

U.S. Department of Energy
Energy Efficiency and Renewable Energy

Central Power Solar Opportunities in Colorado

Mark Mehos
NREL Program Manager
Concentrating Solar Power

December 10, 2004

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Discussion Outline

- CSP Overview
- DOE/WGA 1000MW Initiative and Recent State Interactions
- Central Station Southwest and Colorado Market and Siting Analysis
- Amendment 37 Central Solar Provisions and Colorado Development Scenarios

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CSP Technology Overview

Power Tower

Concentrating Photovoltaics

Parabolic Trough

Dish/Stirling

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Central Station CSP

- **The Solar Energy Generating Systems (SEGS) at Kramer Junction, CA**

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In 2002, Congress asked the Department of Energy to:

“develop and scope out an initiative to fulfill the goal of having 1000 megawatts (MW) of new parabolic trough, power tower, and dish engine solar capacity supplying the southwestern United States”

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In June 2004 the Western Governors’ Association at their annual meeting in Santa Fe, resolved to diversify their energy resources by developing 30GW of clean energy in the West*, including a declaration to:

“establish a stakeholder working group to develop options for consideration by the Governors in furtherance of the 1,000 MW initiative”


*<http://www.westgov.org/wga/policy/04/clean-energy.pdf>

Recent Interactions - California

- Met with utilities (SCE, PG&E, LADWP) and state energy staff (CEC, CPUC) to discuss utility/state interest in CSP.
 - California Governor's Energy Advisors, Joe Desmond/Shannon Eddy, have publicly voiced need to include central station power (CSP) in California's energy strategy.

"Central station solar, concentrating solar power, should and must be able to play a valuable role in participating in RFP contracts"

Joe Desmond, Solar Power 2004
- Met separately with SDG&E transmission planning director (at NREL and in San Diego) to discuss potential locations for CSP in the Imperial Valley.
- Very recent wider CA utility support of 1000MW concept if state can provide sufficient market incentives.



New Mexico CSP Task Force


- New Mexico Governor Richardson's CSP Task Force is nearing completion of detailed feasibility study for 50MW or larger CSP plant.
- Feasibility study tasks include:
 - Technology assessment (completed)
 - State siting analysis (completed)
 - Federal/State incentives analysis (completed)
 - Economic impacts/required incentives analysis (completed last week)
 - Financing (early Dec.)
 - Project development models (early Jan.)
- Final report and recommendations to be completed in time for NM legislative session.



Benefits from Development

Energy

- Produce clean firm dispatchable power in the state
- Hedge against NG price increases and volatility
- Reduce or mitigate transmission problems



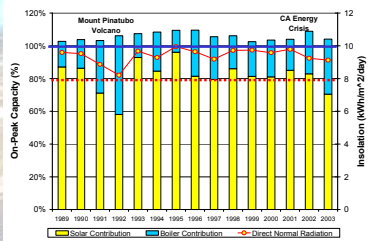
Environment

- Reduce air pollutants
- Reduce greenhouse gas emissions

Economy

- Create new jobs in rural areas
- Reduce cash outflow for energy
- Increase capital investment in the state
- Increase state GSP

Historical On-Peak Performance For 5 Parabolic Trough Plants



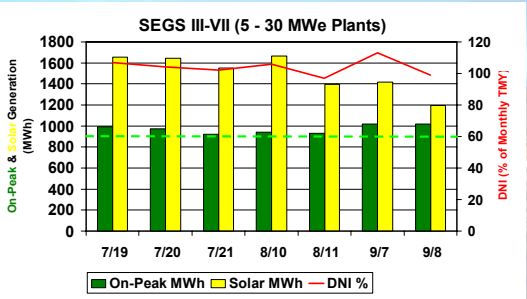
- Averaged 80% on-peak capacity factor from solar
- Over 100% with fossil backup
- Could approach 100% from solar with the addition of thermal energy storage.

SCE Summer On-Peak
Weekdays: Sun - Sep
12 noon - 6 pm

Source: KJC Operating Company

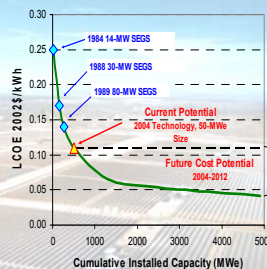
California 2004 New Peak System Loads

SEGS III-VII (5 - 30 MWe Plants)



Legend: On-Peak MWh (Green), Solar MWh (Yellow), DNI % (Red line)

Projected Costs of CSP Generation

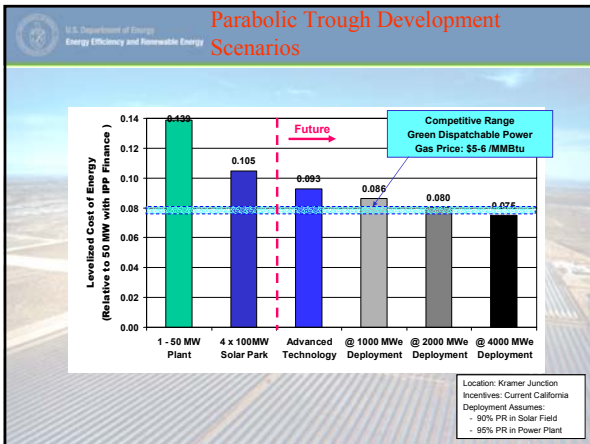
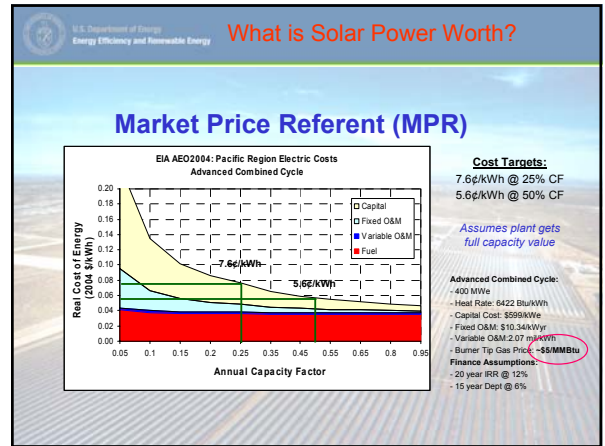
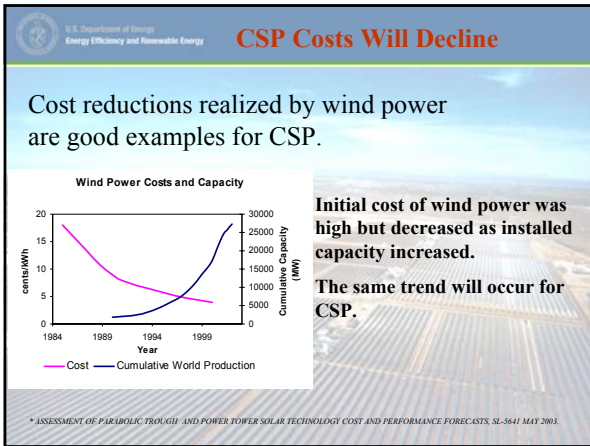


- Sargent & Lundy* and NREL/Sandia each evaluated the potential cost reductions of CSP.
- Cost reductions for trough technology will result from deployment, scale and R&D
- Cost reductions are accelerated with faster deployment schedule

Factors Contributing to Cost Reduction

- Scale-up 37%
- Volume Production 21%
- Technology Development 42%

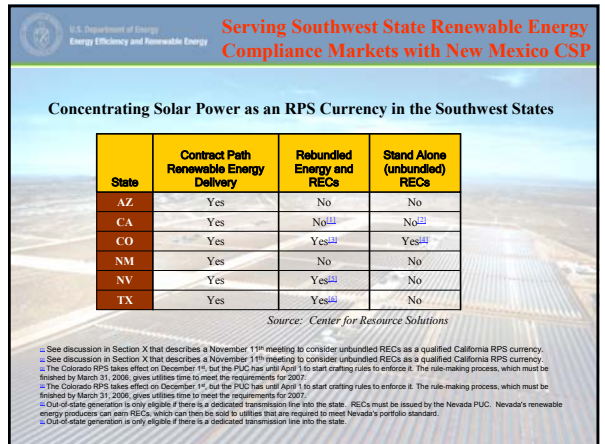
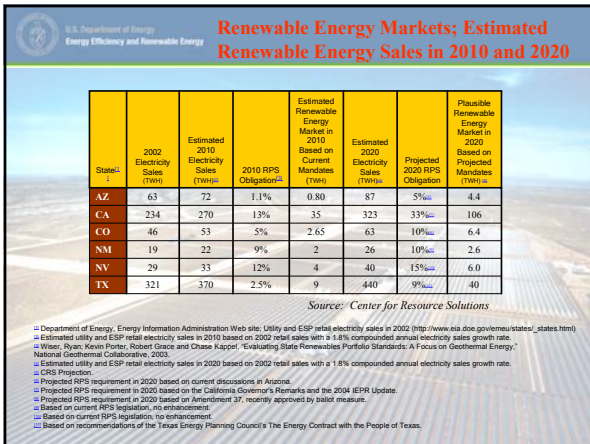
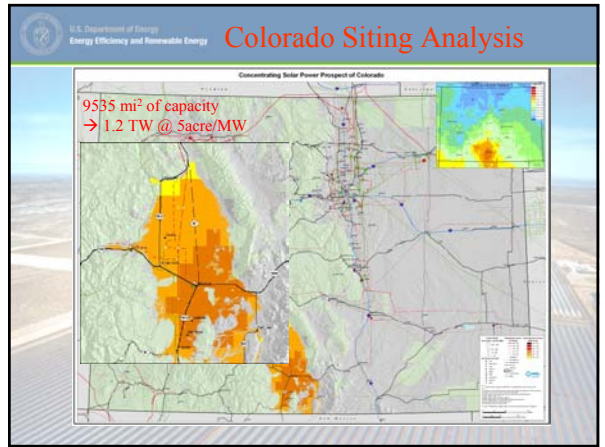
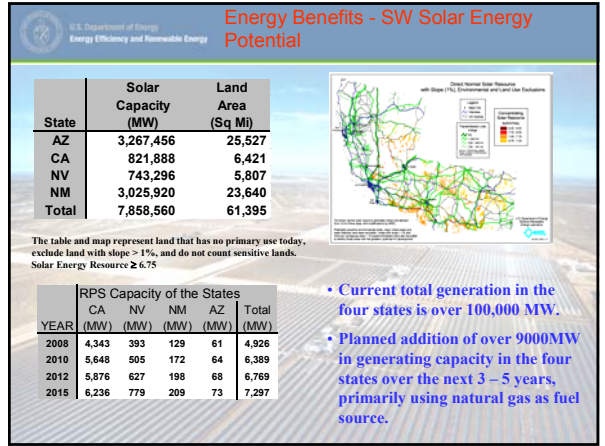
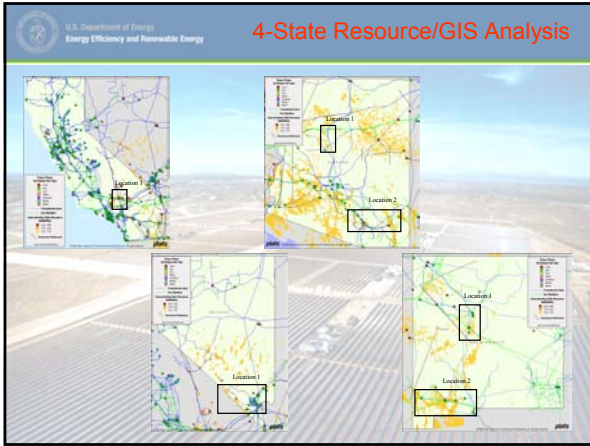
* Sargent and Lundy (2003). Assessment of Parabolic Trough and Power Tower Solar Technology Cost and Performance Impacts. <http://www.nrel.gov/docs/dv04/str/24440.pdf>



- ## CO Central Station Provision
- Solar percentage of RPS obligation under Amendment 37:
 - 4% of 3% (2007-2010)
 - 4% of 6% (2011-2014)
 - 4% of 10% (2015 -)
 - Resulting requirement for 2015 and beyond
 - 58 TWh total retail generation
 - 5.8 TWh total renewable generation
 - 0.23 TWh solar generation
 - 0.12 TWh potential central station
 - ≈ 50 MW central station plant @CF = 0.25

- ## Development Scenarios
- Ideal Location (Mojave Desert)
 - Requires regional Southwest partnership, likely need for RECs
 - Good Location (San Luis Valley)
 - Local energy & economic benefits
 - Transmission and plant size potential issues
 - Large plant size could produce excess solar generation w/ REC value
 - Alternative Location (Front Range)
 - Unconstrained transmission serves major load centers
 - Potential for hybridization w/ existing plants (CC and coal)
 - Potential partnership w/ New Mexico utilities (Xcel, PNM)
 - Direct transmission path?
 - Use of RECs

- ## U.S. Southwest GIS Screening Analysis
- ### Screening Approach
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- Initial GIS screening analysis used to identify regions most economically favorable to construction of large-scale CSP systems.
 - GIS analysis used in conjunction w/ transmission and market analysis to identify favorable regions in four southwest states.



Recommendations

- New CSP plants should receive both capacity and energy value for the generated electricity produced
 - Assumes plant delivers summer peak capacity
 - Provides additional incentive for plant performance
- Support allowance of RECs as a mechanism for regional implementation of central station solar within or outside of Colorado
 - Can yield larger, more cost-effective solar generation
 - Supports implementation of Southwest 1000MW initiative
- Limited hybridization w/ natural gas
 - provide firm power w/o thermal storage
- Implement Colorado CSP Task Force similar (identical) to that implemented for State of New Mexico
 - Task force should include state energy office, utility, PUC, and DOE representation
 - Investigate Colorado-specific economic benefits
 - Evaluate site-specific cost and value of central station generation
 - Provide analytically robust recommendations for implementing central station solar for State of Colorado
- Support Federal incentives for solar generation