

*This document added to the public record for SS for SB 114 in the Senate State Affairs
Committee at the request of the bill sponsor: Senator Lesil McGuire. 2/23/2016*

Callan
FORTY YEARS



February, 2016

Legislation Impact Analysis

Status Quo versus SB128/HB245,
SB114/HB303, HB224

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Objectives

- Build a financial model that simulates the impact of each of the proposals on the permanent fund.
- Compare each proposal to the status quo using a consistent set of capital markets assumptions and asset allocation assumptions.
- Evaluate each proposal in the context of a series of key financial variables:
 - In-flows, out-flows, net-flows;
 - Market value (nominal and real);
 - Statutory net income;
 - Earnings reserve balance;
 - Variability of distributions, real market value, and earnings reserve balance.
- Simulate using both deterministic and stochastic models.
- Discuss potential implications for asset allocation policy, liquidity policy, and cash-management and forecasting policies.

Capital Market Assumptions

Projected Return and Standard Deviation

- Employed Callan's 2015 10-year capital market expectations for all models.
- Expectations are developed annually and used for strategic planning work for all client types.
- Represent long-term consensus expectations.
- Designed to work as a set in optimization and simulation analysis.
- Generally these expectations evolve slowly with only modest year-to-year changes.

Projected Return and Standard Deviation

Asset Class	Projected	Annualized	Annualized Standard Deviation
	Arithmetic Return	10-Year Geometric Return	
US Equity	9.15%	7.60%	19.0%
Non US Equity	9.80%	7.80%	21.5%
Private Equity	13.55%	8.50%	33.0%
Absolute Return	5.55%	5.25%	9.3%
Real Estate	7.35%	6.20%	16.5%
Infrastructure	6.80%	5.50%	17.0%
US Fixed Income	3.05%	3.00%	3.8%
High Yield	5.50%	5.00%	11.1%
Non-US Fixed Income	2.70%	2.30%	9.4%
TIPS	3.10%	3.00%	5.3%
Inflation	2.25%	2.25%	1.5%

Capital Market Assumptions

Projected Correlation Matrix

Projected Correlations between Asset Classes

Asset Class	US Equity	Non US Equity	Private Equity	Absolute Return	Real Estate	Infra Structure	US Fixed Income	High Yield	Non-US Fixed Income	TIPS
US Equity	1.00									
Non US Equity	0.88	1.00								
Private Equity	0.94	0.93	1.00							
Absolute Return	0.76	0.73	0.74	1.00						
Real Estate	0.73	0.67	0.72	0.59	1.00					
Infrastructure	0.63	0.55	0.60	0.55	0.65	1.00				
US Fixed Income	(0.11)	(0.12)	(0.18)	0.10	(0.02)	(0.10)	1.00			
High Yield	0.60	0.59	0.61	0.54	0.54	0.55	0.04	1.00		
Non-US Fixed Income	0.01	0.01	(0.06)	(0.08)	(0.05)	(0.10)	0.51	0.12	1.00	
TIPS	(0.05)	(0.05)	(0.09)	0.07	0.01	0.20	0.58	0.03	0.34	1.00

- Projected correlations between asset classes are the third dimension of capital market expectations.
- Historical trending behavior is evaluated for each pair in the matrix.
- Correlations must be consistent (positive semi-definite) as a set in order to work properly in optimization and simulation analysis.

Assumed Asset Allocation

Used Actual Asset Allocation as of June 30, 2015

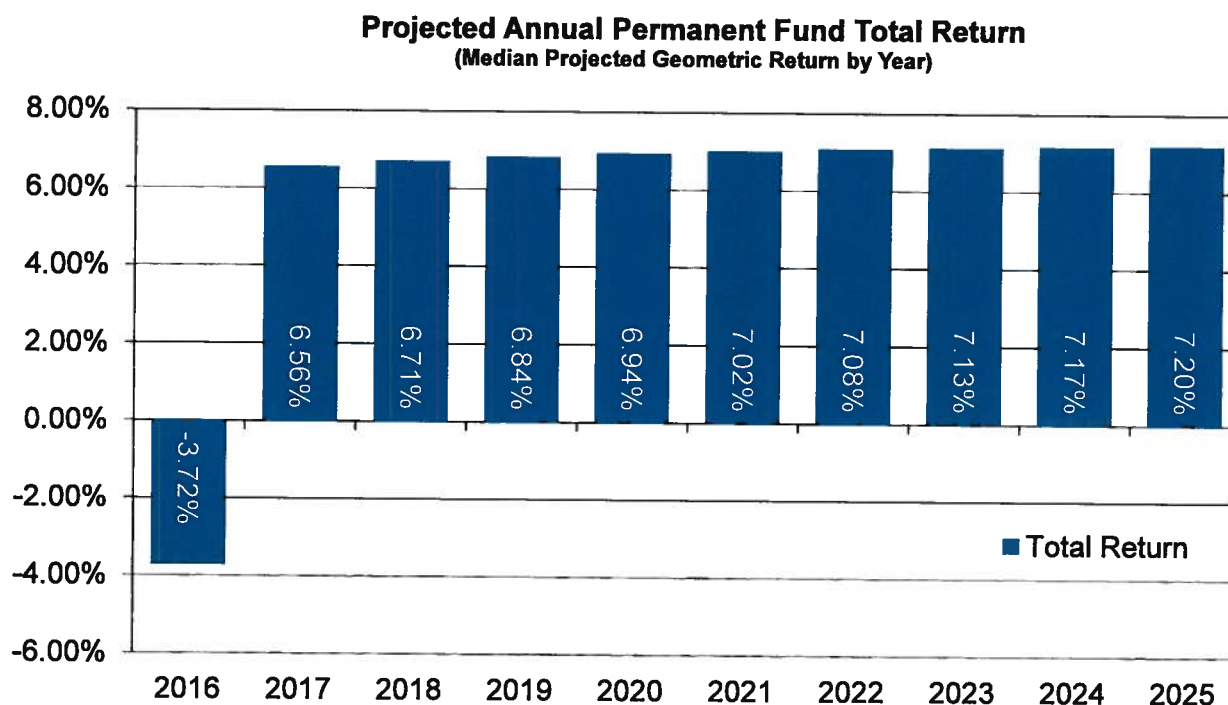
- Employed consistent asset allocation across all models to allow for apples-to-apples comparisons.
- Quarterly rebalancing was assumed which yields more comparable results across the models.
- Rebalancing assumptions are important because they impact turnover in the portfolio which results in gains realization.

Asset Class	APFC Current Allocation
US Equity	17%
Non US Equity	24%
Private Equity	10%
Absolute Return	12%
Real Estate	12%
Infrastructure	3%
US Fixed Income	17%
High Yield	1%
Non-US Fixed Income	2%
TIPS	2%
Total	100%
Projected 10-Year Annualized Geometric Return	6.90%
Projected Annualized Standard Deviation	13.90%

Additional Assumptions Impacting Return Projections

Actual Experience through January, 2016, and Rising Rates

- Estimated total return for Fund through January 29, 2016 (per daily report) was -6.18%.
- Employed actual return for first 7 months and 5/12 of standard Callan 2016 return projection for last 5 months to yield projected return of -3.72%.
- Projected returns in subsequent years employed Callan's standard model which calls for gradually rising rates.
- Rising rates results in lower bond returns in earlier years and higher returns in later years, reaching equilibrium in approximately 2027.



Key Financial Variables

Monitoring these variables allows us to compare and contrast proposals

- **In-flows, out-flows, net-flows;** The key financial difference between the status quo and the three proposals is the size, timing, and variability of flows into and out of the fund.
- **Market value (nominal and real);** Market value is impacted by return and net-flows over time. Real market value is an indication of whether Fund is maintaining its inflation adjusted purchasing power over time.
- **Statutory (realized) net income;** Net-flows will also impact gains realization which impacts this variable. Realized income determines the size of the Earnings Reserve account over time.
- **Earnings Reserve balance;** The size of this account is the limiter on distributions. As long as it remains large relative to pay-outs, pay-outs can be maintained during volatile markets.
- **Variability of distributions, real market value, and earnings reserve balance;** Examining all variables in the context of simulated market volatility allows us to understand the sustainability of each approach in median-case and worst-case outcomes.

Comparing the Proposals

Key Assumptions Impacting Financial Modelling

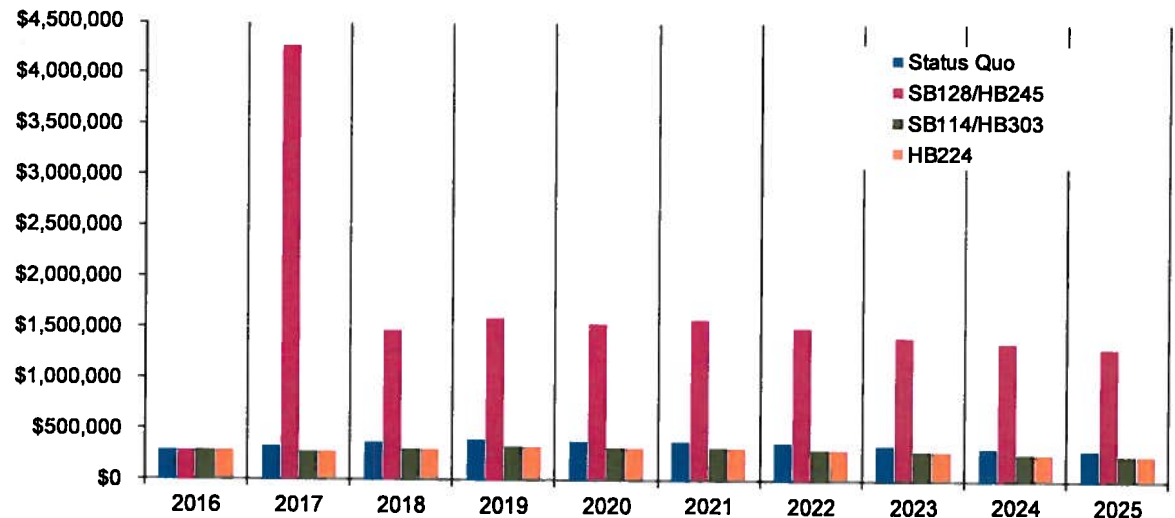
Principal	Status Quo	SB128/HB245	SB114/HB303	HB224
Deposits	30% royalties	25% royalties	25% royalties	25% royalties
Additional appropriations to Principal	Change in inflation rate applied to principal balance at end of year	ER balance in excess target (target = 4 X distribution)		
Earnings Reserve				
Income	Statutory Net Income	Statutory Net Income	Statutory Net Income	Statutory Net Income
Deposits		\$3b from CBR in FY17, 74.5% royalties, 100% production taxes		
FY 2016 Dividend Distribution	Status Quo	Amount necessary to pay \$1,000 dividend	Paid from distribution to government fund	Status Quo
Distributions	Half of 21% of five-year total statutory net income	\$3.3b through FY19, optional inflation adjustment thereafter, plus 50% of royalties	5% of lagged five-year average market value	4.5% of lagged five-year average market value
Limitation on Total Distribution	Earnings Reserve Balance	Earnings Reserve Balance	Earnings Reserve Balance	Earnings Reserve Balance
Timing of Draw	End of July	Throughout year	Throughout year	Throughout year (simplifying assumption)

Projected Net In-Flows to Fund

Contributions

- In-flows are shown on a cash-basis in the year in which they are projected to occur.
- Oil revenue projections are based on the Fall 2015 Revenue Sources Book projections.
- SB128 assumes one-time transfer of \$3 billion from CBR in FY 2017.
- SB128 also transfers additional oil revenues in each year.
- Status Quo receives approximately 30% of royalties.
- Both POMV plans receive 25% of royalties.

Projected Annual In-Flows
(Oil Revenue and CBR Transfer)

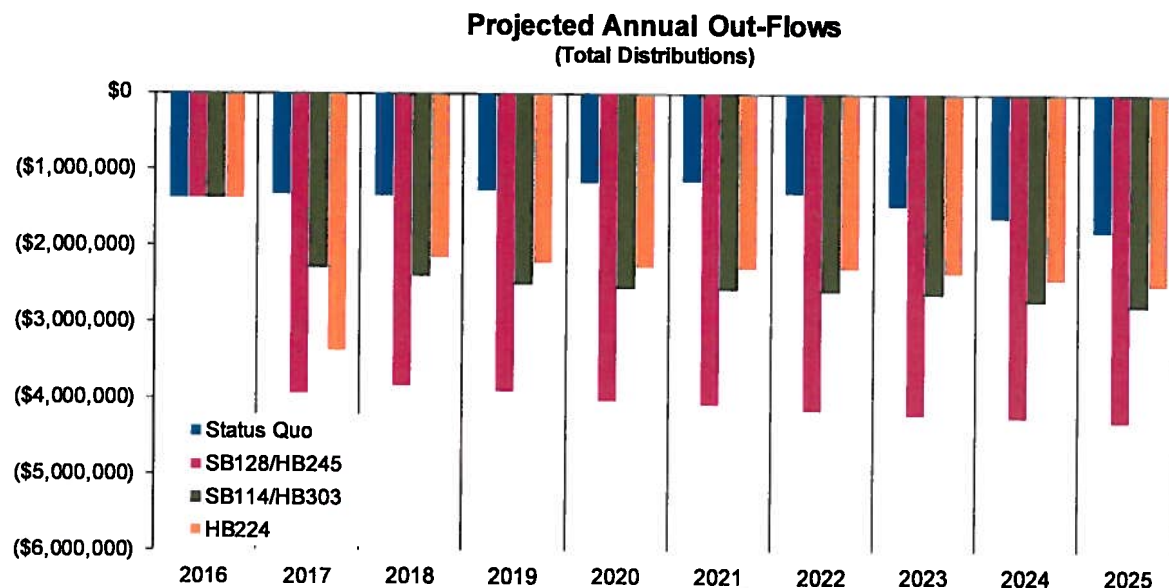


Annual In-Flow	Status Quo	SB128/HB245	SB114/HB303	HB224
2016	\$287,681	\$287,681	\$287,681	\$287,681
2017	\$326,878	\$4,271,962	\$272,399	\$272,399
2018	\$362,445	\$1,478,919	\$302,037	\$302,037
2019	\$390,649	\$1,591,961	\$325,541	\$325,541
2020	\$376,986	\$1,545,936	\$314,155	\$314,155
2021	\$380,751	\$1,581,253	\$317,292	\$317,292
2022	\$361,130	\$1,504,839	\$300,942	\$300,942
2023	\$338,612	\$1,409,783	\$282,176	\$282,176
2024	\$320,244	\$1,354,701	\$266,870	\$266,870
2025	\$301,859	\$1,301,872	\$251,549	\$251,549
5-Year Total	\$1,744,639	\$9,176,458	\$1,501,812	\$1,501,812
10-Year Total	\$3,447,235	\$16,328,906	\$2,920,643	\$2,920,643

Projected Out-Flows From Fund

Total Distributions

- Status quo employs standard dividend distribution formula.
- SB128 assumes \$3.3 billion distributions through 2019, and inflation adjusted thereafter.
- SB128 assumes an additional distribution in FY 2017 sufficient to support a \$1,000 dividend (approximately \$650 million).
- SB114 assumes distributions equal to 5% of 5-year average market value for all years. No additional distribution for dividend in FY 2017.
- HB224 assumes distributions equal to 4.5% of 5-year average market value for all years, plus FY2016 status quo dividend distribution in 2017.

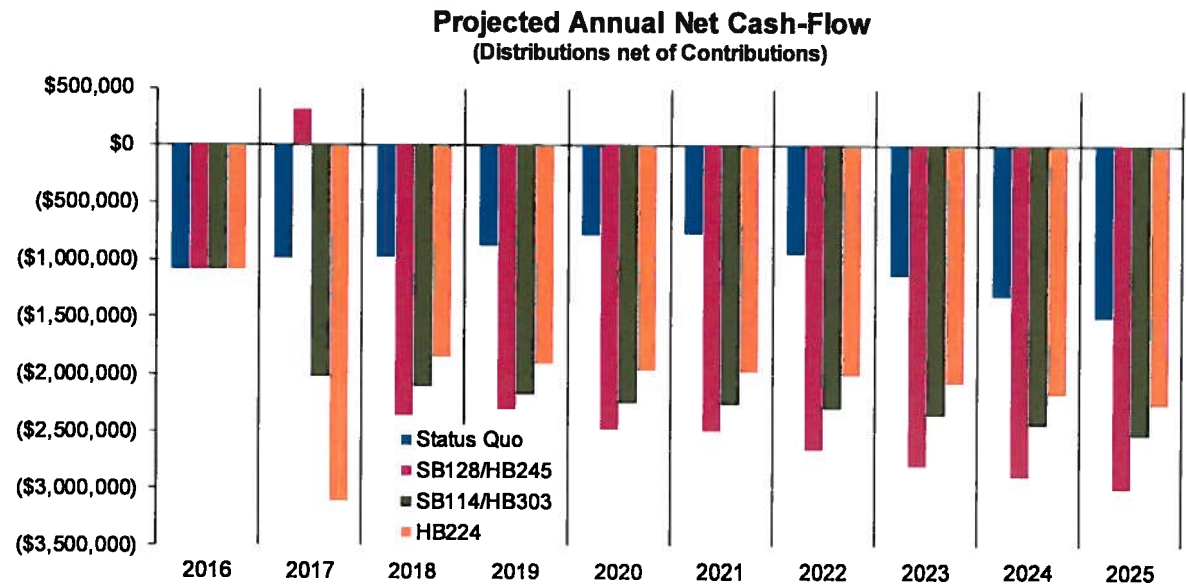


Annual Out-Flow	Status Quo	SB128/HB245	SB114/HB303	HB224
2016	(\$1,373,102)	(\$1,373,102)	(\$1,373,102)	(\$1,373,102)
2017	(\$1,320,348)	(\$3,951,651)	(\$2,293,649)	(\$3,384,632)
2018	(\$1,350,146)	(\$3,844,797)	(\$2,403,248)	(\$2,151,040)
2019	(\$1,271,987)	(\$3,904,074)	(\$2,500,479)	(\$2,230,296)
2020	(\$1,162,892)	(\$4,025,331)	(\$2,584,657)	(\$2,281,682)
2021	(\$1,150,580)	(\$4,078,481)	(\$2,578,279)	(\$2,289,672)
2022	(\$1,303,399)	(\$4,162,384)	(\$2,589,892)	(\$2,298,162)
2023	(\$1,468,242)	(\$4,209,059)	(\$2,634,717)	(\$2,350,870)
2024	(\$1,632,093)	(\$4,252,689)	(\$2,707,171)	(\$2,427,432)
2025	(\$1,796,848)	(\$4,305,064)	(\$2,785,176)	(\$2,509,744)
5-Year Total	(\$6,478,475)	(\$17,098,956)	(\$11,135,135)	(\$11,420,751)
10-Year Total	(\$13,829,637)	(\$38,106,633)	(\$24,430,371)	(\$23,296,632)

Projected Net Cash-Flows

Contributions minus Distributions

- Net cash-flow shows total dollar impact on the Fund each year.
- Status Quo is the lowest, distributing about half the amount of the three proposals over 10 years.
- The three proposals have similar total distribution levels over 10 years.
- The pattern is quite different between SB128 and the two POMV proposals due primarily to the additional contributions from CBR and oil.

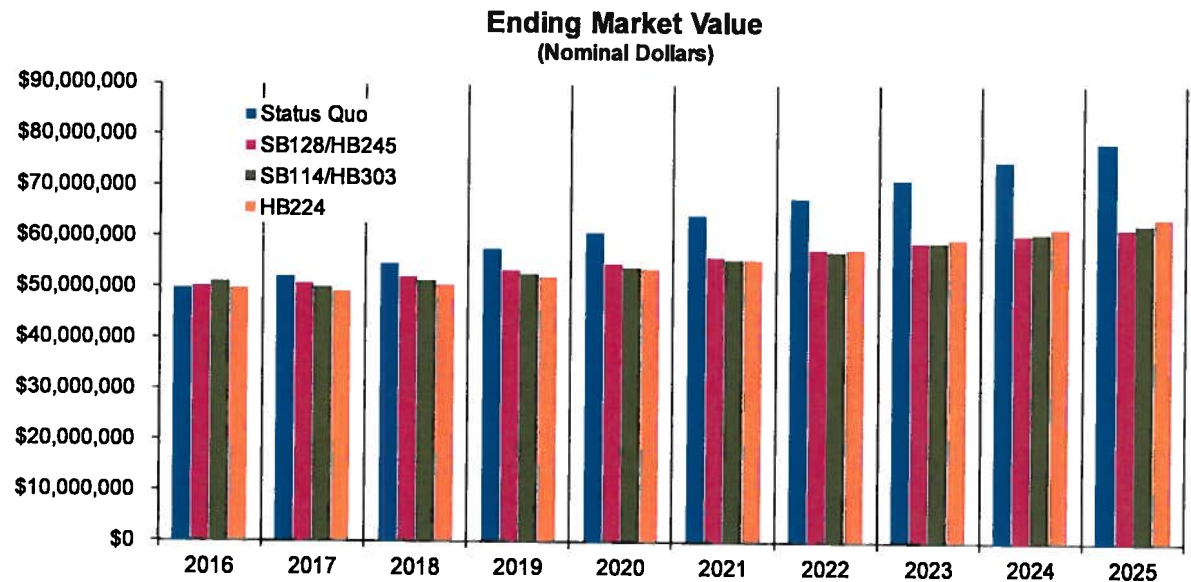


Annual Net Flow	Status Quo	SB128/HB245	SB114/HB303	HB224
2016	(\$1,085,421)	(\$1,085,421)	(\$1,085,421)	(\$1,085,421)
2017	(\$993,470)	\$320,311	(\$2,021,250)	(\$3,112,233)
2018	(\$987,701)	(\$2,365,878)	(\$2,101,211)	(\$1,849,003)
2019	(\$881,338)	(\$2,312,113)	(\$2,174,939)	(\$1,904,755)
2020	(\$785,906)	(\$2,479,395)	(\$2,250,502)	(\$1,967,526)
2021	(\$769,829)	(\$2,497,228)	(\$2,280,987)	(\$1,972,380)
2022	(\$942,269)	(\$2,657,545)	(\$2,288,950)	(\$1,997,220)
2023	(\$1,129,630)	(\$2,799,275)	(\$2,352,541)	(\$2,068,694)
2024	(\$1,311,849)	(\$2,897,989)	(\$2,440,300)	(\$2,160,562)
2025	(\$1,494,989)	(\$3,003,193)	(\$2,533,627)	(\$2,258,195)
5-Year Total	(\$4,733,836)	(\$7,922,497)	(\$9,633,323)	(\$9,918,939)
10-Year Total	(\$10,382,402)	(\$21,777,727)	(\$21,509,728)	(\$20,375,980)

Projected Ending Market Value

Nominal Dollars

- Consistent with what the net flows would suggest, Status Quo results in the highest market value at the end of 10 years.
- The three bills are only slightly different in this dimension.
- SB128 starts out with a higher market value due to the CBR transfer and the lower dividend distribution for FY 2016.
- The larger draws in later years for SB128 result in the market value growing more slowly than for the other proposals.

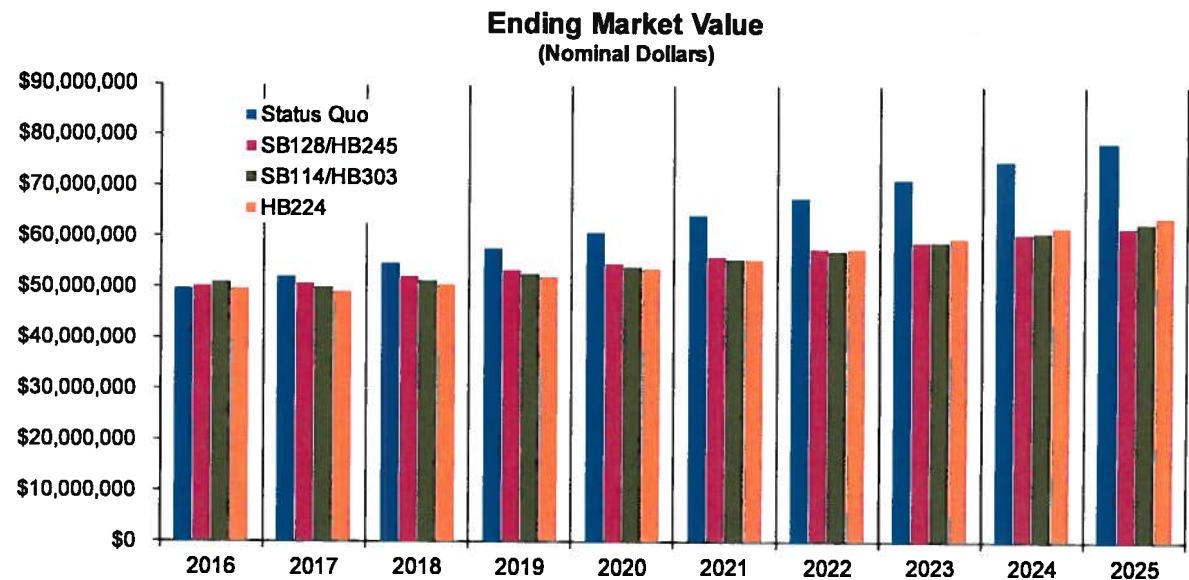


Ending Market Value	Status Quo	SB128/HB245	SB114/HB303	HB224
2016	\$49,779,818	\$50,448,515	\$51,100,166	\$49,779,818
2017	\$52,058,624	\$50,936,833	\$50,056,176	\$49,139,249
2018	\$54,681,107	\$52,085,079	\$51,271,142	\$50,562,854
2019	\$57,685,700	\$53,450,183	\$52,575,910	\$52,101,591
2020	\$60,951,504	\$54,789,750	\$53,985,825	\$53,767,804
2021	\$64,344,989	\$56,223,415	\$55,582,887	\$55,836,304
2022	\$67,835,357	\$57,670,650	\$57,301,502	\$57,646,145
2023	\$71,421,810	\$59,108,139	\$59,071,874	\$59,708,608
2024	\$75,109,444	\$60,562,150	\$60,874,040	\$61,824,347
2025	\$78,899,520	\$62,029,731	\$62,724,863	\$64,006,633

Projected Real Ending Market Value

Inflation Adjusted 2015 Dollars

- In a standard endowment model the objective is often to preserve the purchasing power, or inflation adjusted market value.
- All proposals result in a (slightly) higher real market value at the end of 2025 assuming median capital market results.
- This would imply that they all have a roughly 50% chance of preserving real market value in 2015 dollars.
- Status quo results in meaningfully higher real market value.



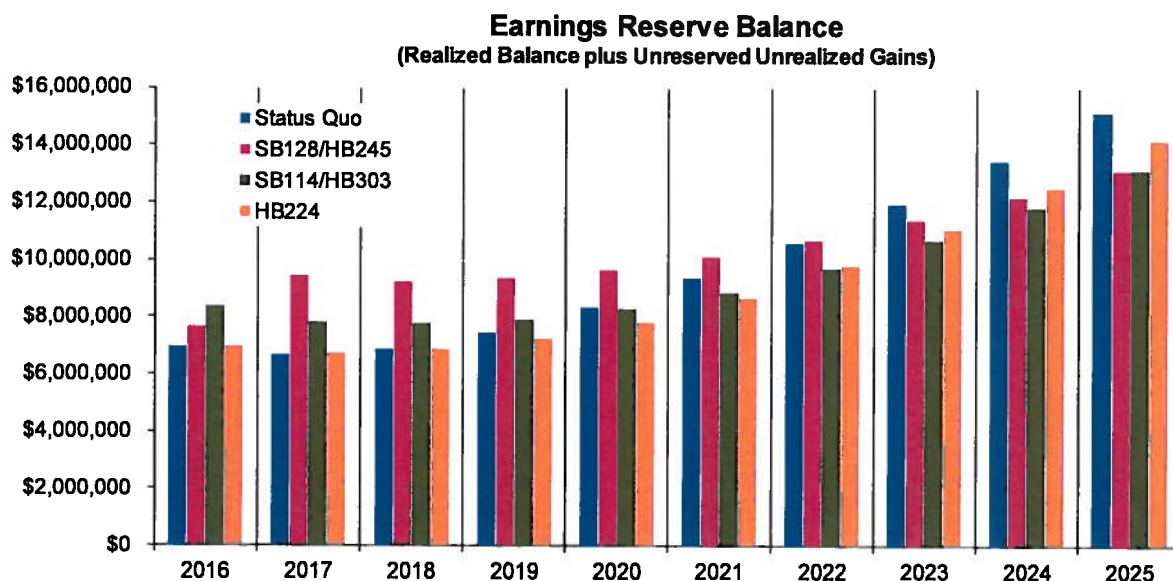
Real Ending Market Value ¹	Status Quo	SB128/HB245	SB114/HB303	HB224
2016	\$48,684,419	\$49,338,401	\$49,975,712	\$48,684,419
2017	\$49,792,743	\$48,719,778	\$47,877,452	\$47,000,436
2018	\$51,150,202	\$48,721,806	\$47,960,427	\$47,297,875
2019	\$52,773,379	\$48,898,545	\$48,098,722	\$47,664,794
2020	\$54,534,061	\$49,021,064	\$48,301,783	\$48,106,717
2021	\$56,303,427	\$49,196,853	\$48,636,200	\$48,683,117
2022	\$58,051,427	\$49,352,781	\$49,036,875	\$49,331,810
2023	\$59,775,651	\$49,469,868	\$49,439,349	\$49,972,423
2024	\$61,478,703	\$49,571,428	\$49,826,717	\$50,604,564
2025	\$63,159,865	\$49,655,428	\$50,211,728	\$51,237,959

1. Market value adjusted to 6/30/2015 dollars using cumulative inflation.

Projected Ending Earnings Reserve Balance

Limitation on Distributions

- Earnings Reserve is equal to all of the cumulative realized gains (and income) to date, net of distributions and appropriations to principal.
- By constitution it places a limit on spending from the Permanent Fund.
- Keeping a healthy balance in the ER is critical to keeping distributions stable through down markets.
- SB128 maximizes the size of the ER early which provides some additional insurance that distributions can be made in sustained bear markets.
- Status Quo results in the highest balance after 10 years.

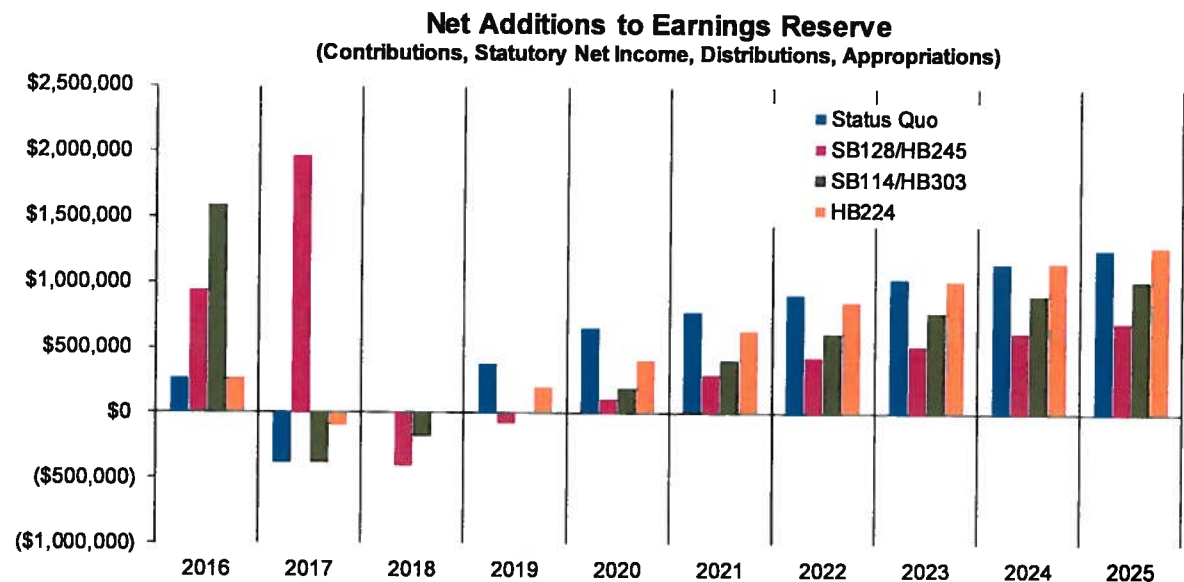


Earnings Reserve Balance	Status Quo	SB128/HB245	SB114/HB303	HB224
2016	\$6,959,529	\$7,675,889	\$8,372,689	\$6,959,529
2017	\$6,718,111	\$9,448,638	\$7,809,255	\$6,735,762
2018	\$6,864,085	\$9,249,035	\$7,778,167	\$6,887,517
2019	\$7,436,381	\$9,354,922	\$7,823,350	\$7,244,245
2020	\$8,333,884	\$9,631,001	\$8,271,251	\$7,830,037
2021	\$9,382,703	\$10,097,375	\$8,860,503	\$8,678,943
2022	\$10,590,569	\$10,697,490	\$9,679,641	\$9,780,232
2023	\$11,955,181	\$11,398,084	\$10,680,627	\$11,074,616
2024	\$13,469,537	\$12,201,325	\$11,824,863	\$12,530,335
2025	\$15,127,032	\$13,100,946	\$13,099,813	\$14,135,227

Projected Net Additions to Earnings Reserve

Contributions, Distributions, Statutory Net Income, Appropriations

- Net contributions to Earnings Reserve allow you to see the large differences between the three proposals and Status Quo.
- The front-loading by SB128 is created by the reduced \$1,000 dividend distribution for FY 2016, and the transfer from the CBR.
- SB114 achieves this as well (to a lesser extent) by not having a dedicated dividend distribution in FY 2016.
- Status Quo is projected to have negative years in 2017 and 2018 due to significant gains realized over last five years, and a down market this year.



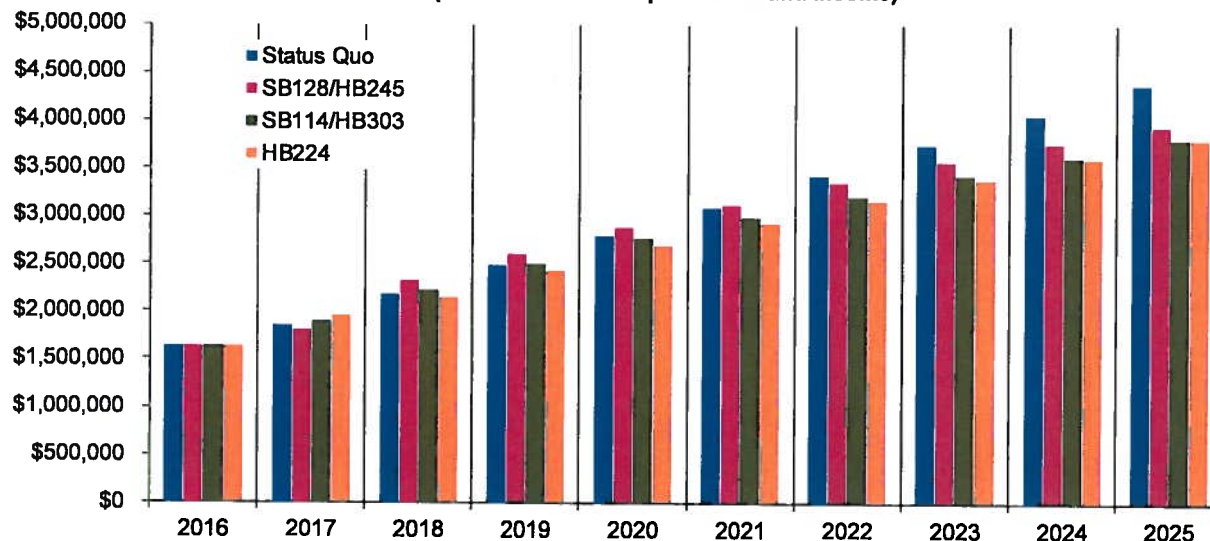
Net Additions to Earnings Reserve	Status Quo	SB128/HB245	SB114/HB303	HB224
2016	\$273,308	\$942,006	\$1,593,656	\$273,308
2017	(\$387,041)	\$1,989,287	(\$388,397)	(\$102,069)
2018	(\$4,620)	(\$405,114)	(\$185,039)	\$1,847
2019	\$384,124	(\$81,797)	\$1,949	\$204,738
2020	\$664,577	\$112,140	\$197,755	\$415,289
2021	\$787,354	\$299,020	\$414,782	\$643,996
2022	\$917,023	\$430,753	\$619,937	\$861,579
2023	\$1,043,888	\$526,805	\$783,709	\$1,030,923
2024	\$1,164,518	\$626,894	\$911,887	\$1,169,880
2025	\$1,279,622	\$714,738	\$1,025,273	\$1,295,798
5-Year Total	\$930,349	\$2,536,501	\$1,219,924	\$793,094
10-Year Total	\$6,122,754	\$5,134,710	\$4,975,511	\$5,795,289

Projected Statutory Net Income

Realized Capital Gains and Income

- Statutory Net Income is function of coupon and dividend income plus realized capital gains.
- Realized capital gains are impacted by turnover.
- Net flows out of the fund force selling which creates turnover which impacts Statutory Net Income.
- Over time the higher market value will ultimately dominate and create higher Statutory Net Income.
- Over shorter periods selling can create anomalies.

Statutory Net Income
(Annual Realized Capital Gains and Income)

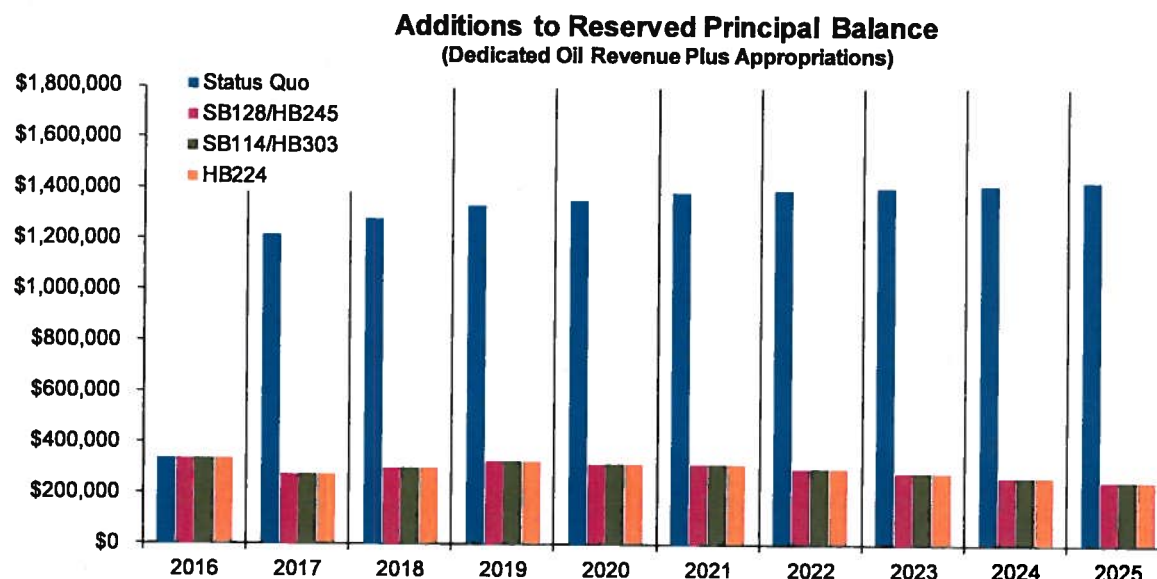


Statutory Net Income	Status Quo	SB128/HB245	SB114/HB303	HB224
2016	\$1,640,654	\$1,640,654	\$1,640,654	\$1,640,654
2017	\$1,851,846	\$1,814,501	\$1,905,251	\$1,982,215
2018	\$2,183,460	\$2,322,078	\$2,218,210	\$2,152,887
2019	\$2,491,876	\$2,602,864	\$2,502,428	\$2,435,034
2020	\$2,790,066	\$2,882,919	\$2,762,412	\$2,696,951
2021	\$3,096,080	\$3,119,814	\$2,993,061	\$2,933,668
2022	\$3,421,778	\$3,356,539	\$3,209,829	\$3,159,740
2023	\$3,743,941	\$3,570,726	\$3,418,426	\$3,381,793
2024	\$4,060,974	\$3,761,140	\$3,619,057	\$3,597,312
2025	\$4,374,378	\$3,938,838	\$3,810,449	\$3,805,542
5-Year Total	\$10,957,903	\$11,263,018	\$11,028,955	\$10,887,741
10-Year Total	\$29,655,054	\$29,010,075	\$28,079,779	\$27,765,797

Projected Additions to Reserved Principal

Reserved Oil Revenue plus Appropriations

- Each of the proposals eliminates the annual “inflation proofing” appropriation to Reserved Principal.
- Status Quo preserves this tradition.
- This allows the proposals to make larger distributions from the Fund while still maintaining a relatively healthy Earnings Reserve balance.
- All three proposals still contribute 25% of oil royalties to Reserved Principal each year.



Additions to Reserved Principal	Status Quo	SB128/HB245	SB114/HB303	HB224
2016	\$334,679	\$334,679	\$334,679	\$334,679
2017	\$1,215,619	\$272,399	\$272,399	\$272,399
2018	\$1,278,538	\$302,037	\$302,037	\$302,037
2019	\$1,335,509	\$325,541	\$325,541	\$325,541
2020	\$1,351,895	\$314,155	\$314,155	\$314,155
2021	\$1,386,078	\$317,292	\$317,292	\$317,292
2022	\$1,397,643	\$300,942	\$300,942	\$300,942
2023	\$1,408,572	\$282,176	\$282,176	\$282,176
2024	\$1,419,852	\$266,870	\$266,870	\$266,870
2025	\$1,433,414	\$251,549	\$251,549	\$251,549
5-Year Total	\$5,516,240	\$1,548,810	\$1,548,810	\$1,548,810
10-Year Total	\$12,559,799	\$2,987,641	\$2,987,641	\$2,987,641

Deterministic versus Stochastic Results

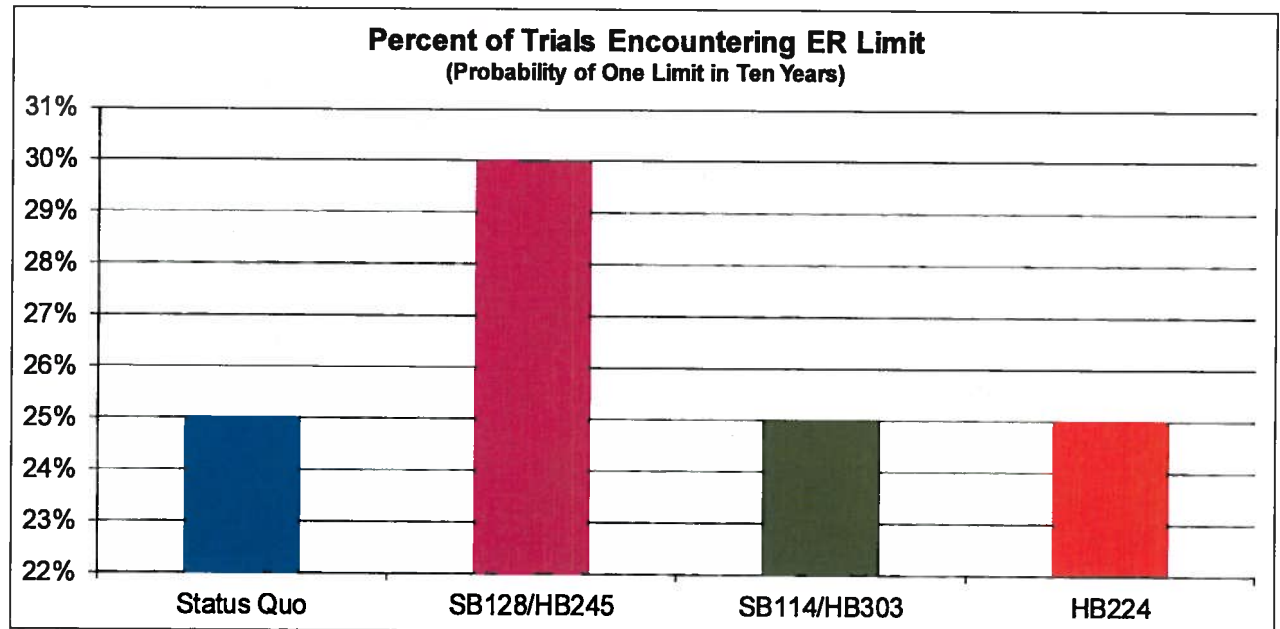
Introducing Volatility

- All of the results so far have assumed median capital market outcomes.
- 10 years of earning exactly the same return with exactly the same inflation level is unrealistic and masks the potential impact of volatility on the system.
- Monte Carlo simulation allows us to explore 1,000's of different capital market outcomes, each with a reasonable level of volatility, and understand the range of potential outcomes.
- I will present a brief demonstration at the meeting to illustrate some of the capital market paths so that Board members can get a feel for how the process works.
- Three variables are used to evaluate and understand the differences between the proposals in the context of market volatility:
 - Ending Real Market Value after ten years.
 - Cumulative Distributions over ten years.
 - The probability of the Earnings Reserve limiting the planned distribution in any one year.

Probability of Encountering an Earnings Reserve Limitation

Inflation Adjusted Market Value

- The Earnings Reserve Account can place a limit on distributions if the cumulative effect of distributions, appropriations, and realized and unrealized losses reduces its balance below that of the planned distribution.
- The legislative proposals are not significantly more likely to hit up against a limitation than the Status Quo.
- This shows the probability of hitting a single limit in 10 years.
- In worse-case outcomes distributions can be limited in multiple years.



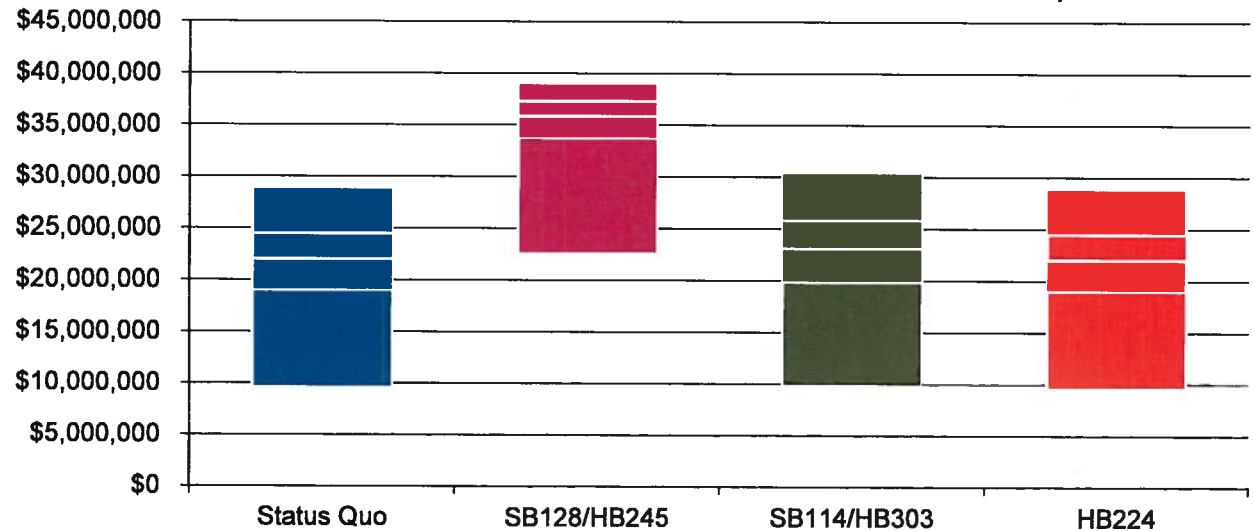
Probability of Hitting an ER Limit	Status Quo	SB128/HB245	SB114/HB303	HB224
Percent Probability	25%	30%	25%	25%

Range of Cumulative Distributions through 2025

Nominal Dollars

- All of the proposals result in higher cumulative distributions under most circumstances relative to Status Quo.
- The big gap between 75th percentile and 90th percentile represents the impact of the Earnings Reserve limitation
- The range of results between SB114 and HB224 in this dimension is relatively small.
- SB128 generates higher distributions in most cases.
 - Baseline distributions to Government Fund are higher;
 - Earnings Reserve Account receives additional oil revenue of approximately \$1.2 billion annually.

Range of Cumulative Distributions through 2025
(Total Distributions, Government Fund and Dividend Fund)

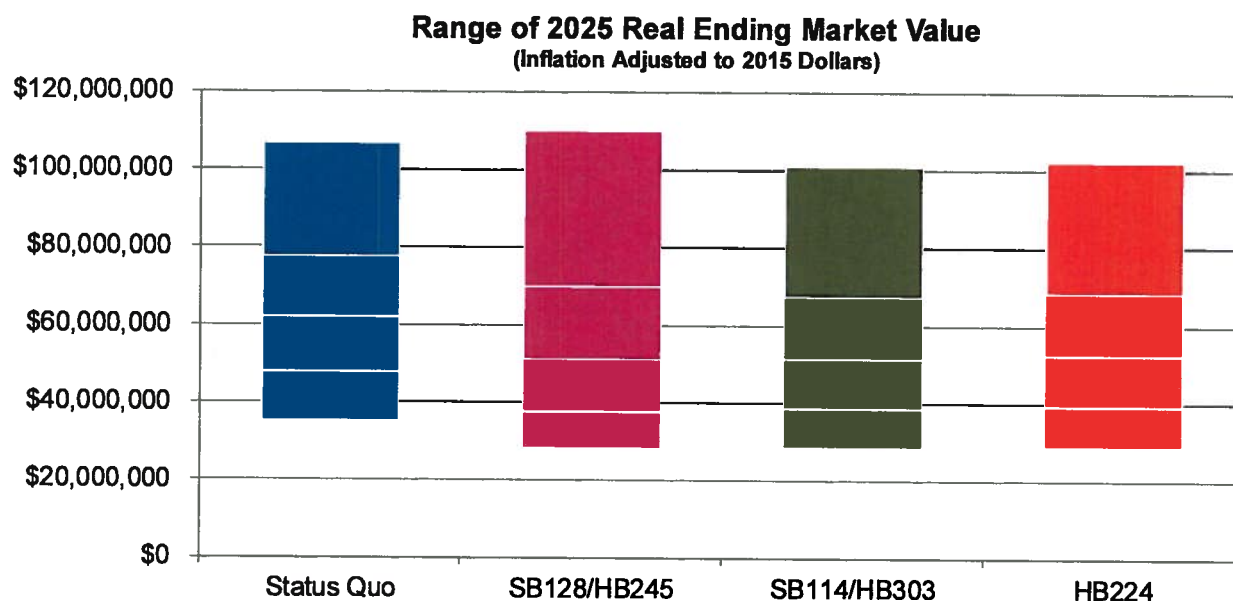


Cumulative 10-Year Distributions	Status Quo	SB128/HB245	SB114/HB303	HB224
5th Percentile	\$29,105,713	\$39,113,299	\$30,452,479	\$28,886,662
25th Percentile	\$19,753,057	\$37,355,976	\$25,811,075	\$24,489,751
Median	\$14,487,974	\$35,943,879	\$23,103,842	\$22,034,081
75th Percentile	\$9,762,045	\$33,756,625	\$19,815,913	\$19,007,454
95th Percentile	\$4,431,591	\$22,541,113	\$9,798,988	\$9,563,227

Range of Ending Real Market Value, 2025

Inflation Adjusted Market Value

- Relative to FY 2015 Ending Market Value of \$52.8 billion, Status Quo and HB224 have highest probability of preserving or growing real market value.
- Differences between the three legislative proposals are relatively small in this dimension.
- SB128 has the highest upside due to the fact that contributions can only grow by inflation even during strong sustained bull market environments.
- Distributions for all other approaches are based on past market returns.



Real Ending Market Value	Status Quo	SB128/HB245	SB114/HB303	HB224
5th Percentile	\$106,683,281	\$110,017,638	\$100,950,717	\$102,332,621
25th Percentile	\$77,514,675	\$69,962,189	\$67,325,268	\$68,399,378
Median	\$61,660,630	\$50,850,570	\$51,381,837	\$52,367,652
75th Percentile	\$47,916,210	\$37,771,110	\$38,617,291	\$39,285,737
95th Percentile	\$35,168,091	\$28,165,335	\$28,500,577	\$29,012,994