Summary of Energy Efficiency Quantification Analysis and Recommendations for the 2009 CEC Electricity Forecast

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Michael Messenger
Senior Principal Energy Consultant
Itron

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Outline of Presentation

- Overview of Itron Work to Date
- Summary of Analysis and Model Comparisons
- Utility Program Savings Estimates
- Recommendations on Means to Reduce Potential Overlap Between Utility Program and Embedded Savings in Forecast
- Methodology and Assumptions for EE Quantification in Committed Forecast
- Next Steps for EE Quantification in Uncommitted Forecast

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Objectives of analysis

- Better understand the level of energy savings (changes in energy intensity) “embedded” in the current CEC model for key sectors and end uses.
- Provide documentation of level of utility program savings in CPUC goals forecasts and the ASSET model used to assess future potential.
- Compare trends in UEC and saturations in CEC and ASSET models for key end uses.
- Shed light on the question of the level of overlap in forecasts of utility program savings compared to forecasts of savings from standards and price elasticity effects in the CEC forecast.

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Summary of Work Completed

- Compared Baseline 2004 EUI and UEC in CEC and ASSET models for key end uses (res lighting, commercial lighting and HVAC) in SDG&E and PG&E.
- Compared methods of estimating energy savings from program induced and naturally occurring efficiency investment in CEC and ASSET models.
- Performed comparisons of trends in Structural Electricity Usage (square footage by building type & equipment saturations), and Energy Intensity Changes from 1990-2004 in CEC and Asset model for 1990 to 2004.

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Summary of Work Completed (2)

- Developed estimates of residential lighting parameters (bulbs per household, daily hours of use, & average watts per bulb) from 1980 to 2000 for CEC use in developing a residential lighting usage forecast.
- Developed revised estimates of changes in structural growth and energy intensity for the refrigerator-freezers end use in the residential sector using latest RASS data.

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Recommendations

- CEC staff should explicitly document forecasted changes in Energy Intensity and Structural growth due to findings from comparison analysis. CEC contemplating resource requirements and feasibility to implement.
- CEC should explicitly incorporate load impacts of utility lighting EE programs from 1992-2003 due to significant differences found in 2004 baseline for commercial lighting EUI in current model. Existing EUI's in CEC model have not been revised to incorporate results of recent 2004 Commercial End Use Survey (CEUS). Significant differences in baseline EUI's found for All Nonresidential building types.

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Utility Program Savings Estimates

- Prepared time series of utility reported program savings by sector for period 1992-2008 for three IOUs for CEC use. Prepared Savings by End Use for 2003-2007 period.
- Recommended reductions in reported program saving estimates to account for verification efforts and evaluations that showed verified savings ranged from 60% to 70% of reported savings from 2004-2007.
- Most recent trends in utility reported and verified program savings in following slides.

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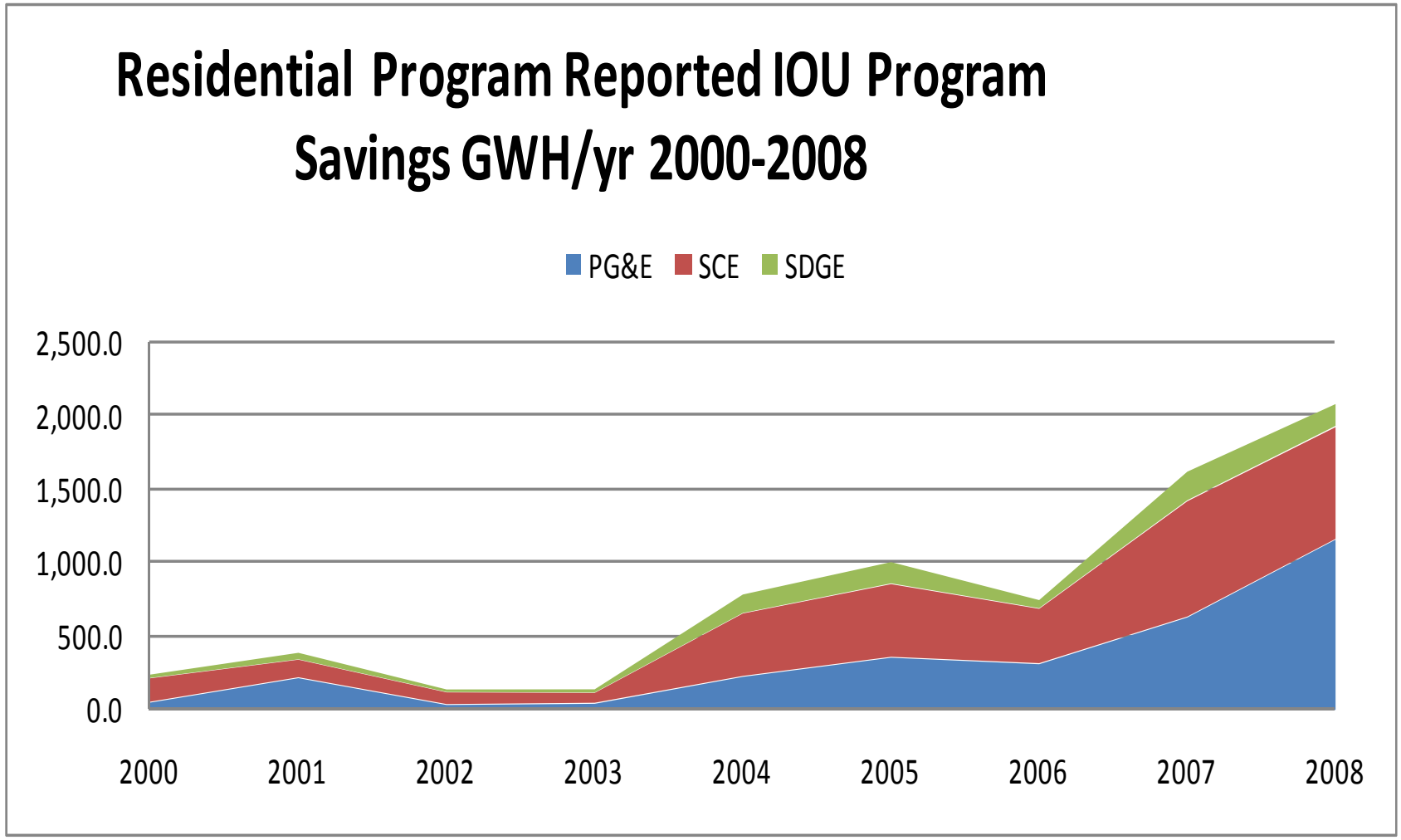

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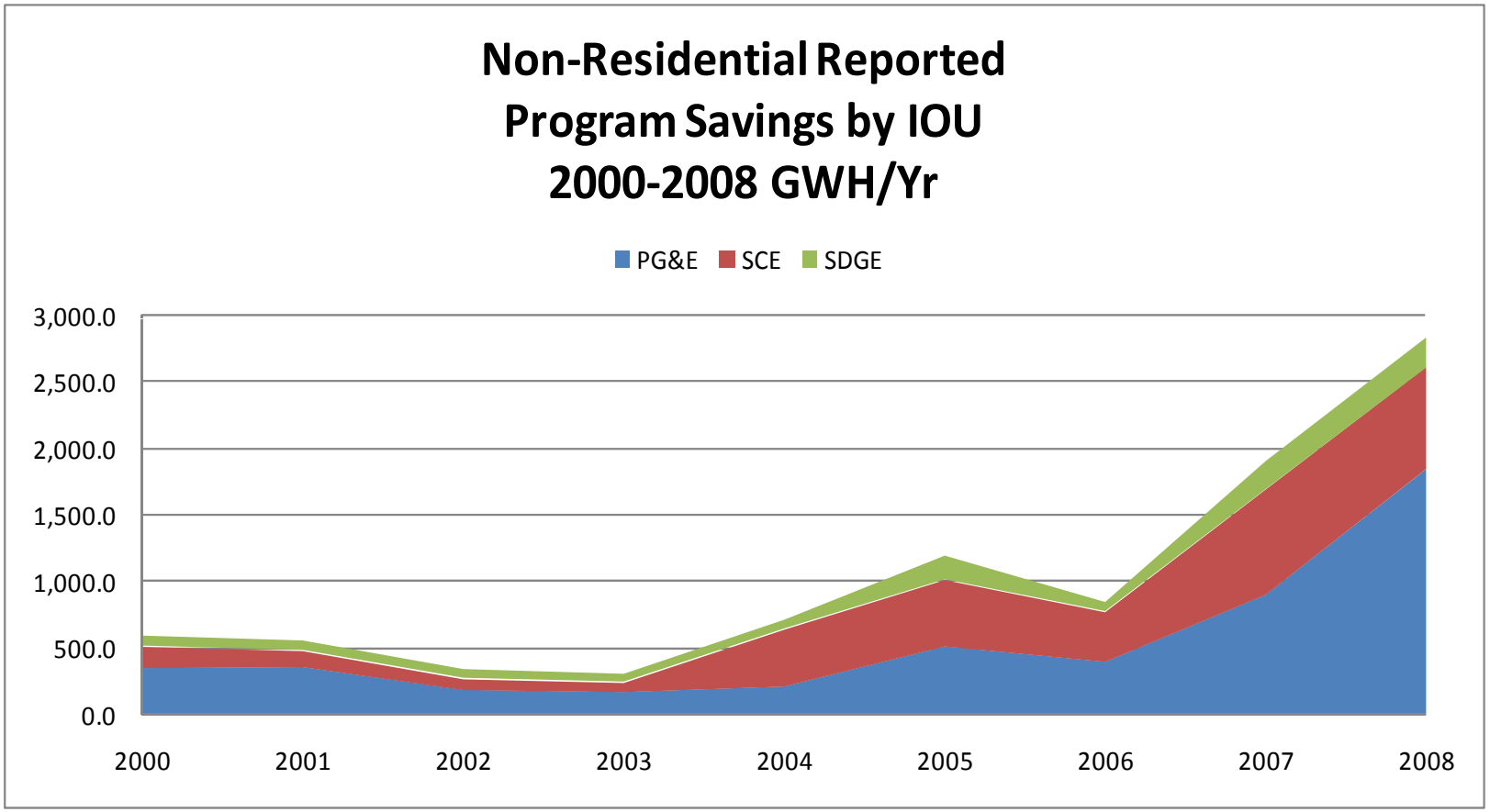

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Recommended Adjustments to Convert Reported to Verified Utility Program Savings

Program years	Utility	PG&E	SCE	SDG&E
2004-2005		**Adjustment Factors**		
	Energy savings	61%	65%	68%
	Peak Savings	60%	61%	64%
2006-2007				
	Energy savings	58%	65%	61%
	Peak Savings	57%	67%	72%

Reported Net Savings * Adjust. factor= Ex Post net savings

Source: Energy Division (CPUC) , Energy Efficiency 2006-2007 Program Verification Report :Published November 18, 2008

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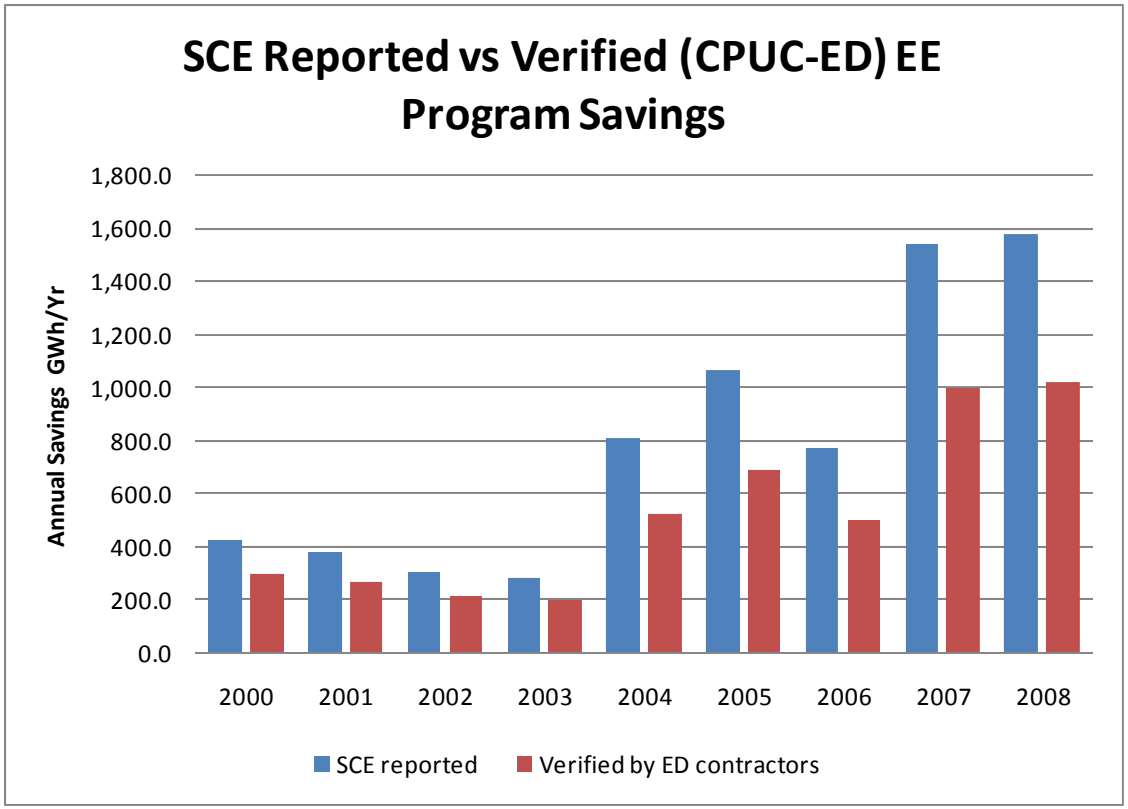

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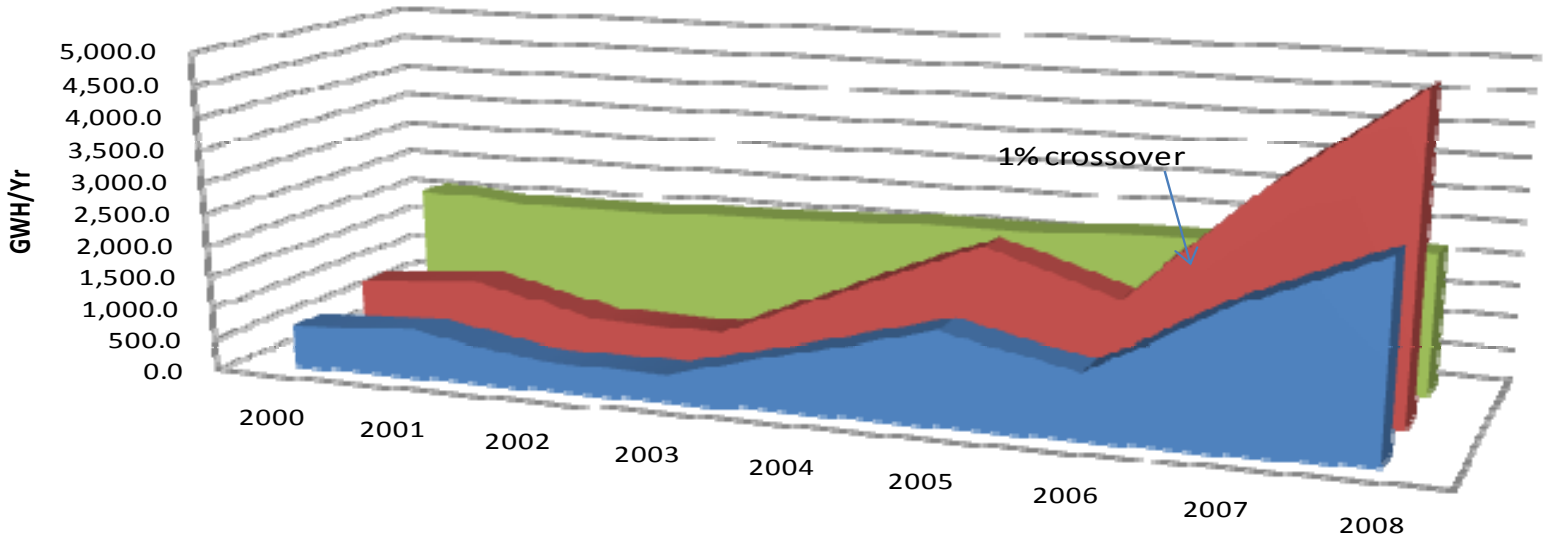
Trend in Energy Efficiency Program Savings from PG&E, SCE, and SDG&E Programs compared to 1% of their Combined Electricity Sales



	2000	2001	2002	2003	2004	2005	2006	2007	2008
Verified	653.5	755.6	429.3	408.8	924.2	1,444.1	992.1	2,134.0	2,993.7
Reported	933.6	1,079.4	613.3	584.0	1,440.3	2,260.6	1,610.8	3,473.3	4,952.3
1 % sales	2,102.1	1,962.9	1,986.1	2,024.7	2,095.4	2,109.6	2,178.1	2,198.1	2,168.6

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Summary of Work Completed – (3)

- Itron also prepared estimates of energy and peak savings by end use and market sector for all three investor owned utilities in CA.
- Example of recent trends in end use savings is shown on the next slide. Note growth in reported and verified savings for CFLs.

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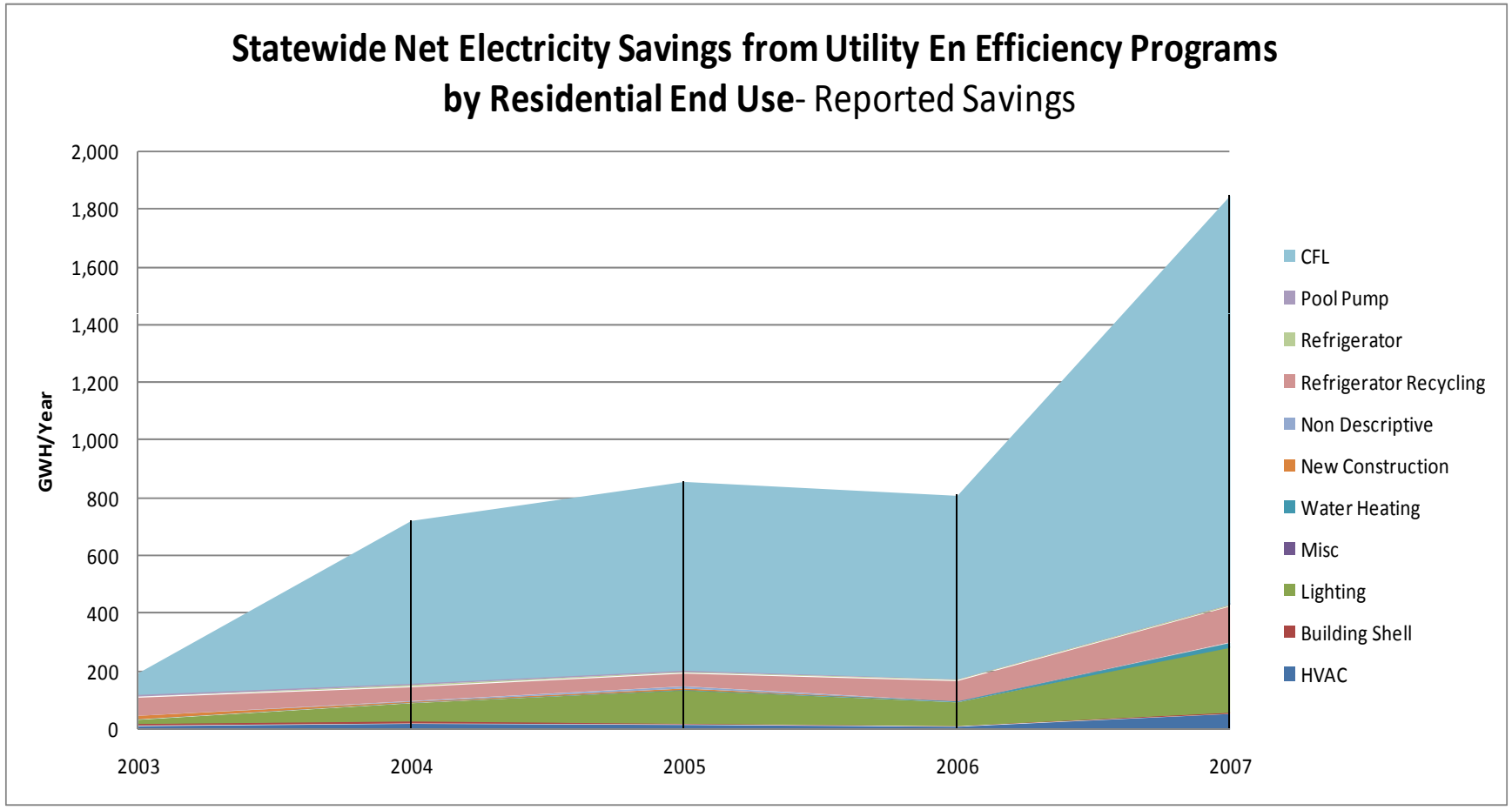

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Key Trends In Utility Program Savings from 2000-2008

- Dramatic increase in reported savings from Residential Sector and CF Lamps in particular.
- Dramatic increase in Proportion of Residential Savings as a fraction of total portfolio savings - Res share went from 28% in 2000 to 52% in 2005 to 42% in 2008.
- Dramatic increase in annual energy savings from utility programs in the last 10 years - 597% (6x) increase in annual savings from 2000 to 2008.
- Verified program savings exceed 1% of sales in 2007 for the first time in CA history.

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Degree of Overlap - Utility Program Savings Compared to Embedded Savings in Forecast

- Two methods for determining potential “overlap”
  - 1. Quantify level of “total” savings embedded in forecast by decomposing total sales growth into service growth and energy intensity changes - compare program savings vs total savings for validity/context
  - 2. Look at details of savings impact calculations for standards, price impacts, and utility programs for key end uses in both models, Compare baseline EUI’s with and without programs to RASS/CEUS results.
  - CEC did not have resources to use either method in short term. They may present some results consistent with method 1 in the June 26 forecast and in the revised forecast."

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Method 1- Provide Time Series of Structural Growth and Energy Intensity Indices for each End Use

- What to provide - Structural Growth and Energy Intensity changes per common forecasting unit.
- Why is providing this information critical?
  - > Provides a better perspective on forecast growth drivers and impact of efficiency trends and programs on forecast and relation ship to past trends.
  - > Identifies which end uses have most savings impact on overall forecast and where quantification work needs improvement
  - > Example on Next page

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Recommended Format to Display Growth in Electricity Growth by End Use Over Time

End Use= Residential Refrigerator Freezers				
Year	Structural Services Change	Stock Energy Intensity Change	Marginal Intensity Change	Overall Energy Use
1990	1	1	1	1.00
2000	1.42	0.95	0.65	1.12
2005	1.54	0.88	0.38	1.15
2013	1.66	0.75	0.30	1.25
2018	1.76	0.62	0.27	1.09

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Structural Service Demand Increases Leads to Overall Increase in Electricity Usage- 1990-2005

- Overall Service demand increase of 145% in refrigerators include: Increases in HH, saturation per HH, average capacity, and amenities (fractions of HH with thru the door ice) outweighs 50% decrease in marginal energy intensity from 1990-2005. Leads to 14% overall increase in energy use from refrigerator-freezers in CA for same period.
- Provides important perspective for policy makers and integration with GHG policy seeking energy use reductions not just efficiency improvements.

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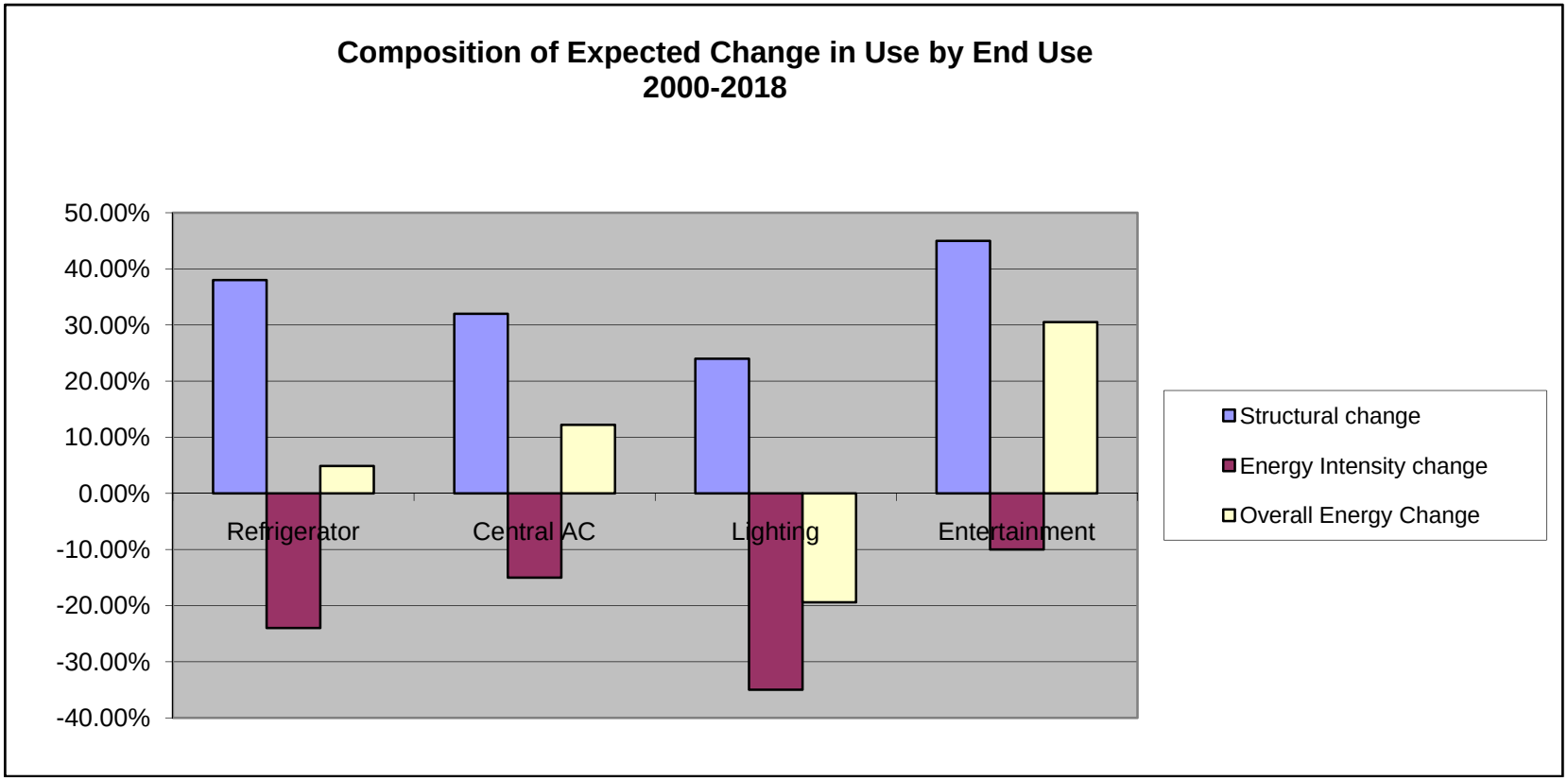
Visual Display of Structural and Energy Intensity Changes in forecast



Source: Itron Terms Paper, Deliverable 1

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Method 2- Compare Baseline EUI and Total Savings by End Use in CEC and ASSET Models

- Compare total savings by end use over time, and then analyze savings attributed to standards, state and utility programs, and Price elasticity impacts by end use.
- Exact savings overlap by end use still unresolved because of difficulties in separating price elasticity impacts from natural trends, & from program impacts. Purpose of EE programs is to increase long run price elasticity (Pe) but Pe has not been re-estimated for 20 years. Separation of price impacts from Programs Possible now?

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Methods to Resolve Savings Overlap (continued)

- Recommended changes in CEC model to account for utility program savings estimates in key end uses is shown in next slide.
- Long term solution is to move towards alternative model specifications that focus on forecasting total energy savings and usage by end use. Need to separate the forecasts of service demand growth and energy intensity changes over time. May require reduced focus on program and standards attribution and more emphasis market data collection and ensuring that data collected gets into the forecast.

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Recommended Adjustments to CEC Forecast Model to Incorporate Savings from Utility Programs and Other Market Changes

- Examined cooling, lighting, & refrigerator end uses for residential sector and interior lighting, refrigeration and HVAC end uses for nonresidential sector.
- Recommended decrementing 100% of verified savings from utility programs in residential lighting and nonresidential lighting end uses for period 1992 to present.
- Recommended not adjusting current model to include utility program savings in refrigeration and cooling end uses (Res sector) and refrigeration and HVAC (Non res) because of low significance and baseline comparisons incomplete or very close.
- Recommend change in expected useful life of refrigerators given findings from most recent RASS study and utility recycling programs.

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Next Steps – Develop Uncommitted Forecast

- CEC/Itron will develop uncommitted (managed) forecast using energy savings estimates for future utility programs and standards from the SESAT model used to estimate CPUC goals.
- CEC and Itron will collaborate on input assumptions to be used in uncommitted forecast for building and appliance standards and utility programs. Main reference case will use baseline assumptions from CPUC medium goals work integrated into CEC model structure.

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Back up Slides if Details Are Needed

- Slides that follow will not be shown in regular workshop presentation

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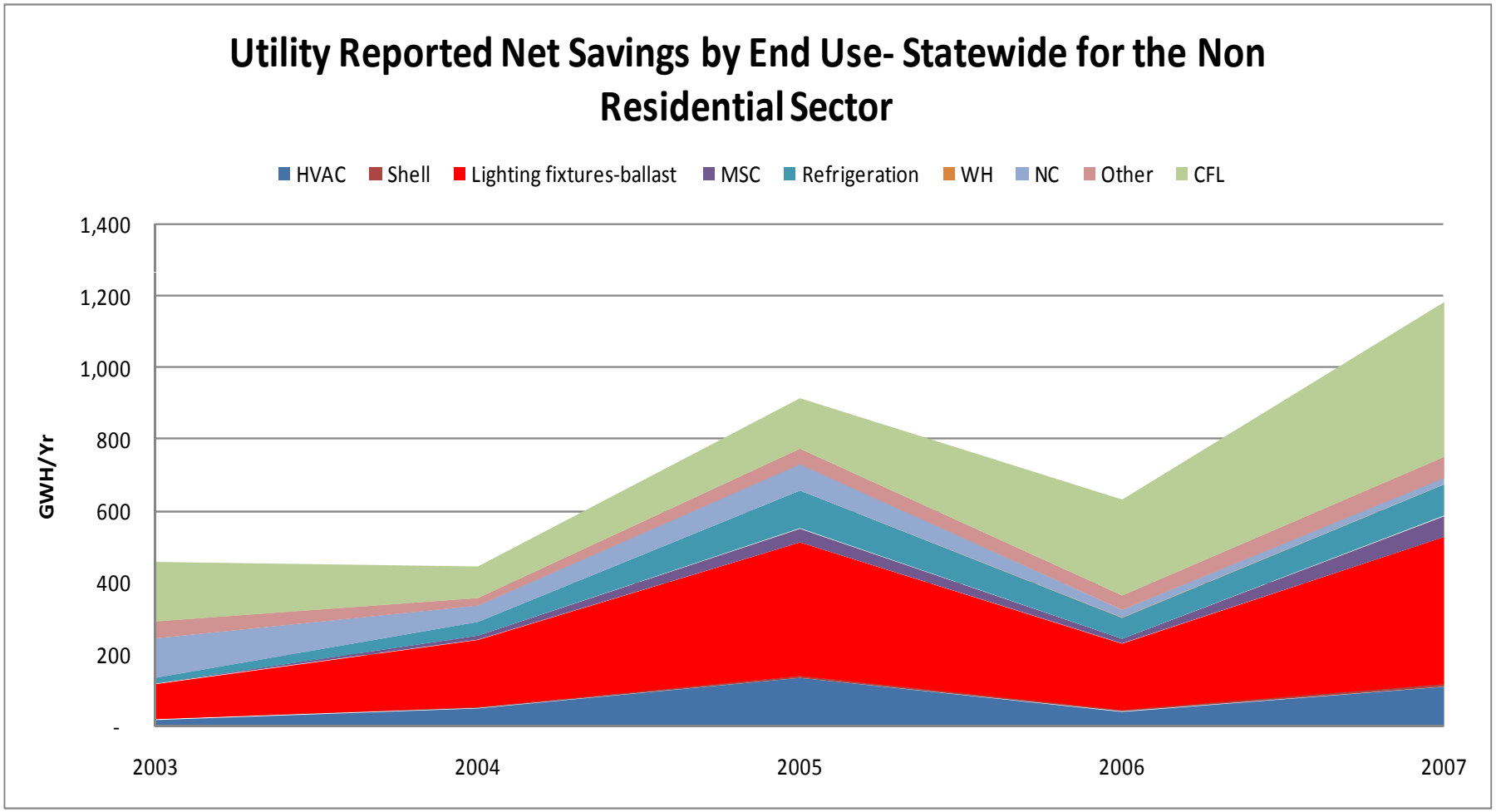

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Method 2 Results- Adjustments to Utility Residential Program Savings and CEC Residential End Use Models

End Use	Need to adjust CEC forecast to include utility program savings?	Rationale-Evidence for conclusion that some portion of Utility program savings should be decremented from CEC forecast.	Magnitude of Utility Program Savings compared to base usage.	Recommended Discount* of Verified Utility Program savings
Space Heating	No	Savings Impacts of Audit programs/ thermal shell programs in 1980's and 90's have been captured in RASS updates and retrofit fixes	**Very small**-Cumulative Program Impact very small <10 GWH in 2008--bigger impact on Nat gas use	**NA**
Space Cooling	Not immediately, but mechanism will be needed to assess impact of big and bold HVAC strategies	Impact of utility HVAC programs in 1990's has not been included in CEC UEC's, they have not been updated to include most recent RASS results in some areas, CEC forecast underestimates cooling usage in MF sector	**Very small** program savings relative to total elec use in this end use= Cumulative Program 61 GWH from 2003-2007 which is <1% of annual HVAC use statewide of	**50%**
Refrigerator	NO	Principal effects of Recycling programs should be to reduce saturation and expected useful life of second refrigerators in res sector . Satuation effect not supported by RASS evidence. reduced EUL effect was supported and should be introduced into CEC forecast.	**Small**-- Program reported savings of 255 GWH are 15% of total res program saving from 2003-2007 but less than .5% of total usage	**100%**
Interior Lighting	Yes	Significant savings from Utility Lighting programs not explicitly accounted for in lighting or Misc usage UEC's- Could have effect on base line UEC and future UEC's	**Large**-2003-3007 residential lighting program savings= 1,745 GWH compared to est. base lighting use of 23,604 GWH in 2008	**10%**
Key		*** Reported Savings*(1- discount factor)= Incremental Program Savings**		

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Method 2 Results - Adjustments to Utility Program Savings and CEC Nonresidential End Use Models

End Use	Need to adjust CEC forecast to include utility program savings?	Rationale-Evidence for conclusion that some portion of Utility program savings should be decremented from CEC forecast.	Magnitude of Utility Program Savings relative to total usage in base forecast	Recommended Discount* of Verified Utility Program savings
Space Cooling	In theory yes, but may not be not worth effort given other forecast improvements needed	Comparisons show CEUS baseline EUI for cooling is 49-1420% higher than CEC estimates by building types. Average overall space cooling usage EUI from CEC model is 20% lower than CEUS numbers. this effect may be counteracted by other EUI's in CEC model being too low for key end uses- CEC office equipment are 5-10% of CEUS values for key building types	Very Small,not worth effort-Program Savings of 349 GWH from 2000-2007 not explicitly included in CEC model but savings fraction is small compared to usage of 13,017 GWH in 2008.	**50%**
Interior Lighting	Yes	Comparisions show CEC baseline EUI in 2004 is 30% higher than CEUS EUIS on average and 100%-200% higher in some building types- CEC model does not incorporate impacts of utilty programs in 1990's and early 2000's	Large, Statewide utility program savings from 1994 to 2003 of > 3000 GWH savings from utility program not included in base yr 2004-Including program impacts reduces baseline EUI from 5.49 to 4.10 kwh/sq ft in 2004	**5%**

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