

Challenges, Opportunities, and New Tools For The Next Level of Energy Efficiency

(Draft released April 2, 2015)

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April 30, 2015

Purpose of Project

- Response to request from CA policymakers:
 - Research barriers to and opportunities for moving to the next level of EE and
 - Develop policy recommendations
- Goal:
 - Adoption of CA EE policy changes and better understanding of the role of EE in a changing energy services world

Scope of Project

- Stationary-related uses of energy (not transportation)
- Residential and commercial energy use, centered on buildings
- Focused on large-scale mobilization and delivery
- Does not address:
 - Rates
 - Water-energy nexus

Stanford Researchers

- Owen Goldstrom
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- Siddharth Fresa
- Caitlin Troyer
- Gireesh Shrimali
- Heidi von Korff
- Kim Quesnel
- Davianna Olert (summer)

Paper Reviewers

- Advanced Energy Economy (AEE)
- CA Air Resources Board (CARB)
- California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA)
- CA Energy Commission (CEC)
- CA Housing Partnership
- CA Independent System Operator (CAISO)
- CA Legislative staff
- CA Public Utilities Commission (CPUC)
- Climate Policy Initiative (CPI)
- ClimateWorks
- Center for Energy Efficiency and Renewable Technologies (CEERT)
- Energy Foundation
- LBNL
- Marin Clean Energy (MCE)
- Natural Resources Defense Council (NRDC)
- Navigant
- Pacific Gas & Electric Company (PG&E)
- Research into Action
- Southern California Edison (SCE)
- StatWizards LLC
- The Climate Registry

CA's Existing EE Policy Framework

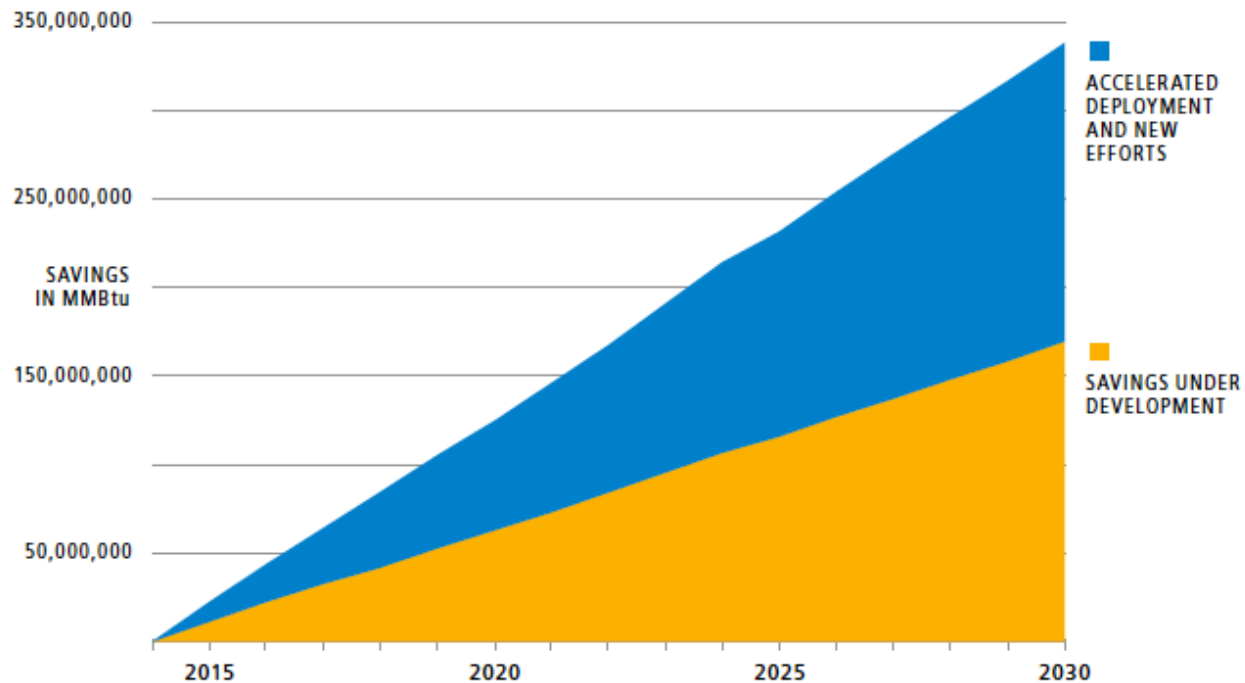
- CA Energy Commission (CEC)
 - Building codes/appliance standards/energy demand forecast/benchmarking/grants/EPIC (R&D \$)/policy development
 - Reviews POUs' EE efforts
- CA Public Utilities Commission (CPUC)
 - IOUs (80% of load), other EE program administrators (RENs, CCAs)
 - EE potential & goals/programs (over 200)/resource planning/funding (\$1B/yr)/IOU shareholder incentives/EM&V/policy/IDSM
- CARB/CAISO/DGS/CAEATFA, etc.

Current EE Framework

- Based on a framework developed over 30 years that is highly regulated, slow moving, seeking easiest, cheapest “widget” savings
- Focused on highly detailed reviews of forecasted energy savings and costs, not sustained reduction of GHG emissions or the evolving grid
- Limited attention to:
 - Leverage of private sector financing and delivery
 - Support for innovation, new technologies, new approaches
- Evaluation, measurement, and verification of results uneven (and disputed)
- Primarily delivered through a public policy/regulatory framework, which is fragmented in its development, implementation, assessment, and oversight

Governor's 2030 EE Savings Goal

DOUBLING THE 2014-2030 ENERGY SAVINGS TRAJECTORY



Source: CEC

The Big Picture:

1) There is No Silver Bullet

2) Multiple Changes are Needed

- Embracing new technologies and information (quickly and comprehensively)
- Targeting a full range of savings (below code, operational, persistence)
- Defining success and savings value based on directly measured results
- Updating policy rules and restructuring the regulatory apparatus
- Leveraging private market activity
- Tracking progress and performance
- Focusing EE on procurement of savings as well as delivery of widgets
- Valuing and expanding EE's role in the changing grid, as part of DER overall

Challenges for Reaching the Next Level of EE

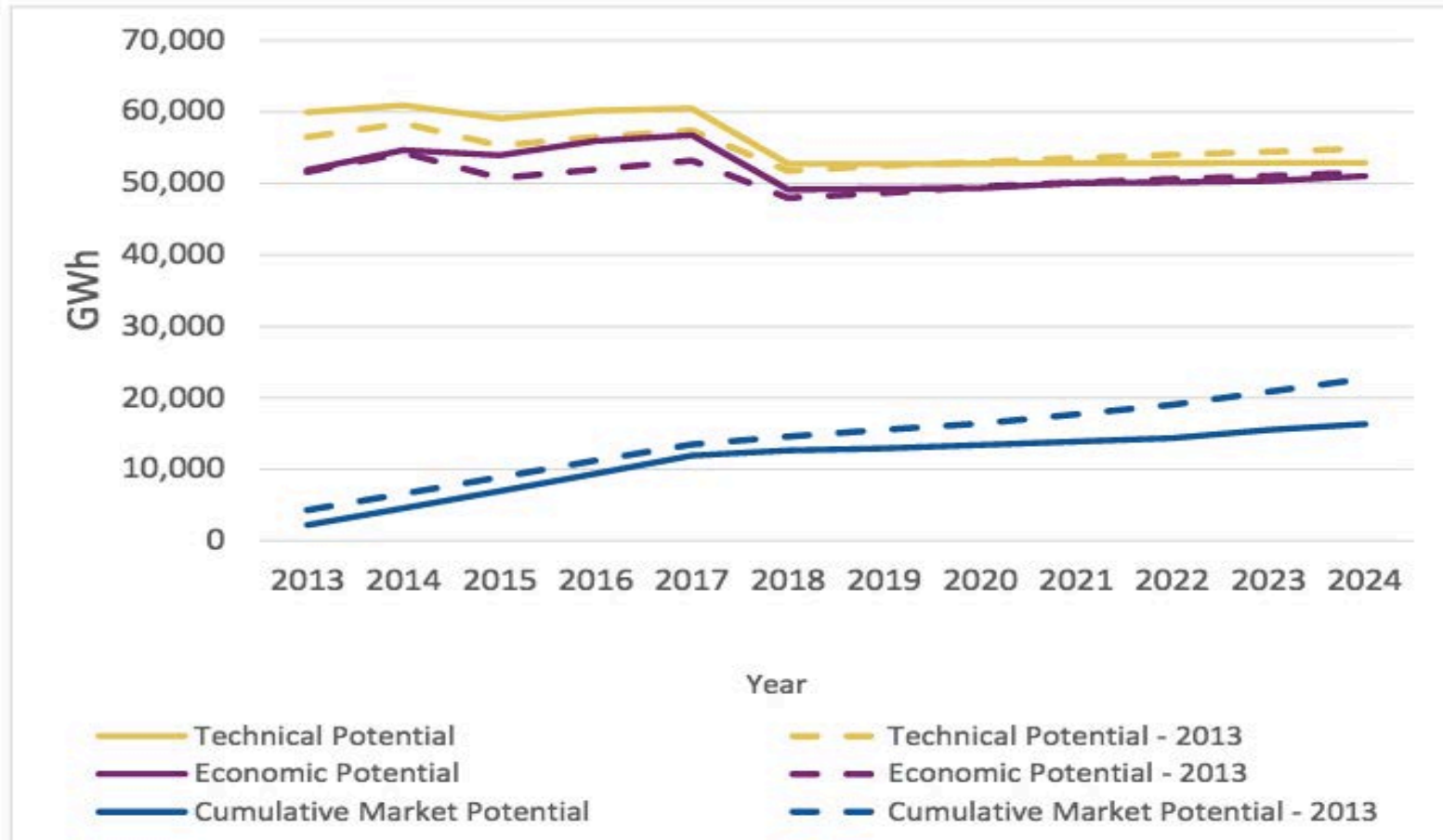
- The magnitude of EE savings must increase dramatically.
 - 2050 GHG modeling indicates that CA's efficiency savings rates must increase over 2x the historical average.
- The sources of EE savings must diversify.
 - CPUC's current rules rewarding proven lighting technologies and historic EE widgets; rules must change to diversity savings.
- Measuring and ensuring the persistence of EE savings must become commonplace.
 - Use smart meter data and data analytics, to identify changes in building energy usage and track the magnitude and persistence of savings.
 - We must also be able to accurately forecast (10 years in the future) EE savings from the measures that will be implemented.
 - By moving to a system based on measured, rather than deemed, savings, incentives for EE service providers will align directly with the goals of those programs.



Challenges cont'd.

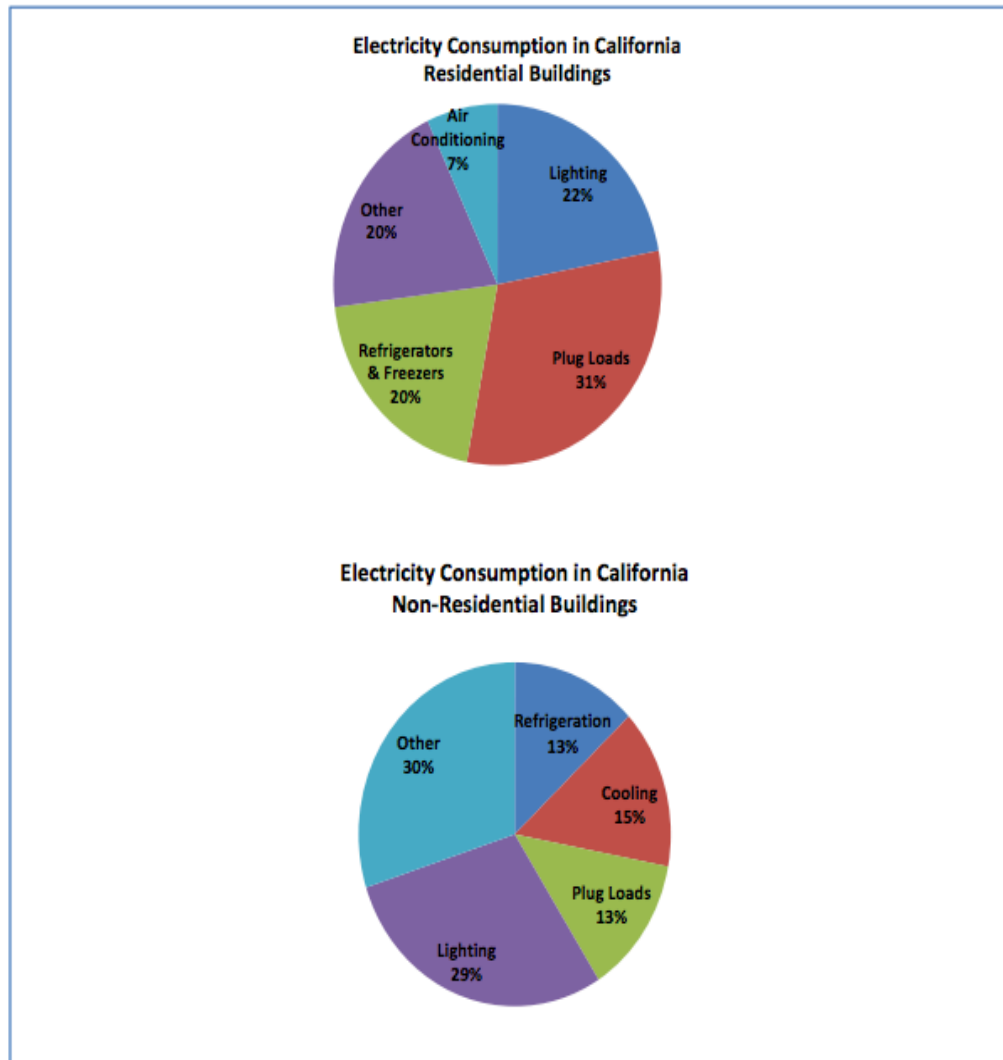
- EE outcomes must be integrated with a carbon reduction framework.
 - CA's methodologies for counting EE savings are not uniform across utilities, programs, or private actions, and thus the reliability of carbon reduction calculations from EE activities will remain uncertain absent a strong focus on developing uniform EM&V methodologies.
 - When evaluating and reporting savings from EE programs in terms of a larger carbon framework, gross savings—not net—matter.
- EE must be understood and valued as part of a larger system of utility-scale renewables, an evolving distribution grid, and distributed energy resources (DERs), esp. Demand Response (DR).
 - Much more is required to determine precisely how specific EE measures can reduce ramp rates and assist in local distribution planning and operations.
 - Taking customer specific load shapes into account can potentially revolutionize the way that utilities determine which customers they target with which EE programs and should be matched up with the net load shape when considering the EE measures to apply.
- EE must maintain its long-standing role as a cost-mitigation strategy.

CA's EE Gap

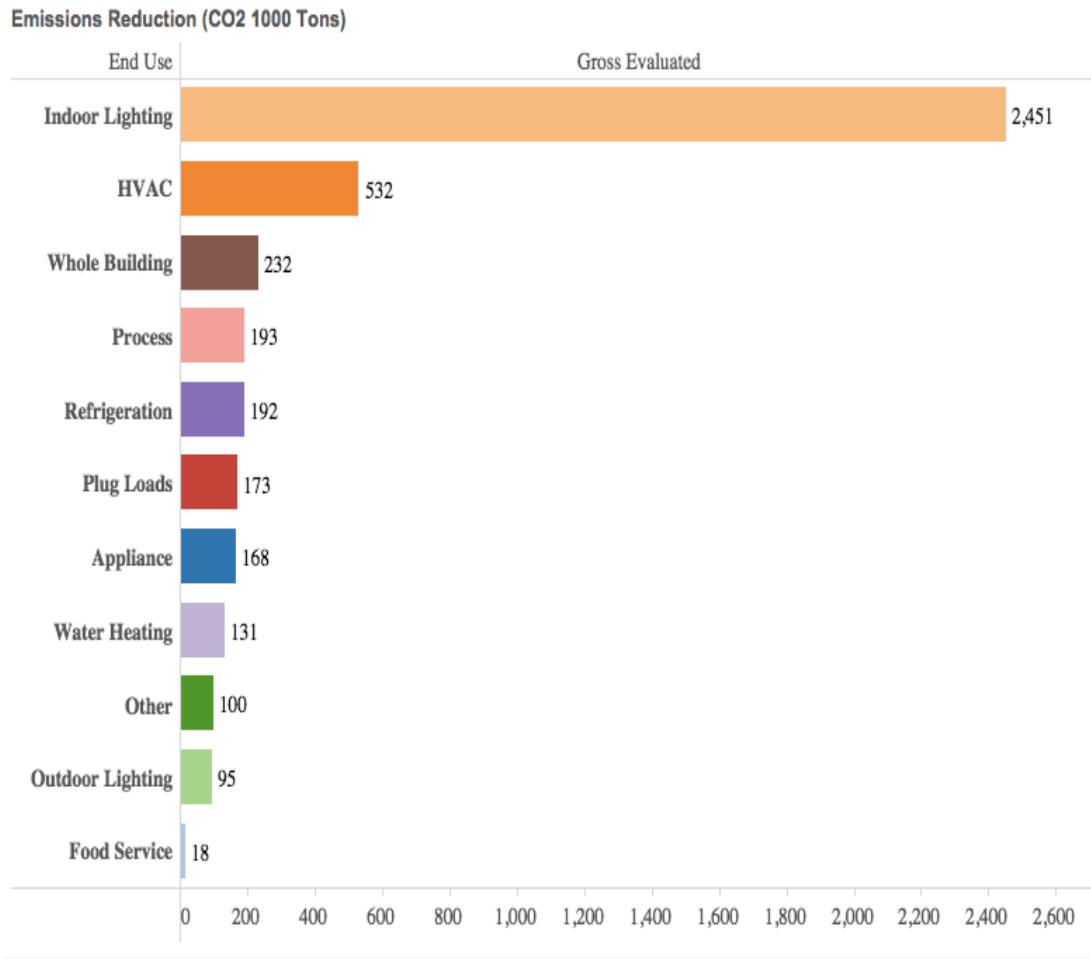


Source: Navigant, 2015 California Potential and Goals Study: Dratt Results Presentation to DAWG

CA's Building Energy Consumption



Next Level EE - Diversity



Source: CPUC
EE Data Portal

New Tools for EE's Next Level

- Intelligent efficiency (smart meter data, advanced analytics, sensors, etc.)
- New technologies (lighting, HVAC, plug-in loads)
- Behavior interventions and information
- Leveraging public financing and private investment
- Localized EE (energy/water/climate goals)

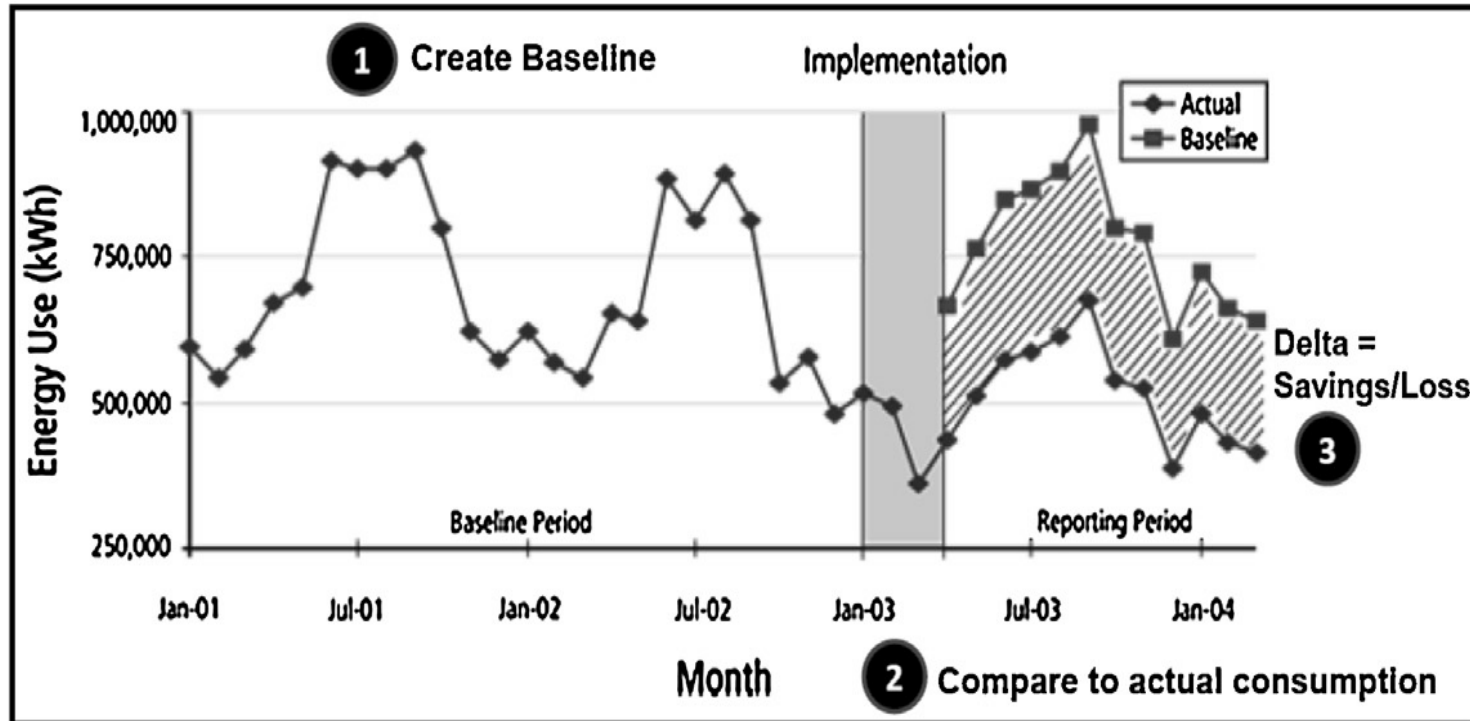
NOTE: Tools should be used in combination (e.g., programs that combine advanced data analytics with behavior interventions)

Where and How Can We Use Behavior Interventions



Source: L. Dethaman, et al., "Paving the Way for a Rich Mix of Consumer Behavior Programs," IEPEC Webinar, Feb. 2015

Metered Data and Software Analytics



Source: D. Grueneich and D. Jacot, "Scale, Speed, and Persistence in an Analytics Age of Efficiency: How Deep Data Meets Big Savings to Deliver Comprehensive Efficiency," April 2014

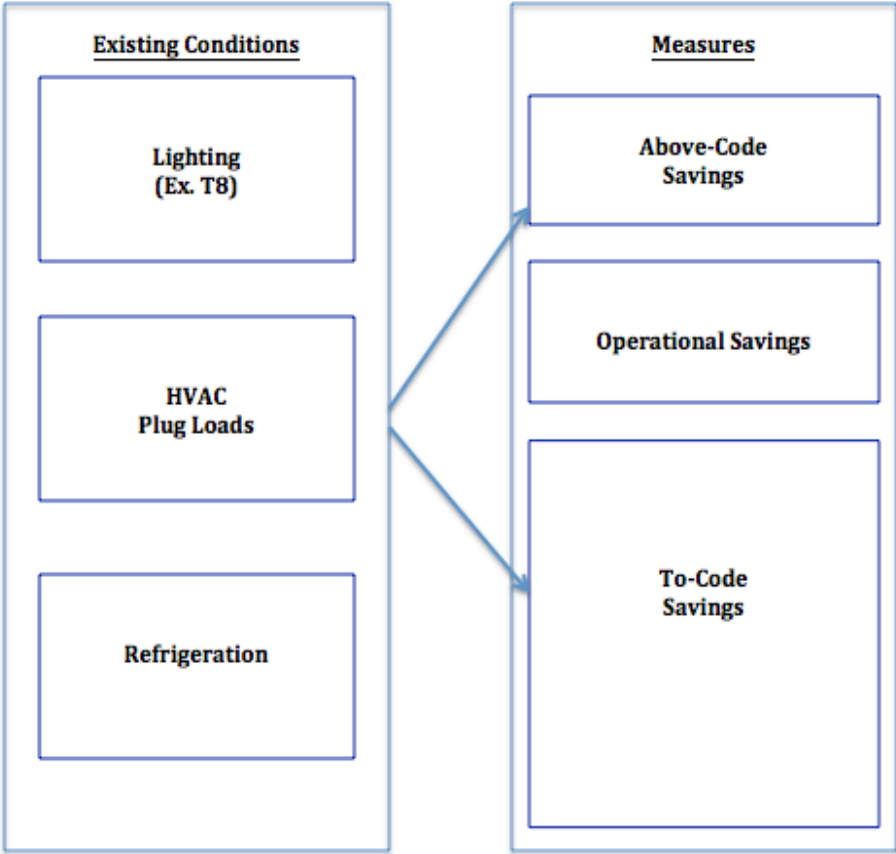
Opportunities – What Needs To Be Done

- Near term:
 - Update rules and policies
 - Enhance agency coordination and integration
 - Expedite use of IE/behavioral interventions/new technology/local EE efforts, etc.
 - Track progress and performance
- Longer term:
 - Develop EE procurement based on metered data
 - Integrate with carbon regime
 - Value and use EE in changing grid
 - Develop IDSM policies and programs, esp. EE/DR

Update Agency Rules and Policies

- Allow counting of:
 - Behavioral Savings
 - Operational Savings
 - To-Code Savings
- Update cost-effectiveness methodology (PAC test discount rate, avoided costs, non-energy benefits)(move from short-term focus)
- Adjust utility shareholder incentive mechanism

Illustrative Title 24 Code Baseline Analysis



Title 24 Code Baseline Analysis

Enhance Agency Coordination and Integration

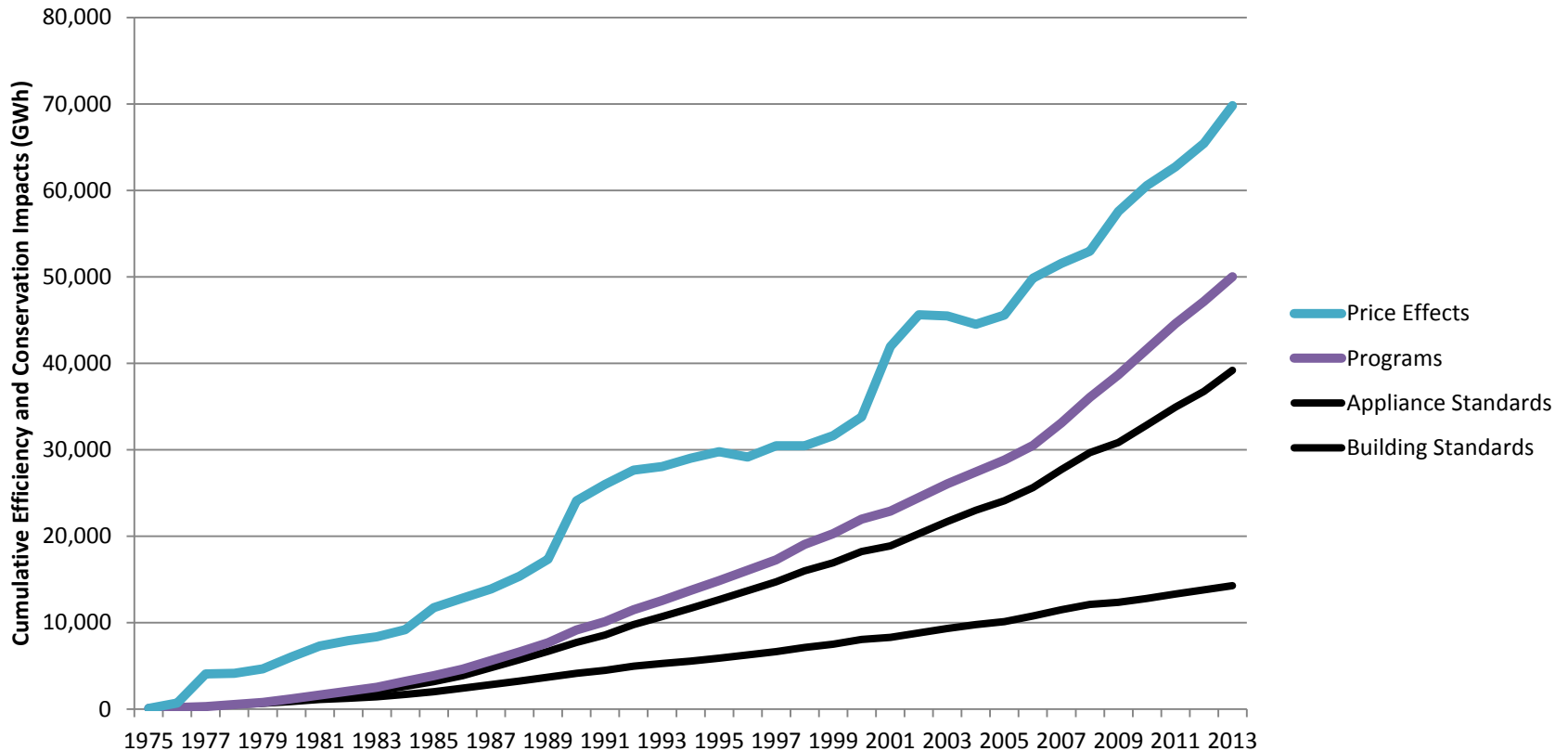
- Establish an agency Principals' EE subgroup with dedicated agency staffing
- Establish an “EE Statewide Leadership Collaborative” (be clear re mission, membership, process, outcomes)
- Working Groups: Intelligent efficiency (M&V); behavioral interventions; cost-effectiveness methodologies
- Expand use of stakeholder collaboration

Track Progress

- Establish statewide EE Tracking Progress website
- Develop new EM&V methodologies for whole building programs, new technologies, using advanced analytics, meter data
- Focus on code compliance and reporting
- Research approaches to track “market and price” EE savings

CA's Efficiency and Conservation Impacts

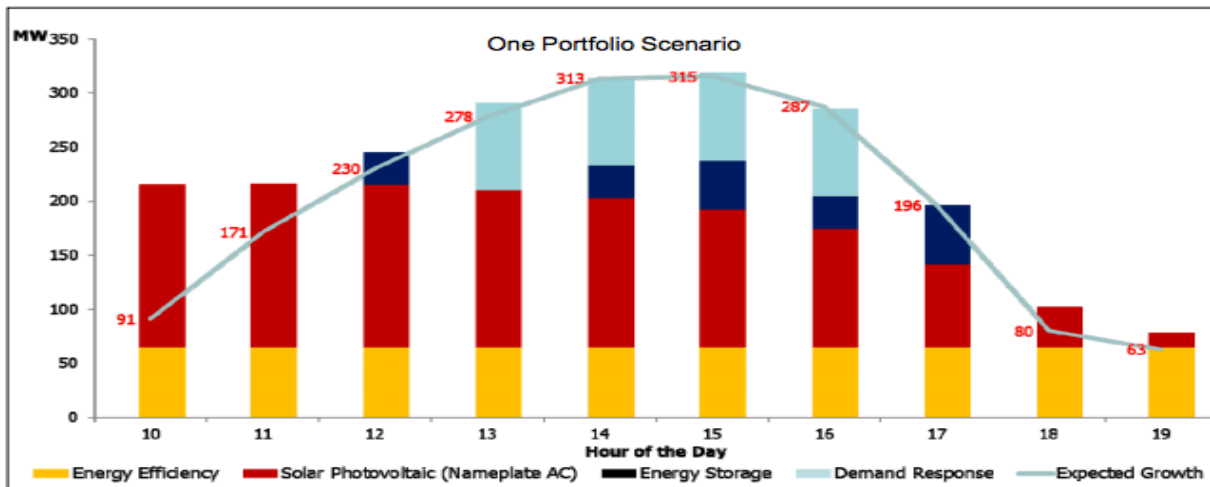
Statewide Efficiency and Conservation Impacts



Longer Term: Valuing EE as Part of the Evolving Grid

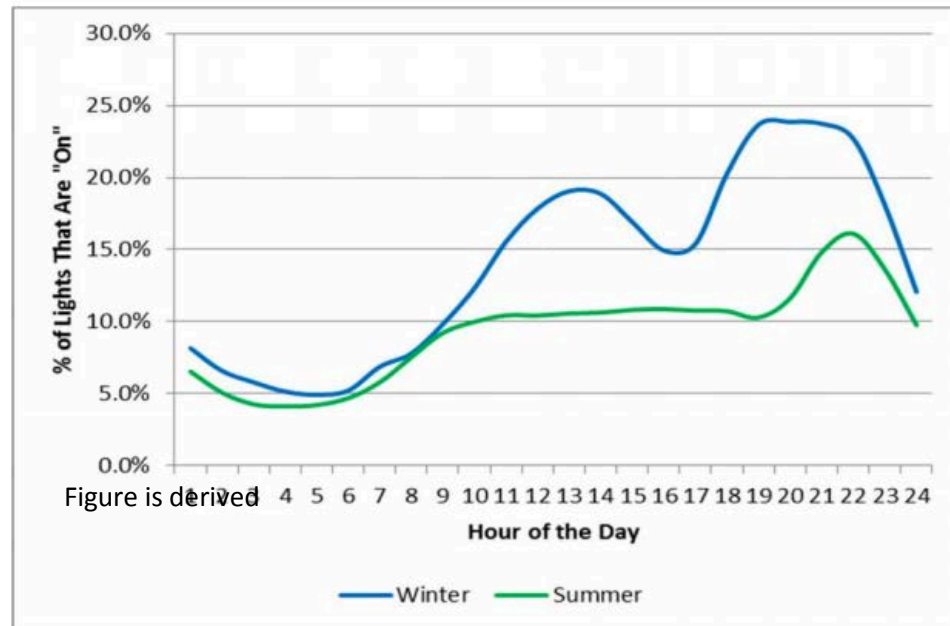
- EE can defer or avoid transmission and distribution (T&D) system investments
- EE can help integrate high levels of renewables and intermittent resources into the grid (“teaching the duck to fly”)

Value EE In a Changing Grid



Source: SCE's Preferred Resources Pilot (PRP) Annual Progress Update

Average Hourly CFL Usage Pattern



Source: Energy Efficiency as a T&D Resource: Lessons Learned from Recent U.S. Efforts to Use Geographically Targeted Efficiency Programs to Defer T&D Investments

Longer Term: Adopt (in part) EE Procurement Model

- Establish a Ten Year “EE Next Level” Program (\$1 Billion?)
 - To deliver meter-measured and persistent savings at the whole building level through competitive procurement
 - \$ flow: Utility ratepayer funding (administered via utilities or 3rd party) to aggregators who guarantee EE (and possibly DR) savings (addt’l private financing required)

Continuing Stanford Activities

- Research EE Procurement Model (issues include goals, procurement mechanism, private sector needs & roles, market demand, standardization to address risk, adjustment of utility shareholder mechanism, M&V)
- Research new tools to support the valuation and integration of EE in a changing electric grid (part of Stanford's Smart Grid 3.0 project)
- Research on establishing CA EE Principals' subgroup and/or Leadership Collaborative
- Possibly – further work on accelerated use of intelligent efficiency (esp. for M&V) and behavior interventions

Thank You!

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