


# ***PROGRAM AND PROCEEDINGS***



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# Incentives as a Tool for Stimulating Photovoltaic Market Growth

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## ABSTRACT

This paper summarizes several studies [1–4] analyzing consumer incentives for the grid-tied domestic photovoltaic (PV) market. Most policy incentives have evolved through state legislative and regulatory utility restructuring activities since 1996. The incentives run the gamut from reducing capital costs, such as buy-downs, grants, and income tax rebates, to optimizing life-cycle benefits, such as net metering and property-tax exemptions. Exemplifying market stimulation, in 1996, only the State of Hawaii's residential break-even turnkey cost (BTC) of \$7.50/W exceeded the lowest-reported installed cost of \$6.21/W [5]. In 1999, however, nine states' BTCs exceeded the installed system cost of \$4.50/W. With installed PV-system costs declining, economic analysis indicates that the market-transition intent of the policy incentives is possible. However, consumer awareness (states typically do not market incentives), PV-industry small-system distribution infrastructure, and utility interconnection are deployment barriers that are causing a slow start to consumer participation, and they may extend the timeframes (currently 4-10 years) for the incentives.

## 1. Introduction

The domestic market for customer-sited photovoltaics (CSPV) has historically consisted of off-grid systems for which the capital cost of the distribution-line extension offsets the CSPV cost. Grid energy prices ranging from 5¢-14¢/kWh for residential and 5¢-12¢/kWh for commercial do not recover capital investment over the life of the system [5]. However, PV-system installed costs have declined from \$6.21/W in 1996 to \$3.90/W in 2000,<sup>1</sup> with levelized energy costs of 17¢-12¢/kWh,<sup>2</sup> respectively [5]. Additionally, the PV industry has developed products targeted at the grid-tied residential and commercial market and has developed financing packages to alleviate the up-front cost burden to the consumer. The gap between consumer value and cost for CSPV is close, but not close enough for most U.S. consumers. The final market stimulus for grid-tied CSPV has been the consumer incentives

evolving from state utility restructuring, intended to transition the electricity service market toward competition. These include:

- 9 states with income tax rebates
- 30 states with net metering [6]
- 12 states with buy-down or grant programs
- 11 states with property tax exemptions

In addition to the state incentives, the federal 10% tax credit and accelerated depreciation allowance for commercial businesses stimulate the CSPV market. The analysis summary identifies the CSPV consumer value, including incentives for the domestic market, which provides industry with geographic market targets (see Figs. 1 and 2).

## 2. Approach

The CSPV consumer-value analysis differs for the residential and commercial sectors because of the assumptions [2, 3], data aggregation, and mapping; but the cash-flow analysis resulting in a BTC is a similar indicator. BTC is the iterated system-cost input to a life-cycle benefit and cost cash flow, which is forced to a net present worth of zero. The BTC is the market hurdle price a consumer can pay for a CSPV system without making or losing money over the life of the system; the consumer breaks even.

## 3. Results

The first residential BTC analysis was completed in 1996, prior to the establishment of any regulatory incentives. The white columns in Figure 2 show the results of this analysis. The analysis was updated in 1999, with 12 new capital cost-reducing incentives included.

The commercial BTC analysis was first completed in 1998 [3] and was expanded to include the values of material replacement of building-integrated PV products, load-control enhancement, emergency generation, and environmental benefits [4]. The results, shown in Figure 2, are indicative of incentives and energy values only. Building-material replacement values, such as PV replacing spandrel glass, could add \$1,70/kW to these values.

## 4. Conclusions

Though many of the incentives used in the analysis have changed or become obsolete, there is potential for new incentives. Currently, 23 states have initiated or implemented restructuring policies, and 16 states have renewables provisions. The system benefits charges (SBC), included in 13 state restructuring policies, are a source of funding for consumer incentives. Thus far, only 7 of the 13 state SBCs have been implemented, leaving potential for more near-term incentives. Additionally, potential new

<sup>1</sup> These costs are the result of an aggregate long-term purchase for the Sacramento Municipal Utility District Pioneer PV program and represent the lowest reported residential installed costs. These are representative of commercial PV systems of 30 kW or more. The year 2000 cost was estimated from the committed contract price.

<sup>2</sup> Levelized costs are for residential systems with first-mortgage financing and retail-rate compensation for energy production at 10¢/kWh.

arenas for consumer incentives include nine states implementing renewable-portfolio standards, the Million Solar Roofs initiative, 40+ community partnerships that are working on consumer awareness, reducing infrastructure barriers and municipal policies [7], and the 50 utility green-pricing programs, either offered or under development.

Though the potential for market stimulation through incentives is established by analyzing the increased consumer value, the effectiveness as measured by

participation of various types of incentives has not been explored and should be a next step to this work.

### 5. References

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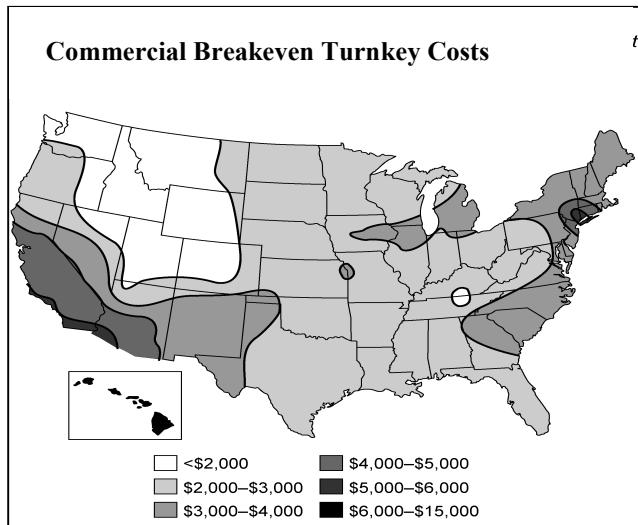


Figure 1. Commercial breakeven turnkey costs.

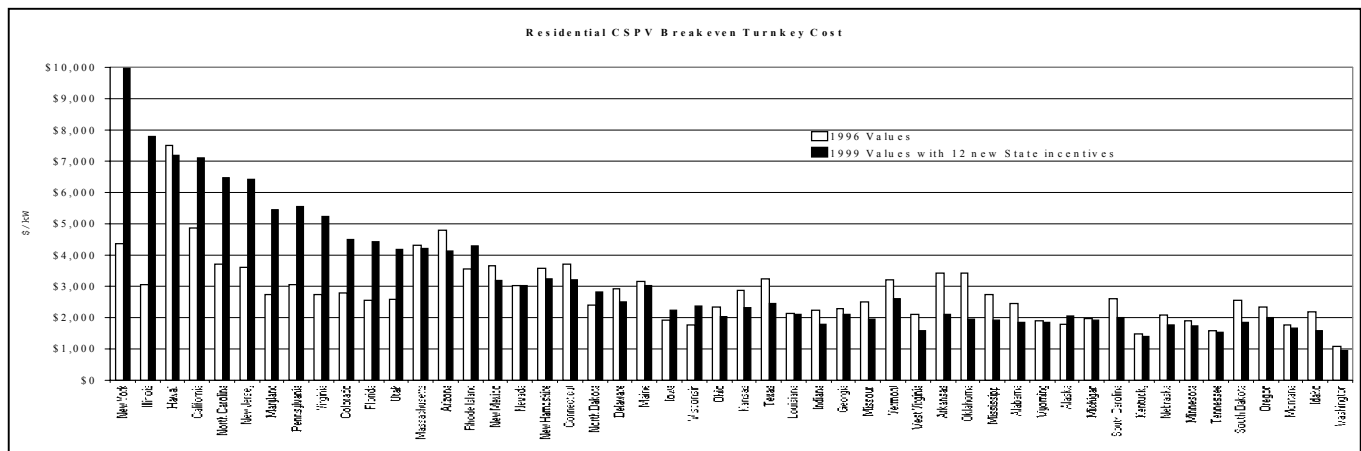


Figure 2. Residential CSPV breakeven turnkey costs.