



Why Nevada Should Develop Its Solar Energy Resource

prepared and presented by:

The Solar Energy Industries Assn. (SEIA), Solar Thermal Power Div.

The DOE Concentrating Solar Power (CSP) Program

**SunLab, a virtual laboratory comprising groups at Sandia National
Laboratories and the National Renewable Energy Laboratory (NREL)**

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Las Vegas, Nevada



Summary

- **Nevada can add another engine for its economy by developing its solar energy resource.**
- **The economic benefits to Nevada far exceed the cost to develop its clean and renewable resource.**

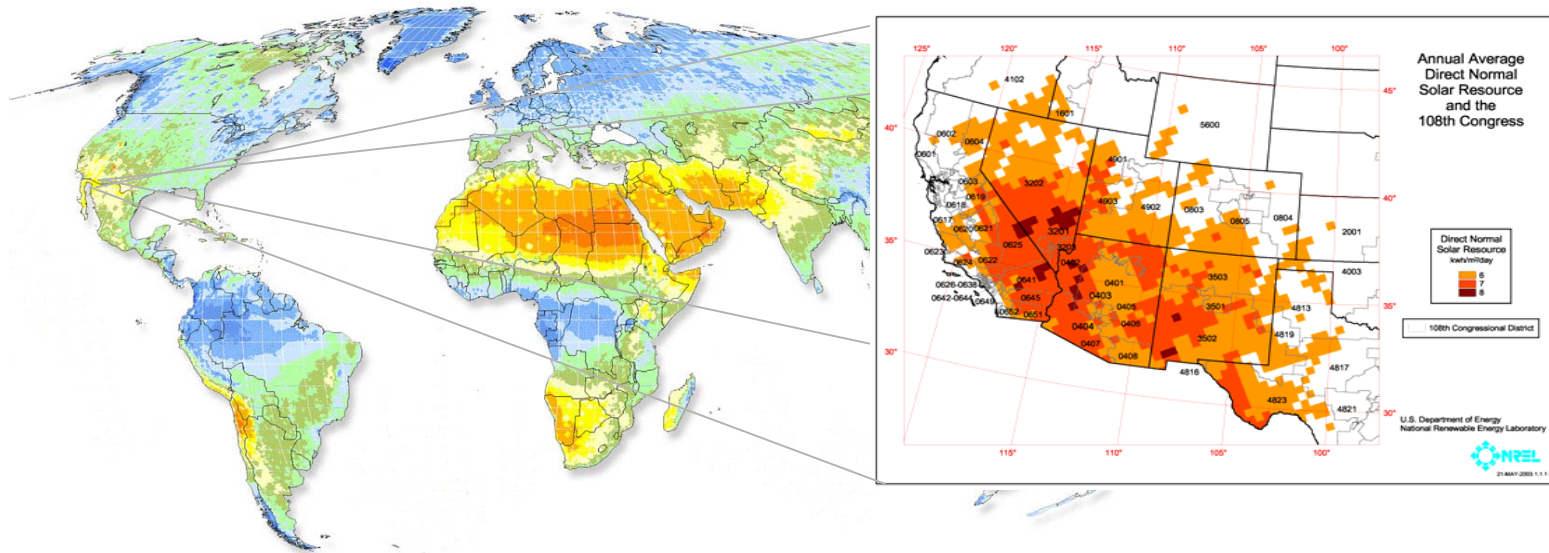


Background

- **In 2001 Congress asked DOE to determine what would be required to deploy 1000 MW of Concentrating Solar Power in the Southwest U. S.**
- **DOE & CSP industry approached the Western Governors' Association through the Western Interstate Energy Board to explore implementation.**
- **Four states - AZ, CA, NM, and NV - have the highest solar potential, the best renewable energy portfolio standards, and the most to gain from development of their solar energy resources.**

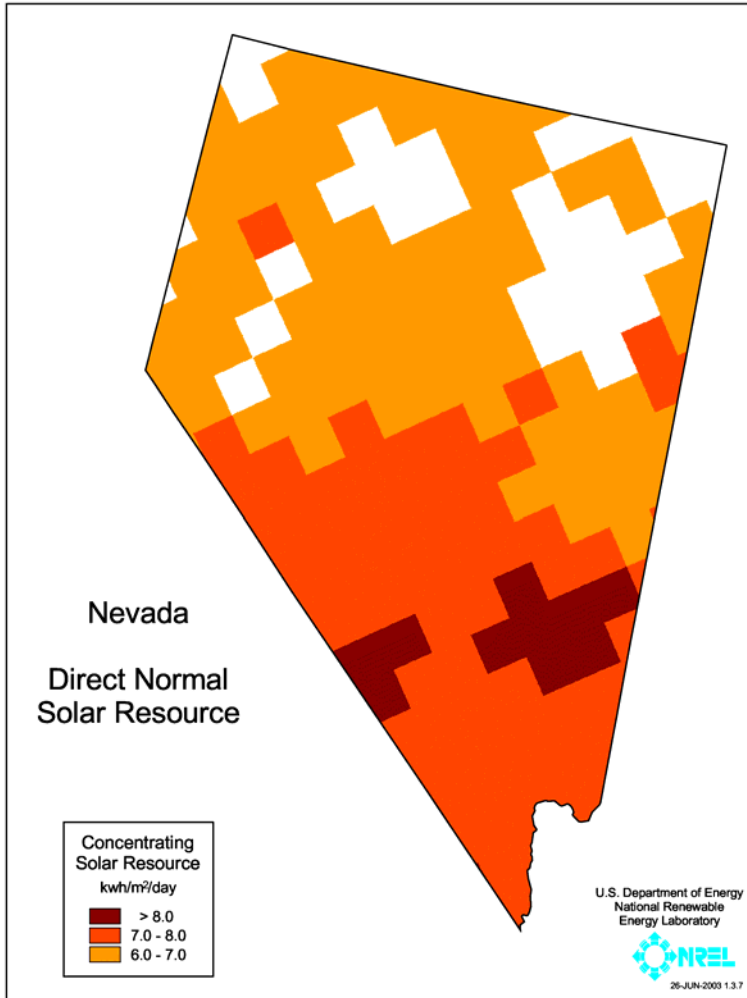


Solar energy resources in the Southwest U.S. are among the finest in the world





Nevada's Solar Resource



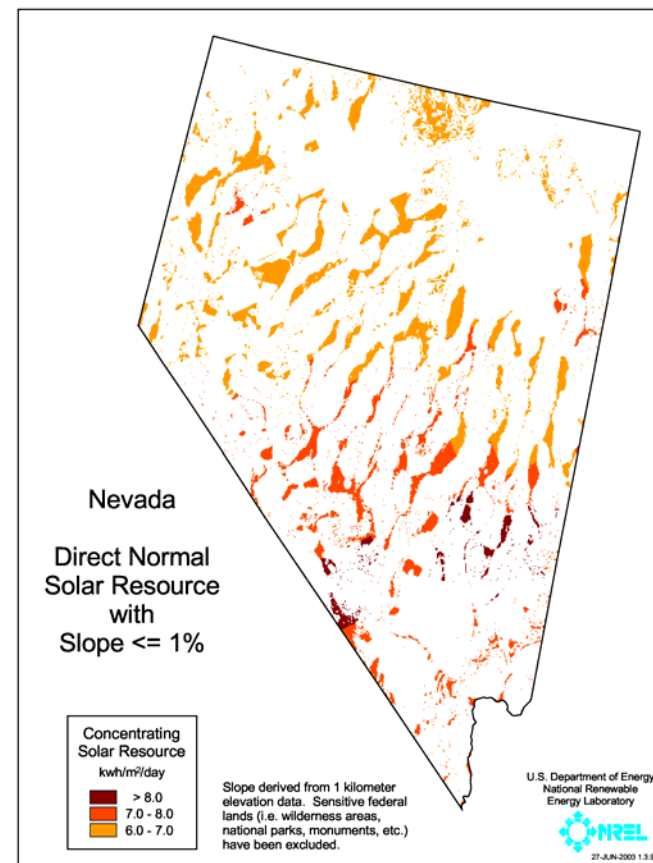
- **Less than one tenth of one percent of Nevada's land could generate all of the state's current electricity needs**
- **This area is 110 mi² (little more than 10 miles by 10 miles) which is less than half the size of Lake Mead.**
- **One "solar dam" could do it all.**



Nevada's Solar Energy Potential

The table and map represent land that has no primary use today, exclude land with slope > 1%, and do not count sensitive lands.

	Resource kWh/m ² /day			
	> 8 kW	7.0 – 8.0	6.0 – 7.0	Total
Available Area (mi ²)	700	4,090	8,360	13,150
Capacity (MW)	90,837	528,573	1,079,480	1,698,890
Generation (MWh/year)	214,996,000	1,251,036,000	2,554,936,000	4,020,968,000





<u>Technology</u>	<u>Capacity (MW)</u>	<u>Energy Delivered (MWhr)</u>
Coal	2,707	17,736,970
Natural Gas	3,029	11,450,564
Geothermal	230	1,121,289
Hydro	1,036	2,504,581
Other	50	911,743
State Total	7,051	33,725,147

Coal and natural gas represent 87% of Nevada's generation mix in 2001.

Source: RDI BaseCase, NewGen and PowerDat Databases



Nevada's Planned Generation

New Capacity 2002 through 2006

<u>Technology</u>	<u>(MW)</u>
Coal	0
Natural Gas	3,585
Hydro	400
Wind	250
Solar	50
Other	<u>120</u>
Total	4,406

Future capacity increases dependence on natural gas and subjects rate payers to price volatility and increases

Source: RDI BaseCase, NewGen and PowerDat Databases



Solar Resource and Land

- **Nevada's solar resource potential is very large and should be developed.**
- **Nevada's planned new capacity is very small relative to that potential.**
- **This small “solar dam” would need 1.9 mi² (1 by 2 miles)**

CSP Capacity (MW)	Land Requirement (mi²)	% of Premium
250	1.9	0.3%
1000	7.7	1.1%
6000	46.4	6.6%

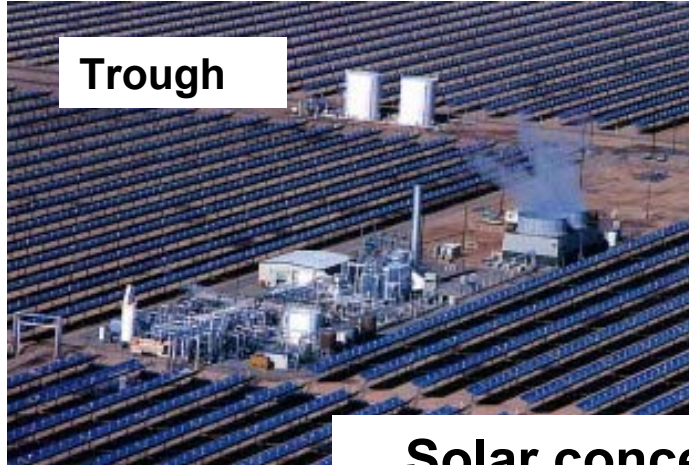


How do we develop this resource?

- **Concentrating Solar Technologies can be used to “mine” this resource.**
- **Some of these technologies use curved mirrors to focus the sun’s rays and to make steam, others directly produce electricity.**
- **This steam is used to produce electricity via conventional power equipment**
- **In multi-Megawatt plants, CSP provides the lowest cost solar electricity**



What is CSP?



Solar concentration allows tailored design approaches





Movie of three CSP Technologies

This film clip shows

- **The Solar Two Power Tower experiment at Barstow, CA**
- **The Solar Energy Generating Systems (SEGS) at Kramer Junction, CA**
- **Two Stirling Energy Systems
10 kW Dish Stirling systems
operating in Albuquerque,
NM**



Concentrating Solar Power (CSP) is.....

- **ideally suited for multi-megawatt central power plants**
- **dispatchable power for peaking and intermediate loads through hybridization and/or thermal storage**
- **distributed power for grid support and remote applications**
- **proven technology with 354 MW operating successfully in California for the past 15 years**
- **rapidly deployed because it uses conventional items such as glass, steel, gears, turbines, etc.**
- **Water requirements similar to coal-fired plant.**



Benefits to Nevada from Development of its Solar Thermal Resource

Economy

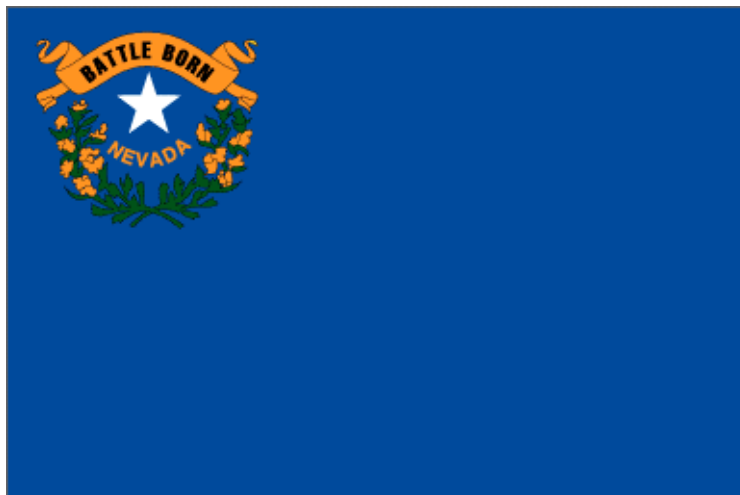
- **Create new jobs in rural areas**
- **Reduce cash outflow for energy**
- **Increase capital investment in the state**
- **Increase state GSP**

Environment

- **Reduce air pollutants**
- **Reduce greenhouse gas emissions**

Energy

- **Produce clean power in the state**
- **Hedge against NG price increases and volatility**
- **Hedge against hydropower fluctuations**
- **Reduce or mitigate transmission problems**





Economy

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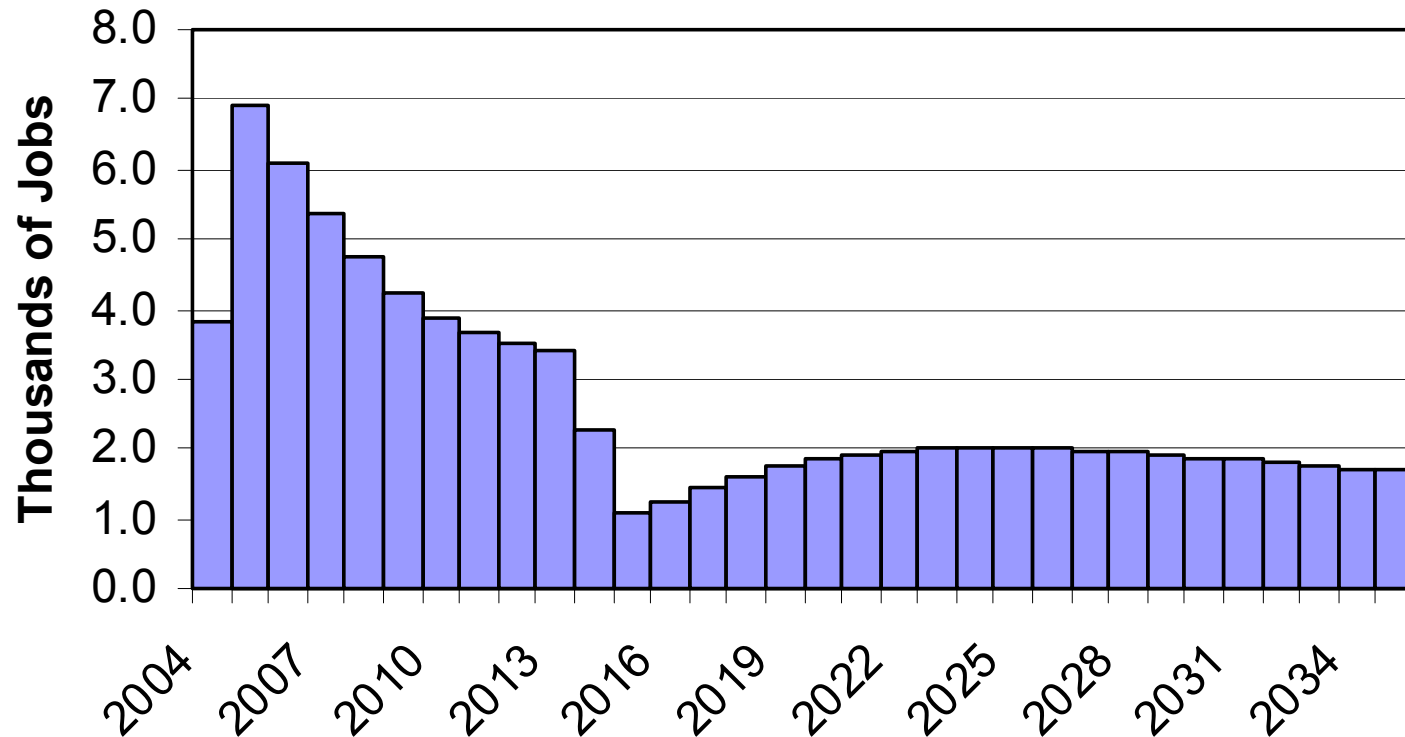


Create New Jobs in Rural Areas

- **At its peak, installation of 1000 MW of CSP power plants would create nearly 7,000 new jobs.**
- **New jobs will be created to build, assemble and operate the CSP plants.**
- **These jobs can readily be created near Nevada's rural areas throughout the southern portion of the state.**
- **With the location of CSP plants in Nevada, manufacturing and assembly plants can be expected to locate in the State.**



Employment Impact of Constructing, Operating, and Maintaining 1000 MW CSP Generation Facilities



*Based on UNLV Center for Business and Economic Research study on the potential impact of constructing and operating solar power generation facilities in Nevada.



Reduce Cash Outflow For Energy

- **Nevada must purchase fuels for its coal and natural gas power plants.**
- **This contributes to the state's \$2.5 Billion cash outflow for energy**
- **250MW CSP plants will save Nevada \$15 million per year in reduced Natural Gas imports**
- **1000MW CSP plants will save \$64 million per year**
- **6000MW CSP plants will save \$381 million per year**
- **The retained funds will contribute to Nevada's GSP, ultimately in multiples of the original savings.**



Increase Capital Investment in the State

- **CSP Plants built in Nevada will bring substantial private investment.**
 - **250 MW – \$750 Million**
 - **1000 MW - \$2 Billion**
 - **6000 MW - \$11 Billion**
- **Should increase income to the state through increased tax base.**



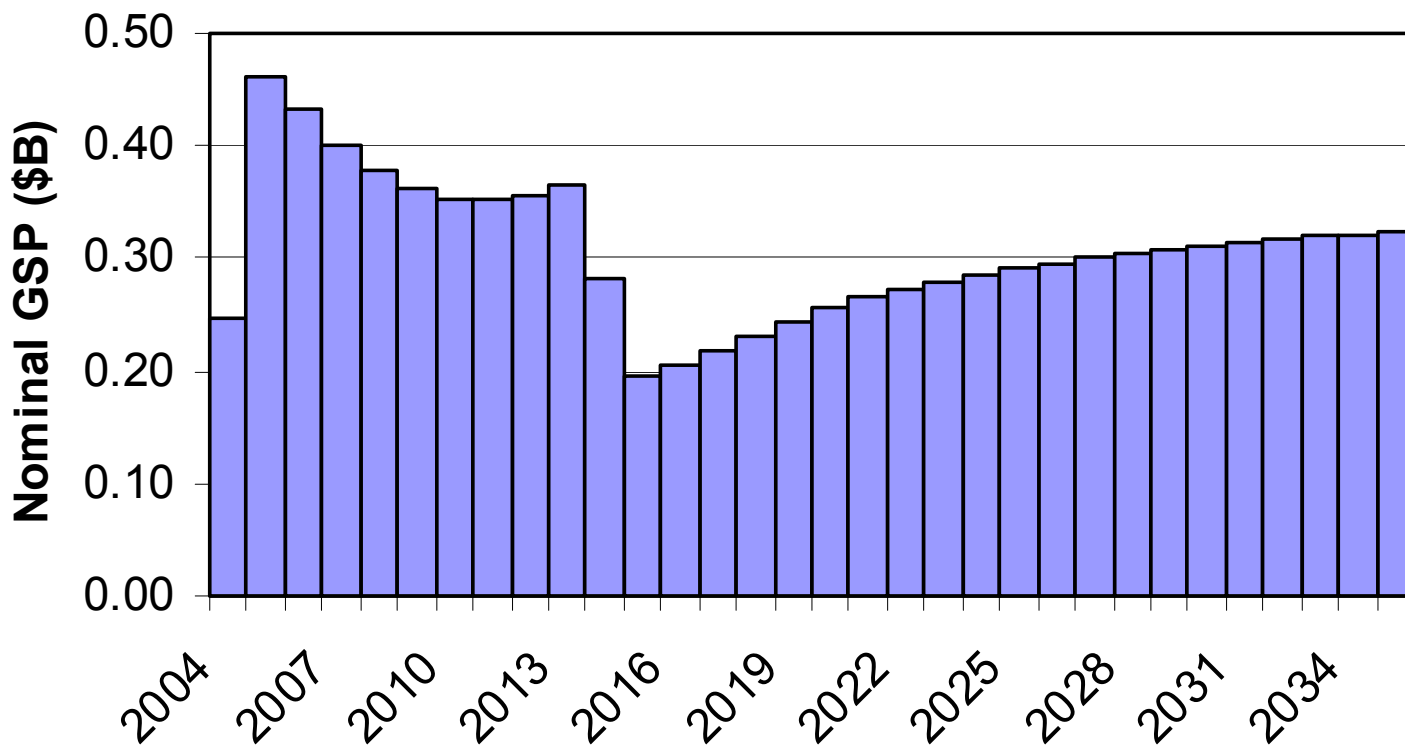
Increase Nevada's GSP

- **Nevada's GSP has been increasing by about \$5 Billion or 8% per year for the past few years.**
- **1000 MW would result in \$300 - \$500M increase to Nevada's annual GSP.**
- **1000 MW will result in local CSP design, construction, and operating experience, allowing Nevada to export these services to neighboring states.**



Economic Benefits to Nevada

Impact on Gross State Product of Constructing, Operating, and Maintaining 1000 MW CSP Generation Facilities*



*Based on UNLV Center for Business and Economic Research study on the potential impact of constructing and operating solar power generation facilities in Nevada.



Environment

- **Reduce air pollutants**
 - **Improve** air quality
 - **Increase** public health
 - **Reduce haze and increase tourism**
- **Reduce greenhouse gas emissions**



Nevada Emissions in 2001

Million lbs.

Technology	Generation (MWh)	CO ₂	SO ₂	NO _x
Coal	17,736,970	35,385	42.1	6.7
Nat. Gas	11,450,564	11,226	0.0	1.9
State Totals		46,611	42.1	8.7

Source: RDI PowerDat Database



Environmental Benefits

Displacement (millions of lbs)

CSP Capacity (MW)	Displacement (millions of lbs)		
	CO ₂	SO ₂	NO _x
250	1,100	1.0	0.9
1000	4,600	3.8	3.6
6000	27,400	23.0	21.6

Based on displacement of best available coal technology

Emissions Based on Planned New NG Gen (millions of lbs)

Planned Capacity (MW)	Emissions Based on Planned New NG Gen (millions of lbs)		
	CO ₂	SO ₂	NO _x
3,585	7,000	0.1	1.8



Photo Source: Western Regional Air Partnership

CSP will contribute to the WRAP goals of cleaner air, reduced air pollution, and haze reduction.



Energy Benefits to NV

Energy

- **Produce** clean power in the state
- **Hedge** against **NG price increases** and volatility
- **Hedge** against hydropower fluctuations
- **Reduce or mitigate** transmission problems



Produce Clean Power in State

- **250 MW of CSP by 2005 will displace 7% of Nevada's planned capacity additions.**
- **1000 MW of CSP by 2007 will displace 23% of Nevada's planned capacity additions.**



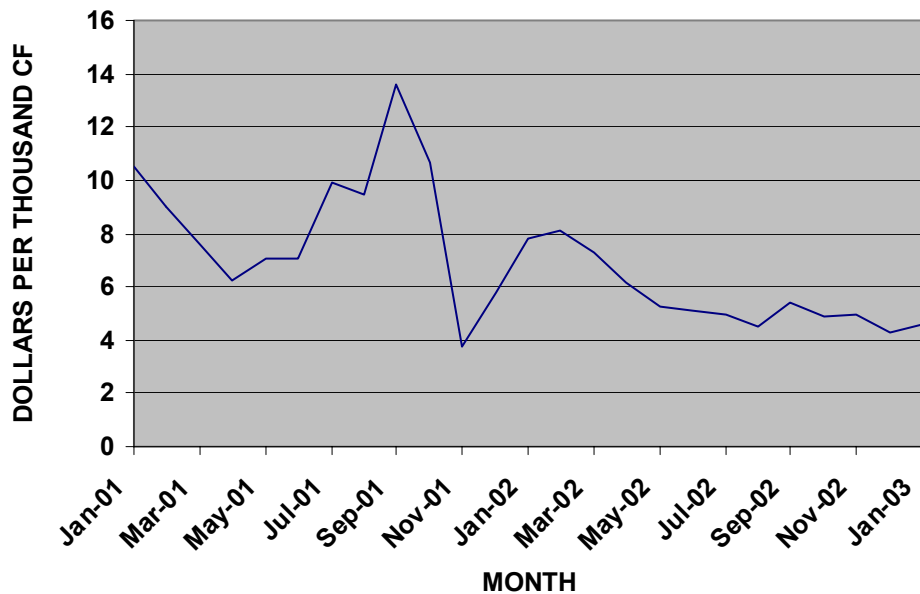
Hedge Against Natural Gas Price Volatility

- **The price of natural gas has a long history of volatility**
- **The price of natural gas has been rising for the past year and is not expected to return to its recent low levels.**
- **New natural gas-based generation will increase natural gas price instabilities.**



Natural Gas Prices in Nevada

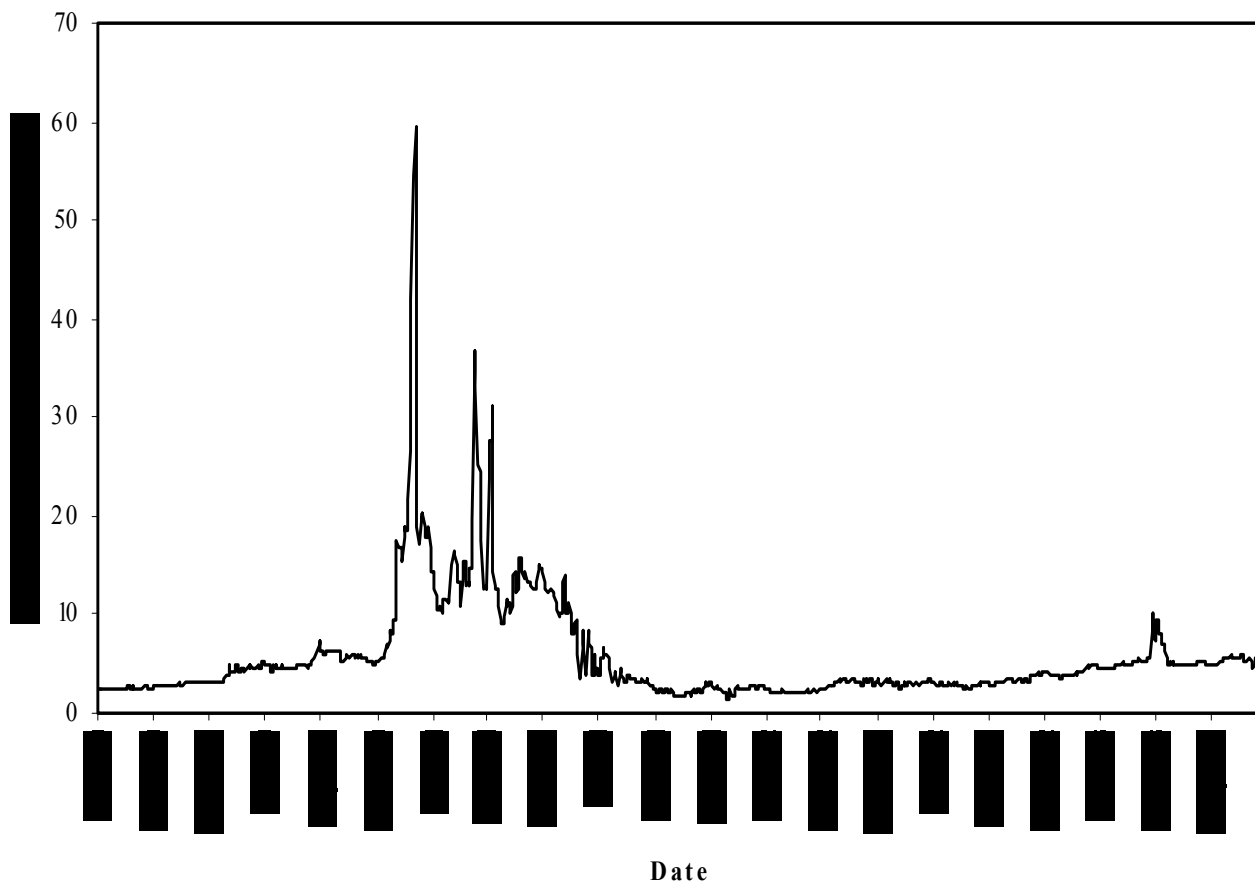
NEVADA UTILITY GAS RATES





Natural Gas Price Volatility

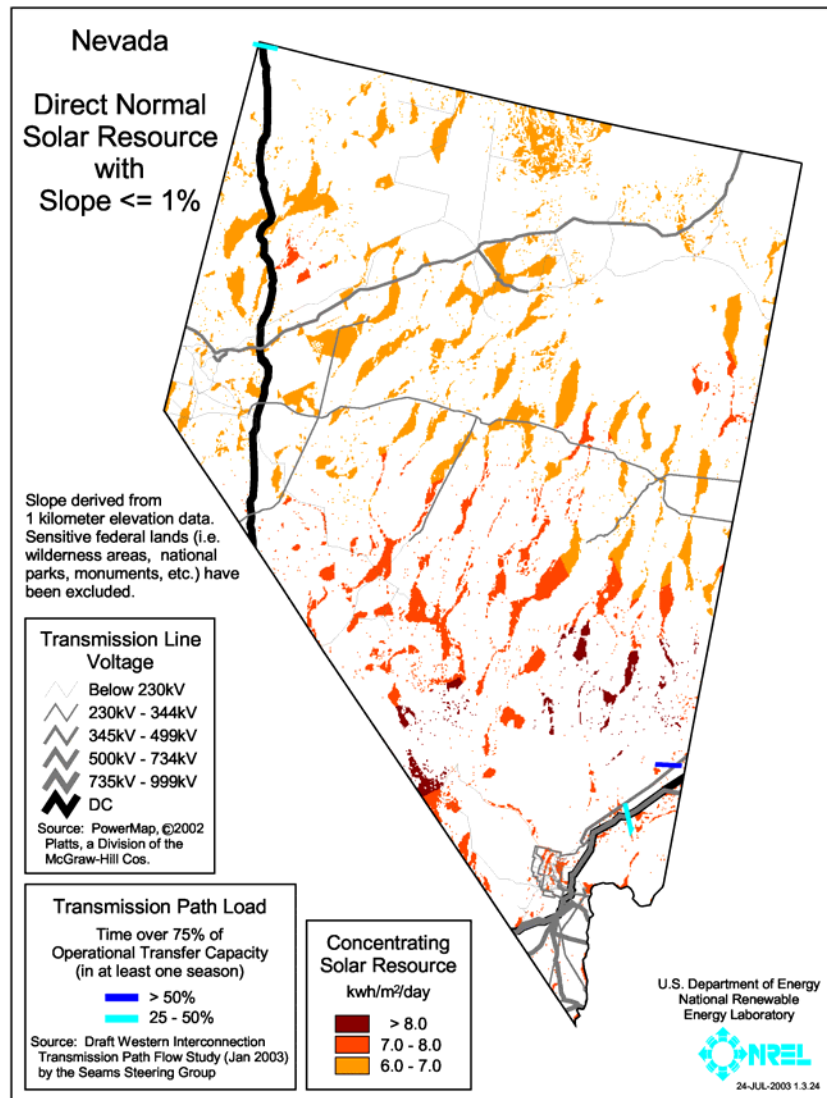
Southern California Hub Nat. Gas Price: Jan. 2000 – Jun. 2003





Major Transmission Constraints

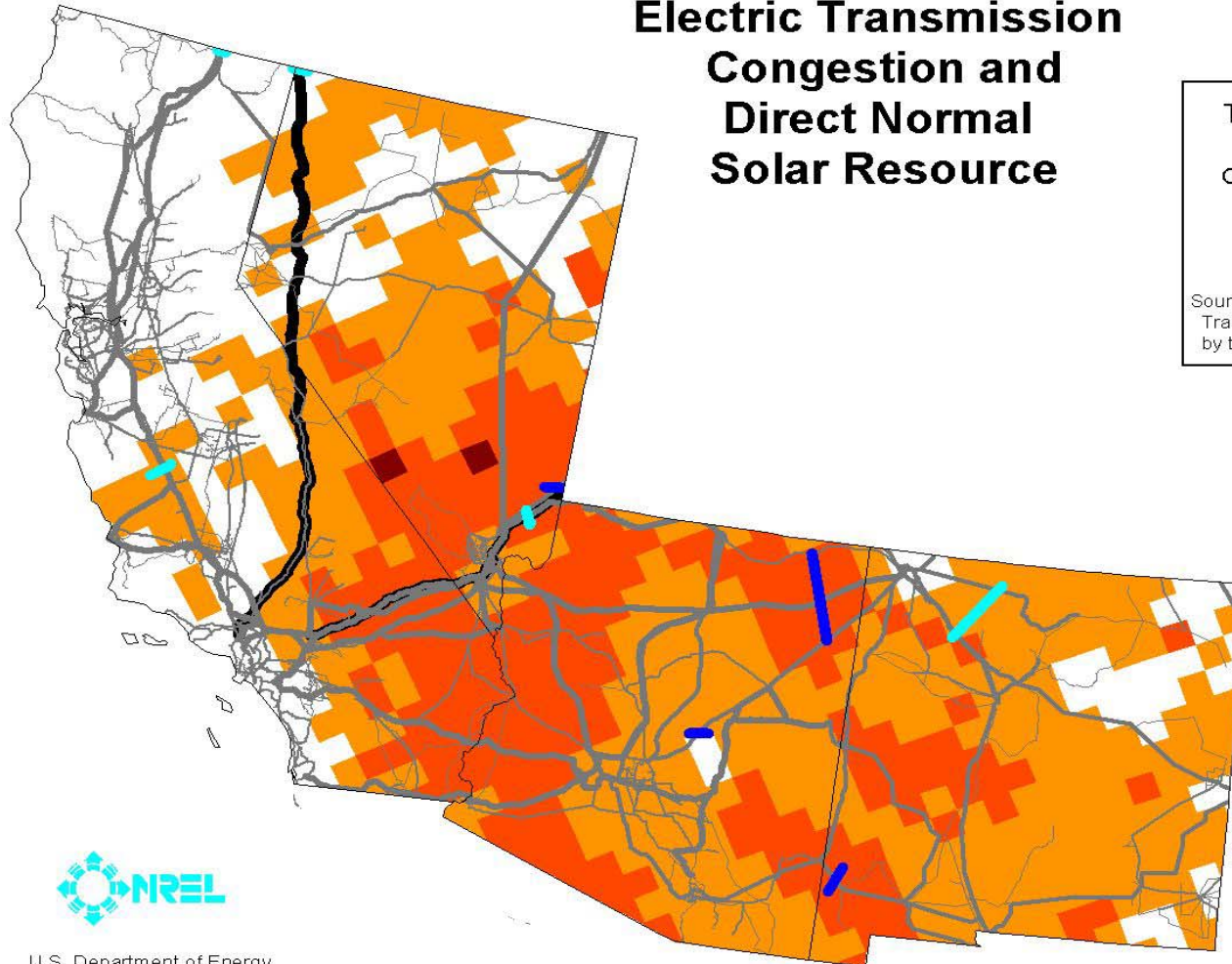
- **Transmission constraints in Nevada have been identified.**
- **CSP plants may help alleviate related problems.**
- **CSP plants can be located throughout the southern part of the state to best deal with transmission and pipeline constraints.**





SW Transmission Barriers

Southwest United States Electric Transmission Congestion and Direct Normal Solar Resource



Transmission Path Load
Time over 75% of
Operational Transfer Capacity
(in at least one season)

- > 50%
- 25 - 50%

Source: Draft Western Interconnection
Transmission Path Flow Study (Jan 2003)
by the Seams Steering Group

Transmission Line
Voltage

- Below 230kV
- 230kV - 344kV
- 345kV - 499kV
- 500kV - 734kV
- 735kV - 999kV
- DC

Source: PowerMap, ©2002
Platts, a Division of the
McGraw-Hill Cos.

Concentrating
Solar Resource

- kwh/m²/day
- > 8.0
 - 7.0 - 8.0
 - 6.0 - 7.0





An example of what it would cost to develop Nevada's solar energy resource.

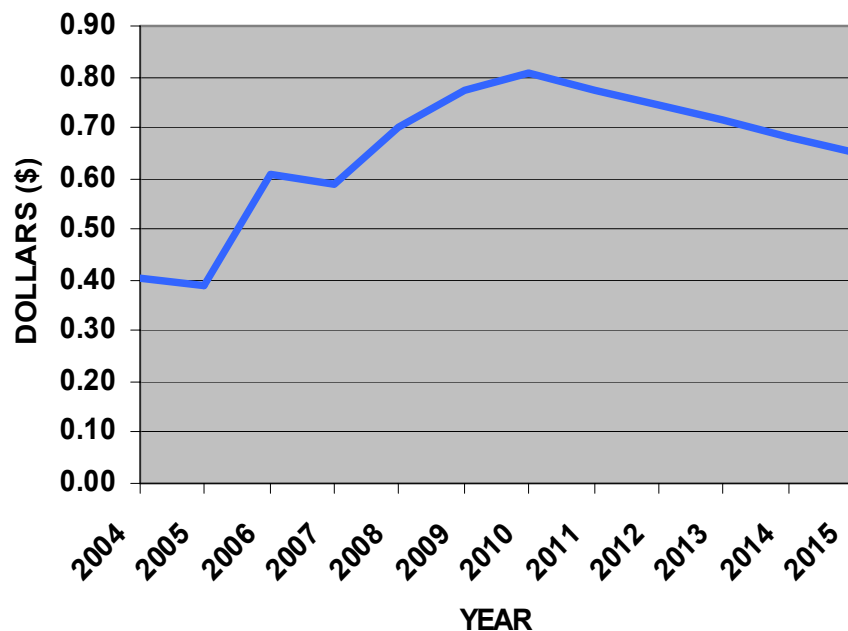
- **The investment to build the CSP plants could come from private money – not from the state's treasury.**
- **The kWh premium to cover this investment is shared among rate payers in the existing RPS.**
- **The incremental cost of 40-90 cents/month could be required of ratepayers to support 250 MW CSP.**
- **The monthly amounts need to be applied as a premium to the kWh purchases from the plant to support the plant developers debt and equity payments.**
- **This premium is smaller than many typical fuel adjustment charges.**



Cost to NV Ratepayers

If rate based, the cost to the NV ratepayer of deployment of 250 MW of CSP Power.

MONTHLY COST TO NV CONSUMER -- 250 MW by
2010



Assumes:

**250 MW deployment
in four states**

**Costs distributed to
customers of 4 NV
IOUs**

**1% per year cost
increase of
conventional power**



Cost to NV Ratepayers

If NV installs 250 MW of CSP power

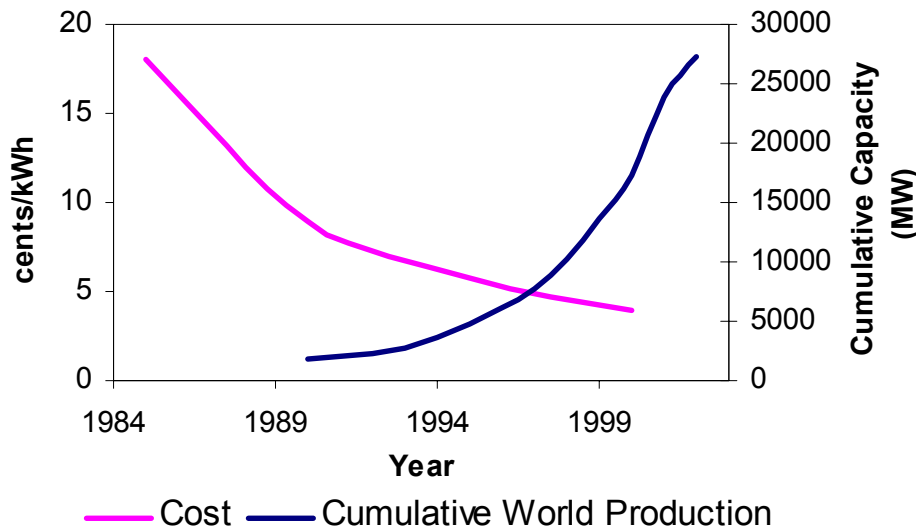
- **The average cost to ratepayers is about 65 cents per month for 15 years.**
- **If other states (and countries) also install CSP capacity, the price will decline faster and the cost to ratepayers will also decline.**
- **Austin Energy offers a voluntary premium of \$2.85 for green power and holds it fixed for 10 years. It's very popular and responsible for that firm being the leader in green power in the US.**



CSP Costs Will Decline

Cost reductions realized by wind power are good examples for CSP.

Wind Power Costs and Capacity



Initial cost of wind power was high but decreased as installed capacity increased.

The same trend will occur for CSP.

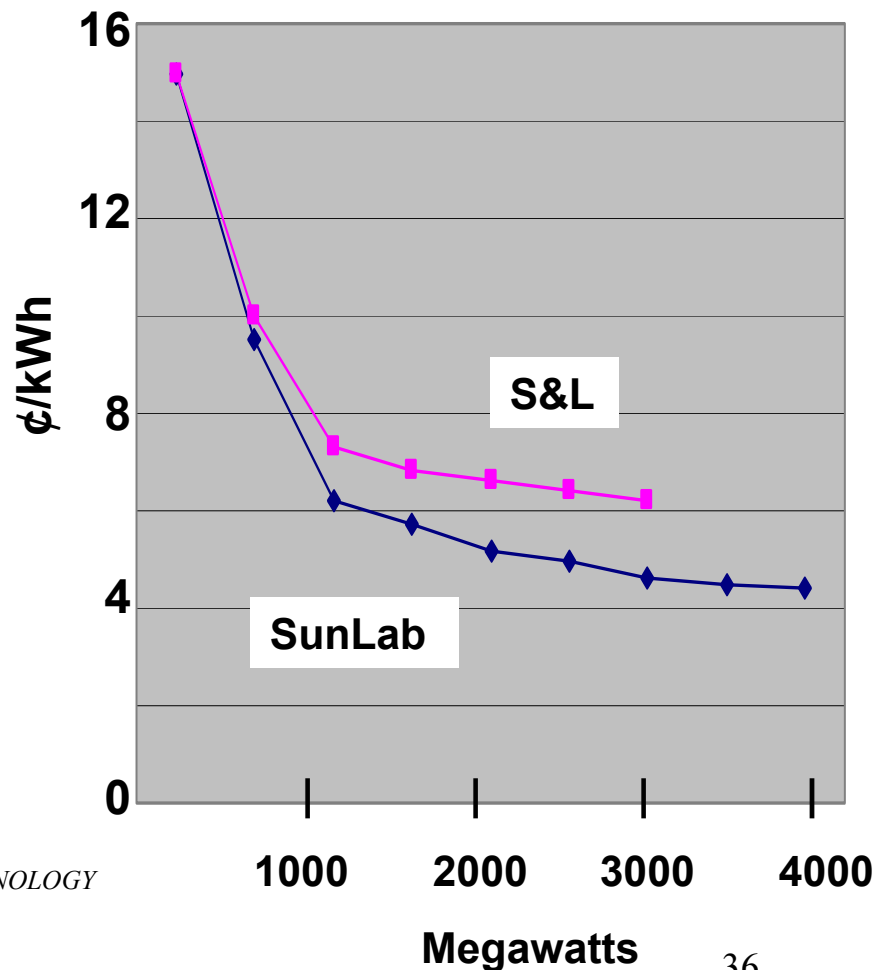


Projected Costs of CSP Generation

Sargent & Lundy* and SunLab 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



* ASSESSMENT OF PARABOLIC TROUGH AND POWER TOWER SOLAR TECHNOLOGY COST AND PERFORMANCE FORECASTS, SL-5641 MAY 2003.



NV Renewable Incentives

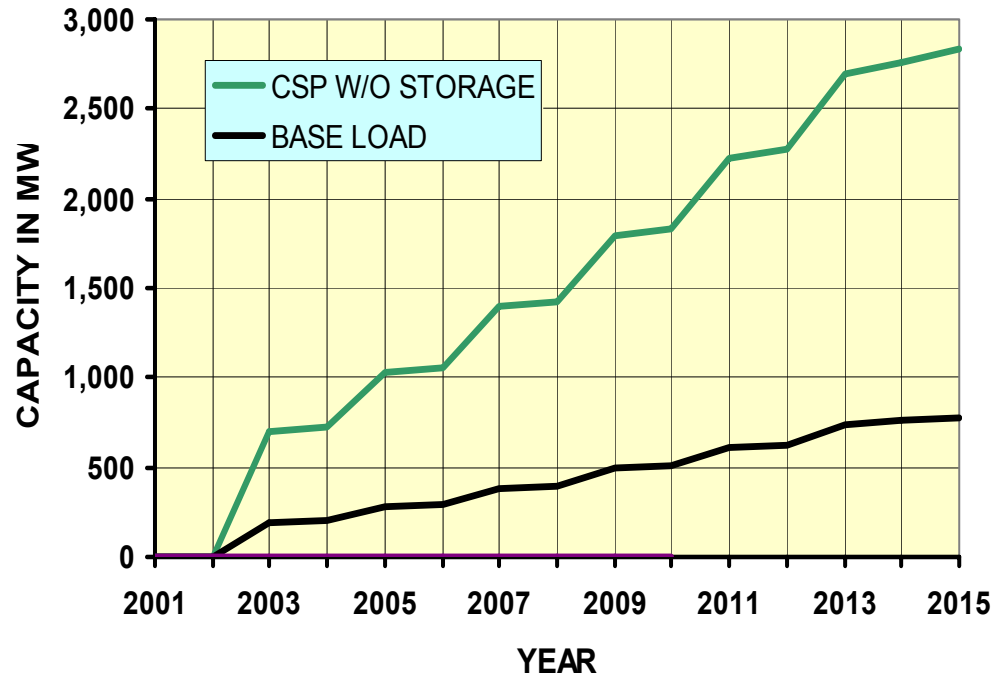
- Renewable Energy Producers Property Tax Exemption (Com, Ind, Res)
- Renewable Energy Systems Exemption (Com, Ind, Res)
- Renewable Energy Sales Tax Exemption
- Boulder City Public Works - Energy Efficient Appliance Program
- Nevada Power Co. - PV Rebate Pilot Program (PV only)
- Nevada Power - GreenPower Program (PV, Geo, Wind, FC)
- Nevada Million Solar Roofs Partnership (SWH, ASH, PV, PH)
- Fuel Mix and Emissions Disclosure
- Interconnection Standards (< 10kW)
- Net Metering (, 30 kW)

Renewable Portfolio Standard

Nevada has at least 10 mandatory and voluntary programs, regulations, and incentives for using renewable energy. Only ONE applies to CSP technology.

The maximum capacity of the Nevada RPS is 750 MW base load equivalent in 2015.

Nevada RPS Requirement



What Needs to be done?

CSP Industry recommendations:

- **Leadership by the Governor to develop the state's solar energy resource.**
- **Amend the Nevada's to increase the solar capacity proportionate to the State's resource.**
- **Participate in the 1000 MW Initiative by deploying a minimum of 250 MW of CSP power over the next 5 years.**
- **Gain PUC approval and support for the required premium.**


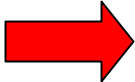
What needs to be done? (2)

CSP Industry recommendations:

- **Encourage continued congressional support for DOE's CSP R&D program.**
- **Support a Federal production tax credit (PTC) for CSP to reduce the burden on NV's rate payers.**
- **Work with WIEB and WAPA to aggregate CSP power plant purchases in the four SW states**
- **Encourage WAPA to aggregate CSP demand and bid to meet this demand.**
- **Explore ways to use federal and tribal lands to site CSP plants.**



Post-1000 MW Situation and Opportunities

- **CSP electricity costs declines to single digit c/kWh.**  **NV has access to a clean, in-state energy source at competitive prices.**
- **NVCSP leadership solidified, US companies positioned to capture international projects.**  **NV businesses gain major market share.**



Nevada can add another engine for its economy by developing its CSP resource.

The economic benefits to Nevada far exceed the cost to develop this clean and renewable resource.