DOCKETED

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Description:	Presentation during November 16 workshop by Martha Brook on the Energy Commission's data needs to evaluate progress in reaching energy efficiency goals
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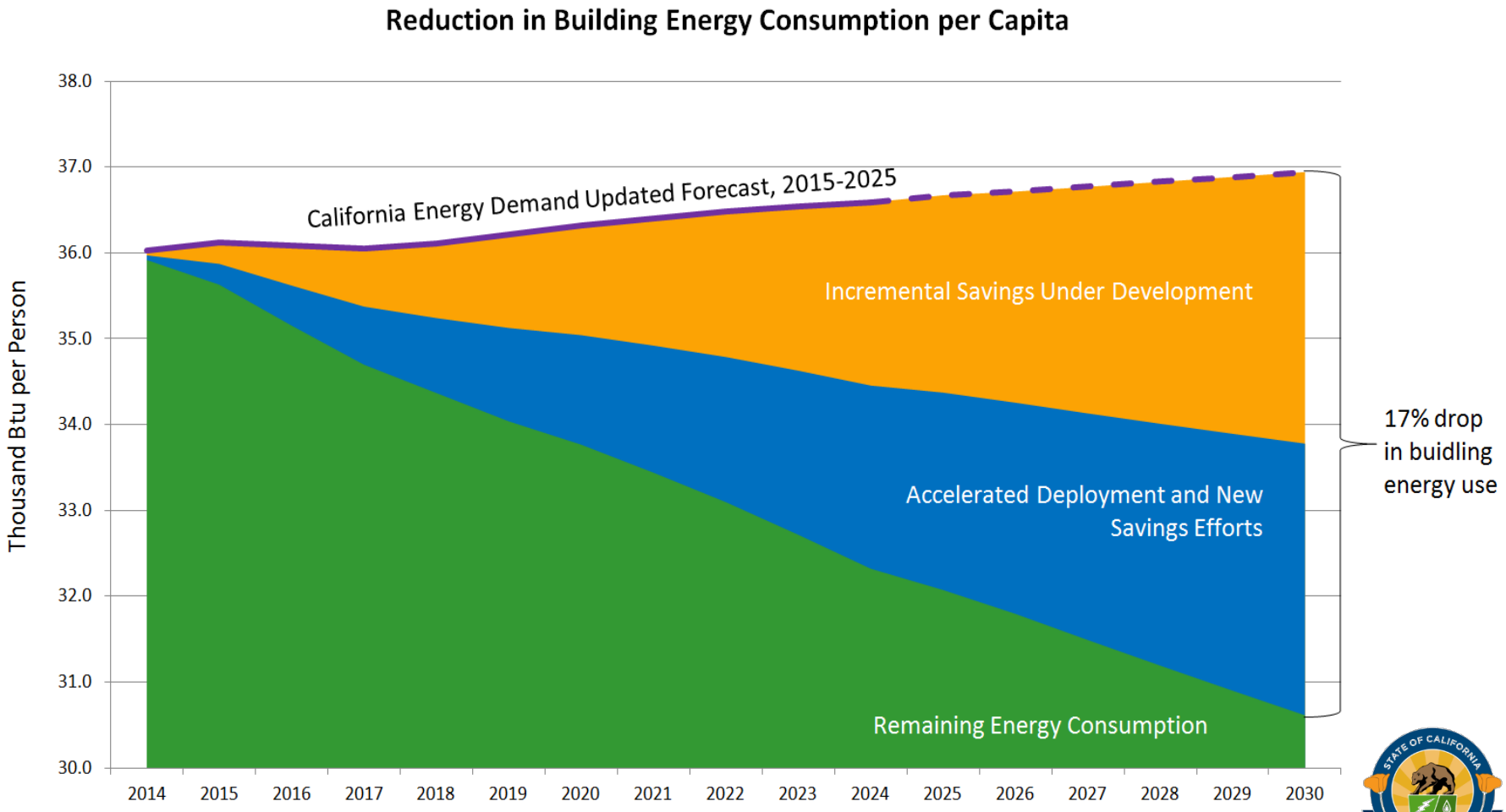
Title-20 Data Collection Workshop

Energy Efficiency Data Needs

Martha Brook, P.E.
California Energy Commission

November 16, 2016

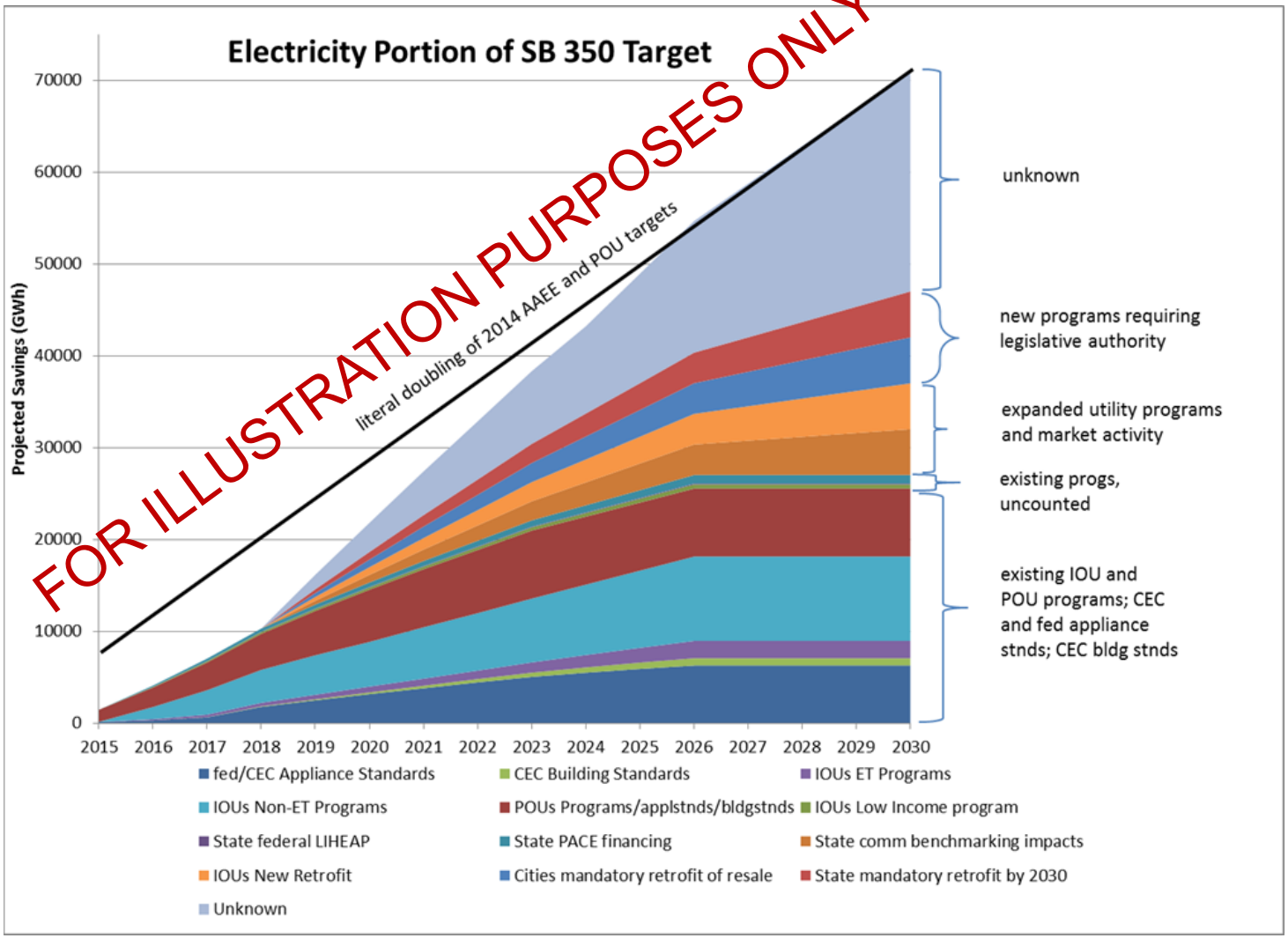
Reduced Energy Consumption by Doubling Energy Savings



Source: CEC Existing Buildings Energy Efficiency Action Plan, March 2015 draft

Existing Building EE Action Plan

- Current efficiency savings trajectory is insufficient to achieve CA's clean energy and emissions reduction goals
  - SB 350 (DeLeon, 2015) re-emphasizes aggressive energy savings goals
- Efficiency efforts will be tracked and reported
  - Integrated Energy Policy Reports- every year
  - EBEE Action Plan updates - every 3 years
- Unlocking EE potential of existing buildings requires market focused solutions
  - Data analytics to support market decisions


Electricity Portion of SB 350 Target
FOR ILLUSTRATION PURPOSES ONLY
literal doubling of 2014 AAEE and POU targets
Projected Savings (GWh)
70000
60000
50000
40000
30000
20000
10000
0
2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030
unknown
new programs requiring legislative authority
expanded utility programs and market activity
existing progs, uncounted
existing IOU and POU programs; CEC and fed appliance stnds; CEC bldg stnds
fed/CEC Appliance Standards
CEC Building Standards
IOUs ET Programs
IOUs Non-ET Programs
POUs Programs/applstnds/bldgstnds
IOUs Low Income program
State federal LIHEAP
State PACE financing
State comm benchmarking impacts
IOUs New Retrofit
Cities mandatory retrofit of resale
State mandatory retrofit by 2030
Unknown

Efficiency Program Data Needs

- Policy Development, Implementation and Tracking
  - Macro consumption modeling
  - Uncertainty analysis
  - Energy use & load shapes mapped to buildings
- Consumer & Market Decision Support
  - Energy use distributions
  - Load shape distributions

Macro Consumption Modeling

- Will be used to estimate the impacts of efficiency policies across the state, using:
  - Consumption (GWh, Mtherm)
  - Weather, energy prices, demographics
  - Building stock characteristics
  - Efficiency program descriptors

- Typically, regression analysis is used:

$$\ln(e_{it}) = \gamma_e \ln(p_{e,it}) + \gamma_g \ln(p_{g,it}) + \beta \ln(I_{it}) + \omega_h \ln(HDD_{it}) + \omega_c \ln(CDD_{it}) + \Sigma_{k=0}^{K} \delta_k EE_{it-k} + \Sigma_{m=1}^{M} \eta_m \ln(NC_{mit}) + \tau(TimeTrend_t) + \lambda_i + \mu_{it} \quad \text{(Equation 1)}$$

See pg. 7, Preliminary Findings Memo, The CADMUS Group, Inc., August 2012 – *for the CPUC*

Macro Consumption Modeling

Table 5. IOU Energy-Efficiency Program Savings and Cost of Conserved Energy Estimates

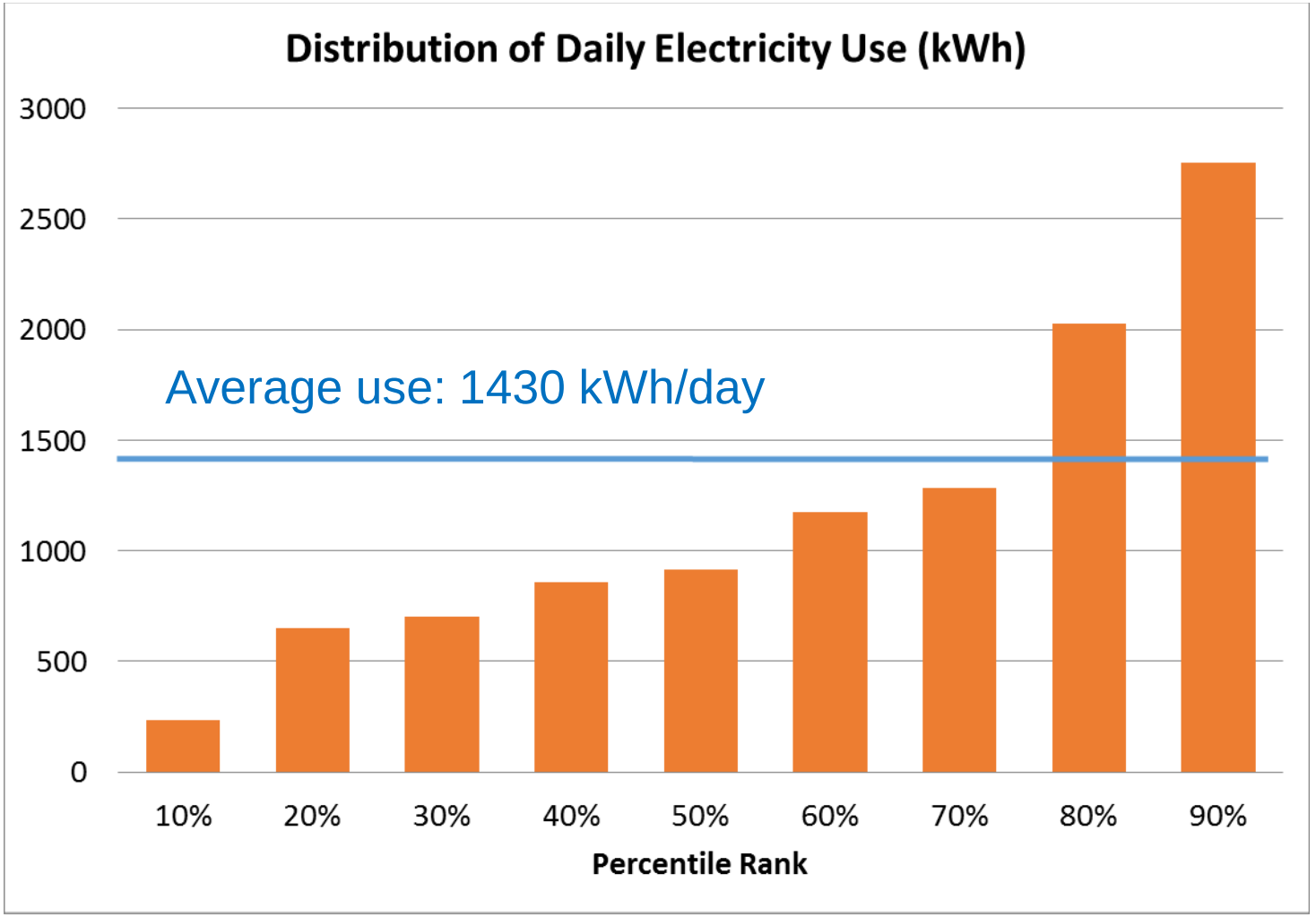
	2005	2006	2007	2008	2009	2010
Panel A: Inputs						
Consumption (GWh)	186,888	193,263	195,195	198,777	190,465	186,207
Energy-efficiency program expenditures ($)	518,481,240	307,405,693	350,768,323	339,355,140	676,311,064	704,521,516
Expenditures per capita ($)	19	11	13	12	24	25
Population (estimate)	27,072,291	27,332,409	27,648,206	27,963,216	28,197,531	28,448,916
Panel B: Savings Estimates						
Model predicted savings from current expenditures (GWh)	1,790	1,087	1,238	1,206	2,284	2,306
Model predicted savings from one-year lag expenditures (GWh)		2,823	1,671	1,920	1,765	3,409
Model predicted savings from two-year lag expenditures (GWh)			7,138	4,261	4,620	4,331
Model predicted savings from three-year lag expenditures (GWh)				442	249	276
Model predicted total savings from current and three previous year expenditures (GWh)				7,830	8,919	10,321
Panel C: Percent Savings						
Model predicted savings from current year expenditures as % of current consumption	0.9%	0.6%	0.6%	0.6%	1.2%	1.2%
Model predicted savings from one-year lag expenditures as % of current consumption		1.5%	0.9%	1.0%	0.9%	1.8%
Model predicted savings from two-year lag expenditures as % of current consumption			3.6%	2.1%	2.4%	2.3%
Model predicted savings from three-year lag expenditures as % of current consumption				0.2%	0.1%	0.1%
Model predicted total savings from current and three previous year expenditures as a % of current consumption				3.9%	4.7%	5.5%
Panel D: Cost of Conserved Energy						
Model predicted cost per kWh saved from current expenditures	$0.290	$0.283	$0.283	$0.281	$0.296	$0.306
Model predicted cost per kWh saved from one-year lag expenditures		$0.000	$0.000	$0.000	$0.000	$0.000
Model predicted cost per kWh saved from two-year lag expenditures			$0.000	$0.000	$0.000	$0.000
Model predicted cost per kWh saved from three-year lag expenditures				$0.000	$0.000	$0.000
Model predicted cost total per kWh saved from current expenditures and three previous year expenditures				$0.043	$0.076	$0.068

See pg. 34, Preliminary Findings Memo, The CADMUS Group, Inc., August 2012 – *for the CPUC*

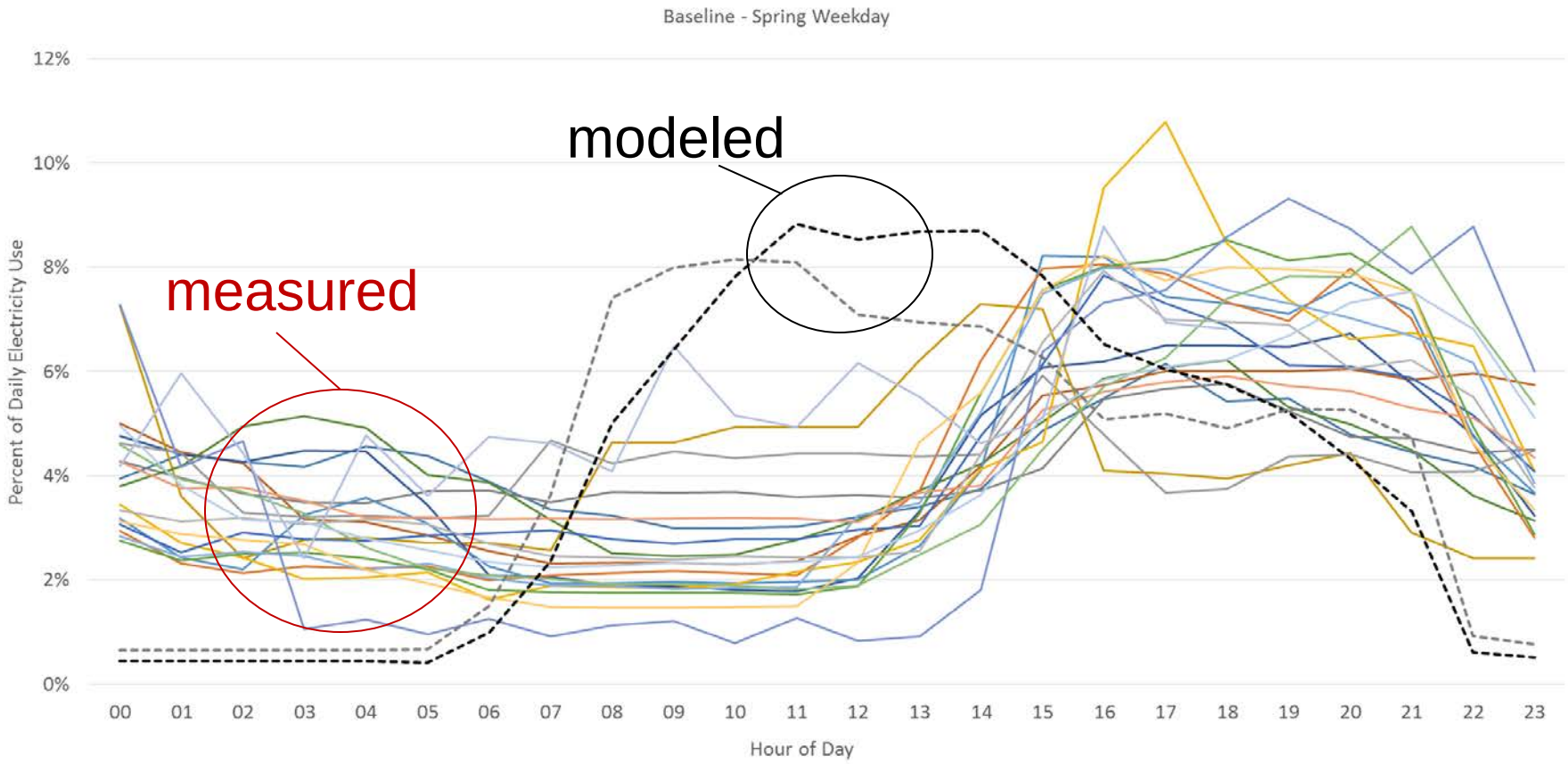
Uncertainty Analysis

- Currently, efficiency policy impacts are reported as singular estimates – without error bounds and/or levels of uncertainty
- Distributions of energy use by sector, building type, geography, and demographics are needed to improve the estimates and to understand expected ranges

Uncertainty Analysis



Uncertainty Analysis



Random sample of PG&E K-12 schools AMI data

CBECC-Com Small School Energy Simulation --- CZ 3 & CZ 12

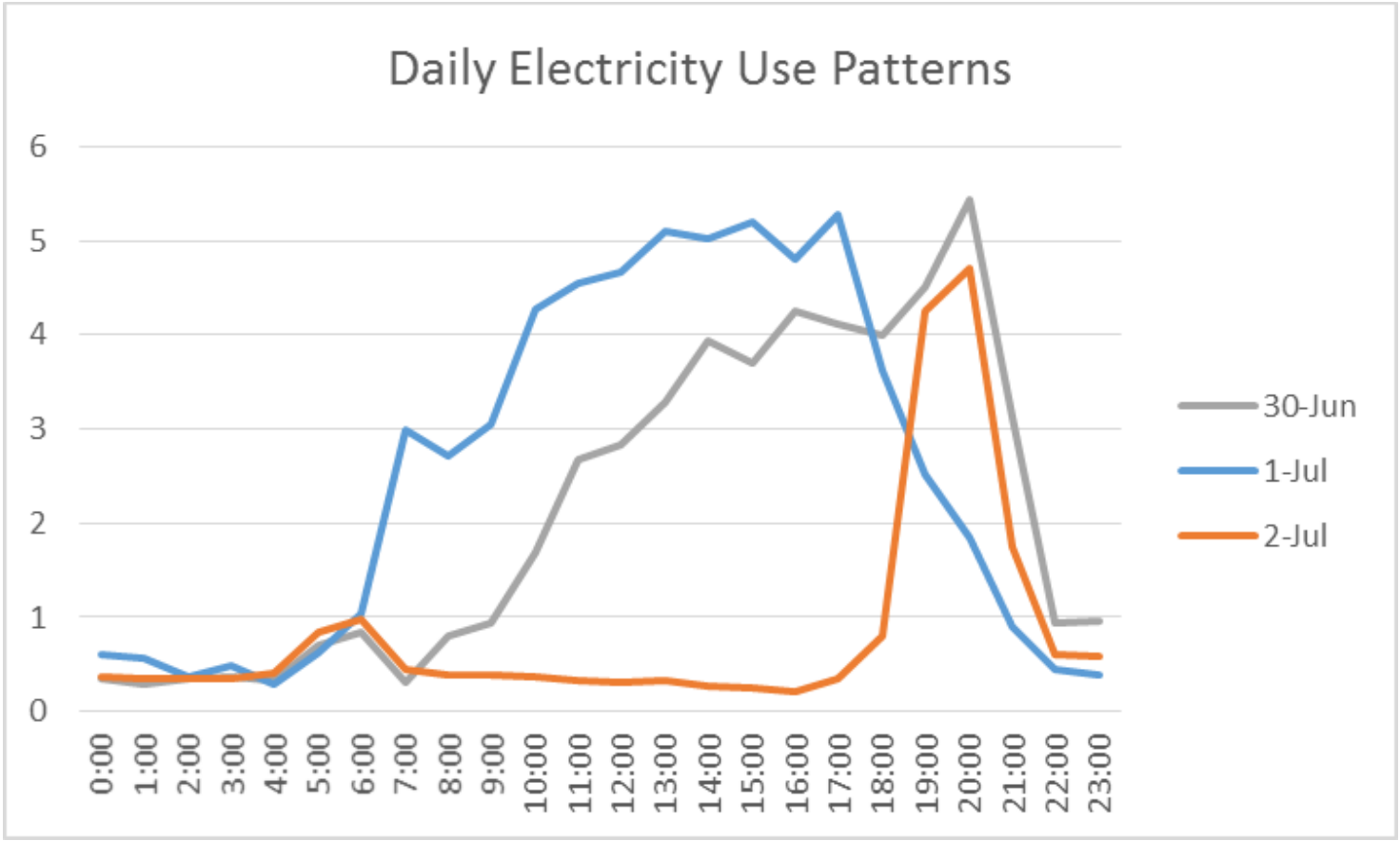
Energy Use Mapped to Buildings

Examples: City Scale Planning & Benchmarking Disclosures

City Building Energy Saver (CityBES), LBNL

Energy Use Mapped to Buildings

Example: AMI Data Analytics Test Bed Development



Consumer & Market Decision Support

Example: Distributions included in Benchmarking Disclosures