Estimating Incremental-Uncommitted Savings from Energy Efficiency in California

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Presentation Overview

- Study objectives
  - Overview of 2008 CPUC Goals study
- Study approach
- Scenario definitions and assumptions
- Results and comparisons
- Key caveats and uncertainty issues
- Q&A on technical modeling issues

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Study Objectives

- Primary objective: to produce quantitative estimates of savings from the “uncommitted” programmatic activities included in Itron’s 2008 CPUC Goals Study that are incremental to those already embedded in the CEC’s 2009 IEPR demand forecast
- Results to form basis of “managed” forecast for 2010 LTPP proceeding

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Key Framing Definitions

- *Committed programs* – current programs and program designs that exist and have been fully authorized and funded by the associated regulatory agency
- *Uncommitted programs* – future programs and program designs that have not been fully developed, authorized, and/or funded by the associated program administrator or regulatory agency as described and assessed in Itron's 2008 CPUC Goals Study
- *Committed program period* – the time period through which committed programs are authorized and savings from those program accumulate accordingly, specifically 2008 through 2012
- *Uncommitted program period* – the time period through which uncommitted programs are assumed to be implemented and savings from those programs accumulate accordingly, specifically 2013 to 2020

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Overview of 2008 CPUC Goals Study

- Itron conducted a set of scenario analyses estimating potential savings from a variety of future IOU, state, and federal programs and activities
- The primary objective of these scenario analyses was to provide a comprehensive quantitative and qualitative assessment of energy savings potential from a variety of perspectives in order to help the CPUC frame and choose energy efficiency goals in a way that best meets the CPUC's policy objectives

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Overview of 2008 CPUC Goals Study

- Analysis designed to leverage, the detailed data, analysis, and results of Itron's 2008 *California Energy Efficiency Potential Study*
  - Detailed, bottom-up assessment of 300+ measures using Itron's ASSET model
  - Achievable market potential from IOU programs only
- Approach developed for the Goals Study built upon, but was not limited to, the results of the 2008 Itron potential update study
  - Itron developed a spreadsheet modeling tool that used the results of the 2008 Itron potential update study as the primary starting points for exploring alternative policy scenarios

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Overview of Scenario Analysis Tool (SESAT)

- Basic analytic identity (residential example):

  $E_{esy} = UEC_{esy} * SAT_{esy} * HH_{sy}$

  where,

  E_{esy} = total annual energy consumption for end-use (e) in market segment (s) in year (y)

  UEC_{esy} = unit energy consumption for end-use (e) in market segment (s) in year (y)

  SAT_{eys} = saturation for end-use (e) in market segment (s) in year (y)

  HH_{ys} = number of households in market segment (s) in year (y)

- Unit energy consumption is further disaggregated into the following relationship:

  $UEC_{esy} = UEC_{esbase} * EffAdj_{esy} * UseAdj_{esy}$

  where:

  UEC_{esbase} = unit energy consumption for end-use (e) in market segment (s) in the base year

  $EffAdj_{esy}$ = technical efficiency for end-use (e) in year (y) relative to technical efficiency in base year (defined as 1.0 in base case scenario)

  $UseAdj_{esy}$ = energy service demand in year (y) relative to energy service demand in base year (defined as 1.0 in base case scenario)

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Baseline Data

- UECs, EUIs, and end-use load shapes by IOU and building type derived from the same key sources used in both the 2006 and 2008 Itron potential studies
  - *California Statewide Residential Appliance Saturation Study* (CEC, 2004)
  - *California Commercial Building End-Use Survey* (CEC, 2006)
  - *California Industrial Existing Construction Energy Efficiency Potential Study* (KEMA, 2006)
- Residential building stock and commercial floor stock by IOU and building type taken from CEC staff forecasts developed for recently released *California Energy Demand 2008-2018, Staff Revised Forecast*

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Scenarios Developed to Support Goal-Setting

Scenario Category	Scenario Components
Theoretical potential benchmarks	• Technical potential • Economic potential (TRC>=1)
IOU program potential	• Full gross market potential (TRC>=0.85) • Base gross market potential (TRC>=0.85) • Naturally-occurring potential
Big Bold Energy Efficiency Strategies (BBEES)	• Small HVAC initiative • Residential new construction initiative • Commercial new construction initiative
Future codes & standards (IOU perspective)	• AB 1109 (“Huffman Bill”) • Strengthening of Title 24 • Code compliance programs
Future codes & standards (societal perspective)	• AB 1109 (“Huffman Bill”) • Strengthening of Title 24 • Revision of federal appliance standards

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Synthesis of Policy Choices into Straw Man Cases

	Low	Mid	High
IOU program funding level?	$Base_{mid}$	$Full_{mid}$	$Full_{mid}$
Gross or net savings?	Gross	Gross	Gross
Huffman Bill?	Yes_{low}	Yes_{low}	Yes_{mid}
Title 24 & appliance standards?	Yes_{low}	Yes_{mid}	Yes_{high}
Code compliance programs?	No	Yes_{mid}	Yes_{high}
BBEES initiatives?	Yes_{low}	Yes_{mid}	Yes_{high}

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Study Approach

- Define analytic scope and boundaries
- Calibrate end-use baselines
- Transform CEC savings estimates into SESAT inputs
- Estimate incremental, uncommitted savings

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Defining Analytic Scope and Boundaries

- Common base year
  - Very different base years in CEC forecasting model (1975) and 2008 Goals Study (2006)
  - Base year for this study defined as 2006
- Geographic scope
  - Limited to service territories of 3 IOUs (as opposed to planning areas or statewide)
  - Maintains consistency with scope of savings goals/LTPP
- Programmatic scope
  - Required carefully assessing scope of the programs modeled in the CEC's 2009 IEPR demand forecast and Itron's 2008 CPUC Goals study

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Programmatic Scope – 2009 IEPR vs 2008 Goals Study

	Committed Program Period	Uncommitted Program Period
2009 IEPR demand forecast	IOU programs	-
	Title 24 triggered retrofits in existing commercial buildings (primarily lighting)	-
	-	"Additional residential lighting savings" from AB1109 lighting standards
	Residential price effects	Residential price effects
	Commercial price effects	Commercial price effects
2008 CPUC Goals study	IOU programs	IOU programs
	Revisions to Title 24	Revisions to Title 24
	-	Revisions to federal appliance standards
	Implementation of AB1109 lighting standards	Implementation of AB1109 lighting standards
	Implementation of BBEES initiatives	Implementation of BBEES initiatives

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Programmatic Scope for Incremental Savings

Delivery mechanism:	Adjustments:
IOU residential programs	decremented by CEC's residential price effects
IOU commercial programs	naturally-occurring adoptions assumed to be already embedded in CEC forecast; incremental savings from net IOU program savings only
IOU industrial programs	no adjustments
Implementation of AB1109	decremented by CEC's "additional residential lighting savings"
Future revisions to Title 24	no adjustments
Future revisions to federal appliance standards	no adjustments
Implementation of BBEES initiatives	no adjustments

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Calibrating End-Use Baselines

- Revised energy service demand drivers with values from 2009 IEPR forecast
  - > Housing stocks, commercial floor stocks, industrial load
  - > Revised energy service demand drivers were all lower than those used in 2008 Goals Study (comparison of 2020 values shown below)

Sector	units	2008 Goals Study	Current Study	difference
Residential	10e6 dwellings	11.77	11.76	-0.1%
Commercial	10e9 square feet	7.36	6.50	-13.3%
Industrial	10e6 kWh load	66.02	54.43	-21.3%

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Calibrating End-Use Baselines

- Cross-checked 2006 UECs, EUIs, saturations, and peak-to-energy ratios for consistency between CEC and RASS/CEUS
- End-use energy and peak demand profiles developed for 2008 Goals study were largely consistent with CEC's estimates of actual 2006 total sales and peak demand
- Small number of revisions required to calibrate bottom-up energy and peak demand to within reasonable range of actuals (i.e. +/- 5%):
  - revised the residential space heating and refrigeration UEC and saturation and saturation data with CEC values; and
  - revised the peak-to-energy ratios for all residential end uses with CEC values.
  - revised the residential space cooling UECs and saturations in SDG&E with CEC values; and
  - revised the peak-to-energy ratios for commercial interior lighting in SDG&E with CEC values.

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Calibrating End-Use Baselines

	SESAT	CEC	difference
2006 sales (GWh)			
PG&E	83,300	84,652	-1.6%
SCE	89,900	89,366	0.6%
SDG&E	20,110	20,032	0.4%
All IOU	193,310	194,051	-0.4%
Forecasted 2009 coincident peak demand (MW)			
PG&E	18,723	18,209	2.8%
SCE	20,513	19,661	4.3%
SDG&E	4,176	4,125	1.2%
All IOU	43,412	41,994	3.4%

- Note that 2006 was an unusually hot summer
- For purposes of baseline calibration, Itron and CEC staff agreed to calibrate bottom-up estimates of coincident peak demand with the CEC's forecasted system peak demand for 2009, which was based on "normal" weather year assumptions

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Transforming CEC Savings Estimates

- CEC provided the following data time series:
  - average and marginal UECs saturations by end use, building type, vintage, and IOU (with and without price effects)
  - GWh savings from IOU programs by end use and IOU
  - GWh savings from Title 24-triggered retrofits in existing commercial buildings
  - GWh savings from AB1109 lighting standards from 2013 forward
- Savings data were transformed from GWh units into %reductions in base year, end-use UECs (savings metric used in SESAT)
  - Step also designed to avoid systematic bias stemming from interacting results generated by different modeling platforms
    - e.g. outcomes that exceed technical potential or result in load growth
  - Nonetheless impossible to eliminate all sources of systematic bias within the constraints of the current study

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Estimating Incremental, Uncommitted Savings

- Re-run the SESAT model with revised and additional inputs
  - Comparable forecasts of savings associated with the delivery mechanisms included in the CEC's 2009 IEPR demand forecast and the Low, Mid, and High Goals scenarios
  - Results then formed the basis for estimating savings from uncommitted programs that are "incremental" to those already embedded in the 2009 IEPR forecast

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Scenario Definitions and Assumptions

- In general, the quantitative assumptions used in each of the scenarios remained identical with those used in the 2008 CPUC Goals study
- Small number of assumptions were revised to reflect knowledge learned since the time the 2008 CPUC Goals study was conducted
  - revised the assumptions associated with the 2008 revision to Title 24 and the assumptions used to describe the impacts of AB1109 (the Huffman Bill)
- All of the scenario definitions, assumptions, and data sources used in this study are documented in detail in section 3 of Itron's technical report (Attachment A of draft CEC Staff Report posted 1/27/10)

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Scenario Definitions and Assumptions

- Goals study assumed fairly aggressive update to Title 24 in 2008
  - In reality, very few significant new energy efficiency requirements, particularly in RNC, and implementation pushed out to 2010
  - For this study, 2008 revision excluded from Title 24 scenario assumptions; other Title 24 assumptions unchanged from 2008 CPUC Goals study
  - Revised interactions with BBEES initiatives accordingly
- Goals study assumed linear progress towards Huffman Bill targets between 2011 and 2020
  - Implementation of the Huffman Bill revised to reflect the performance targets and timelines now specified in Title 20
  - Revised interactions with IOU lighting programs accordingly

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Results and Comparisons

- Using the revised baseline inputs and scenario assumptions, the study team re-ran SESAT to generate comparable forecasts of savings from delivery mechanisms included in 2009 IEPR forecast and 2008 CPUC Goals Study
  - Results for individual delivery mechanisms combined according to the criteria used to construct the Low, Mid, and High Goals cases

	Low	Mid	High
IOU program funding level?	$Base_{mid}$	$Full_{mid}$	$Full_{mid}$
Gross or net savings?	Gross	Gross	Gross
Huffman Bill?	Yes_{low}	Yes_{low}	Yes_{mid}
Title 24 & appliance standards?	Yes_{low}	Yes_{mid}	Yes_{high}
Code compliance programs?	No	Yes_{mid}	Yes_{high}
BBEES initiatives?	Yes_{low}	Yes_{mid}	Yes_{high}

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Results and Comparisons

- Key items to note when interpreting results:
  - Results shown for savings from residential and commercial price effects, as modeled by the CEC, include savings from “additional residential lighting savings” (from 2013 forward)
  - Results shown for IOU programs, as modeled by the CEC, include savings from Title 24-triggered retrofits in existing commercial buildings
  - Results of revised Low/Mid/High Goals Cases do not exactly match the goals adopted in CPUC D.08-07-047
    - Current results use revised forecasts of demand drivers (housing stocks, etc.) and revised residential peak-to-energy factors
    - Revised assumptions with respect to 2008 Title 24 and rollout of the Huffman Bill lighting standards
  - Results reflect estimated savings from programs introduced and operated over the *forecast period* and do not include any attempt to estimate cumulative load impacts from programs or standards adopted from 1975 to the present

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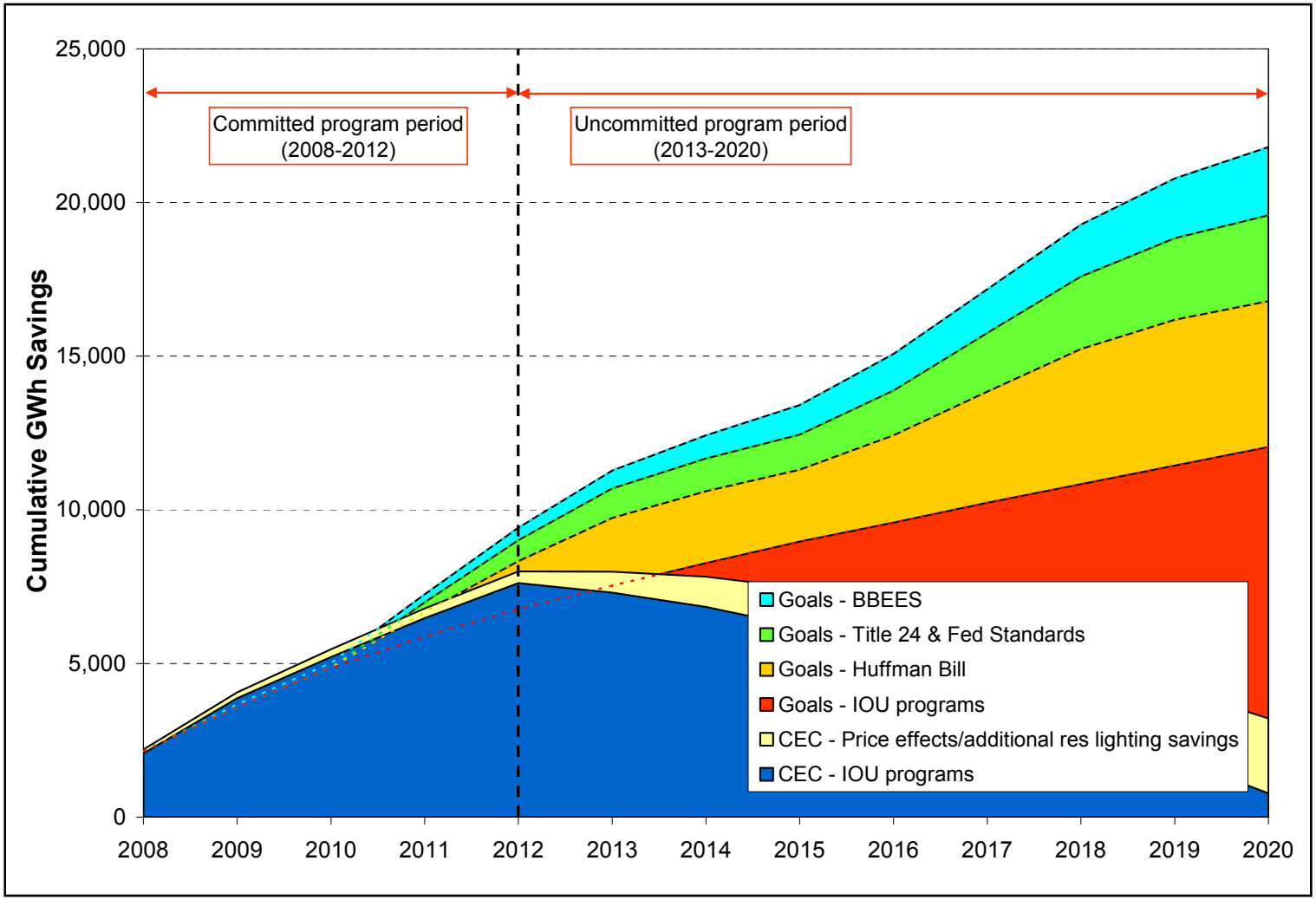
Scenario Results – Low Goals Case (GWh)



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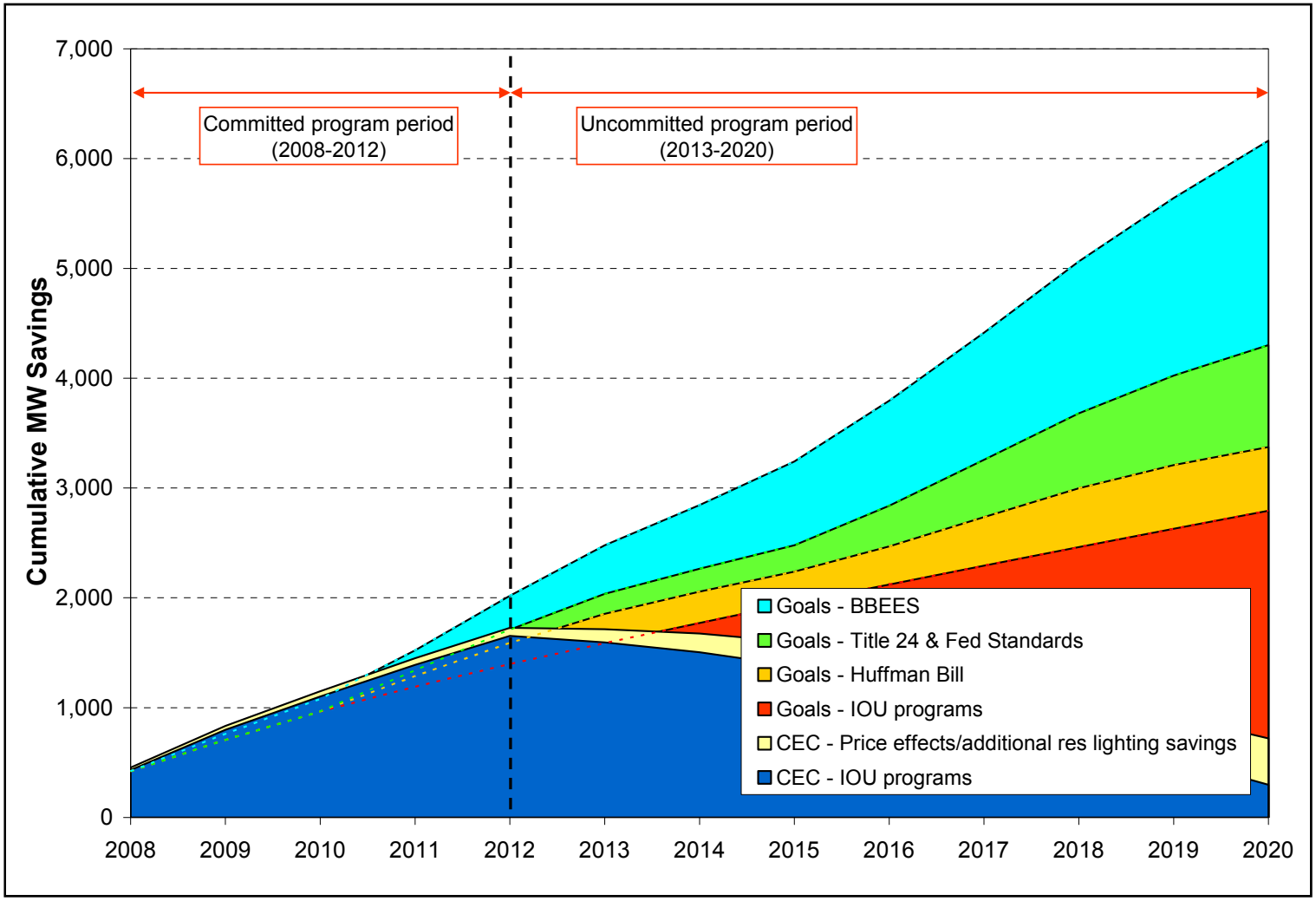
Scenario Results – Low Goals Case (MW)



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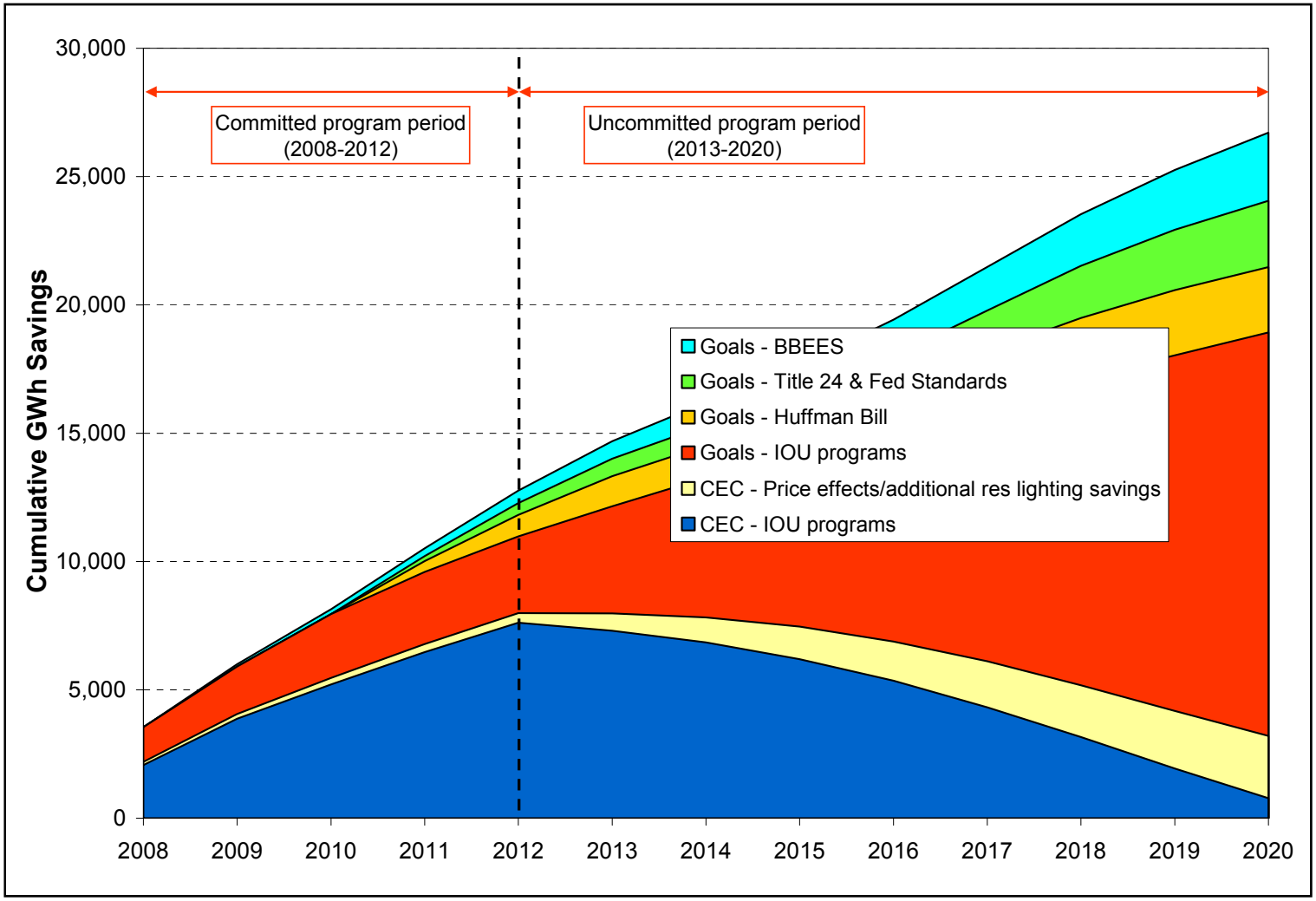
Scenario Results – Mid Goals Case (GWh)



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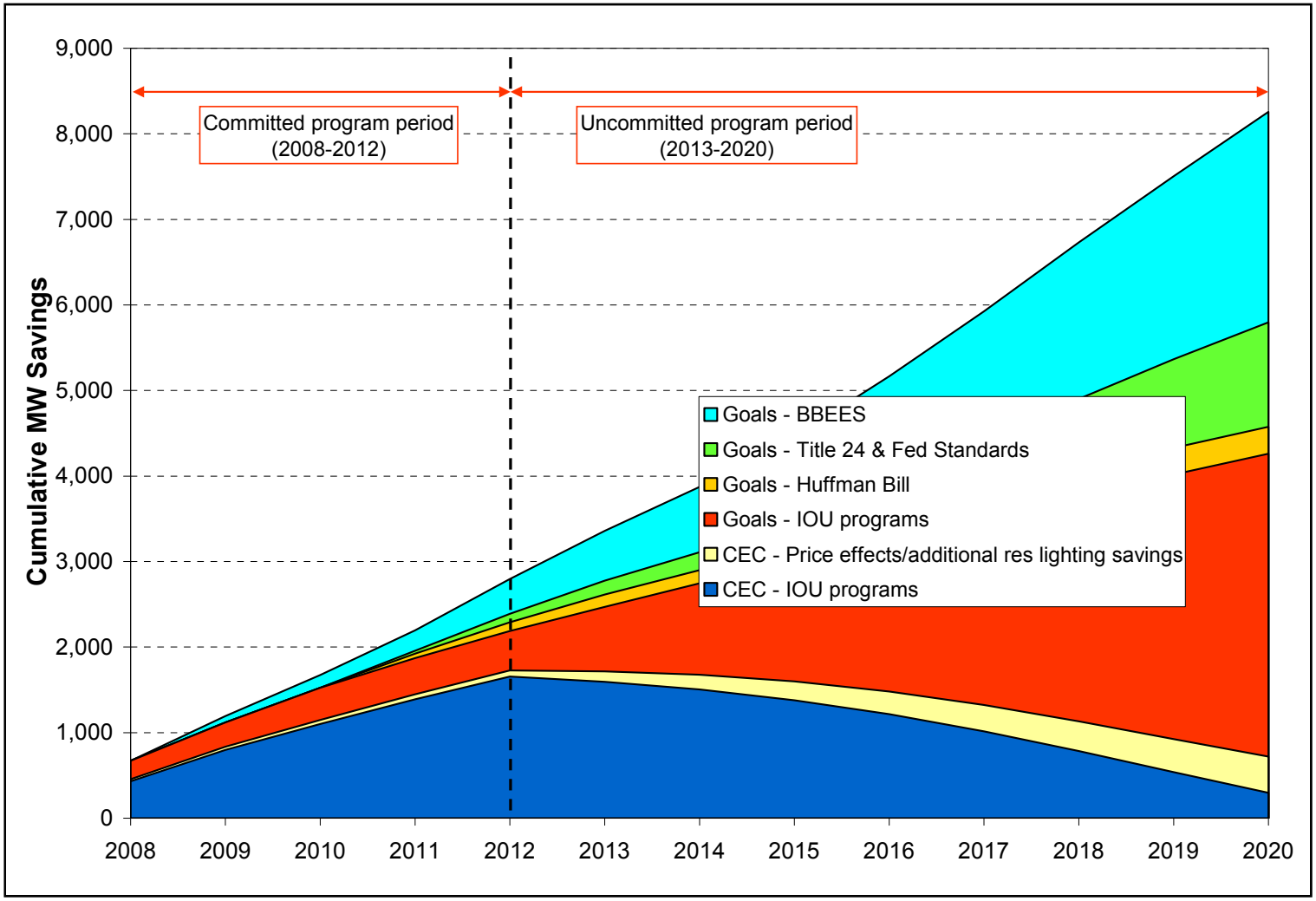
Scenario Results – Mid Goals Case (MW)



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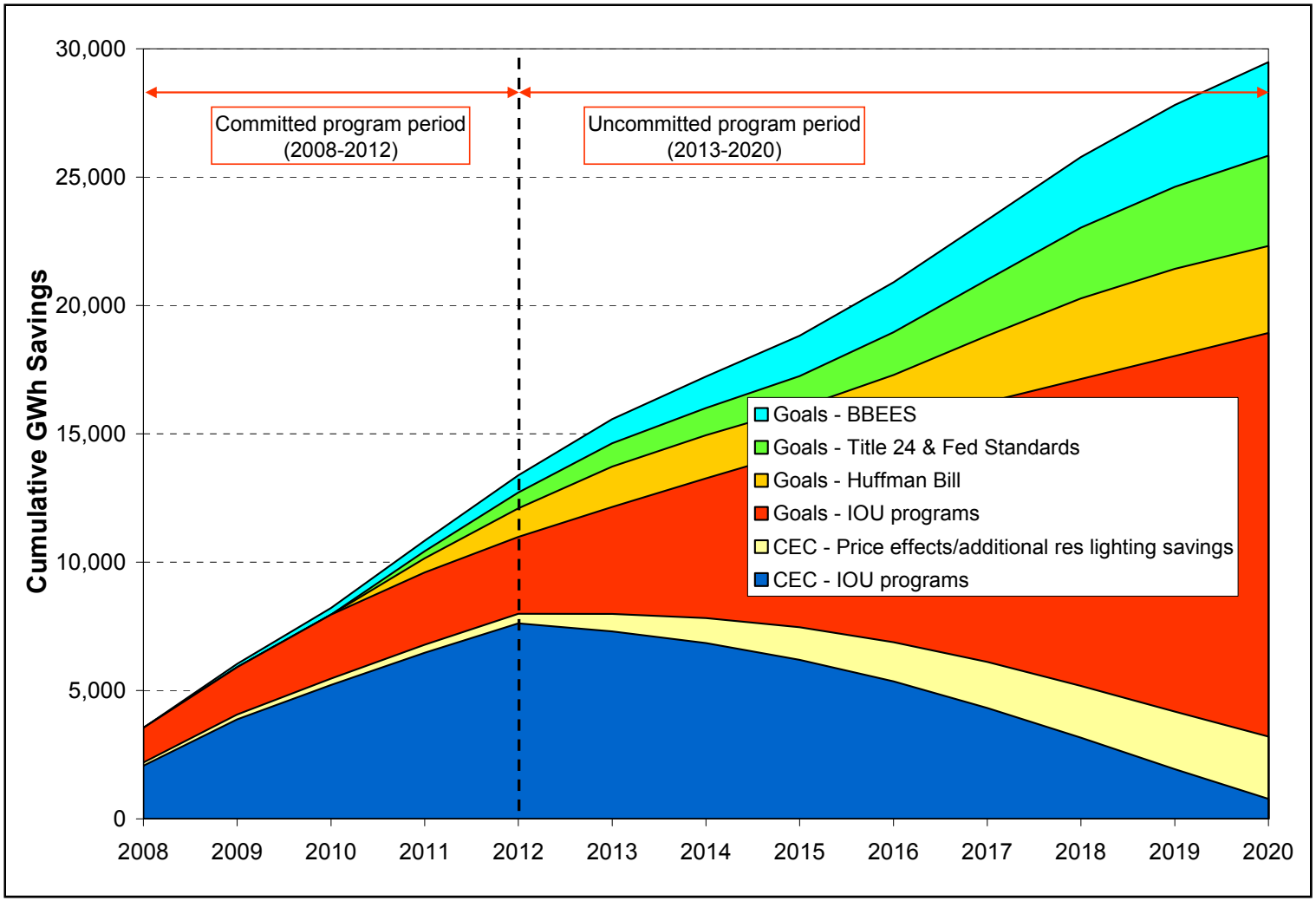
Scenario Results – High Goals Case (GWh)



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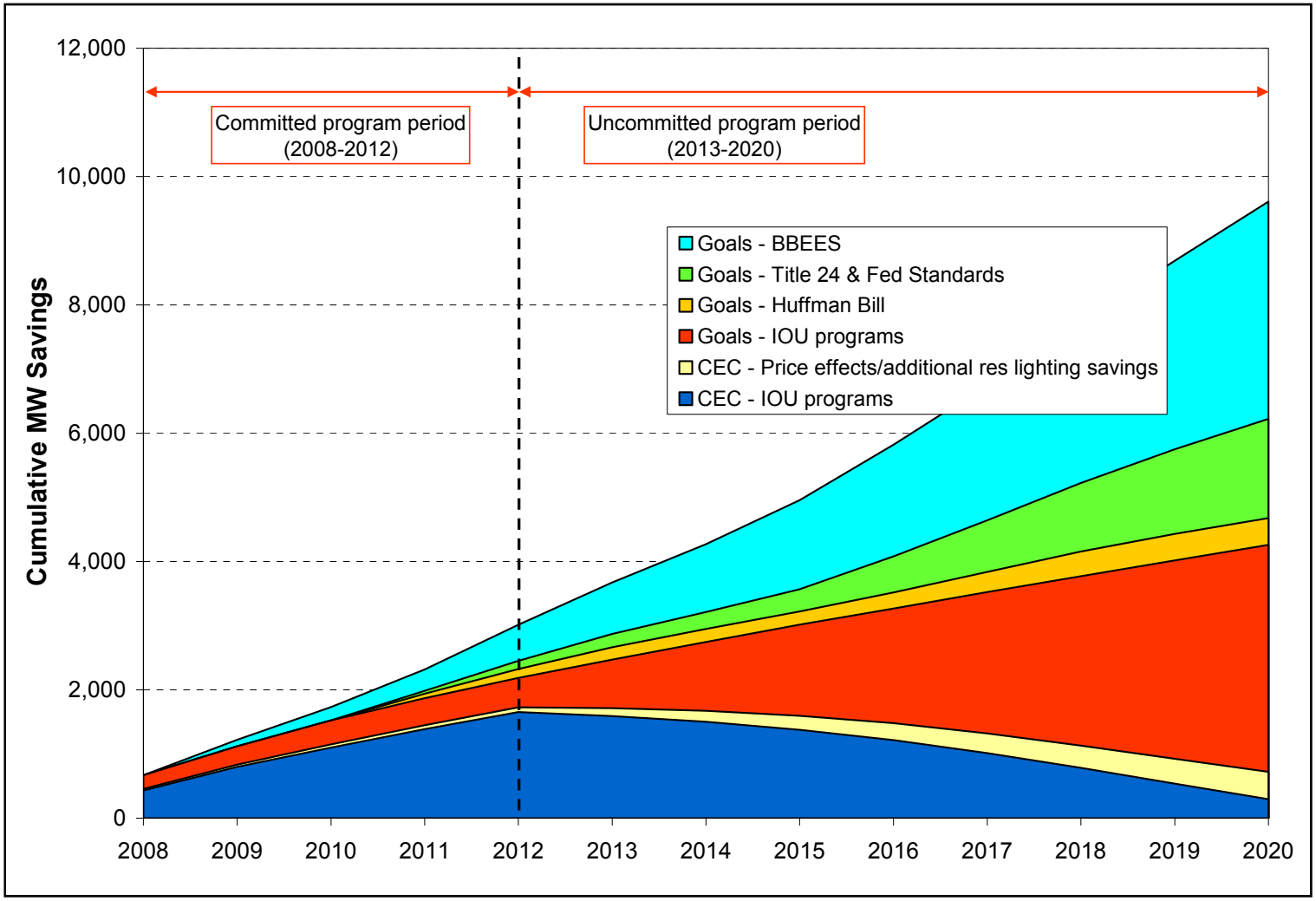
Scenario Results – High Goals Case (MW)



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Calculating Incremental Uncommitted Savings

- Revised scenario results form the basis for calculating the key quantity in question
  - i.e., the portion of savings from uncommitted programs (as represented by those modeled in the 2008 Goals study) that is incremental to the savings already embedded in the 2009 IEPR demand forecast from 2013 forward
- Key step required is to identify the extent to which the delivery mechanisms modeled in the 2008 CPUC Goals study overlap or duplicate those modeled in the 2009 IEPR forecast

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Calculating Incremental Uncommitted Savings

- Based on the assessments and methodological decisions of the study team and CEC staff, we defined incremental uncommitted savings to be - *the cumulative savings from 2013 through 2020 from the delivery mechanisms modeled in the 2008 CPUC Goals study with the specific adjustments shown below*:

Delivery mechanism:	Adjustments:
IOU residential programs	decremented by CEC's residential price effects
IOU commercial programs	naturally-occurring adoptions assumed to be already embedded in CEC forecast; incremental savings defined to be *net* savings from new IOU programs
IOU industrial programs	no adjustments
Implementation of AB1109	decremented by CEC's "additional residential lighting savings"
Future revisions to Title 24	no adjustments
Future revisions to federal appliance standards	no adjustments
Implementation of BBEES initiatives	no adjustments

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Calculating Incremental Uncommitted Savings

- Important to understand two specific aspects of the incremental uncommitted savings calculation methodology:
  - First, this accounting method does not incorporate or account for any differences between CEC's estimates of savings from committed programs and savings in the CPUC Goals Cases through the end of the committed period, i.e. 2012.
  - Second, this accounting method effectively treats savings from committed IOU programs (as estimated by CEC) as constant from 2013 forward rather than decaying (as shown previously)
    - Reflects the decision by CPUC and CEC staff to conform to CPUC's policy rules under which the IOUs are responsible for replacing decayed savings from previous program cycles
    - We thus considered replacement of decayed savings as associated with committed programs rather than uncommitted programs
    - Our estimates of incremental uncommitted savings do not interact with any assumed levels of measure savings decay from previous IOU program cycles

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Summary of Inc-Unc Savings Results (GWh)

	2013	2014	2015	2016	2017	2018	2019	2020
Low Goals Case								
IOU programs	642	1,258	1,853	2,376	2,920	3,431	3,940	4,448
AB 1109 lighting standards	740	785	645	1,220	2,213	3,224	3,653	3,602
Title 24 & Fed Standards	28	75	143	261	380	516	656	798
BBEES	163	333	549	776	1,013	1,267	1,533	1,809
Total GWh	**1,573**	**2,452**	**3,191**	**4,632**	**6,526**	**8,439**	**9,782**	**10,658**
Mid Goals Case								
IOU programs	1,050	2,055	3,017	3,847	4,716	5,521	6,325	7,126
AB 1109 lighting standards	345	302	163	430	941	1,469	1,678	1,628
Title 24 & Fed Standards	55	133	254	437	624	844	1,071	1,304
BBEES	194	397	655	926	1,209	1,516	1,835	2,167
Total GWh	**1,644**	**2,888**	**4,089**	**5,640**	**7,490**	**9,350**	**10,909**	**12,225**
High Goals Case								
IOU programs	1,050	2,055	3,017	3,847	4,716	5,521	6,325	7,126
AB 1109 lighting standards	514	509	369	768	1,486	2,220	2,524	2,473
Title 24 & Fed Standards	79	187	356	606	864	1,168	1,482	1,805
BBEES	266	544	899	1,271	1,659	2,078	2,515	2,970
Total GWh	**1,910**	**3,296**	**4,642**	**6,492**	**8,724**	**10,988**	**12,845**	**14,374**

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Summary of Inc-Unc Savings Results (MW)

	2013	2014	2015	2016	2017	2018	2019	2020
Low Goals Case								
IOU programs	189	373	554	723	895	1,063	1,230	1,396
AB 1109 lighting standards	102	110	93	172	307	445	504	498
Title 24 & Fed Standards	16	35	66	162	260	368	477	588
BBEES	132	271	455	647	849	1,073	1,308	1,552
Total MW	**439**	**788**	**1,168**	**1,705**	**2,312**	**2,949**	**3,518**	**4,034**
Mid Goals Case								
IOU programs	284	560	830	1,081	1,336	1,583	1,830	2,075
AB 1109 lighting standards	49	46	29	67	137	210	240	234
Title 24 & Fed Standards	36	76	143	294	448	623	803	987
BBEES	175	358	602	857	1,123	1,421	1,732	2,056
Total MW	**544**	**1,039**	**1,604**	**2,298**	**3,045**	**3,839**	**4,605**	**5,352**
High Goals Case								
IOU programs	284	560	830	1,081	1,336	1,583	1,830	2,075
AB 1109 lighting standards	72	74	57	112	211	312	355	349
Title 24 & Fed Standards	43	92	173	365	560	782	1,009	1,241
BBEES	241	492	827	1,177	1,543	1,951	2,377	2,820
Total MW	**640**	**1,217**	**1,887**	**2,735**	**3,651**	**4,629**	**5,570**	**6,484**

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Key Caveats and Uncertainty Issues

- Inherent uncertainties in trying to reasonably predict outcomes from future actions
- Unique challenge of trying to interact the inputs and outputs from two different modeling platforms in a way that avoided systematic bias and ensured a reasonable level of internal consistency
- Identifying and reconciling all of the differences between the CEC's 2009 IEPR forecast and the 2008 CPUC Goals study was beyond the scope of this study

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Key Caveats and Uncertainty Issues

- We focused our analytic efforts and priorities on identifying and reconciling as many of the most important differences in key inputs, methodologies, and assumptions as possible within the project schedule
  - Reconciling key differences in baseline end-use characterizations (e.g. UECs and saturations) and adopting common forecasts of key energy service demand drivers (e.g. housing counts and commercial floor stock)
  - Framing cumulative savings using a common base year
  - Expressing savings in common metrics
  - Identifying areas of duplication and contradiction across the two forecasts and, where possible, developing methods to address such them

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Key Caveats and Uncertainty Issues

- Some differences do remain and therefore introduce an unknown level of overall uncertainty in the results
- Based on professional judgment of the study team, the five most important analytic caveats and uncertainties are:
  - Electricity price assumptions
  - Differences in committed savings estimates
  - Annual savings trends
  - Savings decay from IOU programs
  - Uncertainty associated with achieving the BBEES targets

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Electricity Price Assumptions

- Electricity prices increase ~15%, in real terms, from 2008 to 2020 in the 2009 IEPR demand forecast
- Electricity prices were assumed to be constant, in real terms, in the 2008 Itron potential update study
- Results, in principle, in different levels of naturally-occurring adoptions and other forms of price-sensitive customer behavior between the 2009 IEPR forecast and the 2008 Itron potential update study
- Straightforward (analytically) to incorporate the CEC's electricity price forecasts into Itron's estimates of achievable market potential from IOU programs
  - Would require significant time and resources beyond the scope and schedule of current study

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Differences in Committed Savings Estimates

- CEC's estimates of savings from committed IOU programs exhibit some significant differences with those estimated under the Goals Cases
  - Measure rebate levels assumed in the 2009 IEPR forecast are known to be higher than those assumed in the Low Goals case and lower than those assumed in the Mid and High Goals Cases
- Differences in realization rate assumptions and net-to-gross accounting
  - Reconciling most significant differences is an area that could be potentially addressed in a more timely fashion, ideally leveraging the full set of 2006-2008 ex-post program evaluation studies (none of which were available in time for the 2008 CPUC Goals Study or the 2009 IEPR forecast)
  - Important to note that these differences only affect the respective estimates of savings from committed programs through 2012 and do not, by definition, affect the estimates of incremental savings from uncommitted programs

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Annual Savings Trends

- SESAT modeling framework designed to focus primarily on end-point outcomes (e.g. 2020) and leverages results of stock turnover modeling outside of the model to estimate year-to-year trends
  - e.g. the detailed stock turnover modeling embedded in Itron's ASSET model, new construction rates developed by CEC
- In this study, the temporal dynamics of savings from Huffman Bill are the most uncertain across all delivery mechanisms assessed
  - Title 20 specifies interim efficiency levels for two distinct product segments defined by lumen output for which there is insufficient market data to reasonably segment lighting market according to lumen output
  - Unable to directly estimate expected temporal dynamics, particularly over the period covered by the interim standards
  - Also, new lighting standards face potentially significant savings "leakage" due to sheer volume and diversity of manufacturers and products affected which could significantly impact actual realized savings over time

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Savings Decay from IOU Programs

- Savings from IOU programs (as estimated by the CEC) were shown as decaying significantly from 2013 forward
  - Represents theoretical absence of efforts to replace efficiency measures at the end of their useful lives as assumed in the 2009 IEPR forecast
- CPUC and CEC staff agreed to treat savings from committed IOU programs as constant from 2013 forward per CPUC's policy rules
  - Thus considered savings-replacement to be associated with committed programs rather than uncommitted programs
  - Current estimates of incremental, uncommitted savings do not interact with any assumed levels of measure savings decay from previous IOU program cycles

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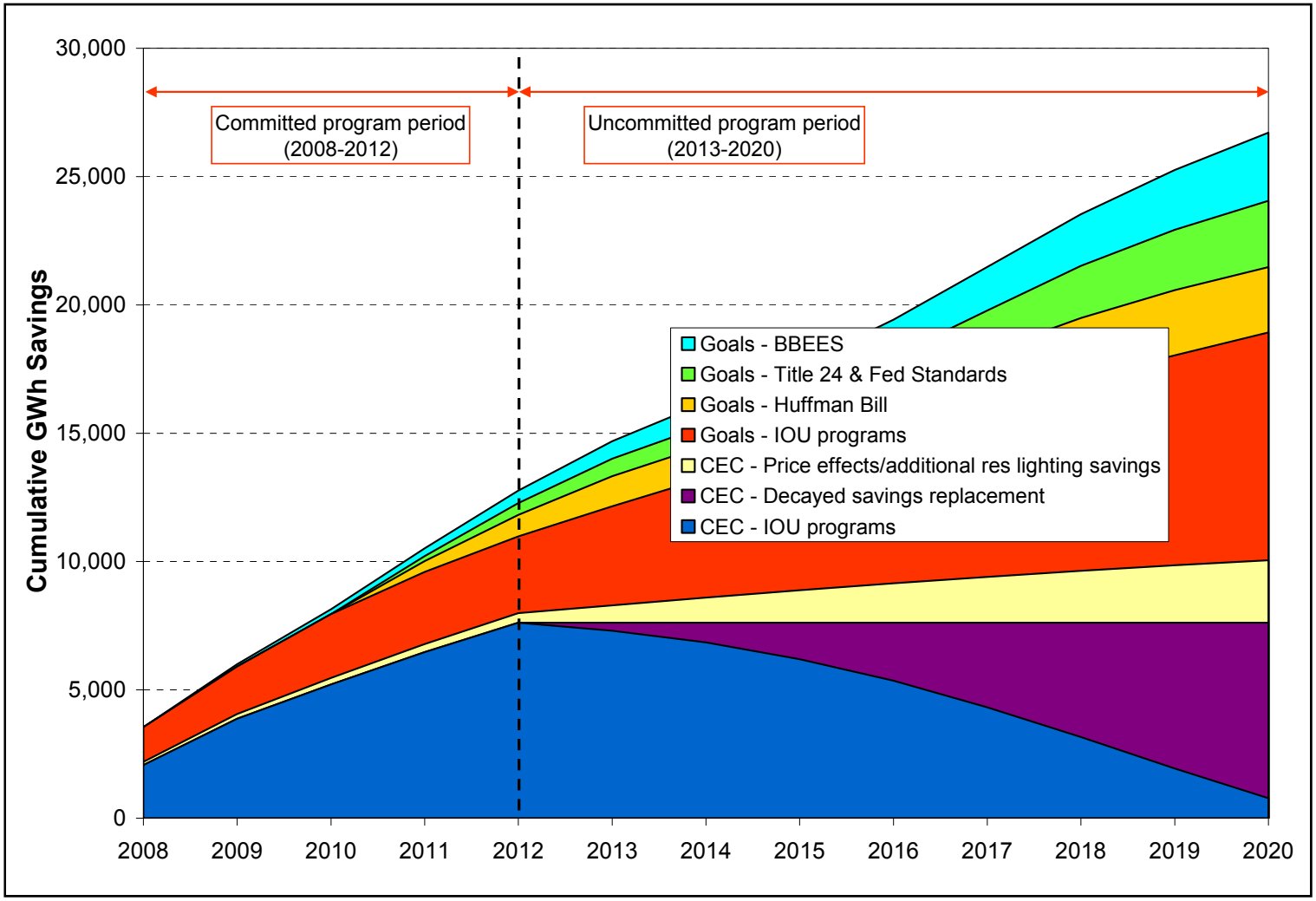
Savings Decay from IOU Programs



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Savings Decay from IOU Programs

- Considerable uncertainty associated with modeling and predicting measure savings decay
  - Decay rates used by the Energy Commission and reflected in the 2009 IEPR forecast currently depend on assumptions rather than observed behavior
- Clearly a need for comprehensive, quantitative assessments of measure savings decay across a wide range of measures being offered through IOU programs in order to reliably estimate measure savings decay in aggregate
  - E.g., on-going market saturation studies, panel studies of program participants, and detailed analyses of ex-post program evaluation results over multiple program cycles

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Uncertainty of Achieving BBEES Targets

- All programmatic activities modeled are well established with the key exception of the BBEES initiatives
  - Significant departure from vast majority of current IOU program portfolios or current procedures and mandates that govern Title 20 and Title 24
  - Regardless of the assumed delivery mechanism, achieving the specific market penetration rates for ZNE new construction reflected in the BBEES targets will require, by the CPUC's own characterization, "an aggressive and creative action plan"
- Reasonable to describe the outcomes associated with the BBEES initiatives for ZNE homes and buildings as highly uncertain
  - Potential energy and peak demand savings from BBEES initiatives currently estimated as penetration-weighted technical potential

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Uncertainty of Achieving BBEES Targets

- Important to consider the share of total incremental, uncommitted savings from the BBEES initiatives
  - Relatively modest share of total incremental, uncommitted energy savings by 2020 (~20%)
  - But nearly half of total incremental, uncommitted peak demand savings by 2020 (38-44%)
  - 90% of energy and peak savings from BBEES initiatives from ZNE new homes and commercial buildings
- Total incremental, uncommitted peak demand savings are highly sensitive to one's expectations about whether and to what extent the BBEES targets for ZNE new construction can be achieved
  - Critical to actively monitor development of all aspects of the ZNE market in order to assess actual progress towards the BBEES targets and evaluate likelihood of achieving the BBEES milestones on a regular and timely basis

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Q&A on Technical Issues

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Appendix Slides

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ASSET Scenarios – IOU Program Potential

- Full restricted market potential
  - Amount of customer measure adoption and resulting savings that would occur over time in response to incentives equivalent to full incremental measure costs
  - Takes into account a variety of factors such as participant cost-effectiveness or payback period, awareness, and willingness to adopt
  - "Restricted" to the potential savings from measures with TRC ≥ 0.85
- Base restricted market potential
  - Amount of customer measure adoption and resulting savings that would occur over time in response to incentives equivalent to current average measure incentives
  - "Restricted" to the potential savings from measures with TRC ≥ 0.85
- Naturally-occurring potential
  - Potential savings from customer adoptions that would occur in the absence of *further* utility programs from the outset of the forecast period, including free-riders, participant and non-participant spillover, and longer-term market effects

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Big Bold Energy Efficiency Strategies (BBEES)

- Commissioner Grueneich defined the BBEES initiatives as "strategies to promote maximum energy savings through the coordinated actions of utility programs, market transformation, and codes and standards" (April 13, 2007 scoping ruling)
- The BBEES initiatives therefore represent a significant departure from the incentive-based voluntary programs that comprise the vast majority of the current IOU program portfolios
- The CPUC directed the utilities to include specific programs to support the implementation of three specific BBEES initiatives in their 2009-2011 portfolio applications and their long-term Strategic Plans
  - Small HVAC
  - Residential new construction
  - Commercial new construction

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BBEES – Residential New Construction

- Definition: penetration of Tier 2 efficiency new homes according to milestones in D.07-10-032 and Tier 3 homes according to milestones in *California Energy Efficiency Strategic Plan (Draft)*
- Attribution not addressed; savings estimated as penetration-weighted technical potential going forward
- Technical savings (35% and 55% better performance than 2005 Title 24) adjusted to be incremental to ASSET NC market potential savings estimates (based on voluntary incentives promoting 15% better performance than Title 24)
- Modeled based on annual NC market penetration assumptions
- Penetration-weighted savings estimates applied to WH+HVAC (assumes no significant change in scope of Title 24 and avoids double-counting with lighting and appliance measures in other scenarios)

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BBEES – Residential New Construction

- Market penetration and savings assumptions

Efficiency level:	Case:	Market Penetration:		
		2011	2015	2020
Tier 2 (35% reduction in HVAC and WH from 2005 Title 24 levels)	High[a]	40%	90%	100%
	Mid	30%	60%	80%
	Low	20%	30%	60%
Tier 3 (55% reduction in HVAC and WH from 2005 Title 24 levels)	High[b]	10%	40%	90%
	Mid	8%	25%	60%
	Low	5%	10%	25%

[a] High values reflect milestones in D.07-01-032
[b] High values reflect milestones in *California Energy Efficiency Strategic Plan (Draft)*

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BBEES – Commercial New Construction

- Definition: penetration of high-efficiency new commercial buildings according to milestones in D.07-10-032
- Attribution not addressed; savings estimated as technical potential going forward
- Technical savings (30% better performance than Title 24) adjusted to be incremental to ASSET NC full and base market potential savings estimates (based on voluntary incentives promoting 15% better performance than Title 24)
- Modeled based on annual NC market penetration assumptions
- Penetration-weighted savings estimates applied to WH, HVAC, interior lighting, and exterior lighting

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BBEES – Commercial New Construction

- Market penetration and savings assumptions

Efficiency level:	Case:	Market penetration:		
		2011	2015	2020
30% reduction in HVAC, WH, and lighting from 2005 Title 24 levels	High[a]	30%	50%	70%
	Mid	20%	35%	55%
	Low	10%	20%	40%

[a] High values reflect milestones in D.07-01-032

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BBEES – Small HVAC

- Definition: reshaping the residential and small commercial HVAC industry in California to promote retrofit/replacement with high-quality installations of optimally-sized, high-efficiency HVAC systems with low leakage ductwork
- Attribution not addressed; savings estimated as penetration-weighted technical potential going forward
- Modeled as ROB measure starting in 2009 in existing res segment only (to avoid double-counting savings from BB RNC scenarios) assuming 15-year EUL
- CPUC did not define specific performance or market penetration milestones for the BB HVAC initiative
- ROB market penetration assumptions developed to represent a significant acceleration of the SEER 15 CAC market in advance of the incoming federal standard in 2016: 10% in 2009, 50% in 2015, 75% in 2016, and then 100% through 2020
- Unit savings estimates based on: 1) field test results of PIER-funded HDAC demonstration project, 2) DEER values for savings from duct sealing and refrigerant charging

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BBEES – Small HVAC

- Savings assumptions

BB HVAC case:	HDAC savings	Duct sealing savings	Duct sealing incomplete
High	29%	14% - SFD 11% - MFD	50%
Mid	20%		50%
Low	17%		25%

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New Codes and Standards

- IOU perspective
  - Revisions to C&S often obviate IOU programmatic efforts for related measures that are subsumed by new C&S
  - In the absence of new efficiency measures and programs, the impact of revisions to C&S is a relative decrease in the achievable energy efficiency resource available to be captured by voluntary IOU programs going forward
  - Frequent and significant revisions to C&S, therefore, could have potentially important impacts on the achievable market potential available to IOUs, especially in the absence of an influx of new, cost-effective efficiency measures and technologies
- Societal perspective
  - Most relevant savings metric for resource procurement and GHG mitigation planning is the total savings potential for society at large, independent of whether the savings are derived through IOU programs, state codes and standards, or federal codes and standards

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New Codes and Standards

- IOU perspective
  - AB 1109 (Huffman Bill)
  - Title 24
  - Code compliance programs
- Societal perspective
  - AB 1109
  - Title 24
  - Federal appliance standards
- Kept scope limited to new C&S judged to have most significant impacts and where sufficient information was available to adequately model potential impacts
  - did not consider incoming Title 20 standards for battery chargers or federal standards for commercial clothes washers, vending machines, commercial freezers

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Codes & Standards – IOU Perspective

- Huffman bill
  - Definition: implementation of AB1109, using general service CFL potential as proxy (excludes specialty lamps, including reflectors)
  - Final rulemaking occurred in 2009; interim standards take effect in 2011 (~20 I/W), final standards take effect in 2018 (45 I/W)
  - Modeled as phase-out of general service CFLs from IOU portfolios over 2011-2018
  - Uncertainty bounds reflect uncertainty in forecasted adoptions levels in the ASSET full and base market potential forecasts at time of assumed IOU program phase-out

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Codes & Standards – IOU Perspective

- Strengthening of Title 24
  - Definition: the implementation of revisions to Title 24 that obviate current voluntary programs administered by the IOUs targeting new residential and commercial construction
  - Modeled as phase out of current IOU NC programs (which promote 15% better performance than 2005 Title 24 levels) due to implementation of revisedTitle 24 standards in 2012
    - accounting for typical one-year lag between final rulemaking and implementation
  - Penetration-weighted savings estimates applied to WH+HVAC in residential and WH, HVAC, and lighting in commercial
  - Uncertainty bounds reflect uncertainty in forecasted adoptions levels in the ASSET full and base market potential forecasts at time of assumed phase-out

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Codes & Standards – Societal Perspective

- AB 1109 (Huffman Bill)
  - Definition: implementation of AB1109 according to changes to Title 20 adopted in August 2009
  - Modeled as implementation of efficiency standards for general service lamps (~20 l/W starting in 2011, increasing to 45 l/W in 2018)
  - Savings based on targets stipulated in AB1109 (aggregate residential lighting savings of 50% by 2020 and commercial lighting savings of 25% by 2020)
  - Uncertainty bounds reflect uncertainty in lighting technical potential

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Codes & Standards – Societal Perspective

- Strengthening of Title 24
  - Definition: periodic strengthening of Title 24 performance levels for RNC and CNC
  - Modeled as phase out of IOU voluntary NC programs, concurrent phase-in of higher Title 24 performance levels over time starting in 2011
    - assumed typical 1-year lag between rulemaking and implementation of Title 24 revisions
  - Savings estimated as technical potential going forward, taking into account annual NC rates and technical unit savings assumptions
  - Penetration-weighted savings estimates applied to WH+HVAC in residential and WH, HVAC, and lighting in commercial
  - Uncertainty bounds reflect uncertainty in technical potential of revised Title 24 performance levels

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Title 24 – Societal Perspective

- Technical unit savings and periodicity assumptions

Title 24 case	Technical unit savings (relative to previous code)	Periodicity
	2011-2020	
Residential:		
High	10%	2011, 2014, 2017 (3 revisions)
Mid	10%	2011, 2014 (2 revisions)
Low	10%	2014 (1 revision)
Commercial:		
High	5%	2011, 2014, 2017 (3 revisions)
Mid	5%	2011, 2014 (2 revisions)
Low	5%	2014 (1 revision)

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Codes & Standards – Societal Perspective

- Strengthening/expansion of Federal appliance standards
  - Definition: revision of federal appliance standards according to USDOE's *Five-Year Schedule of Issuance of Appliance Rulemakings* (published January 31, 2006)
  - Most significant standards anticipated: high-efficiency CD, DW, CAC, RAC, PTAC, and PTHP
  - Modeled as ROB measure in existing building segment (to avoid double-counting with measures in NC C&S scenarios)
  - Savings estimated as stock-turnover weighted technical potential going forward
  - Currently none of these measures pass TRC and thus are not included in ASSET estimates of economic or market potential; savings in C&S (societal) scenario thus treated as incremental to ASSET market potential savings estimates

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Appliance Standards – Societal Perspective

- Technical unit savings and periodicity assumptions

Equipment type:	Unit savings	EUL	Periodicity	
			rulemaking	implementation
Clothes dryers	13%	18 years	2011	2016
Dishwashers	48%	13 years	2009	2014
Residential CAC	12% - SFD 15%- MFD	15 years	2011	2016
Residential RAC	10%	12 years	2011	2016
Commercial PTAC	18%	15 years	2008	2013
Commercial PTHP	18%	15 years	2008	2013

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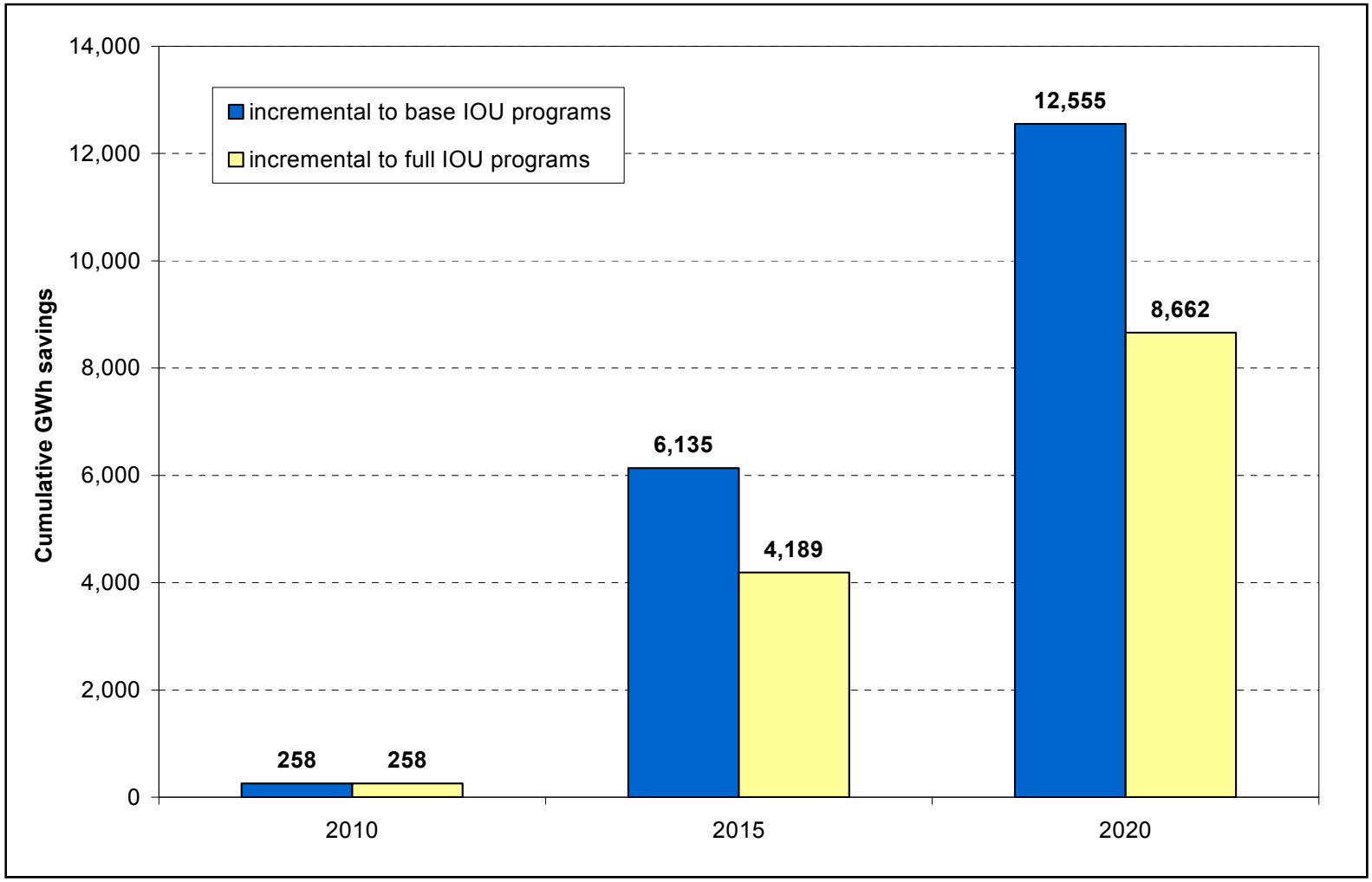
Key Interactions – Huffman Bill and IOU Programs



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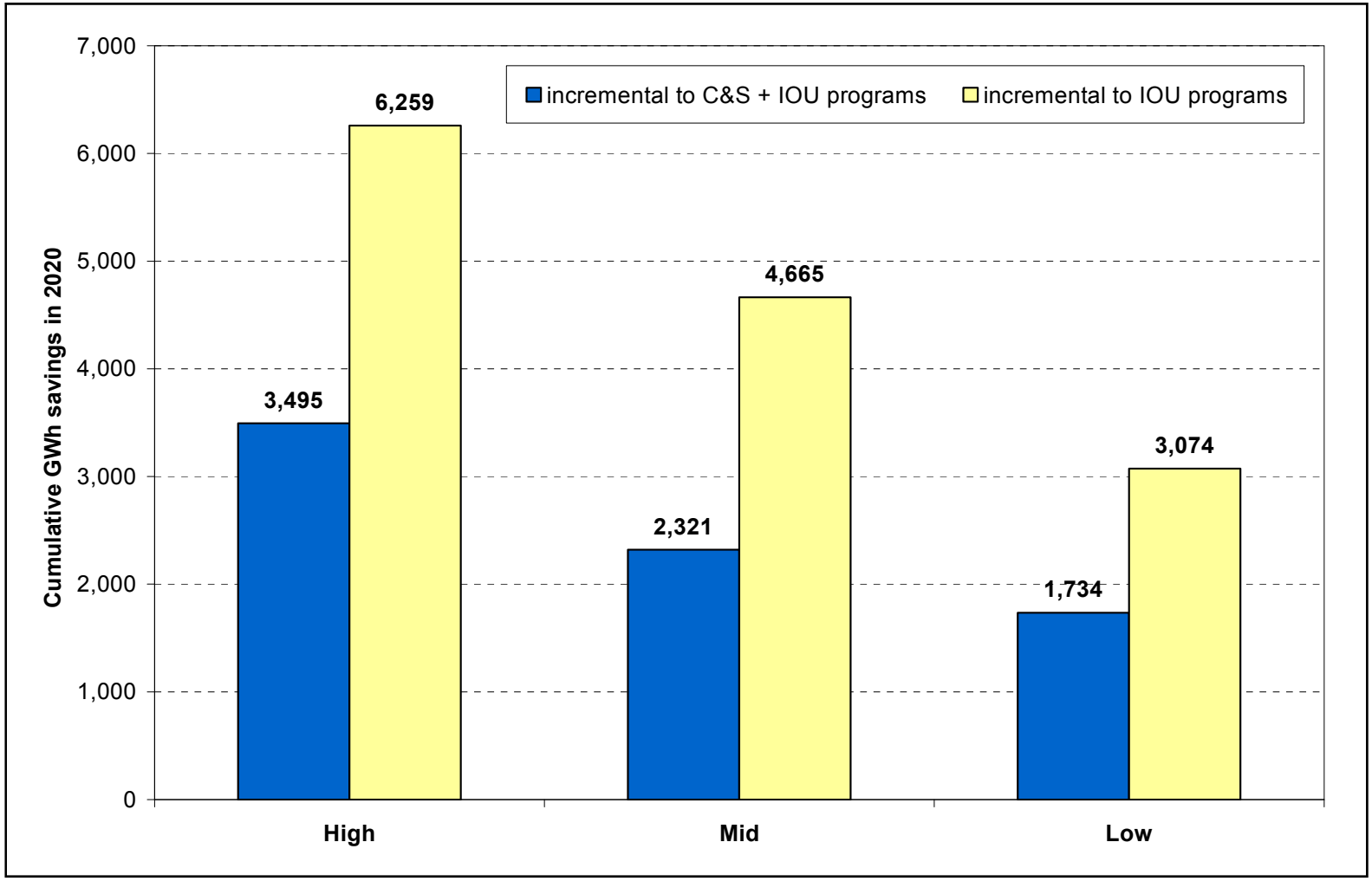
Key Interactions – BBEES and Title 24



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