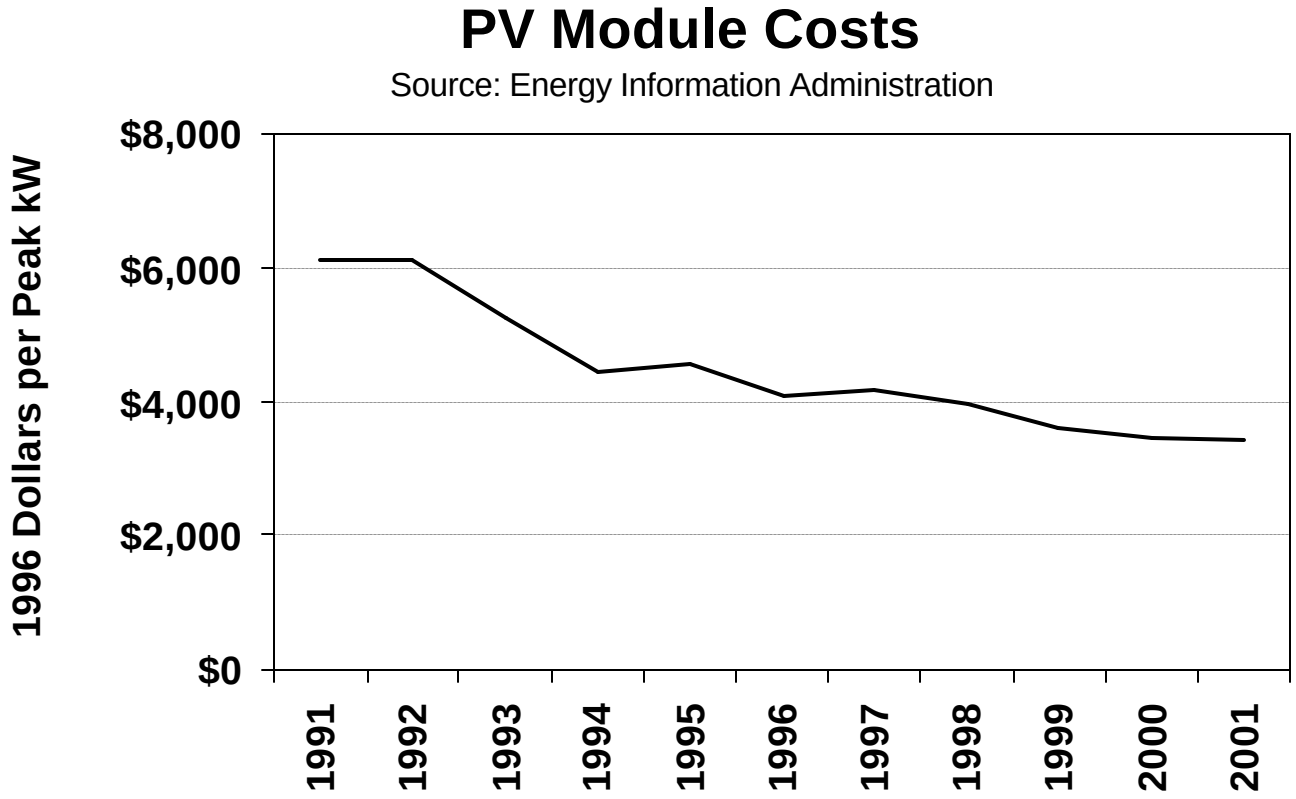
Case Study: Arizona

In February 2001, Arizona began implementation of an Environmental Portfolio Standard (EPS), which required electricity utilities to provide 1.1% of the total retail energy sales through qualified renewable energy resources by 2007. Recognizing that solar was the most abundant renewable energy source, the EPS directed that 60% of these projects be solar. The EPS created a means to assist in financing this venture through capped surcharges to electricity customers. The electricity companies collected and then, largely, controlled the use and distribution of the revenues created by these surcharges. To date almost 6 MW of PV, 5 MW of landfill gas, and 200 kW of peak demand displacement from solar thermal are being used to meet the requirements of the EPS.

EPS legislation required a progress review in June 2003. "The EPS provides that the Commission would continue the annual increase in the portfolio percentage after 2004 only if the cost of environmental portfolio electricity has declined to a Commission-approved cost/benefit point. Otherwise, the retail energy percentage will remain 0.8 percent from 2004 through 2012." The legislation created a Cost Evaluation Working Group (CEWG) committee to conduct the review.

While the committee agreed that progress is being made and prices for solar projects are declining (see figure below), they concluded that the 1.1% goal would not be met based on the current trends and the original timeline. Part of the committee felt that a more moderate goal of 0.8% should be adopted while another part felt the original standards should be maintained with some modifications to accounting and management practices.



Cost-Benefit Analysis for Photovoltaic Program

This cost-benefit analysis process is a critical bottleneck in the development of renewables in Arizona. Assumptions made and methodology used to perform the cost-benefit analysis can significantly affect the outcome of the analysis.

Cost data from the two major utilities that provide over two-thirds of Arizona's power, Arizona Public Service (APS) and Tucson Electric Power (TEP), formed the basis of calculations in the committees review process. Photovoltaic (PV) system benefits include avoided conventional generation energy and capacity costs, avoided carbon dioxide and sulfur dioxide emissions, and the hedge value of PV against fuel cost increases. Both costs and benefits are calculated on a simple net cost basis. Economic impacts related to in-state spending and job creation are estimated using RIMS, a regional input-output modeling system. However, these benefits were not included in the CEWG per-kWh cost benefit analysis.

REPP conducted the same cost-benefit analysis with modified assumptions. The CEWG and REPP cost-benefit analyses are compared side-by-side in Table 1.

Table 1. Arizona PV Program Cost-Benefit Analysis

Costs	CEWG Report	REPP Analysis
PV Capital Cost ($/watt)[1]	$7.15	$4.00
Annual Generation (kWh per installed watt)	1,890	1,890
PV Lifetime (years)	25	25
Lifetime Generation (kWh per installed watt)	47,250	47,250
Simple Net Cost ($/kWh)	$0.151	$0.085
Benefits		
Avoided conventional energy costs ($/kWh)[2]	$0.0212	$0.0450
Avoided conventional capacity costs ($/kWh)	$0.0099	see note[3]
Avoided carbon dioxide emissions ($/kWh)[4]	$0.0052	$0.0052
Avoided sulfur dioxide emissions ($/kWh)[5]	$0.0002	$0.0002
Hedge value of price stability ($/kWh)	$0.0004	$0.0004
Benefits subtotal ($/kWh)	$0.0369	$0.0507
Net Benefits ($/kWh)	($0.114)	($0.034)
REPP Labor Benefits ($/kWh)[6]		$0.032
REPP Recalculated Net Benefits ($/kWh)		($0.002)

REPP modifications to CEWG assumptions:

(1) The CEWG report noted that PV costs have been declining for a number of years, and that PV costs declined during the Arizona PV program, ranging from $4.31-24.12 per watt depending on project specifics and date of installation. While the lowest PV cost reported was $4.31 per watt, CEWG used the average PV cost of approximately $7.15 per watt (based on CEWG reported capacity and expenditures) in their cost-benefit analysis. Rather than base the cost-benefit on previous PV cost numbers, REPP bases its cost-benefit analysis on the likely costs of present-day and near-term future PV costs. REPP assumes future PV purchases can be effected at $4.00 per watt or less. This means that for a given capital expense, more PV modules can be purchased, and more jobs will be created from the investment;

(2) Historic conventional fuel costs used in the CEWG analysis are significantly lower than current fuel costs and likely future fuel costs. REPP uses cost-estimates for new natural gas plants in its analysis. REPP assumes that the combined fuel and capital costs of new, more efficient natural gas plants will be $0.045 per kWh; and

(3) The CEWG did not include labor benefits in their cost-benefit analysis. Based on CEWG figures of a cumulative capacity of 5.521 MW, 25-year project lifetime, $8.4 million in-state direct and indirect earnings, and 268 in-state full-time equivalent direct and indirect jobs, REPP calculates local direct and indirect labor benefits to be $0.032 per kWh. This labor benefit is included in REPP's modified cost-benefit analysis

Including labor benefits in the analysis increases net benefits significantly. Including lowered PV costs and increased conventional fuel costs increases net benefits even more. While the CEWG report performed a cost-benefit analysis, the benchmark for rating the performance of the renewable program is never clearly stated. We see that including the benefits of job creation, as well as incorporating more realistic assumptions about future energy and technology costs significantly improves the outcome of the analysis.

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1. CEWG reported PV costs vary from $4.31-24.12 per watt. This analysis uses the average PV cost based on CEWG reported capital expenditures. REPP assumes future PV purchases will experience declining costs.
2. REPP assumes future generation costs will be higher due to natural gas price volatility.
3. Combined fuel and capacity cost for new natural gas power plant.
4. Based on the CEWG high value of $9 per metric ton avoided CO2
5. Based on the CEWG value of $100 per ton avoided SO2
6. REPP calculates the labor benefit of PV installed to date to be $0.0322 per kWh. This calculation is based on CEWG figures of a cumulative capacity of 5.521 MW, 25-year project lifetime, $8.4 million in-state direct and indirect earnings, and 268 in-state full-time equivalent direct and indirect jobs.