Navajo Nation
Navajo-Hopi Land Commission

Feasibility Study for Renewable Power at the Paragon-Bisti Ranch

DOE TEP Review, Golden, CO

May 7, 2015
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
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

- **Navajo**
- **Hopi**

Map: "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

09/24/2013 16:28
Land Controls at Paragon-Bisti
PV Solar Radiation (Flat Plate, Facing South, Latitude Tilt)

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

230-kV

3x345-kV
Transmission and Interconnection

230-kV

3x345-kV

SITE 1

Bisti 230kV Substation

SITE 2

SITE 3

SITE 4

Lake Valley

Miles

SOLAR RANCH FEATURES

SOLAR SITE- SOURCE TRUST

- NAVAJO NATION
- NAVAJO-BPI SETTLEMENT
- PLSS GRID
- US HIGHWAY
- STATE HIGHWAY
- LOCAL ROAD
- POWER LINES
- NATURAL GAS
**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
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 Assessment 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

<table>
<thead>
<tr>
<th>Performance</th>
<th>Summary Dashboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Size (KW DC)</td>
<td><strong>Output: Before-Tax IRR</strong></td>
</tr>
<tr>
<td>Yearly fuel consumption (tons)</td>
<td>Equity %-age v</td>
</tr>
<tr>
<td>Net Output after House Load</td>
<td>0.09</td>
</tr>
<tr>
<td>Adjusted System Size (KWac)</td>
<td>204,550</td>
</tr>
<tr>
<td>Capacity Factor</td>
<td>18.00%</td>
</tr>
<tr>
<td>Performance degradation, %/year</td>
<td>1.00%</td>
</tr>
<tr>
<td>Capital Cost per mnmwipsite wth use for BEST CASE: $1.50/MW; LIKELY $2.00; REASONABLY WORST $2.50</td>
<td>$ 1.50</td>
</tr>
</tbody>
</table>

### Key Rates

<table>
<thead>
<tr>
<th>See tabs</th>
<th><strong>Output: After-Tax IRR</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Receipt Fee ($/ton)</td>
<td>Equity %-age v</td>
</tr>
<tr>
<td>O &amp; M ($/MWh)</td>
<td>0.010</td>
</tr>
<tr>
<td>General Monetary Inflation Rate Americas est (%)/year</td>
<td>3.90%</td>
</tr>
<tr>
<td>Electricity Price Inflation, US PPI 1950-2005 (%/year)</td>
<td>2.20%</td>
</tr>
<tr>
<td>Discount Rate est. for West:</td>
<td>4.90%</td>
</tr>
<tr>
<td>Assumed Corporate Tax Rate (%)</td>
<td></td>
</tr>
<tr>
<td>State Income Tax Rate (%)</td>
<td></td>
</tr>
<tr>
<td>Local Jurisdiction Income Tax Rate (%)</td>
<td></td>
</tr>
<tr>
<td>Property Tax (%)</td>
<td></td>
</tr>
<tr>
<td>REC Current Rate ($1000/Kwh)</td>
<td></td>
</tr>
<tr>
<td>REC Value Change (%/year)</td>
<td></td>
</tr>
<tr>
<td>Current Electricity Usage (kwh)</td>
<td></td>
</tr>
<tr>
<td>Land Rate Escalation (%/year)</td>
<td>2.66%</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>

**TAKEAWAYS:**
- Maximize PPA ¢/kWh (= $/MWh)
- Minimize equity portion, maximize debt
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 training for tribal members
- Connecting with developers – share FS data
- Developing internal tribal procures for lease
- NN funded study of transmission and interconnect
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
(Revenue, 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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