

MEMORANDUM

TO: Matt Moser
FROM: Gene Kalwarski
DATE: May 12, 2022
SUBJECT: Stress Testing / Monte Carlo Simulations

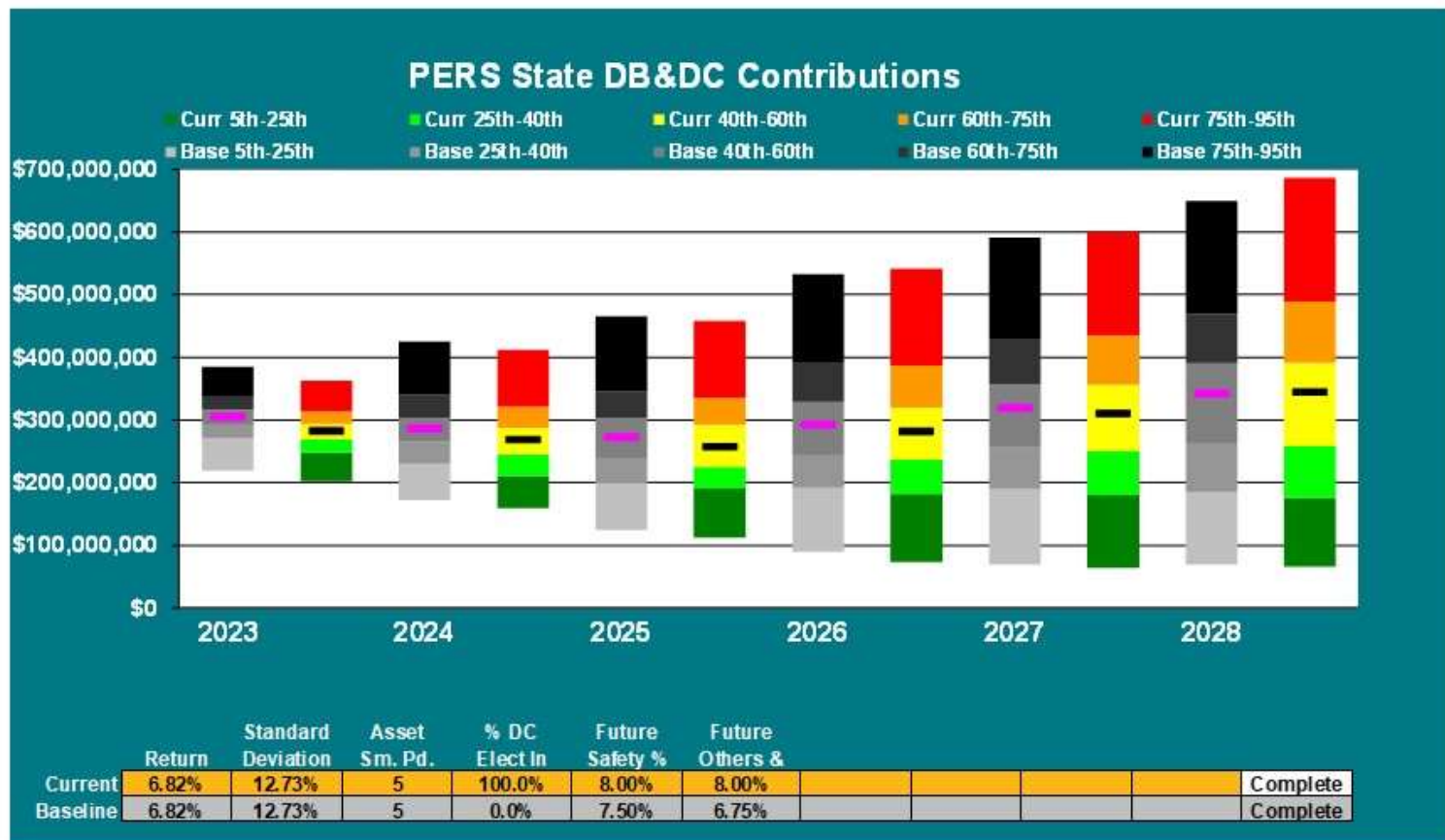
At the House Finance Committee hearings on April 22, 2022 Cheiron presented stress testing analysis of HB 220 CS-B. The stress testing slides from that presentation are attached hereto, but the charts themselves are not self-explanatory to anyone who is not familiar with Monte Carlo simulation projections. So we will briefly explain what is Monte Carlo simulation analysis and what the charts tell the observer.

In a typical actuarial projection one set of assumptions is used to model the future and a single number for a given plan statistic is produced for each year in the projection. This outcome is unlikely to happen especially for the most volatile part of plan operation – the investment return. Monte Carlo analysis integrates potential return volatility into the actuarial projections using random sampling of the underlying distribution of potential future investment returns. (The random sampling is what led to technique being called Monte Carlo analysis.) Instead of one projection of the future a Monte Carlo analysis makes many projections, each one based on a randomly selected but statistically possible path for the future. It then ranks the results and displays the rankings as ranges of outcomes each year for the statistic modeled. The distribution of possible future asset returns is developed from Capital Market Assumptions for each asset class in which the pension system invests. These Capital Market Assumptions are drawn from a survey of the investment community's expectations for return and risk for each common asset class together with a pairwise correlation of how returns between each pair of asset classes are linked. The resulting ranking allows a best-case / worst-case view of the statistic modeled rather than a single number.

The charts presented by Cheiron model the State's Total Contribution before and after HB 220 CS-B. The before case is displayed in Monochrome, the after in Color. Each year has a before and after bar. For the before bars there are 5 shades of gray. The lightest shade represents the range of contribution that resulted from the best (lowest) projections while the darkest shade shows the range of contribution from the worst (highest) projections. For the after bars there are 5 colors – dark green covers the best outcomes and dark red the worst. There is a line at about the center of each bar – this is the median outcome, i.e., 50% of the random projections are better than this line and 50% are worse.

The first chart entitled "Monte Carlo Projection w/ 8% member rate" shows the potential outcomes for the State Contribution if members contribute 8% of pay. The median contribution after HB 220 CS-B is lower than the before median. The worst of the worst results however (top of the bars) show the State cost after HB 220 CS-B slightly higher than the before worst case in the last year of the projection. The subsequent charts show how the DOA Commissioner can reduce State costs by increasing the member contribution so that the State's costs under HB 220 CS-B are always expected to be below the system before HB 220 CS-B. The member rate assumed in each projection is shown in the title.

Monte Carlo Projection w/ 8% member rate

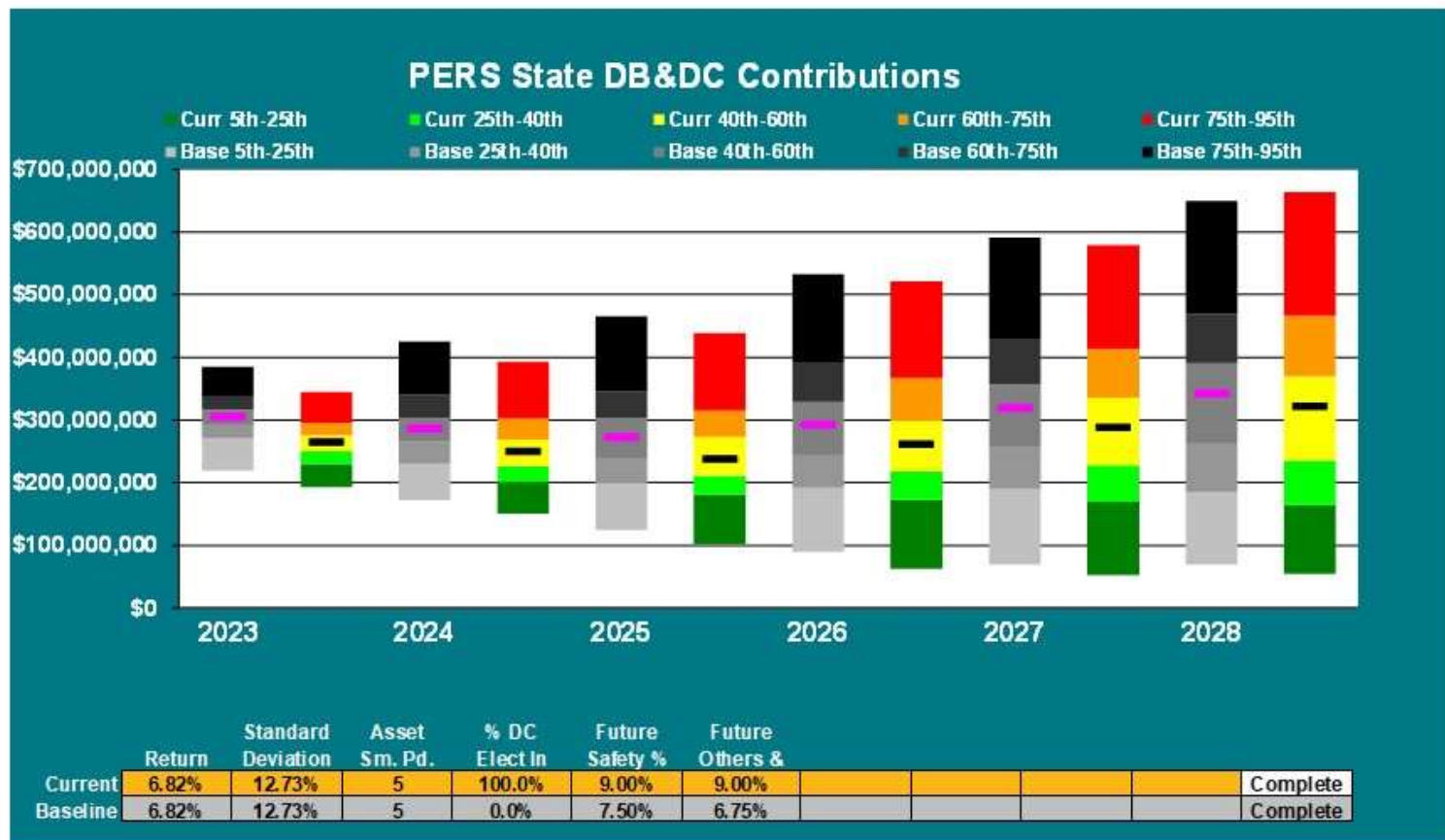


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Monte Carlo Projection w/ 9% member rate

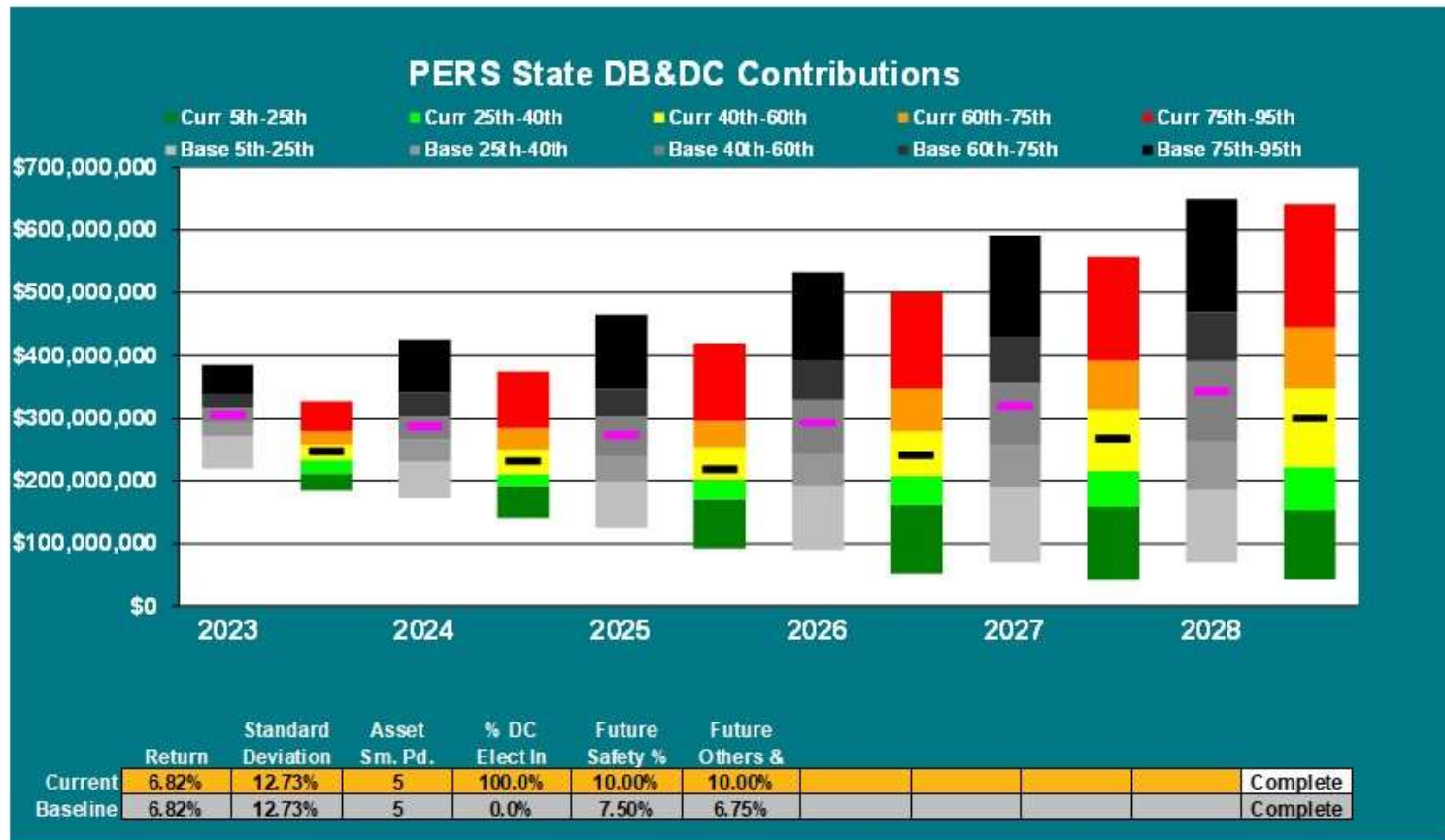


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Monte Carlo Projection w/ 10% member rate

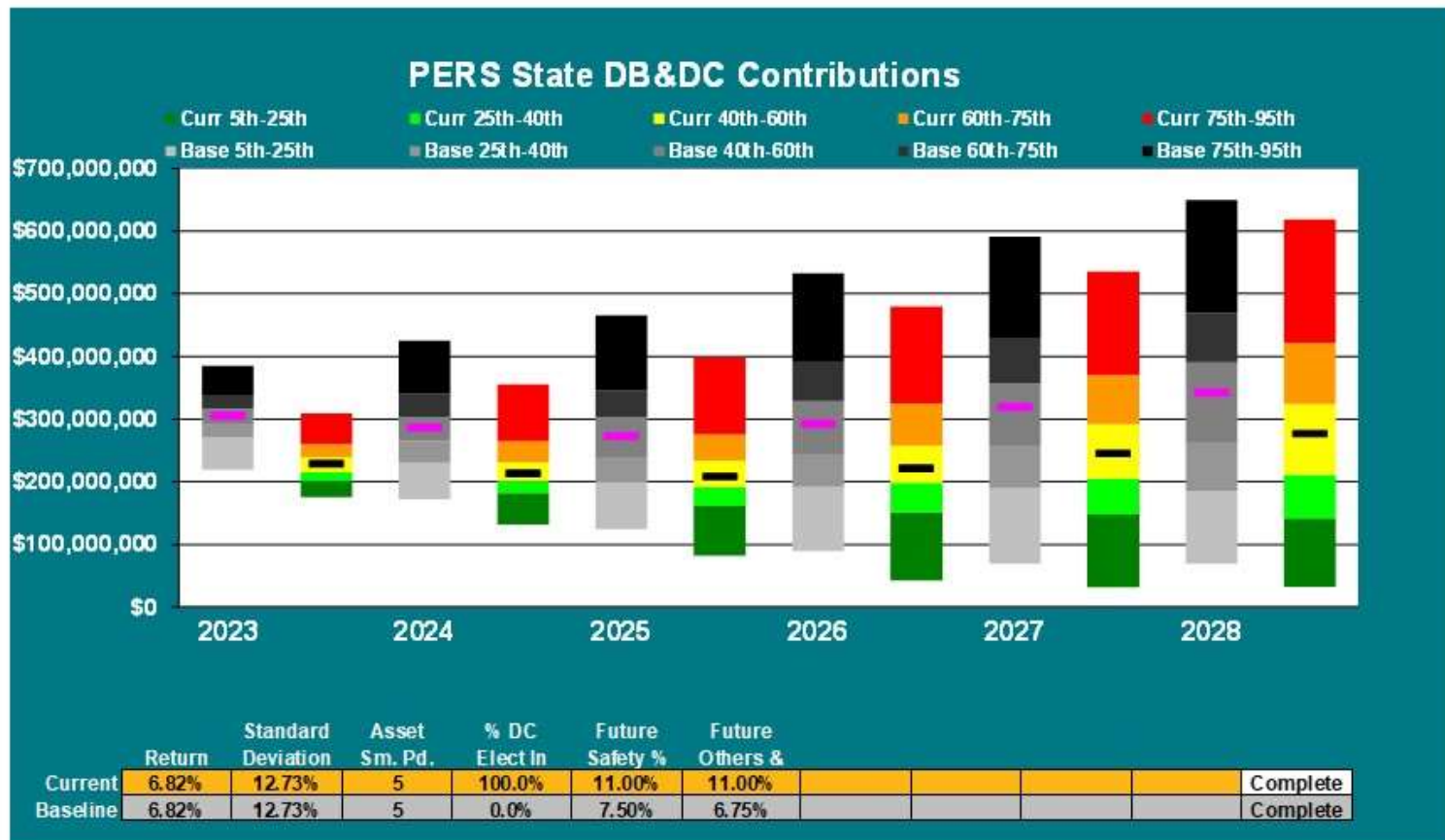


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Monte Carlo Projection w/ 11% member rate

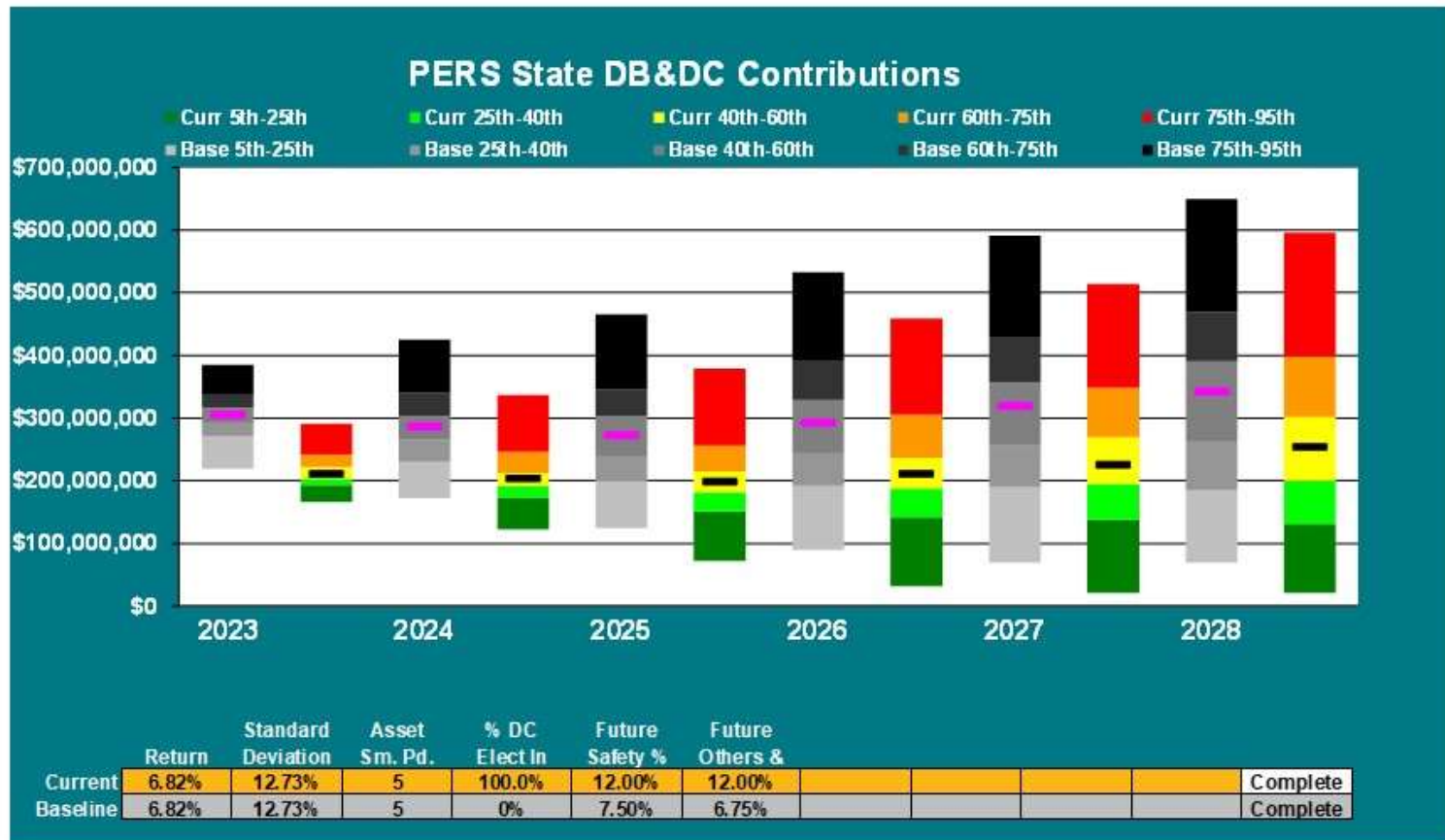


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Monte Carlo Projection w/ 12% member rate



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