
Balancing Cost and Risk:

The Treatment of Wind Power in Western Utility Resource Plans

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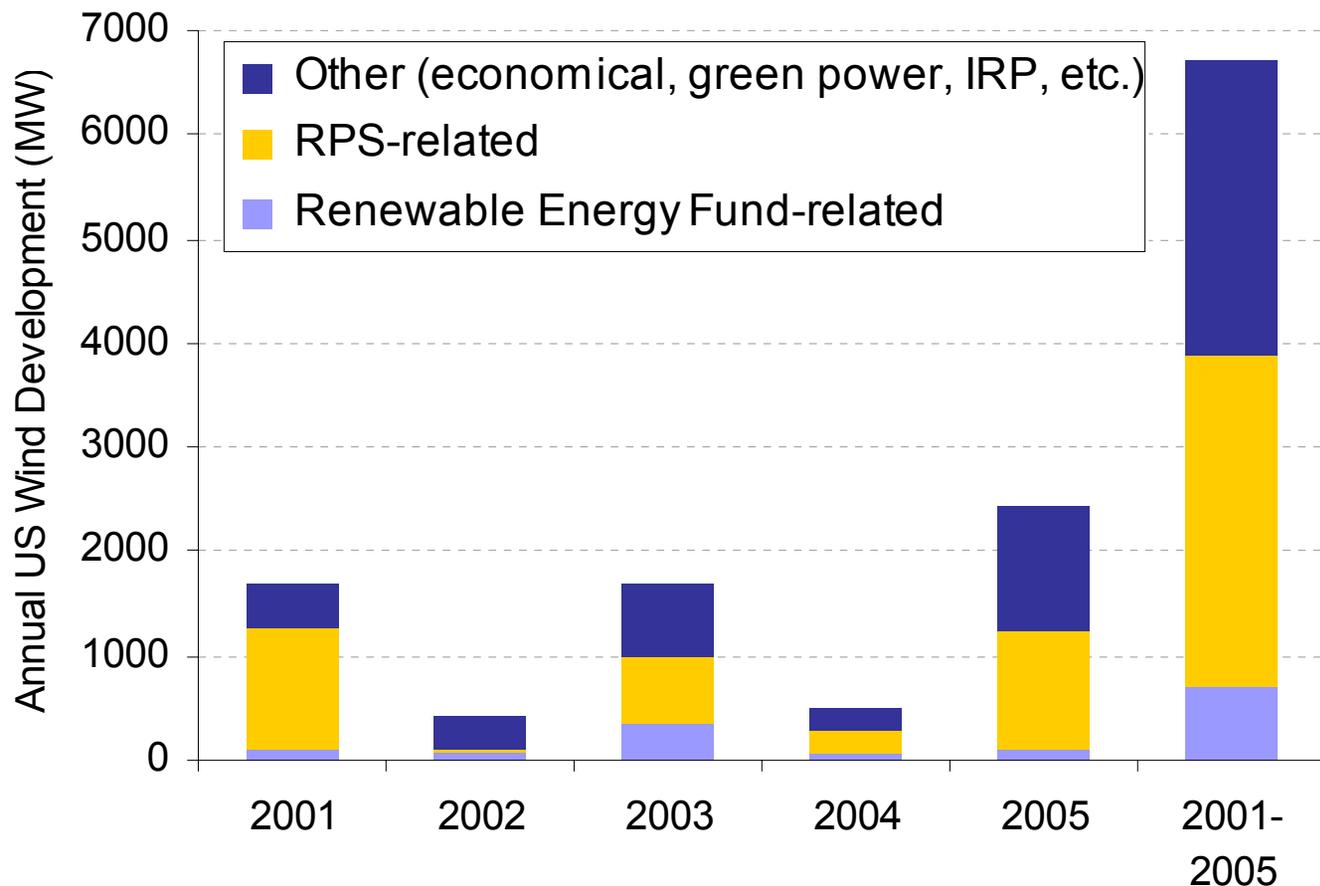
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Energy Analysis Department



Current Renewable Energy Market Drivers in the United States

- ❖ Renewables Portfolio Standards
- ❖ Renewable Energy Funds
- ❖ Federal and State Tax Incentives
- ❖ Green Power Markets
- ❖ Integrated Resource Planning



Integrated Resource Planning (IRP)

- A formal process by which utilities analyze the costs, benefits, and risks of *all* resources available to them
- Goal is to identify a portfolio of resources that meets future needs at lowest cost and/or risk
- Re-emerging as an important planning process in states that are no longer exploring retail competition

Overview of Presentation

Objective: Summarize western utility resource plan treatment of wind power, based on compilation and analysis of resource plan assumptions and methods

- 1) Planned Renewable Energy (RE) Additions in Western Resource Plans
- 2) Factors that Limit, or Promote, Planned Wind Additions
 - Exogenous caps on wind or renewable energy
 - Wind power cost and performance assumptions
 - Treatment of natural gas price and carbon regulation risk
- 3) Conclusions

Western Utility Resource Plans Included in Our Sample: ~50% of Western Load

Resource plans from utilities subject to a Renewables Portfolio Standard (RPS)

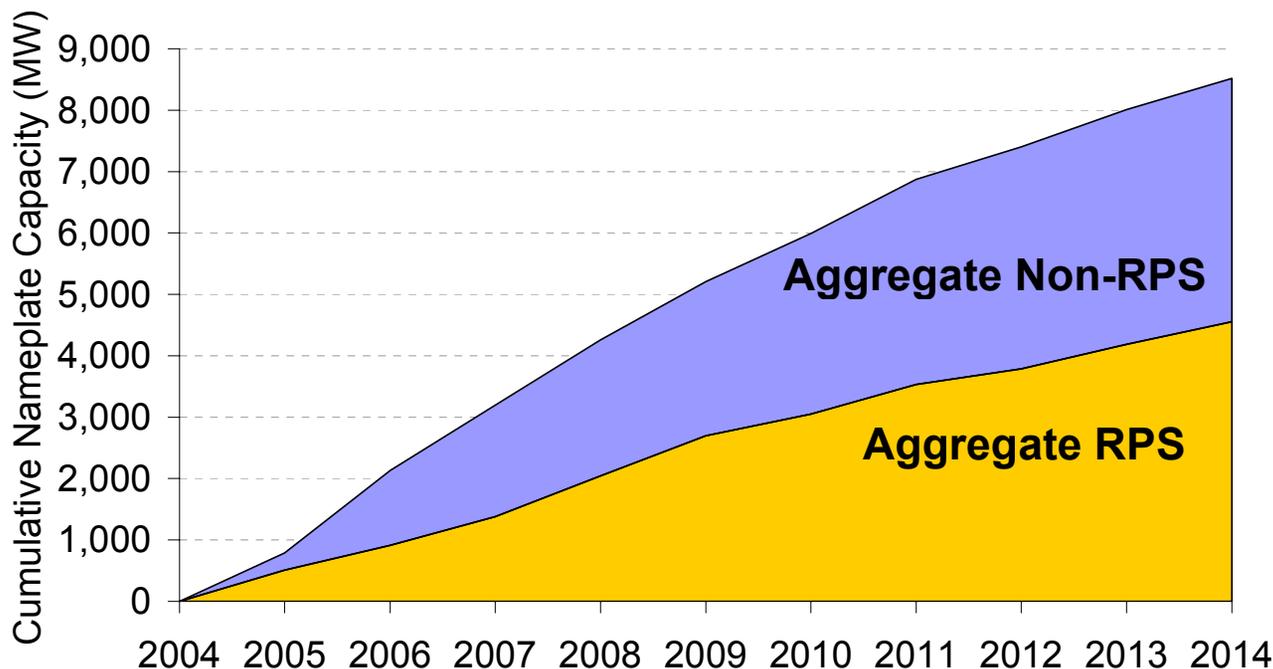
Pacific Gas & Electric (PG&E), Southern California Edison (SCE), San Diego Gas & Electric (SDG&E), Nevada Power, Sierra Pacific

Resource plans in which no regulatory requirements compel RE additions

Avista, Idaho Power, NorthWestern Energy (NWE)*, Portland General Electric (PGE), PacifiCorp, Puget Sound Energy (PSE), Public Service Company of Colorado (PSCo)*

*PSCo's and NWE's most-recent resource plans preceded each state's RPS

Western Resource Plans Could Be a Major Source of Demand for New Renewables



Non-RPS:

Wind accounts for 92% of new RE capacity in 2014

RPS:

Resources often unspecified

New Renewables Capacity in 2014 (MW)

	PG&E	Pacifi-Corp	SCE	PSE (2005)	SDG&E	PSCo	Idaho Power	Nevada Power	PGE	North-Western	Sierra Pacific	Avista (2005)
Non-RPS	0	1,420	0	745	115	500	450	0	195	150	0	390
RPS	<u>2,150</u>	<u>NA</u>	<u>1,021</u>	<u>NA</u>	<u>630</u>	<u>NA</u>	<u>NA</u>	<u>599</u>	<u>NA</u>	<u>NA</u>	<u>154</u>	<u>NA</u>
Total	2,150	1,420	1,021	745	745	500	450	599	195	150	154	390

Resource Plans Leading to Wind Contracts in Non-RPS States *(though not always at the expected pace)*

- **PGE:** 75 MW Klondike II (2005); in 2006, purchased development rights to Biglow Canyon (126 MW in 2007, 350-450 MW total)
- **Idaho Power:** 100 MW RFP reactivated in October 2005 (company estimates 300 MW of wind on its system by end of 2007)
- **Pacificorp:** 41 MW Combine Hills (2003); 64.5 MW Wolverine Creek (2005); 20 MW Schwendiman project (expected 2007); reissued RFP in 2006 for 100 MW by end of 2006, more in 2007
- **NorthWestern:** PPA with 135 MW Judith Gap (2005)
- **Avista:** PPA of 35 MW from Stateline (2004); RFP for 35 aMW issued January 2006
- **PSE:** 150 MW Hopkins Ridge (2005) and 230 MW Wild Horse (2006)

Variation in Planned Wind Additions Depends Largely on IRP Assumptions/Methods

A Wind-Friendly Integrated Resource Plan

Exogenous caps on wind penetration are not applied, and the direct and indirect costs and benefits of wind are fairly evaluated

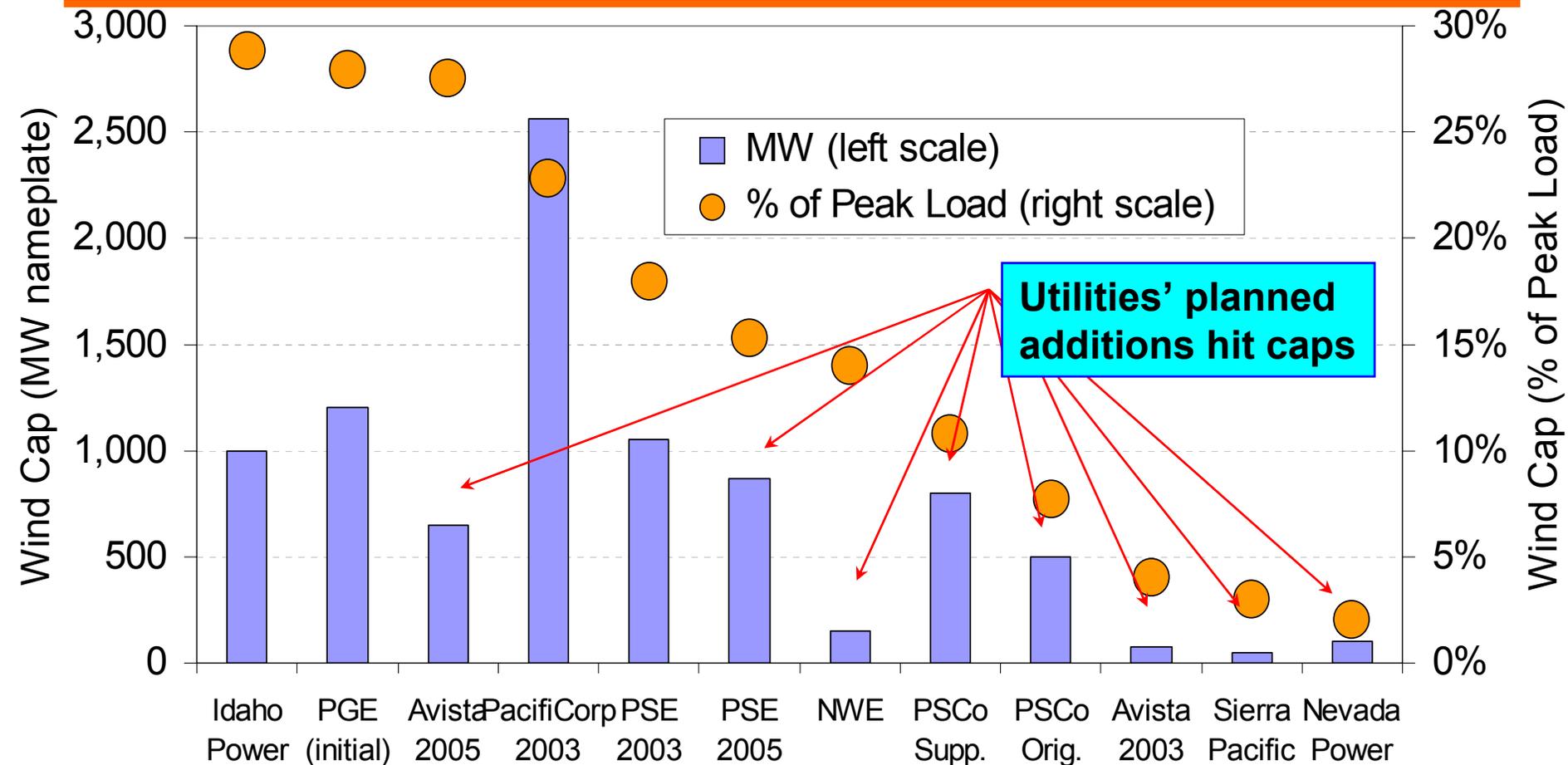
The cost of new conventional resources is correctly evaluated, including consideration of *base-case* fuel prices and fuel price *risks*

The financial risk of future environmental regulations, most importantly carbon, is considered and evaluated

Exogenous Caps Limit the Contribution of Wind Power in Many IRPs

- Resource plans in states with RPS obligations frequently do little to analyze the potential value of exceeding those obligations
 - Nevada Power, Sierra Pacific, SCE, PG&E (original plan)
- Resource plans in states without RPS obligations often exogenously cap the maximum amount of wind additions, to account for concerns over integration costs, transmission constraints, resource limits, etc.
 - In some cases caps are set at very low levels
 - Effectively pre-defines amount of wind ultimately selected

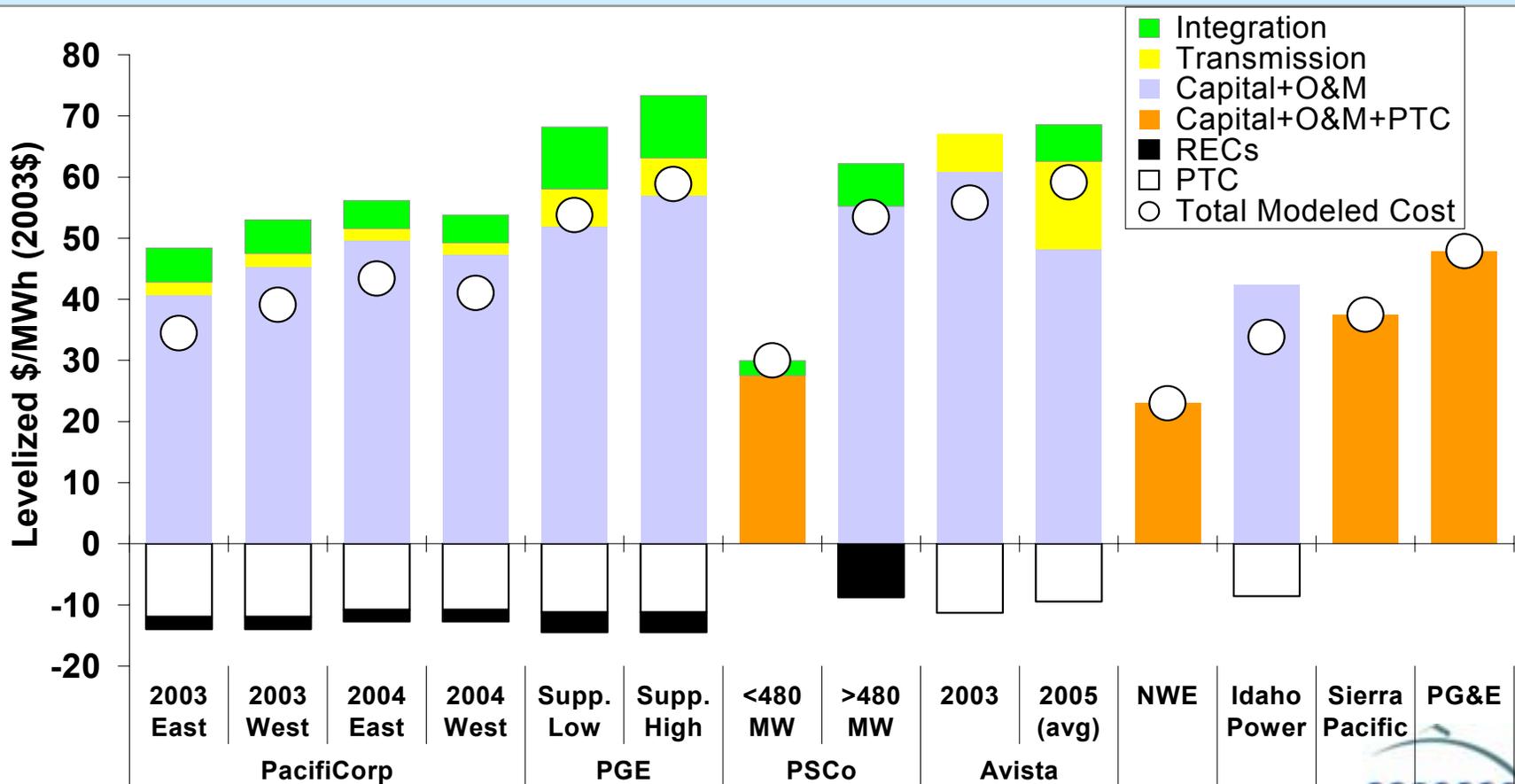
Exogenous Build Limits “Cap” the Amount of Wind Selected by Some Resource Plans



PSE, NWE, PSCo, and Avista all chose portfolios with wind at the cap (Sierra Pacific and Nevada Power do not report RE additions by technology, but presumably would also hit their low caps)

Wind Power Cost and Performance Assumptions Vary Considerably Among the Plans

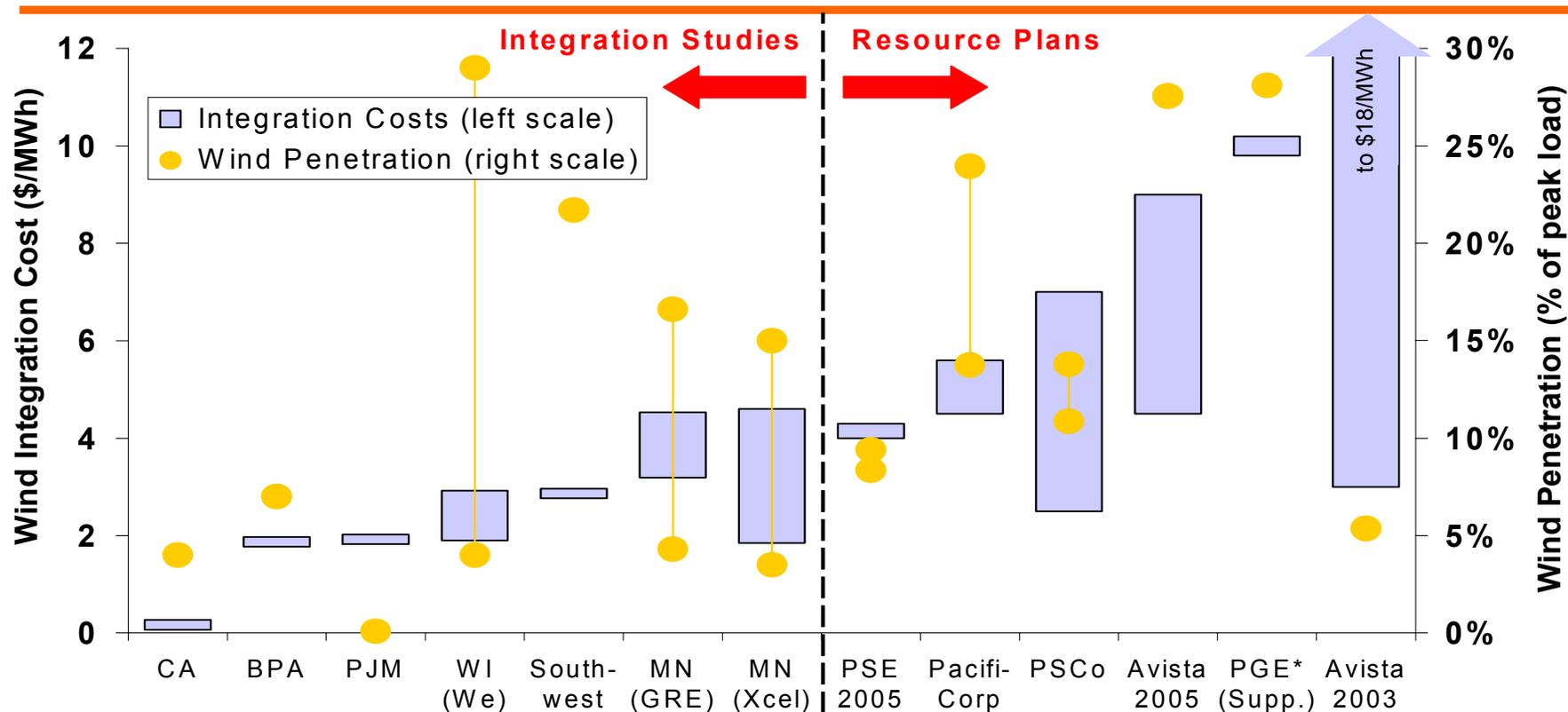
Total cost for wind, including capital and O&M, PTC, integration, transmission, and RECs, ranges from \$23/MWh to \$59/MWh



Assumptions About Cost/Performance of Wind Need Improvement in Some Cases

- **Busbar Costs:** Capital and O&M assumptions are reasonable, but may need to be increased based on recent turbine prices
- **Production Tax Credit:** Undervalued by some resource plans, but many plans overstate the likelihood of renewal
- **Transmission Costs:** Plans often do not try to carefully evaluate transmission expansion needs
- **Integration Costs:** Some plans seem to over-estimate integration costs (or set low caps on wind), but improvements are dramatic in this area
- **Capacity Value:** Undervalued by many plans, but more recent plans more accurately evaluate capacity value

Some Resource Plan Integration Cost Assumptions Are High Compared to Recent Literature

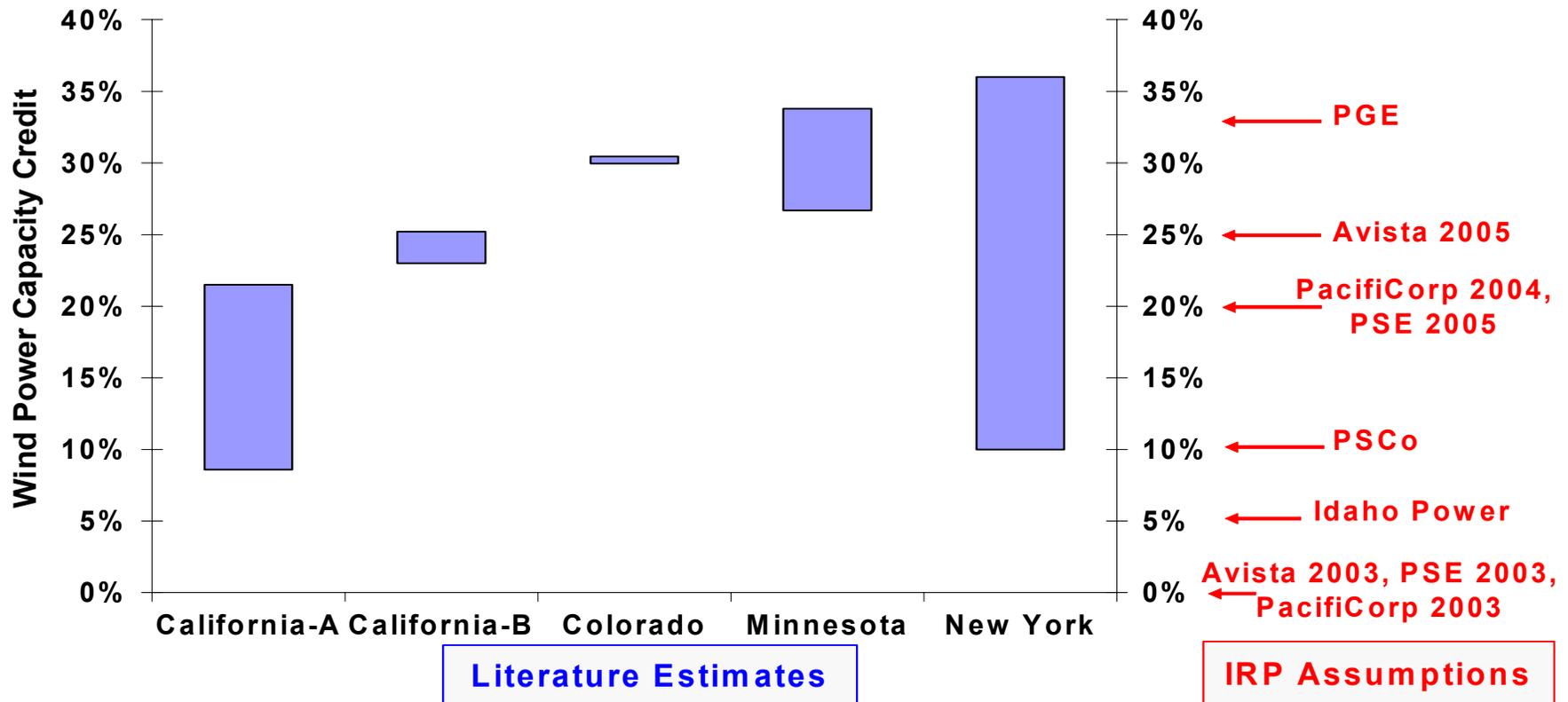


**PGE's supplemental IRP estimates the cost of creating a flat, base-load block of power out of variable wind production, rather than simply the cost of integrating variable wind production. As such, its cost estimate is not directly comparable to the others.*

Some resource plans set strict limits on wind penetration due to concerns about integration costs: Avista 2003 (75 MW, 4% of peak load), Nevada Power (100 MW, 2% of peak load), and Sierra Pacific (50 MW, 3% of peak load)

Some Resource Plan Capacity Value Assumptions Are Low Compared to Recent Literature

- Though less dependable than other resources, wind provides *some* capacity value
- ELCC is the most widely recognized method for determining capacity value
- Most utility plans did not use ELCC to calculate capacity value
- Many plans assumed lower capacity value than suggested in the literature



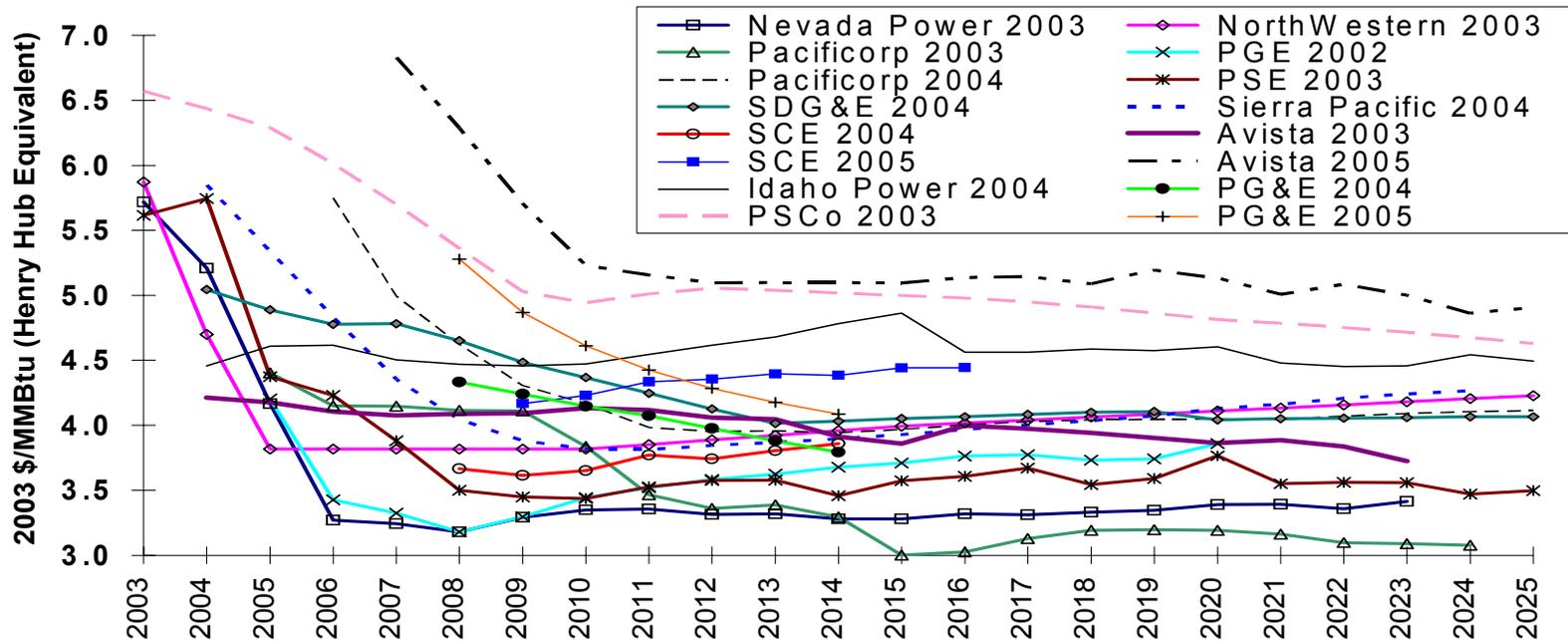
Renewable Energy as a Risk Mitigation Tool

Renewable energy may reduce at least two important risks...

- Risk of high and volatile natural gas prices
- Risk of more stringent environmental regulations

Resource plans are becoming increasingly sophisticated in analyzing both risks, but further improvements are still needed

Plans Increasingly Using Improved Tools to Evaluate Gas Price Risk

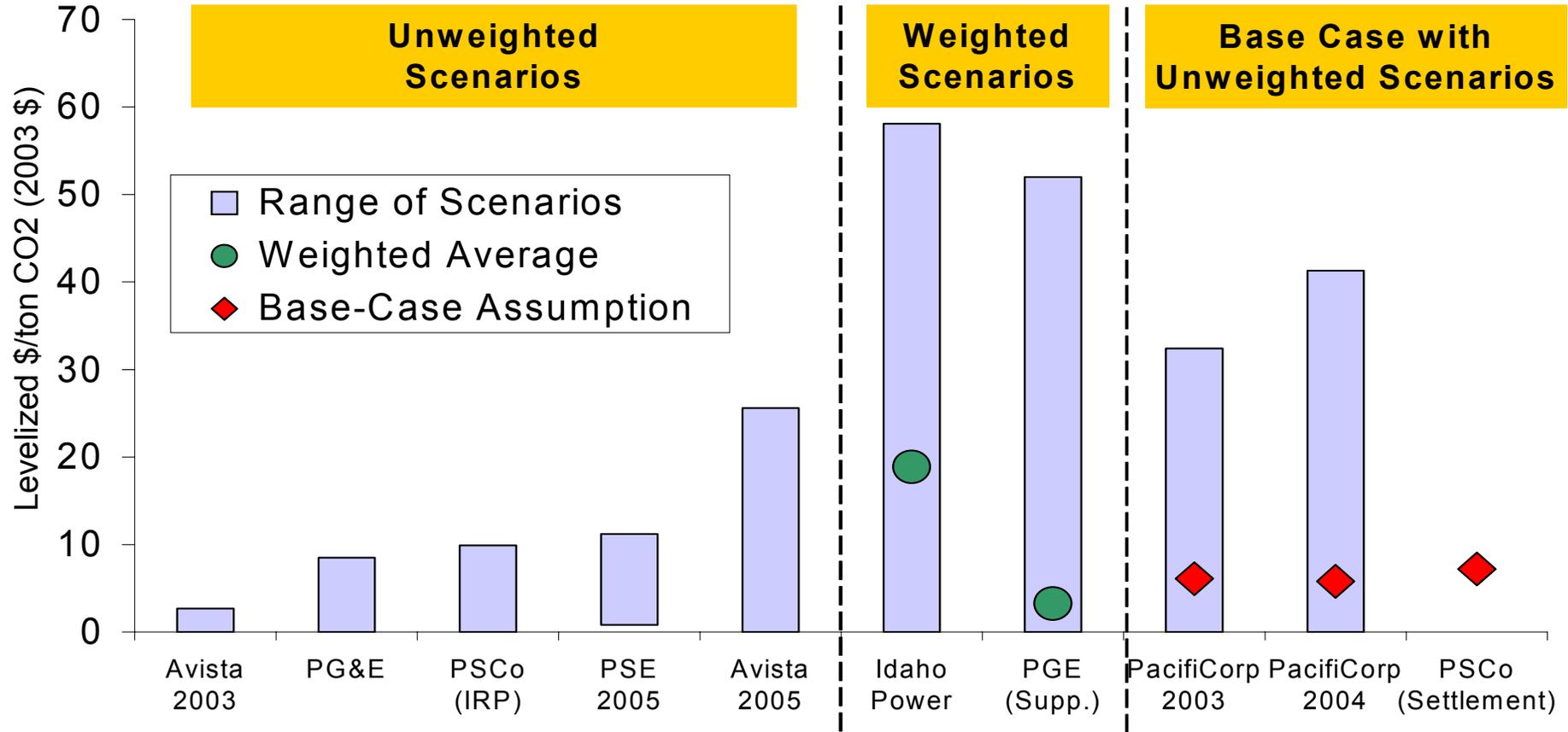


- Current price expectations as revealed through NYMEX futures markets suggest that higher gas-price forecasts are warranted
- IRPs using improved tools to evaluate uncertainty, but range of plausible prices may be greater than assumed in some cases

Resource Plans Are Beginning to Evaluate Carbon Regulatory Risk

- 7 of 12 considered risk in latest round of resource plans
- Minimum of 10 of 12 plans will consider this risk in next round
 - Two outliers: Nevada Power, Sierra Pacific
- For those utilities considering this risk, approaches vary
 - 1) Carbon scenarios but with no probabilities attached
 - 2) Carbon scenarios with probabilities attached
 - 3) Included in base-case, sometimes with scenarios
- Some utilities may not be evaluating a sufficiently broad range of possible carbon regulation scenarios
- Risk of heightened environmental regulations, beyond carbon, are routinely ignored, but likely are of lesser importance to wind

Methods and Approach to Carbon Risk Evaluation Vary



Avista 2003 vs. 2005: What a Difference a Single Planning Cycle Can Make!

	Avista 2003	Avista 2005
Levelized Cost (w/PTC and Transmission) <i>(2003 \$/MWh)</i>	55.8	53.1
Capacity Value <i>(% of nameplate)</i>	0%	25%
Integration Cost Range <i>(\$/MWh)</i>	3-18	4.5-9
Natural Gas Price Forecast (Base-Case) <i>(levelized 2003 \$/MMBtu)</i>	4.0	5.4
Carbon Cost Scenario Range <i>(2003 \$/ton CO₂)</i>	0-3	0-26
Exogenous Cap on Wind Allowed in Portfolio	75 MW	650 MW
Wind Included in Preferred Portfolio	75 MW	650 MW

Even with little change in assumed cost, “fixing” other related inputs can lead to vastly greater wind penetration

Conclusions

Resource plans increasingly consider wind a serious resource option, and methodological improvements are dramatic

But further improvements are still possible and needed:

- 1) Exogenous caps on wind penetration should be removed and replaced with credible analysis of the cost of increased penetrations
- 2) Evaluation of integration and transmission costs, and capacity value, should continue to be refined (especially at higher wind penetration levels)
- 3) The value of the federal production tax credit, and its risk of expiration, could be more consistently addressed
- 4) Assumed installed cost of wind may need to increase given recent cost dynamics
- 5) A more consistent and comprehensive approach to the incorporation of fuel price and carbon regulatory risk should be sought

Continuous benchmarking of *actual* procurements relative to resource *plans* is warranted

For More Information...

Download the full report from:

<http://eetd.lbl.gov/ea/ems/re-pubs.html>

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