U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Tribal Energy Program

2013 PROGRAM REVIEW

Pueblo of Zia Renewable Energy Development Feasibility Study

U.S. Department of Energy – Award No: DE-EE0005628

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Pueblo of Zia Renewable Energy Development Feasibility Study, U.S. Department of Energy Award No: DE-EE0005628

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Project Location: Zia Pueblo, NM

- Located in Sandoval County - approx. 35 miles NW of Albuquerque, NM and 17 miles NW of Bernalillo, NM
- Lands of Zia Reservation : 167,000 acres/261 sq. miles
- Elevation range: 5,200 ft. to over 9,000 ft.: includes pine forest, red bluffs, white mesas, extensive cattle grazing lands & clear-unimpeded views in all directions

Historical Background

- Zia Pueblo central village is situated alongside the Jemez River atop a mesa that provides spectacular views of surrounding Zia Pueblo lands & outlying neighboring areas
- Continuous inhabitation of current homelands since < 1250 A.D.
- Part of Keres Indian Nation: ancestral roots to upper San Juan River basin & Mesa Verde
- Traditional language of Zia Pueblo is Keresan
- Longstanding practices of agriculture and traditional arts & crafts

Zia Sun Symbol

Birthplace of the renowned historic “Zia Sun symbol,” which displays sixteen stylized rays radiating in each of the traditional four directions from a central sun. In the 1920’s, the symbol was adopted by the State of New Mexico for use as its official NM State flag emblem.

Contemporary Pueblo Life & Economic Development

- 875 Tribal Members (2013), living in 178 housing units
- Sustainable Tribal Economic Development (i.e., non-gaming), includes:

ZIA ENTERPRISE ZONE (ZEZ)

ZIA BERNALILLO PLAZA (ZBP)

SUSTAINABLE AGRICULTURE & FARMERS MARKETS

RENEWABLE ENERGY & NATURAL RESOURCES

Project Overview

Goal: Conduct a *comprehensive feasibility study* for best-use applications for developing renewable energy resources on Zia Tribal lands including :

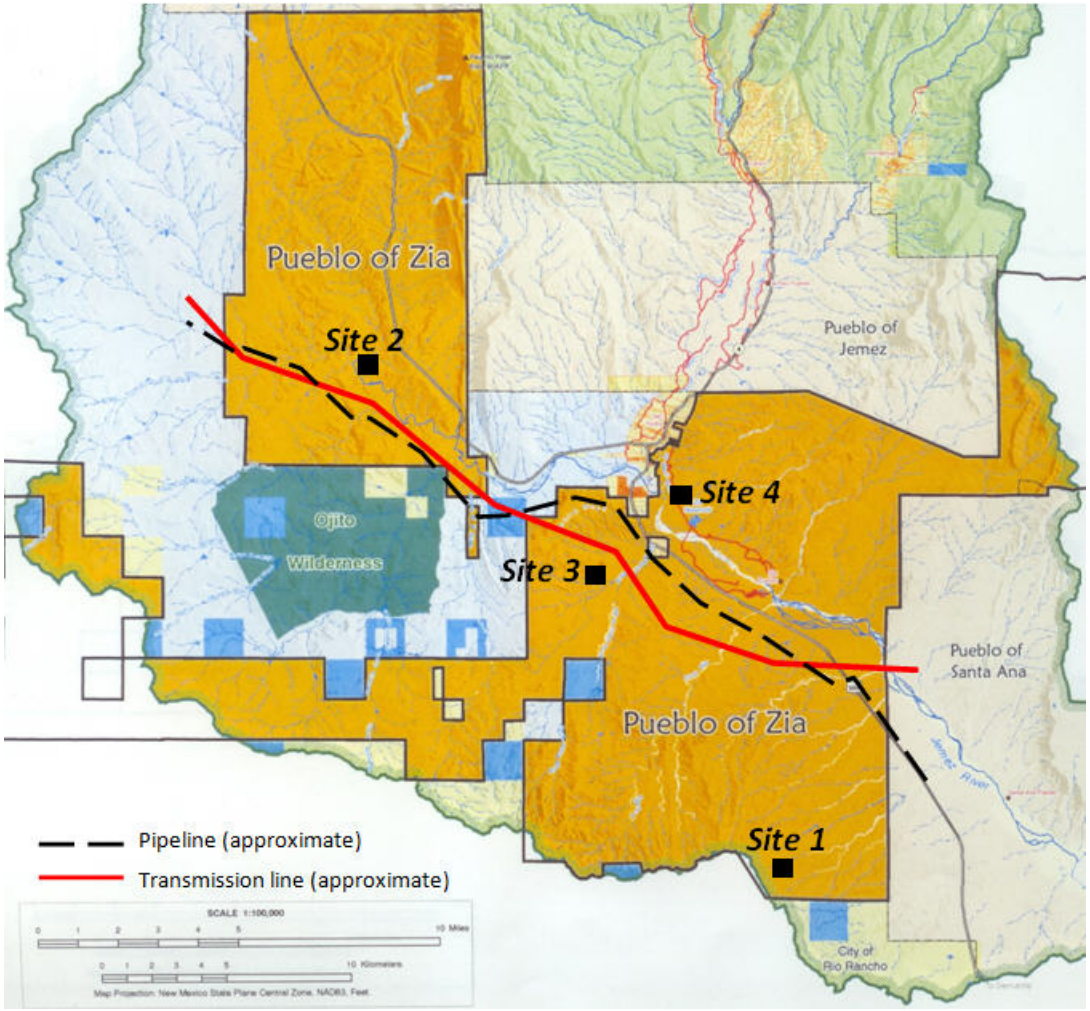
- A. Provide a balanced local renewable power supply for Zia Pueblo, its members, tribal offices, schools, buildings, and businesses.
- B. Provide a firm power supply for export and commercial market distribution
- C. Provide economic development for the tribe and its tribal members, including job training and creation

Project Milestones & Accomplishments

Milestone	Completion
Project Commencement/Team Retreat	August 2012
Site Down-Select Process	December 2012
Geothermal Evaluation Complete	June 2013
Solar/Wind Evaluation Complete	August 2013
Power Firming Evaluation Complete	November 2013
Integrated Project Report Final Draft	December 31, 2014
DE 5628 Project Final Study Report	March 2014
Developer Interactions	***Ongoing***

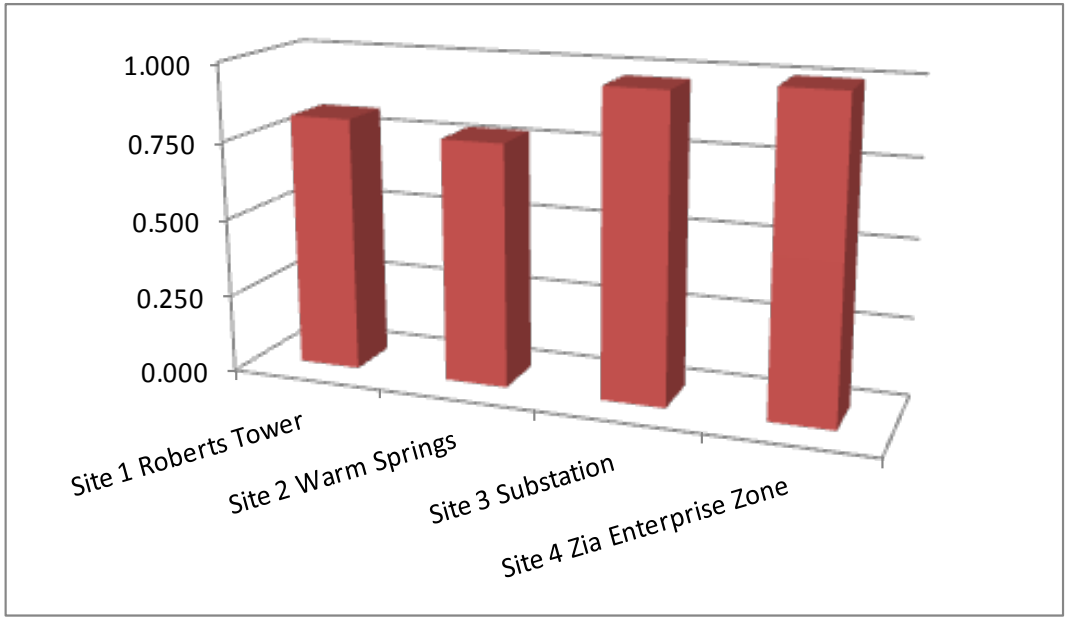
POZ Development Sites

- Wind Sites: ***1,3***
- Solar Sites: ***1,2,3,4***
- Geothermal Sites: ***1,2,3,4***
- Major utility asset: San Ysidro 115 kilovolt Substation



Site Down Selection

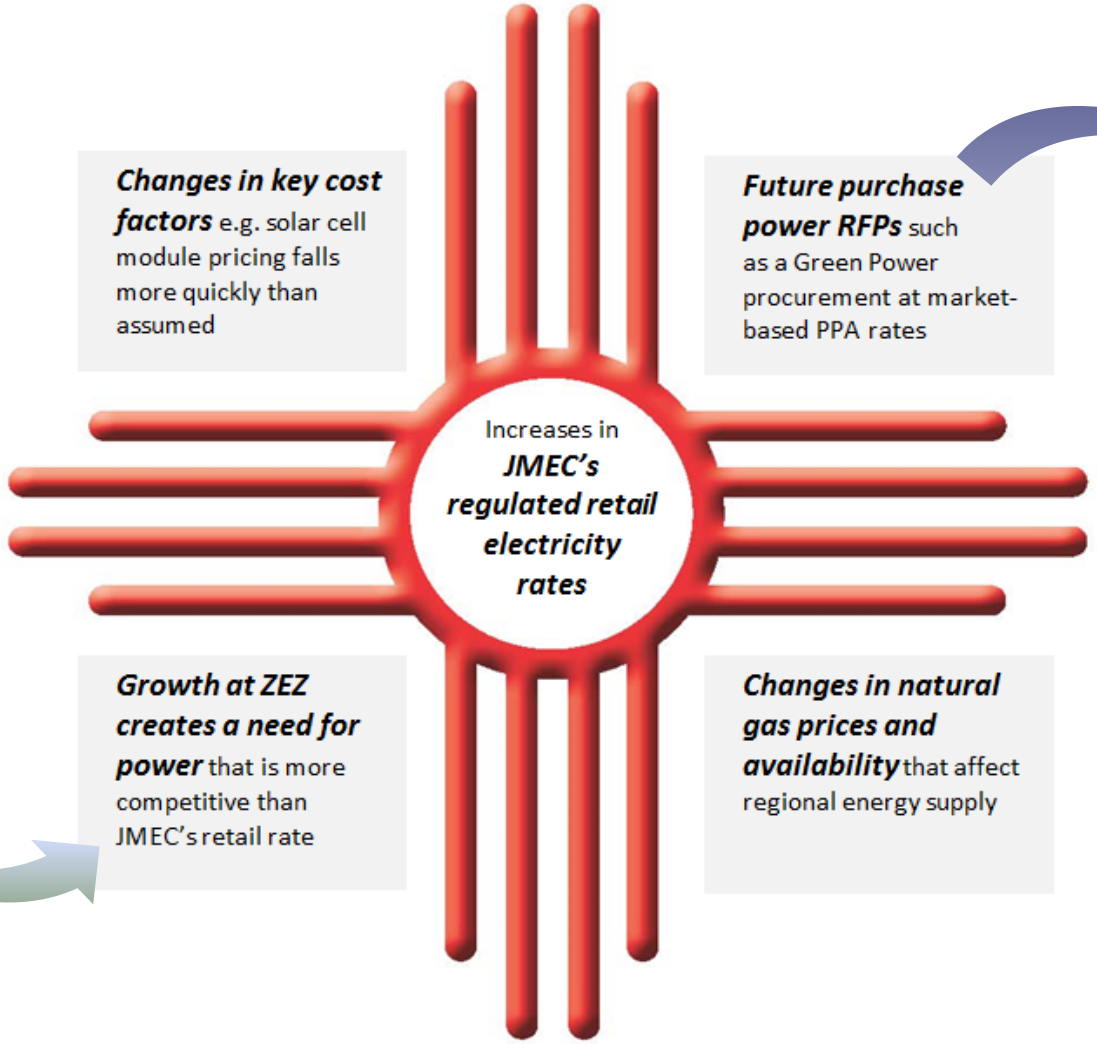
- Four development sites plus three technologies offer ***many siting combinations of value to POZ***
- POZ team facilitated exercise in Dec. 2012 to reduce number of site combinations
- 14 technical and non-technical factors were used to score POZ's development sites



Above: Site scoring; Sites 3 and 4 received significantly higher scores than Sites 1 and 2

POZ Business Development Issues

Siting combinations affect POZ's ***tribal income, ability to create jobs and cost of electricity****....*

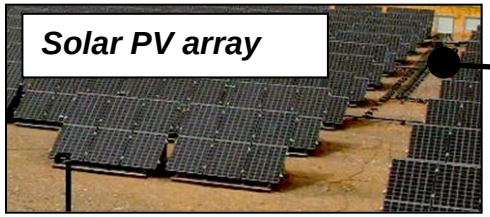


Net Metering of electricity *offers POZ's best short-term business strategy....*

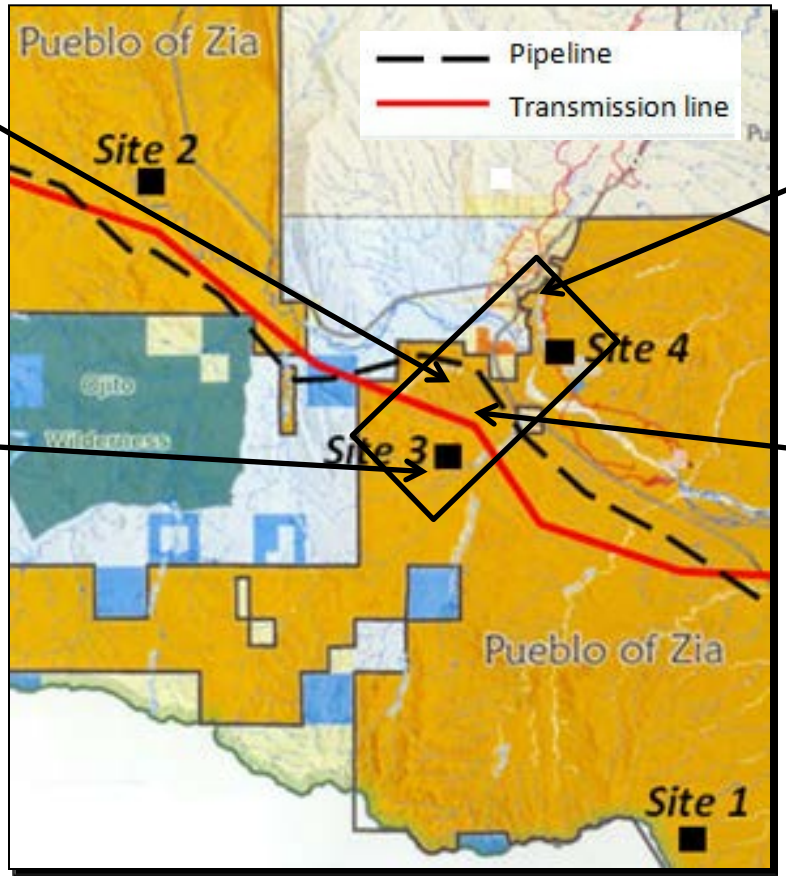
POZ Development "Cluster" 5,430 kW Capacity

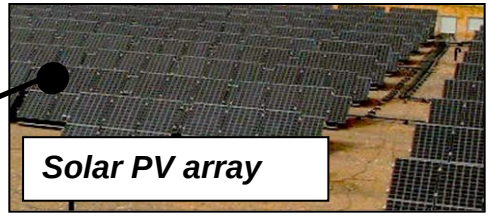
- Preferred development cluster for Geothermal, Wind and Solar technologies is located at Sites 3,4

White Mesa
1,370 kW



Substation
2,130 kW





ZEZ
330 kW

ZEZ
1,300 kW

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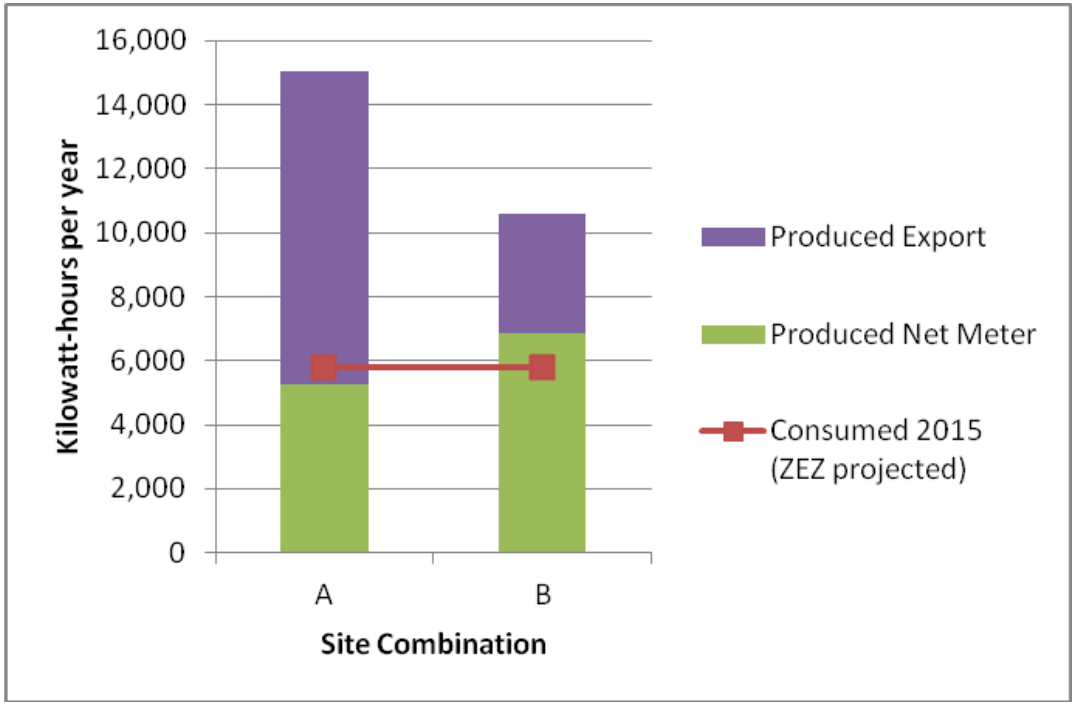
PUEBLO OF ZIA

Cluster Energy Production: Net Metering versus Export

- ***Combination A:*** Geothermal, solar, and wind capacity is installed; 55% capacity factor; installed cost: $15.1 Million
- ***Combination B:*** Geothermal and solar capacity is installed; 40% capacity factor; installed cost: $13.6 Million

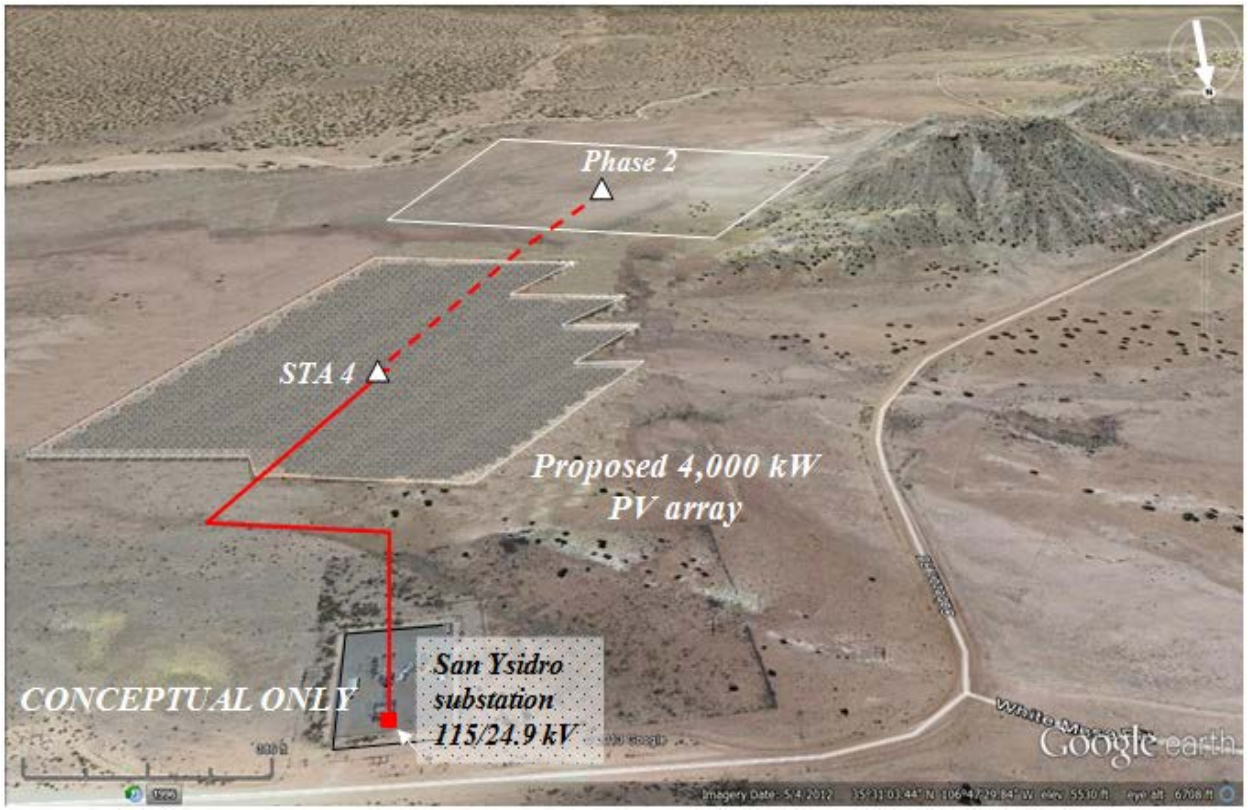


Above: Net meter location is at ZEZ; "Consumed 2015" is based on projected ZEZ development plus existing consumption of tenants and Zia Village

Example: Solar PV Array Site 3

20-Year cumulative for 2,130 kW capacity, 7.5% IRR:

- Total cost: **$6.3 Million**
- Operating expenses: **$4.4 Million**
- Energy revenue: **$12.1 Million**
- POZ payment: **Up to $940,000**



Above: Phase 1: up to 3,000 racks of solar PV panels; plant occupies approximately 20 acres

Example: Project Risk Scoring

Siting Options	Financial	Technology	Regulatory	Resource Availability	Water use	Emissions, waste, disposal
Site 3 Geothermal 2,000 kW	2	1	3	2	2	3
Site 4 Geothermal 500 kW	1	1	3	2	2	3
Site 4 Solar PV 1,000 kW	3	3	3	3	3	3
Site 3 WECS 6,000 kW	3	2	3	2	2	2
Site 3 Solar PV 4,000 kW	**2**	**3**	**3**	**3**	**2**	**2**

Above: :***"1"*** is not preferred, unacceptable or too much risk; ***"2"*** is acceptable, possibly favorable, some risk;***"3"*** is very favorable, little or no risk, preferred.

Observations and Lessons Learned

- *Multiple sites & Diversity of technologies* requires significant lead-time, research & structured selection process w-active ongoing tribal participation.
- Tribal interface with commercial vendors & potential developers requires *realistic advance & lead time*
- Tribal considerations & cultural preferences combined w/scientific & technical feasibility are KEYS to strategic planning.
- History of challenges for PPA's w/tribes: No existing PPA's
- High value of forming key strategic project partnerships, technical expertise and collaboration

Next: Proving Commercial Feasibility

- Export Market Analysis
  - Community Power / Export Power
  - Customer Pool
  - PPAs
- Partnership Development
  - Financial Backing
- Financial Analysis
  - Model All Economic Parameters
- Operational Integration
  - Bring All the Study Results and Plans Together in a Market-Driven Solution

Pueblo of Zia Renewable Energy Development- Q&A

The expertise and assistance provided to the Pueblo of Zia by DOE TEP has been invaluable to our success thus far…

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