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

August 4, 2015

MEMORANDUM

TO: **Council members**

FROM: **Tom Eckman**

SUBJECT: **Scenario Analysis Update and Proposed Elements of Draft Resource Strategy**

BACKGROUND:

Presenter: Tom Eckman and Ben Kujala

Summary: Staff will summarize the results of the last batch of scenario analysis and sensitivity studies conducted to support the development of the Seventh Power Plan. These include:

- Scenario 4A – Unplanned Loss of Major Non-GHG Emitting Resource
- Scenario 4B – Planned Loss of Major Non-GHG Emitting Resource
- Scenario 5B – Increased Reliance on External Regional Market
- Sensitivity S2.1 – Scenario 2C w/Lower Natural Gas Prices
- Sensitivity S3.1 – Scenario 2C w/o Demand Response (DR)
- Sensitivity S5 – Scenario 1B - 35% RPS
- Sensitivity S9 – Scenario 1B – No Transmission and Distribution Deferral Cost Credit

Staff will also present the proposed principle elements of the draft Seventh Plan's resource strategy. This will include recommendations on the level of conservation, demand response and renewable resource development as well as the need for additional natural gas generating capacity. Other elements of the proposed strategy include policies that would best position

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the region to comply with the Administrations' Clean Power Plan and maintain regional adequacy standards.

Relevance: A resource strategy is one of the mandatory components of the Council's power plans. It is generally viewed as the most important element of the plan.

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

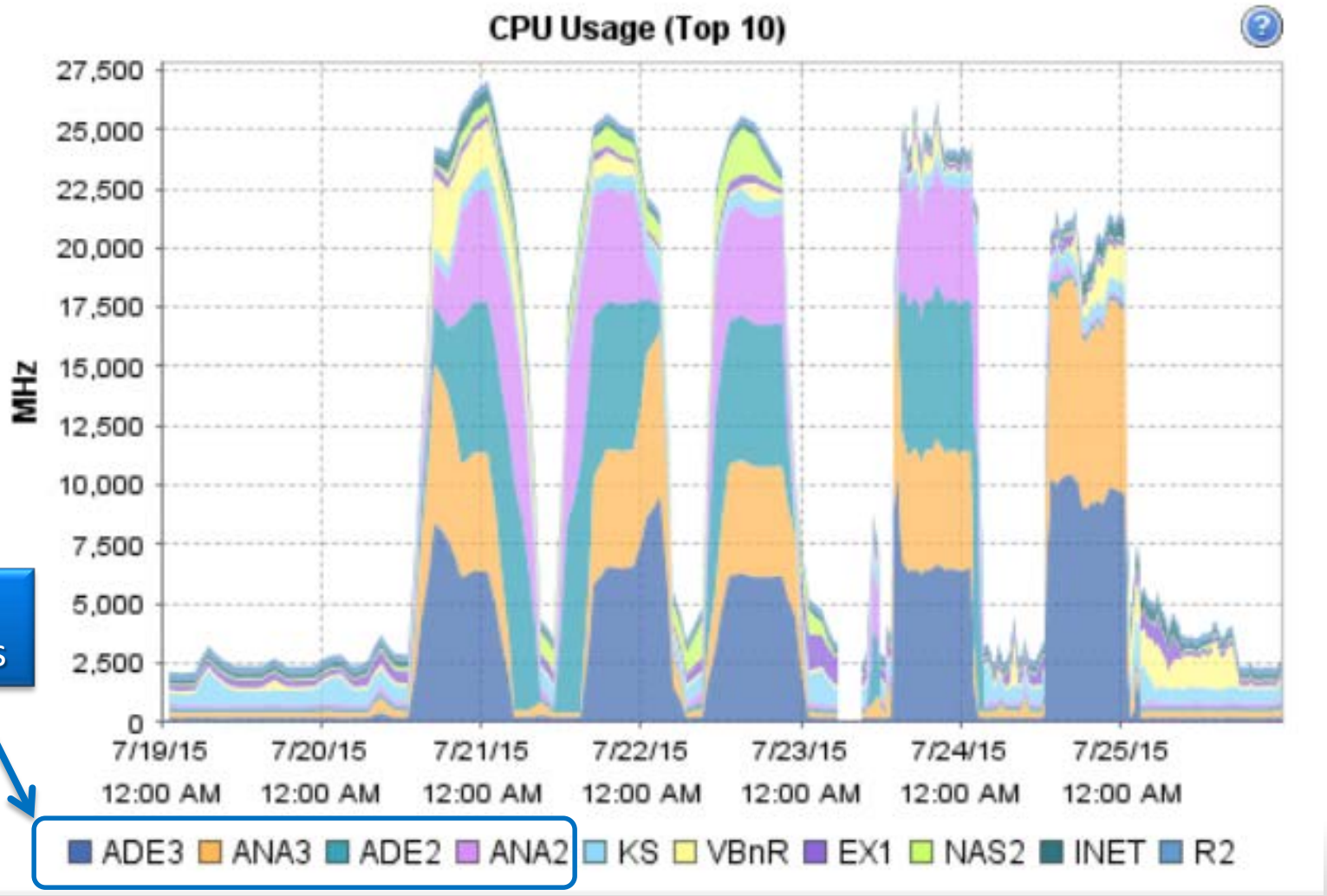
Background: All proposed scenario analysis and sensitivity studies have been completed. Based on the full array of results observed from these analysis staff is developing a draft resource strategy. Staff will present the outlines of the proposed draft resource strategy to the Power Committee at its August 6th webinar. Staff views this outline as a straw proposal intended for prompt discussion among Council members and to assist the staff in developing a revised version for full Council discussion at the August meeting. Additional iterations of the resource strategy, including the actual plan chapter text will submitted for Council consideration prior to draft plan's adoption in October.

More Info: See accompany PowerPoint presentation

Selected Findings from Scenario and Sensitivity Analysis Conducted To Date and Proposed Elements of Draft Resource Strategy

August 12, 2015

Progress Since The July Council Meeting: All Planned Scenario Analysis Completed!



RPM Systems

Scope of Today's Presentation
Scenario and Sensitivity Study Results

- Scenario Analysis Results
  - Scenario 4A – Unplanned Loss of Major Non-GHG Emitting Resource
  - Scenario 4B – Planned Loss of Major Non-GHG Emitting Resource
  - Scenario 5B – Increased Reliance on External Regional Market

- Sensitivity Study Results
  - Sensitivity S2.1 – Scenario 2C w/Lower Natural Gas Prices
  - Sensitivity S3.1 – Scenario 2C w/o Demand Response (DR)
  - Sensitivity S5 – Scenario 1B - 35% RPS

Summary of Findings: Remaining Scenarios

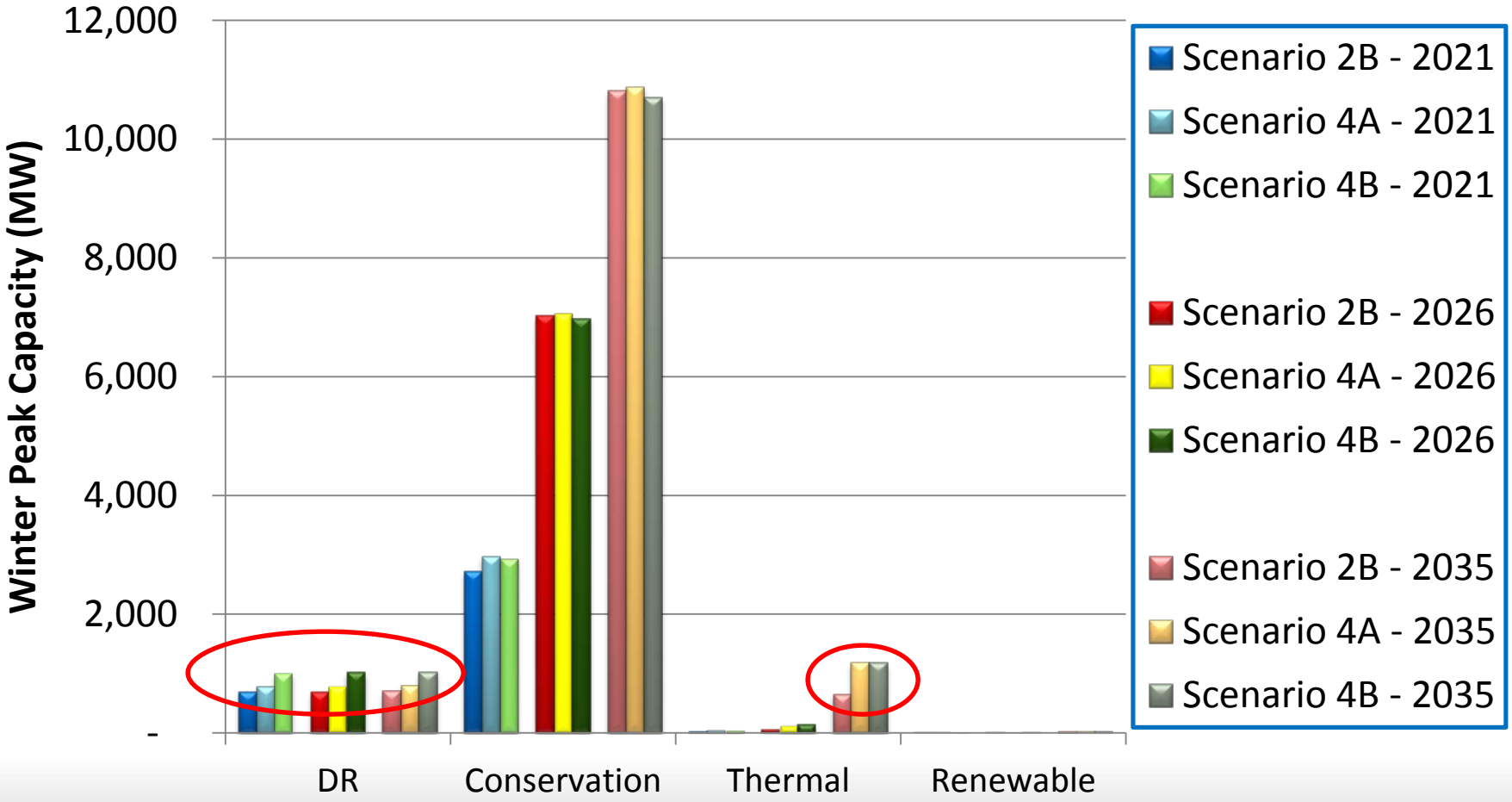
Scenario 4A – Unplanned Loss of Major Non-GHG Emitting Resources

- Assumptions
  - ~1200 NW Nameplate Resource
    - ~1000 aMW average annual generation
  - Probability of Loss Increases Through Time
  - 75% Probability Resource Lost by 2030, 100% by 2035
    - Assumes 111(d) compliance date remains unchanged from draft rule)
  - Scenario 2B – Social Cost of Carbon @ 3% Level Assumed as Baseline

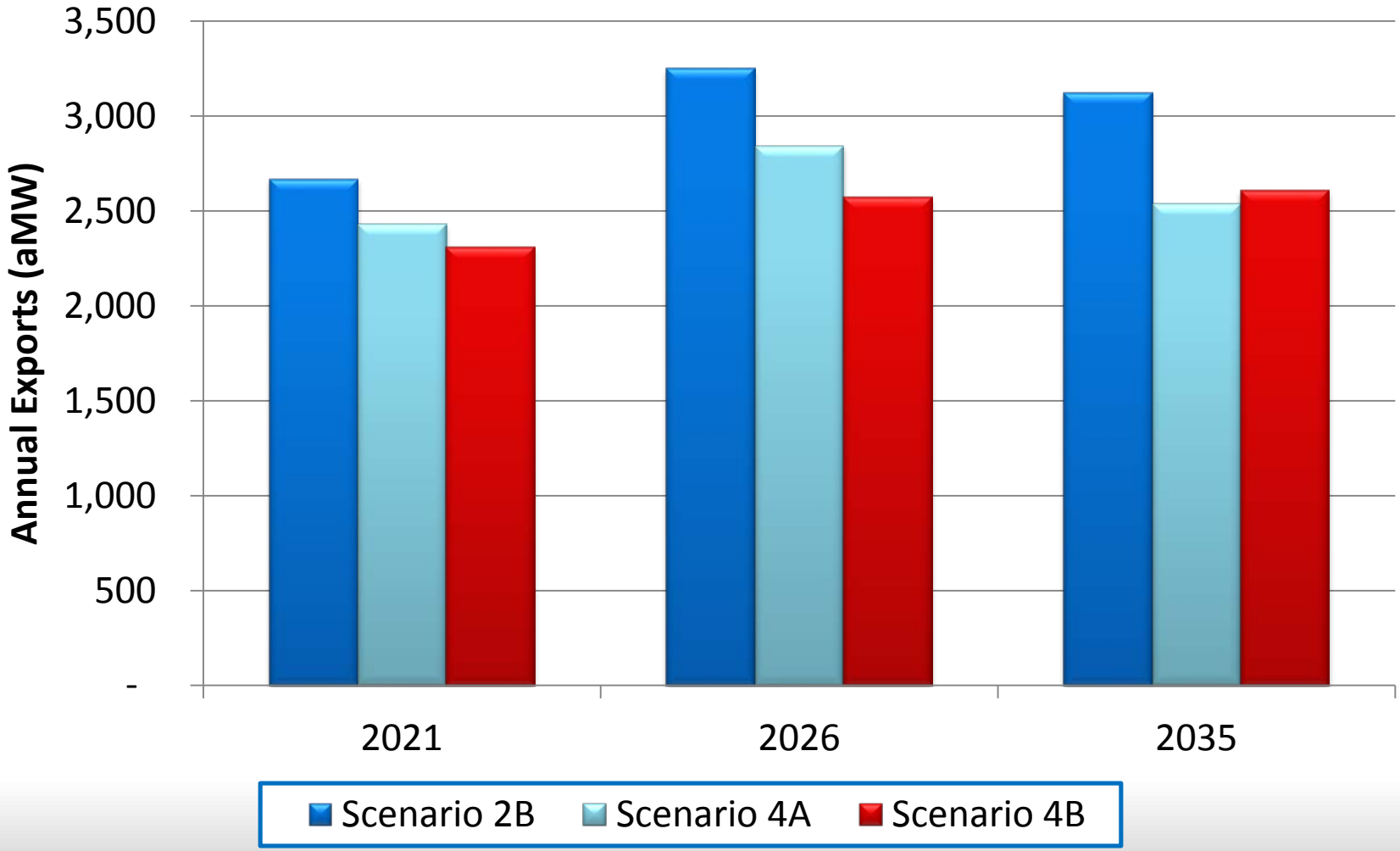
Scenario 4B – Planned Loss of Major Non-GHG Emitting Resources

- Assumptions
  - ~1000 MW Nameplate Resource
    - 855 aMW annual energy generation
  - Retired in ~855 aMW in roughly equal increments every 3-years
  - All retirements occur by 2030
    - Assumes 111(d) compliance date remains unchanged from draft rule
  - Scenario 2B – Social Cost of Carbon @ 3% Level Assumed as Baseline

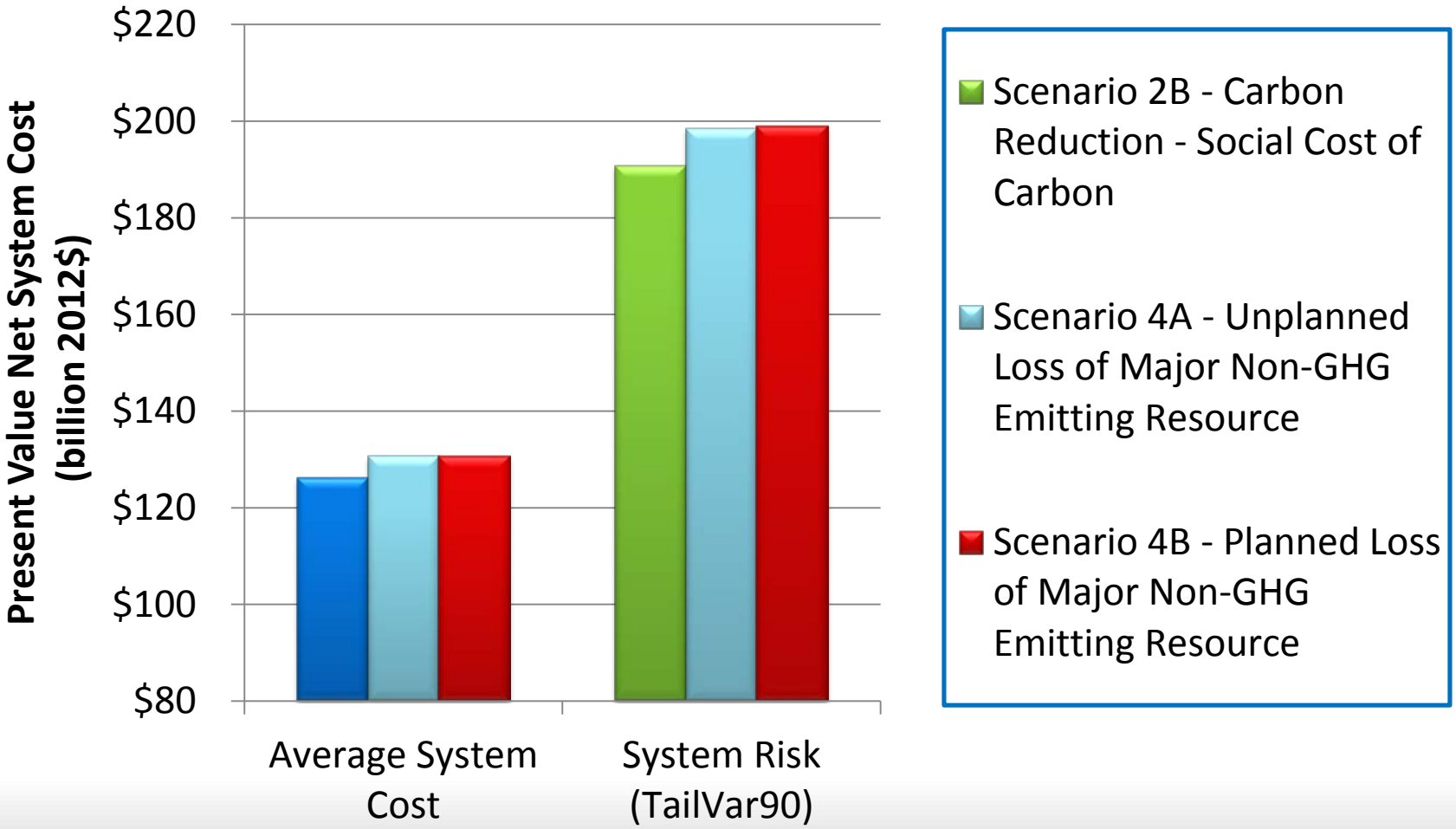
The Least Cost Resource Strategies in Scenarios 4A and 4B Compared to Scenario 2B Rely More on Demand Response and Gas Generation to Meet Winter Capacity Demands



The Least Cost Resource Strategies in Scenarios 4A and 4B Compared to Scenario 2B Rely on Reduced Regional Exports to Meet Energy Requirements



The Least Cost Resource Strategies in Scenarios 4A and 4B Compared to Scenario 2B Have Higher Net Present Value System Costs and Risks



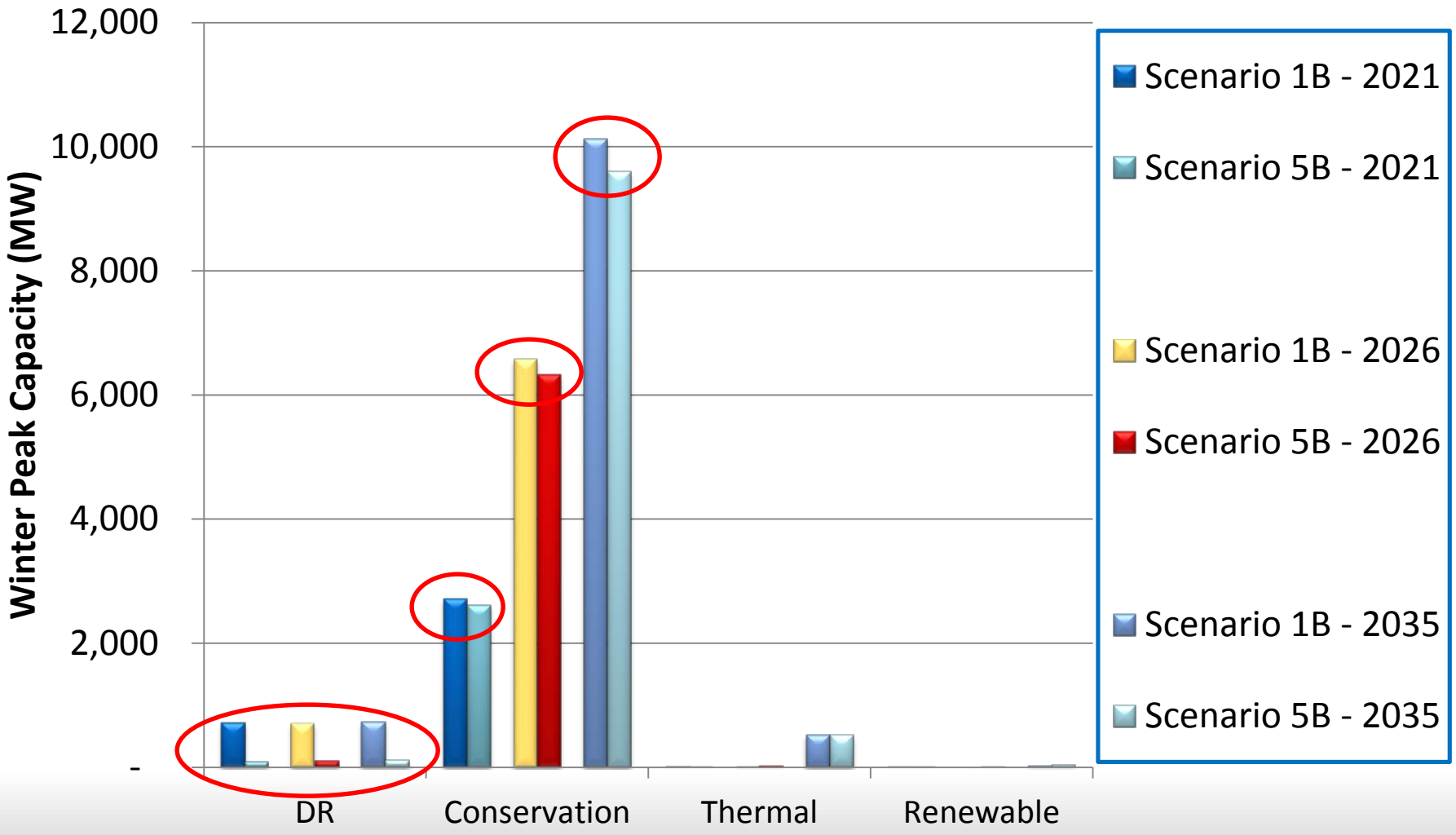
Observation from 4A and 4B Scenario Analysis Results

- Resource strategies to address both planned and unplanned resource loss rely on
  - Increased DR (especially in planned case)
  - Increased new gas-generation
  - Reduced regional exports
- Still achieve final 111(b) + 111(d) carbon emissions reductions by 2030
- Increase net system cost and risk

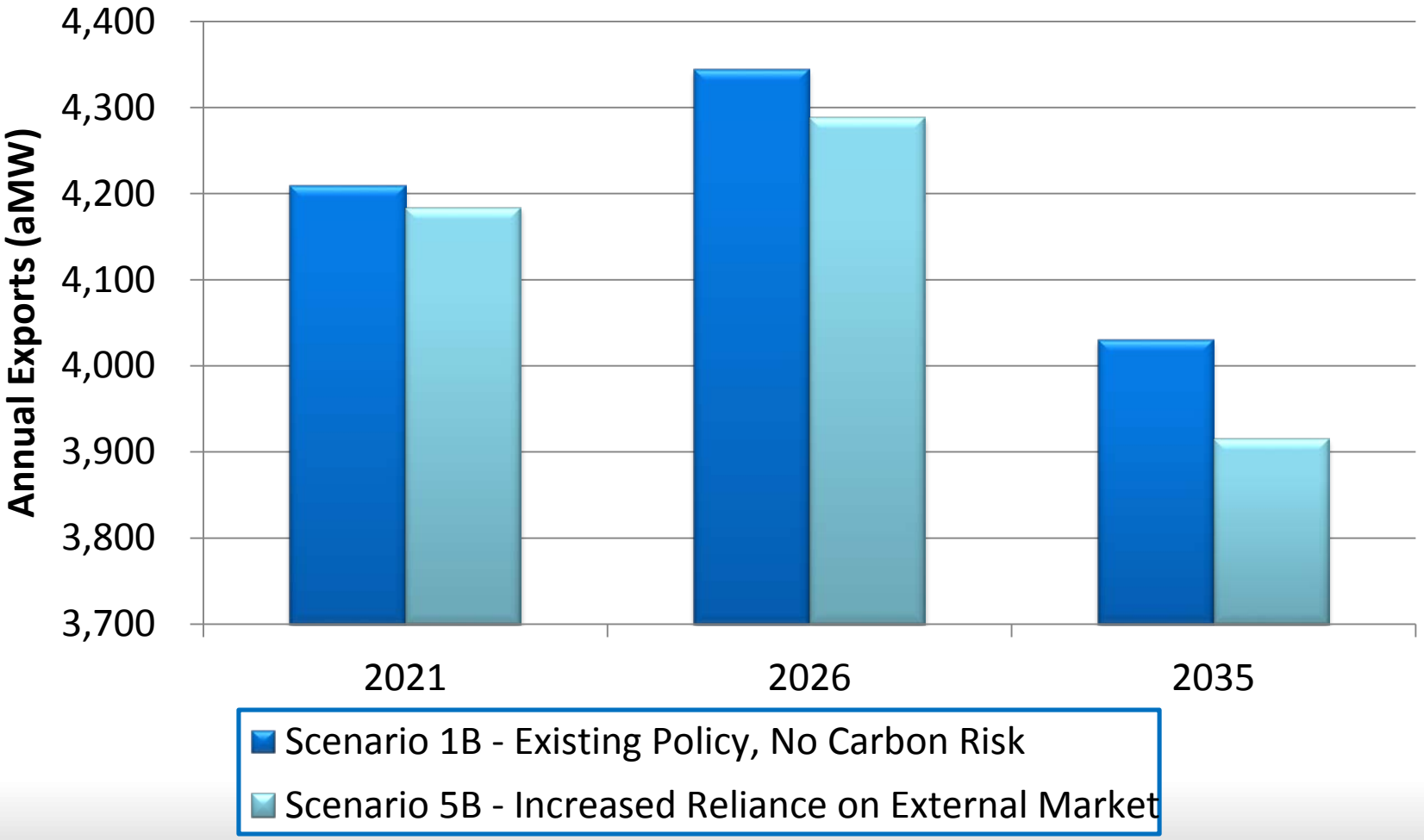
Scenario 5B – Increased Reliance on Extra-Regional Market

- Assumptions
  - Resource Adequacy Standard constraint changed from 2500 aMW to 3400 aMW for high load hours in winter quarter
  - GENESYS used to estimate revised Adequacy Reserve Margins (ARMs) for capacity and energy
  - Scenario 1B – Existing Policies, No Carbon Risk Assumed as Baseline

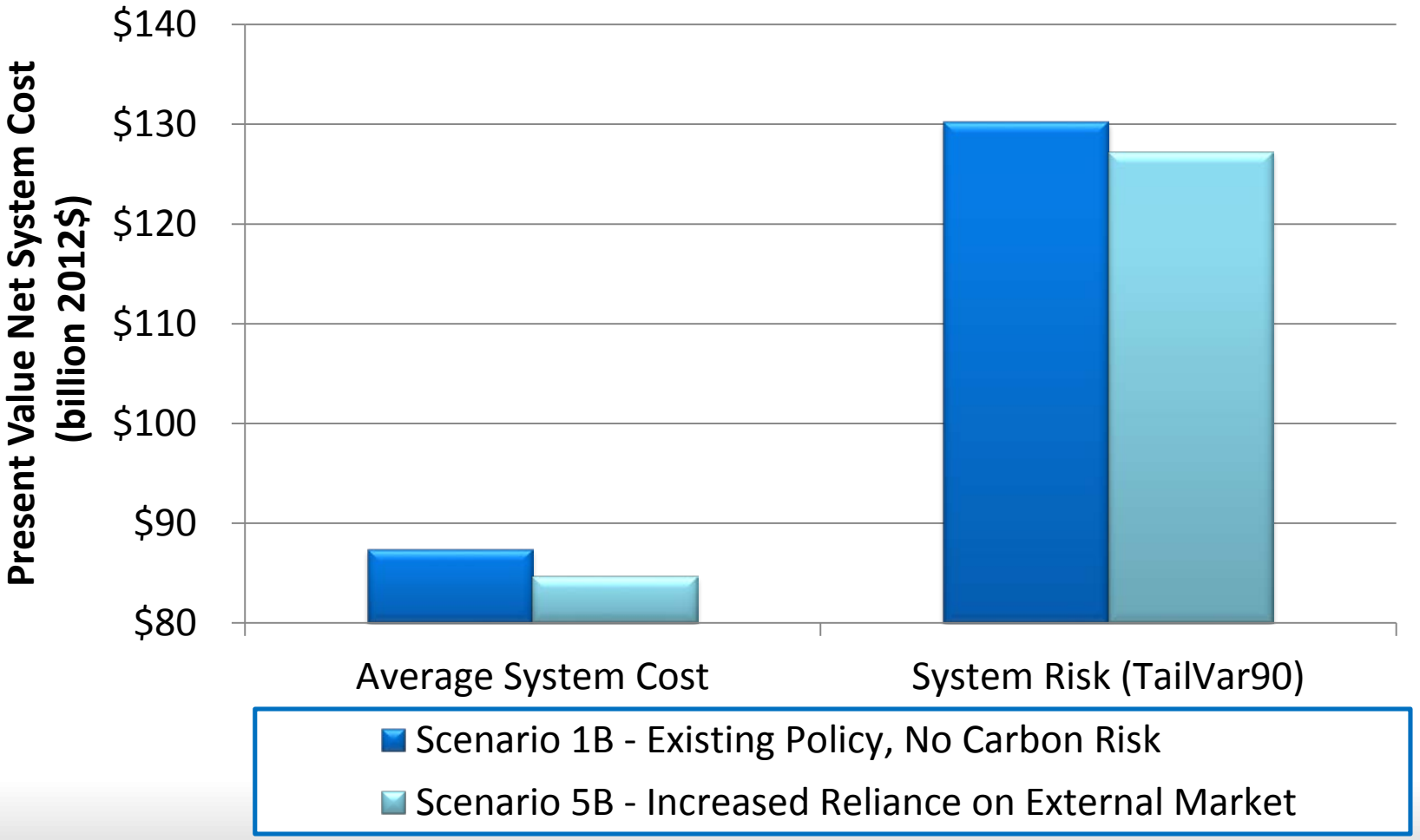
The Least Cost Resource Strategy in Scenario 5B Compared to Scenario 1B Relies Less on Demand Response and Conservation to Meet Winter Peaks



The Least Cost Resource Strategy in Scenario 5B Compared to Scenario 1B Slightly Reduces Regional Exports to Meet Annual Energy Requirements



The Least Cost Resource Strategy in Scenario 5B Compared to Scenario 1B Has a Lower Net Present Value System Costs and Risks



Observations from 5B Scenario Analysis Results

- Resource strategies that place greater reliance on external markets rely on:
  - Slightly less Energy Efficiency for capacity and energy
  - Significantly less Demand Response for capacity
  - Slightly decreased regional exports for energy
- Decrease Net System Cost and Risk
- Still achieve final 111(b) + 111(d) carbon emissions reductions
- Potential for large reduction in NPV system cost suggests Council should recommend review of current Resource Adequacy Assessment limits on external market reliance for winter capacity

Summary of Findings: New Sensitivity Studies

- Sensitivity S2.1 – Scenario 2C w/Lower Natural Gas Prices
- Sensitivity S3.1 – Scenario 2C w/o Demand Response (DR)
- Sensitivity S5 – Scenario 1B - 35% RPS

Staff generated this sensitivity study after review of results from Sensitivity Study 2B.1 Which used the 95% percentile estimate of Social Cost of Carbon. Findings will be discussed with other carbon reductions policies.

Observation from Sensitivity Studies 2.1 and 3.1

- Resource strategies in scenarios with *systematically lower natural gas and electricity prices* in futures where the Social Cost of Carbon is considered increase regional reliance on existing natural gas generation and reduce conservation development and coal generation
  - Least cost strategies with lower gas and electricity prices have a lower cost and risk
- Resource strategies that *exclude demand response* in futures where the Social Cost of Carbon is considered rely on increased use of natural gas
  - Least cost strategies without DR have a higher net system cost and risk
- Under both sensitivity studies the final 111(b) + 111(d) carbon emissions targets are achieved by 2030

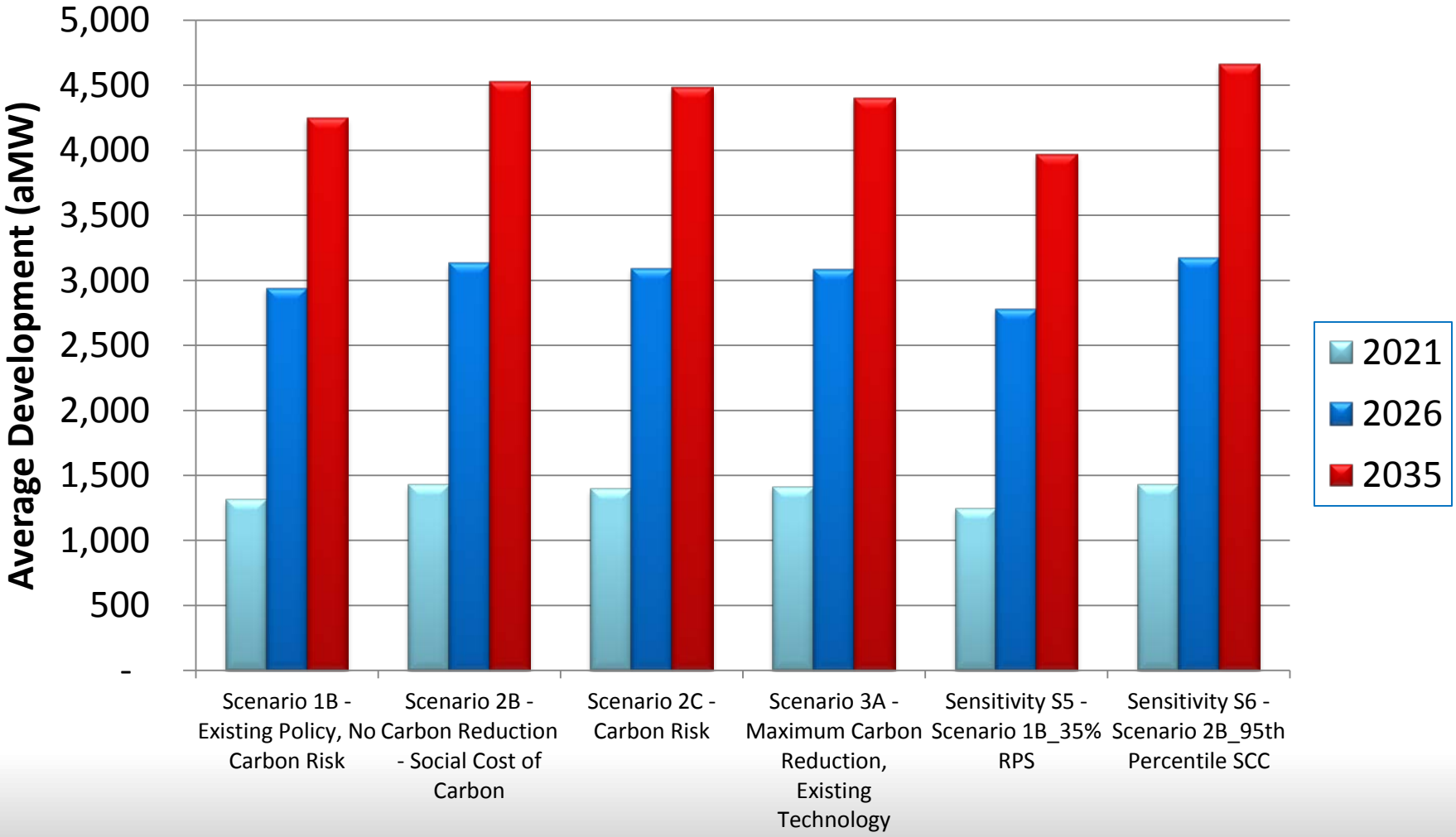
Carbon Reduction Policy Comparisons

August 12, 2015

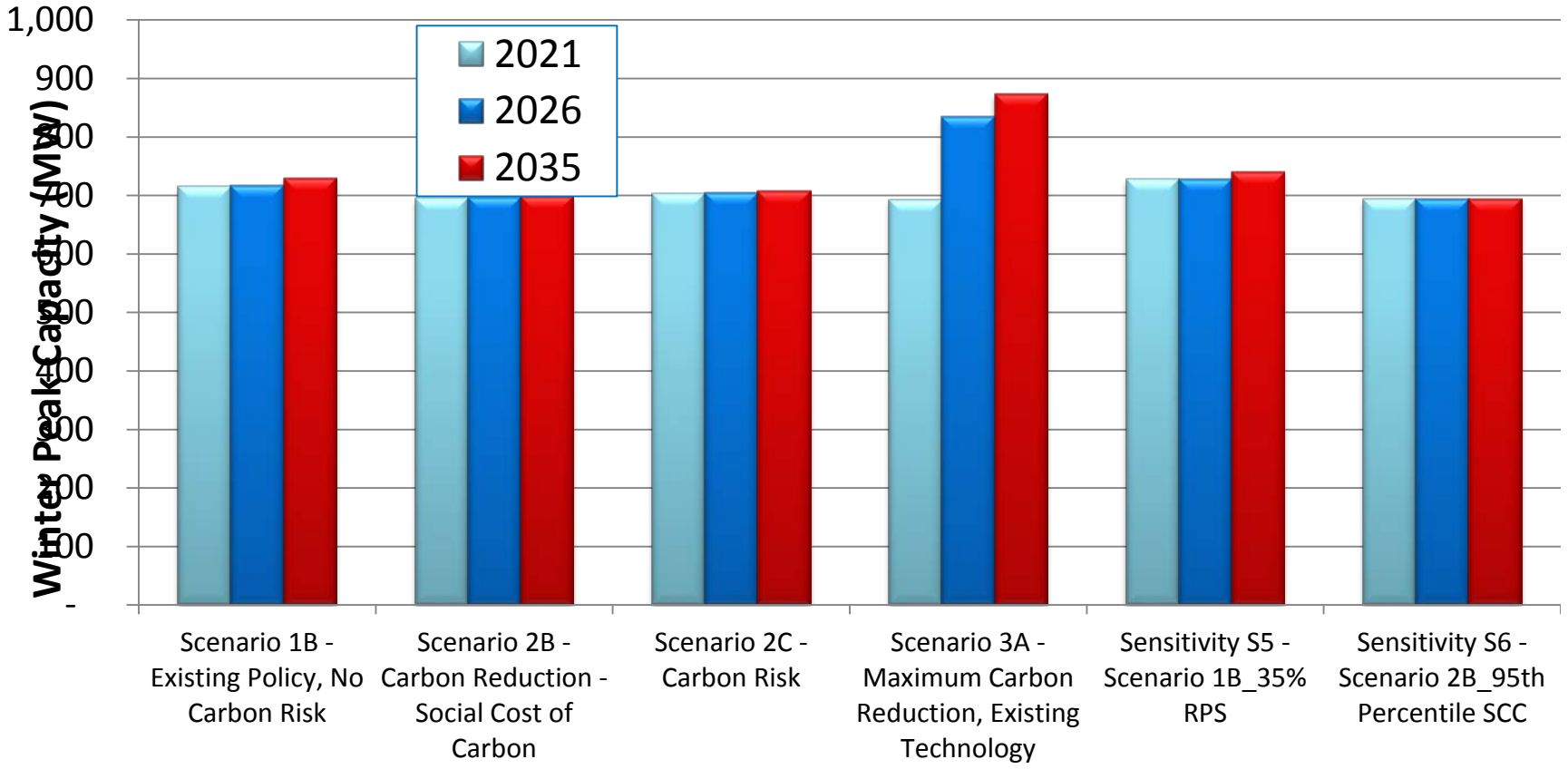
Carbon Reduction Policy Comparisons

- Review of Five Scenarios/Sensitivity Studies
  - Scenario 2B – Social Cost of Carbon (@ 3% Estimate of SCC)
  - Scenario 2C – Carbon Risk
  - Scenario 3A – Maximum Carbon Reduction with Existing Technology
  - Sensitivity S5 – Social Cost of Carbon @ 95% Percentile Estimate of SCC
  - Sensitivity S6 – Renewable Portfolio Standard @ 35%
- Basis of Comparison:
  Scenario 1B – Existing Policies, No Carbon Risk

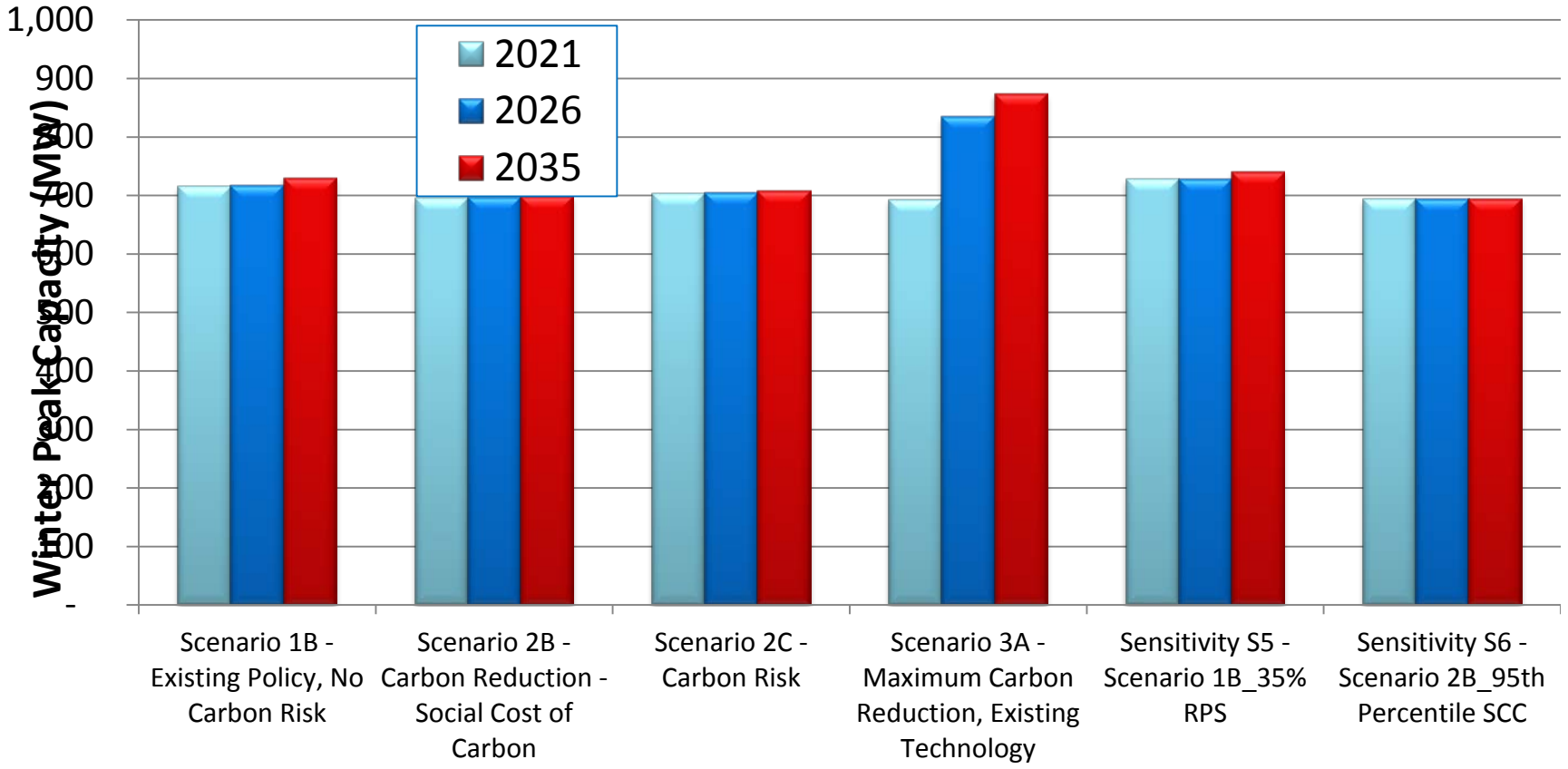
Average Conservation Development Under Alternative Carbon Emissions Reduction Policies Is Very Similar, Except for RPS @ 35% Policy Which Develops Less Energy Efficiency Than the Existing Policy, No Carbon Risk Scenario



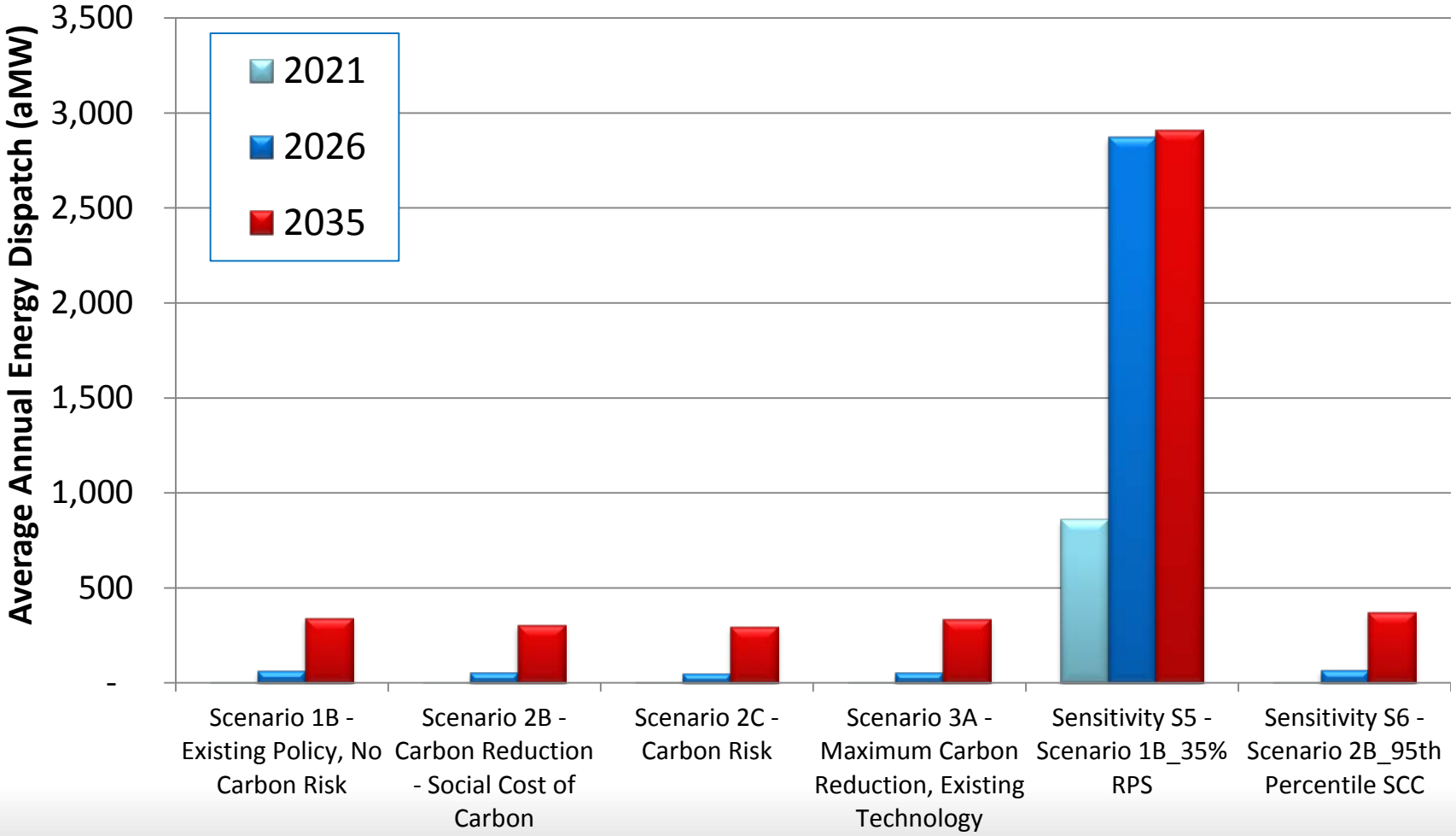
Average Demand Response Development Under Alternative Carbon Emissions Reduction Policies is Similar To the Existing Policy, No Carbon Risk Scenario, Except for Post-2026 in the Maximum Carbon Reduction Scenario Policy (3A)



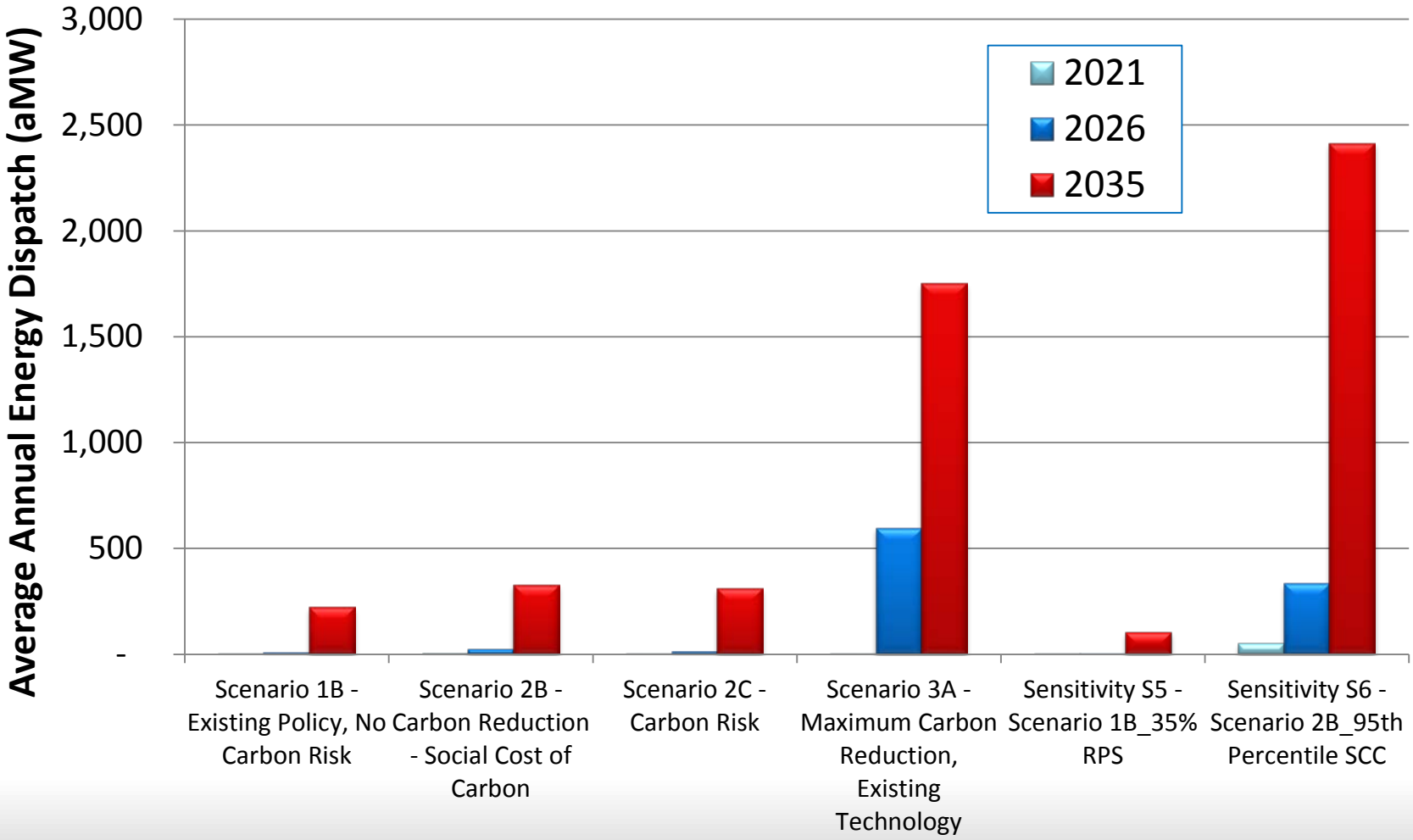
Average Demand Response Development Under Alternative Carbon Emissions Reduction Policies is Similar To the Existing Policy, No Carbon Risk Scenario, Except for Post-2026 in the Maximum Carbon Reduction Scenario Policy (3A)



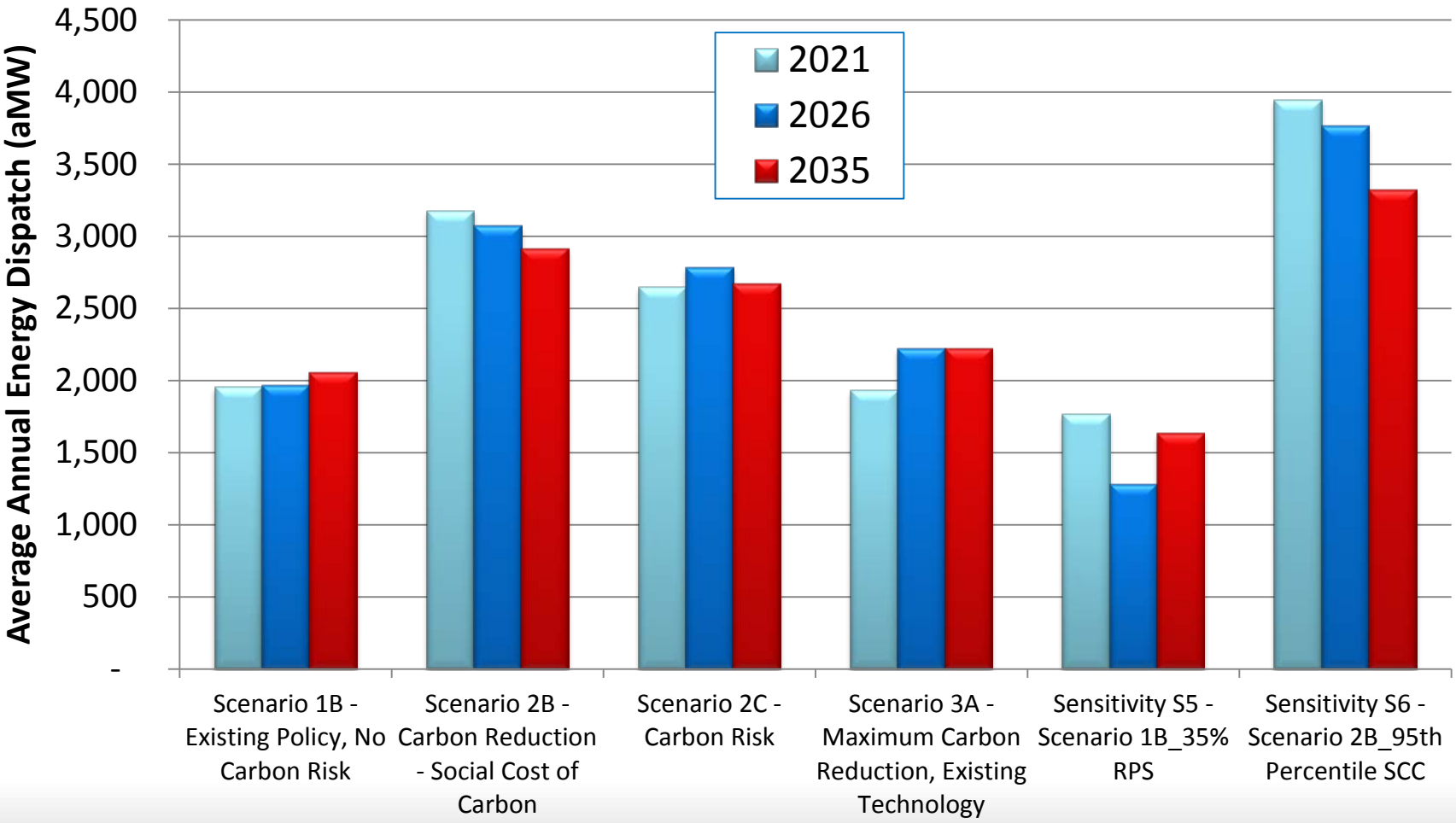
Average Renewable Resource Development Under Alternative Carbon Emissions Reduction Policies Is Very Similar to the Existing Policy, No Carbon Risk Scenario, Except for the RPS @ 35% Policy



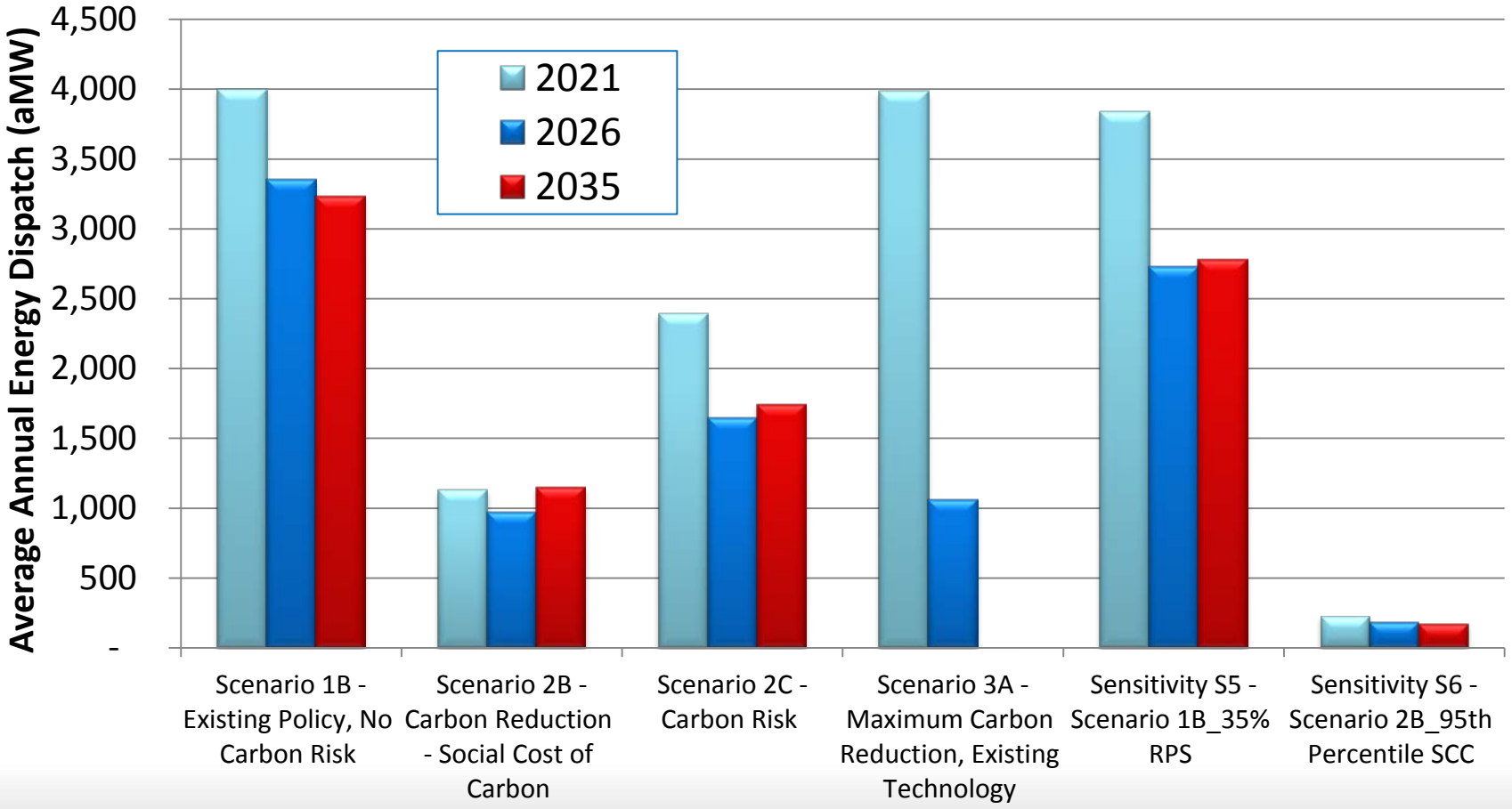
Average New Gas Generation Development Under Alternative Carbon Emissions Reduction Policies Is Very Similar To the Existing Policy, No Carbon Risk Scenario, Except for the Maximum Emissions Reduction Scenario (3A) and Social Cost of Carbon at the 95th Percentile Policies



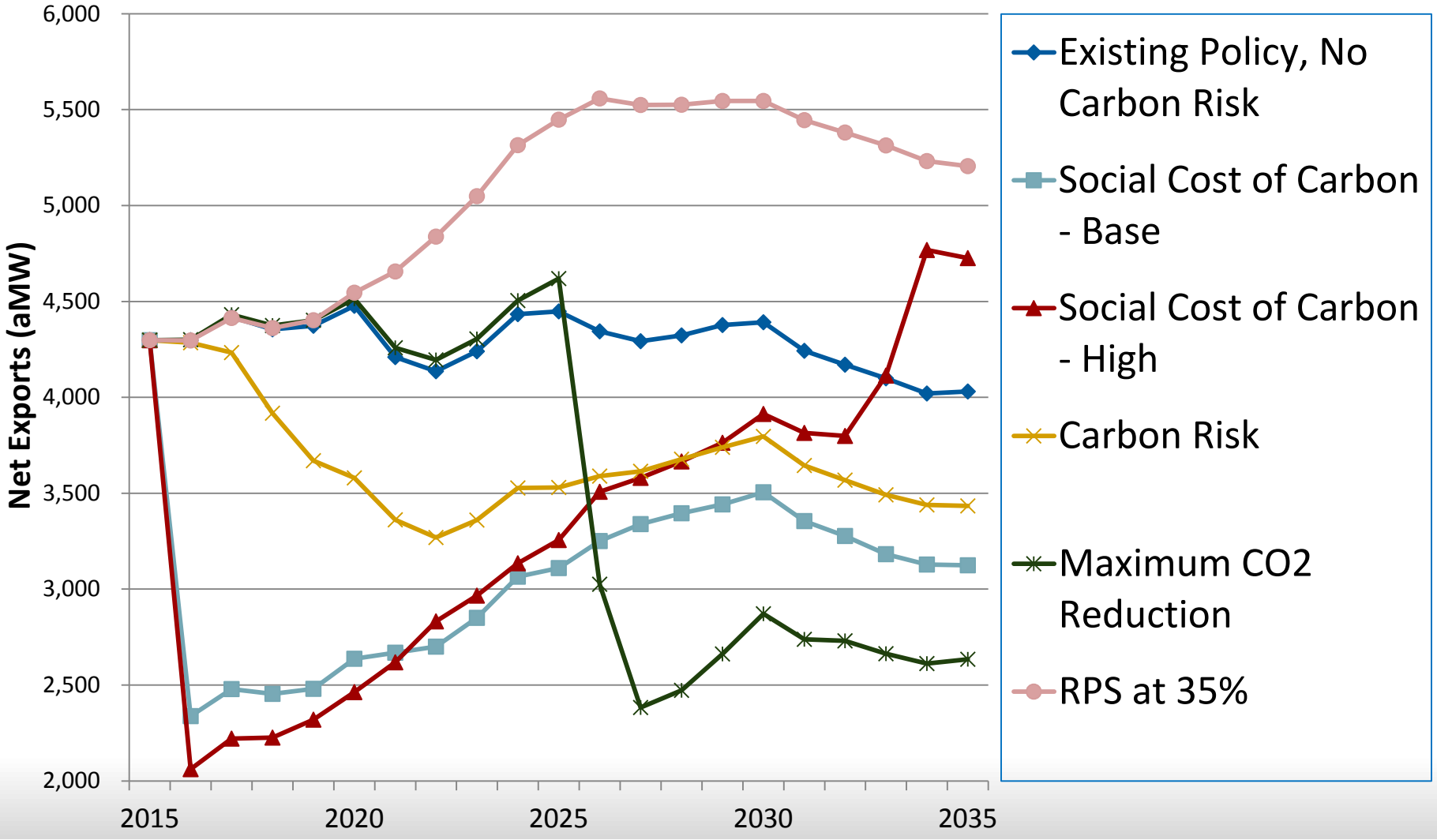
Average Existing Gas Generation Dispatch Under Alternative Carbon Emissions Reduction Policies Is Generally Higher Than the Existing Policy, No Carbon Risk Scenario, Except for the RPS @ 35% Policy



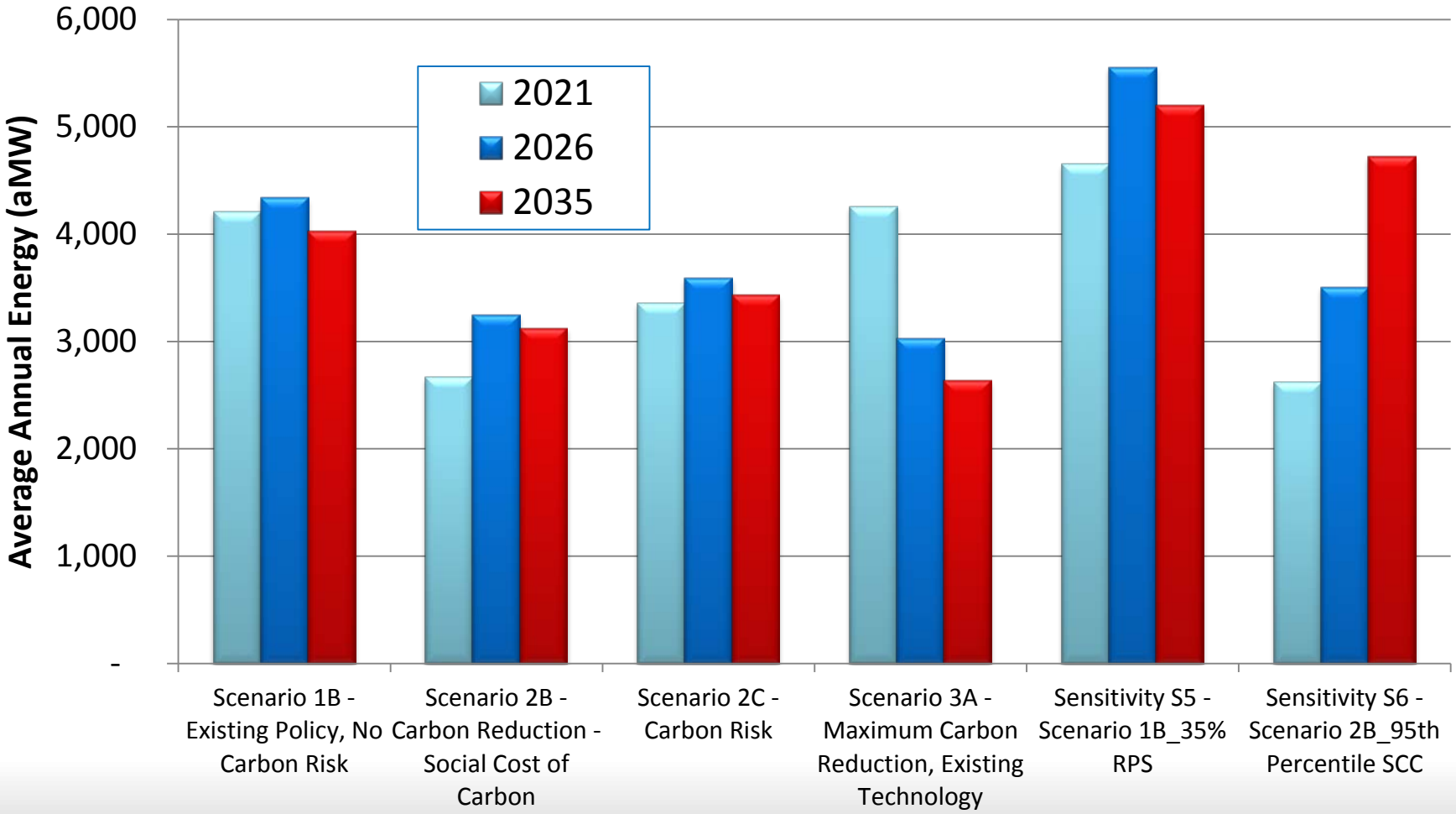
Average Existing Coal Generation Dispatch Under Alternative Carbon Emissions Reduction Policies Is Significantly Reduced or Eliminated Under Most Strategies, With The Least Long Term Reduction Occurring Under the RPS @ 35% Policy



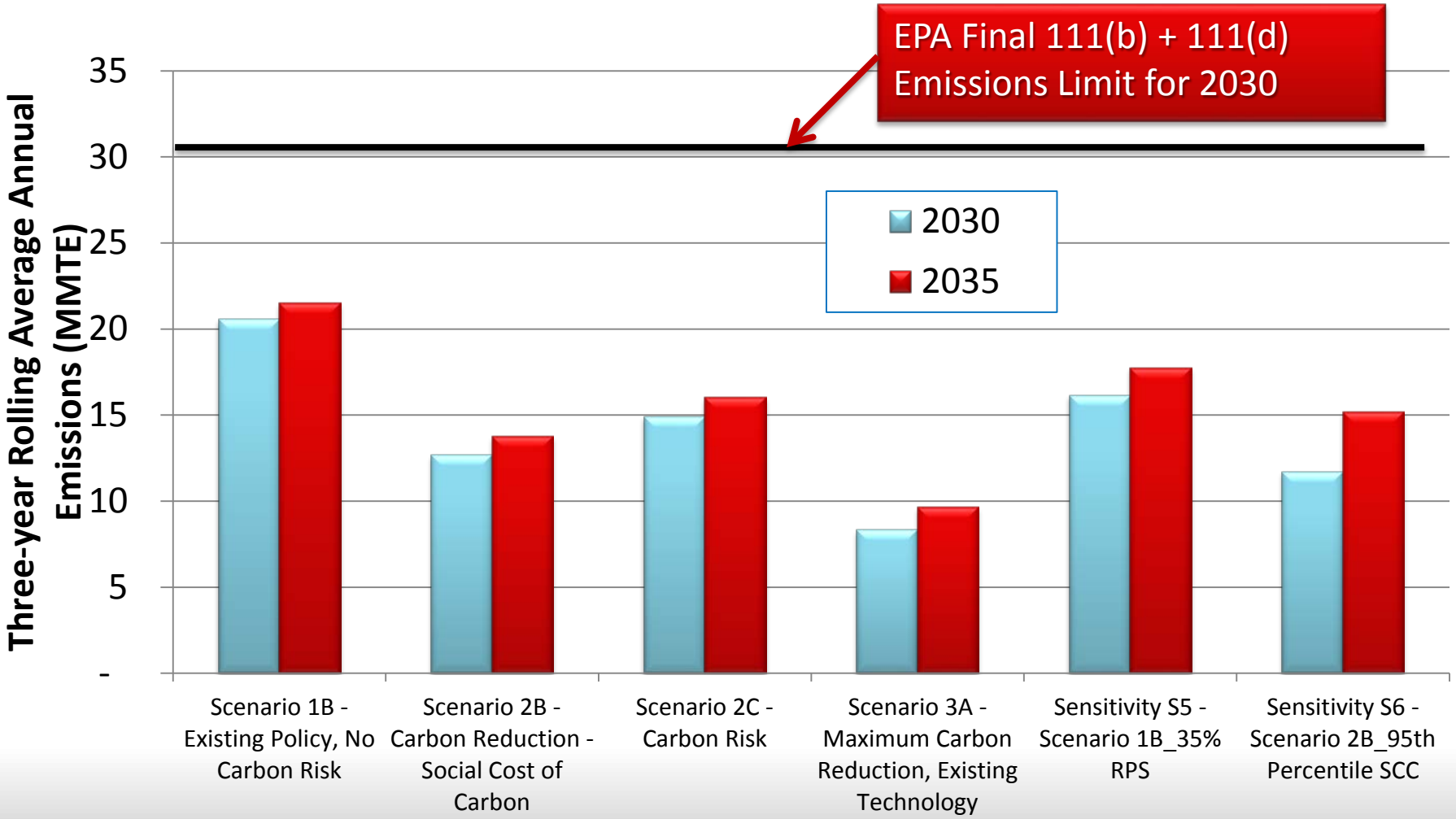
Alternative Carbon Reduction Policies Have Major Influence on Regional Electricity "Net Exports"



Overall, Average Net Regional Exports Under Alternative Carbon Emissions Reduction Policies Are Generally Lower than the Base Scenario, Except for the RPS @ 35% Policy

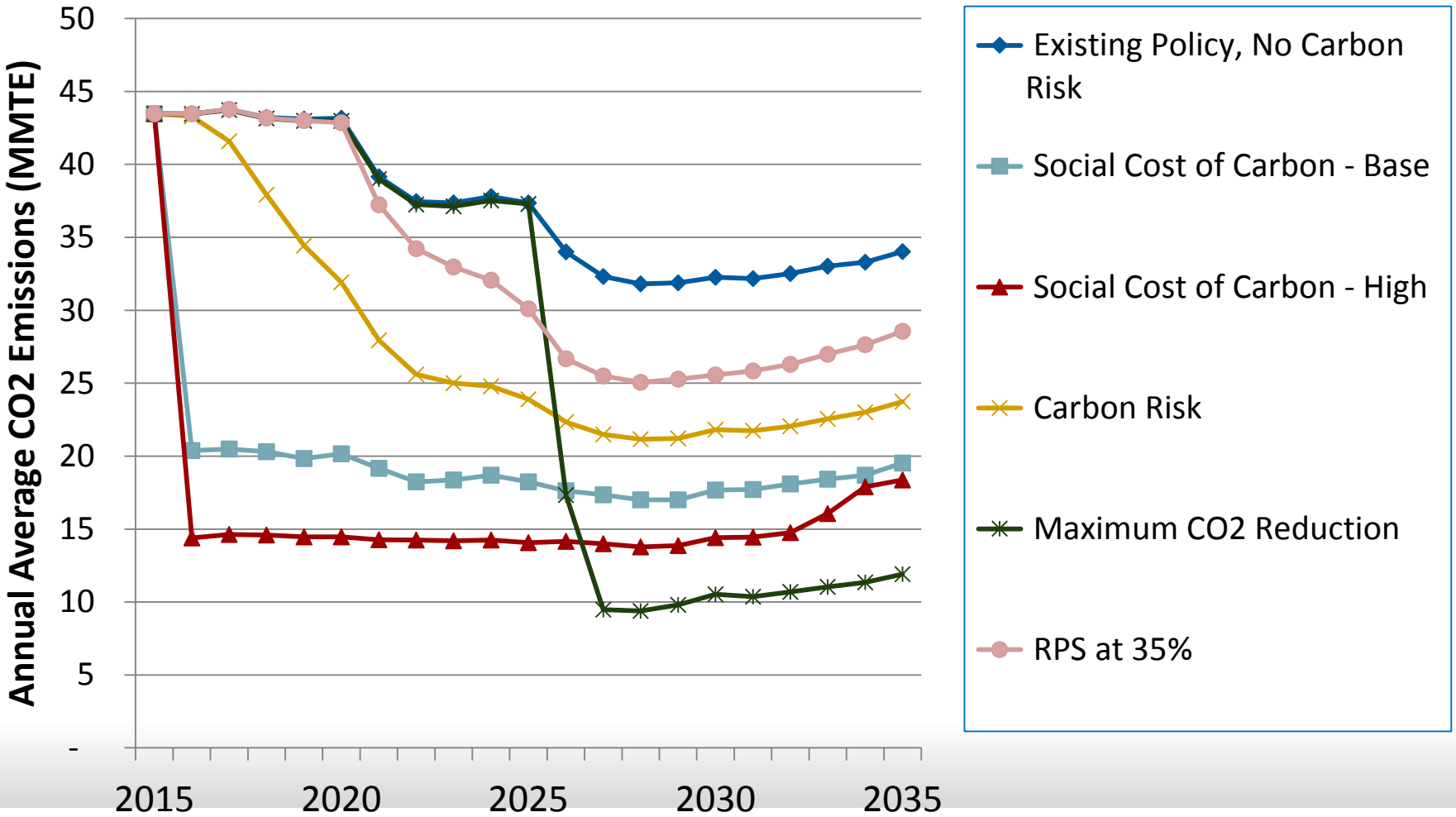


The *Average* Annual 111(b) + 111(d) System CO2 Emissions for the Least Cost Resource Strategies for All Scenarios Are Below The EPA's Proposed Limit for 2030, and Remain So Through 2035



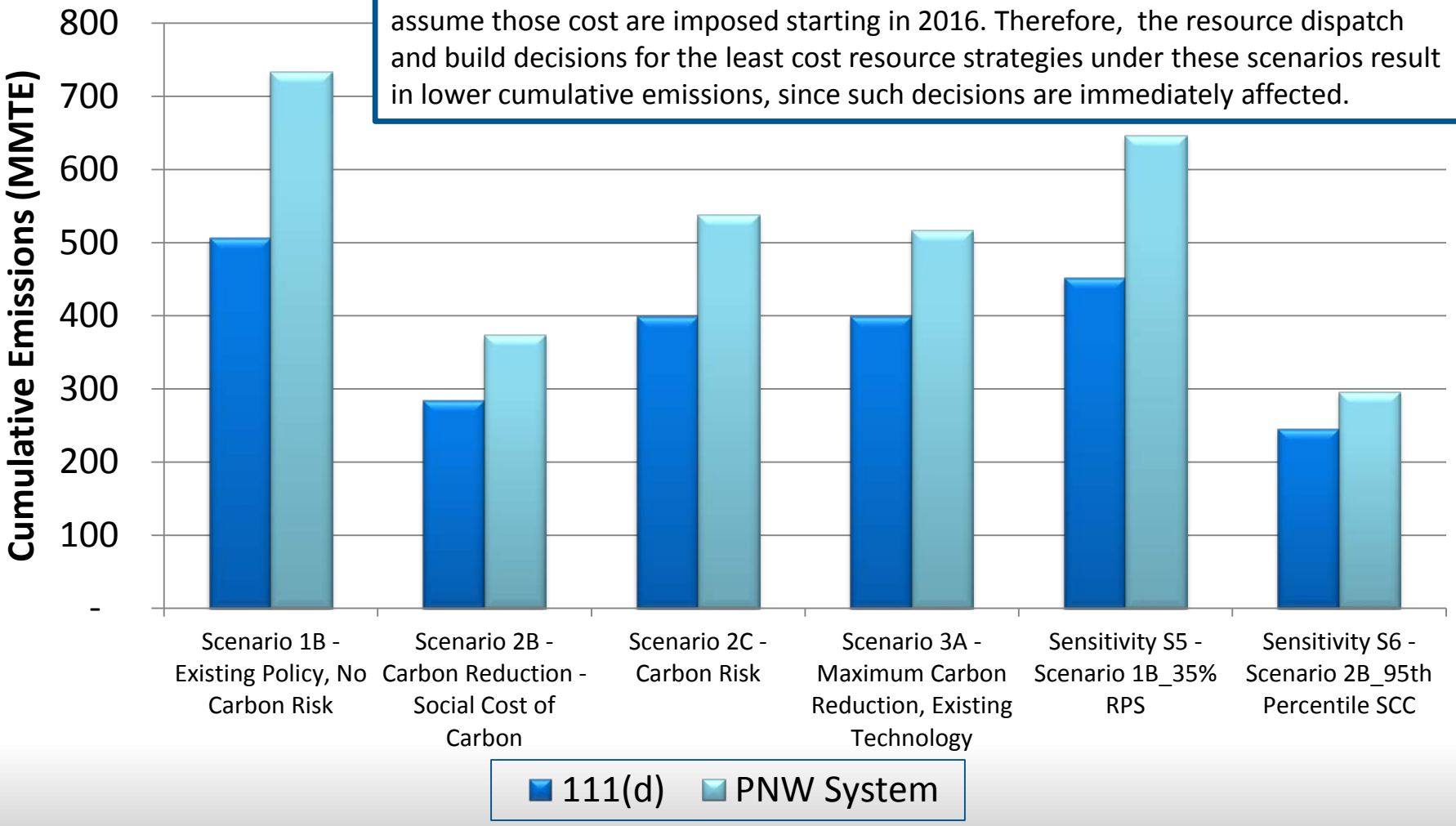
Alternative Carbon Reduction Policies Have Different Patterns of Carbon Reduction

Annual Average CO2 Emissions by Scenario for PNW Power System

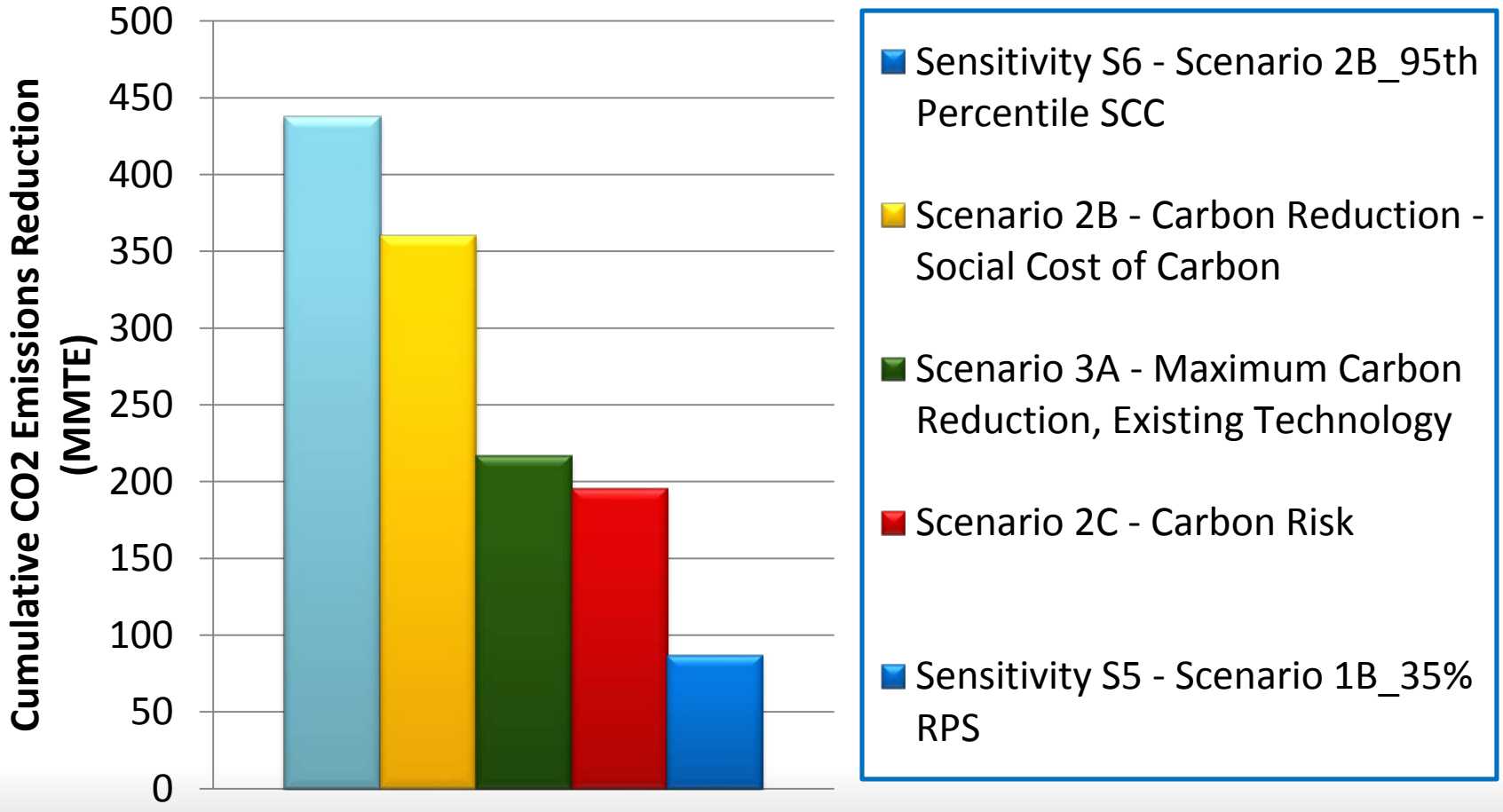


The Lowest Cumulative CO2 Emission 2016-2035 Result From Alternative Carbon Emissions Reduction Policies That Impact Near-Term Resource Dispatch and Development

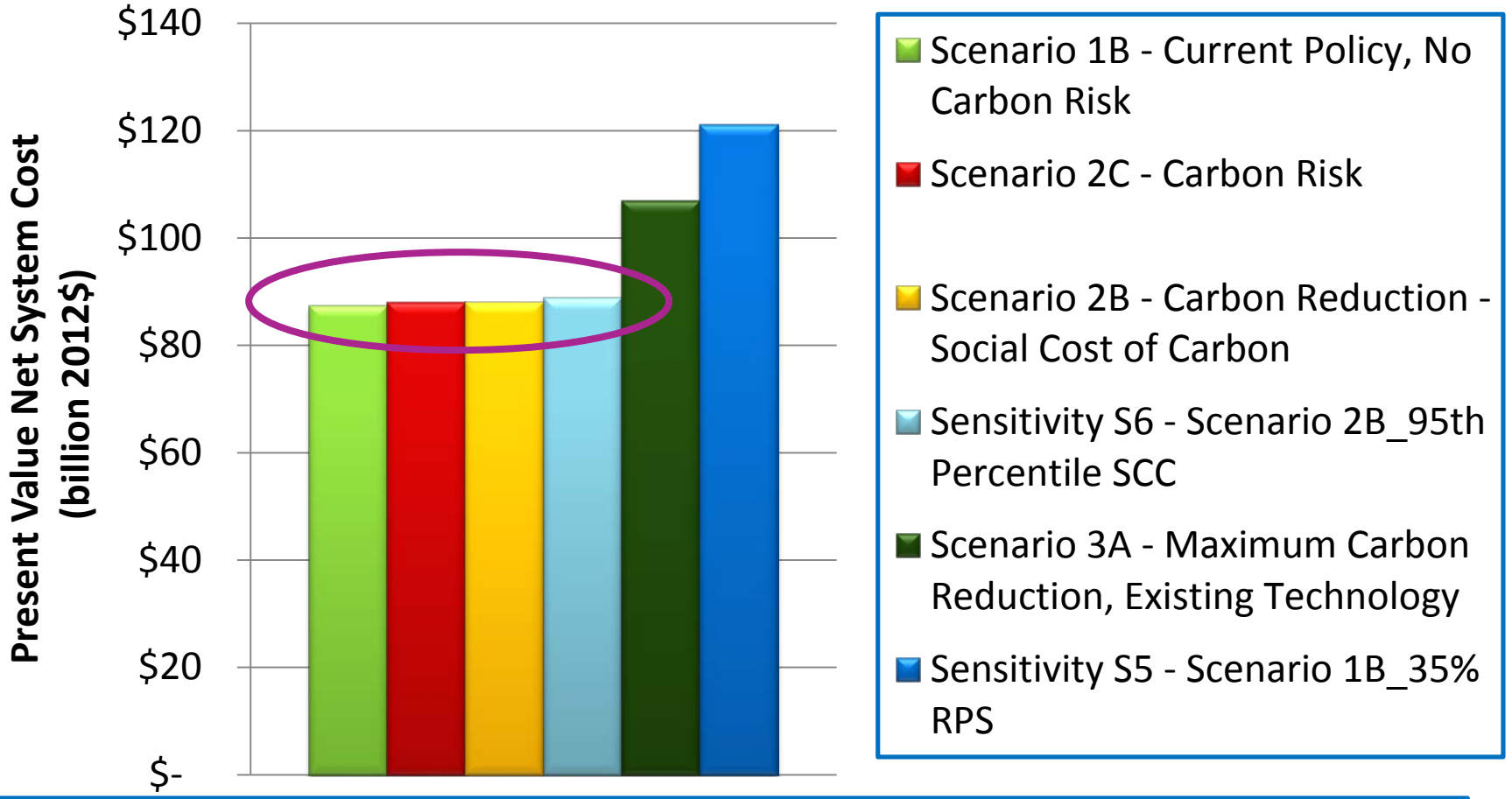
CAUTION: The Social Cost of Carbon (2B, S5 & S6) and Carbon Risk (2C) Scenarios assume those cost are imposed starting in 2016. Therefore, the resource dispatch and build decisions for the least cost resource strategies under these scenarios result in lower cumulative emissions, since such decisions are immediately affected.



Therefore, The Largest PNW Power System Cumulative CO2 Emissions Reductions Also Occur Under Alternative Resource Strategies That Must Respond Immediately to Carbon Reduction Policies

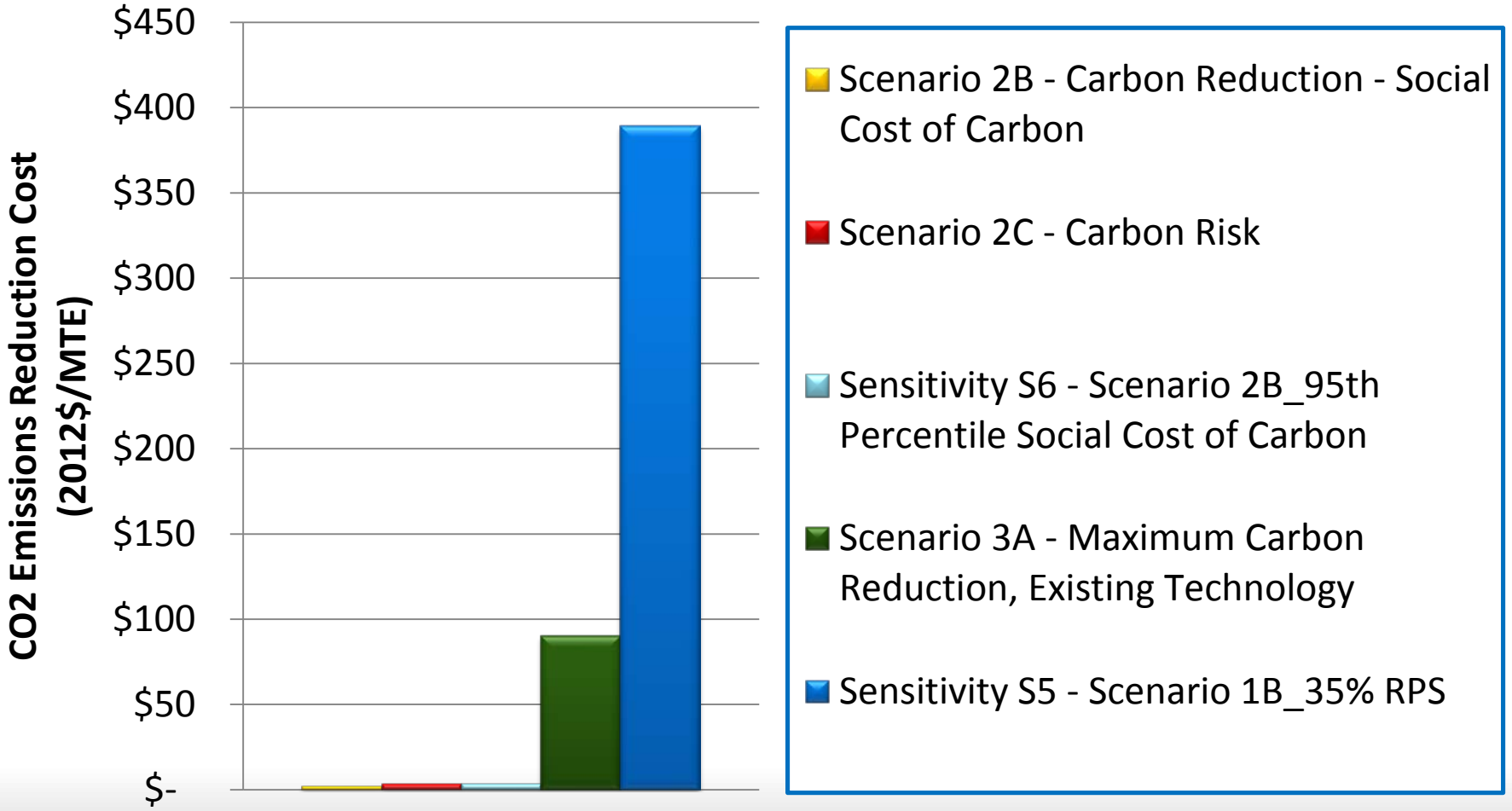


The Average Present Value Net System Cost for Least Cost Resource Strategies (*Without* Carbon Cost*) Result From Increased Reliance on Existing Natural Gas Use and/or New Natural Gas or Renewable Resource Development



*Carbon "tax" revenues were subtracted from the NPV System Cost to assess the actual resource portfolio cost, including capital, fuel and other operating cost.

The Lowest Cost per ton of CO2 Emissions Reduction Are Resource Strategies That Result From Adaptation to Carbon Cost or Direct Retirement of Coal and Inefficient Gas Generation



Observations from Scenario Analysis: Carbon Emissions Reduction

- The *least cost* resource strategies that meet proposed CO2 Emissions Limits *at the regional level:*
  - Meet all (or nearly all) load growth with energy efficiency
  - Meet near and mid-term needs for capacity with demand response
  - Retire and/or reduce the dispatch of existing coal plans and replace them by first increasing existing gas-fired generation and later with new combined cycle combustion turbines
  - Do not significantly expand the use of renewable resources
- Why
  - Increasing the dispatch of the more efficient existing gas-fired generation to offset reductions in coal-fired generation produces lower cost carbon emissions reduction than the development of renewable resources
  - In addition, currently commercially available Renewable Resources (solar PV and wind) provide limited or no winter peaking capacity, hence are not good matches for system need, so increasing RPS is currently the most costly policy option for reducing CO2 emissions

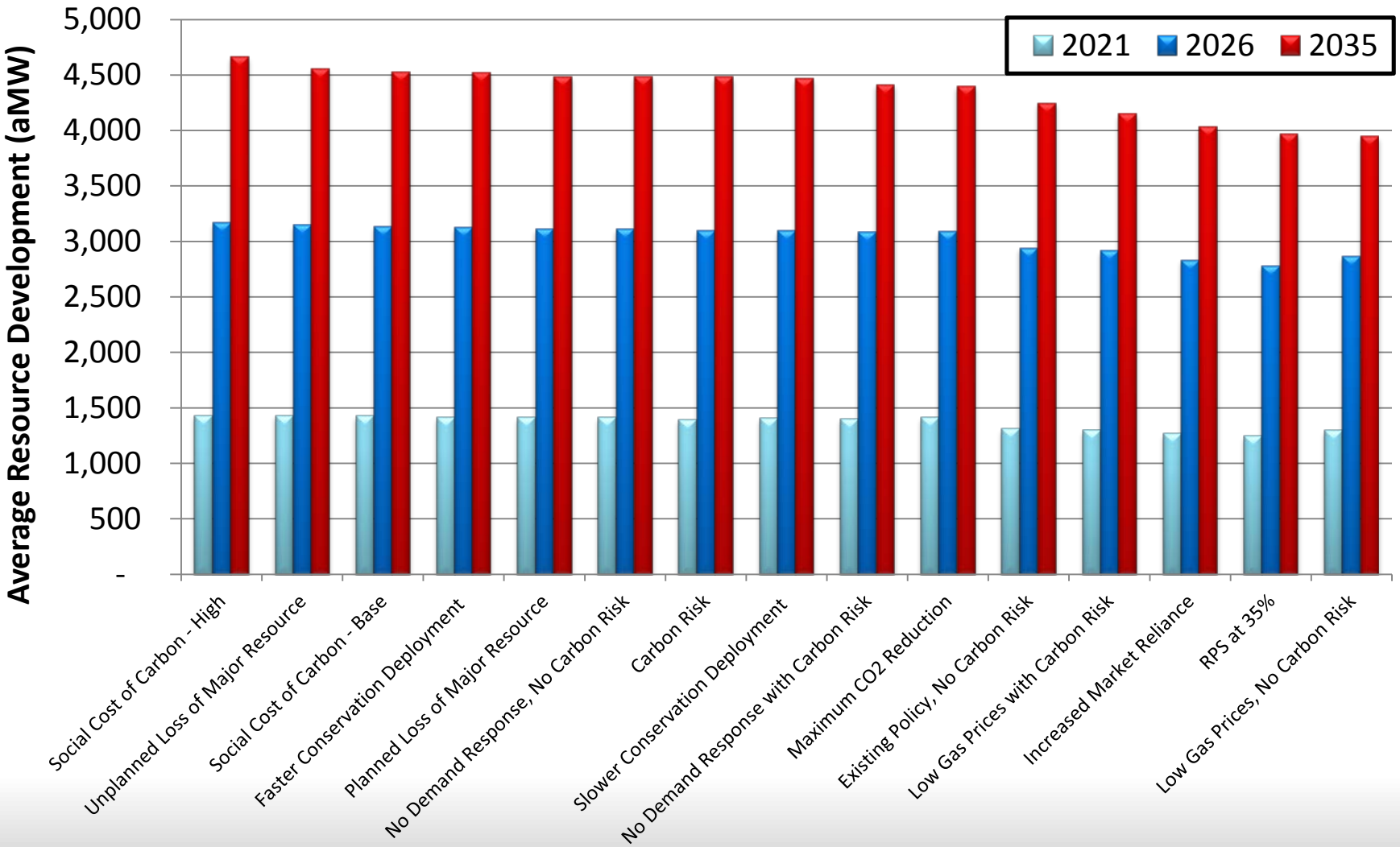
Proposed Major Elements of Draft Resource Strategy

August 12, 2015

Key Findings

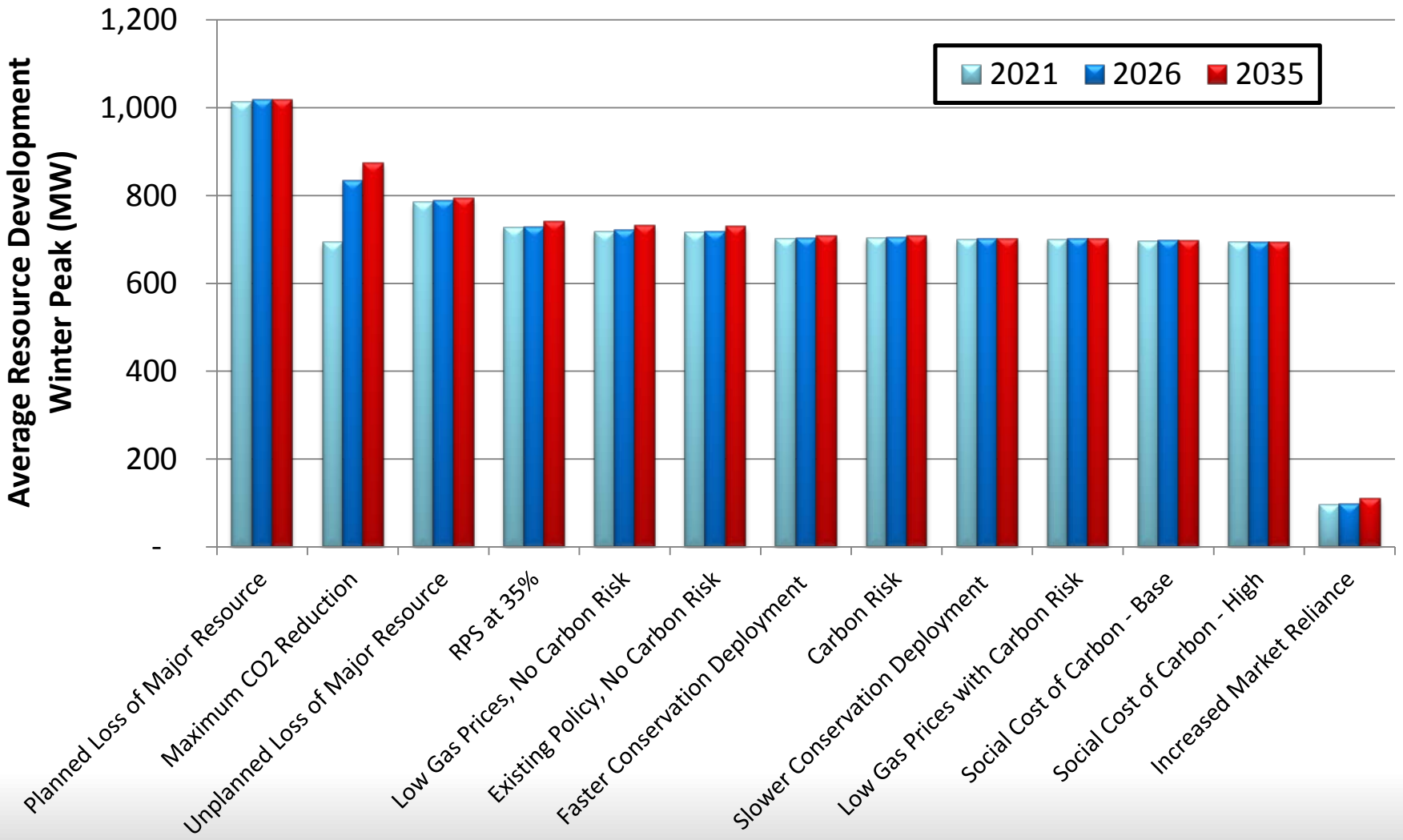
- Least Cost Resource Strategies Consistently Rely on Conservation and Demand Response to Meet Future Energy and Capacity Needs
- Demand Response or Increased Reliance on External Markets are Potentially Competitive Options for Providing Winter Capacity To Meet Regional Resource Adequacy Requirements
- Replacement of announced coal plant retirements can generally be achieved with only modest new development of natural gas generation
- Northwest Exports Play A Significant Role in Regional Resource Development
- Compliance with EPA CO2 emissions limits *at the regional level*, is attainable through resource strategies that do not depart significantly from those that are not constrained by those regulations.

Key Finding:
Average Conservation Development Across Scenarios Varies Little Across Scenarios Except Under Sustained Low Gas Prices and Increased RPS

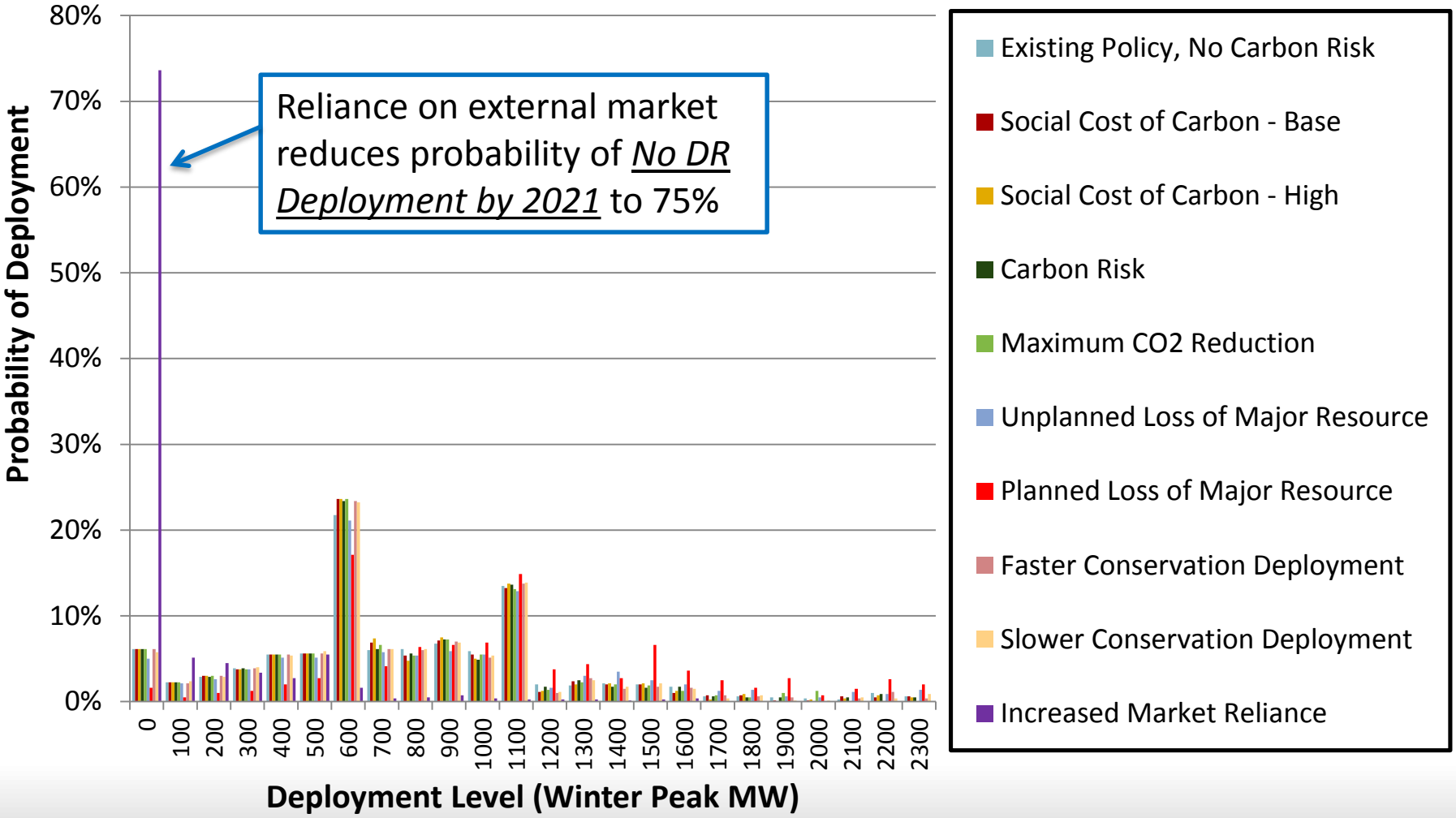


Key Finding:

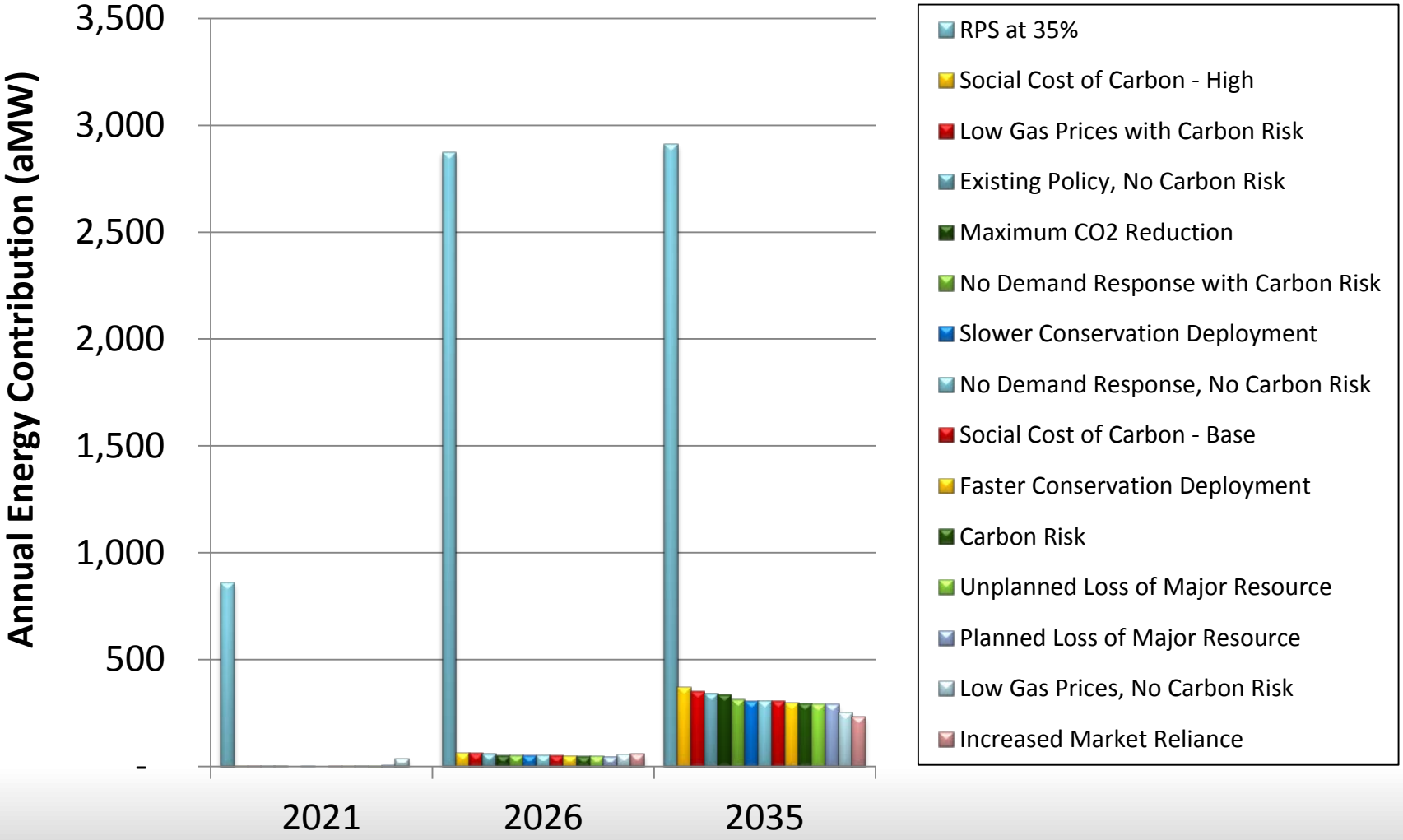
Average Demand Response Development Across Scenarios Varies Little Across Scenarios Except in Scenarios with Major Resource Loss or Increased External Market Reliance



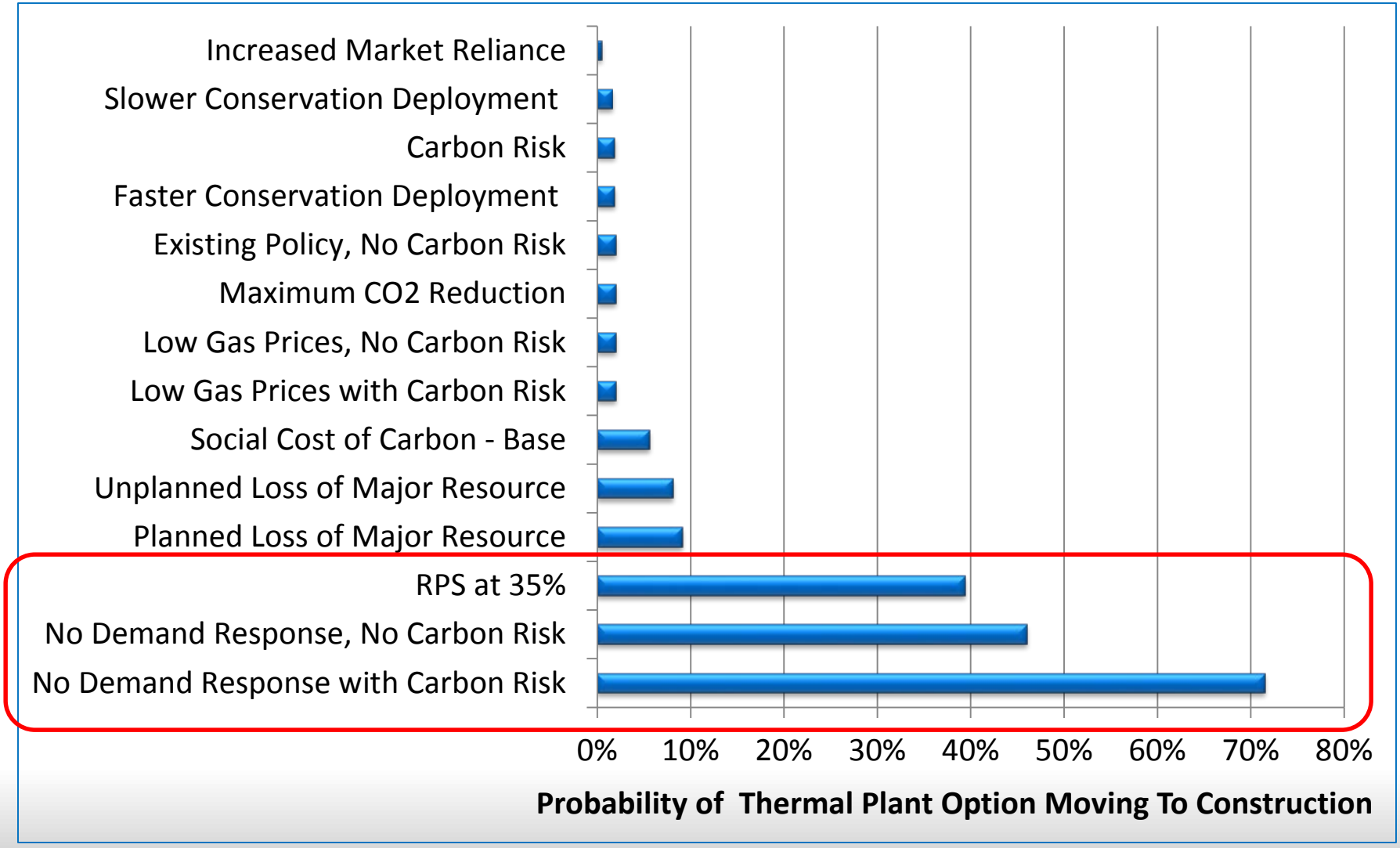
Key Finding:
The *Probability and Amount* of Demand Response Varies Over a Wide Range, and is Particularly Sensitivity to Extra-Regional Market Reliance Assumptions



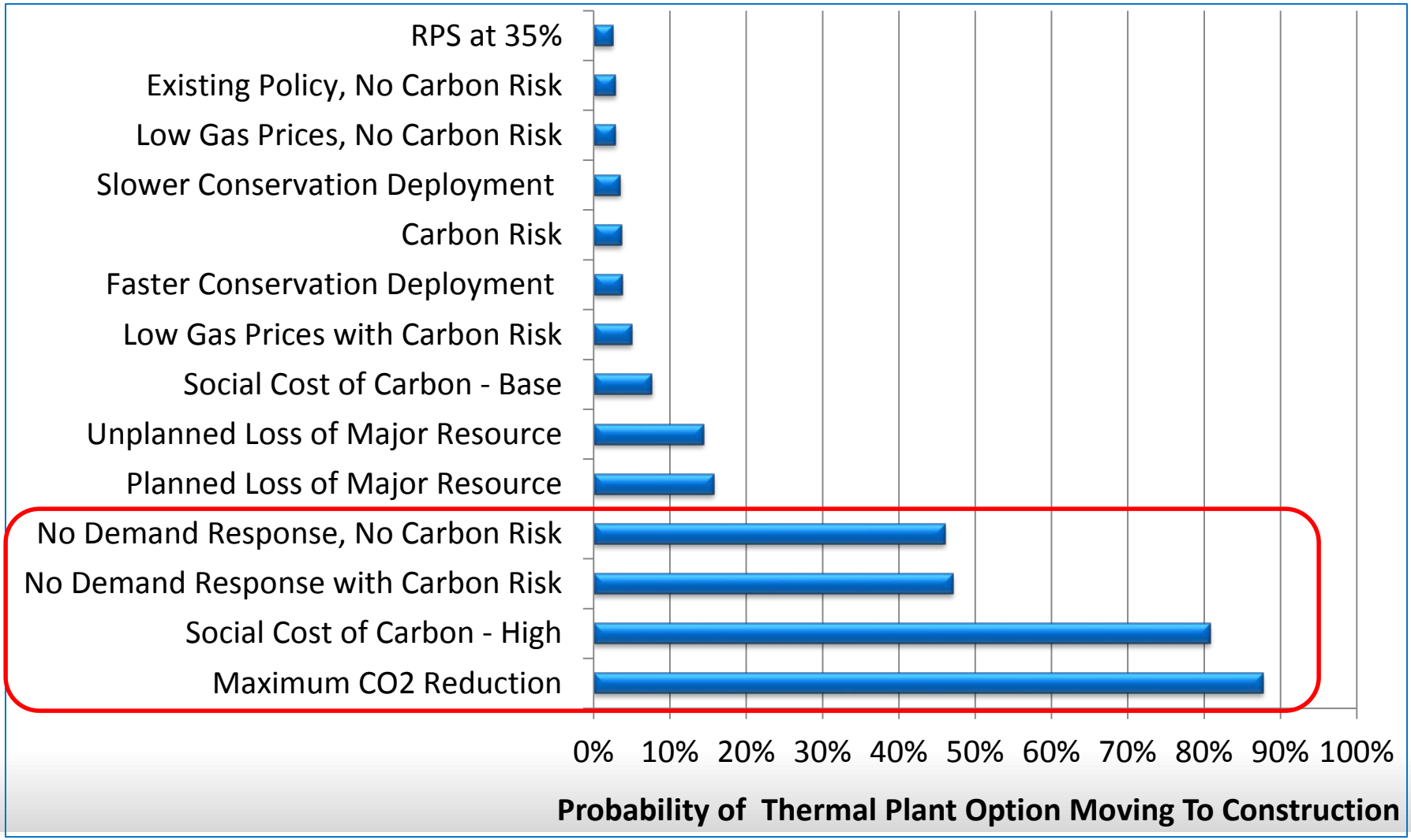
Key Finding:
Average New Renewable Resource Development *Does Not* Significantly Increase In Carbon Emissions Reduction Policy Scenarios Except For A Policy That Sets Renewable Portfolio Standard at 35%



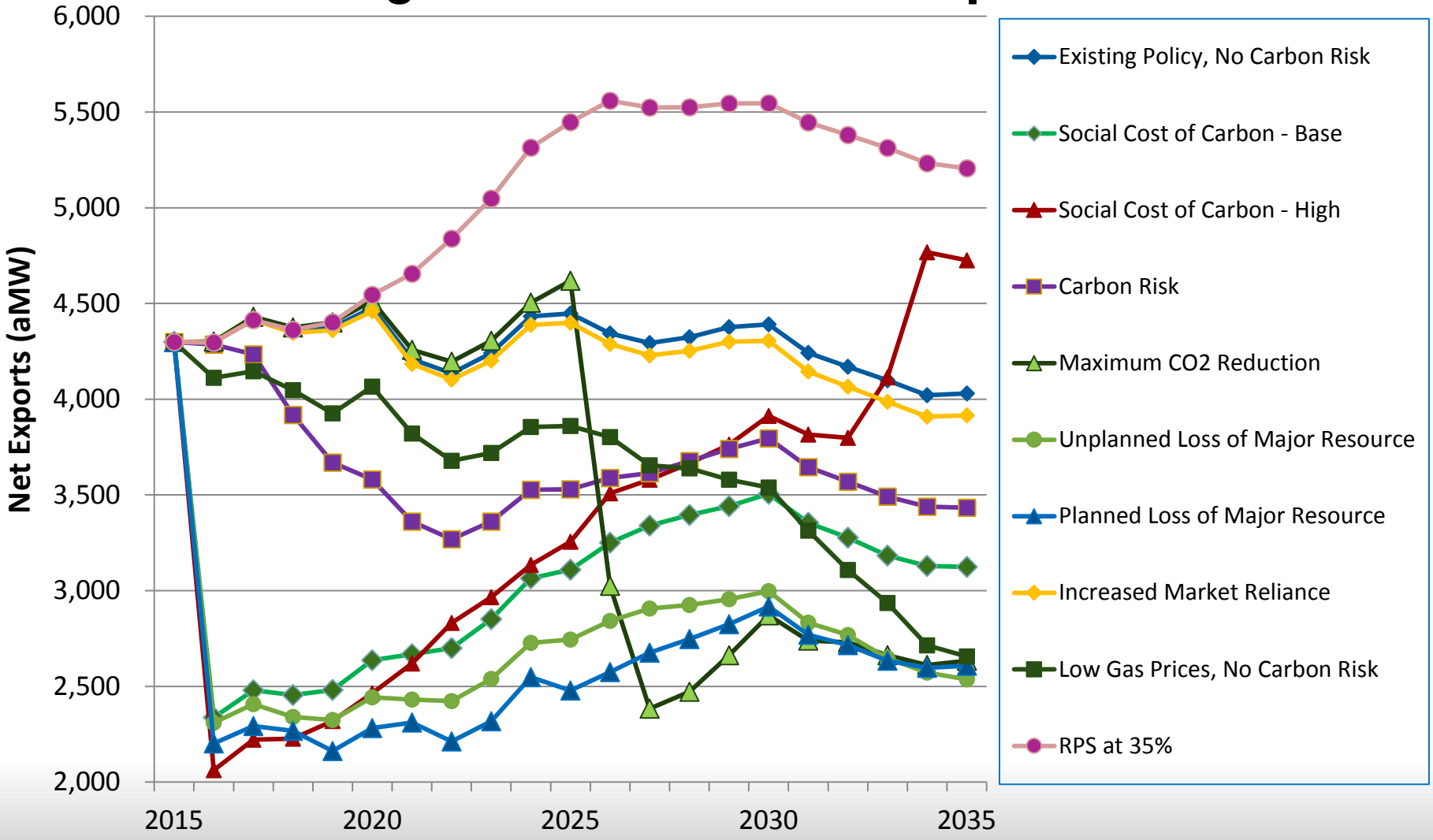
Key Finding:
There is a Low Probability of Any Thermal Development by 2021
Except Under Scenarios That Increase RPS or Do Not Develop Demand Response



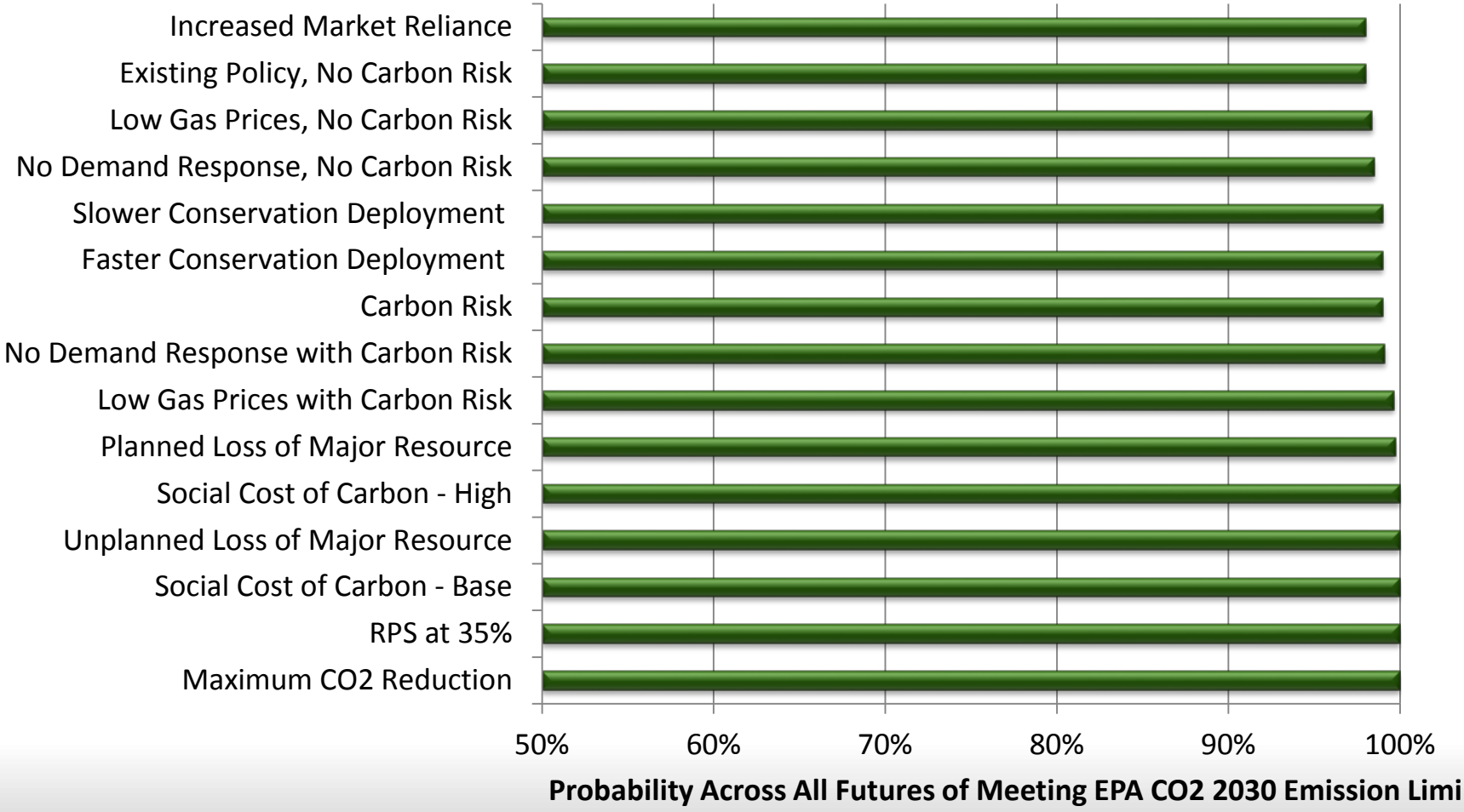
Key Finding:
The Probability of Thermal Development by 2026 Is Modest
Except In Scenarios That Assume All Coal Plant Retirements or Do Not Develop Demand Response



Key Finding:
Net Exports (Exports-Imports) Are Strongly Influenced By Regional Resource Development

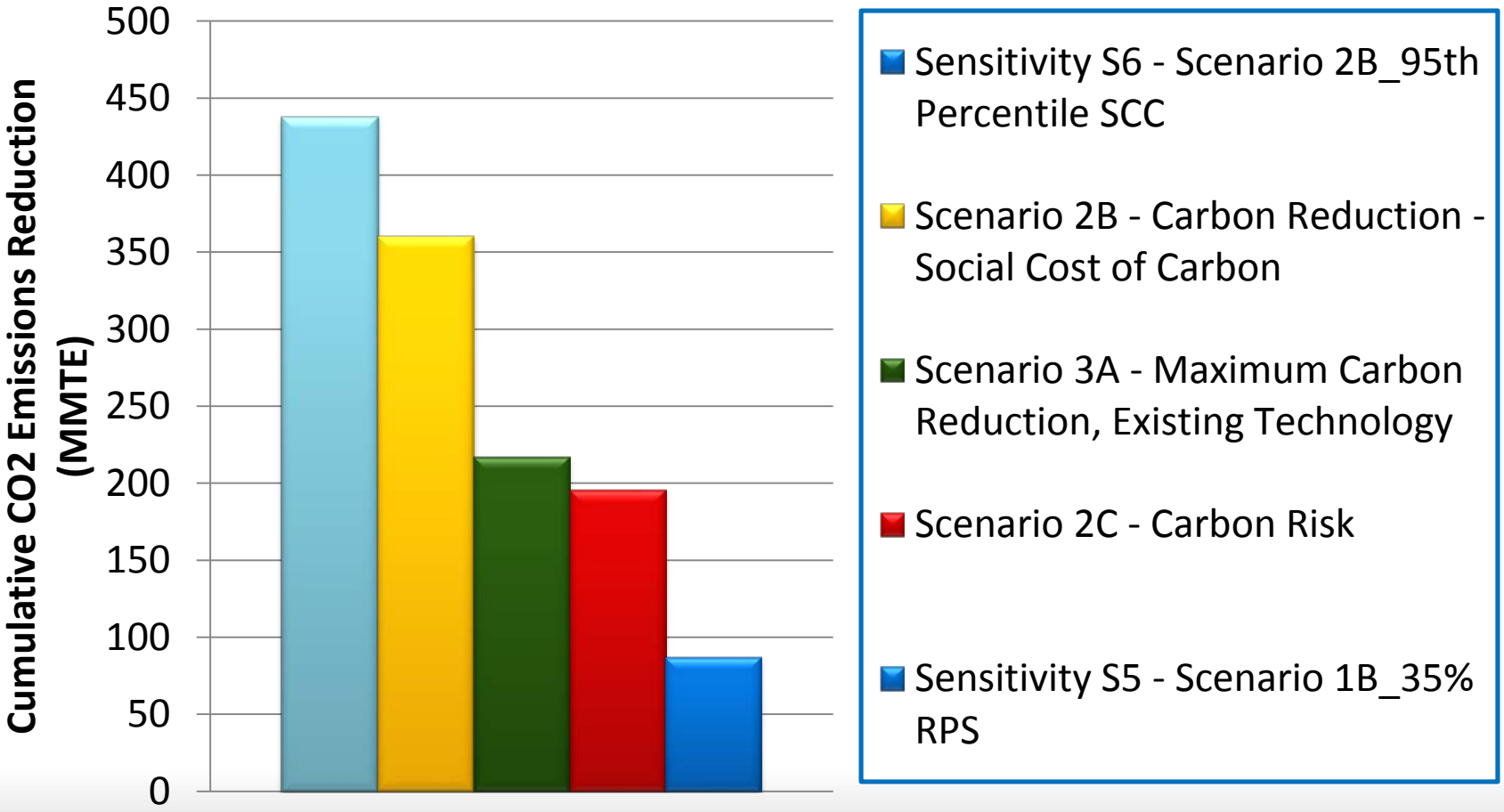


Key Finding:
There is A Very High Probability of Meeting EPA 111(d) Emissions Limits Across All Scenarios and Future Conditions Tested



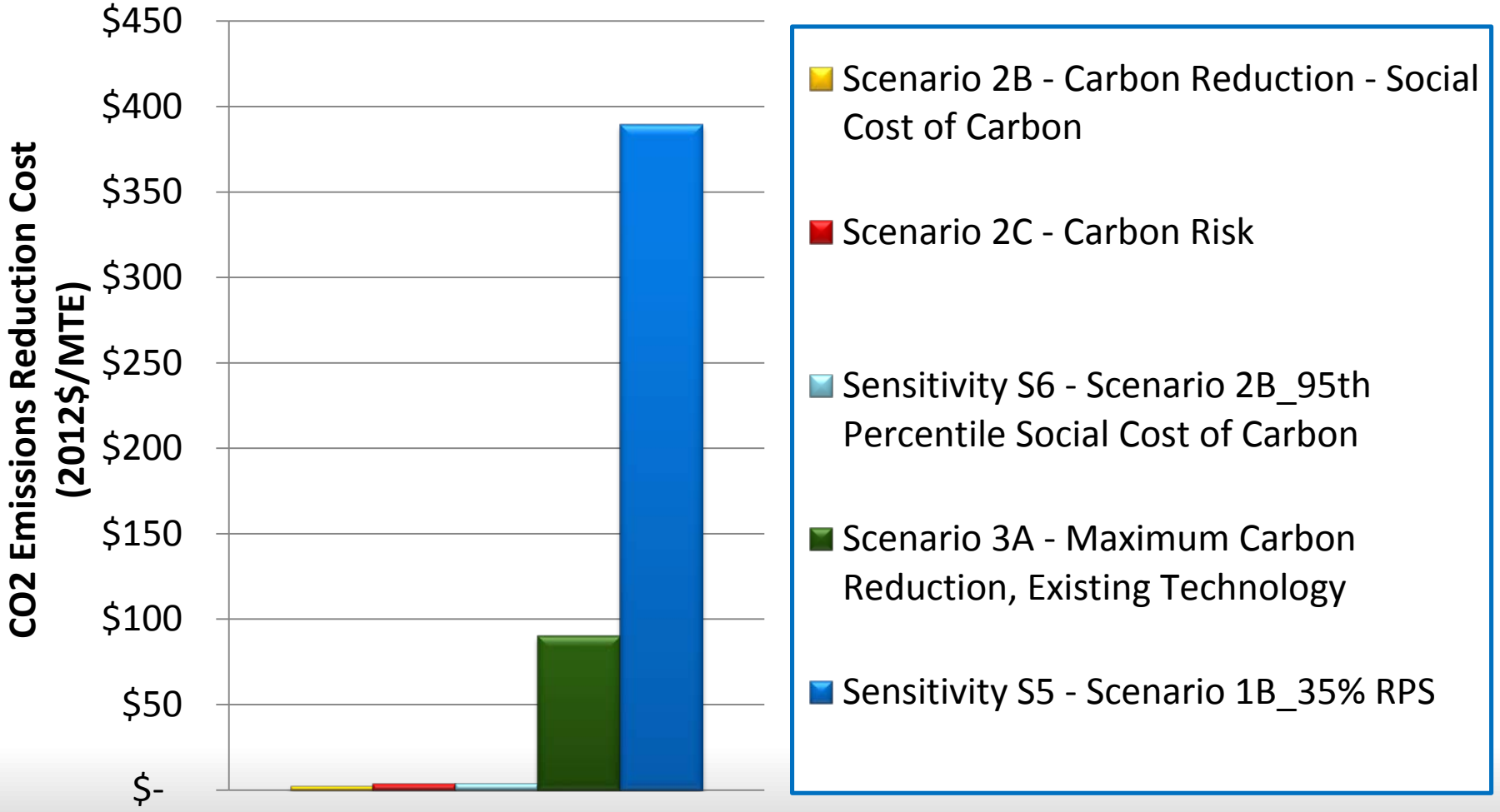
Key Finding:

The Largest PNW Power System Cumulative CO2 Emissions Reductions Occur Under Resource Strategies That Must Respond Immediately to Carbon Reduction Policies



Key Finding:

The Lowest Cost PNW Power System CO2 Emission Reduction Resource Strategies Are Those That Result From Adaptation to Carbon Cost or Direct Retirement of Coal and Inefficient Gas Generation



Seven Principle Elements

- Develop Conservation
  - 1400 aMW by 2021
  - 3100 aMW by 2026
  - 4500 aMW by 2035
- Expand Use of Demand Response
  - Prepare to develop 700 MW by 2021
  - Review Resource Adequacy Assessment Assumptions
- Satisfy Existing Renewable Portfolio Standards
- Option gas-fired generation for capacity and other ancillary services as dictated by local utility circumstances
- Reducing regional exports in order to serve in-region energy and capacity demand can result in lower total NPV System Cost and less need for new resource development
- Expand Resource Alternatives (EE & Non-GHG emitting)
- Monitor and Be Prepared to Adapt to Changing Conditions

Next Steps

- August 21st and 28th Webinars
  - Review Scenario 3B "Narrative"
    - Emerging technology options for further reducing PNW Power System CO2 Emissions
  - Review Proposed Draft Resource Strategy
  - Review Draft Action Plan