
Building a Market for Small Wind: The Break-Even Turnkey Cost of Residential Wind Systems in the United States

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Background

□ Small Wind Overview

- Includes systems $< 100\text{kW}$, installed on customer side of meter
- Typical installed cost is \$4.00 - \$5.00/Watt for 10 kW units
- U.S. market is small, but growing, driven by sizable incentives offered in a few states (e.g., California buy-down program has resulted in over 200 systems in 5 years)

□ Purpose of Analysis

- Evaluate the economics of small residential, grid-connected wind systems by state
- Show which states provide the most promising markets for small wind based on current incentive levels
- Use tool to determine the impact of different policy incentive levels and policy types, and ultimately to assist in policy design

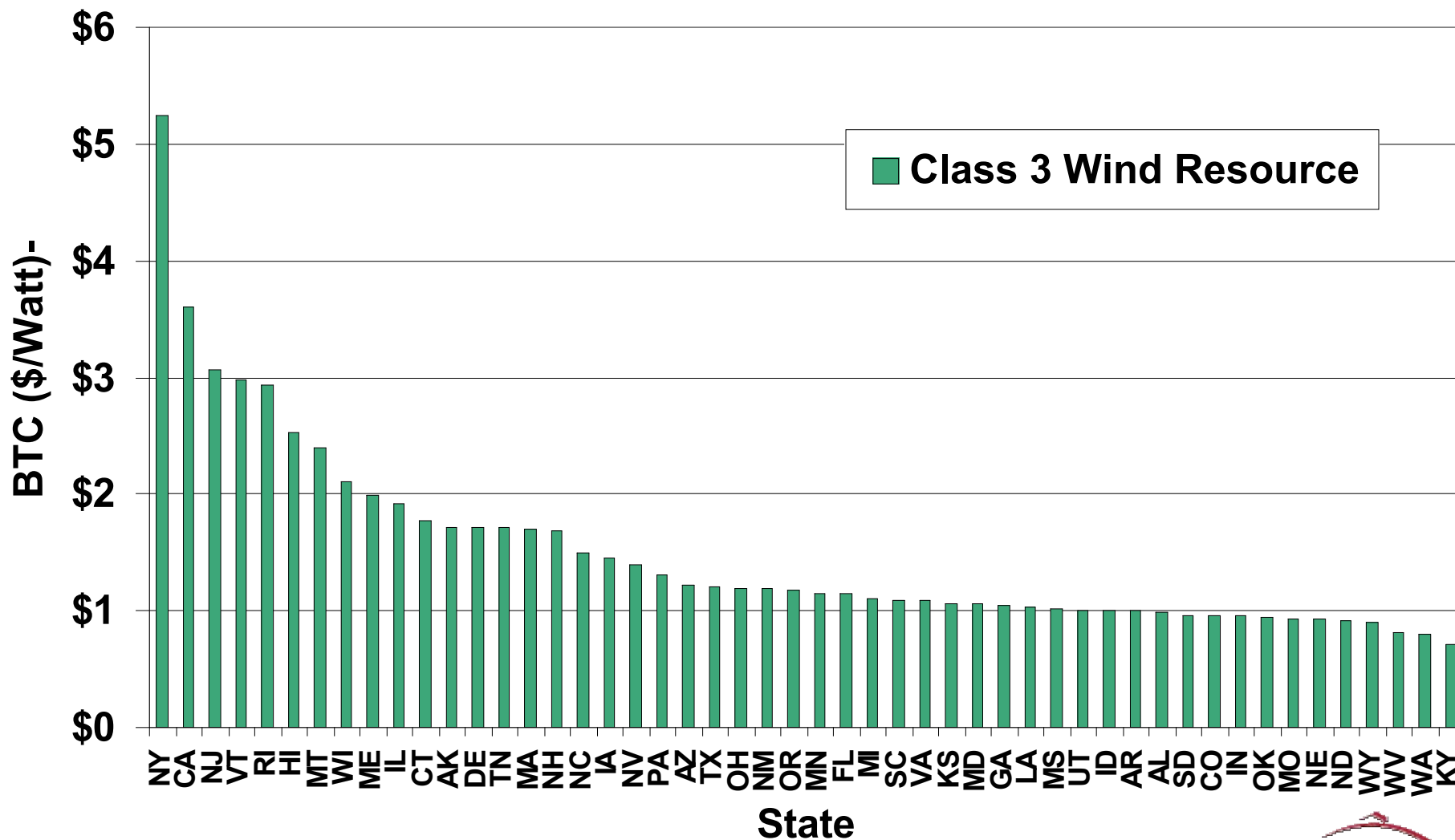


Model Overview

- ❑ Excel model calculates the break-even turnkey cost (BTC) or simple payback of a residential small wind system
 - BTC is the aggregate installed cost at which the customer's investment just pays off over the system lifetime (assuming a required IRR)
- ❑ BTC is calculated by balancing NPV of various costs/benefits:
 - Customer up-front payment for installation
 - Financing terms
 - O&M payments
 - Property tax
 - Offset of average state electricity costs
 - State incentives (financial incentives, tax incentives, loan programs)
- ❑ Results vary by state and wind resource class (2-6)



Break-Even Turnkey Cost (BTC): Sample Model Output



Base-Case Assumptions

□ System Assumptions:

- 10 kW system
- 30 m tower height
- 25 year system lifetime
- O&M is 1.5 ¢/kWh

□ Economic Assumptions:

- Cash payment, unless state loan results in higher BTC
- Customers require 8% IRR on their investment

- Grid-connected residential systems on customer-side of meter
- All wind production is valued at the full average residential electricity rate, escalated over time according to EIA forecasts
- State incentives taken at 2004 values



State Incentives Included

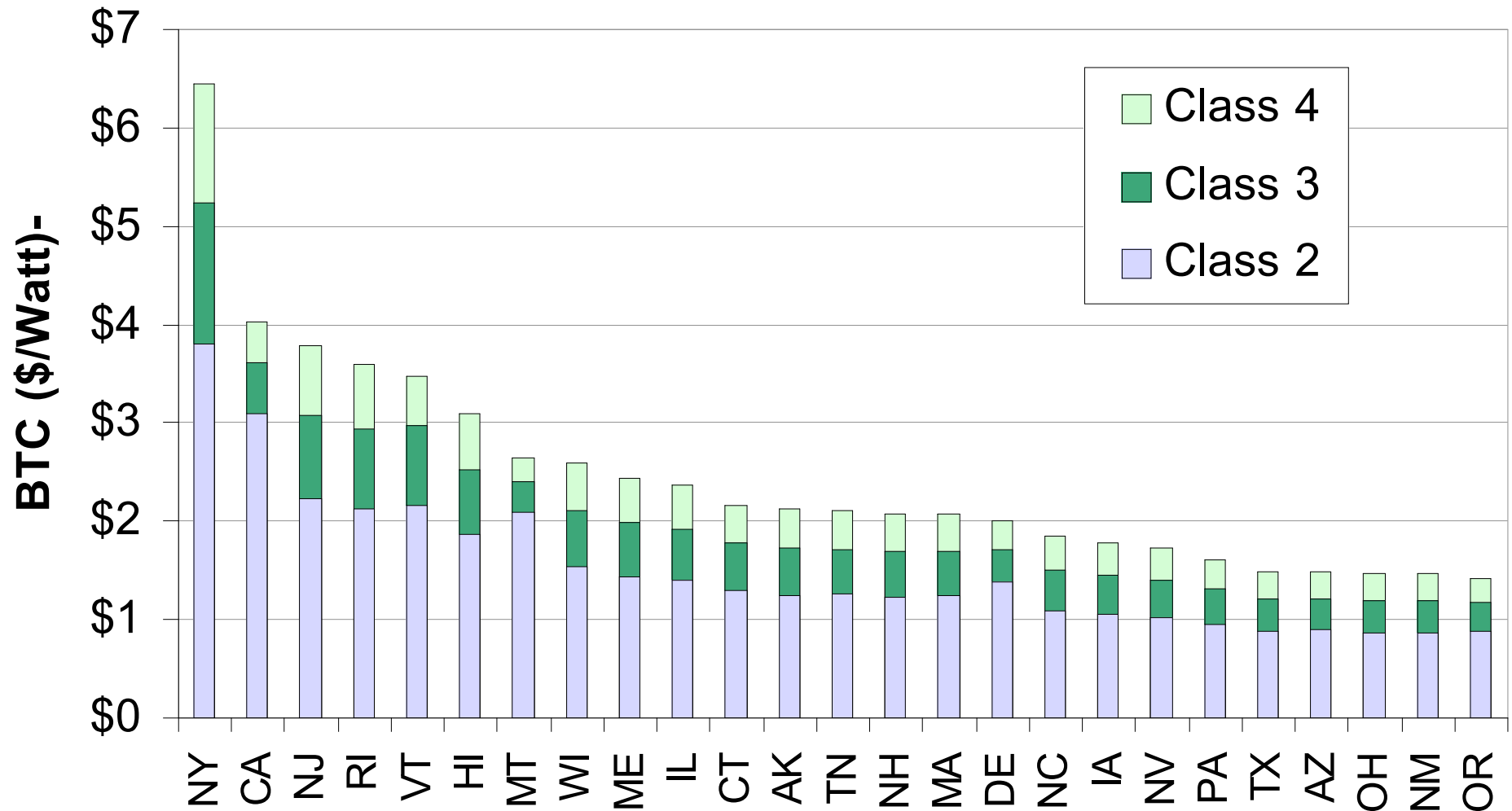
Incentive Type	Number of Programs
Financial Cash Incentives <i>(Buy Down Programs or Production Incentives)</i>	10
Income Tax Credits or Deductions	11
Property Tax Exemptions	11
Sales Tax Exemptions	9
Low-Interest Loan Programs	10

Note: Analysis does not consider federal USDA Energy 9006 grants for certain rural applications of small wind (which can provide significant grants for specific applications)

State financial cash incentives, some of which cover as much as 40-60% of installed costs, are most important



The Economics of Small Wind is Highly Variable by State and Wind Resource Class

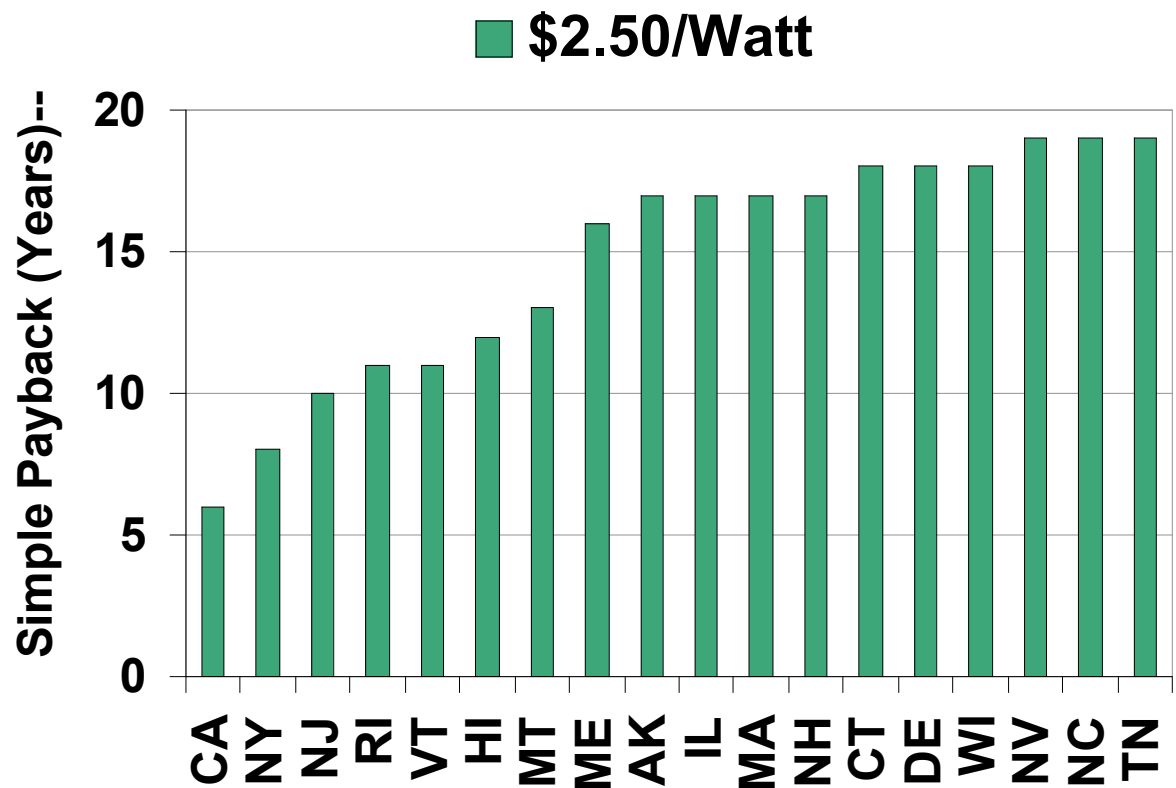
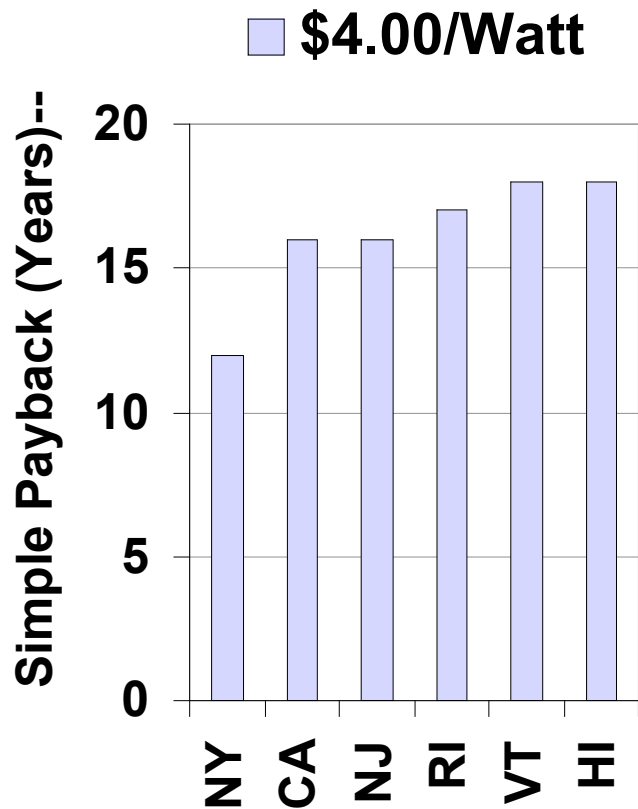


Note: All states not shown on graph have even lower BTCs

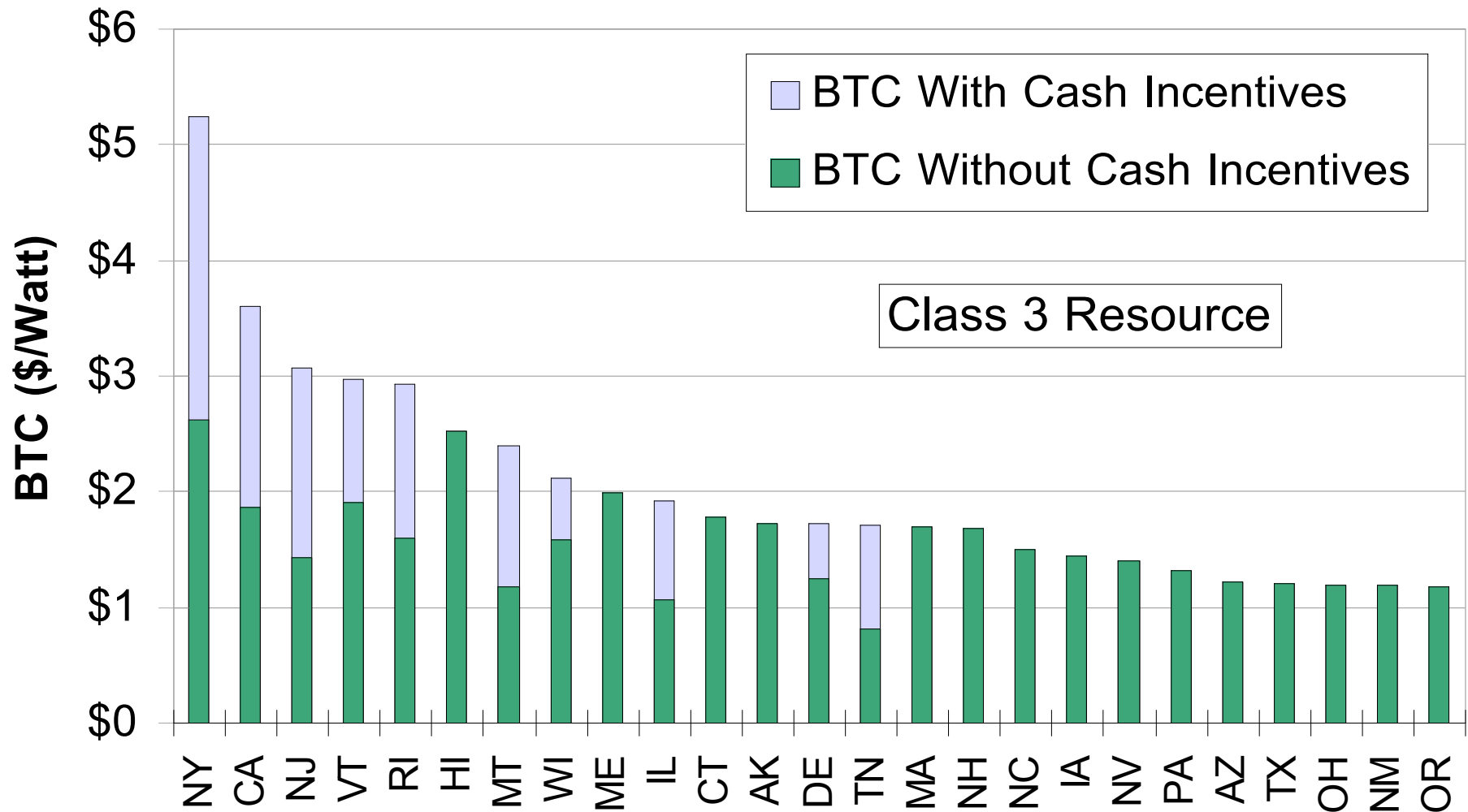


Cost Reductions are Necessary to Reach More Widespread, Economically Attractive Markets

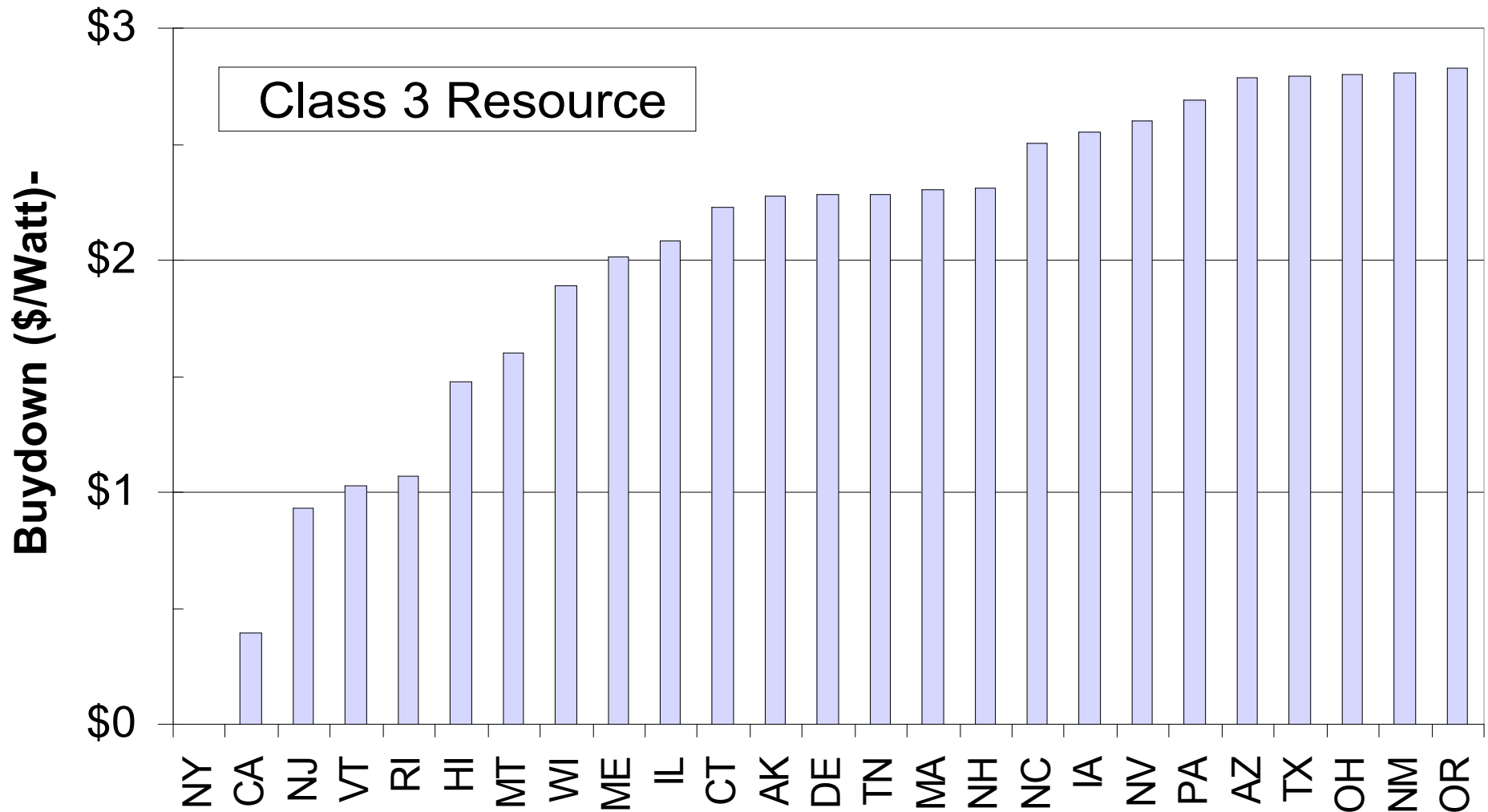
Results for Class 3 Resource –
States With Paybacks Less than 20 Years are Shown



State Financial Cash Incentives Are an Essential Element of the Small Wind Market



The Incremental “Buydown” Required to Achieve a \$4/Watt 25-Year BTC Differs by State

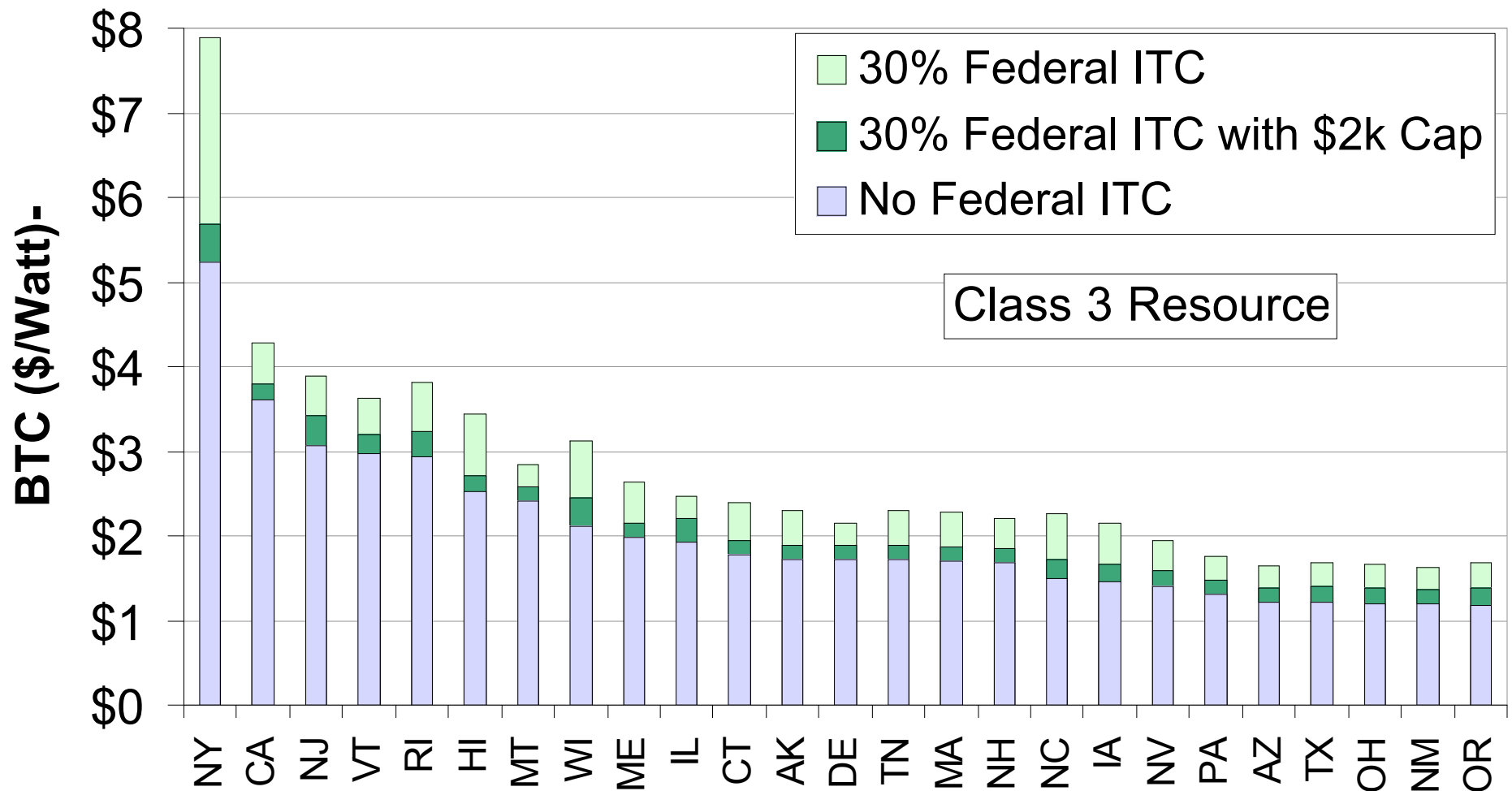


Other Policy Incentives Are Important, But Are Far Less Important than Cash Incentives

- ❑ **State Cash Incentives:** Incentives cover as much as 40-60% of system costs, and are most important form of support (e.g., in NY, BTC increases by \$2.5/W due to rebate)
- ❑ **Property Tax Exemptions:** Property taxes on small wind systems, if required, can significantly degrade economics; exemptions can increase the BTC by as much as ~\$1/W
- ❑ **State Income Tax Credits:** ITCs range from 5-35% of system cost, but most state ITCs are too low (or have caps that are too low) to have a large impact on the BTC for a 10kW system (existing ITCs increase BTC by \leq \$0.75/W)
- ❑ **Low-Interest Loans:** Low-interest loan programs make small wind more affordable; the most attractive programs increase BTC by \leq \$1/W relative to cash purchase with 8% IRR

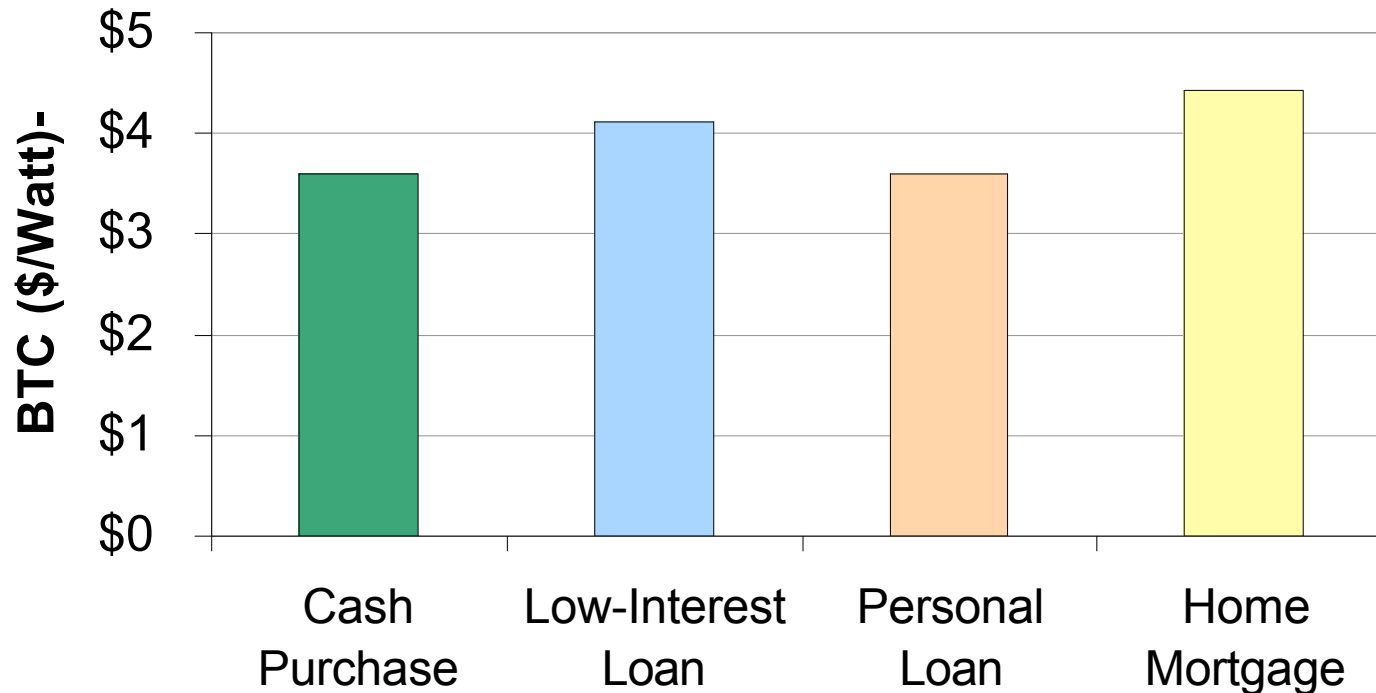


The Proposed 30% Federal Investment Tax Credit Could Help, but the \$2,000 Limit is Binding



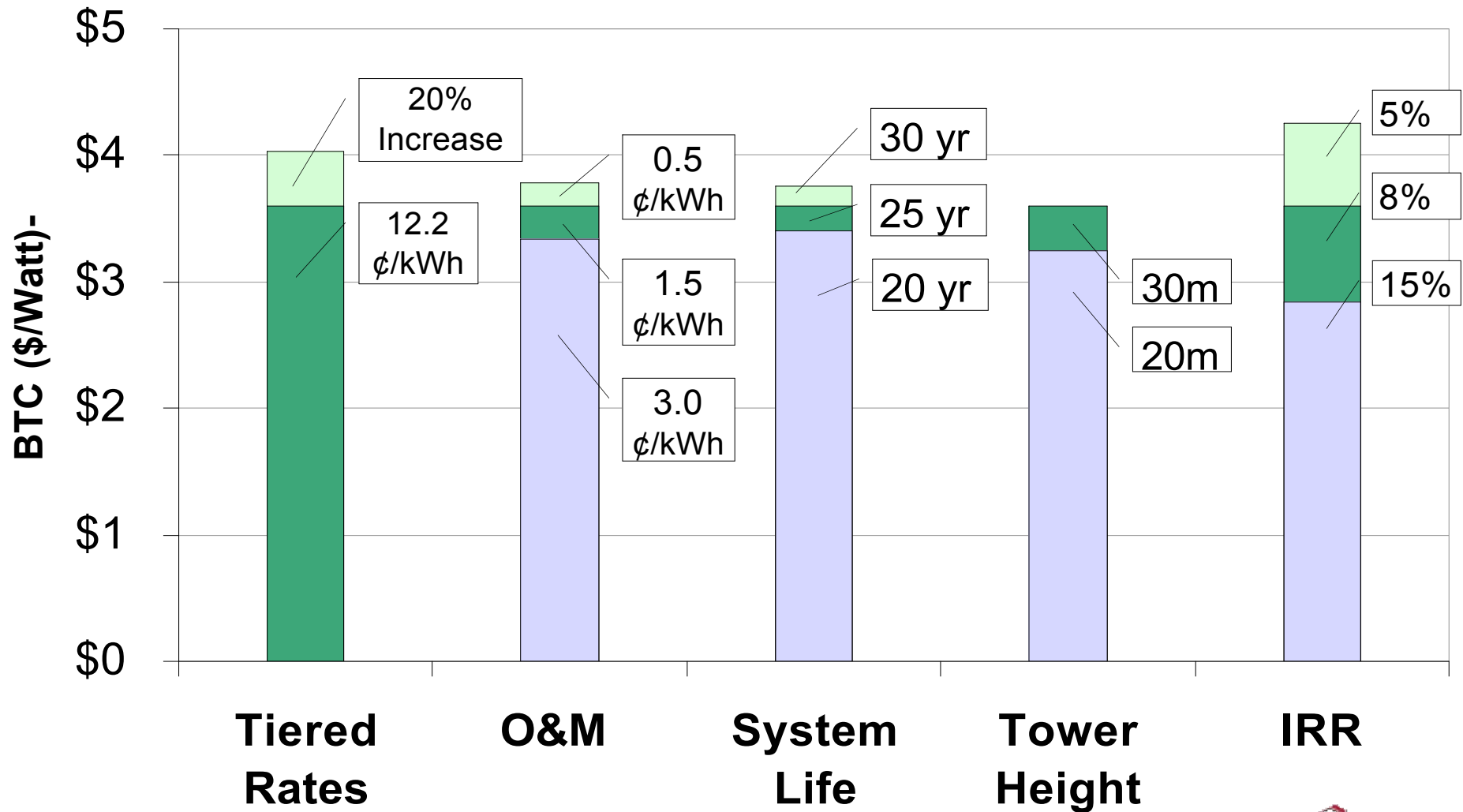
Alternative Financing Scenarios Have an Impact on the BTC

Results for California (Class 3 Resource)



Cash Purchase	8% required IRR on customer investment
Low-Interest Loan	10 year and 2% Interest Rate
Personal Loan	10 year and 8% Interest Rate
Home Mortgage	30 year and 6% Interest Rate (Tax-Deductible)

Additional Sensitivities: California Class 3 Examples



Conclusions

- ❑ Market for small, grid-connected residential wind systems in the U.S. remains small, but is growing
- ❑ Economics of these systems are highly variable by state
- ❑ Significant cost reductions are necessary to stimulate widespread market acceptance absent significant change in policy support
- ❑ A number of policies could help stimulate the market, but state cash incentives currently have the most significant impact, and will be a critical element to continued growth of this market
- ❑ Modeling tool presented here could be used by policymakers to help determine appropriate types and levels of policy support

