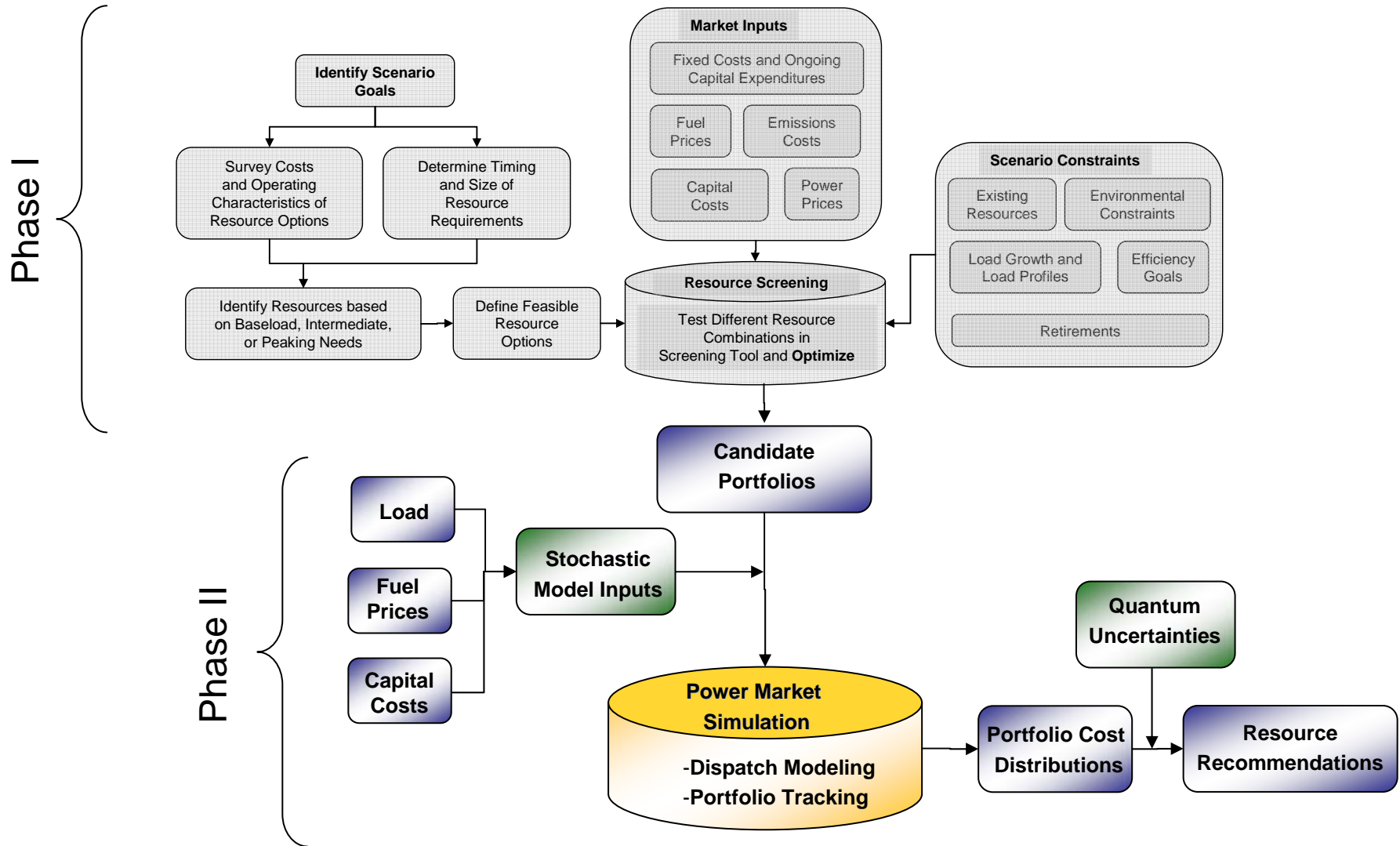




# **Risk Analysis Results Austin Energy**

September 9, 2009

# Risk Analysis – Phase II of Resource Planning Effort



# Portfolios

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- No Additional Generation (Status Quo Risk Profile)
- Draft Energy Resource Plan (“Strawman”)
- Lowest Cost Impact Meeting Council Goals
- Replace FPP with Renewables
- Replace FPP with Nuclear
  - *Replace 300 MW in 2014 and replace with renewables; replace 300 MW in 2020 and replace with nuclear*
- Staff Recommendation

# Portfolio Risk Analysis: Approach

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- Pace evaluated 6 major portfolio concepts
  - Stochastic confidence intervals were developed to represent uncertainty for local and regional electricity demand, fuel prices, capital costs, and wind generation
  - Simulations of Austin Energy's system were performed in the context of wider ERCOT market 500 times ("iterations")
  - Portfolio costs were tracked by year for each iteration
  - Analyzed range of outcomes in addition to mean of total costs
  - Tracked CO<sub>2</sub> emissions for each portfolio for each iteration
  - Analyzed performance of portfolios against quantum scenarios
    - A quantum scenario is intended to capture the effects of a specific market event that can dramatically alter portfolio performance

# Market Risks

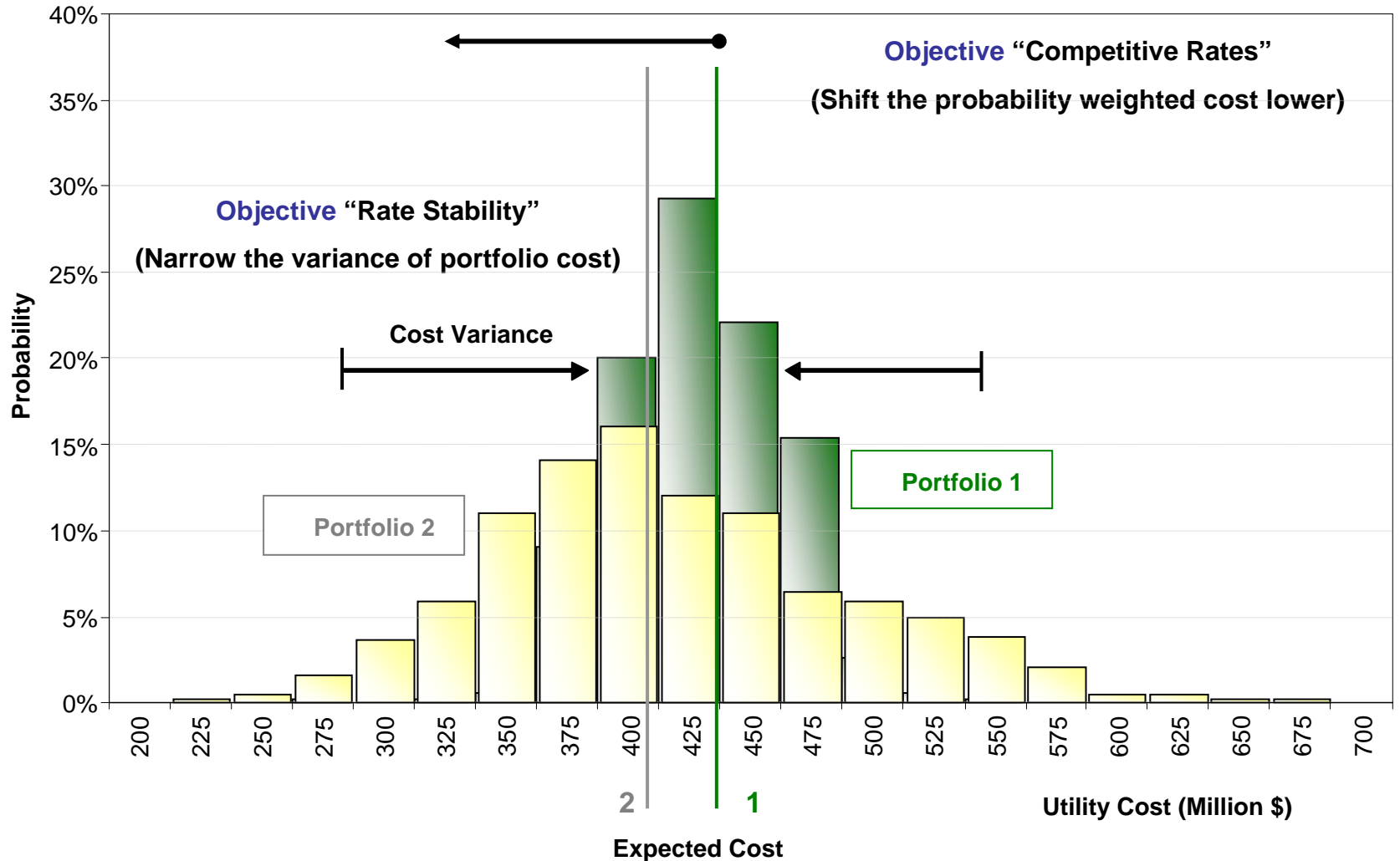
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- Fuel Prices
  - Natural gas prices are highly volatile and expected prices heavily impact power market prices, plant dispatch, and renewable expansion economics
- Electricity Demand
  - Load forecast impacts required capacity additions (timing and type) for Austin as well as wider market price projections
- Power Market Prices
  - Power market prices highly dependent on fuel prices and supply-demand balance in wider market area
- Capital Cost Uncertainty
  - Materials costs and capital costs have been volatile in recent years
  - Technology uncertainty results in wide range of potential outcomes
- CO<sub>2</sub> Costs and Regulations
  - Significant uncertainties exist for cost of CO<sub>2</sub> allowances and timing and stringency of regulations
- Resource Availability
  - Many scenarios are heavily dependent on significant renewable capacity additions, which have variable generation and may not be available when expected
  - Transmission risk for significant wind expansion also exists. This could either limit wind procurement or raise the costs, due to transmission charges.
  - Geothermal and LFG additions are highly uncertain

# Summary of Objectives and Metrics

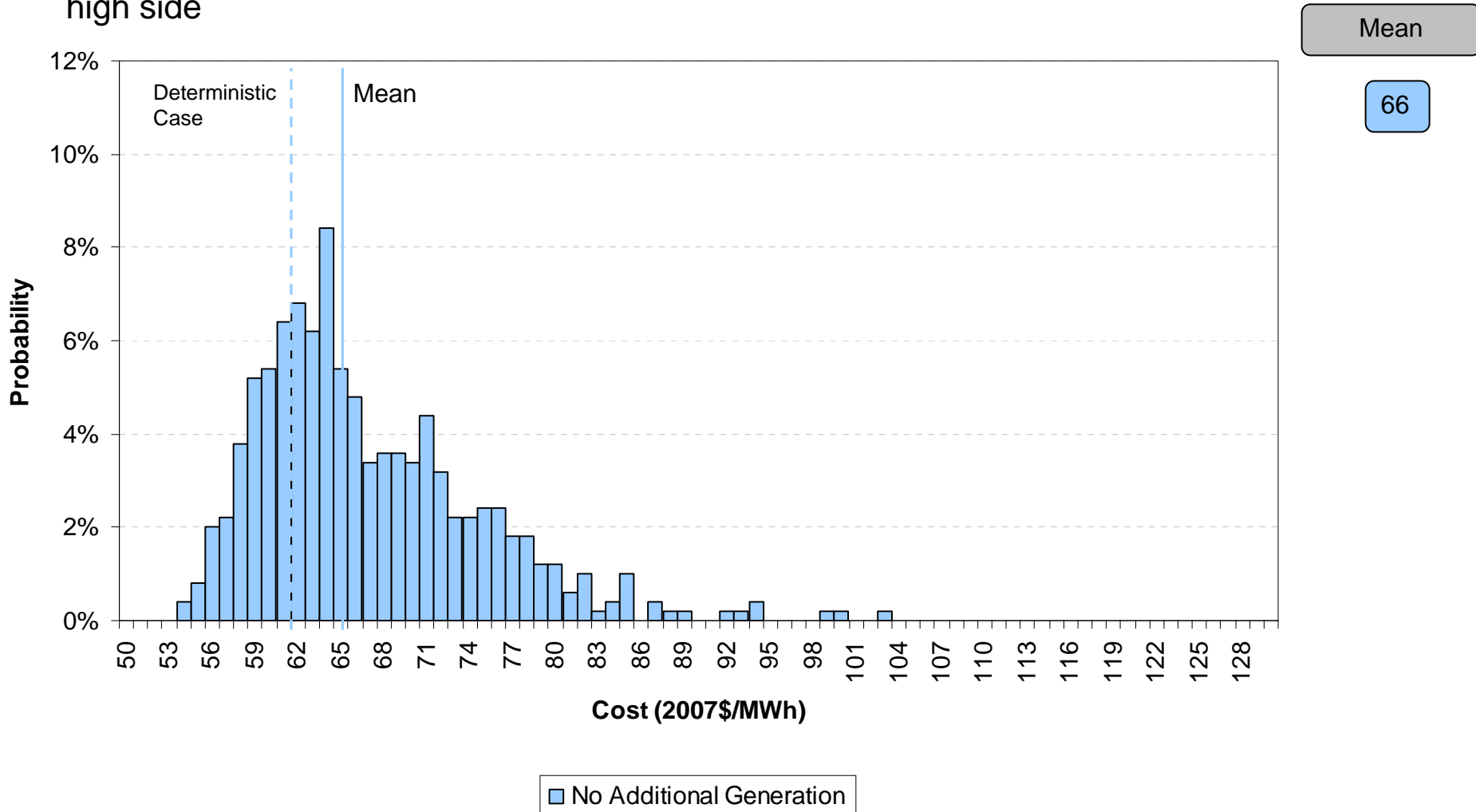
<i>Objectives</i>	<b>Metrics</b>	
	<b>Screening Analysis (Phase I)</b>	<b>Risk Analysis (Phase II)</b>
<i>Low Cost and Competitive Rates</i>	Cost per MWh	Expected Value of cost per MWh
<i>Rate Stability</i>	N/A	Worst outcome cost per MWh (95 <sup>th</sup> percentile)
<i>Environmental Stewardship</i>	CO <sub>2</sub> emissions reduction; RPS compliance with Council Goals	Expected Value of CO <sub>2</sub> emissions reduction and Expected Value of RPS percentage
<i>Reliable Supply</i>	N/A	Cost per MWh without unsecure technologies

# Risk Integrated Portfolio Distributions



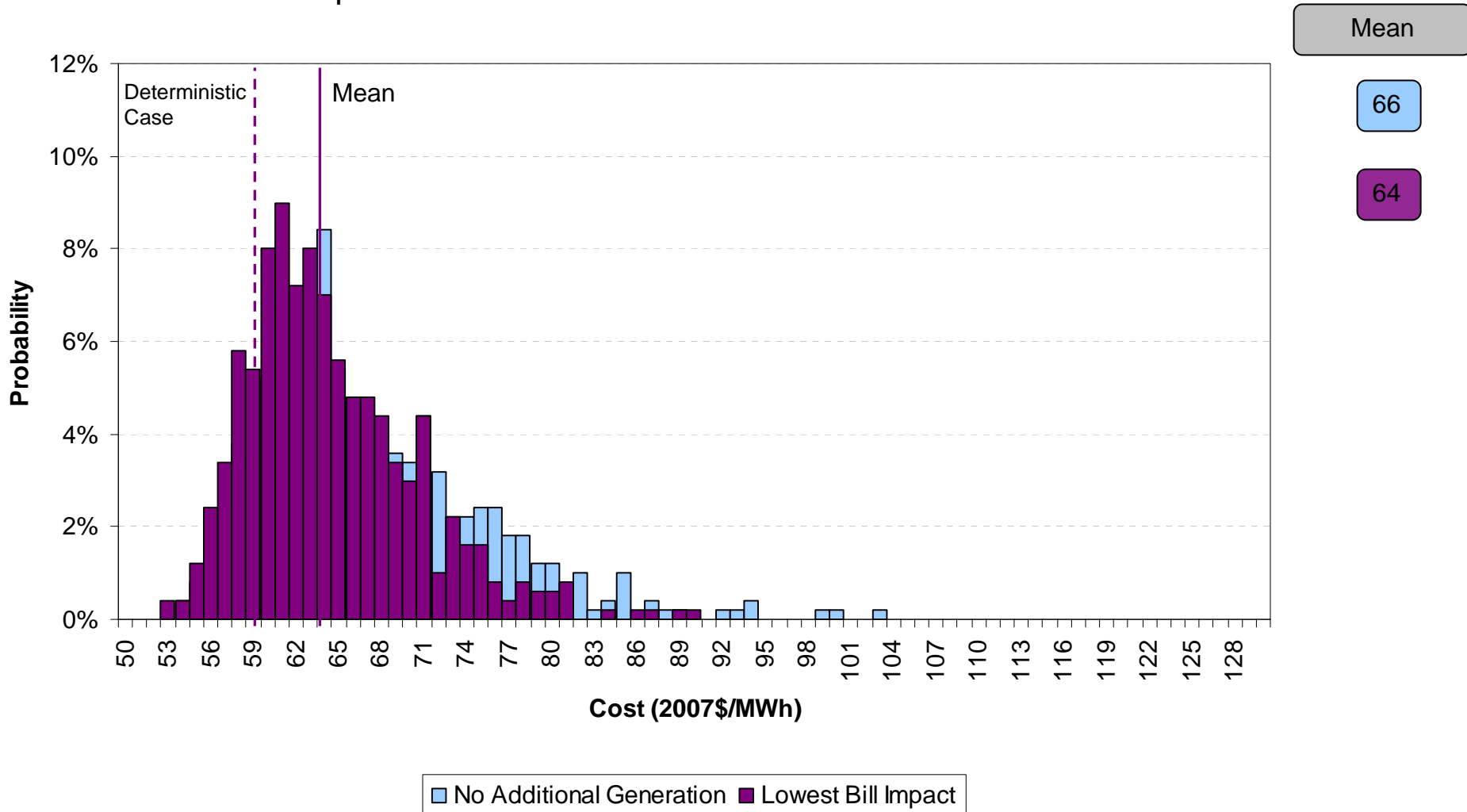
# Portfolio Distributions (2020): Status Quo - No Additional Generation

- Status Quo portfolio is exposed to market purchases uncertainty, skewing distribution to the high side



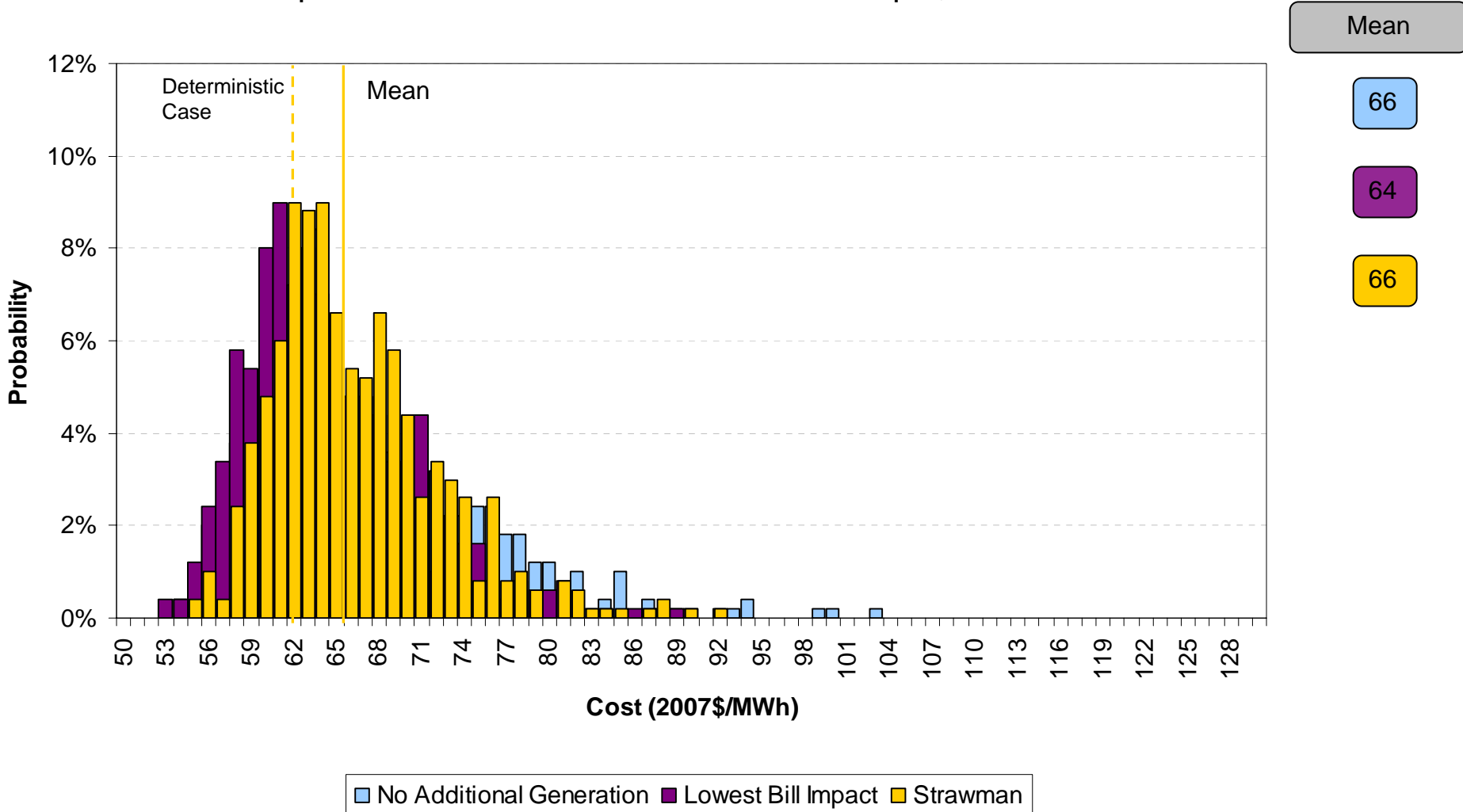
# Portfolio Distributions (2020): Lowest Cost Meeting Council Goals

- The Lowest Cost portfolio shifts distribution to the left and narrows it



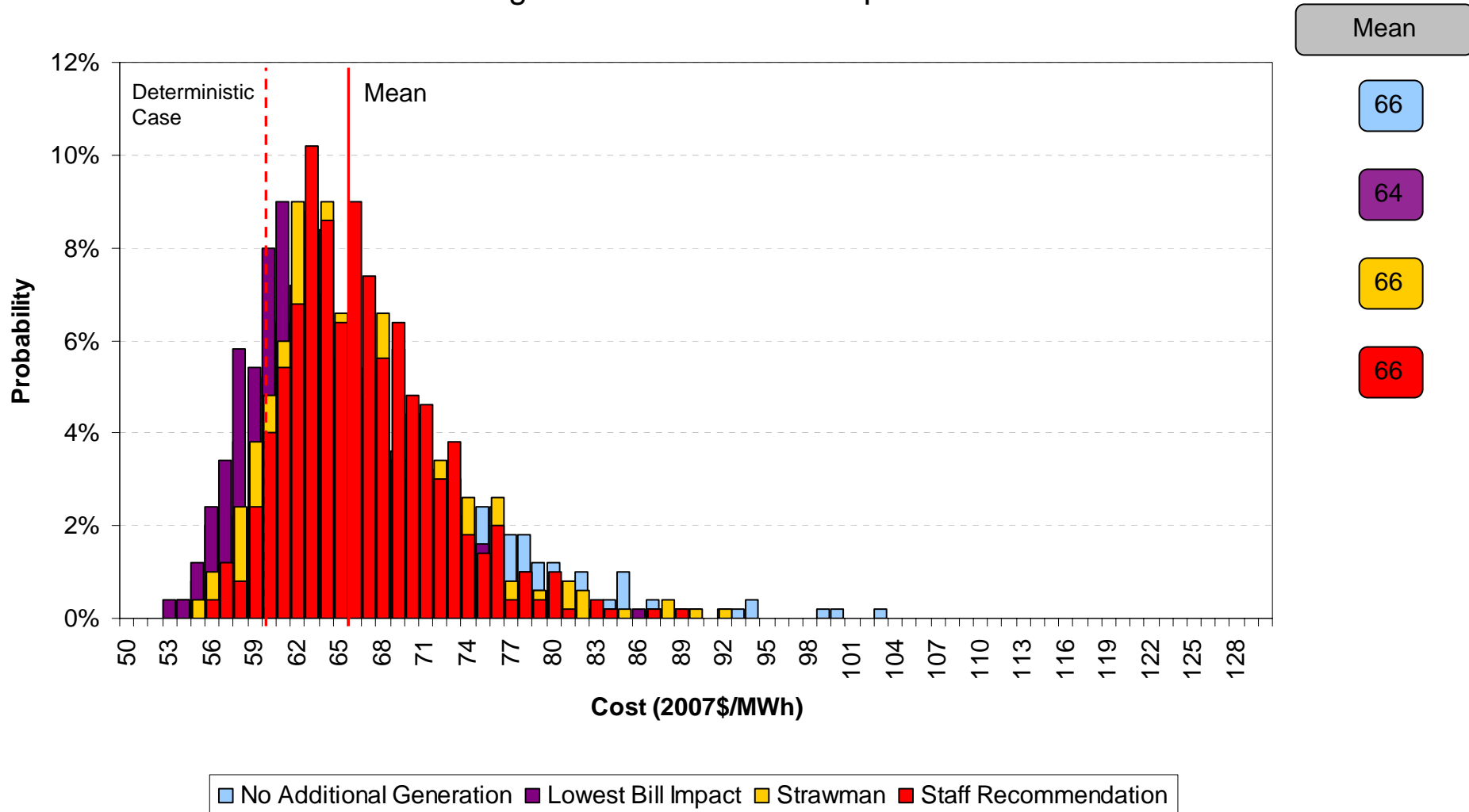
# Portfolio Distributions (2020): Strawman

- The Strawman portfolio has similar costs to the status quo, but has a narrower distribution



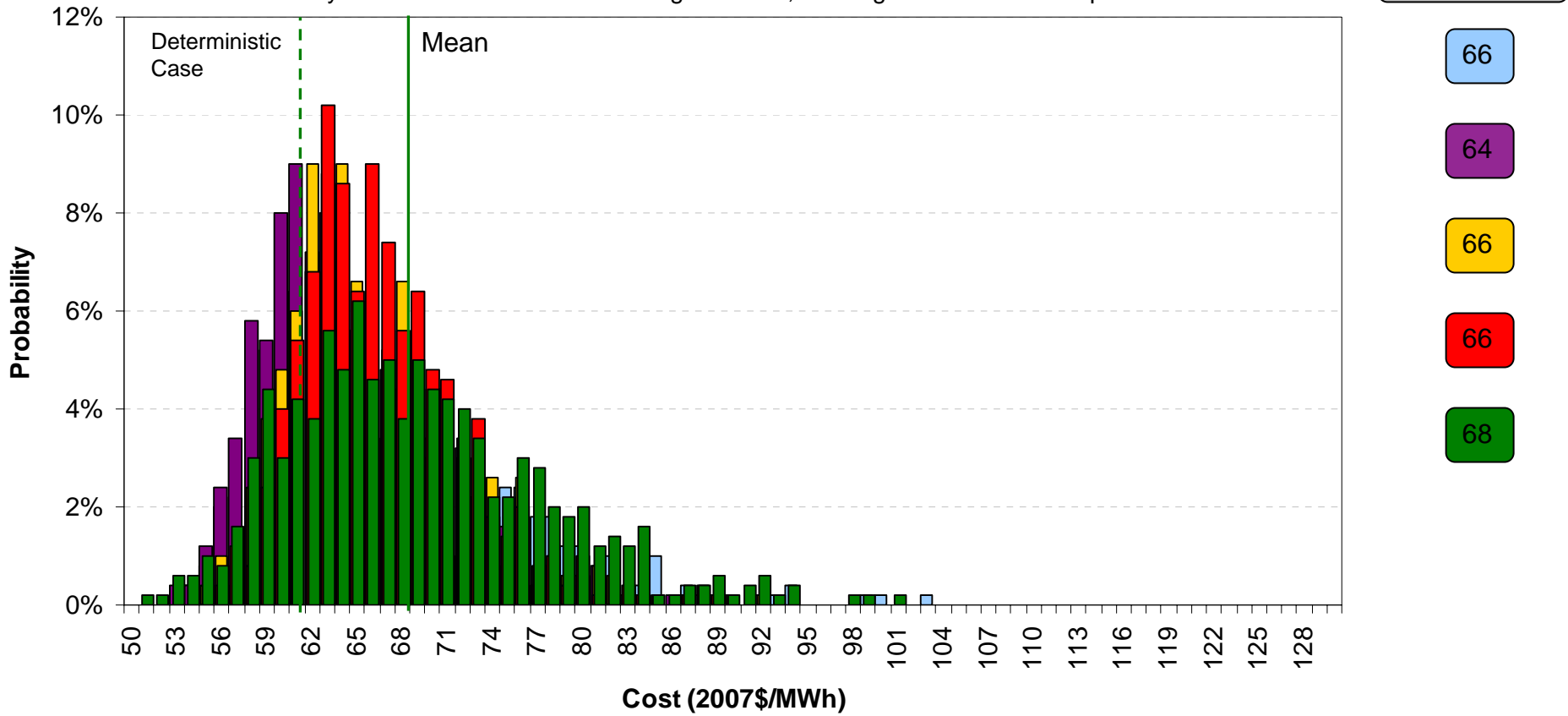
# Portfolio Distributions (2020): Staff Recommendation

- Staff Recommendation has tightest distribution of all portfolios



# Portfolio Distributions (2020): Replace FPP with Renewables

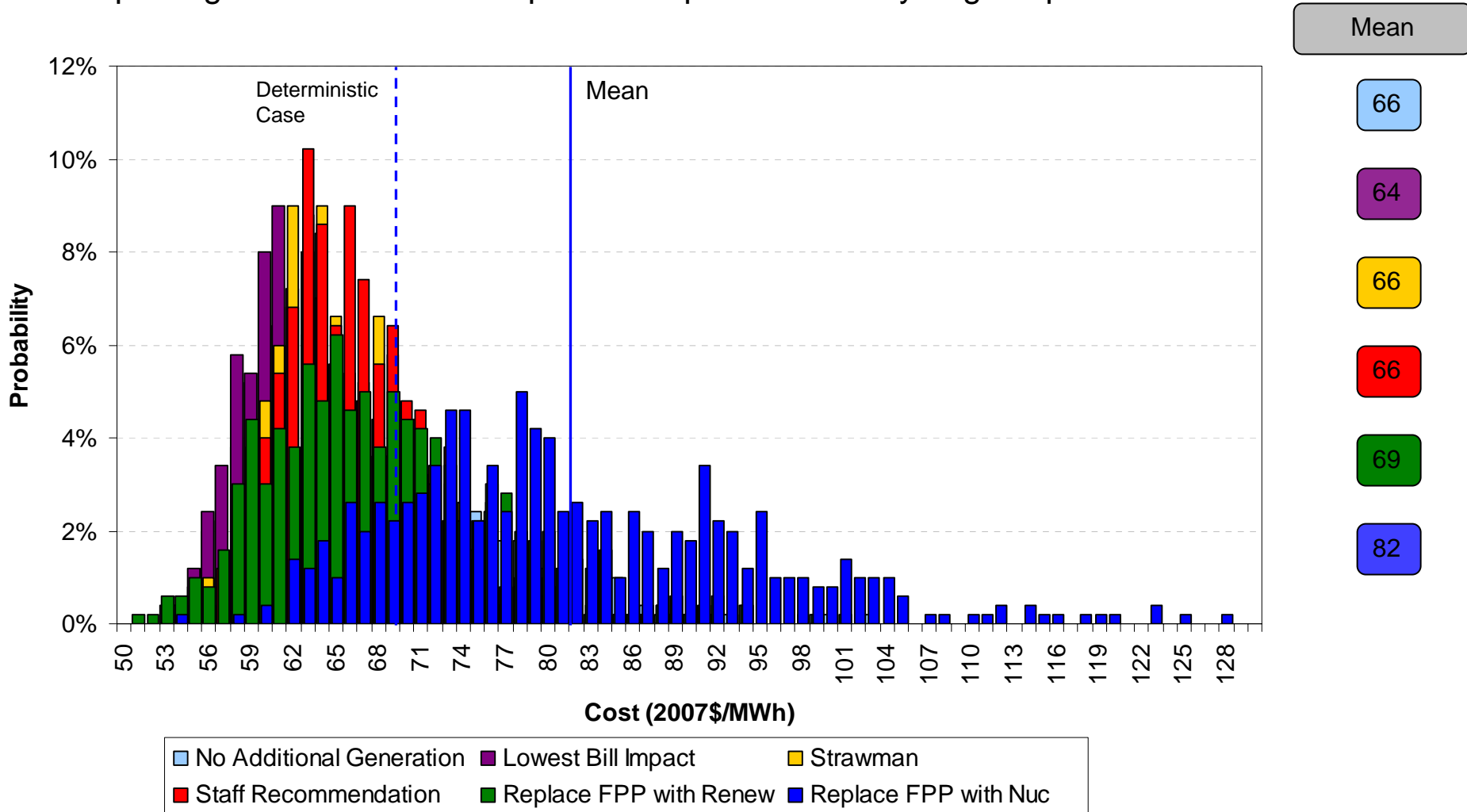
- Replacing FPP adds cost and risk relative to all previous portfolios
  - This portfolio builds more capacity and thus is exposed to more capital cost risk
  - It is also heavily reliant on variable renewable generation, causing increased market purchases



■ No Additional Generation  
 ■ Lowest Bill Impact  
 ■ Strawman  
 ■ Staff Recommendation  
 ■ Replace FPP with Renew

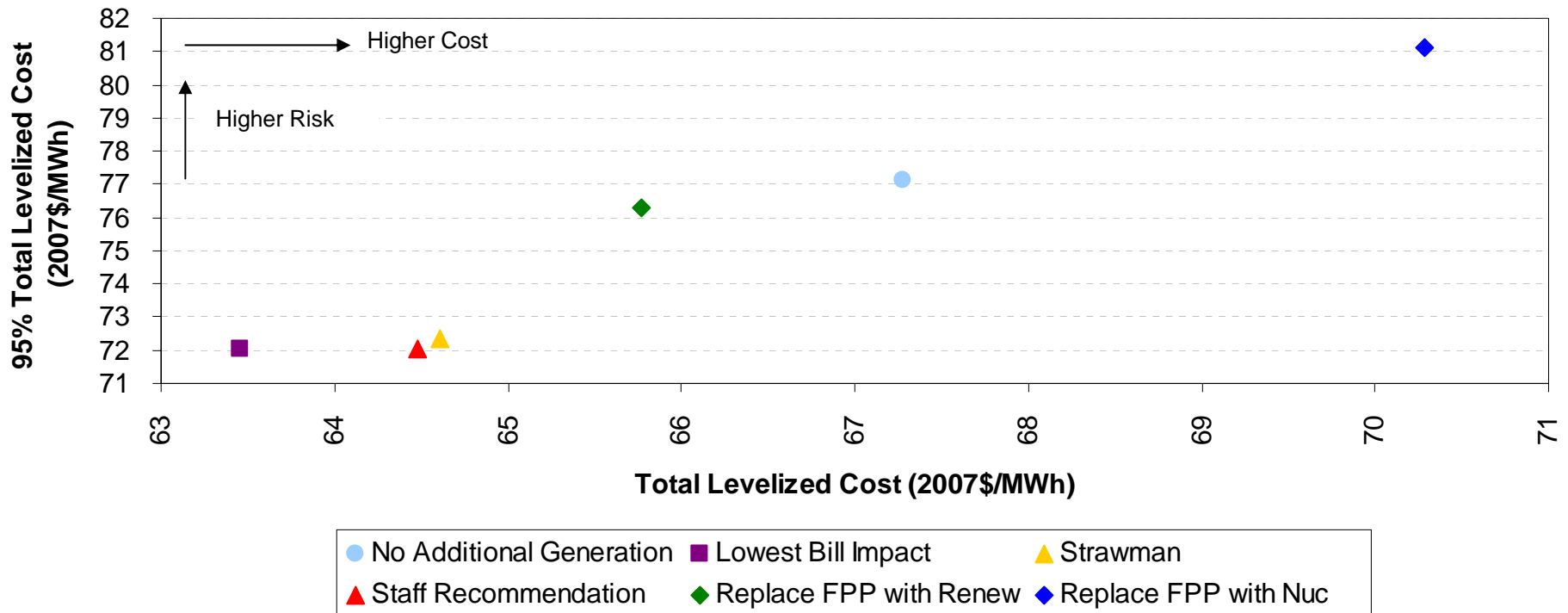
# Portfolio Distributions (2020): Replace FPP with Nuclear

- Replacing coal with nuclear exposes the portfolio to very large capital cost risk



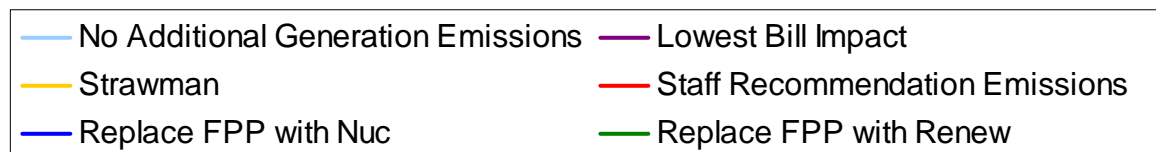
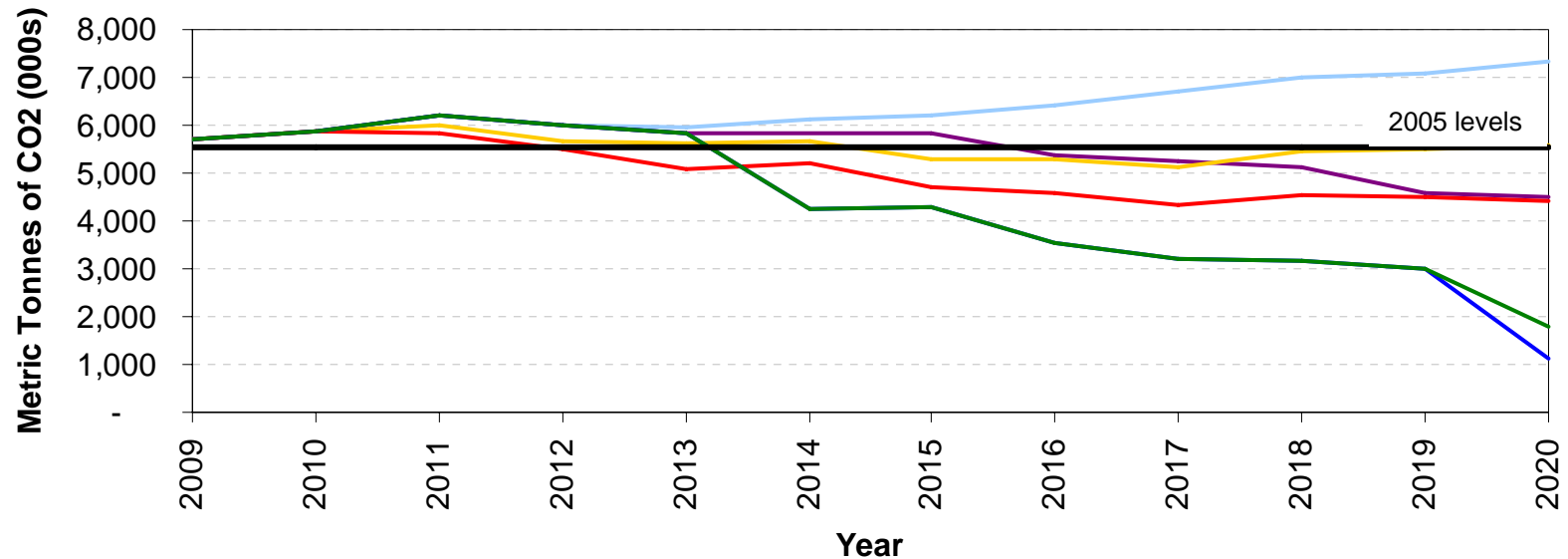
# Expected (mean) Value of Levelized Cost (500 iterations)

- When the costs are levelized from 2009 through 2030 (NPV averaged across time), the differences in 2020 are offset by the fact that most portfolios are similar prior to 2017
- The No Additional Generation portfolio increases in cost and risk at it becomes more exposed to the market over time



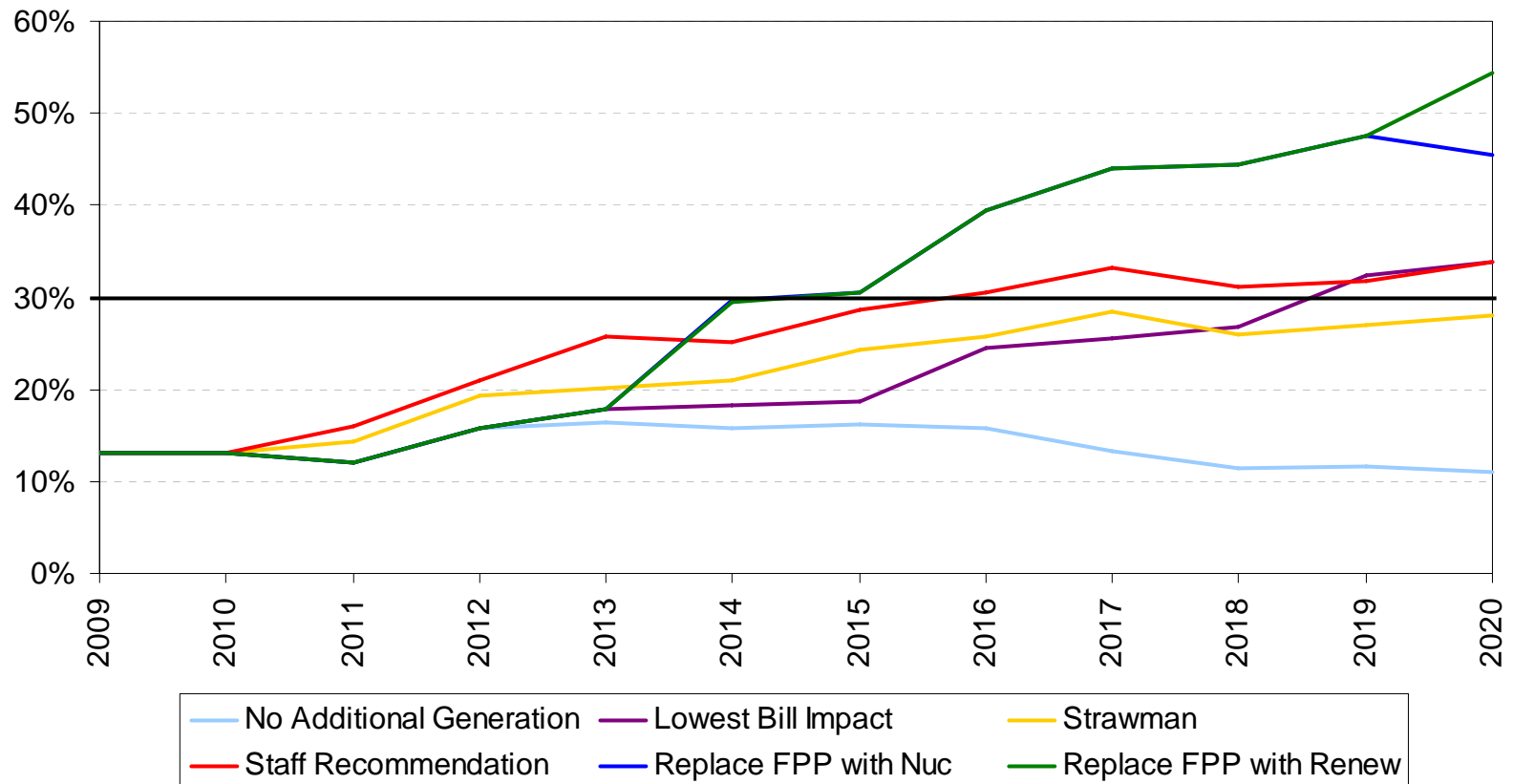
# Expected Value of Portfolio Emissions (500 iterations)

- The Staff Recommendation and Replace FPP portfolios reduce below 2005 levels by 2014
- The Staff Recommendation, the Lowest Bill Impact, and the Replace FPP portfolios reduce below 17% of 2005 levels by 2020
- The Staff Recommended portfolio achieves larger reductions sooner than the Lowest Bill Impact case from 2011-2018.



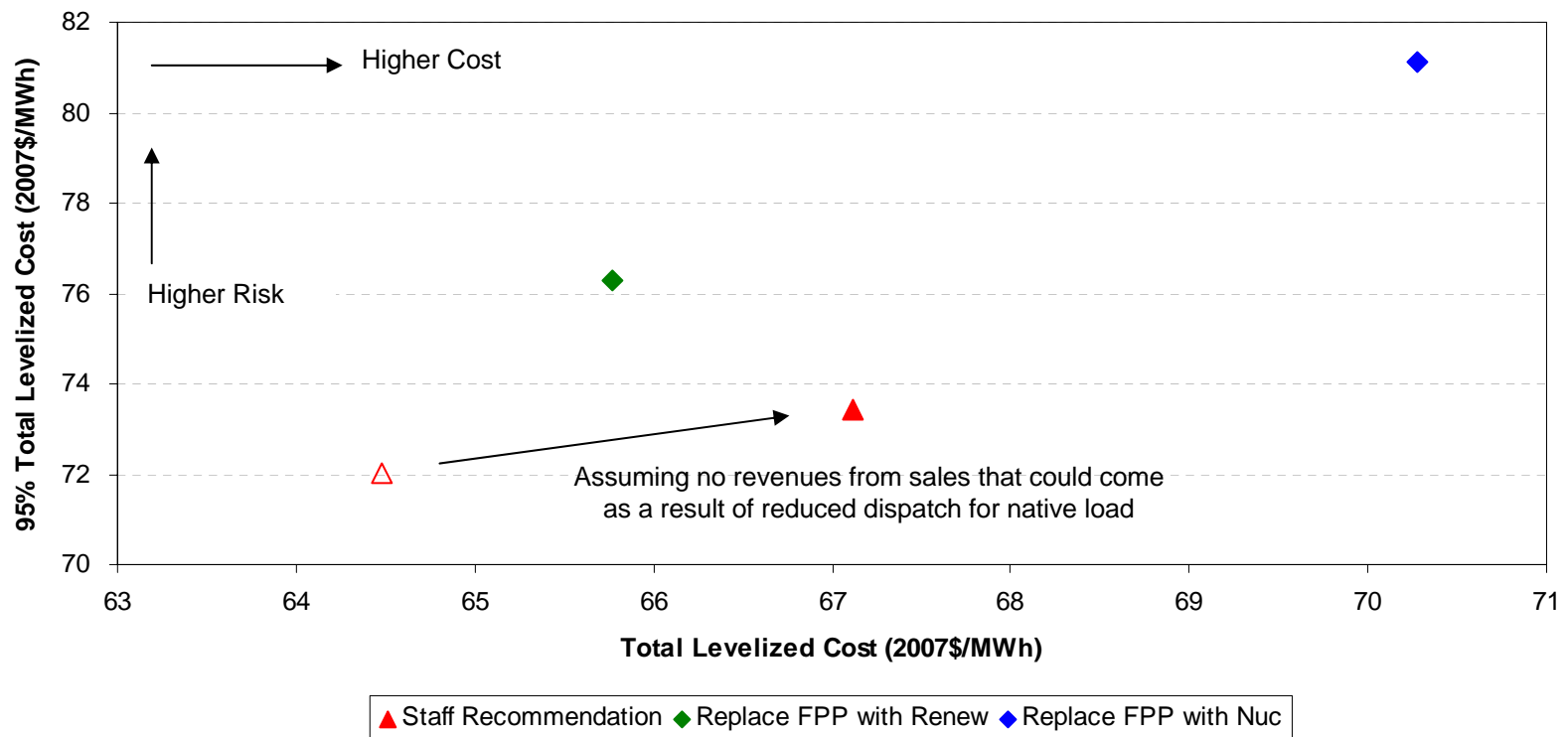
# Expected Value of Percentage Renewable Generation

- All Portfolios except for No Additional Generation achieve around 30% generation from renewables by 2020
- Replacing FPP and the Staff Recommended Portfolio achieve the 30% threshold earlier than the Lowest Bill Impact and Strawman Portfolios



# Potential Sale of FPP or Power from FPP

- If Austin Energy's share of FPP power can be sold at a margin around \$8-10/MWh, the expected value of portfolio costs become similar to the Staff Recommendation on a levelized basis through 2030, though at higher risk.
  - If levelization is done only through 2020, sale margin must be around \$17-18/MWh
- Assuming a 20 year stream of such revenue, a 75% capacity factor and a 5 percent discount rate, this equates to a sale price in the range of \$700 - \$1,500/kW (\$425 – \$910 million dollars)

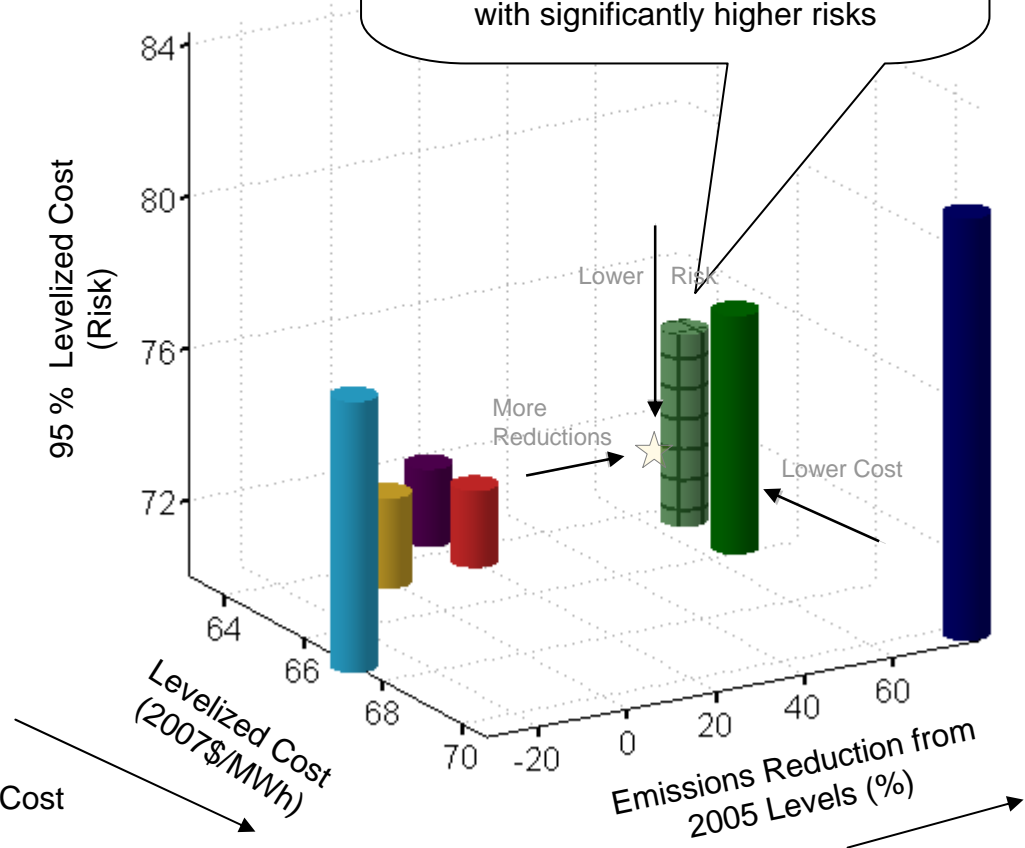


# Levelized Comparison of Cost, Risk, and Emission Reductions

If FPP is able to be sold, the Replace FPP with Renewable Portfolio can be cost-competitive with the Staff Recommendation, while maintaining higher emissions reductions, although with significantly higher risks

- Portfolios**
- No Add. Gen.
  - Lowest Bill Impact
  - Strawman
  - Staff Rec.
  - Replace FPP Ren
  - Replace FPP Nuc

Increasing Risk

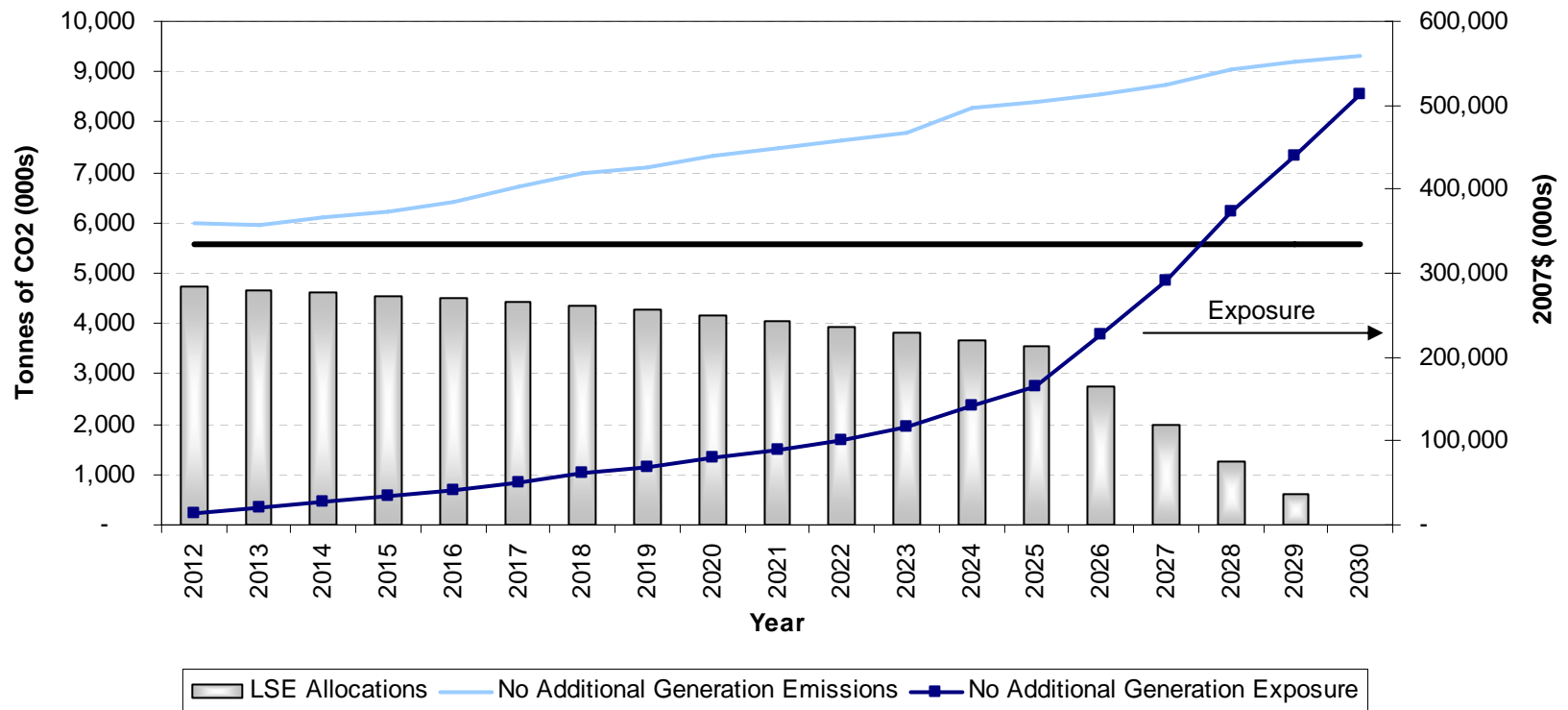


Increasing Cost

Better Emissions Reductions

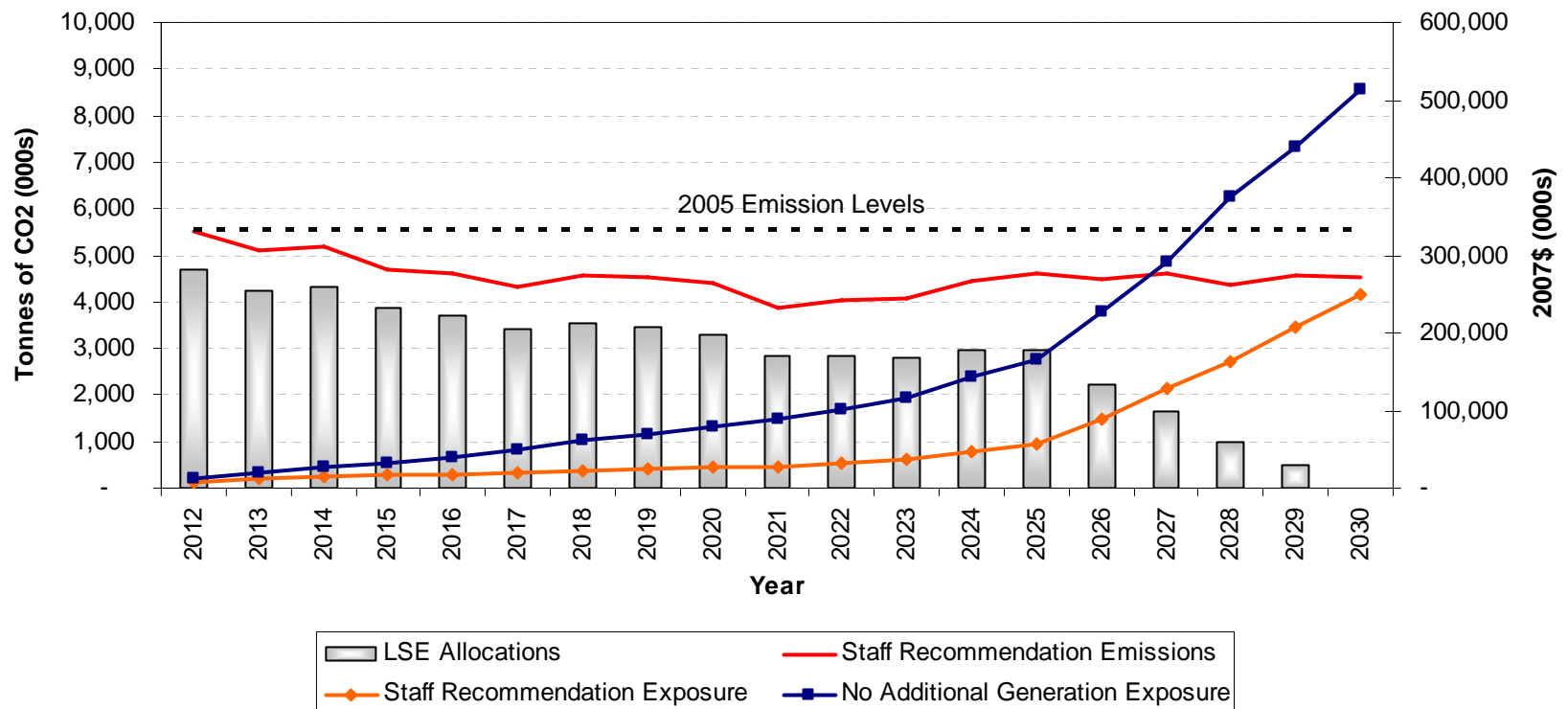
# Emission Allowance Exposure Would Grow Significantly under Status Quo Conditions

- As free allocations decline and as price of allowances is expected to increase, total value of emissions exposure increases exponentially



# Potential Staff Recommendation Carbon Exposure

- Staff Recommendation reduces emissions in line with expected allowance allocations under Waxman-Markey until after 2025
  - Beyond 2025, exposure (value of carbon liability not covered by free allowance allocations) grows significantly



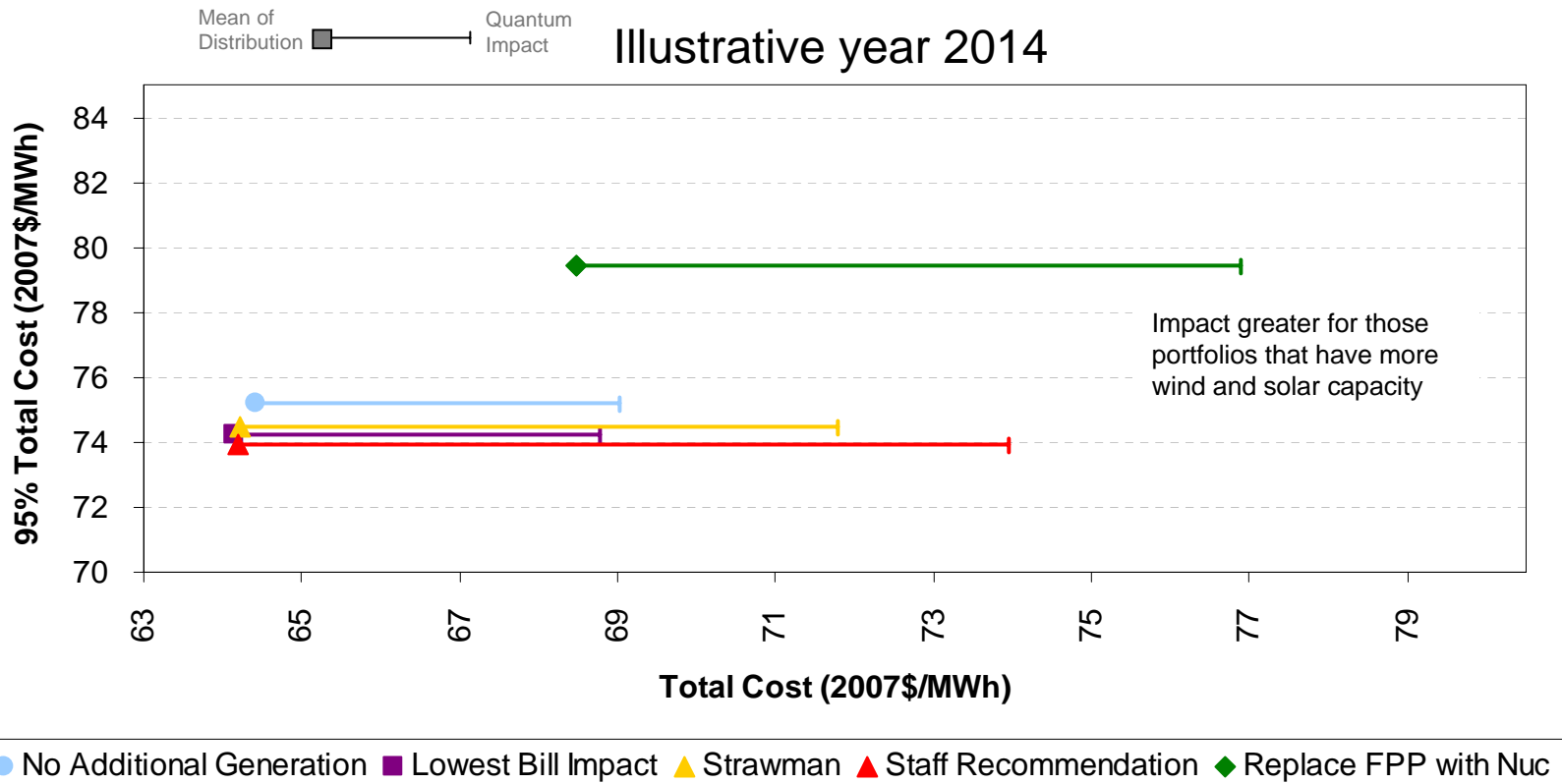
# Quantum Scenarios

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- CREZ transmission expansion uncertainty
  - Delay expected transfer capability increases between ERCOT West and ERCOT South
  - Congestion price expected to be equal to the zonal price differential between West and South
  - Delay transmission expansion and determine impact for each year on the consequences of more congestion on total portfolio costs
- High CO<sub>2</sub> price regime
  - Assume stricter CO<sub>2</sub> policy that would result in more significant coal retirements and higher carbon compliance prices in the market

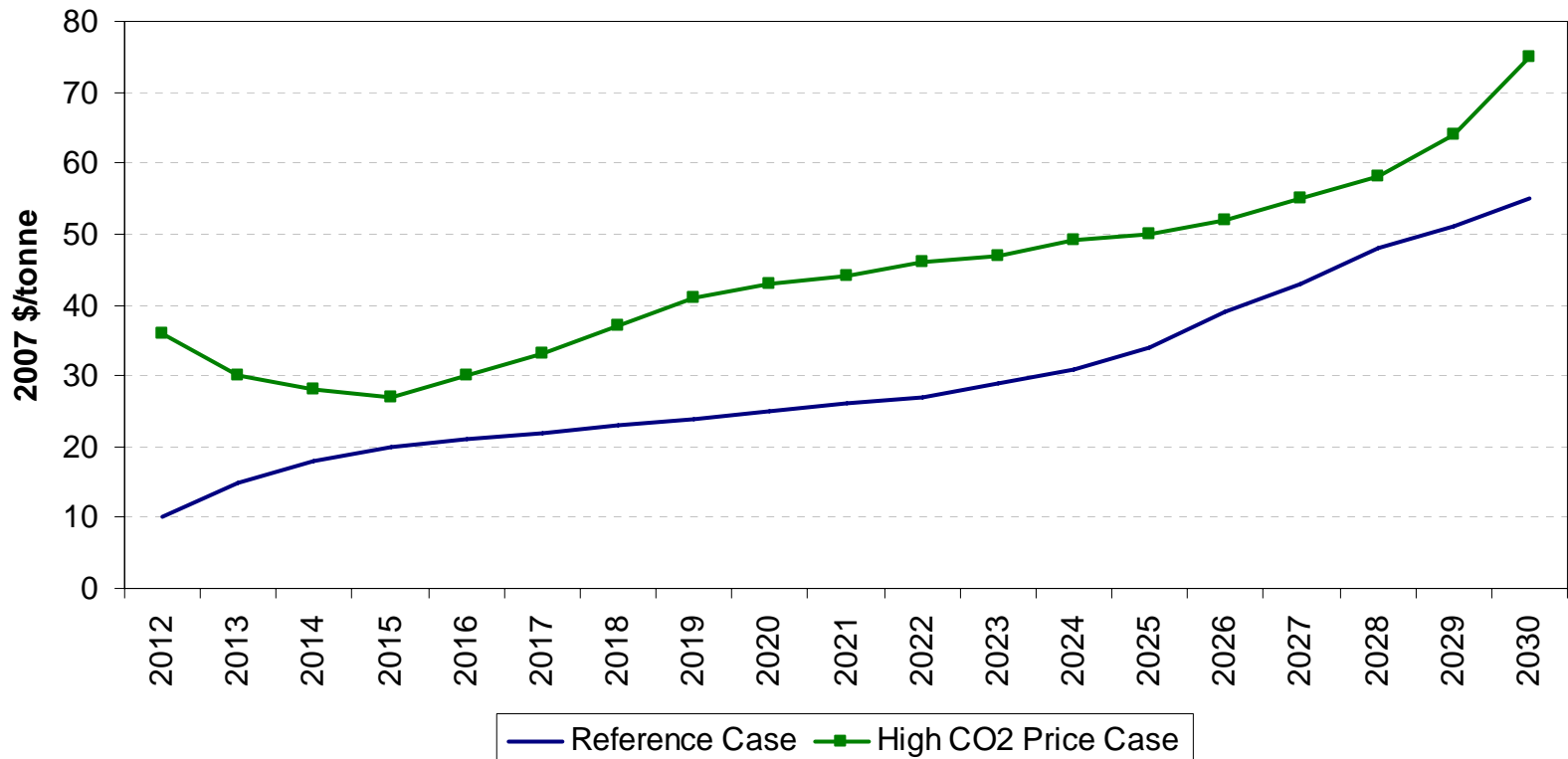
# CREZ Quantum Scenario – Delay in Transmission Expansion

- Staff Recommendation has significant wind and solar capacity additions by 2014
  - Quantum scenario results in an expected impact on total portfolio costs of ~\$10/MWh if no changes were made to the portfolio in response to transmission delays
- Portfolios with higher remote renewable additions increase portfolio costs close to 95<sup>th</sup> percentile levels



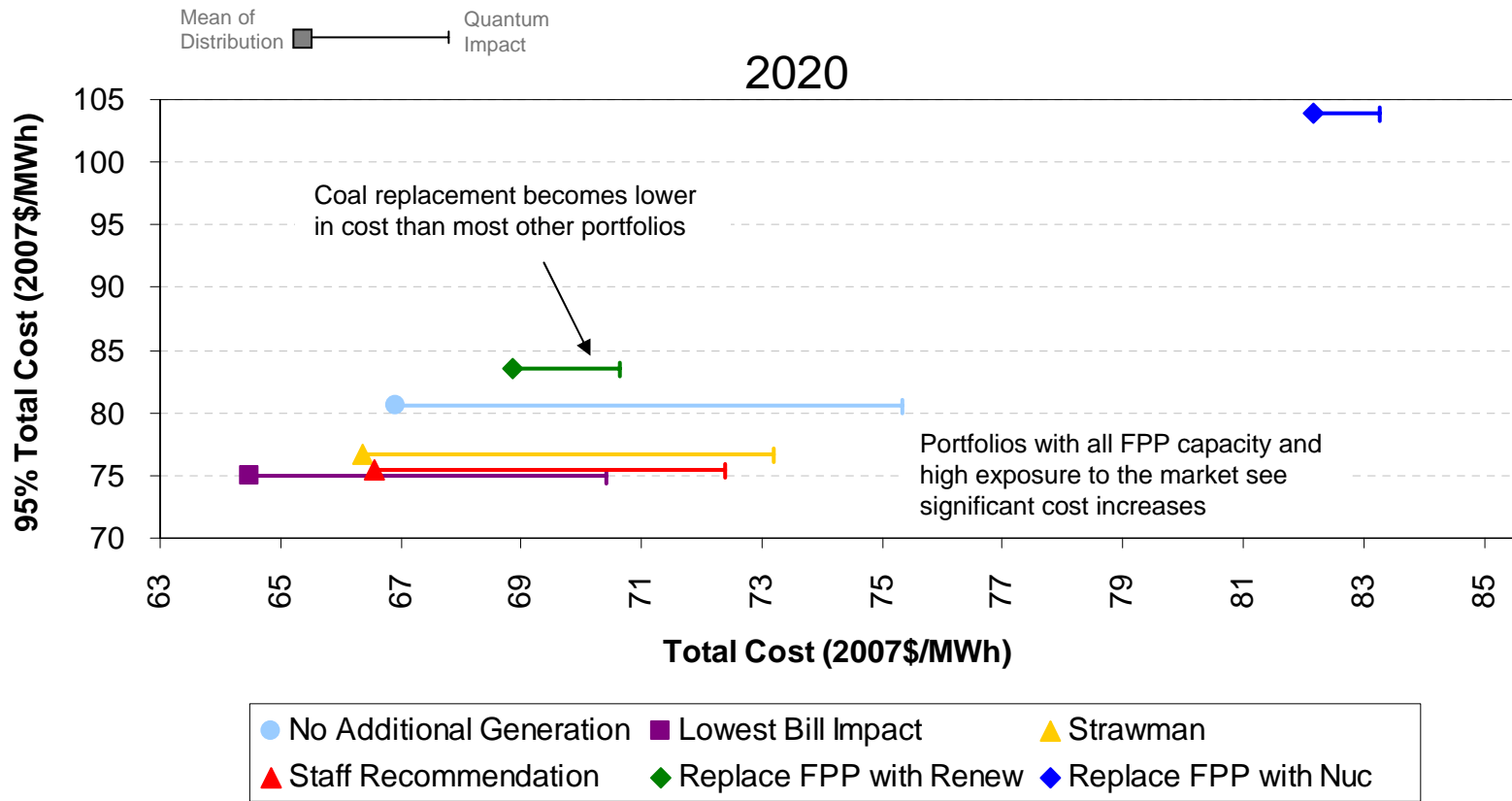
# High CO<sub>2</sub> Price Scenario

- Increase in expected price of CO<sub>2</sub> results in:
  - Increased market coal retirements
  - Longer term market response with additional non-emitting resource additions
  - Increased natural gas demand and price in intermediate years, but lower demand and price in the out years as larger amounts of renewable capacity come online



# High CO<sub>2</sub> Quantum Scenario

- High CO<sub>2</sub> costs increase No Additional Generation portfolio costs by \$8.50/MWh, while portfolios that replace FPP experience cost increases in the \$1-2/MWh range



# Summary of Results and Conclusions

Portfolios	Primary Objectives						Additional Concerns	
	Cost in 2020 (\$/MWh)	Risk 95% of Cost (\$/MWh)	RPS % in 2014	% CO2 Reduction Below 2005 Levels in 2014	RPS % in 2020	% CO2 Reduction Below 2005 Levels in 2020	Exposure to High CO2 Costs Increased Cost in 2020 (\$/MWh)	Exposure to Transmission Uncertainty Increased Cost in 2014 (\$/MWh)
No Additional Generation "Status Quo"	66 ●	81 ●	16 ●	-10 ●	11 ●	-32 ●	8 ●	5 ●
Strawman	66 ●	77 ●	21 ●	-2 ●	28 ●	0 ●	7 ●	8 ●
Staff Recommendation	66 ●	75 ●	25 ●	7 ●	34 ●	20 ●	6 ●	10 ●
Lowest Bill Impact	64 ●	75 ●	18 ●	-5 ●	34 ●	19 ●	6 ●	5 ●
Replace FPP with Renew with CC	69 ●	83 ●	30 ●	25 ●	54 ●	71 ●	2 ●	8 ●
Replace FPP with Renew No CC	68 ●	84 ●	30 ●	24 ●	54 ●	68 ●	2 ●	8 ●
Replace FPP with Nuclear	82 ●	104 ●	30 ●	24 ●	45 ●	80 ●	1 ●	8 ●

- The Staff Recommendation and the Lowest Bill Impact portfolios achieve lowest cost and low risk, with CO<sub>2</sub> emission reductions in line with the 2020 targets of the current Waxman-Markey federal proposal; the Staff Recommendation achieves goals earlier
- Replacing FPP significantly reduces CO<sub>2</sub> emission liability, but at the expense of increases in cost and risk associated with new capital expenditures and exposure to power or fuel market uncertainty
- CREZ transmission expansion uncertainty poses a risk for all portfolios with wind additions, especially in years prior to 2015

Note: Expected value of distribution of potential outcomes is displayed for primary objectives. This differs from deterministic "best guess" results from Phase I.

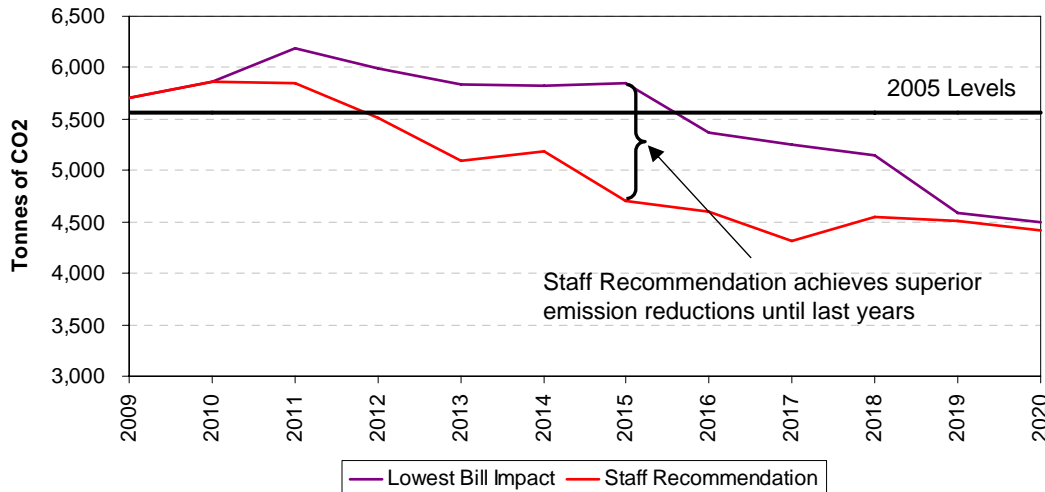
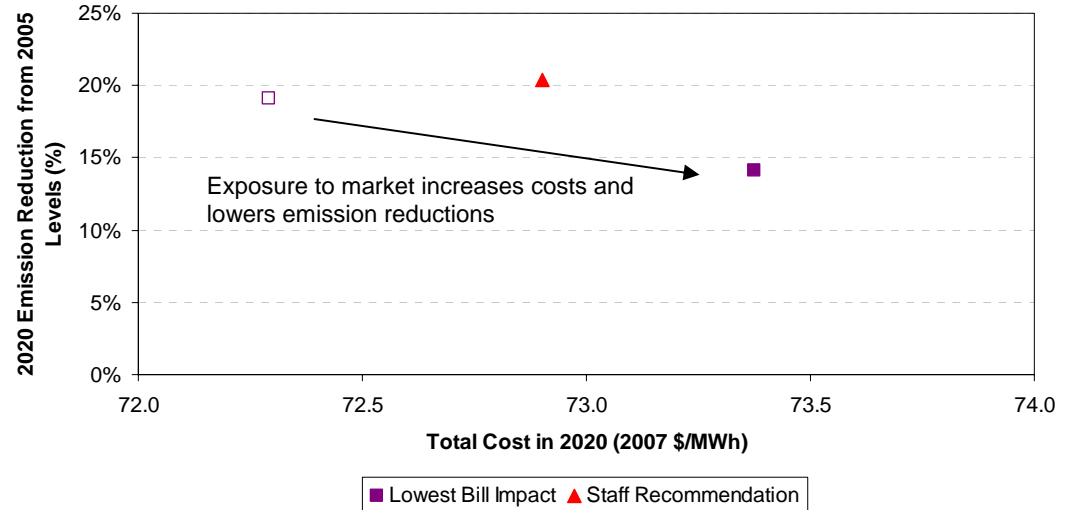
# Staff Recommendation Portfolio

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- The Staff Recommendation achieves high and early levels of environmental stewardship at a cost less than 2.5% higher than the Lowest Bill Impact portfolio on a levelized basis and with the same level of cost risk
  - It displaces around 15% of existing coal-fired generation with over 1,200 MW of renewable additions from 2009 through 2020
  - It achieves the 2020 RPS goal and 2020 likely CO<sub>2</sub> emission reduction target *by 2016*
  - It surpasses the RPS target (34%) and carbon emission limits (20% below 2005 levels) by 2020

# Comparison of Staff Recommendation to Lowest Bill Impact

- Staff Recommendation mitigates against risk of supply unavailability for geothermal and landfill gas additions with CC and more readily available renewable additions



- Staff Recommendation reduces emissions and achieves higher RPS much earlier than Lowest Bill Impact portfolio

# Comparison of Staff Recommendation to Replace FPP

- Replacement of FPP increases cost and widens the distribution of potential outcomes by removing coal generation from resource base
  - Staff Recommendation results in smaller reduction in coal generation for native load through renewable displacement
- Higher than expected CO<sub>2</sub> compliance costs could make replacement more competitive, but lower than expected costs would result in higher deviation in costs

