
Reading the Tea Leaves: **How Utilities in the West Are Managing Carbon Regulatory Risk in their Resource Plans**

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Project Overview

Motivation: Uncertainty about the nature and timing of future carbon dioxide regulations poses substantial financial risks for utility shareholders and ratepayers, but these risks can be managed through effective long-term resource planning

Scope: A comparative analysis of the most recent resource plans issued by utilities in the Western U.S., focusing on issues related to carbon regulatory risk

Two components

- 1. Analysis of carbon regulatory risk:** Comparison of utilities' methods and assumptions used to assess carbon regulatory risk and risk management options
- 2. Preferred resource portfolios:** Comparison of preferred resource portfolios selected by utilities and their carbon intensities

Our Sample of Resource Plans

- **The most recent resource plans issued by 15 Western U.S. utilities**
- **Represents ~60% of Western utility sales**
- **Focus on largest utilities**
- **No utilities from Arizona (no formal IRP) or New Mexico (IRP just getting started)**

Utility	IRP Year
Avista	2007
Idaho Power	2006
LADWP	2006
Nevada Power	2006
NorthWestern Energy	2007
PacifiCorp	2007
PG&E	2006
PGE	2007
PSCo	2007
PSE	2007
SCE	2006
SDG&E	2006
Seattle City Light	2006
Sierra Pacific	2007
Tri-State G&T	2007

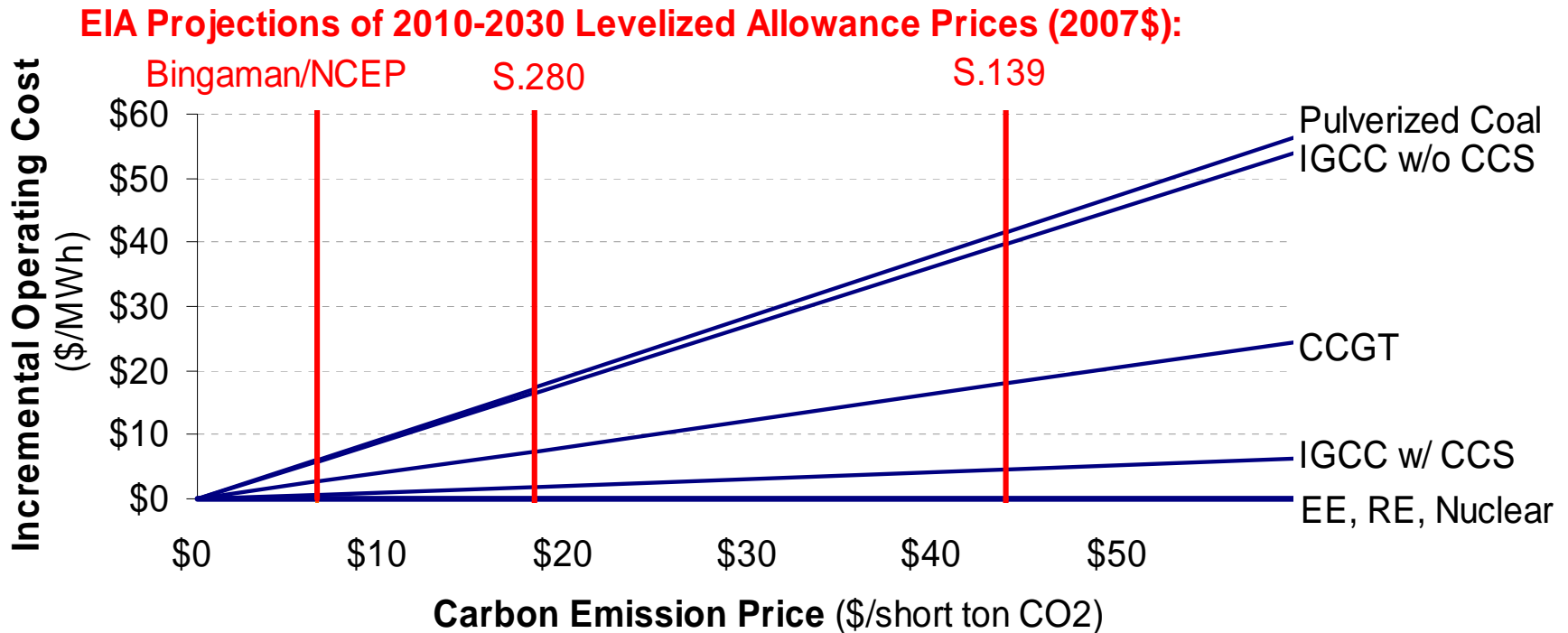
Presentation Outline

- **The significance of carbon regulatory risk for utility resource planning**
- **Analysis of carbon regulatory risk in Western utilities' resource plans**
 1. Assumptions about future carbon emission costs
 2. The type and quantity of low-carbon resources evaluated
 3. Assumptions about indirect impacts of carbon regulations on utility planning environment (e.g., natural gas prices, load growth)
 4. The manner in which uncertainty in candidate portfolio costs is considered in the process of selecting the preferred portfolio
- **The composition and carbon intensity of Western utilities' preferred resource portfolios**
- **Summary and recommendations**

Future Carbon Regulations Could Have Far-Reaching Impacts for the Electricity Industry

EIA's Analysis of:	EIA Projection of U.S. Electric Sector Carbon Dioxide Emissions under Proposed Legislation	Percent of Economy-Wide Greenhouse Gas Emission Reductions Obtained from the Electricity Sector
McCain-Lieberman 2003 (S.139)	76% decline from 2010 to 2025	68%
McCain-Lieberman 2007 (S.280)	48% decline from 2010 to 2030	73%
Bingaman/NCEP 2006 draft legislation	11% increase from 2010 to 2030 (compared to a 31% increase in reference case)	30%

The Potential Impact on the Relative Economics of Electric Resources is Highly Uncertain



- **Uncertainty in the relative impact on different resource options creates significant financial risk for utilities and their ratepayers**
- **Low-carbon resources offer a hedge against these risks**

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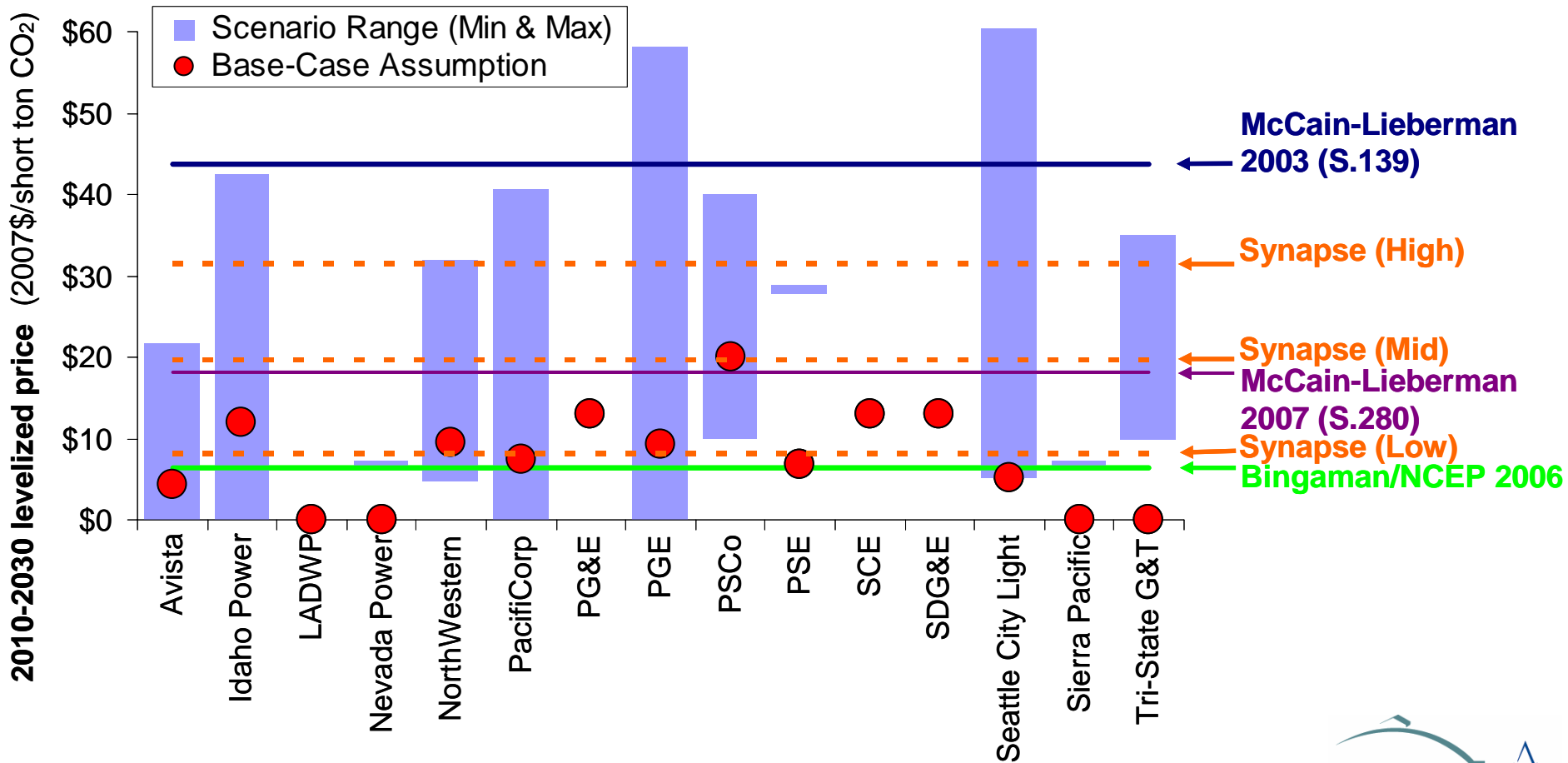
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Incorporating Carbon Costs into Resource Planning Analyses is Common Practice

- **All utilities except LADWP modeled candidate portfolio costs subject to carbon regulations** (beyond existing state laws)
 - Ten utilities assumed future carbon regulations in their base case
 - Eight utilities evaluated multiple future carbon regulations
- **Mandatory carbon reductions generally modeled by utilities as a carbon tax or cap-and-trade**
 - No utilities specifically modeled a state or regional cap-and-trade programs
- **Specific carbon price projections based on:**
 - PUC rules (OR, CA, NM)
 - Federal policy proposals (e.g., NCEP recommendations)
- **Limited consideration of other types of carbon regulations**
 - PacifiCorp considered a multi-state generator emission performance standard
 - PGE assumed that existing Oregon carbon mitigation law would be expanded to cover coal

Utilities' Base-Case and Alternate Carbon Emission Price Projections

Levelized Carbon Emission Price Projections (2010-2030)

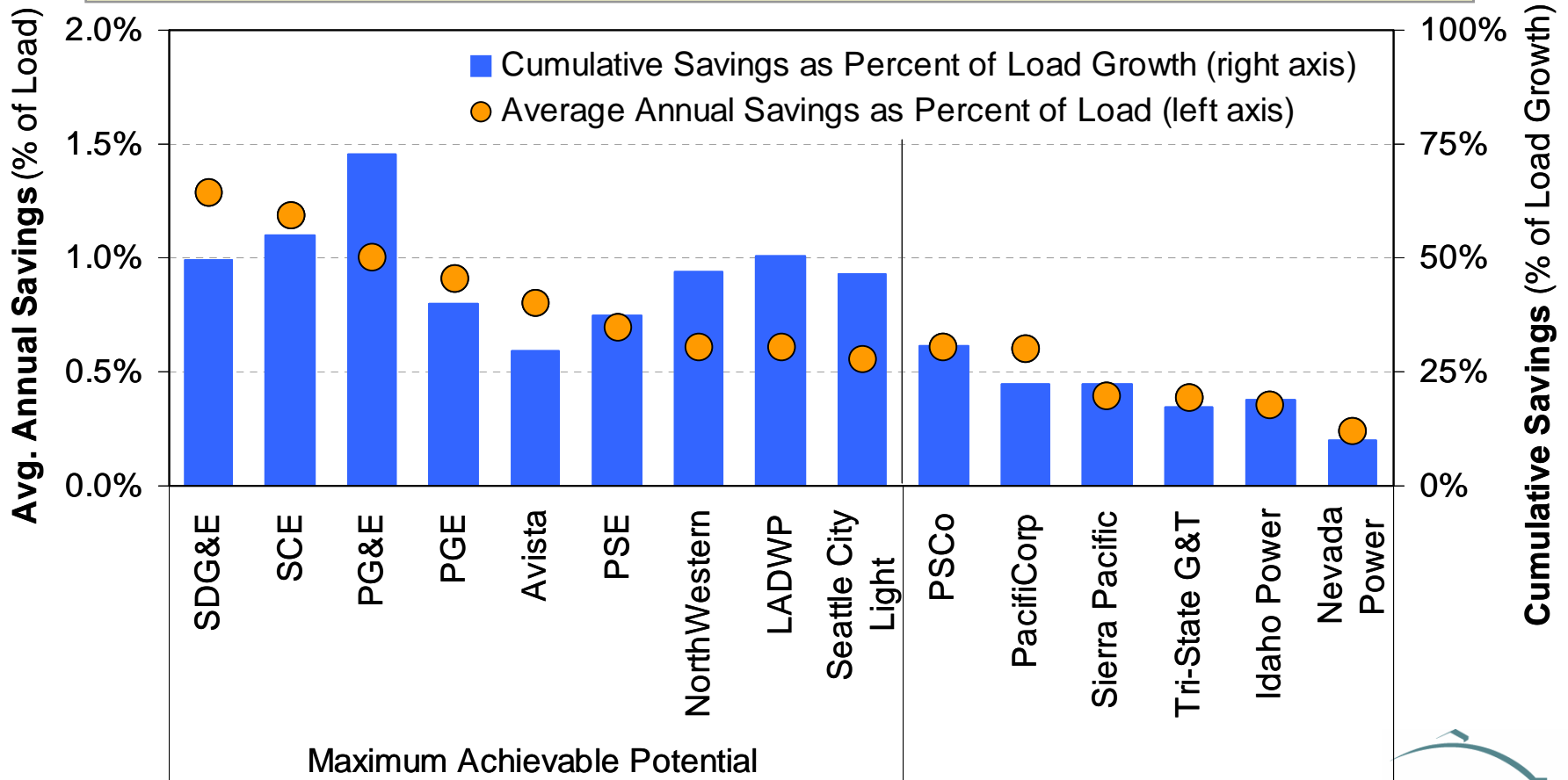


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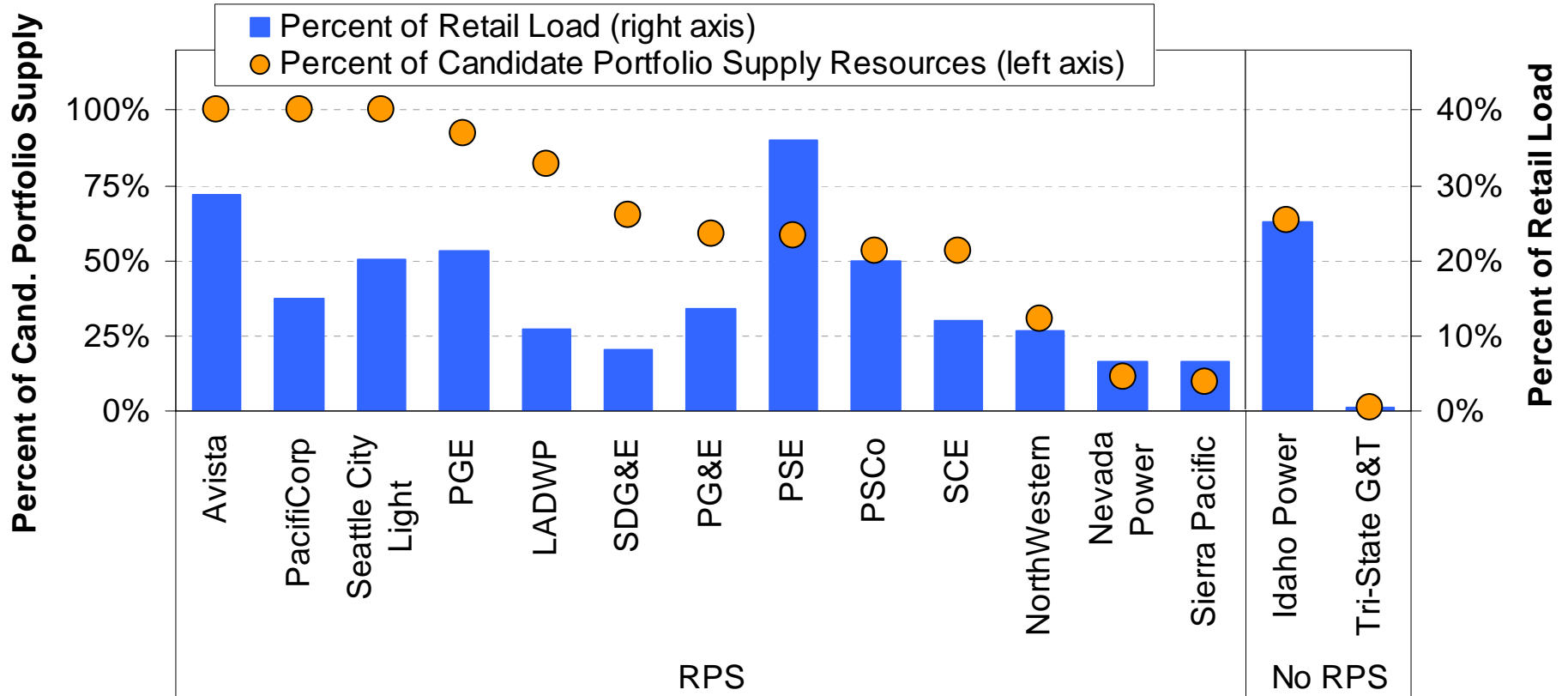
Most Utilities Considered Aggressive Long-Term EE Targets in their Resource Plans

Maximum Quantity of EE Evaluated in Candidate Portfolios
(utility-funded programs over the planning period)



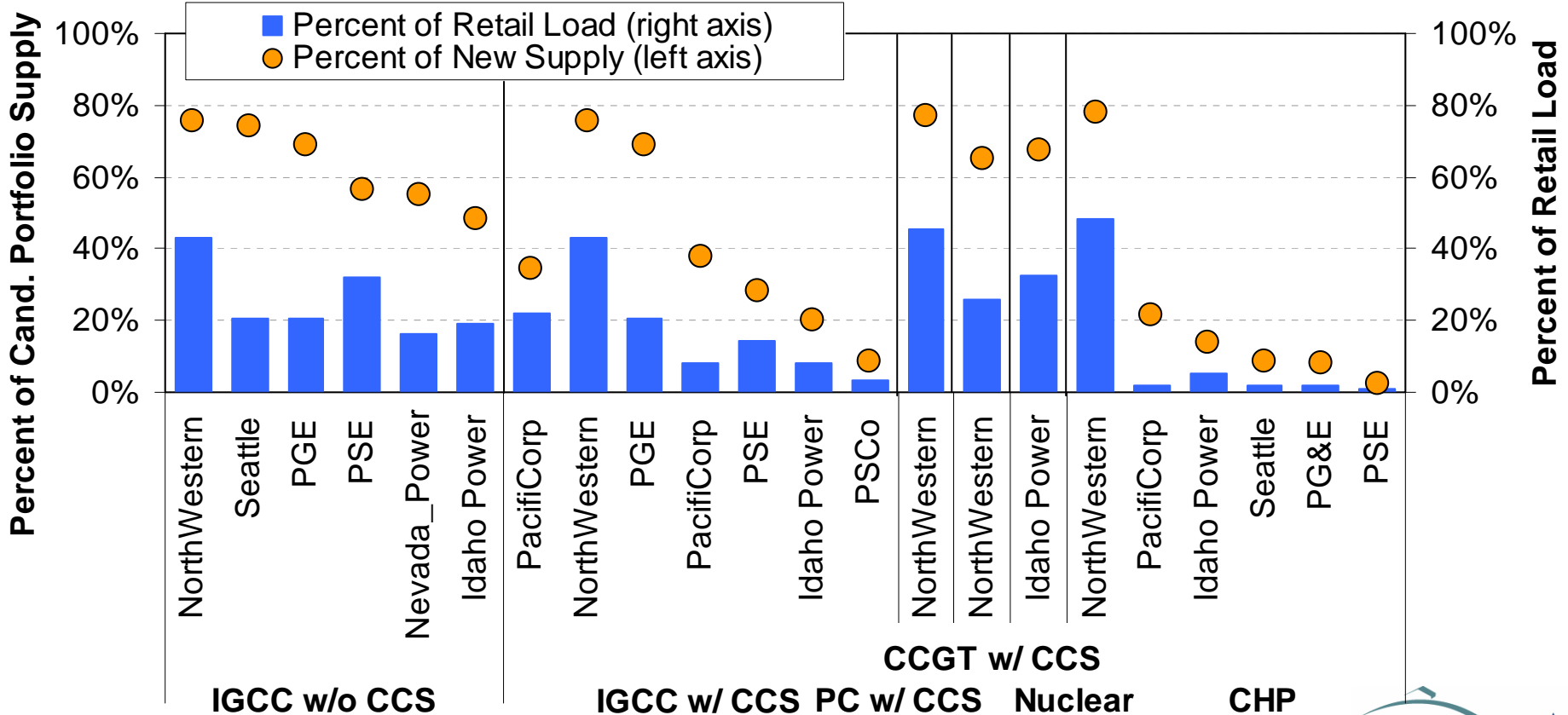
Most Utilities Evaluated Candidate Portfolios with Aggressive Levels of Renewables

Maximum Quantity of New Renewables Evaluated in Candidate Portfolios
 (excludes already-planned resources and contract renewals)



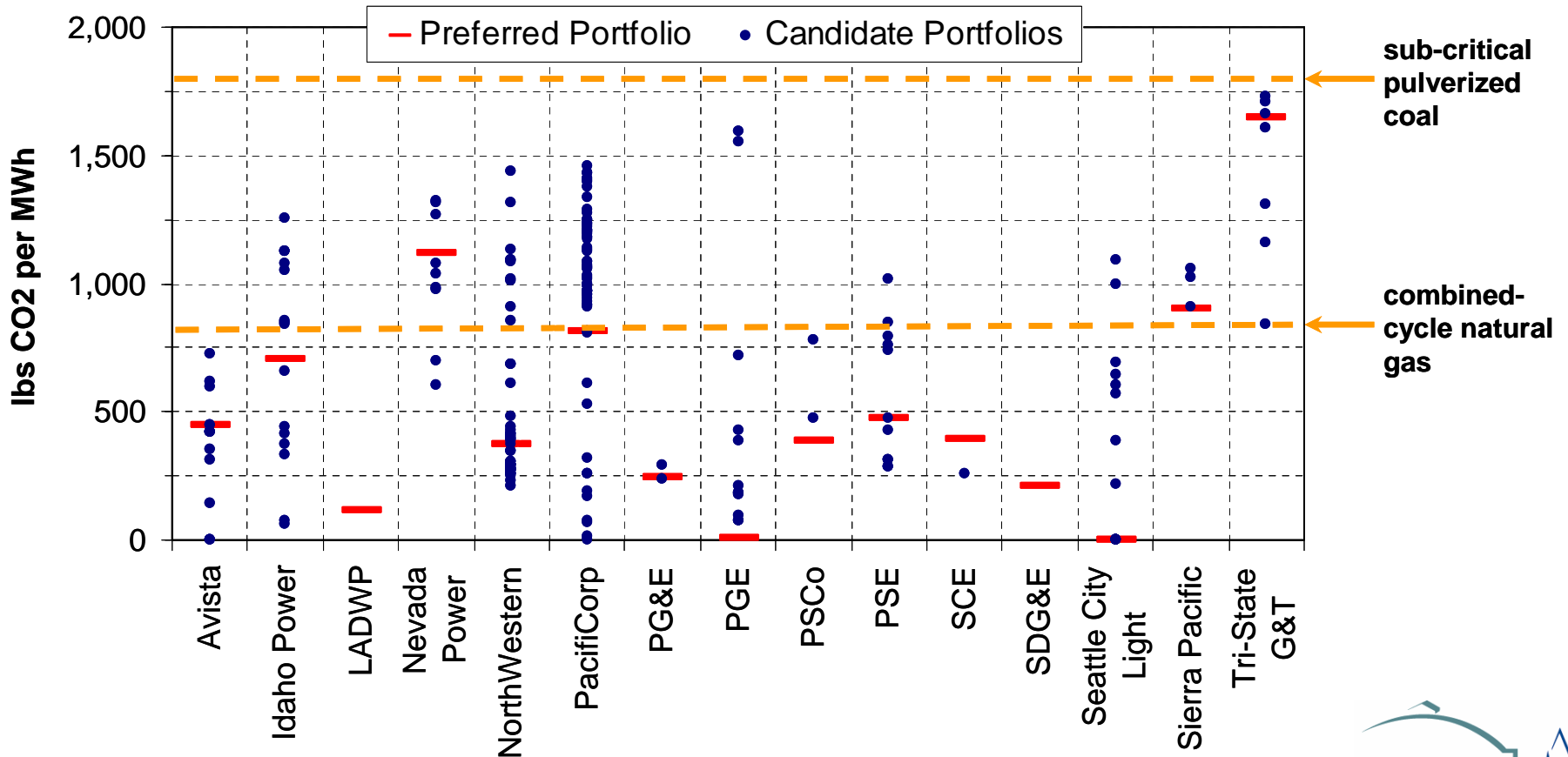
Utilities' Evaluation of other Types of Low-Carbon Resource Options is More Limited

Maximum Quantity of IGCC with/without CCS, CCGT w/ CCS Nuclear, and CHP Evaluated in Candidate Portfolios



Most Utilities Constructed Multiple Low-Carbon Candidate Portfolios

Carbon Intensity of Utilities' Candidate Portfolios and Preferred Portfolios
(weighted-average emission rate of new supply- and demand-side resources)



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Utilities Often Ignore Potentially Important Indirect Effects of Carbon Regulations

Elements of the Portfolio Analysis Varied with Carbon Regulations

Utility	Marginal Generation Costs in Wholesale Electricity Market	Natural Gas Prices	Air Pollutant Permit Prices	Load Growth	Coal Plant Retirement	Regional Generation Expansion	Regional Transmission Expansion	Availability of Federal Incentives	Generation Capital Costs and Technology Development
Avista	✓			✓		✓		✓	
Idaho Power	✓								
LADWP									
Nevada Power			✓						
NorthWestern	✓								
PacifiCorp	✓	✓	✓			✓			
PG&E	*								
PGE	✓				✓				
PSCo	✓	✓		✓	✓				
PSE	✓	✓		✓		✓			
SCE	*								
SDG&E	*								
Seattle City Light	✓	✓		✓		✓			
Sierra Pacific			✓						
Tri-State G&T									

The absence of a check mark (✓) indicates either that the utility did not account for a particular impact or that its resource plan did not provide sufficient detail to determine whether or not it accounted for that impact. Asterisks () shown for PG&E, SCE, and SDG&E indicate that these utilities did not account for carbon regulations in their electricity price forecast, but they did include their base-case carbon price as an adder when evaluating the cost effectiveness of energy efficiency and renewable energy resource acquisitions.*

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Incorporating Carbon Risk into the Portfolio Selection Process

Candidate portfolios can be compared in terms of:

- Expected cost
- Uncertainty in cost

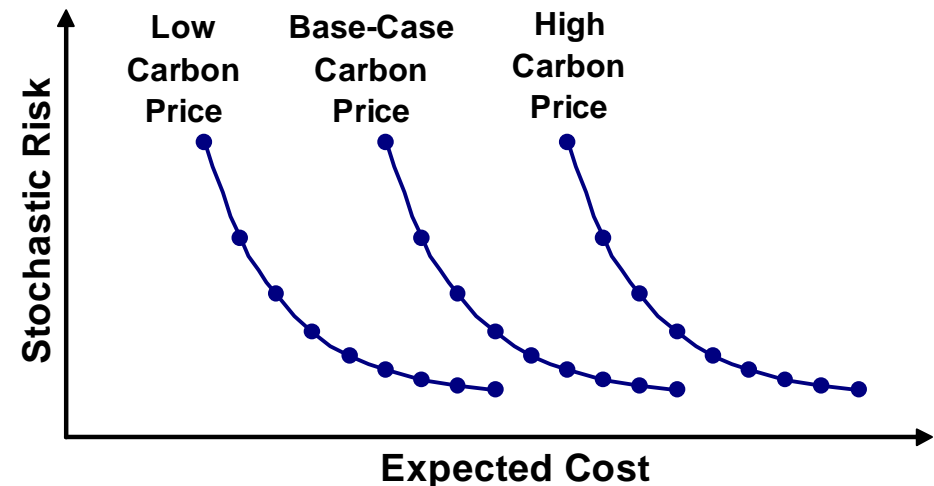
Probabilistic uncertainties can be reduced to single stochastic risk metrics

Carbon regulatory risks are less amenable to this type of approach

Two challenges in dealing with carbon regulatory risk

1. How to characterize and compare candidate portfolios' exposure to carbon regulatory risk (given the absence of objectively-defined probabilities)
2. How to make trade-offs between minimizing expected cost and minimizing overall portfolio risk

The “efficient frontier” of candidate portfolios across carbon price scenarios



It Is Often Unclear How or Whether Carbon Risk Informs Selection of the Preferred Portfolio

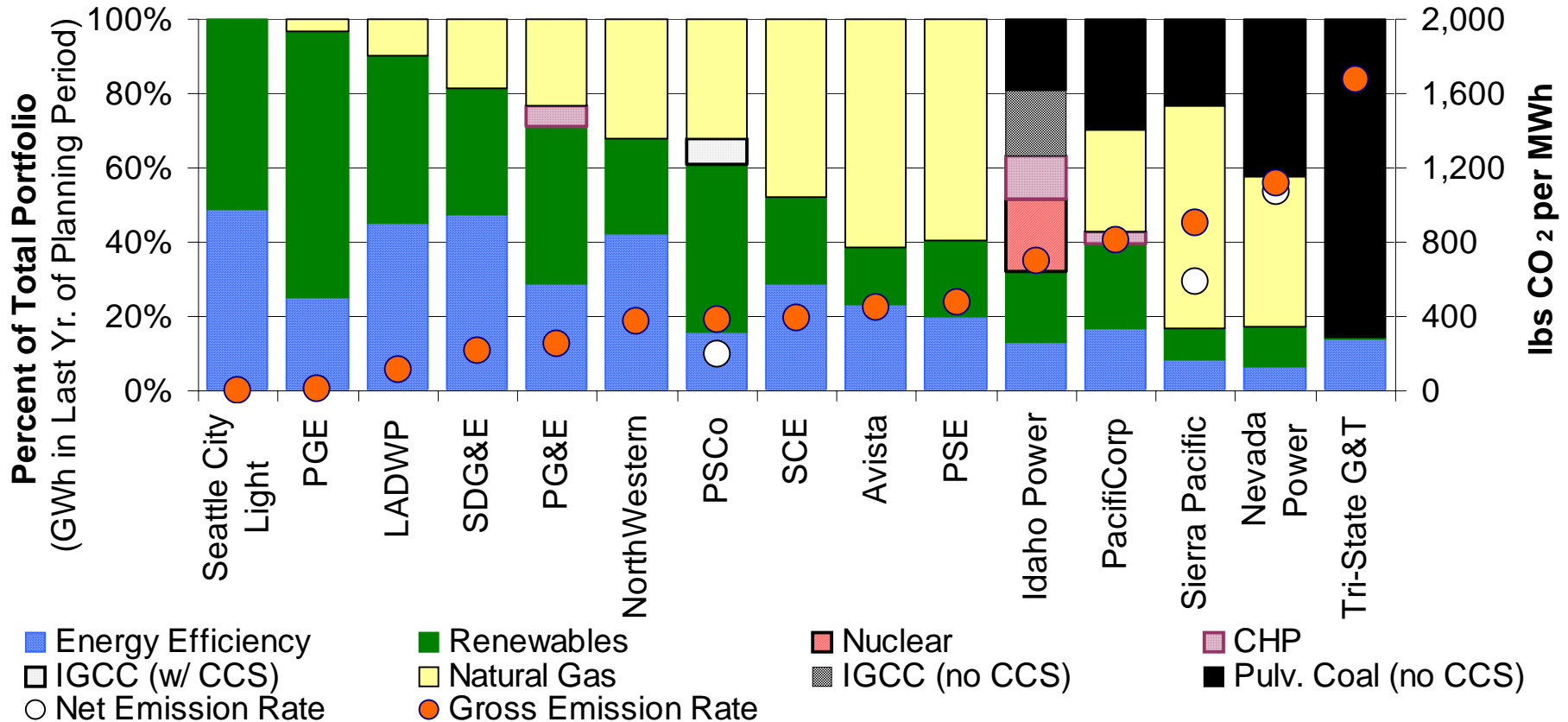
- **Eleven utilities evaluated candidate portfolio costs across multiple carbon price scenarios...**
- **But only five clearly relied upon results from these scenarios in selecting their preferred portfolios:**
 - **Avista:** Modeled carbon regulations as a stochastic variable and selected portfolio along the efficient frontier
 - **Idaho Power:** Developed “risk adders” for various scenario risks and ranked portfolios according to both expected cost and total risk
 - **Northwestern:** Developed risk-adjusted cost metric for each candidate portfolio, by assigning weights to alternate scenarios
 - **PacifiCorp:** Used to capacity expansion model to determine which resources were “robust” across carbon scenarios
 - **PSE:** Identified “threshold probability” of high carbon prices

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The Carbon Intensity of Utilities' Preferred Portfolios Varies Widely

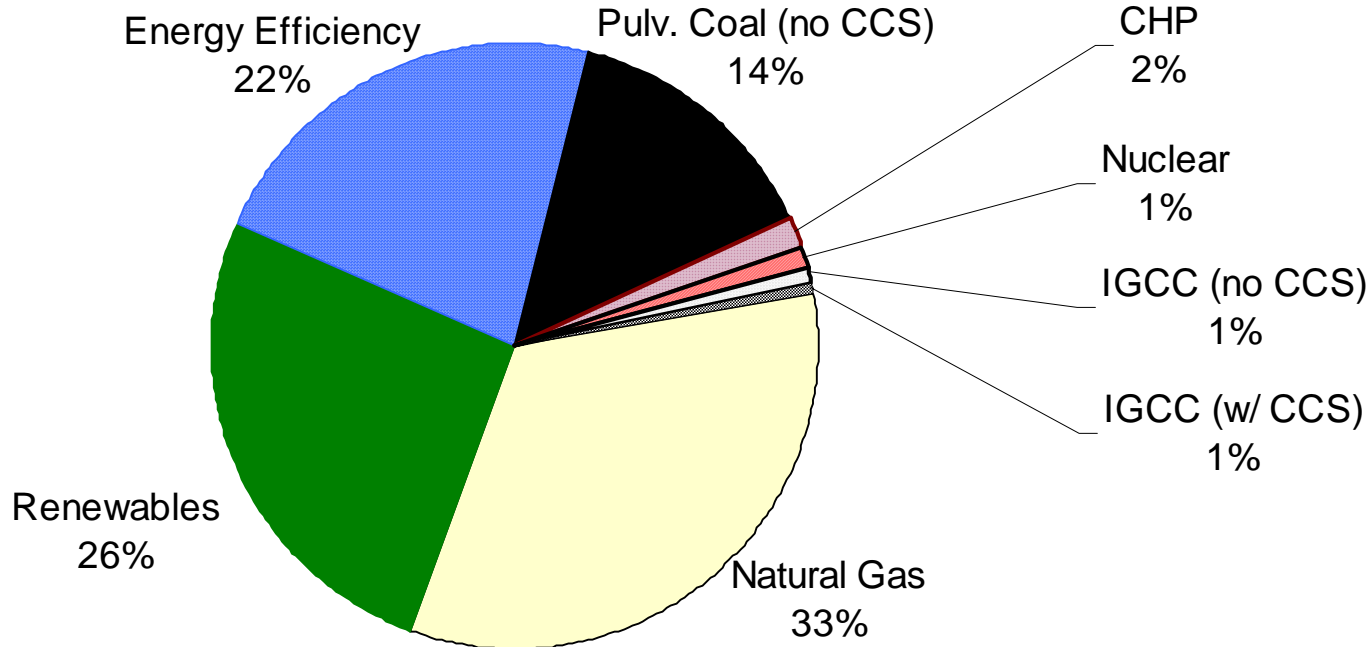
Composition & Composite CO₂ Emission Rate of Utilities' Preferred Portfolios



Notes: The figure reflects new, long-term resources in utilities' preferred portfolios (i.e., excludes contract renewals and short/medium-term market purchases) in the last year of their planning periods. Gross emission rate reflects new incremental resources; net emission rate also accounts for retirements.

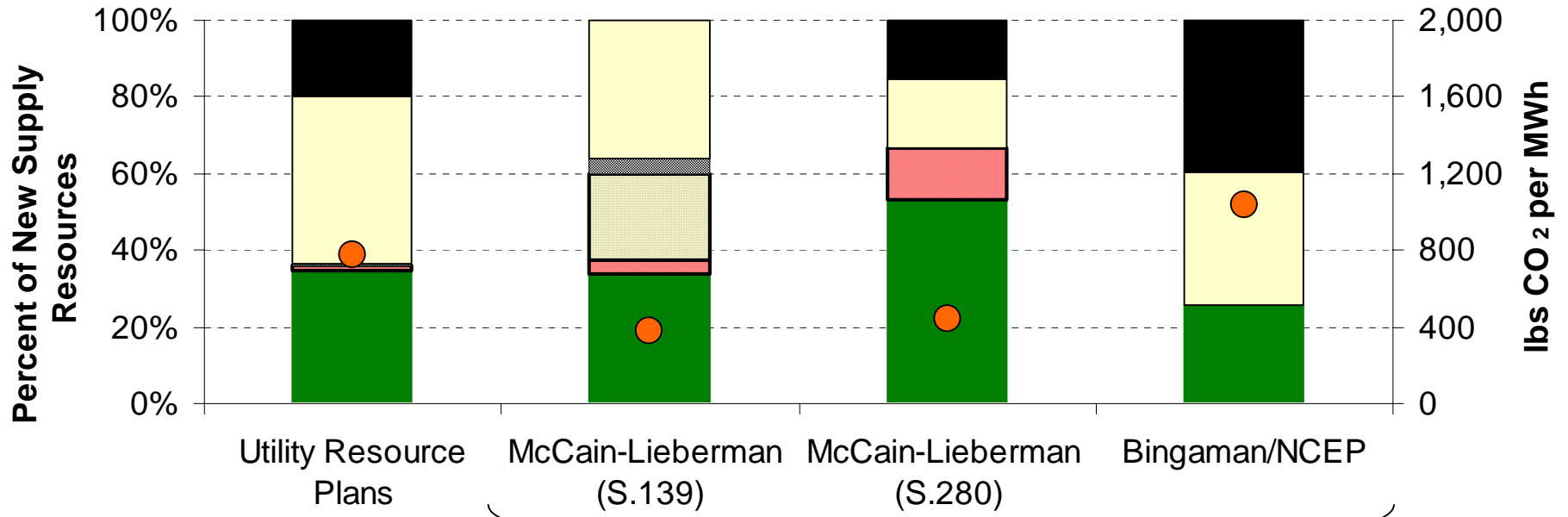
In Aggregate, Natural Gas Generation is the Largest Component in Utilities' Preferred Portfolios

Aggregate Resource Additions in Utilities' Preferred Portfolios (annual GWh)



In Aggregate, Utility Preferred Portfolios are Consistent with a Modest Carbon Policy

Comparison of Aggregate New Supply-Side Resources in Utility Preferred Portfolios to EIA Projections of Generation Additions in the West through 2025

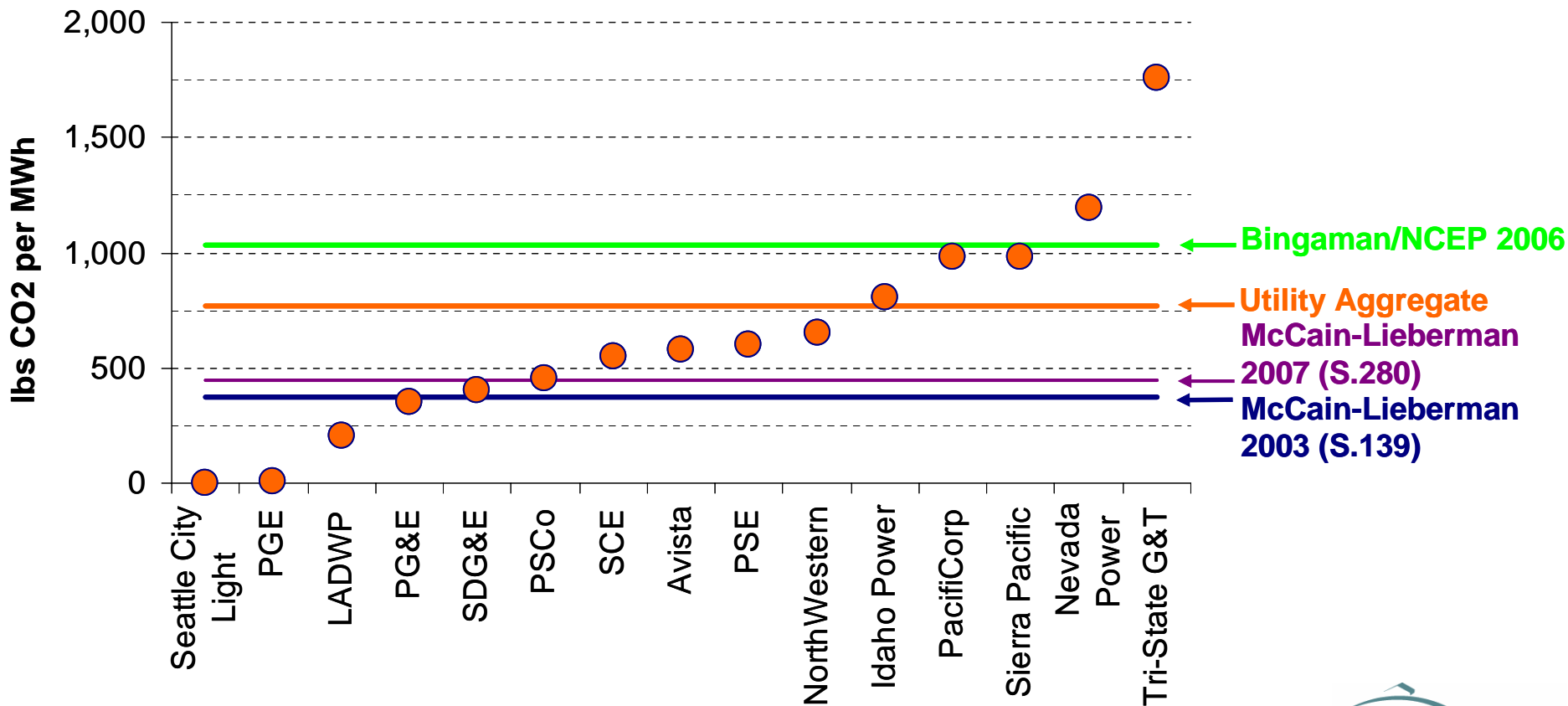


EIA projected generation additions in the West (2005-2025)

- RE
- Nuclear
- Natural Gas (w/ CCS)
- Coal (w/ CCS)
- Natural Gas (no CCS)
- Coal (no CCS)
- CO2 Emission Rate

Exposure to Carbon Regulatory Risk Varies Substantially Across Utilities

Carbon Intensity of Individual Utility Preferred Portfolios Compared to EIA Projections of Generation Additions in the West through 2025



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At the Highest Level...

- **Utilities are making important strides in evaluating carbon regulatory costs and risks in their resource plans**
 - As evident by the fact that virtually all utilities considered carbon costs
 - And several utilities made it a primary focus of their analysis
- **But methods and assumptions are highly varied, and reveal opportunities for improvement**
- **Guidance from regulators is essential to building confidence in the results and to ensuring that ratepayers are adequately protected from risks**

Recommendations to Consider

- 1. Include a reasonable estimate of the “most likely” carbon policy in your state in the base-case scenario and evaluate a broad range of alternate carbon price projections**
 - Workshops or technical advisory groups may be appropriate forums for developing an informed consensus
- 2. Construct candidate portfolios with the maximum achievable energy efficiency potential**
- 3. Value the avoided carbon costs from energy efficiency and the reduced carbon regulatory risk**
 - Show how much energy efficiency would be cost-effective under high carbon price scenarios vs. base-case scenario
- 4. Construct candidate portfolios with the full range of renewable generation options AND at levels above minimum RPS requirements**

Recommendations to Consider (cont.)

- 5. Undertake efforts to develop credible assumptions about the future cost and availability of IGCC, CCS (for IGCC and CCGT), and new nuclear power**
- 6. Account for potentially important indirect effects of carbon regulations**
 - Especially impacts on wholesale electricity market prices, natural gas prices, load growth, and coal-plant retirements
- 7. Develop transparent methods for incorporating information about carbon risk into the portfolio selection process**

For More Information...

Download the Report

<http://eetd.lbl.gov/ea/emp/rplan-pubs.html>

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