

# Actuarial Methods, Rate Calculations & Financial Projections

## OREGON PUBLIC EMPLOYEES RETIREMENT SYSTEM

March 29, 2013

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# Agenda

- Introduction to:
  - Actuarial methods
  - Rate calculations
- Discussion of:
  - Shortfall levels
  - Currently scheduled 2013 rate increases
- Stochastic financial projections

# Part One:

# Introduction to Actuarial Methods & Rate Calculations

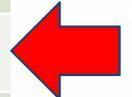
# Overview

- Actuarial methods are the foundation of rate calculations
- PERS Board reviews and approves methods every two years
  - Next scheduled review: May and July 2013 meetings
- Actuarial method changes were adopted in December 2005
  - Projected unit credit cost allocation method
  - Assets measured at fair market value
  - Direct contribution rate smoothing , also called the “rate collar”
- Another method is payoff of Tier 1/Tier 2 experience deviations from assumption over 20 years as a level percent of payroll
  - The most significant deviations are investment returns
  - 20 year amortization became fully effective for the 12/31/2007 valuation

# Contribution Rate Development

- “Base” pension contribution rates have two major components:
  - Normal Cost Rate – Economic value of benefits for current year service
  - UAL Rate – Amortization of shortfalls related to past service
- System-wide average collared rates are shown in the table below

Base Pension Rate Components	2011-2013	2013-2015
Normal Cost Rate	7.96% of payroll	8.16% of payroll
UAL Rate	7.80% of payroll	12.62% of payroll
Total Rate	15.76% of payroll	20.78% of payroll



- Base pension rates have two funding sources:
  - Employer contributions
  - Transfers from employer side accounts

# Cost Allocation Method

- Rates are calculated to pre-fund retirement benefits during a member's working career if all assumptions are met
- The present day value of projected future benefits allocated to a particular working year is the **Normal Cost**
- The present day value of projected future benefits allocated to prior years is the **Accrued Liability**
- The division between past, current & future service is done through use of a *cost allocation method*
- The two most commonly used cost allocation methods are:
  - Entry age
  - Projected unit credit

# Cost Allocation Method

- For projected retirements under the Money Match formula, the two methods have very different cost allocation patterns
- Projected unit credit allocates the full benefit to pre-2004 service, consistent with the timing of member contributions
- Entry age allocates the benefit over the full working career, even though Money Match benefits are tied to pre-2004 contributions

This chart illustrates the normal cost pattern as a percent of pay for a sample full career active projected to retire under the Money Match formula



# Cost Allocation Method

- Projected unit credit was adopted in 2005, with its primary advantages being viewed as increased transparency and fully accruing projected Money Match benefits
  - Projected unit credit provides a more realistic allocation of Money Match costs between past (accrued liability) and future (normal cost) service
- New GASB standards will require financial reporting calculations be done under the entry age allocation method
  - Previously six different cost allocation methods were permissible
  - GASB has made it very clear that its new standard with the entry age mandate should not serve as a template for contribution rate policy
- We will discuss the pros and cons of each allocation method for contribution rate policy at the next meeting

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# Asset Measurement & Rate Smoothing

- In 2005, the Board elected to use assets measured at fair market value in rate calculations
  - The UAL Rate component of the contribution rate is based on the shortfall, which is the difference between accrued liability and fair value of assets
- To spread rate changes due to major asset swings across multiple biennia, the Board also adopted a direct rate smoothing policy
  - The smoothing policy is commonly referred to as the “rate collar”
- The fair value/rate collar approach was viewed by the Board as more transparent than the traditional asset smoothing methodology, which provides indirect rate smoothing

# Asset Measurement & Rate Smoothing

- The traditional approach has indirect rate smoothing through use of a non-market actuarial value of assets, or AVA, to calculate shortfall
- Investment return deviations from assumption are gradually recognized in the AVA over a smoothing period
- Previous to the adoption of fair value/rate collar, PERS used a four year asset smoothing period
  - A four year smoothing period would have incrementally reflected 2008 investment losses in 2008, 2009, 2010 and 2011
- If the previous approach had been continued, 2008 investment losses would have been fully reflected in the valuation that set 2013-2015 rates
  - Calculations with that approach are very similar to the scheduled rates

# Asset Measurement & Rate Smoothing

- The direct rate smoothing approach has three steps:
  - Calculate shortfall based on fair market asset values
  - Calculate the UAL Rate based on a 20 year shortfall amortization period
  - Check the calculated overall rate against the rate currently in effect
    - If the rate change is too large, part of the calculated increase is “collared” and deferred to the subsequent period
- The maximum change permitted by the initial collar is the greater of:
  - 3% of payroll OR 20% of the rate currently in effect
- If funded status is 70% or lower, the width of the collar doubles
  - Greater of 6% of payroll OR 40% of rate currently in effect
- If the funded status is between 70% and 80%, the collar size is pro-rated between the initial collar and double collar level

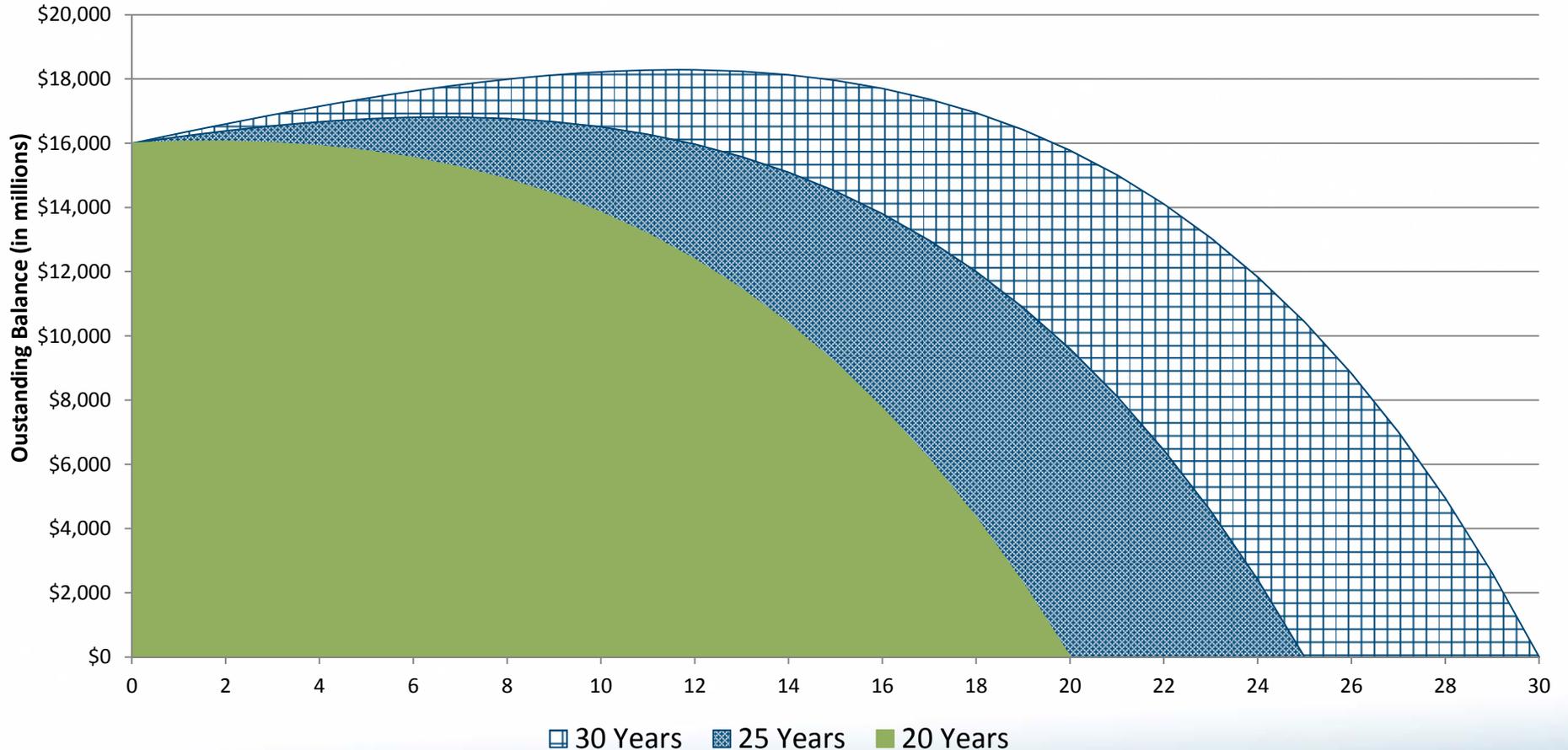
# Shortfall Amortization Periods

- Another key method is amortization of Tier 1/Tier 2 shortfalls over twenty years as a level percentage of payroll
  - Many other systems nationally use thirty-year amortization
  - Recent prominent funding guidance encourages amortization periods that are markedly shorter than thirty years
- The use of twenty years tries to balance the guiding principles of:
  - Predictable and stable rates,
  - Equitable across generations, and
  - Protect funded status

Twenty years is an amortization period that avoids significant “negative amortization”, where the shortfall actually increases in the initial “pay down” years even if assumptions are met and contributions are made

# Shortfall Amortization Periods

**UAL Balance by Amortization Period**  
Level % of Pay, 8.0% interest, 3.75% salary growth



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# The Fundamental Cost Equation

- Changes in methods or in benefits should be reviewed for their effects on the fundamental cost equation

$$BENEFITS = EARNINGS + CONTRIBUTIONS$$

- The long-term program costs are the contributions, and only two factors affect those costs:
  - Actual investment earnings
  - Future benefit levels
- Actuaries can accurately project future benefit levels
- Investment earnings are market-driven and much less predictable
  - OIC has influence via asset allocation policy and portfolio management

# The Fundamental Cost Equation

- A “current budget” emphasis can lead to an expanded equation

$$BENEFITS = EARNINGS + CONTRIBUTIONS NOW + CONTRIBUTIONS LATER$$

- Searches for savings can focus on “contributions now”, with potential solutions having differing impacts on the cost equation
- Benefit reductions lower both categories of contributions
- Deferring contributions now increases contributions later
  - The estimated annual deferral cost is the plan’s assumed earnings rate
  - \$400 million in deferred contributions now is estimated to be financially equivalent to over \$460 million in contributions made two years later

# Why Are Rate Increases So Large?

- System average base pension contribution rates are increasing 5.02% of payroll at 2013-2015
- Even with that large increase, an additional increase (2.3% of payroll) was deferred by the fair value/rate collar method
- Setting aside the effects of methods, does OPERS structurally need larger rate increases than other systems to respond to a downturn?
- Rate changes are primarily driven by investment losses but are funded as a percent of payroll on each active participant's salary
- As such, rate sensitivity can be assessed with the following measure

$$\frac{\text{Value of fair market assets}}{\text{Number of active members}}$$

# Why Are Rate Increases So Large?

- The NASRA Public Fund Survey can be used to assess how OPERS compares to the 98 other largest US state systems
  - The most recent study results (published November 2012) are below

	Oregon PERS	Survey Average
Fair market assets per active member	\$304,000	\$200,000

- These measures indicate OPERS rates are about one-and-a-half times as sensitive to investment returns as the average state system
  - For example, if actual investment returns for a year are 10% below assumption the investment loss is:
    - \$30,400 per OPERS active member
    - \$20,000 per active member of the average state system
  - Those investment losses are then translated into contribution rate increases based on the methods used by the system

# Summary – Methods & Rates

- Methods determine the timing of contributions, but long-term cost is determined by benefit provisions and the investment markets
- A fair market/rate collar approach is used to directly smooth rates
- Tier 1/Tier 2 investment losses are amortized over 20 years as a level percentage of payroll, with that pay off period selected to avoid persistent negative amortization
- The methods approved by the Board have a goal of transparency
- OPERS rates are markedly more sensitive to investment return variations than the average state system
- We will review methods in depth at the May & July meetings

# Part Two:

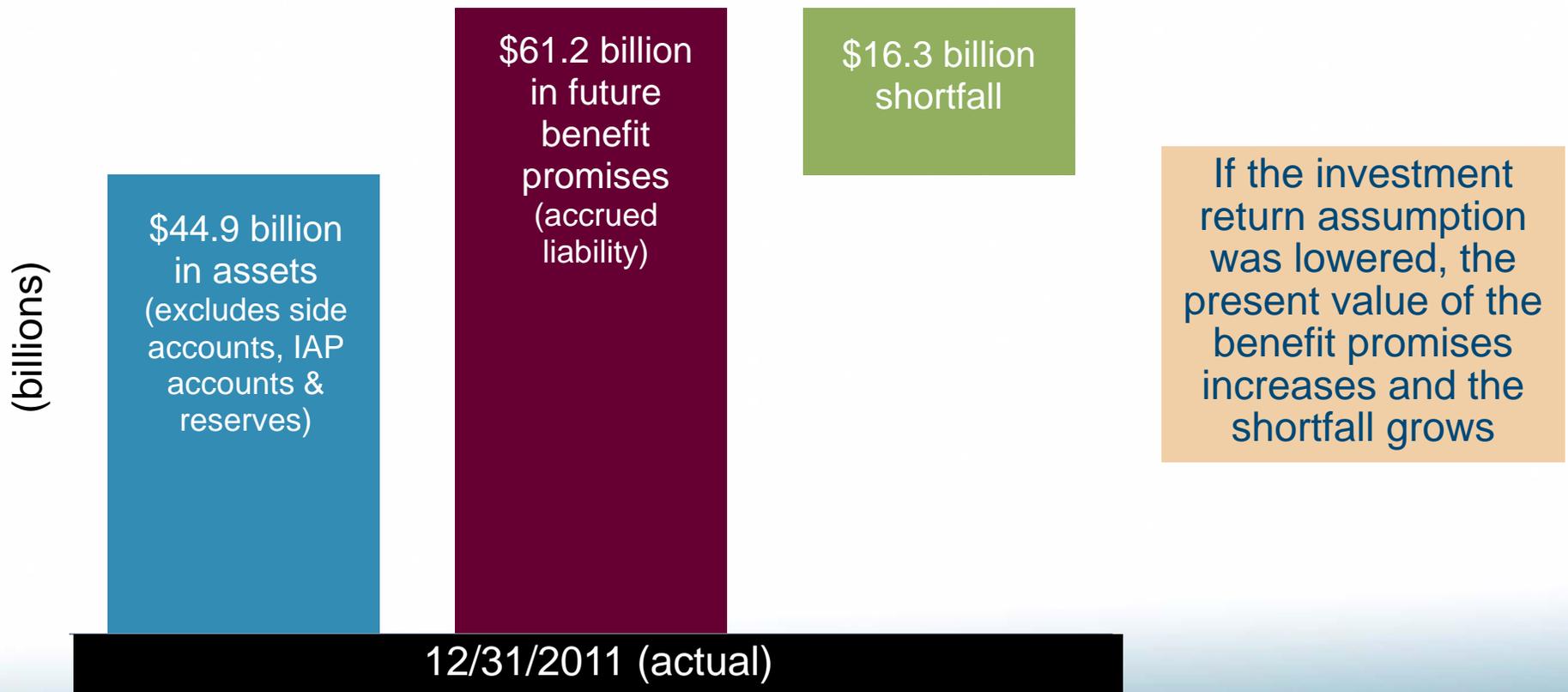
## Discussion of Shortfall Levels & 2013 Rate Increases

# Overview

- A shortfall can be defined as presently having insufficient assets on hand to fully meet a promised obligation
- The difference between the assets and the magnitude of the obligation is the shortfall
- How does a shortfall change over time?
- How will the currently scheduled July 2013 rate increases affect the shortfall?

# Shortfall Calculation and Growth

- The shortfall in our last valuation was \$16.3 billion, with the present value of future benefit promises predicated on 8% assumed future investment returns

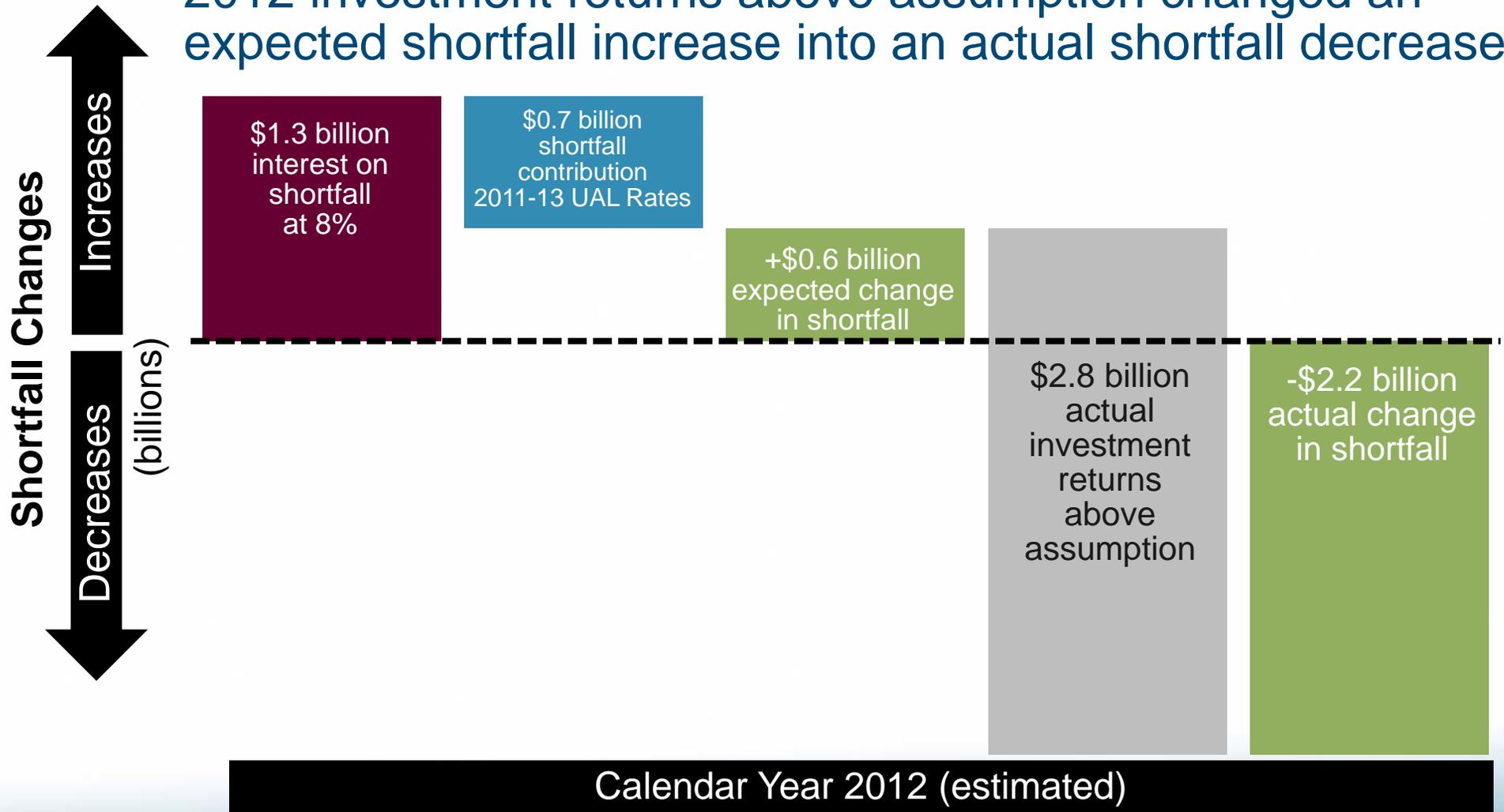


# Shortfall Calculation and Growth

- Year to year changes in shortfall can be understood through a simplified model
  - The shortfall grows with interest each year
    - The interest rate is currently 8%
  - Shortfall contributions, represented by the UAL Rate, lower shortfall
    - Employer contributions and side account transfers pay the UAL Rate
  - Shortfall is adjusted either up or down for annual deviations from the long-term investment return assumption – currently 8%
- The next slides show the estimated shortfall changes for 2012 based on both assumed and actual investment returns

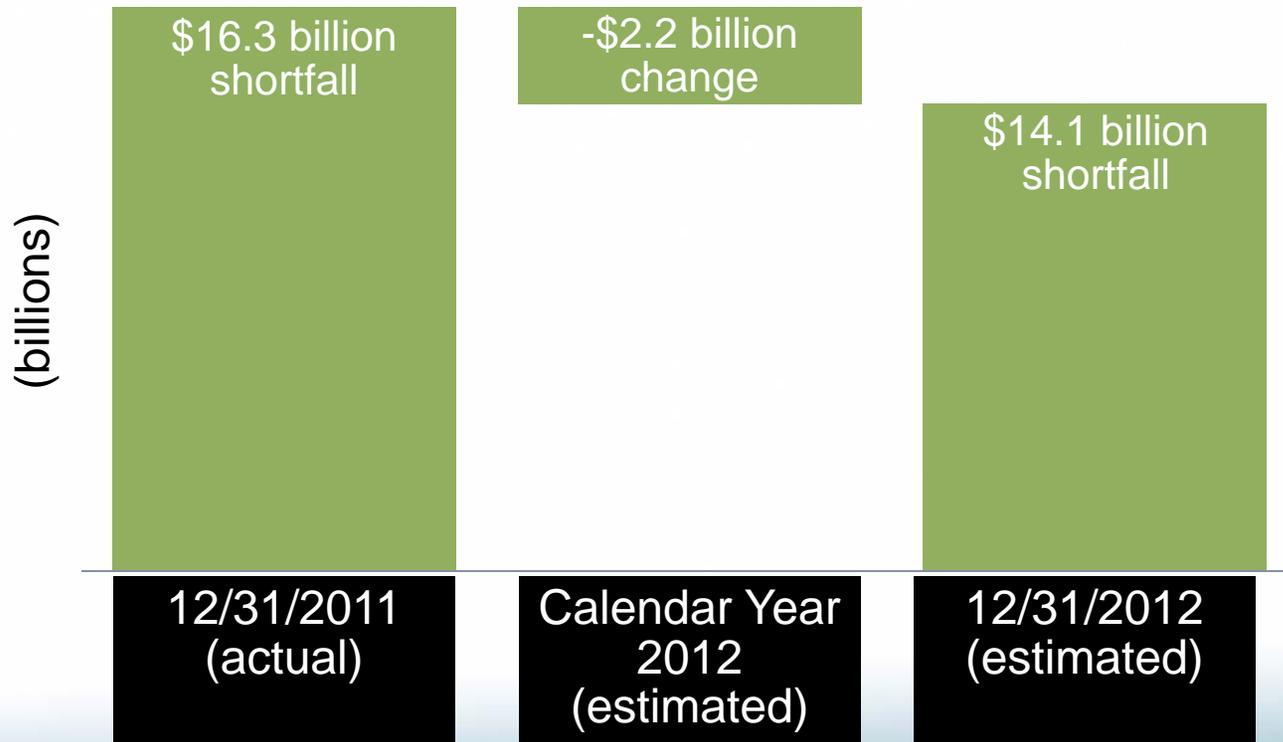
# Shortfall Calculation and Growth

2012 investment returns above assumption changed an expected shortfall increase into an actual shortfall decrease



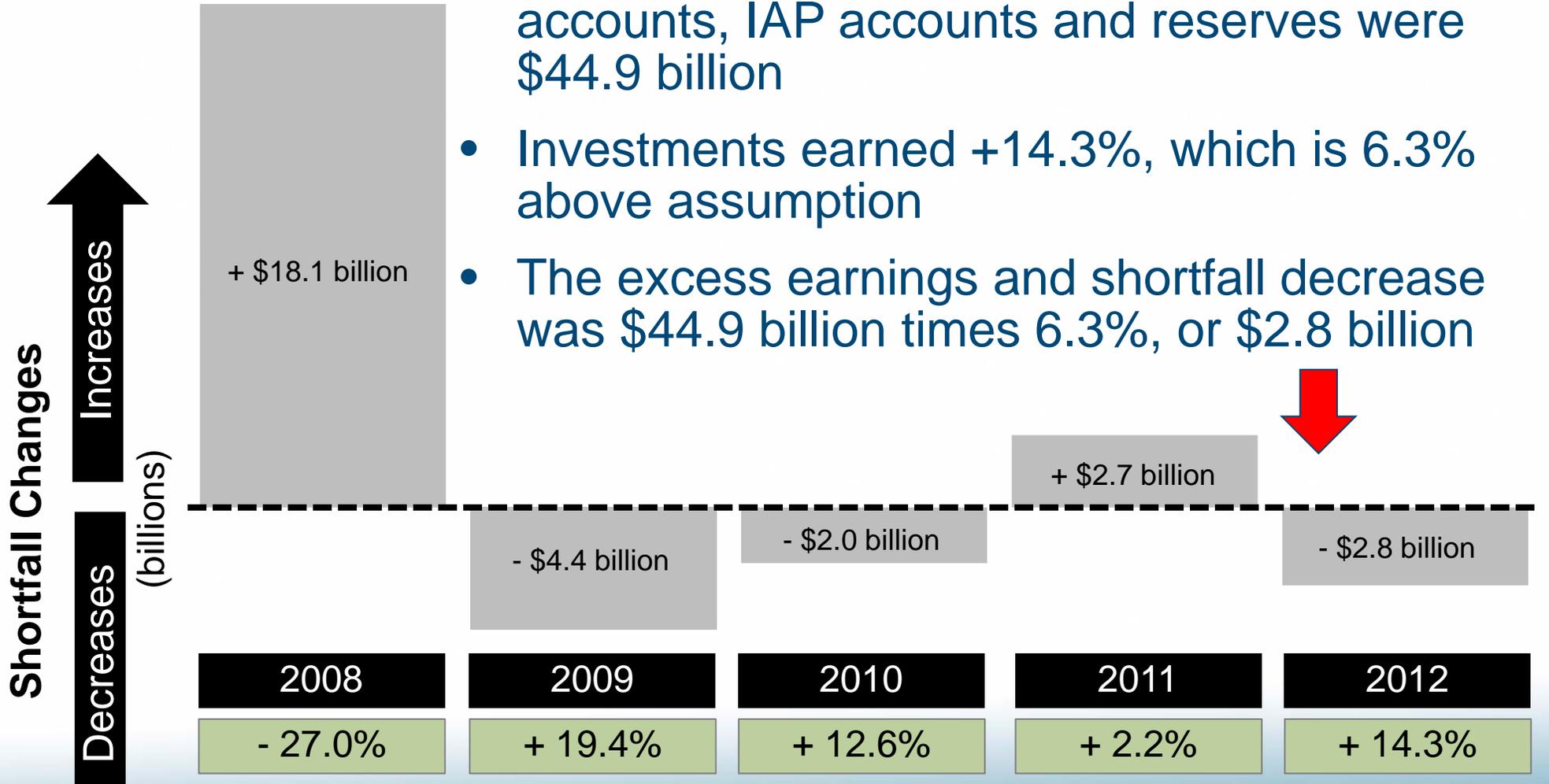
# Shortfall Calculation and Growth

- Shortfall is below all-time highs but well above pre-2008 levels
- If investments had earned exactly the assumed 8% in 2012, the shortfall would have increased
- Actual 2012 returns better than assumption lowered shortfall



# Shortfall Calculation and Growth

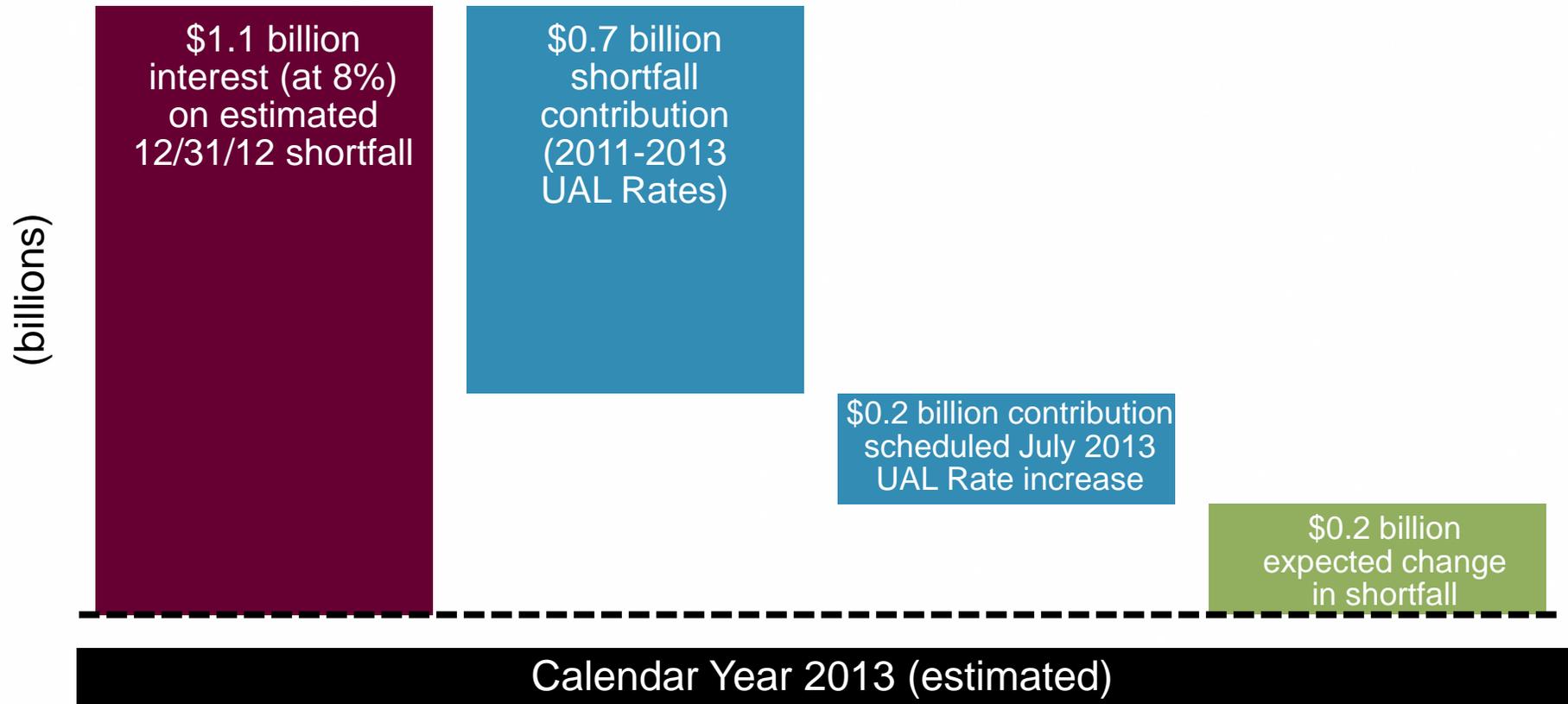
- At the start of 2012, assets excluding side accounts, IAP accounts and reserves were \$44.9 billion
- Investments earned +14.3%, which is 6.3% above assumption
- The excess earnings and shortfall decrease was \$44.9 billion times 6.3%, or \$2.8 billion



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# Shortfall Calculation and Growth

- Despite the 2012 investment returns, shortfall is expected to increase slightly in 2013 if investments earn exactly 8%

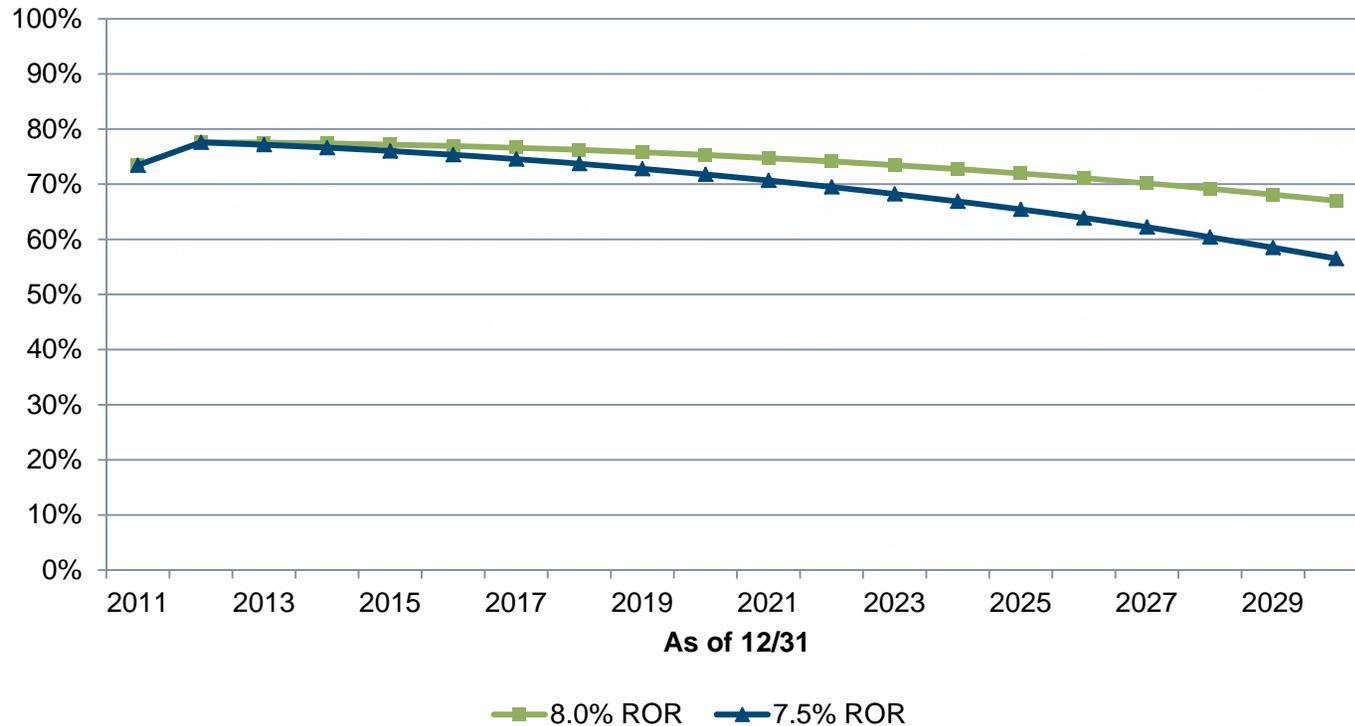


# Projected Shortfall Without Rate Increases

- The dynamic of earning 8% but still having the shortfall increase would not reverse itself without a rate increase above 2011-2013 contribution rate levels
- This is illustrated on the next slide, which shows projected funded status levels at steady annual 8% (or 7.5%) post-2012 investment returns if 2011-2013 contribution rates were used indefinitely

# Projected Shortfall Without Rate Increases

System-Wide Funded Status (excluding Side Accounts)



At 2011-2013 contribution levels, a 9.25% annual investment return would be needed to restore funded status to 100% over the projection period

- With 8% returns and 2011-2013 rates, the shortfall would increase to \$31 billion by the end of the projection period

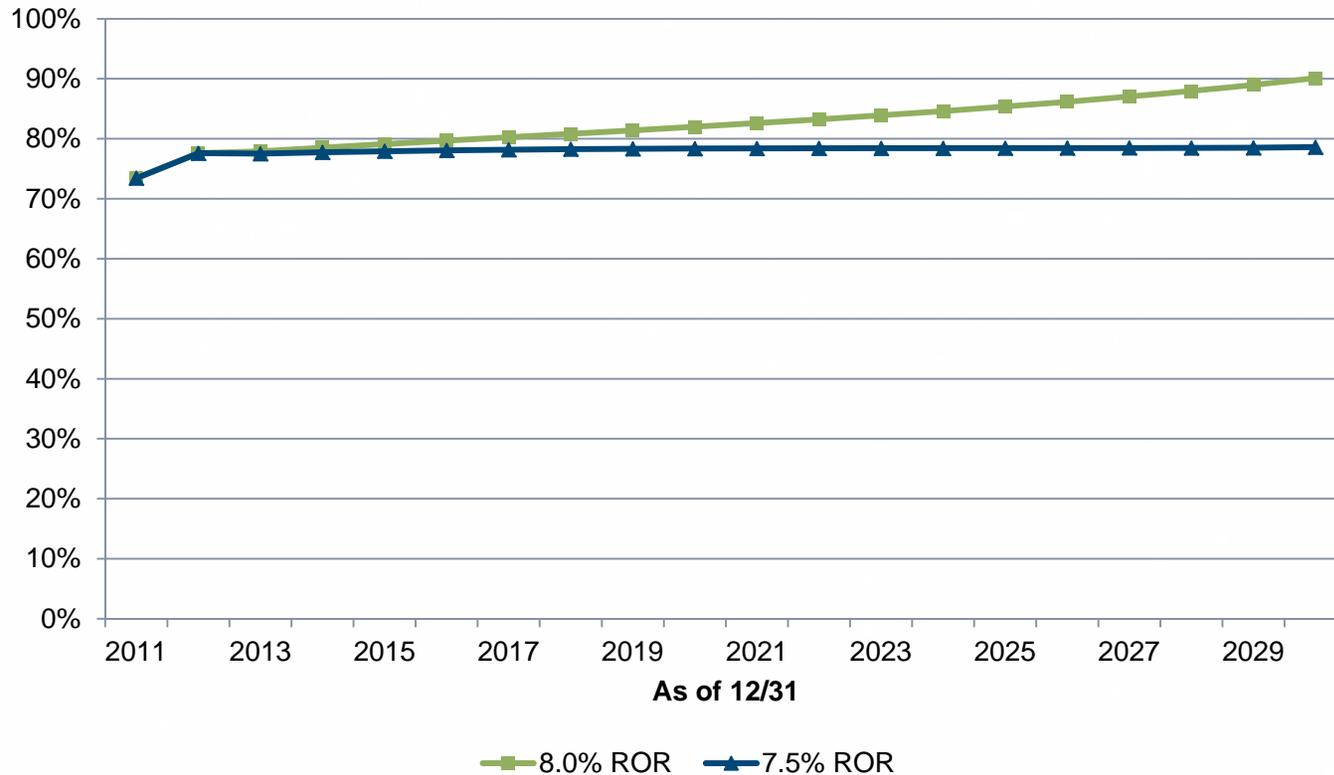
# Effect of Scheduled 2013 Rate Increases

- The currently scheduled rate increase for July 2013 is needed to reverse the dynamic of shortfall growing if investments earn 8%
- The additional \$0.5 billion contribution in 2014 means that 2014 will be the first post-downturn year where the shortfall decreases if investments return 8%\*
- Do the scheduled increases reverse the long-term trend if assumptions are met?
- The next slide projects funded status if rates are held at the currently scheduled 2013-2015 levels indefinitely

\* Assuming actual 2013 returns are near or above the 8% return assumption

# Effect of Scheduled 2013 Rate Increases

System-Wide Funded Status (excluding Side Accounts)



At currently scheduled 2013-2015 contribution levels, an 8.25% annual investment return would be needed to restore funded status to 100% over the projection period

- With 8% returns & currently scheduled 2013-2015 rates, the shortfall drops to \$9 billion by the end of the projection period

# Summary – Shortfall Levels & Rate Increases

- The shortfall has persisted since the market downturn
- The 2011 rate increase & the currently scheduled 2013 rate increase position PERS so that 2014 should be the first post-downturn year where the shortfall decreases if investment returns meet assumption
  - Taking six-plus years after a major downturn to “reverse the shortfall math” is consistent with the rate movements that would be observed with the more traditional indirect rate smoothing methods
- Without the scheduled 2013 rate increase, the shortfall would increase in magnitude if the assets returned exactly 8% annually
- The scheduled 2013 rate increase reverses that dynamic, and causes the program funded status to improve if 8% returns occur

# Part Three:

# Stochastic Financial Projections

# Overview

- When it comes to investment returns, the only thing that can be predicted with certainty is future unpredictability
- As such, we have developed financial projections to illustrate the effect of varying future investment performance
- In the prior section, we showed a “static” model with consistent annual investment returns
- This section has a more dynamic “stochastic” model that allows investment returns to vary from year to year
  - These projections, while complex, illustrate the potential effects of significant investment return volatility in the near and long-term

# Models and Inputs

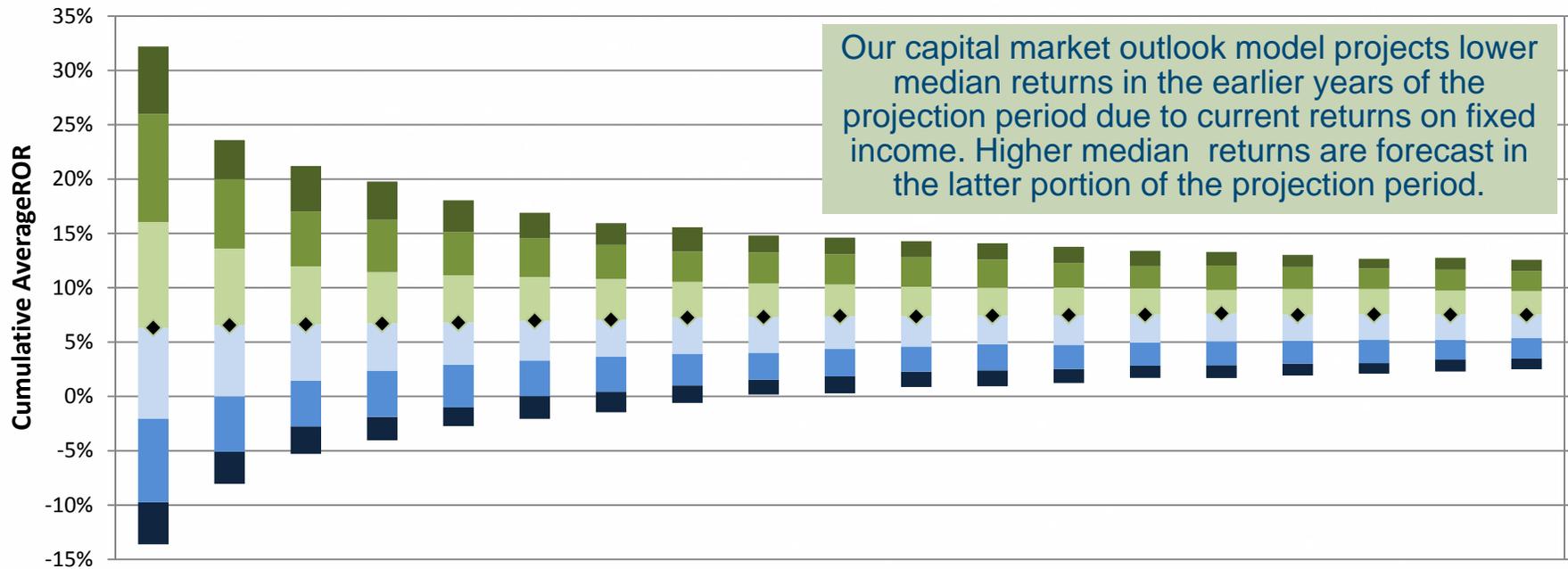
- Basis for modeling is most recent available year-end assets and liability information
  - 12/31/2011 liabilities and assumptions
    - Modeling assumes 8% annual investment return assumption remains in place for duration of modeling period
  - 12/31/2012 assets based on preliminary Board crediting decisions
    - Reflects 14.3% return during 2012
  - Current investment policy selected by the OIC
- We used a stochastic model to develop future results as a probability distribution, rather than a single amount
  - The distribution is based on a stochastic simulation using 1,000 trials
  - Economic scenarios were developed by our national team that specializes in capital market models, and uses the current OPERF asset allocation policy

# Interpreting Results

- In our distribution charts, the dots represent median outcomes
- We graphically display results from the 5<sup>th</sup> to 95<sup>th</sup> percentiles
  - Ten percent of model outcomes fall outside of the depicted range
- The chart format is demonstrated on the next slide for the actual investment return experienced by the fund

# PERS Fund Rate of Return

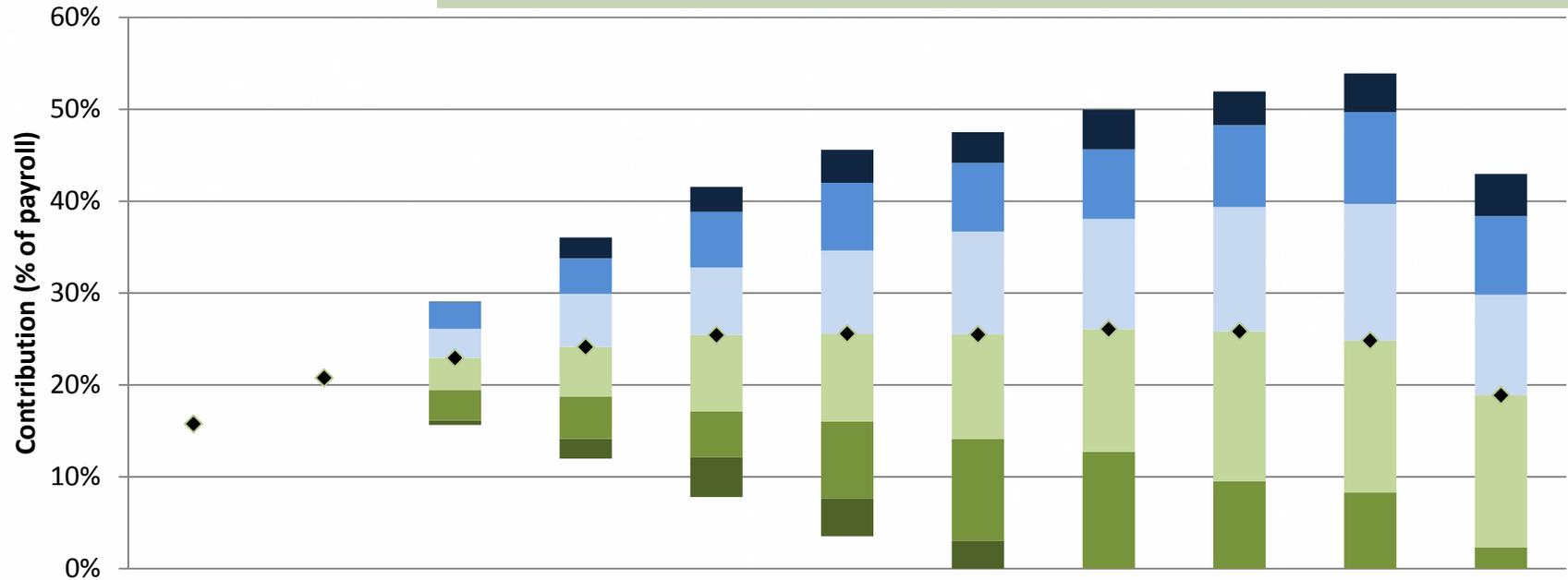
## Annualized Average Post-2012 Investment Return (Geometric Average)



PY Ending 12/31	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
95th	32.2%	23.6%	21.2%	19.8%	18.1%	16.9%	16.0%	15.6%	14.8%	14.6%	14.3%	14.1%	13.8%	13.4%	13.3%	13.0%	12.7%	12.8%	12.6%
90th	26.0%	20.0%	17.0%	16.2%	15.1%	14.6%	13.9%	13.3%	13.3%	13.1%	12.8%	12.6%	12.3%	12.0%	12.1%	11.9%	11.8%	11.7%	11.5%
75th	16.0%	13.6%	12.0%	11.4%	11.2%	11.0%	10.8%	10.5%	10.4%	10.3%	10.1%	10.0%	10.0%	9.9%	9.8%	9.9%	9.9%	9.7%	9.7%
50th	6.3%	6.6%	6.6%	6.7%	6.8%	7.0%	7.1%	7.3%	7.3%	7.4%	7.4%	7.4%	7.5%	7.5%	7.6%	7.5%	7.6%	7.5%	7.5%
25th	-2.0%	0.0%	1.5%	2.4%	2.9%	3.3%	3.7%	3.9%	4.0%	4.4%	4.6%	4.8%	4.8%	4.9%	5.1%	5.1%	5.2%	5.2%	5.4%
10th	-9.7%	-5.1%	-2.7%	-1.9%	-1.0%	0.0%	0.4%	1.0%	1.5%	1.8%	2.3%	2.4%	2.5%	2.8%	2.9%	3.0%	3.1%	3.4%	3.5%
5th	-13.6%	-8.1%	-5.3%	-4.0%	-2.7%	-2.1%	-1.5%	-0.6%	0.2%	0.3%	0.9%	0.9%	1.2%	1.7%	1.7%	1.9%	2.1%	2.3%	2.5%

# Base Contribution Rates

“Base” rates are system-wide average Tier 1/Tier 2/OPSRP contribution rates excluding IAP contributions, the effect of side accounts & pension bond debt service, and contributions to the retiree healthcare programs



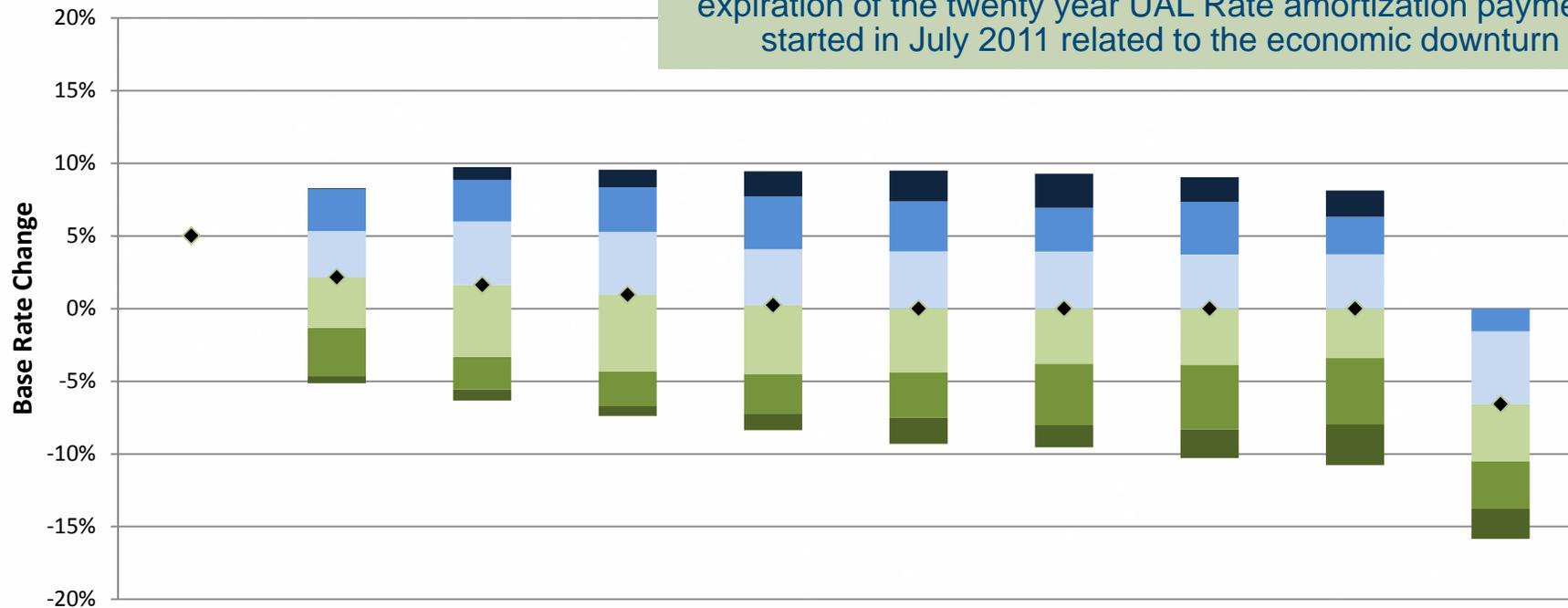
Biennium		2011-2013	2013-2015	2015-2017	2017-2019	2019-2021	2021-2023	2023-2025	2025-2027	2027-2029	2029-2031	2031-2033
5th		15.8%	20.8%	29.1%	36.1%	41.6%	45.6%	47.5%	50.0%	52.0%	53.9%	43.0%
10th		15.8%	20.8%	29.0%	33.8%	38.8%	42.0%	44.2%	45.7%	48.3%	49.7%	38.4%
25th		15.8%	20.8%	26.1%	29.9%	32.8%	34.6%	36.7%	38.1%	39.4%	39.7%	29.8%
50th		15.8%	20.8%	22.9%	24.1%	25.4%	25.6%	25.5%	26.1%	25.8%	24.8%	18.9%
75th		15.8%	20.8%	19.5%	18.8%	17.1%	16.0%	14.1%	12.7%	9.5%	8.3%	2.3%
90th		15.8%	20.8%	16.1%	14.1%	12.1%	7.6%	3.0%	0.0%	0.0%	0.0%	0.0%
95th		15.8%	20.8%	15.6%	12.0%	7.8%	3.5%	0.0%	0.0%	0.0%	0.0%	0.0%

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# Biennium to Biennium Change

## Base Contribution Rates

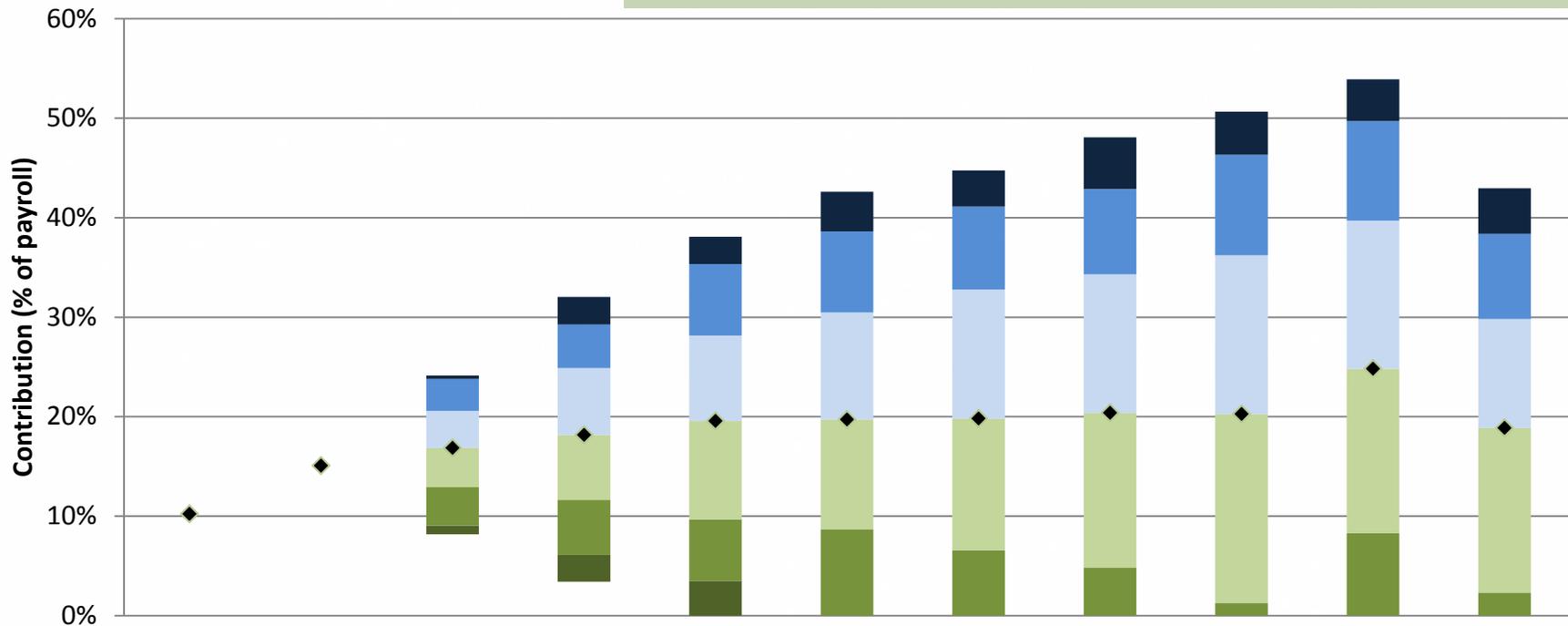
Rates are forecast to decrease at 2031-2033 due to the expiration of the twenty year UAL Rate amortization payments started in July 2011 related to the economic downturn



Change from:	2011-2013 to 2013-2015	2013-2015 to 2015-2017	2015-2017 to 2017-2019	2017-2019 to 2019-2021	2019-2021 to 2021-2023	2021-2023 to 2023-2025	2023-2025 to 2025-2027	2025-2027 to 2027-2029	2027-2029 to 2029-2031	2029-2031 to 2031-2033
5th	5.0%	8.3%	9.7%	9.6%	9.4%	9.5%	9.3%	9.0%	8.1%	0.0%
10th	5.0%	8.2%	8.9%	8.3%	7.7%	7.4%	6.9%	7.4%	6.3%	0.0%
25th	5.0%	5.3%	6.0%	5.3%	4.1%	3.9%	3.9%	3.7%	3.7%	-1.6%
50th	5.0%	2.2%	1.6%	1.0%	0.2%	0.0%	0.0%	0.0%	0.0%	-6.6%
75th	5.0%	-1.3%	-3.3%	-4.3%	-4.5%	-4.4%	-3.8%	-3.9%	-3.4%	-10.5%
90th	5.0%	-4.7%	-5.6%	-6.7%	-7.2%	-7.5%	-8.0%	-8.3%	-8.0%	-13.8%
95th	5.0%	-5.1%	-6.3%	-7.4%	-8.4%	-9.3%	-9.5%	-10.3%	-10.8%	-15.8%

# Net Contribution Rates

“Net” rates are base rates adjusted to reflect the projected effect of side account rate offsets and other pre-SLGRP rate offsets

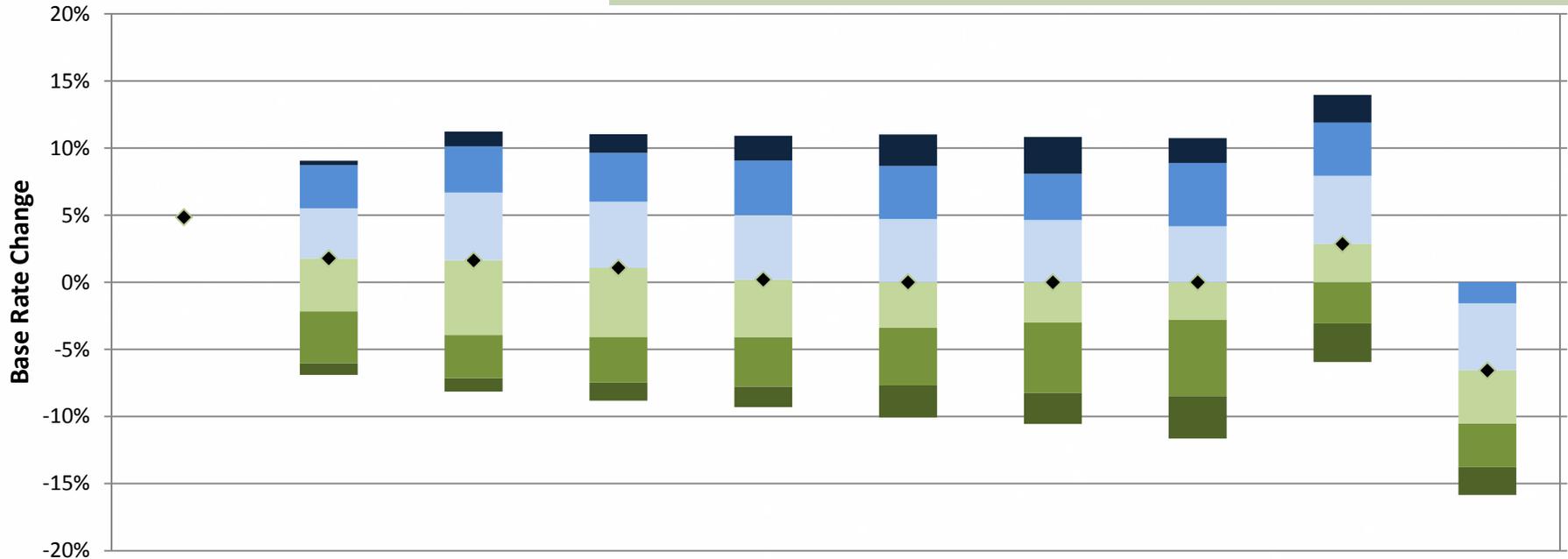


Biennium	2011-2013	2013-2015	2015-2017	2017-2019	2019-2021	2021-2023	2023-2025	2025-2027	2027-2029	2029-2031	2031-2033
5th	10.2%	15.1%	24.1%	32.0%	38.1%	42.6%	44.8%	48.1%	50.7%	53.9%	43.0%
10th	10.2%	15.1%	23.8%	29.3%	35.3%	38.6%	41.1%	42.9%	46.3%	49.7%	38.4%
25th	10.2%	15.1%	20.6%	24.9%	28.2%	30.5%	32.8%	34.3%	36.2%	39.7%	29.8%
50th	10.2%	15.1%	16.9%	18.2%	19.6%	19.7%	19.8%	20.4%	20.3%	24.8%	18.9%
75th	10.2%	15.1%	12.9%	11.6%	9.7%	8.7%	6.6%	4.8%	1.2%	8.3%	2.3%
90th	10.2%	15.1%	9.1%	6.1%	3.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
95th	10.2%	15.1%	8.2%	3.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

# Biennium to Biennium Change

## Net Contribution Rates

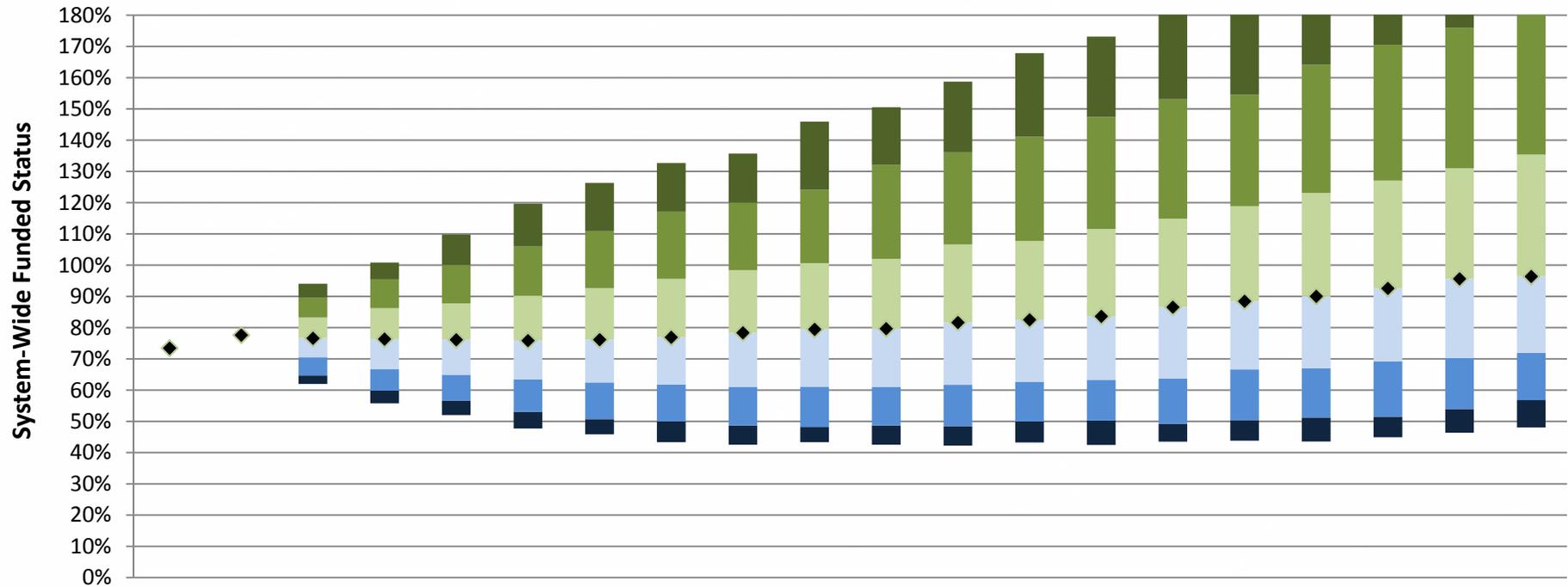
The increase at 2029-2031 is related to the expiration of most side account and pre-SLGRP rate offsets prior to the expiration of the 20 year shortfall amortization charge started in 2011-2013



Change from:	2011-2013 to 2013-2015	2013-2015 to 2015-2017	2015-2017 to 2017-2019	2017-2019 to 2019-2021	2019-2021 to 2021-2023	2021-2023 to 2023-2025	2023-2025 to 2025-2027	2025-2027 to 2027-2029	2027-2029 to 2029-2031	2029-2031 to 2031-2033
5th	4.8%	9.1%	11.2%	11.0%	10.9%	11.0%	10.8%	10.7%	14.0%	0.0%
10th	4.8%	8.7%	10.1%	9.6%	9.1%	8.7%	8.1%	8.9%	11.9%	0.0%
25th	4.8%	5.5%	6.7%	6.0%	5.0%	4.7%	4.6%	4.2%	7.9%	-1.6%
50th	4.8%	1.8%	1.6%	1.1%	0.2%	0.0%	0.0%	0.0%	2.9%	-6.6%
75th	4.8%	-2.2%	-3.9%	-4.1%	-4.1%	-3.4%	-3.0%	-2.8%	0.0%	-10.5%
90th	4.8%	-6.0%	-7.1%	-7.5%	-7.8%	-7.7%	-8.2%	-8.5%	-3.1%	-13.8%
95th	4.8%	-6.9%	-8.1%	-8.8%	-9.3%	-10.1%	-10.6%	-11.6%	-5.9%	-15.8%

# Funded Status (without side accounts)

At the 50<sup>th</sup> percentile, funded status progresses toward 100% over the modeled period



PY Ending 12/31	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
95th	73.4%	77.6%	94.0%	100.8%	109.8%	119.7%	126.3%	132.7%	135.7%	145.9%	150.5%	158.7%	167.9%	173.2%	180.7%	185.2%	198.0%	203.2%	210.4%	220.2%
90th	73.4%	77.6%	89.5%	95.5%	100.1%	106.0%	110.9%	117.2%	120.0%	124.1%	132.2%	136.1%	141.1%	147.4%	153.1%	154.5%	164.1%	170.6%	176.0%	183.7%
75th	73.4%	77.6%	83.3%	86.2%	87.8%	90.2%	92.6%	95.6%	98.4%	100.6%	102.0%	106.6%	107.7%	111.6%	114.9%	118.9%	123.1%	127.1%	131.0%	135.4%
50th	73.4%	77.6%	76.6%	76.3%	76.1%	75.8%	76.2%	76.9%	78.3%	79.5%	79.6%	81.6%	82.5%	83.6%	86.6%	88.4%	90.0%	92.5%	95.6%	96.4%
25th	73.4%	77.6%	70.5%	66.7%	64.9%	63.5%	62.5%	61.8%	61.0%	61.1%	61.0%	61.7%	62.7%	63.3%	63.7%	66.6%	67.0%	69.2%	70.3%	71.9%
10th	73.4%	77.6%	64.7%	59.8%	56.6%	53.0%	50.7%	50.0%	48.7%	48.3%	48.7%	48.5%	49.9%	50.3%	49.2%	50.4%	51.2%	51.5%	54.0%	56.8%
5th	73.4%	77.6%	61.9%	55.8%	52.0%	47.7%	45.9%	43.3%	42.5%	43.3%	42.5%	42.2%	43.2%	42.5%	43.5%	43.8%	43.5%	44.9%	46.4%	48.0%

## Wrap Up / What's Next?

- If actual 2013 investment returns are near assumption and valuation assumptions (e.g., 8% investment return) are held constant, contribution rates will increase again in 2015-2017
- Base rates in projected median scenarios are in the 24% to 26% range for an extended period of time
- The currently scheduled 2013 rate increase positions PERS to return to 100% funded status if investments earn 8% per year
- OPERS contribution rates are more sensitive to investment returns (either good or bad) than peer US state systems
- We will have additional discussion of methods and economic assumptions at the May meeting

# Certification

This presentation summarizes deterministic and stochastic modeling of the Oregon Public Employees Retirement System (“PERS” or “the System”) over a 20-year period beginning December 31, 2011. For complete actuarial valuation results, including cautions regarding the limitations of use of valuation calculations, please refer to our formal Actuarial Valuation Report as of December 31, 2011 (“the Valuation Report”) published on October 26, 2012. The Valuation Report, including all supporting information regarding data, assumptions, methods, and provisions, is incorporated by reference into this presentation.

In preparing this presentation, we relied, without audit, on information (some oral and some in writing) supplied by the System’s staff. This information includes, but is not limited to, statutory provisions, employee data, and financial information. We found this information to be reasonably consistent and comparable with information used for other purposes. The results depend on the integrity of this information. If any of this information is inaccurate or incomplete our results may be different and our calculations may need to be revised.

All costs, liabilities, rates of interest, and other factors for the System have been determined on the basis of actuarial assumptions and methods which are individually reasonable (taking into account the experience of the System and reasonable expectations); and which, in combination, offer our best estimate of anticipated experience affecting the System.

A valuation report is only an estimate of the Fund’s financial condition as of a single date. It can neither predict the Fund’s future condition nor guarantee future financial soundness. Actuarial valuations do not affect the ultimate cost of Fund benefits, only the timing of Fund contributions or cost recognition. While the valuation is based on an array of individually reasonable assumptions, other assumption sets may also be reasonable and valuation results based on those assumptions would be different. No one set of assumptions is uniquely correct.

Future actuarial measurements may differ significantly from the current measurements summarized in this presentation due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan’s funded status); and changes in plan provisions or applicable law. The PERS Board has the final decision regarding the appropriateness of the assumptions and adopted them as indicated in July 2011. This presentation contains only a limited analysis of the range of potential future measurements due to variation in investment returns.

# Certification

Actuarial computations presented in this report are for based on the current methodology adopted by the PERS Board for determining the recommended funding amounts for the System. The calculations in the enclosed report have been made on a basis consistent with our understanding of the System's funding requirements and goals. The calculations in this report have been made on a basis consistent with our understanding of the plan provisions described in the appendix of this report. Determinations for other purposes may be significantly different from the results contained in this report. Accordingly, additional determinations may be needed for other purposes.

Milliman's work is prepared solely for the internal business use of the Oregon Public Employees Retirement System. To the extent that Milliman's work is not subject to disclosure under applicable public records laws, Milliman's work may not be provided to third parties without Milliman's prior written consent. Milliman does not intend to benefit or create a legal duty to any third party recipient of its work product. Milliman's consent to release its work product to any third party may be conditioned on the third party signing a Release, subject to the following exception(s):

- (a) The System may provide a copy of Milliman's work, in its entirety, to the System's professional service advisors who are subject to a duty of confidentiality and who agree to not use Milliman's work for any purpose other than to benefit the System.
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The consultants who worked on this assignment are pension actuaries. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel.

On the basis of the foregoing, we hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices. We are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein.

# Circular 230 Notice

The following disclosure is provided in accordance with the Internal Revenue Service's Circular 230 (21 CFR Part 10). This communication is not intended to constitute tax advice to any specific taxpayer or for any specific situation. Any tax advice contained in this communication is intended to be preliminary, for discussion purposes only, and not final. Any such advice is not intended to be used for marketing, promoting or recommending any transaction or for the use of any person in connection with the preparation of any tax return. Accordingly, this advice is not intended or written to be used, and it cannot be used, by any person for the purpose of avoiding tax penalties that may be imposed on such person.

# Appendix

## Actuarial Basis

### Data

We have based our projection of system liabilities on the data supplied by the Oregon Public Employees Retirement System (PERS) and summarized in the December 31, 2011 Actuarial Valuation (“2011 Valuation Report”) for Oregon PERS.

Assets as of December 31, 2011, were based on values provided by Oregon PERS as shown in the 2011 Valuation Report. Calendar year 2012 asset returns were assumed to be equal to the one-year returns published by the Oregon Investment Council as of December 31, 2012. For regular accounts, this was equal to a 14.29% return; for variable accounts, it is equal to a 16.98% return.

We have assumed that the active participant data reflected in the valuation of the Plan remains stable over the projection period (i.e. participants leaving employment are replaced by new hires in such a way that the total counts remain stable from year to year). No new members are assumed to be eligible for Tier 1 and Tier 2 benefits; all new entrants are assumed to become members under the OPSRP benefit formula.

### Methods / Policies

*Actuarial Cost Method:* Projected Unit Credit, as described in the 2011 Valuation Report.

*Normal cost:* Normal cost increases with assumed wage growth adjusted for wage, demographic, and asset return experience (if applicable). Demographic experience follow assumptions described in the 2011 Valuation Report.

*Accrued liability:* Liabilities increase with normal cost and decrease with benefit payments. Results are adjusted for wage, demographic, and asset return experience (if applicable). Demographic experience follow assumptions described in the 2011 Valuation Report.

*Contribution Rates:* The projected contribution rates are calculated on each odd year valuation date in accordance with methodologies described in the 2011 Valuation Report. Rates are applied 18 months after the valuation date.

# Appendix

## Actuarial Basis

### Methods / Policies (cont'd)

*UAL Amortization:* The UAL for Tier 1/Tier 2, OPSRP, and Retiree Health Care as of December 31, 2007 are amortized as a level percentage of combined valuation payroll over a closed period. For the Tier 1/Tier 2 UAL, this period is 20 years; for OPSRP, it is 16 years; for Retiree Health Care, it is 10 years. Gains and losses between subsequent odd-year valuations are amortized as a level percentage of combined valuation payroll over the amortization period (20 years for Tier/Tier 1, 16 years for OPSRP, 10 years for Retiree Health Care) from the odd-year valuation in which they are first recognized.

*Contribution rate stabilization method:* For valuation purposes, contribution rates for a rate pool (e.g. Tier 1/Tier 2 SLGRP, Tier 1/Tier 2 School Districts, OPSRP) are confined to a collar based on the prior contribution rate (prior to application of side accounts, pre-SLGRP liabilities, and 6 percent Independent Employer minimum). The new contribution rate will generally not increase or decrease from the prior contribution rate by more than the greater of 3 percentage points or 20 percent of the prior contribution rate. If the funded percentage excluding side accounts drops below 70% or increases above 130%, the size of the collar doubles. If the funded percentage excluding side accounts is between 70% and 80% or between 120% and 130%, the size of the rate collar is increased on a graded scale.

For system-wide contribution rate projections, the entire Tier 1/Tier 2 program was treated as a single rate pool.

*Expenses:* OPSRP administration expenses are assumed to be equal to \$6.6M and are added to the OPSRP normal cost.

*Actuarial Value of Assets:* Equal to Market Value of Assets excluding Contingency and Tier 1 Rate Guarantee Reserves. The Tier 1 Rate Guarantee Reserve is not excluded from assets if it is negative (i.e. in deficit status).

# Appendix

## Actuarial Basis

### Assumptions

In general, all assumptions are as described in the 2011 Valuation Report.

The major assumptions used in our projections are shown below. They are aggregate average assumptions that apply to the whole population and were held constant throughout the projection period. The economic experience adjustments were allowed to vary in future years given the conditions defined in each economic scenario.

- Valuation interest rate – 8.00%
- Tier 1 Regular account growth – 8.00%
- Actual fund investment return– Varies by scenario according to capital market assumptions
- Variable account growth – 0.25% greater than fund investment return
- Inflation assumption – 2.75%
- Inflation experience – Varies by scenario according to capital market assumptions
- Wage growth assumption – 3.75%
- Wage growth experience– 1.00% greater than inflation experience
- Demographic experience – as described in 2011 Valuation report

# Appendix

## Actuarial Basis

### Reserve Projection

Contingency Reserve as of 12/31/2012 was assumed to be \$603.7M, based on the PERS Board's preliminary 2012 crediting decisions. No future increases or decreases to this reserve were assumed.

The Tier 1 Rate Guarantee Reserve ("RGR") was assumed to be -\$19.8M (i.e., in deficit status) as of 12/31/2012, based on the PERS Board's preliminary 2012 crediting decisions. The reserve was assumed to grow with returns in excess of 8% on Tier 1 Member Accounts. When aggregate returns were below 8%, applicable amounts from the RGR were transferred to Tier 1 Member Accounts to maintain the 8% target growth on the member accounts. The RGR reserve is allowed to be negative, but the reserve is not excluded from valuation assets when it is negative. We did not include in rates any potential additional employer levy that could be required to eliminate a persistent negative RGR.

### Provisions

Provisions valued are as described in the 2011 Valuation Report.

# Appendix

## Actuarial Basis

### Capital Market Model

For each 20-year projection, we ran 1,000 stochastic scenarios for inflation and asset class rates of return. The scenarios were calibrated to represent Milliman's capital market assumptions in terms of expected average returns, the expected year-to-year volatility of the returns, and the expected correlation between the returns of different asset classes. Annual rates of return for each of the asset classes and inflation are generated from a multivariate lognormal probability distribution. Rates of return are independent from year to year.

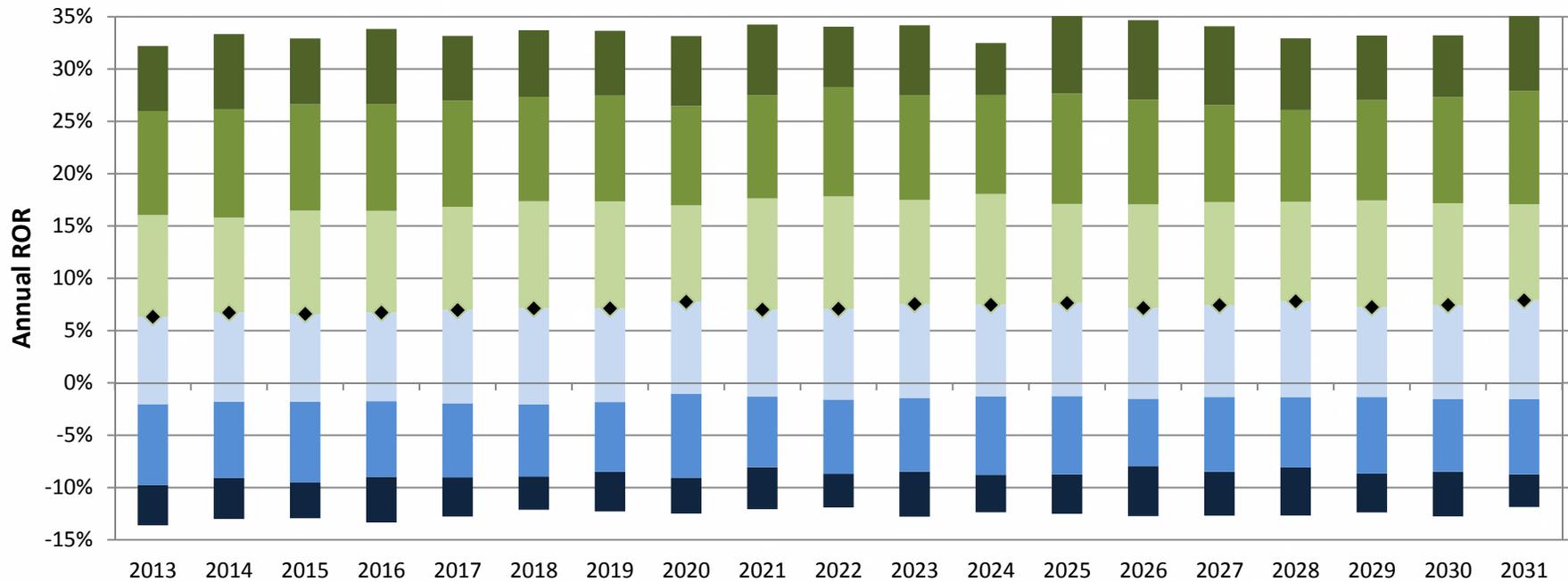
For this purpose, we considered the Oregon PERS Fund to be allocated among the model's asset classes as shown below. This allocation is based on the Oregon Investment Council's Statement of Investment Objectives and Policy Framework for the Oregon PERS Fund, as revised December 18, 2012.

	Annual Arithmetic Mean	30-Year Annualized Geometric Mean	Annual Standard Deviation	Policy Allocation
US Large/Mid-Cap Equity	8.75%	7.25%	18.45%	17.81%
US Small-Cap Equity	9.70%	7.35%	23.45%	2.61%
Non-US Developed Large/Mid-Cap Equity	9.00%	7.10%	21.30%	15.20%
Non-US Developed Small-Cap Equity	9.80%	7.70%	22.15%	2.17%
Emerging Markets Equity	11.25%	7.50%	30.10%	5.21%
Private Equity	11.70%	8.00%	30.00%	16.00%
US Universal Fixed Income	5.00%	4.90%	4.10%	15.25%
Emerging Market Bonds	7.30%	6.25%	15.25%	2.50%
Leveraged Loans	6.90%	6.40%	10.20%	5.00%
High Yield	7.80%	7.25%	11.05%	2.50%
Real Estate	7.10%	6.50%	12.00%	10.30%
Global REITs	8.90%	6.60%	23.15%	2.20%
Natural Resources	6.55%	6.25%	8.30%	2.25%
Hedge Funds	6.50%	6.25%	7.35%	1.00%
US Inflation (CPI-U)	2.75%	2.75%	1.70%	N/A
<b>Fund Total (reflecting asset class correlations)</b>	<b>8.45%</b>	<b>7.60%</b>	<b>14.25%</b>	<b>100.00%</b>

This work product was prepared for discussion purposes only and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Any recipient of this work product who desires professional guidance should engage qualified professionals for advice appropriate to its own specific needs.

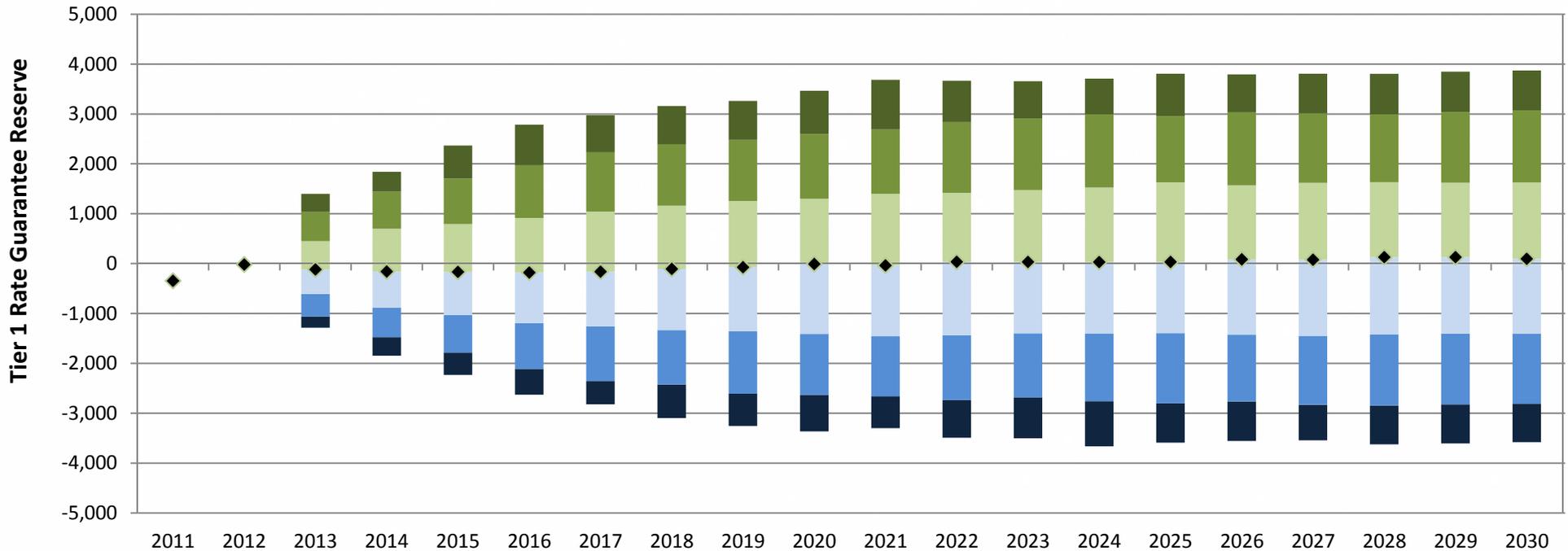
# PERS Fund Rate of Return

## Annual Investment Return



PY Ending 12/31	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
95th	32.2%	33.3%	32.9%	33.8%	33.2%	33.7%	33.7%	33.2%	34.2%	34.0%	34.2%	32.5%	35.2%	34.7%	34.1%	32.9%	33.2%	33.2%	36.1%
90th	26.0%	26.2%	26.6%	26.7%	27.0%	27.4%	27.5%	26.5%	27.5%	28.3%	27.5%	27.5%	27.7%	27.1%	26.5%	26.1%	27.0%	27.3%	27.9%
75th	16.0%	15.8%	16.5%	16.4%	16.8%	17.4%	17.3%	17.0%	17.6%	17.8%	17.5%	18.1%	17.1%	17.1%	17.3%	17.3%	17.4%	17.2%	17.1%
50th	6.3%	6.7%	6.6%	6.7%	7.0%	7.1%	7.1%	7.8%	7.0%	7.1%	7.5%	7.5%	7.6%	7.2%	7.4%	7.8%	7.2%	7.4%	7.9%
25th	-2.0%	-1.8%	-1.8%	-1.7%	-1.9%	-2.0%	-1.8%	-1.1%	-1.3%	-1.6%	-1.4%	-1.3%	-1.3%	-1.5%	-1.3%	-1.4%	-1.3%	-1.6%	-1.5%
10th	-9.7%	-9.1%	-9.5%	-9.0%	-9.0%	-8.9%	-8.5%	-9.0%	-8.1%	-8.7%	-8.5%	-8.8%	-8.7%	-7.9%	-8.5%	-8.1%	-8.7%	-8.5%	-8.7%
5th	-13.6%	-13.0%	-12.9%	-13.3%	-12.8%	-12.1%	-12.3%	-12.5%	-12.1%	-11.9%	-12.8%	-12.4%	-12.5%	-12.7%	-12.7%	-12.7%	-12.4%	-12.8%	-11.9%

# Tier 1 Rate Guarantee Reserve



PY Ending 12/31	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
95th	(345.3)	(19.8)	1,397.7	1,841.1	2,366.8	2,787.0	2,976.3	3,159.6	3,261.3	3,463.7	3,684.8	3,666.6	3,656.0	3,706.8	3,807.9	3,793.9	3,806.2	3,805.2	3,849.5	3,870.5
90th	(345.3)	(19.8)	1,033.5	1,443.6	1,705.2	1,973.7	2,232.0	2,394.6	2,480.3	2,601.2	2,689.8	2,836.3	2,909.6	2,993.4	2,960.9	3,030.7	3,012.8	2,993.5	3,039.2	3,074.2
75th	(345.3)	(19.8)	451.4	698.6	792.3	915.1	1,042.5	1,161.5	1,255.9	1,299.2	1,398.4	1,420.4	1,474.2	1,526.7	1,630.5	1,569.4	1,620.5	1,632.9	1,622.2	1,626.7
50th	(345.3)	(19.8)	(118.0)	(159.6)	(167.8)	(179.0)	(162.2)	(107.8)	(72.9)	(7.4)	(36.4)	36.8	34.2	29.6	33.6	84.7	77.8	129.1	128.4	96.5
25th	(345.3)	(19.8)	(607.1)	(881.2)	(1,034.3)	(1,194.2)	(1,259.5)	(1,332.1)	(1,357.3)	(1,409.6)	(1,455.9)	(1,435.4)	(1,395.8)	(1,399.0)	(1,395.4)	(1,424.8)	(1,449.2)	(1,418.2)	(1,402.5)	(1,406.4)
10th	(345.3)	(19.8)	(1,059.3)	(1,474.2)	(1,784.7)	(2,110.6)	(2,353.5)	(2,424.9)	(2,608.7)	(2,630.2)	(2,660.4)	(2,734.8)	(2,679.6)	(2,758.8)	(2,799.1)	(2,762.3)	(2,831.8)	(2,844.2)	(2,824.0)	(2,807.1)
5th	(345.3)	(19.8)	(1,285.3)	(1,845.2)	(2,230.5)	(2,627.2)	(2,820.3)	(3,096.9)	(3,254.0)	(3,362.9)	(3,299.6)	(3,491.9)	(3,500.3)	(3,663.4)	(3,589.2)	(3,555.0)	(3,544.0)	(3,624.5)	(3,605.5)	(3,578.7)

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