



Southwest Tribal Energy Consortium Renewable Energy Feasibility Study



U.S. Department of Energy Tribal Energy Program Review
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Project Overview >> Background

- Feasibility study to develop renewable energy generation projects
 - ❖ Renewable projects considered will not generate firm power
 - ◆ Solar
 - ◆ Wind
 - ❖ Access to nearby gas pipelines could allow for a “hybrid” project, providing a “firm” power product
 - ❖ Power generated to serve both electric loads and wholesale power markets
- Renewable generation project development can have significant positive impacts
 - ❖ Help resolve existing on-reservation power quality and reliability problems
 - ❖ Create local short-term and long-term employment opportunities
 - ❖ Promote energy self-sufficiency and economic development opportunities
- Project could generate adequate power to meet a portion or all of member tribes’ electric needs
 - ❖ Reservation+
 - ❖ Village
 - ❖ Entity/facility
- Capacity building is a major component of the effort



Project Overview >> Project Scope/Goals

Consortium Development/Capacity Building

Energy Needs Analysis

Review member loads, needs and relevant regulatory/legislative issues

Project Identification

Identify project opportunities based on member interests/resources

Fatal Flaw Analysis

Identify major issues that would eliminate possible projects

Project Economics

Evaluate feasibility of community-supported projects

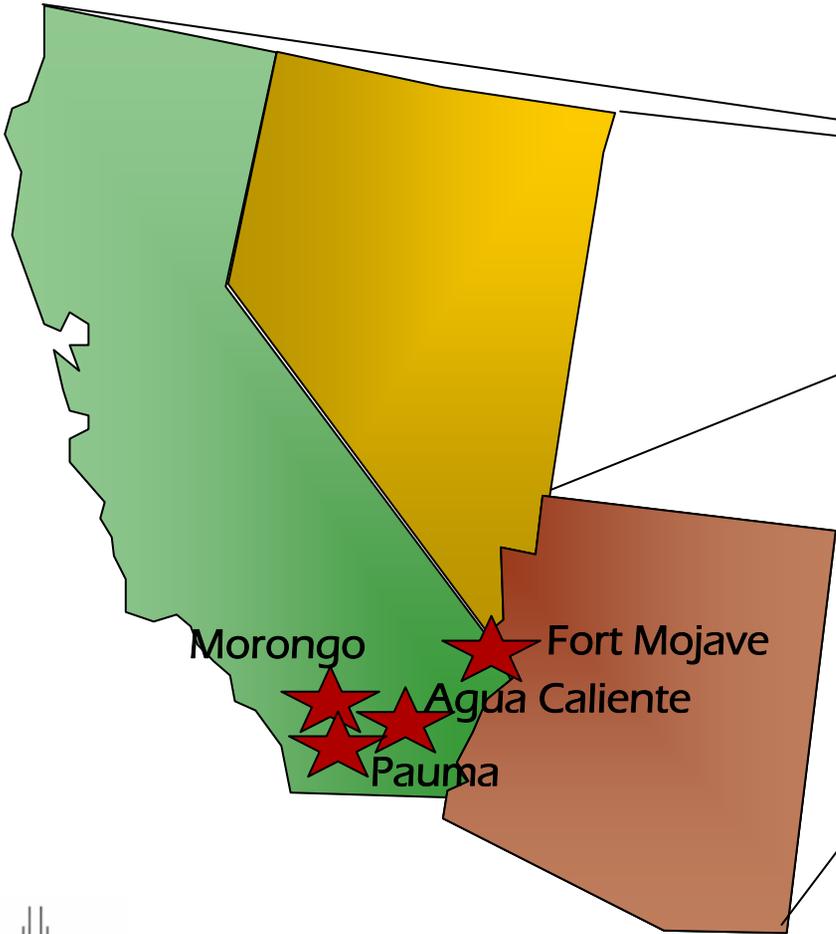
Decision Support

Presentation/decisions re: pursuit of feasible projects

- Increase energy knowledge and capacity
- Promote energy self-sufficiency
- Encourage economic development
- Contribute to environmentally clean energy
- Provide data needed to proceed with renewable energy development, as an owner or participant



Project Location



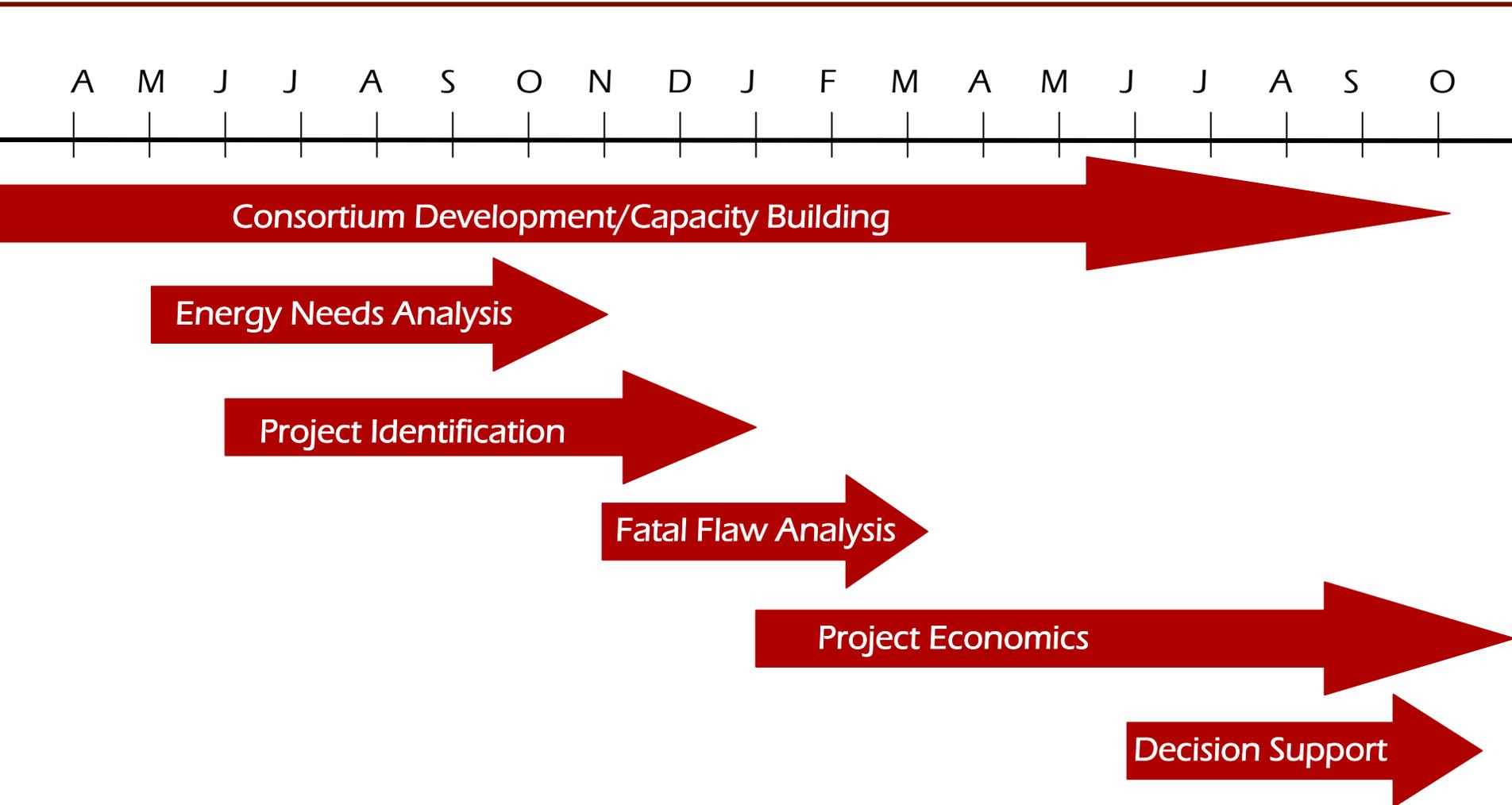
Project Participants

- Tribal and Staff Participants:
 - ❖ Morongo Band of Mission Indians
 - ❖ Agua Caliente Band of Cahuilla Indians
 - ❖ Fort Mojave Indian Tribe
 - ❖ Pauma Band of Luiseno Indians

- Project Consultant:
 - ❖ Red Mountain Energy Partners

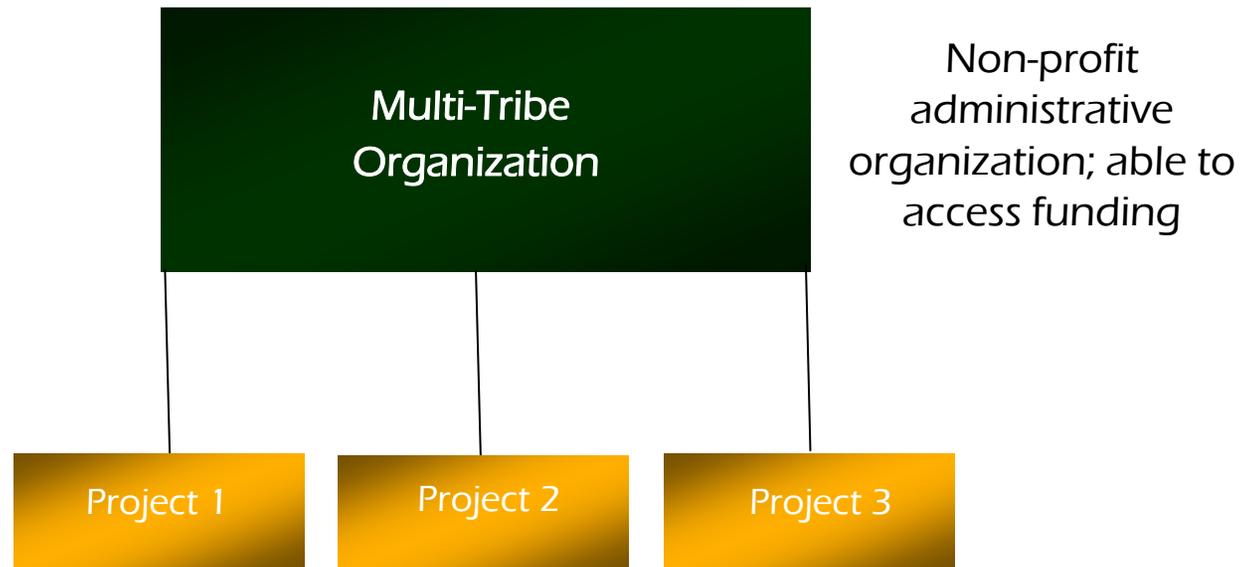


Project Schedule



Project Status >> Consortium Development

- Reviewed/analyzed existing Tribal organization structures
- Identified possible SWTEC structure concepts
- Developed MOU
- Responded to multiple tribal requests for information



Individual project entities provide flexibility for existing/new participants to participate in any/all potential projects



Project Status >> Energy Needs Analysis

- Energy Use/Project Goals
 - ❖ Load Assessments
 - ❖ Reservation-located projects
 - ❖ Project power goals
- Participation/Planned Energy Use
 - ❖ Tribal support for RE projects
 - ❖ Inaugural project scale
- Financial Participation
 - ❖ Equity/participation interest
 - ❖ SWTEC project capital potential
 - ❖ Willingness to consider non-Tribal capital partners

**Southwest Tribal Energy Consortium
Energy Needs Survey**

About Existing Energy Use

Studies are often conducted to understand patterns of electricity consumption and opportunities for energy conservation, efficiency improvements, or electricity demand management. Such studies, often called "load profiles" or "load assessments", usually include analysis of consumed energy measured in kilowatt-hours (kWh) and peak power demand requirements measured in kilowatts (kW). Load assessments may be conducted for individual dwellings and buildings, for a community or Reservation, and may examine energy and power on an hourly, daily, monthly, seasonal, and/or annual basis.

1. Has your Tribe conducted a load assessment for any Tribally-owned or Reservation facilities in the last five years? Yes No
 If "No", skip to Question #6.
2. If an assessment has been performed, for what years was analysis performed? Check all that apply.

2005	<input type="checkbox"/>
2004	<input type="checkbox"/>
2003	<input type="checkbox"/>
2002	<input type="checkbox"/>
2001	<input type="checkbox"/>
3. If an assessment has been performed, are you able to share any reports or records of results of the most recent 2 year (or most recent single year if others are unavailable) period for the exclusive purpose of the SWTEC Renewable Energy Feasibility Study? Yes No
4. If records are available, please indicate your preferred means of contact to discuss arrangements for any photocopying, delivery, or electronic exchange of information.

 [choose from list] _____
 Indicate contact information above
5. If an assessment has been performed, please indicate the types of information available. Check all that apply.

<p>Facility Types Studied</p> <input type="checkbox"/> All Reservation facilities <input type="checkbox"/> All Tribally owned facilities <input type="checkbox"/> Commercial building(s) <input type="checkbox"/> Institutional building(s) (Schools, health facilities, Tribal offices, etc.) <input type="checkbox"/> Dwellings	<p>Energy Information Available</p> <input type="checkbox"/> Monthly energy (kWh) consumption <input type="checkbox"/> Monthly peak demand (kW) <input type="checkbox"/> Hourly demand (kW) <input type="checkbox"/> Annual consumption (kWh) profile <input type="checkbox"/> Annual peak demand (kW) profile <input type="checkbox"/> Electricity rate schedules applicable <input type="checkbox"/> Applicable facility description(s) (Square feet, occupancy, construction type, age, weatherization condition, etc.)
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Project Status >> Regulatory Environment

Issues

- Interconnection
 - ❖ Utilities required by law to allow interconnection
 - ❖ Standard process
- CA generation for resale limitations
 - ❖ CA prohibits sale of electricity to ultimate consumers (as of 9/20/01)
 - ❖ Tribes subject to state laws re: retail supply to consumers?
 - ❖ Tribes subject to CPUC jurisdiction?

Strategies to Address

- Engage in activities not subject to CPUC jurisdiction
 - ❖ Nonconventional generation at generation plant sites
 - ◆ Cogeneration
 - ◆ Landfill gas
 - ◆ Digester gas
 - ❖ Establish distribution utilities and generate/buy wholesale power
 - ❖ Community Choice Aggregation (generate/buy wholesale power for partner cities)
 - ❖ District heating/cooling/electricity resale (charges embedded within other fees)



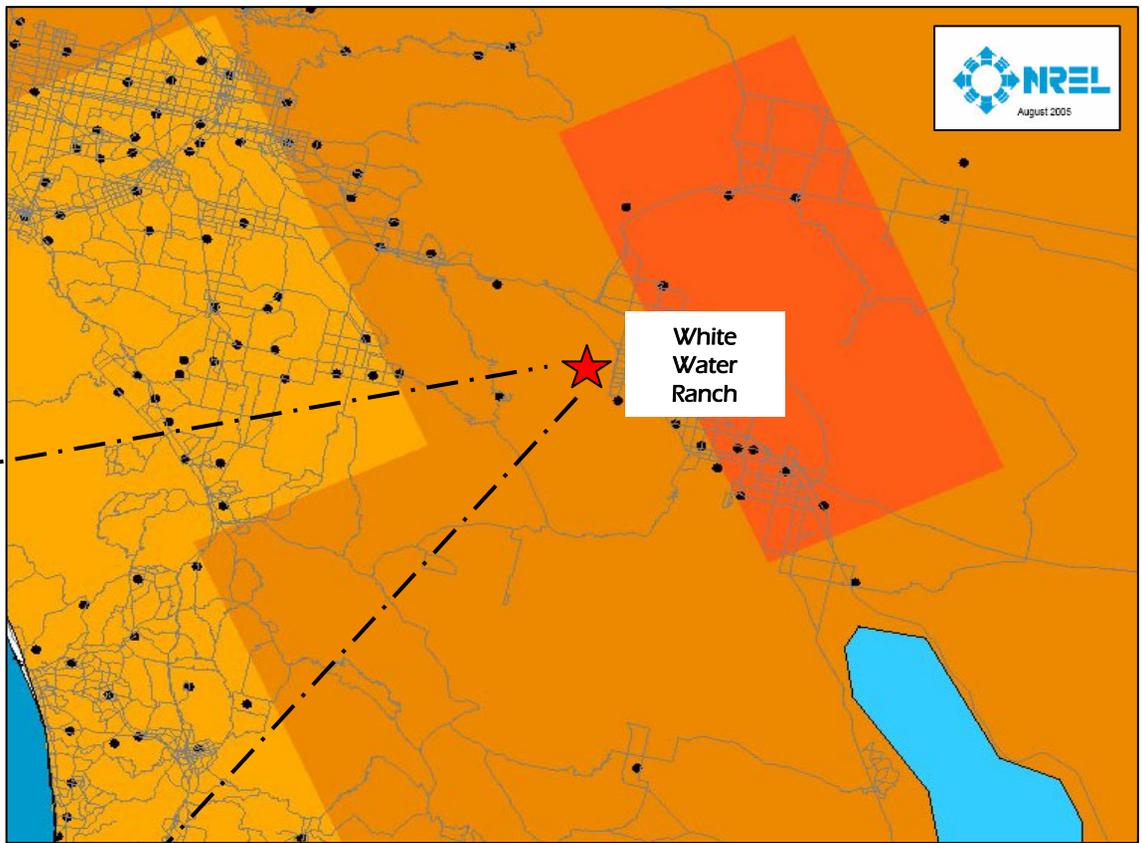
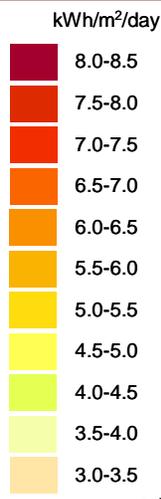
Project Status >> Project Criteria

- SWTEC member preferences
- Available resources
- SWTEC member energy needs
- Transmission proximity/capacity
- Several projects selected for future consideration
- Additional waste-to-energy technology selected for further study



Solar Resource in the Palm Springs Area: Diffuse Solar Radiation

Solar resource, or “insolation”, is measured in different ways. Flat plate collectors are used to measure insolation levels relevant for Photovoltaic (“PV”) systems.

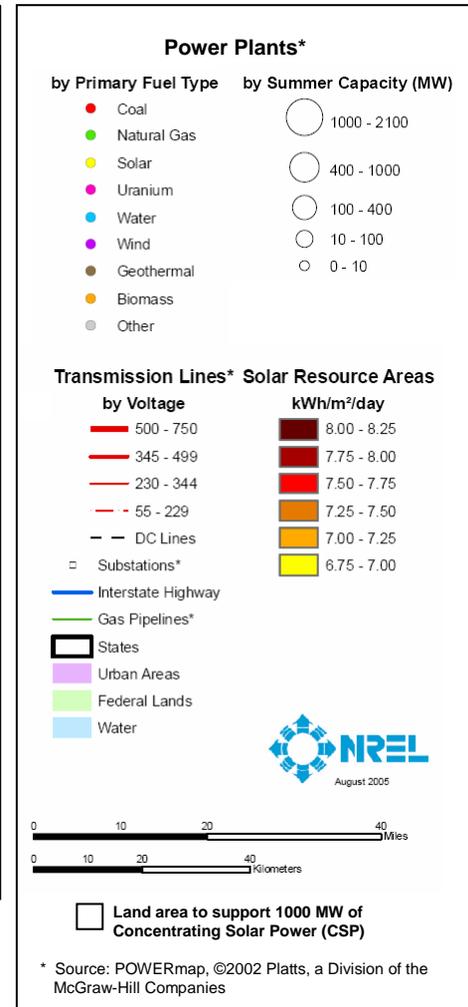
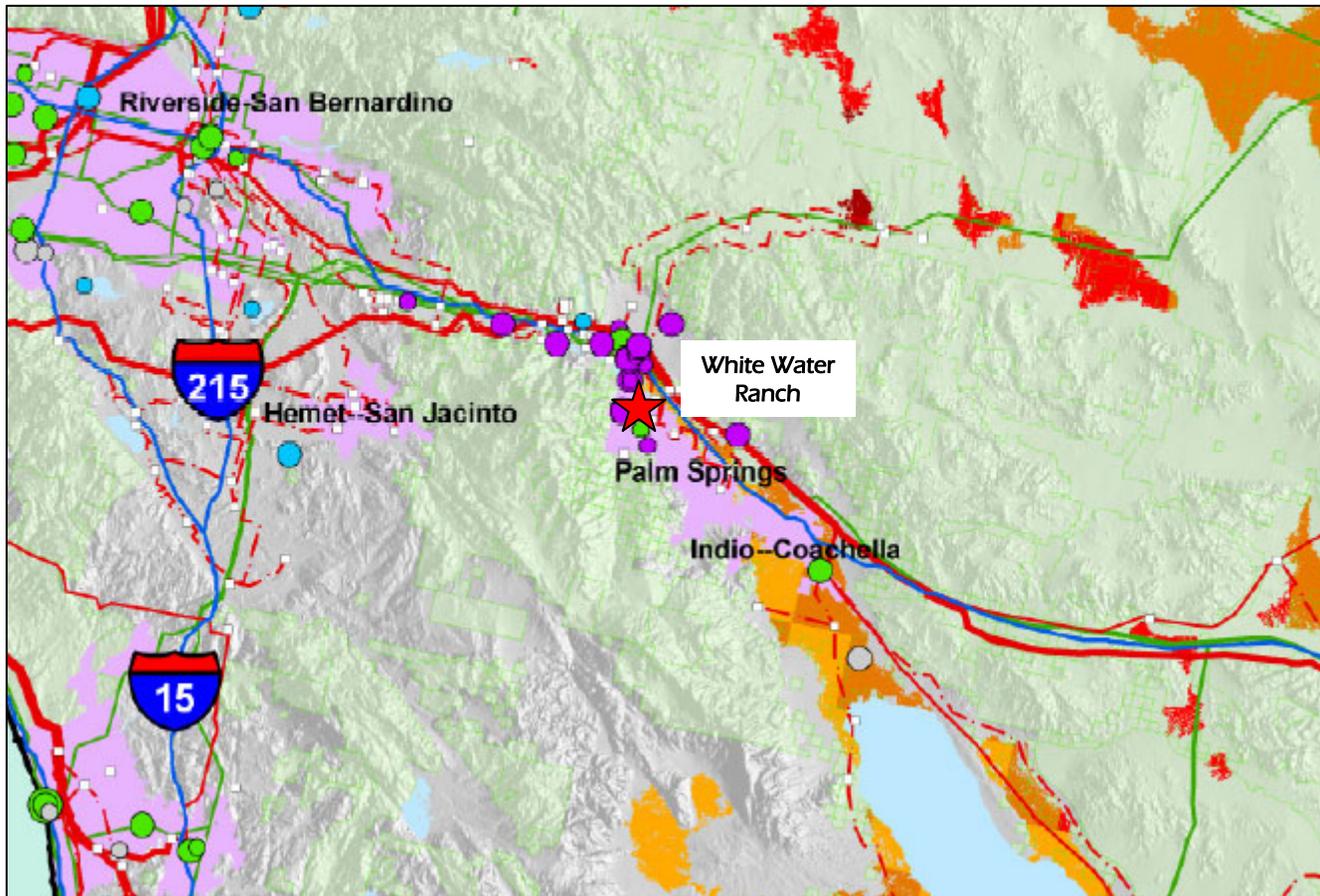


Average annual insolation at the site falls in the range of 6.0 – 6.5 kWh/m²/day, a range very suitable for PV applications.

Source: National Renewable Energy Lab (NREL)



Solar Resource in the Palm Springs Area: Regional Prospects for CSP



Insolation relevant for CSP technology is measured with collectors that track the sun. With today's capital costs, CSP projects are generally most cost effective where the solar resource is above 6.5 kWh/m²/day. Specific site measurements should be conducted prior to design stage.

Source: National Renewable Energy Lab (NREL)



Initial Agua Caliente Project Concepts

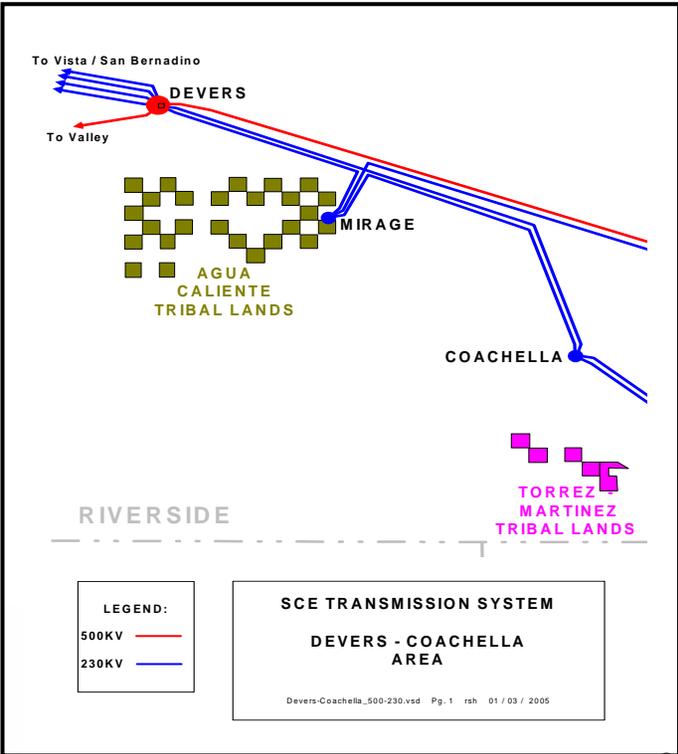
Project Concept

- Solar generation technology to produce power on a 200-acre parcel of Tribally-owned land adjacent to the Agua Caliente Reservation
- Other compatible land uses may be considered:
 - ❖ Warehousing with roof top solar panels
 - ❖ Commercial land use with solar shade structures (carports)
 - ❖ Large-scale ground-mounted arrays combined with other land use
 - ❖ Dedicated centralized generation also considered
 - ◆ Parcel could support up to 40 MW generating capacity



White Water Ranch Potential Project

- Project Location:
 - ❖ Adjacent to Agua Caliente Reservation, near Palm Springs, CA
- Site Description:
 - ❖ Approximately 200 acres
 - ❖ Currently a blend of trust & fee land; converting to trust lands



Possible Solar Project Configurations for White Water Ranch

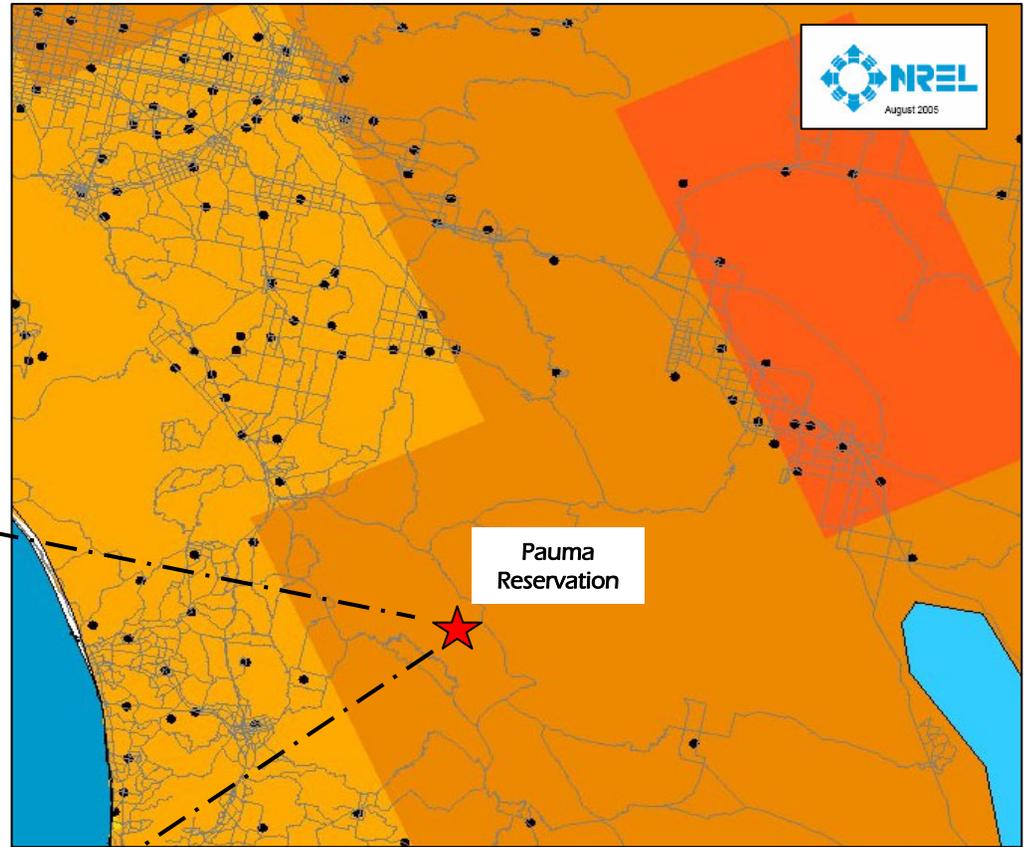
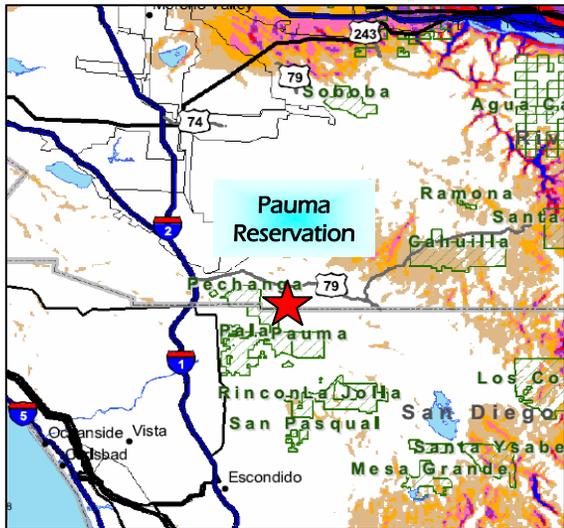
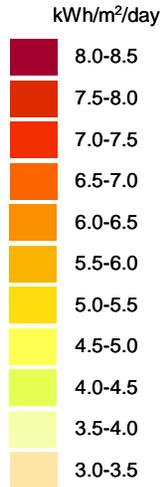
Project Configuration	Peak Power Demand	Possible Technology Selections (All Grid-Connected)	Peak Power Produced	Expected Capacity Factor	Projected Annual kWh	Initial Capital Cost ¹
Warehousing with Roof-top PV	9.4 MW	Fixed horizontal flat-plate PV	13.1 MW _{pac} ²	14.3%	16,330,000	\$88M
Warehousing with Roof-top PV and PV Shade Structures	9.4 MW	Roof: fixed horizontal PV; Shades: fixed latitude-tilt flat-plate PV	14.4 MW _{pac}	Roof: 14.3% Shades: 18.6%	18,513,000	\$97M
Industrial Space w/ Roof-top PV	9.4 MW	Fixed horizontal flat-plate PV	13.1 MW _{pac}	14.3%	16,330,000	\$88M
Industrial Space with Roof-top PV and PV Shade Structures	9.4 MW	Roof: fixed horizontal PV; Shades: fixed latitude-tilt flat-plate PV	14.4 MW _{pac}	Roof: 14.3% Shades: 18.6%	18,513,000	\$97M
Warehousing or Industrial Space with Adjacent Ground-mount HCPV Tracking Arrays	4.7 MW	600 Amonix HCPV (High Concentration PV) arrays @ 25 kW each	15.0 MW _{pac}	23.2%	30,450,000	\$105M
Warehousing or Industrial Space with Adjacent Ground-mount Fixed-Tilt Arrays	4.7 MW	Fixed, flat-plate PV, latitude tilt	20.0 MW _{pac}	18.6%	32,600,000	\$120M
Dedicated Generation for Power Export – Fixed-Tilt Arrays	N/A	Fixed, flat-plate PV, latitude tilt	40.0 MW _{pac}	18.6%	65,200,000	\$240M
Dedicated Generation for Power Export – Tracking Arrays	N/A	1,200 Amonix HCPV (High Concentration PV) arrays @ 25 kW each	30.0 MW _{pac}	23.2%	60,900,000	\$210M

1. Initial capital costs are for solar equipment only; costs represent rough estimates only and do not include “all-in” development, site preparation, or installation costs. Actual costs will vary with quantities, commodity market fluctuation, tax credit cycles, and other factors.
2. “MW_{pac}” refers to peak wattage, alternating current.



Solar Resource in the Pauma Valley Area: Diffuse Solar Radiation

Flat-plate collector measurements relevant for PV systems



Average annual insolation at the site falls in the range of 6.0 – 6.5 kWh/m²/day, a range very suitable for PV applications.

Source: National Renewable Energy Lab (NREL)

Initial Pauma Project Concept

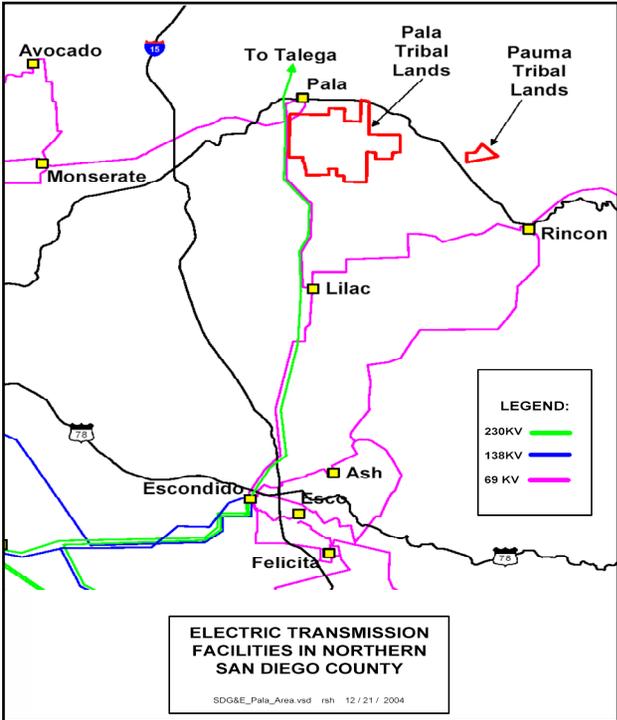
Project Concept

- Utilize distributed solar generation technology to serve a future planned casino on Reservation land
- Conceptual project model assumes a 500 kW, 35,000 ft² facility with a load factor (ratio of average use to peak use) of 80%, and power density of 14.3 W/ft².
- Project contemplates:
 - ❖ Roof-mounted Photovoltaic (PV) modules
 - ❖ Ground-mounted fixed-tilt PV modules
 - ❖ Ground-mounted single-axis tracking arrays



Pauma Potential Solar Project

- Project Location:
 - ❖ Pauma Reservation, northeastern corner of San Diego County, CA
- Project/Site Description:
 - ❖ Project would require 2-5 acres for both casino and solar equipment
 - ❖ Total Reservation comprises 5,877 acres



Possible Project Configurations for Pauma Solar Projects

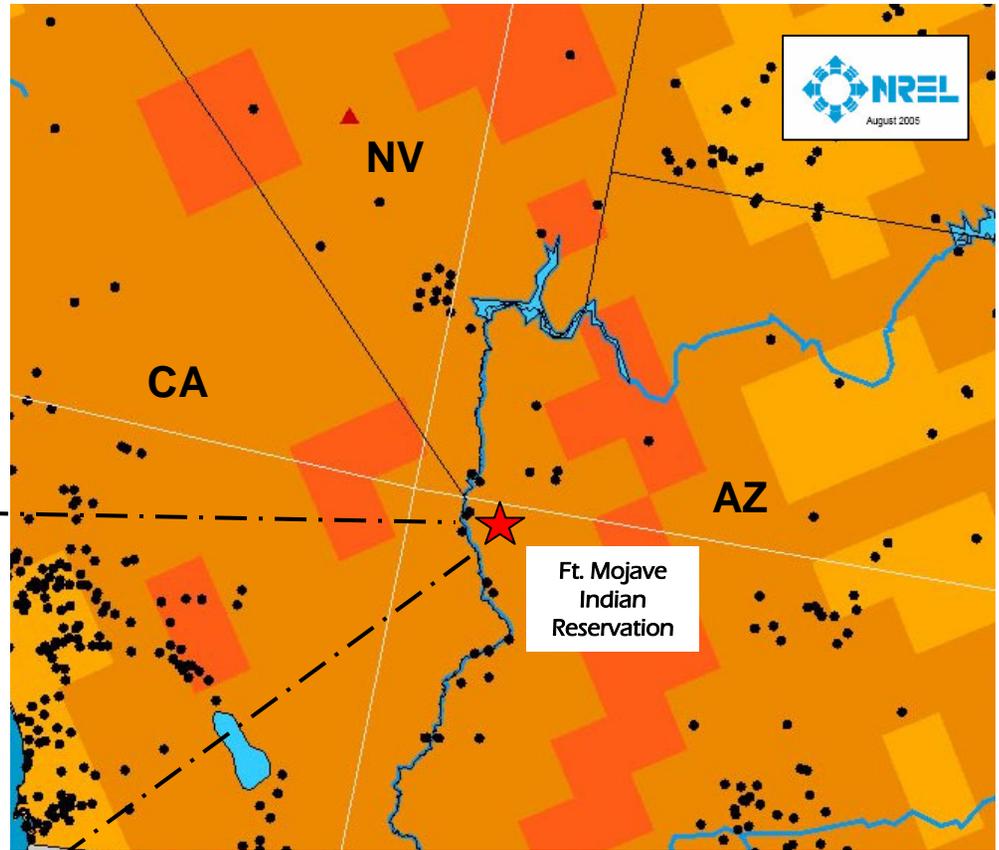
Project Configuration	Peak Power Demand	Possible Technology Selections (All Grid-Connected)	Peak Power Produced	Expected Capacity Factor	Projected Annual kWh	Initial Capital Cost ¹
Roof-top PV Mounted on Casino	500 kW	Fixed horizontal flat-plate PV	15.2 kW _{pac} ²	14.3%	19,040	\$102,600
Ground-mounted Fixed-Tilt PV Modules Adjacent to Casino	500 kW	Fixed latitude-tilt flat-plate PV	500 kW _{pac}	18.6%	815,000	\$3.4M
Ground-mounted Tracking PV Modules Adjacent to Casino	500 kW	Single-axis tracking PV arrays	375 kW _{pac}	27.9%	918,750	\$2.9M

1. Initial capital costs are for solar equipment only; costs represent rough estimates only and do not include "all-in" development, site preparation, or installation costs. Actual costs will vary with quantities, commodity market fluctuation, tax credit cycles, and other factors.
2. "MW_{pac}" refers to peak wattage, alternating current.



Solar Resource in the Ft. Mojave Area: Diffuse Solar Radiation

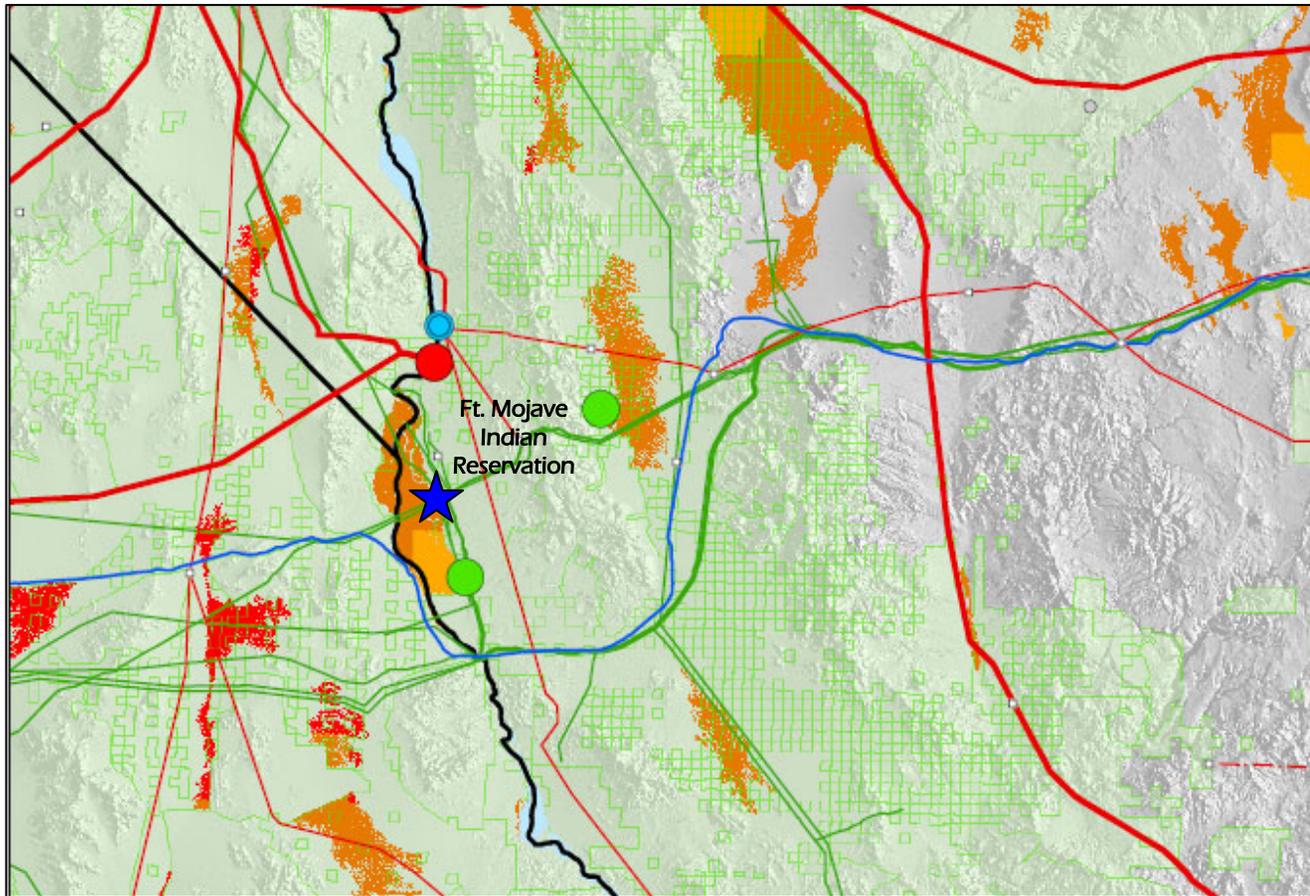
Flat-plate collector measurements relevant for PV systems



Average annual insolation at the site falls in the range of 6.0 – 7.0 kWh/m²/day, a range very suitable for PV applications.

Source: National Renewable Energy Lab (NREL)

Solar Resource in Ft. Mojave Area: Regional Prospects for CSP



Power Plants*

by Primary Fuel Type	by Summer Capacity (MW)
● Coal	○ 1000 - 2100
● Natural Gas	○ 400 - 1000
● Solar	○ 100 - 400
● Uranium	○ 10 - 100
● Water	○ 0 - 10
● Wind	
● Geothermal	
● Biomass	
● Other	

Transmission Lines* Solar Resource Areas

by Voltage	kWh/m²/day
— 500 - 750	■ 8.00 - 8.25
— 345 - 499	■ 7.75 - 8.00
— 230 - 344	■ 7.50 - 7.75
- - - 55 - 229	■ 7.25 - 7.50
- - - DC Lines	■ 7.00 - 7.25
□ Substations*	■ 6.75 - 7.00

— Interstate Highway
 — Gas Pipelines*
 □ States
 ■ Urban Areas
 ■ Federal Lands
 ■ Water

August 2005

0 10 20 40 Miles
 0 10 20 40 Kilometers

□ Land area to support 1000 MW of Concentrating Solar Power (CSP)

* Source: POWERmap, ©2002 Platts, a Division of the McGraw-Hill Companies

Average annual direct beam insolation at the site falls in the range of 7.0 – 7.5 kWh/m²/day, a range very suitable for CSP applications.

Source: National Renewable Energy Lab (NREL)



Initial Fort Mojave Project Concepts

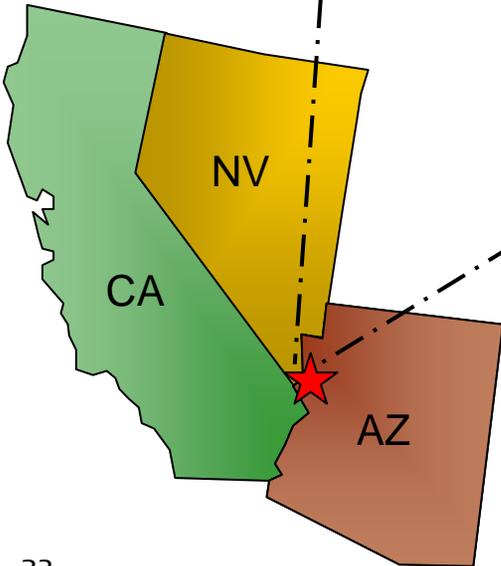
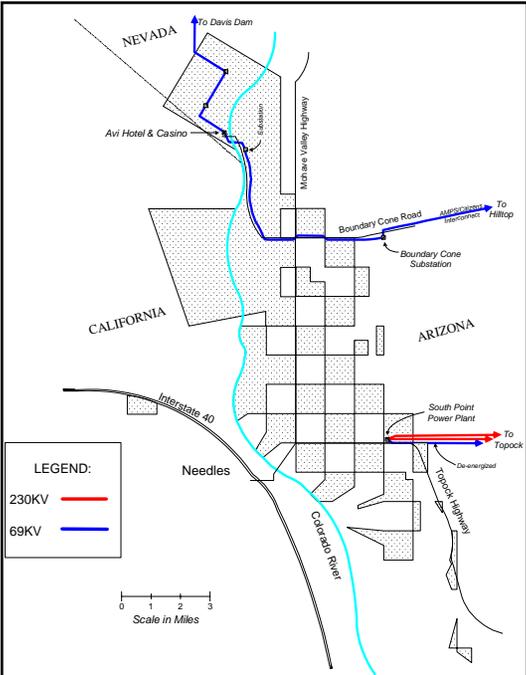
Project Concept

- Large-scale, central station solar generation
- Project would be designed to serve Reservation load and for power export.
- Project contemplates:
 - ❖ High Concentration Photovoltaic (HCPV) Arrays
 - ❖ Dish-Stirling Engine Modules
 - ❖ Parabolic Trough Technology



Fort Mojave Potential Solar Projects

- Project Location:
 - ❖ Fort Mojave Reservation located along Colorado River in Arizona, California, and Nevada where all three states meet
- Project/Site Description:
 - ❖ Project would require between 300 and 1,250 acres for the range of project sizes considered
 - ❖ Total Reservation comprises 22,820 acres



Possible Project Configurations for Ft. Mojave Solar Projects

Project Configuration	Peak Power Demand	Possible Technology Selections (All Grid-Supplemented)	Peak Power Produced	Expected Capacity Factor	Projected Annual Energy	Initial Capital Cost ¹
Ground-Mounted HCPV on 400 acres	N/A	2,400 Amonix 25kW HCPV Dual-Axis Tracking Modules	60 MW _{pac} ²	23%	121.8 GWh	\$380 M
Ground-Mounted Dish-Stirling Modules on 300 acres	N/A	2,400 Dish-Stirling Heliostats	60 MW _{pac}	31%	164.4 GWh	Note 3
Parabolic Trough Solar Plant	N/A	Steam Turbine Power Plant with Parabolic Trough Solar Collector Field; Thermal Storage or Natural Gas Burners for Firming/Storage	250 MW _{pac}	23%	500 GWh	\$1 B

1. Initial capital costs are for solar equipment and BOS; costs represent rough estimates only and do not include “all-in” development, site preparation, or installation costs. Actual costs will vary with quantities, commodity market fluctuation, tax credit cycles, and other factors.
2. “MW_{pac}” refers to peak wattage, alternating current.
3. Stirling Energy System is currently the leading commercial provider of dish-engine systems; pricing is kept confidential during ongoing contract negotiations with SCE and SDG&E.



Next Steps

- Further project definition
- Begin fatal flaw analysis
 - ❖ Applicable resource quantification
 - ❖ Potential site identification
 - ❖ Preliminary system design/cost
 - ❖ Transmission access/interconnection costs
 - ❖ Preliminary environmental review
 - ❖ Project levelized costs



Further Information

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