Northwest **Power** and **Conservation** Council

March 31, 2015

MEMORANDUM

TO: **Council Members**

FROM: **Tom Eckman and Ben Kujala**

SUBJECT: **Update on Power Plan Scenario Analysis**

BACKGROUND:

Presenter: Tom Eckman and Ben Kujala

Summary

This presentation is comprised of two parts. The first portion of the presentation seeks Council guidance on specific inputs to the proposed scenarios. It is anticipated that the Power Committee will have recommendations regarding these inputs based on committee discussions. The second portion of the presentation will describe some initial results from the Regional Portfolio Model (RPM) analysis of a sample of resource strategies.

Items for Staff Guidance

At the March Council Meeting, staff presented a list of proposed scenarios to the Power Committee Members and the full Council. The Council agreed on the high level description of these scenarios. However, the Council sought additional input from the Resource Strategies Advisory Committee (RSAC) on specific input assumptions relating to carbon emission limits and climate change impacts.

With respect to Scenario 2B which is designed to test the impact of pricing carbon emissions at a level that is equivalent to the US Interagency

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Working Group on the Social Cost of Carbon's estimates of the damage cost of climate change, the staff recommends using the values shown in the following table in the column labeled "3% Discount Rate."

Staff recommends these values for two reasons. First, they are similar to the average carbon costs assumed in Scenario 2C which randomly varies carbon prices across all futures between zero and $100 per metric ton. A comparison between the results of Scenario 2B, which assumes a specific carbon emissions cost in every future tested in the RPM and Scenario 2C, which assumes random carbon emissions cost will reveal the cost and risk associated with militating against uncertain carbon emission control policies.

The second reason the staff recommends the use of the values in the three percent column is because both lower and higher emission cost assumptions will likely be tested in other scenarios. Specifically, Scenario 2A, which is designed to reflect the Environmental Protection Agency's 111(d) regulations, will likely produce alternative "carbon control" prices that are below the estimates provided by the Interagency Working Group. Scenario 3B, which is designed to determine the lowest level of carbon emissions achievable with current technology, will likely produce alternative "carbon control" prices that are above the other estimates provided by the Interagency Working Group.

Table 1 - Interagency Working Groups Estimated Social Cost of CO_2 2015-2050 and 6th Plan Carbon Risk Scenario Average (2012$/Metric Ton)

	Discount Rate and Statistic				**6th Plan Carbon Risk Scenario (Average Across All Futures**
Year	**5% Average**	**3% Average**	**2.5% Average**	**3% 95th Percentile**	
2015	$12	$40	$62	$118	$36
2020	$13	$47	$69	$139	$52
2025	$15	$51	$75	$156	$57
2030	$17	$56	$81	$173	$58
2035	$20	$61	$87	$190	
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2050	$29	$77	$106	$239	

Scenarios 4C and 4D are intended to shed insight on the impact of the maximum pace of development for energy efficiency resources. Analysis

in the Fifth and Sixth power plans showed considerable increases in both cost and risk from retarding development of cost-effective conservation.

Staff recommends that the Council assume that the same total amount of efficiency available over the twenty-year planning period, but the maximum annual rate will be increased or decreased in the fast and slow cases respectively. Staff proposes that the changes will be symmetric and applied to all cost bins and all measures. This approach will allow the Council to isolate the impacts of the changes with respect to pace alone. Staff recommends testing inputs for scenarios 4C and 4D that increase or decrease the maximum annual pace by plus or minus about one third. In Scenario 4C, the faster pace case, ramp rates would be increased in the early years and decreased in the later years to assure that total conservation available by measures remains the same over twenty years. The same is true for Scenario 4D, the slower pace case, but rates will be decreased in the early years and increased later.

Staff has yet to develop its recommendation on whether to include the indirect effects potential increase temperatures as a result of climate change. Staff analysis of these effects on the resource strategies and associated cost and risk is still underway and will be presented at both the Power Committee and Council meeting.

RPM Results for Sample Resource Strategies

This portion of the presentation will examine four different resource strategies using the draft inputs for scenario 1B to discuss the type of results being produced by the RPM and how what insights might be gained from analysis of those results.

The resource strategies selected for presentation will examine four different conservation purchase strategies in combination with difference generation resource options. These resource strategies are:

- No Conservation, generation or demand response resources available
- Low Conservation without generation or demand response resources available
- Medium Conservation with only low cost demand response and natural gas-fired peaking generators available
- Medium Conservation with all generation resource options available
- High Conservation with all generation resource options available

Using these resource strategies staff will discuss the outputs from RPM and look at methods for comparing them. Staff will be seeking Council guidance on how best to communicate the results of future scenario analysis to be presented at Power Committee webinars and meetings.

Relevance One of the primary tools used to inform the development of the Council's Seventh Power Plan are the results of its scenario analysis. Selection of the scenarios to be tested during the development process is a critical step in this process, since it establishes scope of the constraints and "stresses" to which potential resource strategies to which will be subjected.

Workplan: 1. B. Develop Seventh Power Plan and maintain analytical capability

- Define resource portfolio

Background: The RPM was recently redeveloped by Navigant for the Council. The draft inputs for the starting scenarios have been finalized. This presentation is to examine outputs from RPM with the initial data and discuss methods for comparison of resource strategies.

More Info: The RPM or Regional Portfolio Model was recently redeveloped by Navigant for the Council. The RPM estimates the regional costs and risks associated with pursuing resource development strategies and it uses optimization to look for strategies that minimize the estimated cost and risk. The draft inputs for the starting scenarios have been finalized. This presentation is to examine outputs from RPM with the initial data and discuss methods for comparison of resource strategies.

Update on Scenario Analysis

April 8, 2015

Guidance on Scenario Input Assumptions

- Scenario 2B – Which Social Cost of Carbon Should Be Assumed?
  - *Proposal - Use Interagency Working Group Estimates based on 3% Discount Rate*
- Scenarios 4C and 4D – What Should Be the Range of Conservation Resource Uncertainty Tested?
  - *Proposal – Assume 33 percent faster and 33 percent slower maximum pace of conservation resource development*
- All Scenarios – Should the Potential Direct Impacts (i.e., increased temperatures) of Climate Change Be Assumed in All Scenarios or Treated As Sensitivity Study
  - *Proposal – Treat as sensitivity study*
- Demand Response – How should we establish the "cost" of demand response resources?
  - *Proposal – Use "incentive payments" as a proxy for the cost of developing demand response resources that require load curtailment (Note: This cost is in addition to marketing, administration and hardware cost required to enable DR)*

RPM Results Disclaimers

- The long-term capacity expansion logic is still being reviewed so there is still potential for revision.
  - Received current version April 4th
  - The SAAC and RAAC will be reviewing the RPM's capacity expansion logic which uses GENESYS results to ensure resource strategies satisfy regional adequacy standards
- *Caveat emptor* –
  - All results in this presentation *are still preliminary*
  - The RPM test resource strategies across 800 different futures
    - Each future has a unique result
    - Staff interpretations of results, communicated with terms like "on average" or "in general," will likely not hold in one or more of those futures.
  - These qualification are missing because they wouldn't fit on every slide!

What We Compare in the RPM

- Single *Resource Strategies* across a single future (or subsets of futures) to ascertain why it is more or less "successful" under specific conditions
- Multiple *Resource Strategies* across 800 futures within a single *Scenario* to find the "least cost" and "least risk" resource strategies
- The "least cost" and "least risk" *Resource Strategies* across multiple *Scenarios* to find the most robust *Resource Strategies*

What We Have Today

- Comparison of four illustrative *Resource Strategies* across 800 futures
  - Distribution of Net System Cost ($)
  - Distribution of conservation development (aMW)
  - Impact of conservation development levels on Net System Cost ($)
  - Distribution of RPS resource development (MW)
  - Impact of conservation development levels on other resource development (MW)
  - Impact of conservation development levels on CO2 emissions (tons)

First – A Note About Terminology
What's Do We Mean by Net System Cost?

- Costs of building and operating new resources and operating (e.g., fuel costs, fixed O&M) the existing power system
- Benefits and costs from selling (+$) or buying (-$) power outside the region
- Penalties (-$) associated with not meeting system adequacy requirements (referred to as "curtailment cost.")

Illustrative Resource Strategies

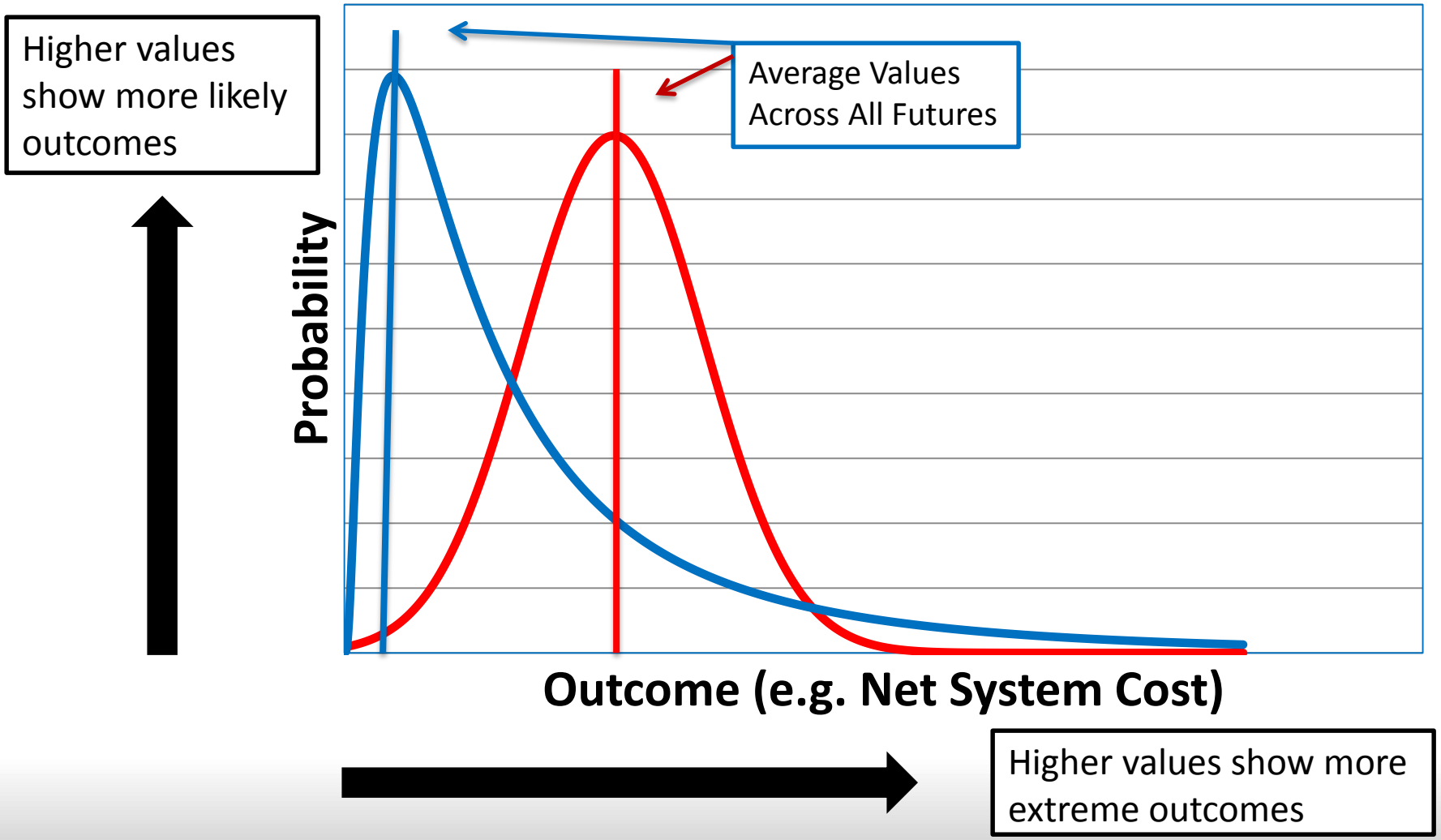
- ***No New Resource Additions***
  - No conservation, no new generation except for RPS required generation
- ***Conservation Resource Additions At Cost Up to Short-Run Market Price (aka: low conservation)***
  - No new generation except for RPS required generation
- ***Generation Resource Additions for Reliability and Economics with "low conservation"***
- ***Generation Resource Additions for Reliability and Economics with "high conservation"***
  - Conservation Resource Additions At Costs Exceeding Long-run generating resource costs without carbon emissions limits/costs.

The RPM "Builds" Resources to Maintain Resource Adequacy or Because It's Economical (i.e., profitable) To Do So

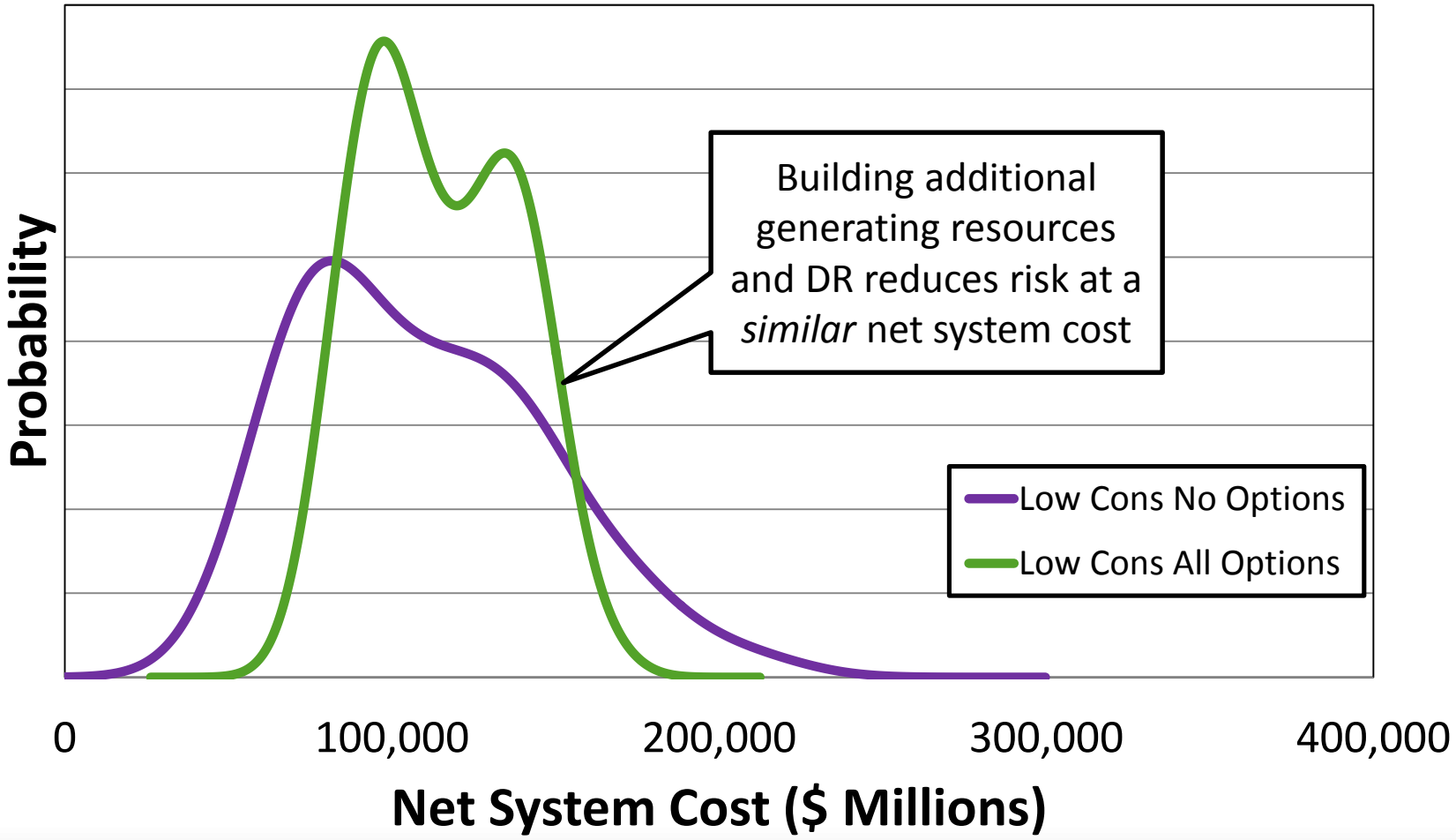
Period Range	Percentage of Futures
By Q4 2020	1%
By Q3 2035	12%

. . .But Mostly for Reliability

Many RPM Results Are Shown As Distributions Across All Futures

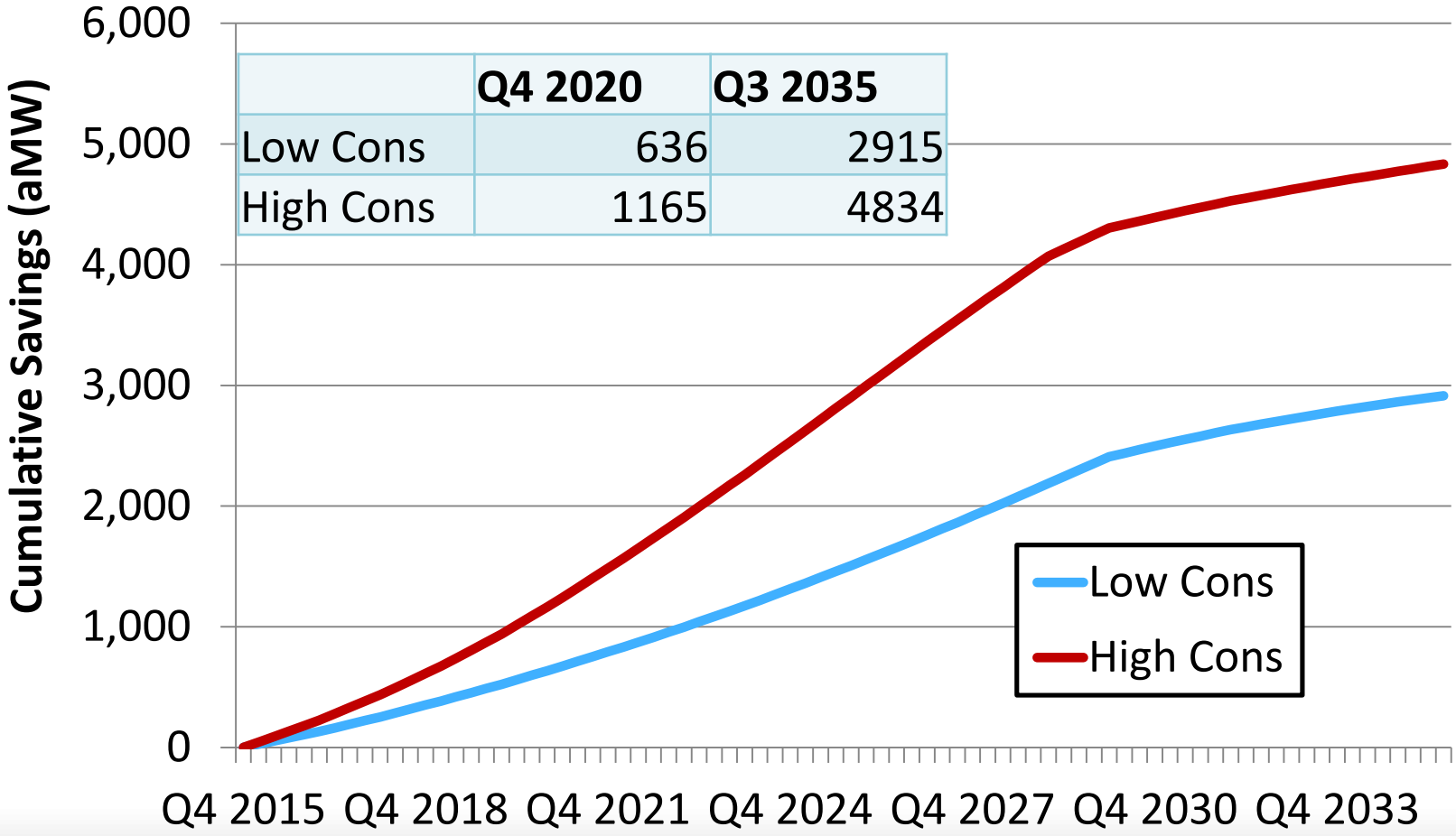


Net System Cost of No New Generation vs. Additional Generation Resource Strategies

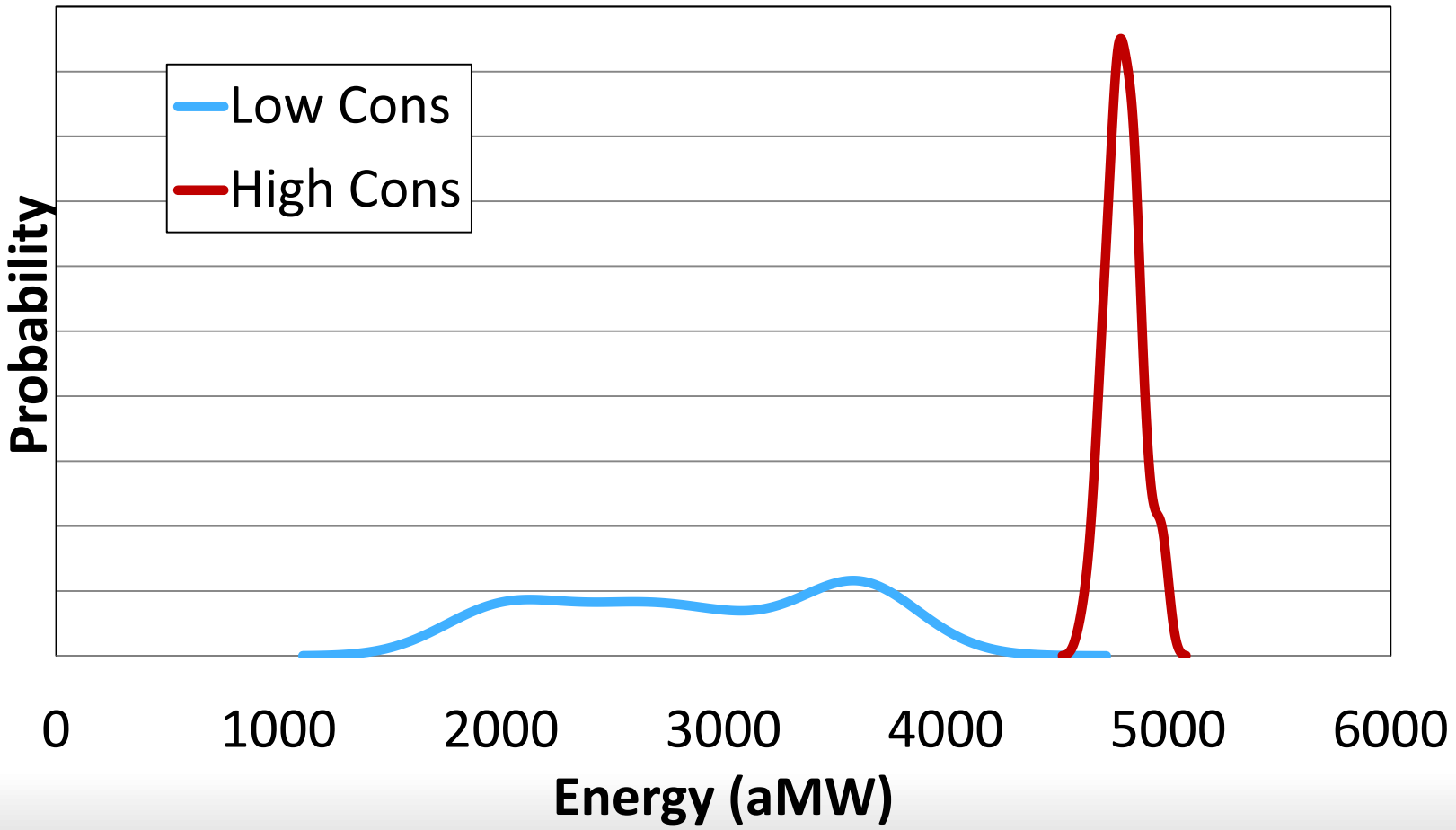


Conservation Development by Resource Strategy

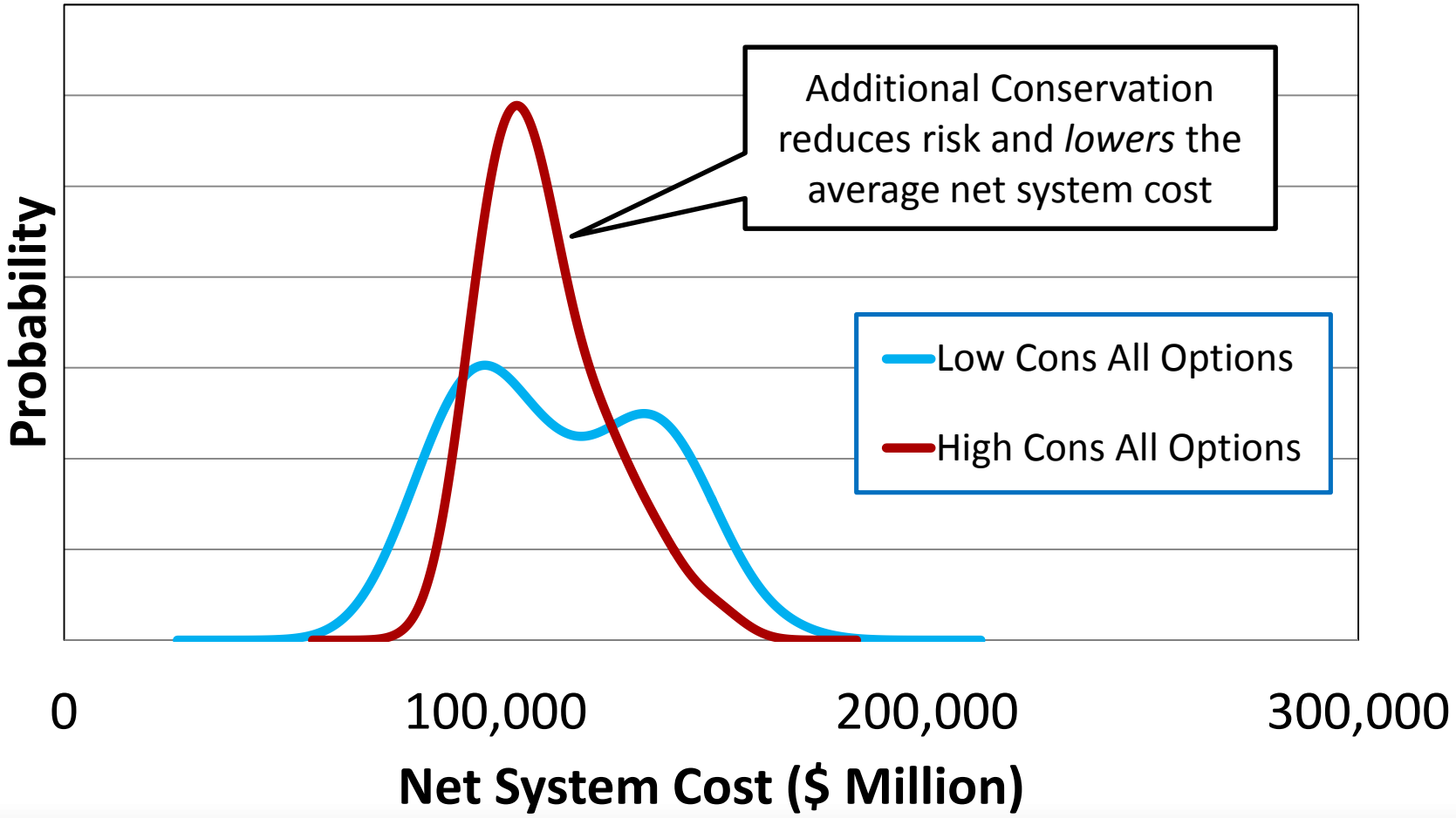
	Q4 2020	Q3 2035
Low Cons	636	2915
High Cons	1165	4834



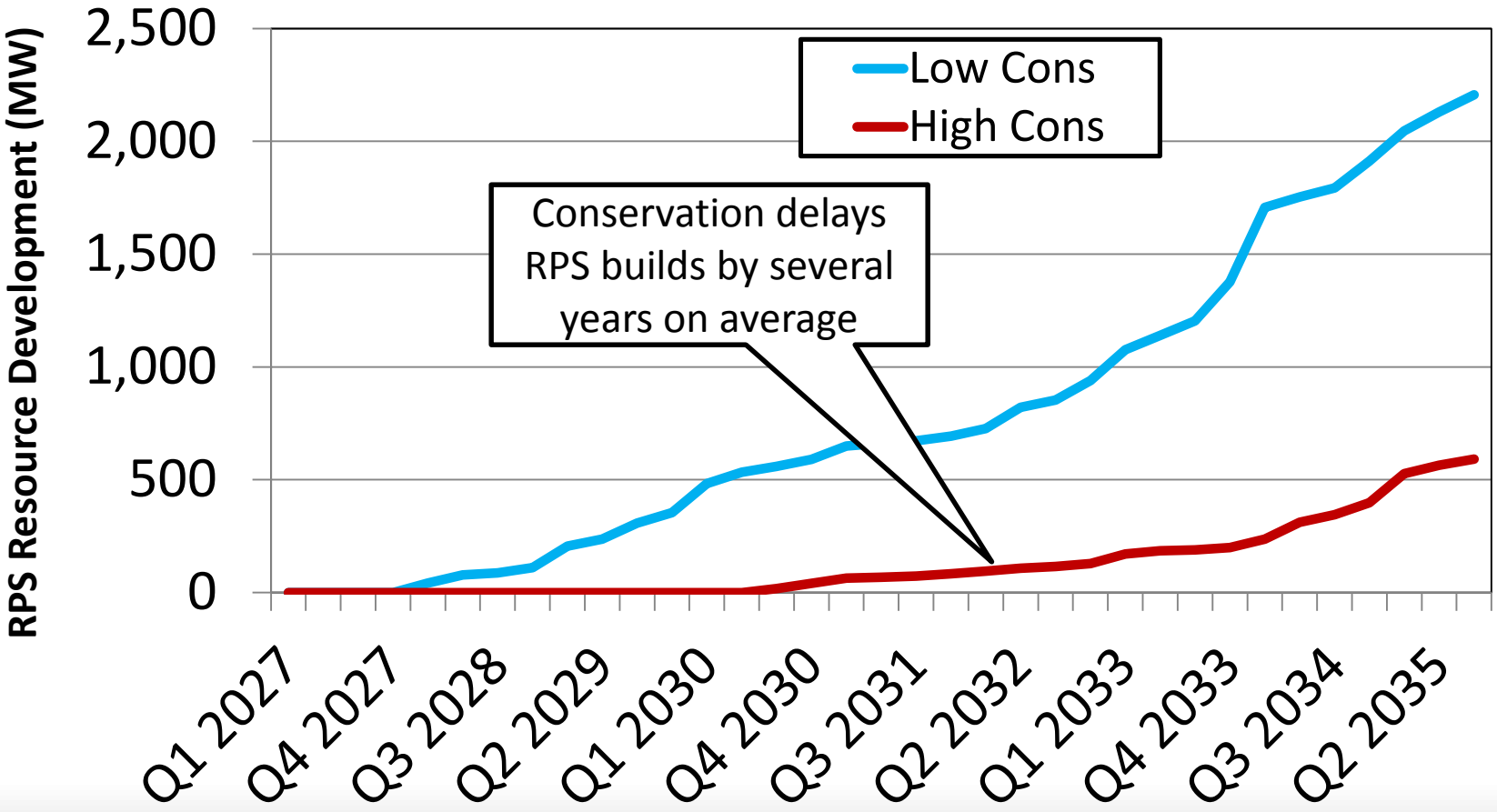
Total Study Conservation Development



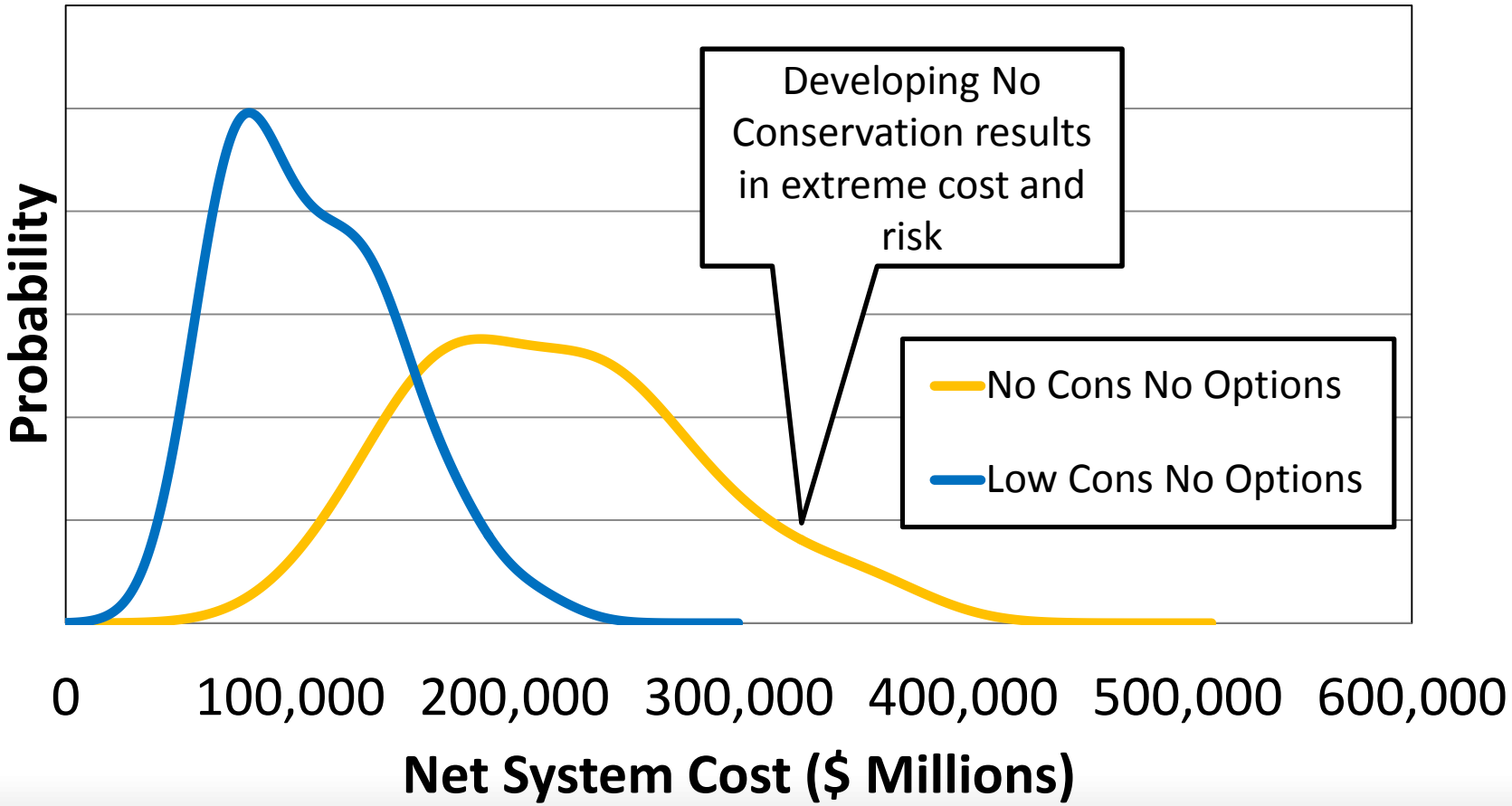
Net System Cost of Low vs. High Conservation Acquisition Resource Strategies



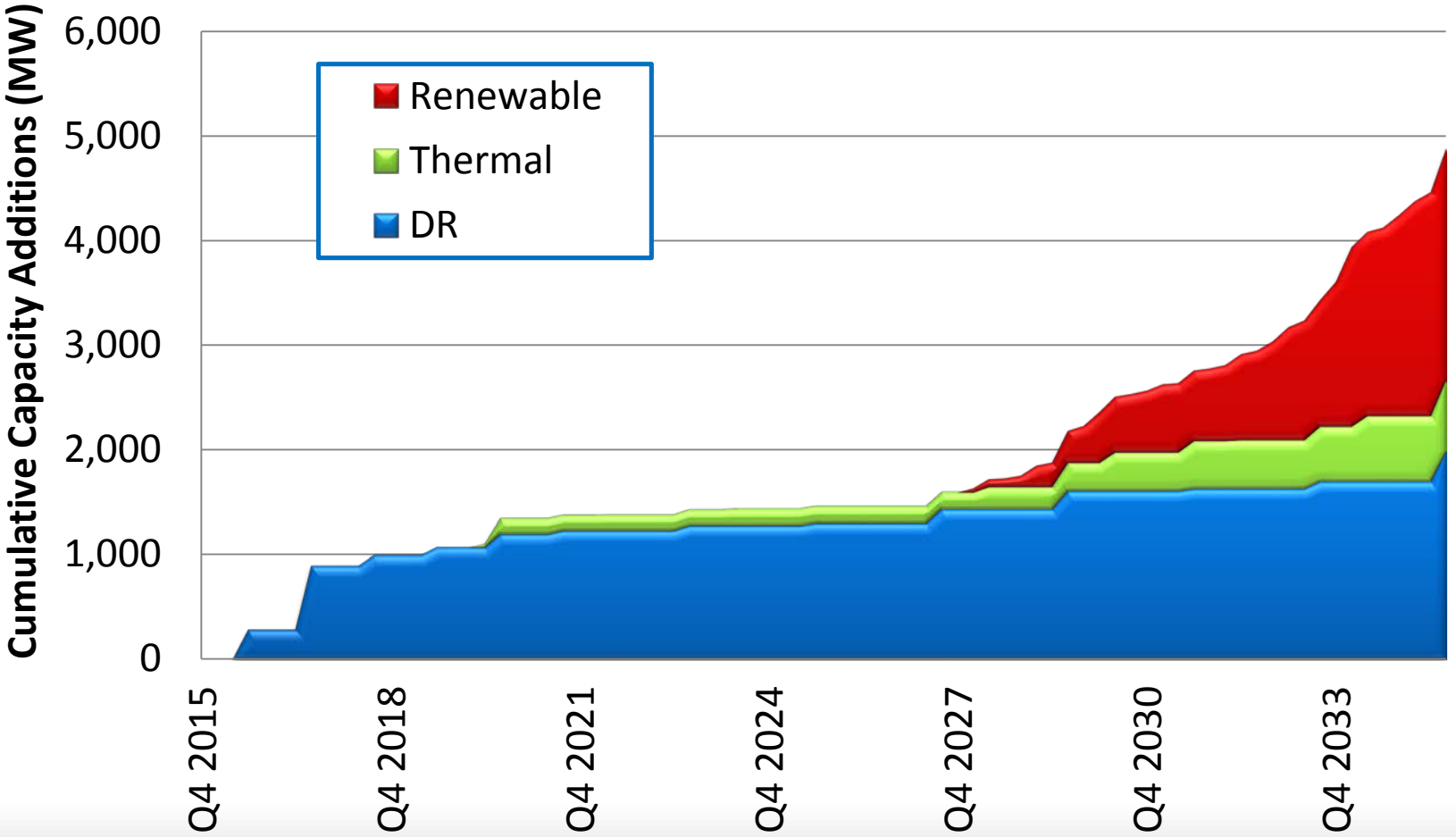
Resource Strategies with Higher Conservation Development Reduces RPS Resource Development



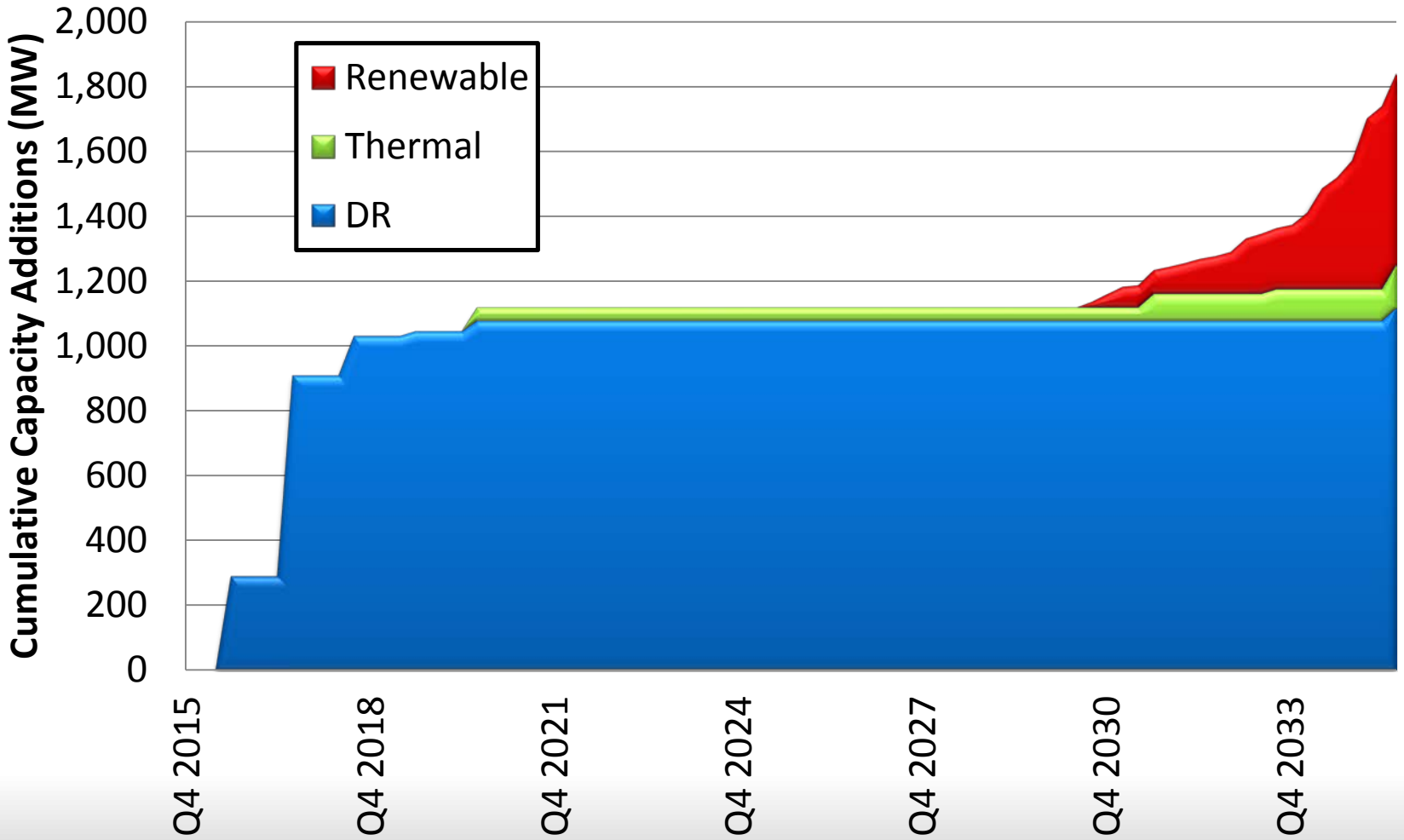
The No Conservation Resource Strategy Increases Net System Cost and Risk



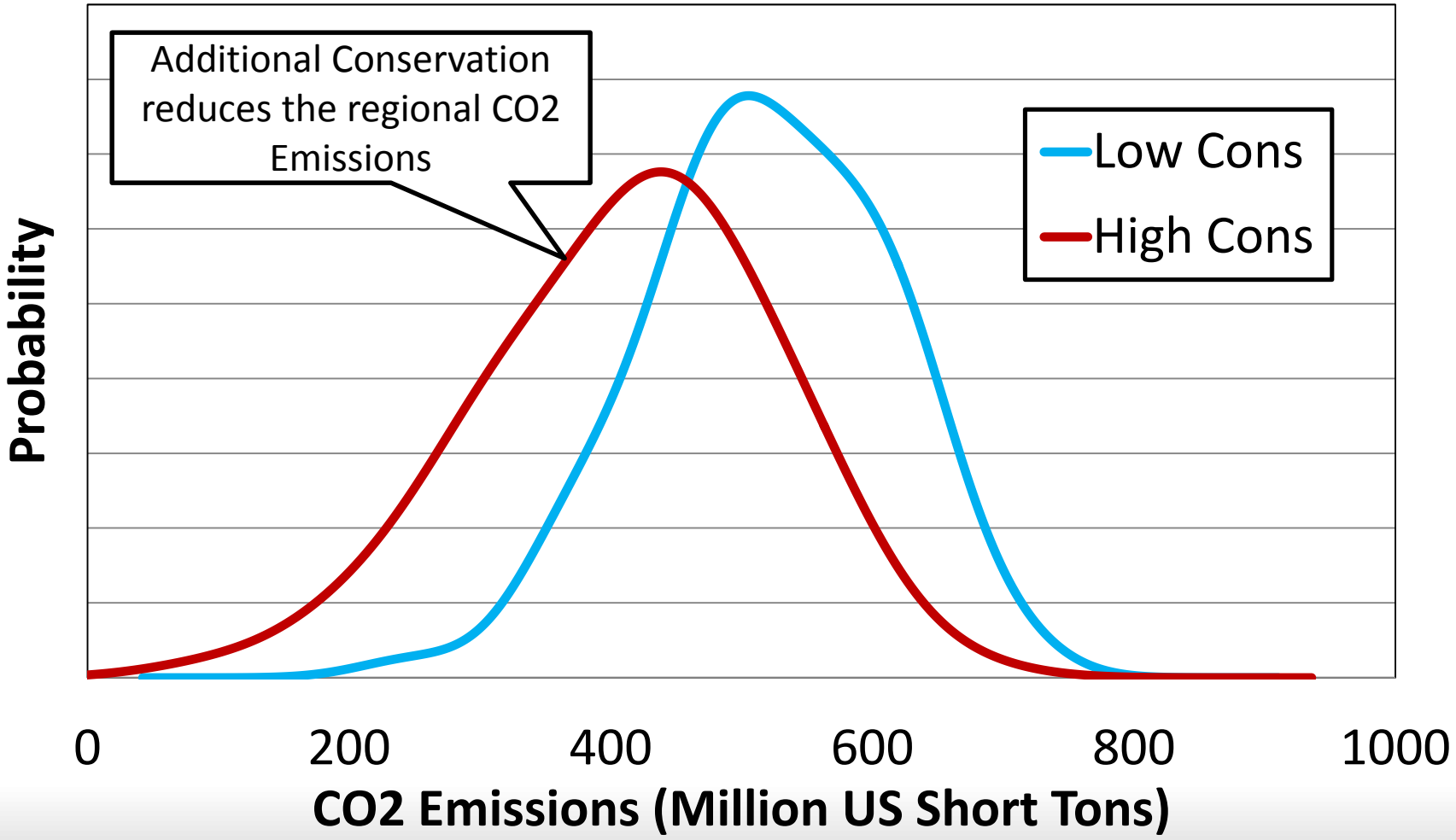
Average Generating and Demand Response Resource Building Out Under Low Conservation Development Resource Strategy



Average Generating and Demand Response Resource Building Out Under High Conservation Development Resource Strategy



Resource Strategies with Higher Conservation Development Reduce CO2 Emissions



QUESTIONS?

Backup

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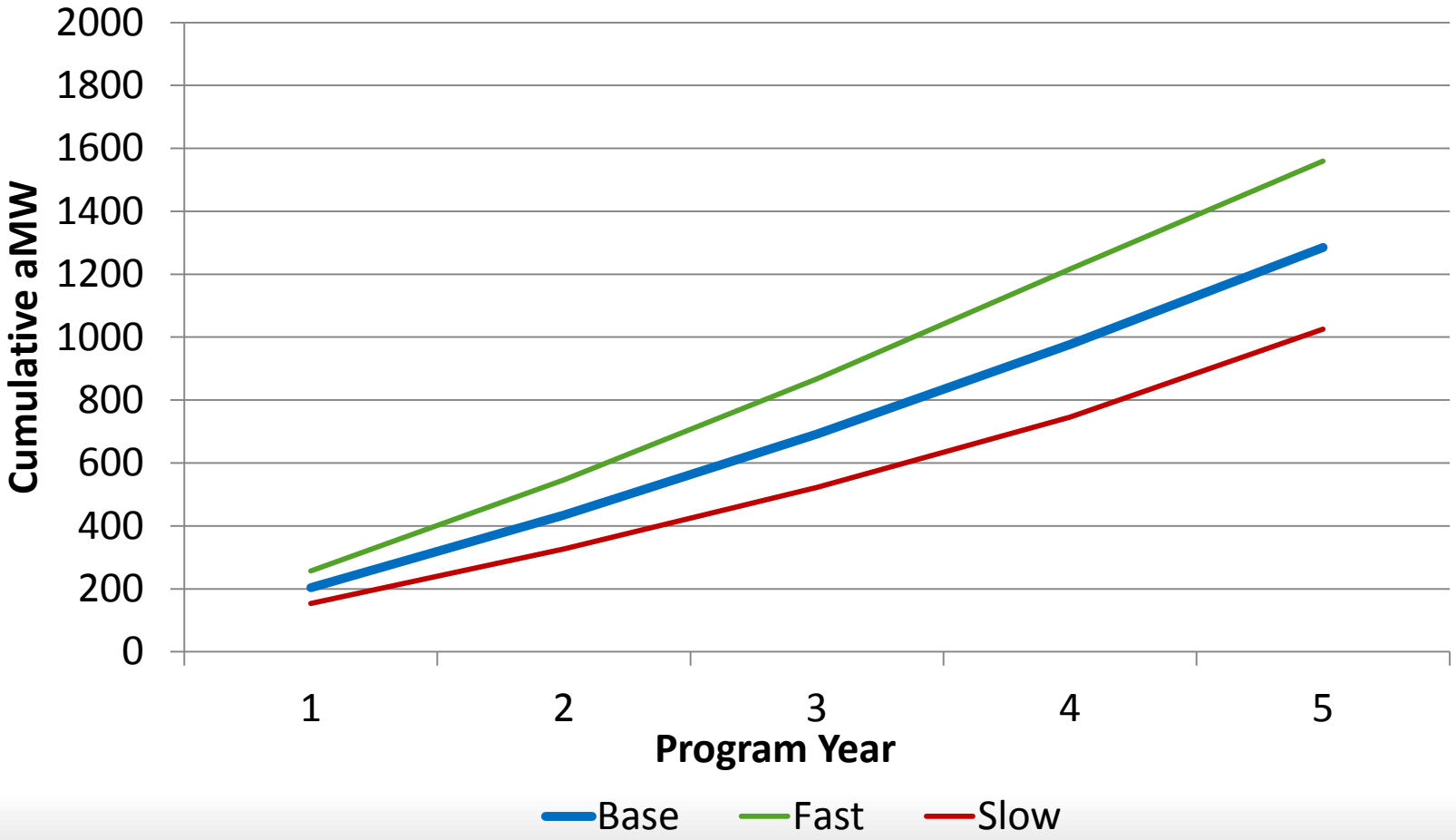
Impact of Shifts: Cumulative

First Five Years, All Measures All Cost Bins (33% shift)



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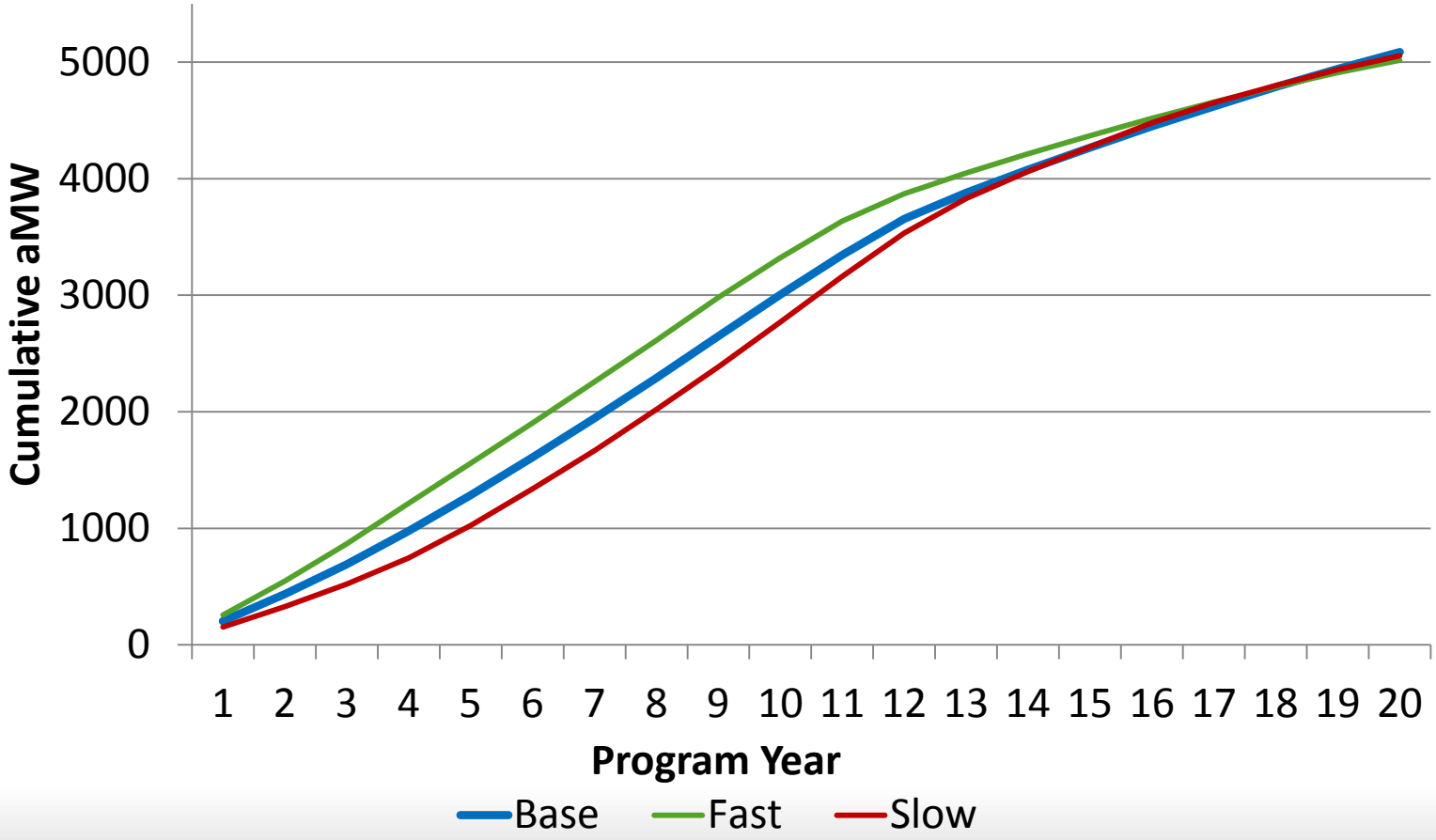
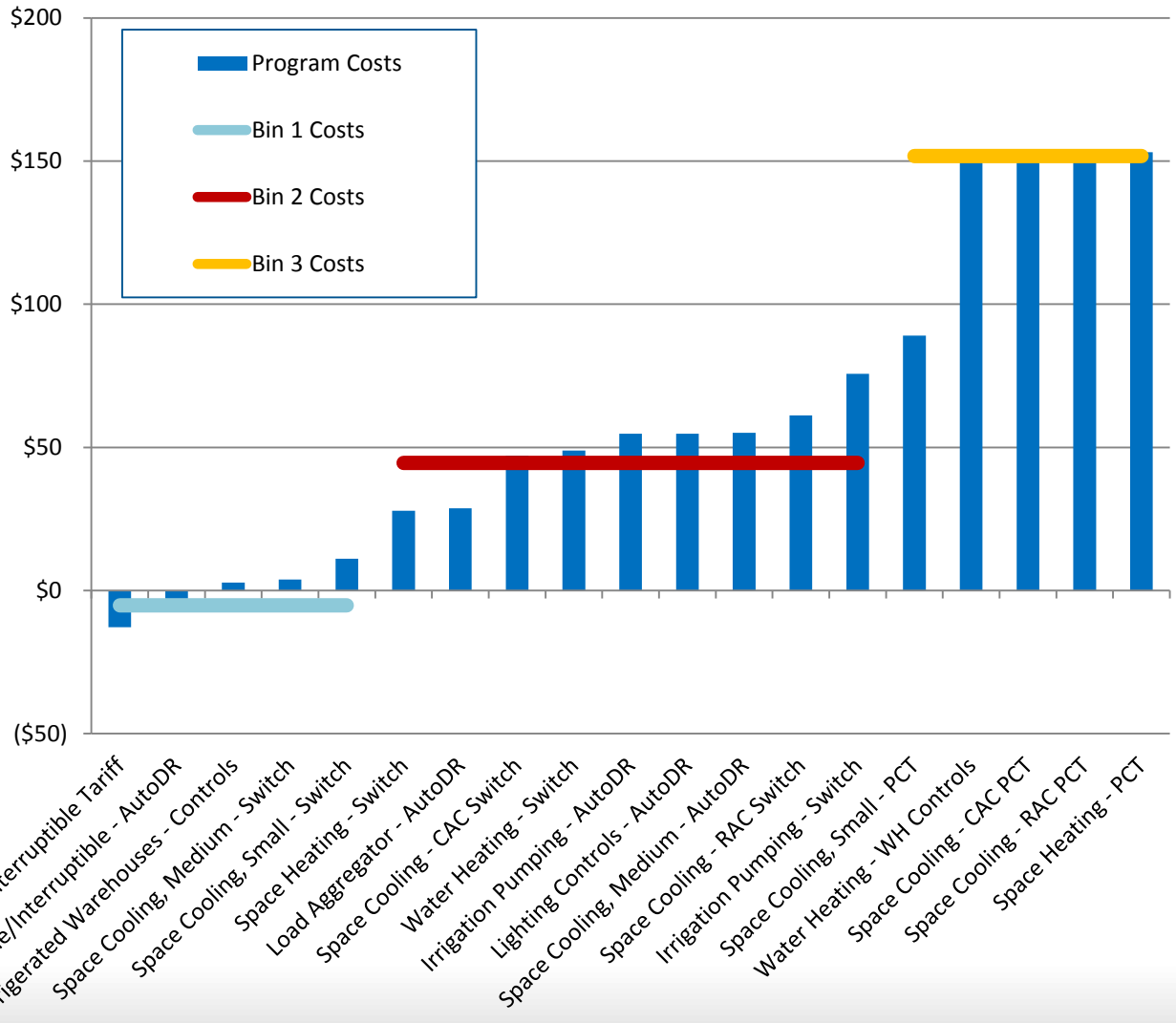


Demand Response Resource Programs by Cost Bin
(No Incentives, 2012$ per kW-year)



Demand Response Resource Programs by Cost Bin
(Added Incentive Cost, 2012$ per kW-year)