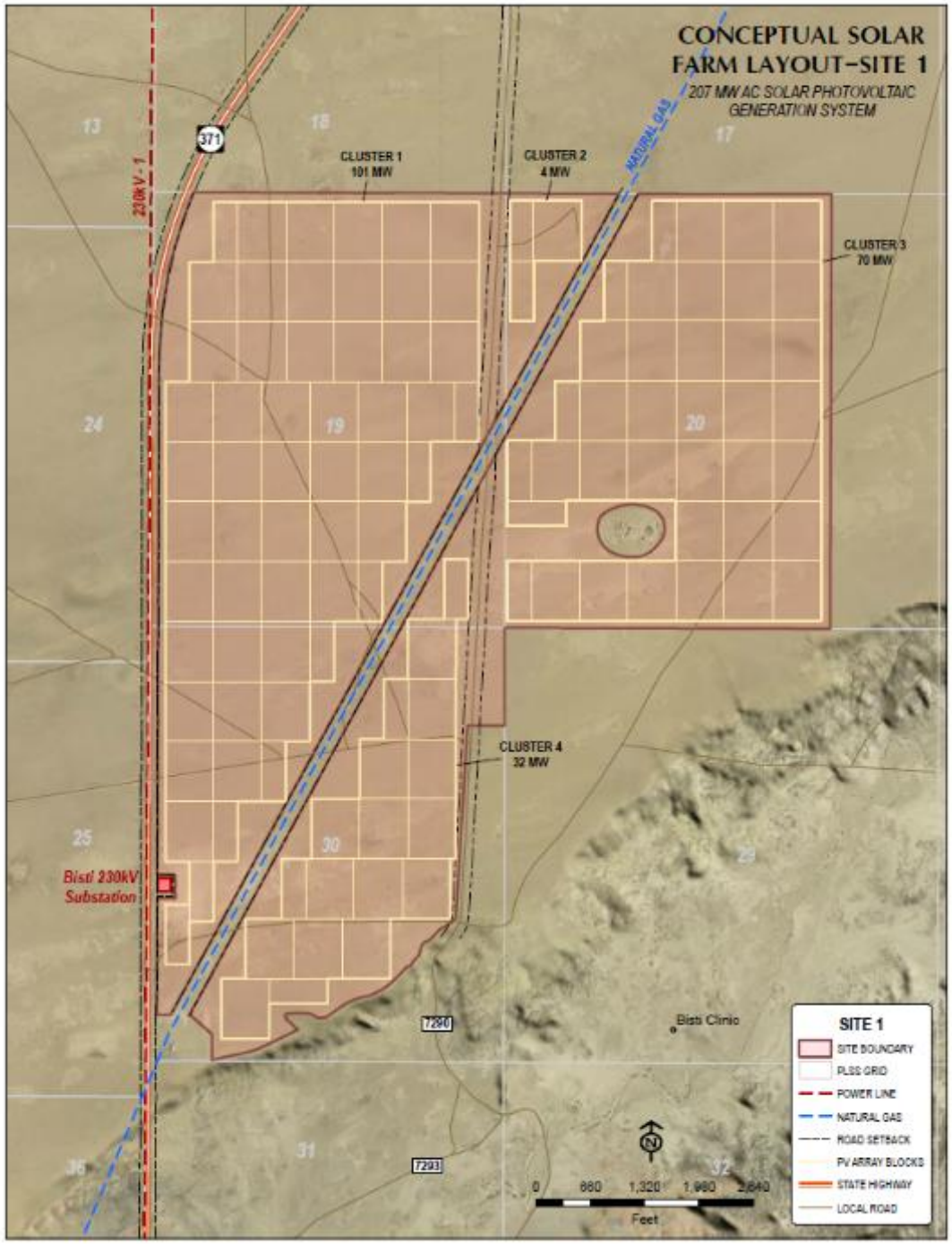
- Solar
  - fixed flat panel photovoltaic (PV) **selected**
  - tracking PV not selected due to marginal cost
  - solar thermal not selected due to marginal cost
- Geothermal
  - geopower not available
  - direct-use hydrothermal resource not utility-scale
- Windpower and Biopower ruled out early

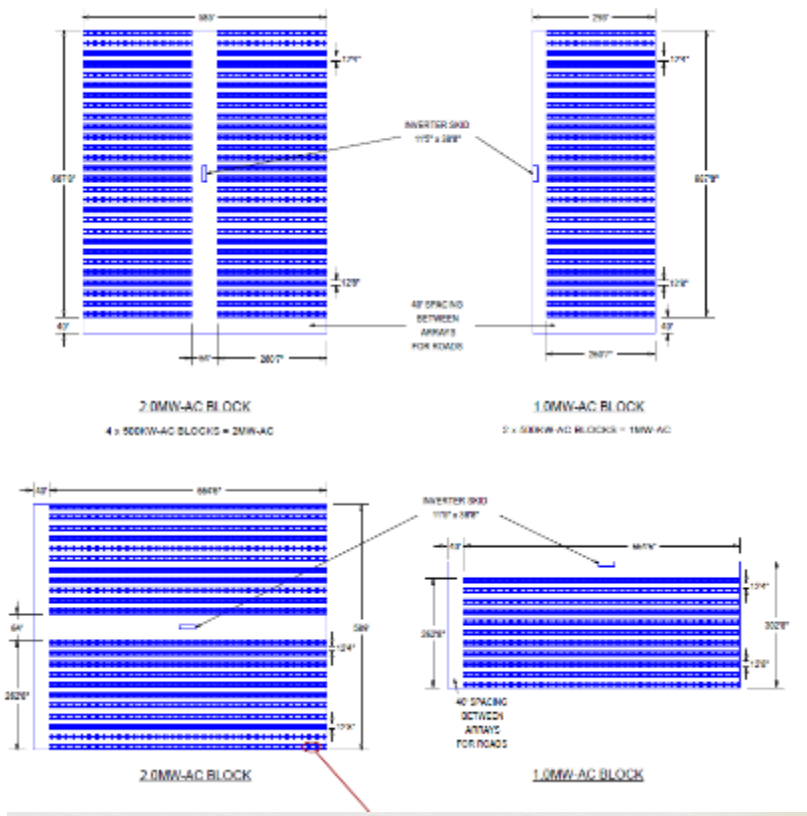

4 Solar Sites
plus 1 alternate
SOLAR RANCH FEATURES
SOLAR SITE- SOURCE TRUST
NAVAJO NATION
NAVAJO-HOPI SETTLEMENT
PLSS GRID
US HIGHWAY
STATE HIGHWAY
LOCAL ROAD
POWER LINES
NATURAL GAS
SITE 1
SITE 2
SITE 3
SITE 4
Bisti 230kV Substation
230kV - 1
NATURAL GAS
PARAGON-BISTI RANCH
NEW ALLOTMENT
371
7290
7023
7650
7022
57
Lake Valley
N
2
Miles

oblique view of Site #1 via flyover in ARC GIS Explorer



207-MW Site #1: Bisti Substation, 230-kV line & Hwy 371
(data directory hidden, 5% slopes shown in red)





Preliminary Design of Site #1 and 1- & 2-MW power blocks

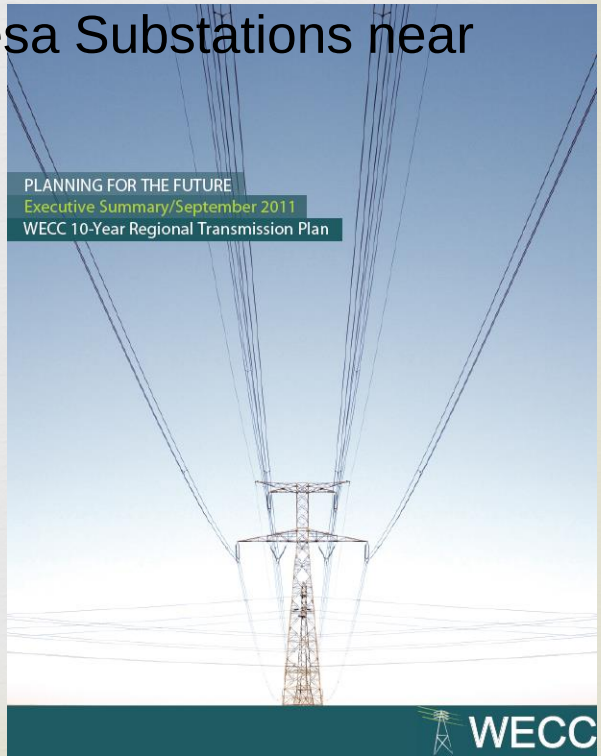
Summary of 4 Solar Sites & alternate

Site # / Name	Devel-opable Acres	Power [MWe]	Access	Development Potential and Status
1. BISTI CORNERSTONE	1,321	207	grid YES paved road YES	• Very high priority, goes 1st • Non-Settlement, but still Tribal (Eastern Land Commission)
3W. "the WEDGE" (alternate to #1)	333	36	grid NO paved road YES	• Alternate to 1st, if 1st not available • Settlement, Selected & Conveyed
2. "DOG-EYE SOLAR FARM"	612	94	grid NO paved road YES	• High, goes 2nd • Settlement, Selected & Conveyed
3. TANNER LAKE/ COAL CREEK	3,171	468	grid NO paved road NO	• Moderate, goes 3rd • Settlement, Selected & Conveyed
4. SPLIT LIP FLATS/ BLACK LAKE	4,201	694	grid NO paved road NO	• Medium-low, goes last • Settlement, Selected & Conveyed
TOTAL ALL SITES	9,638 acres	~1,499 MW_e		

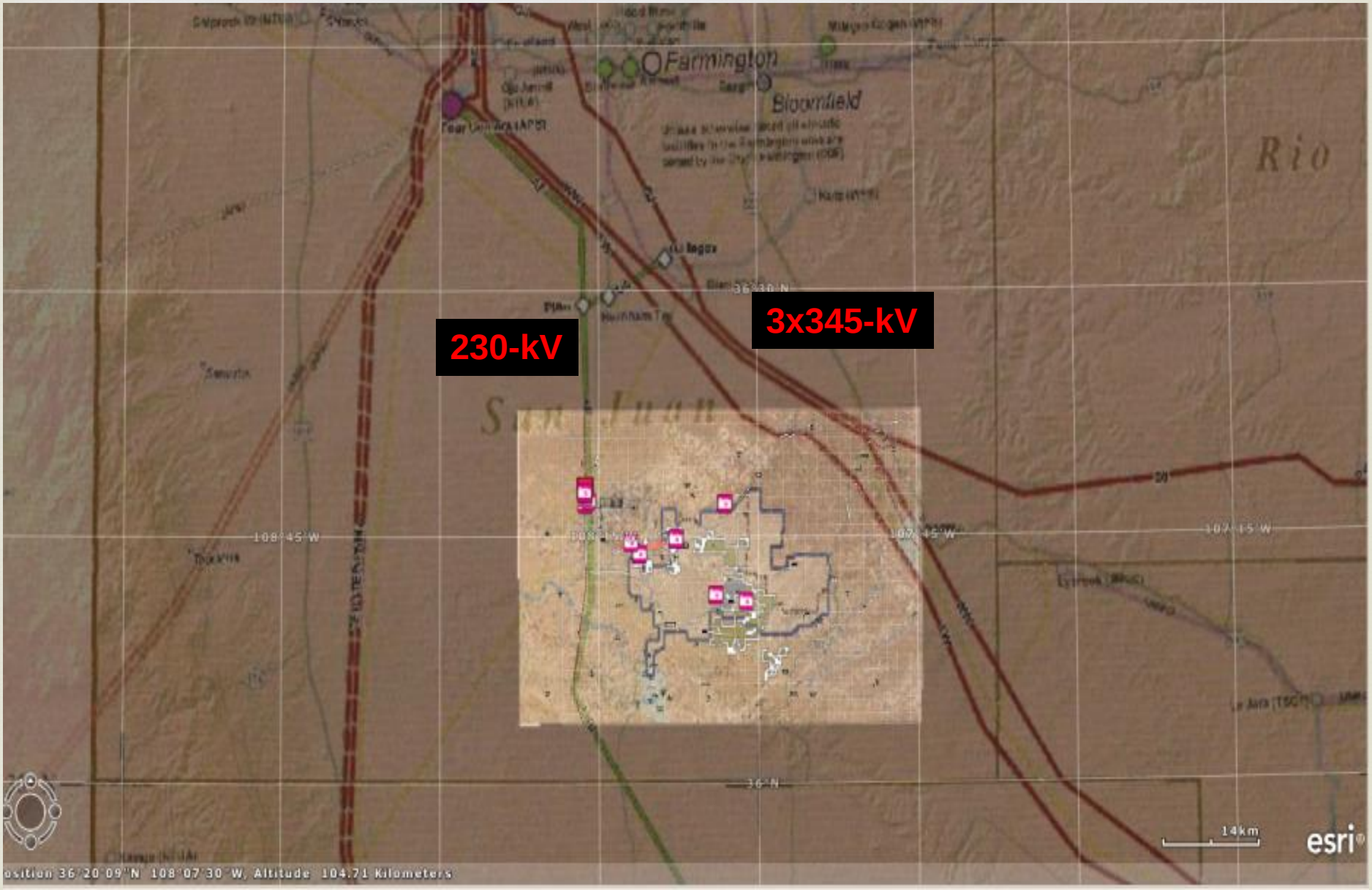
Transmission and Interconnection

Transmission

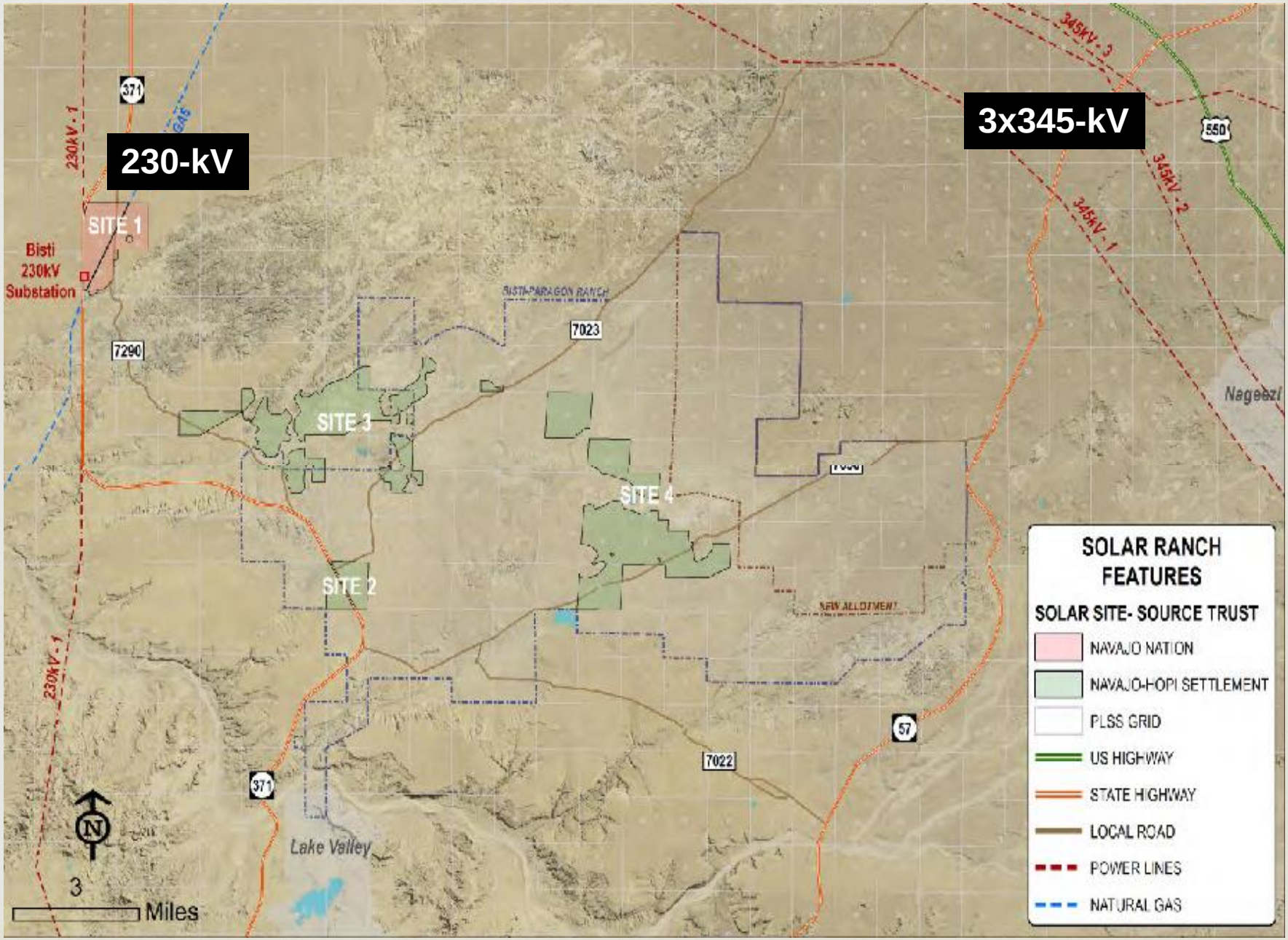
- Public Service Company of New Mexico (PNM) owns the 5 lines surrounding the site
- 230-kV line that passes just west of the site - 6 miles Line connects the Four Corners Power Plant to Ambrosia Substation
- three 345-kV lines east of the site, West Mesa Substations near Albuquerque
- Connects San Juan Power Plant to Rio Puerco Substation
- Connects San Juan Power Plant to Ojo Substation



Transmission and Interconnection



Transmission and Interconnection



Transmission and Interconnection

Interconnection - Meeting with PNM to understand their process

- Follow process approved by FERC
- PNM advise that their ability to handle intermittent is limited
- renewable resources in their balancing authority is very limited.
- Generator comply with a Large Generator Interconnection Agreement (LGIA) costing $300K+
- Signed LGIA - must put down a deposit to begin
- Timeline for completing
- LGIA requires a system impact study to identify if any system upgrades
- Improvements-(new a substation) costed and the generator's share is determined in a facilities study
- LGIA has a 3-year shelf life- per FERC rule
- LGIA doesn't guarantee capacity on the system-only the right to connect

Transmission and Interconnection

GOOD NEWS

Possibly 150 MW of capacity on 230-kV line

Need to enter the Interconnect Study

Transmission and Interconnection

Export Markets

- Extensive interview and meetings with possible off-takers
- PNM, NTUA, Farmington NM Utility Sys, Gallup NM Joint Utilities, Los Alamos NM, Albuquerque NM…
- Pathway for transmission into Arizona/Nevada/California markets
- Many developers in the FERC queue
- Price sensitivity is a major concern, <$45/MHh
- RPS is being achieved through Utility owned and Roof Top systems- 20%
- Initial offering in the ~100MW range

Economic Analysis, Cost:Benefit, & *pro forma*

Financial Model for the Economic Feasibility Assesment of Power Plants

Total Cost of Ownership - TCO **Date: 5/6/2015**

Title: Navajo Paragon-Bisti Solar Site #1

Version: 1.9.2

Input Assumptions

IOC from groundbreaking [enter at least 1 yrs]		1
Performance		
System Size (kW DC)		207,000
Yearly fuel consumption (tons)		-
Net Output after House Load		99.00%
Adjusted System Size (kWac)		204,930
Capacity Factor		18.00%
Performance degradation, %/year		*1.00%*
Capital Cost per nameplate watt	$	1.50
use for BEST CASE: $1.50/W; LIKELY $2.00; REASONABLY WORST $2.50		
Key Rates		
Internal Utility Electricity Price ($/kWh, see ind.tabs)		see tabs
Fuel Receipt Fee ($/per ton)	$	-
O & M ($/kWh)	$	*0.010*
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 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)		2.00%

Summary Dashboard

Output: Before-Tax IRR

Equity %-age v	Elec price [¢/kWh]	0.09	0.10	0.11	0.12
100%		8.77%	10.31%	11.77%	13.19%
67%		9.11%	11.22%	13.26%	15.26%
50%		9.40%	12.01%	14.58%	17.12%
33%		9.86%	13.34%	16.90%	20.55%
20%		10.49%	15.41%	20.91%	26.84%

Output: After-Tax IRR

Equity %-age v	Elec price [¢/kWh]	0.09	0.10	0.11	0.12
100%		5.95%	7.39%	8.78%	10.12%
67%		5.80%	7.80%	9.75%	11.68%
50%		5.68%	8.16%	10.63%	13.12%
33%		5.49%	8.76%	12.20%	15.86%
20%		5.26%	9.67%	15.00%	21.26%

TAKEAWAYS:

- maximize PPA ¢/kWh (= $/M
- minimize equity portion, maximize

Business Plan for Implementation

- Complete the FS
- Internal meeting with Tribal oversight committees
- Navajo Nation in Transition – new administration
- Meeting with PNM
- Meeting with NTUA - planned
- Meeting with Tribal EPA
- Exploring education and traning for tribal members
- **Connecting with developers – share FS data**
- Developing internal tribal procures for lease
- NN funded study of transmission and intercnnect

Environmental Study

- Meetings with Navajo Nation EPA (NNEPA)
- Developed environmental overview of the 22,000-acre site
- Conducted general field/environmental reconnaissance survey of entire 22,000 acre
- Preparing for future Environmental Assessment (EA) on Site 1

Environmental Study

Environmental Issue Areas - No major areas of concerns

More Field Work Required - based on specific site

- Cultural Resources- - Archaeological/Paleontological/Historical
- Avoidance of Sensitive Tribal Lands-Grave Sites/Sacred Sites

Consider in the Design Phase

- Biological Resources-Vegetation and Wildlife
- Hydrology and Flood Potential
- High Susceptibility of Soil to Erosion

Environmental Study

- Water - Supply of Suitable for Solar Panel Washing
- Visibility and Effect on Visual Resources – no major concern
- Land Use - Ensuring compatibility of RE facilities with the traditional Navajo lifestyle and future

Social Economic Factors

Benefit Assessment (Employment, Cultural & Social)

- Employment –
  - Secure Healthy Jobs
  - ~15K man-years,
  - payroll ~$1B in the O&M Phase

- Full construction buildout cost ~$3.5B

Benefit Assessment (Employment, Cultural & Social)

Cultural and Social

- Consistent with Navajo values
- Supports domestic development
- Support nation and state objectives for Energy Independence

Social Economic

- **Training** – meeting with local technical schools
- **Gain Tribal Community Support –** meetings with committees, agencies and chapters
- **Gain Tribal Leadership Support -** meetings with president and other leaders

What's Next

1. Initial Study
2. **Feasibility Study**
3. Pre-Construction – **meetings with developers**
4. Construction
5. Operation & Maintenance

What's Next

- Finalize site boundaries – at least site 1
- Continue to work with PNM
- Work with new tribal Govt to gain support
- Define and map the internal - NN process
- Develop financial model & lease agreement
- Engage developers
- Move into Pre-Construction Phase

Thank you. Questions?

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