



Economic Evaluation of Palo Verde Devers Line # 2 (PVD2)

by

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Topics

- I. Study Scope
- II. Changes from Oct 1 , 2004 Results
- III. Preliminary Study Results 2008, 2013
- IV. Alternative Congestion Revenue Allocation
- V. Generation Alternatives



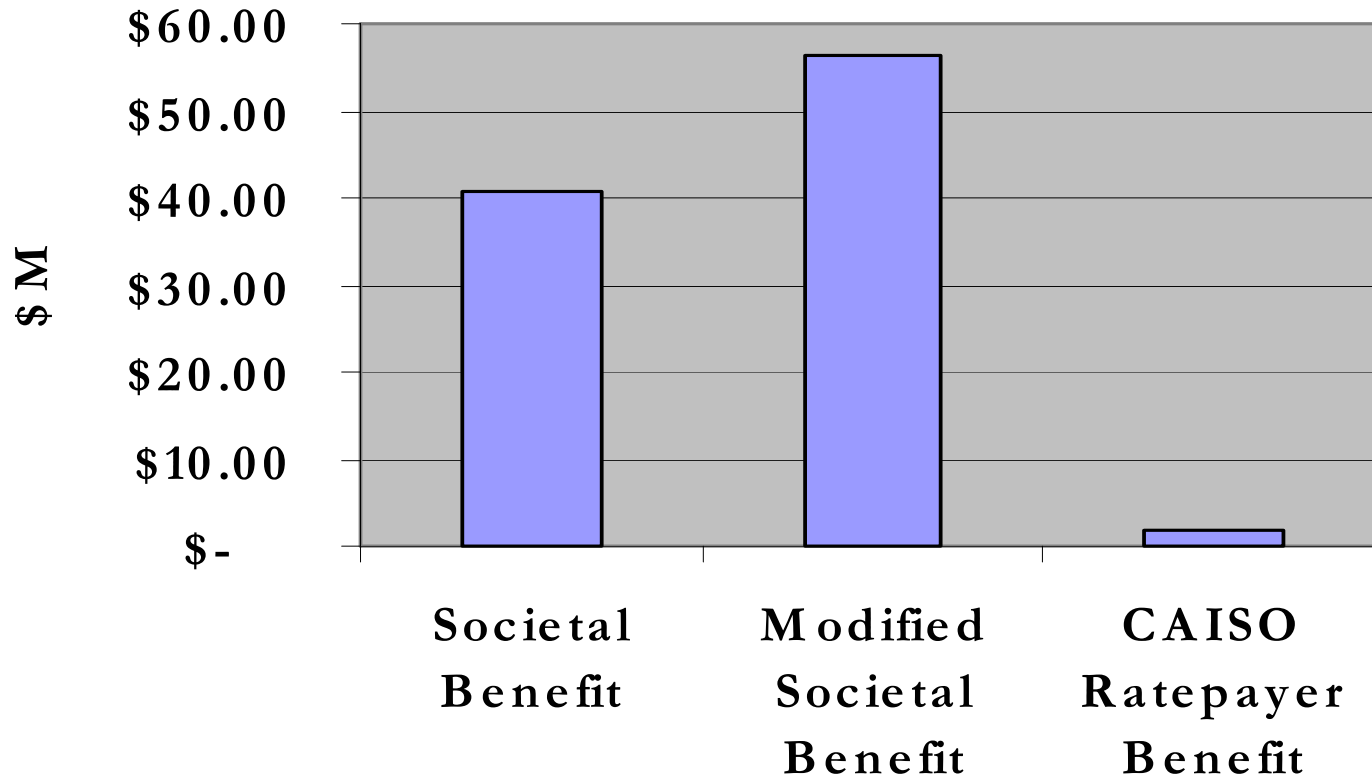
Application of TEAM to PVD2 Study

- I. **Benefits Framework-** Utilized standardized benefit cost frame to calculate WECC wide benefits and regional impacts.
- II. **Network representation-** PLEXOS Full network represented with 17,450 lines, with 3 DC lines and 284 lines 500KV or above enforced.
- III. **Market prices-** Dynamic hourly bidding based on empirically estimated price cost mark-up which vary by system conditions.
- IV. **Uncertainty-** 30 sensitivity cases runs for 2008 based on various assumptions on load growth, gas prices, hydro conditions, and market pricing assumptions.
- V. **Resource substitution-** Alternative transmission and generation projects were studied



Oct 1, 2004 Results

Expected energy benefits for 2008

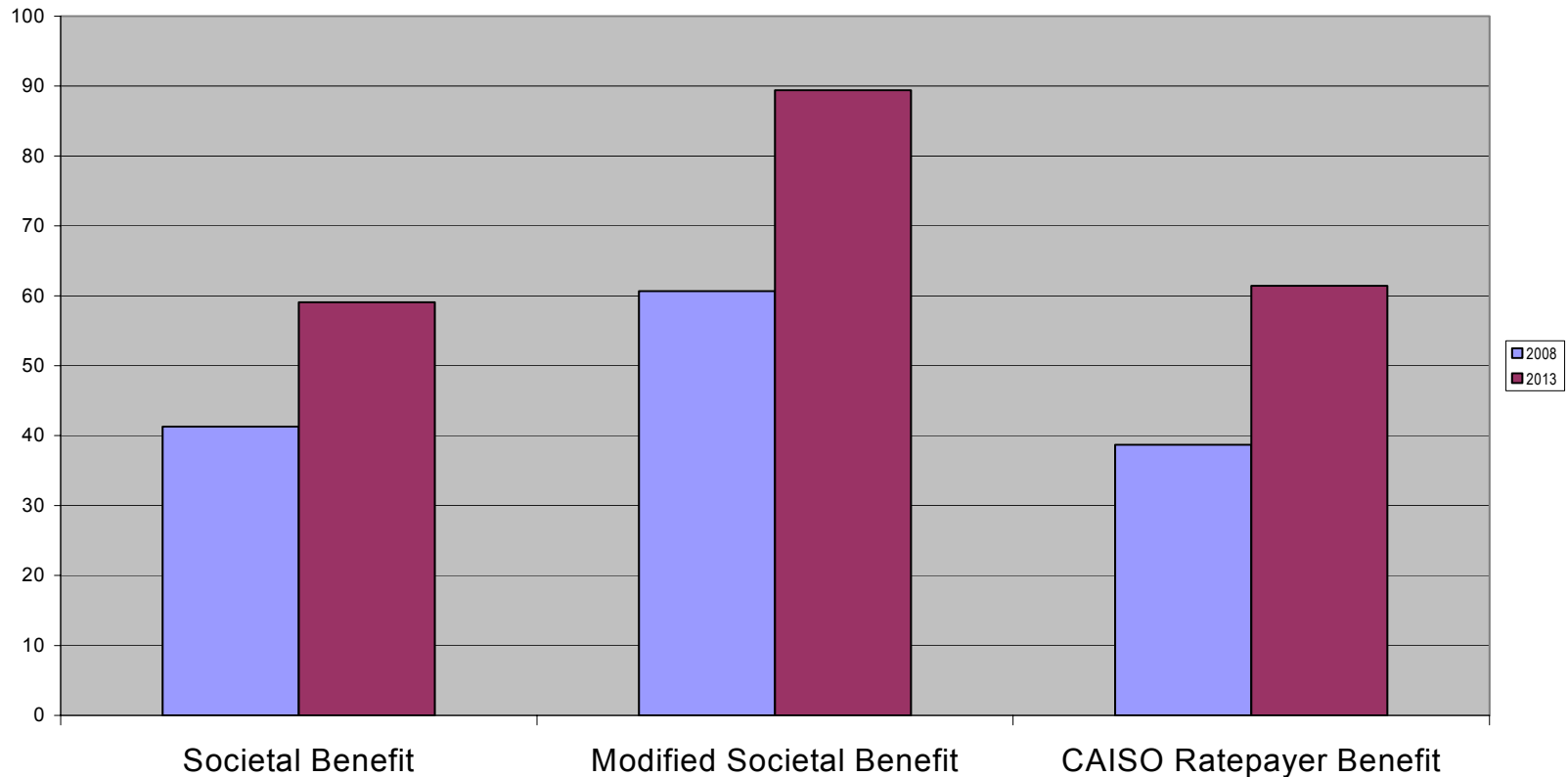




Feb 5, 2005 Results

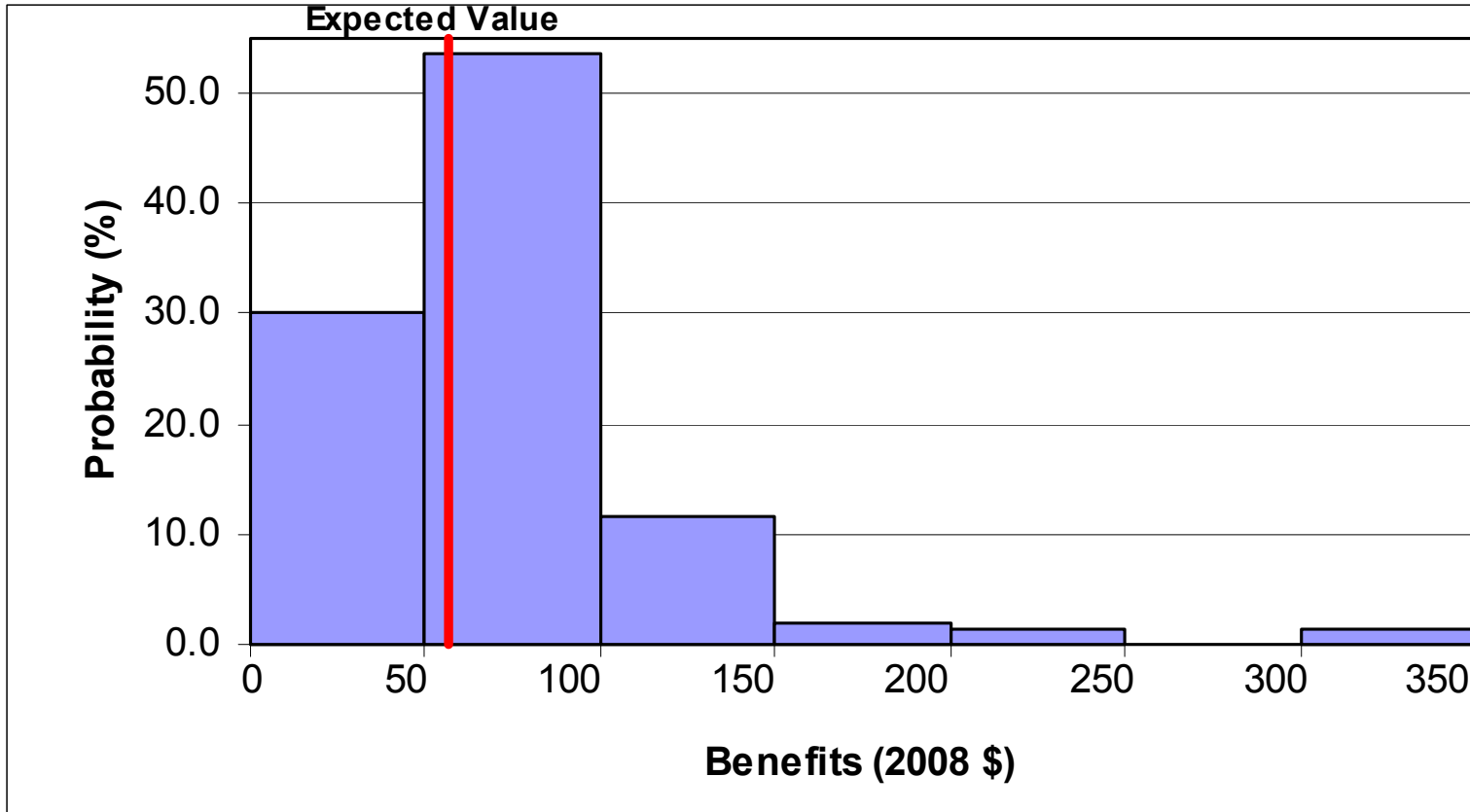
Expected energy benefits for 2008 and 2013

Expected Benefit of Palo Verde Devers 2 Upgrade





Probability Distribution of Energy Benefits (2013, CAISO Ratepayer – LMP Only)





Total Benefit-Cost Ratio

In 2008 Millions \$

	WECC or Societal	Enhanced WECC Competition or Modified Societal	CAISO Ratepayer (LMP Only WECC-Wide)	CAISO Ratepayer (LMP + Contract Path)
Levelized Benefits				
- Energy	\$56	\$84	\$57	\$198
- Operational	\$23	\$23	\$23	\$23
- Capacity	\$12	\$12	\$6	\$6
- System Loss	\$2	\$2	\$1	\$1
- Emissions	\$1	\$1	\$1	\$1
- Total	\$94	\$122	\$88	\$229
Levelized Costs	\$71	\$71	\$71	\$71
Benefit-Cost Ratio	1.3	1.7	1.2	3.2



Generation Alternatives

Comparison of Combined Cycle Costs In California and Arizona (2008 \$)

Parameter	Units	California	Arizona	Percent Dif.
Installed Capital Cost	\$/kw	\$1,184	\$1,080	10%
Real Econ. Carrying Charge	%	10%	10%	0%
Annual Capital Cost	\$/kw-yr	\$118	\$108	10%
Fixed O&M Costs	\$/kw-yr	\$15	\$10	50%
Annual Fixed Costs	\$/kw-yr	\$133	\$118	13%
PVD2 Transmission Costs	\$/kw-yr	\$0	\$59	-100%
Total Fixed Costs	\$/kw-yr	\$133	\$177	-25%
Average Heat Rate	btu/kwh	7,100	7,100	0%
Fuel Costs	\$/mmbtu	\$5.08	\$4.71	8%
Fuel Costs	\$/MWh	\$36	\$33	8%
Variable O&M Costs	\$/MWh	\$3	\$2	50%
Total Variable Costs	\$/MWh	\$39	\$35	10%
Assumed Capacity Factor	%	90%	90%	0%
Total Costs	\$/MWh	\$56	\$58	-4%



- ❖ CA needs to add 5000+ MW capacity in the next 5 years
- ❖ Need is greater than ability to site in urban areas due to public opposition & other constraints
- ❖ Study conclusion is not to build out of state instead of in-state, but rather to aggressively pursue best of both generation and transmission options due to magnitude of need