

“Bundled EE Measures” Issue Statement

With the launch of the new measure development process to 3Ps, a high probability exists that new measure types will be submitted. Ideally, new measure types should be vetted proactively to recommend how these measures must be documented and to provide clarity on key considerations. Starting these discussions before the new measure development process begins may limit delays, categorize new measure ideas quickly, and improve our ability to evaluate new measure proposals consistently.

One potential new measure type is a “bundled EE measure”. A bundled EE measure is the combination of two or more energy efficient measures for which savings are developed and that are offered to end users as a single offering. Examples of bundled EE measures include: TXV + showerhead, home energy upgrade, HVAC QM, software controls + efficient HVAC system, advanced lighting controls with LEDs, HVAC controls/lighting controls, smart thermostat, heat pump water heater + DR controller (new for PG&E), and industrial pumping system upgrades. Many EE bundled measures include AOE with a “host” EE measure. Some (but not all) bundles involve interdependencies and interactive effects.

The objective of this white paper is to present key considerations and propose recommendations that will facilitate standardization/consistency.

Target Audience

Who cares about this problem? Who are we trying to persuade? Who will be able to take action?

- CEC building standards – existing buildings
 - Local gov’t/regional organizations are proactive at identifying and promoting EE bundles in support of decarbonization initiatives.
 - PAs (IOUs POU’s CCAs/RENs) CCAs are very involved to push electrification
 - Codes & standards
 - Developers, designers (architects/engineers), contractors (AS)
 - LADWP working on electrification program for homes investigating bundles. Home energy upgrade partnership with SCG uses interactive effects table. Looking at permutation approach + interactive effects table
 - Implementers and customers who need streamlined incentive offerings rather multiple paths or measures for one project. (RM)
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Potential Research / Analysis Approach

What is the analysis approach to the research that needs to be done to devise one or more potential solution(s)?

- Analysis approach will depend on measure type, channel, and application; break down approach into categories and define boundaries. (EN)
- Look for lowest hanging fruits based on market sector, building type, vintage, and climate zone. (AS)
 - Create suggested logical bundles for each combination of these permutations
- Systems / whole-building analysis possible through energy modeling platforms. (EN)
- NMEC approach (EN)
- Are there specific measure bundles that should be avoided based on relatively simple review and no modeling? Develop inventory of measure bundle permutations (based on known and potential future bundles) and identify anticipated savings interactions (e.g., none, additive, synergistic, negative) and sources of uncertainty in estimating savings. (DH)
- Are modeling errors compounded with measure bundles? Proper methodology for using AMI data to calibrate models to ensure savings interactions from specific measure bundles are accurately captured. (DH)
- Packaged analysis method for HVAC control measures, such as RCx related measures that could cover several measures bundled together. Existing tools include BOA or CBOA tool or whole-building simulation software. (RM)

Potential Data Sources (Primary and Secondary)

What are the data sources that will be analyzed? Is the data accessible?

- CEC EPIC is funding projects that can influence incentive programs to bundle EE measures
- LBNL “beyond widgets” working with various utilities to get bundles into portfolio
- DOE BTO funded PNNL/NREL to investigate bundled measures and comparing the savings modeled as one measure or separately
- Bundled measures with rooftop solar for SCE (Mudit)
- Study to examine modeled bundles vs single measures (Vrushali)
- Custom program data for multi-measure projects, if available (EN)
- Home Energy Upgrade EM&V studies (AS)

Key Technical & Policy Considerations and Challenges

What are the barriers to address this problem? What are the barriers to completing this white paper? Any timeline considerations?

Technical

- Calculation Approach: Deemed, Hybrid, Custom?
 - Note that the realization rate could be low as Henry (PG&E) mentioned that they were experiencing this issue in the Home Energy Upgrade Program when using modeled approach—although slightly better when using custom approach. (AS)

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- Marketing and Feasibility: Creating measure bundles that are able to reach a wide range of customers could be difficult. There is no “one-size” fits all so there should be different bundle types for different application types—as a start maybe you can start with one type: retrofit or new construction. (AS)
 - Commercial buildings - without lighting, utilities are looking for other opportunities. More risky measures are bundled with more certain measures
 - How do you account for communications of controls that shift usage?
 - Model measures together or separately? The interactive effects between envelope/components and the measure itself determines if modeled separately, together, or whole-building simulation
 - More interesting bundles will have deep interactive effects
 - AMI data is critical topic and it's important to bring calibration into picture. Simulation is common, but results must be trued up as an important step or savings will get cut in evaluation (See Home Energy Upgrade case study below)
 - Energy model assumptions are diluted, could be very outdated, and do not reflect actual conditions.
 - Baseline assumptions need to be considered
 - Caution when comparing modeled results b/c differing metrics, assumptions, etc. (see case studies below for example)
 - Some bundled measures can prevent unintended consequences of replacing gas furnace w/ heat pump. Leaking refrigerants can reduce benefit of electrification from gas by ~30%. Also, adding AC to buildings that do not have or need AC adds unnecessary summer peak load. Measures to bundle could include: attic insulation, radiant barrier, exterior wall insulation. (George B. provided additional details)
 - Consider incentive structure for bundled measures, base incentives on degree of GHG reduction (similar to SMUD), reward HP with low SWP refrigerants, reward combi-space and DWH systems using HPWH that are for heating only and avoiding peak from AC
 - Technical rigor based on project size (savings/incentive/system) (EN)
 - With multiple measure bundled together as one measure, the variation between the bundled measures is a lot more and it is hard to standardize the savings and analysis methodology. (RM)

Process / Implementation

- Are projects implemented and documented correctly? Was project installed as planned or are measures value engineering out?
 - Implementation challenge – implementers face challenge choosing correct implementation code out of many permutations
 - Caution to avoid overcomplicating the choices (home energy audits have followed this path previously).
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- Some bundles might not “work” in some climate zones
- Bundled measures can be more attractive to homeowner/end user
- Creating EE measure bundles encourages implementers to group measures for “deeper” savings
- Bundled measures simplify the process of installing multiple measures together.

Key Technical & Policy Considerations and Challenges (cont.)

Policy

- An area of concern is how implementation parameters, such as EUL, are calculated for bundled measures
- Some measures by themselves are not cost effective but a bundle of measures could be cost effective. Cost effectiveness at “bundle level” will better support program design.
- Carbon reduction is key metric
- In California, bundled measures are not encouraged by the regulators. (RM)
- How would bundled measures be categorized: deemed or custom? (RM)

Definition

- Bundled measure inherent assumption that everything is done at once – *is it a bundle if not installed all at once?*
- Should bundled measures be a hybrid measure?
- Bundle EE with other (non-EE) electrification measures?

Case Studies

- Home Energy Upgrade Program (Henry) ~14 measures to choose from, need 3 to qualify for rebate = many permutations. Ex ante modeled results were different than evaluation results. Evaluation results showed ex ante values ~ 80% off. Need to evaluate savings appropriately. The workpaper didn’t enable existing data; rather, assumptions were adopted from RASS, code, etc. There was not much empirical data to support assumptions and AMI data not used for calibration. AMI data used for evaluation of program. Thus, comparing ex ante values and evaluation results was comparing apples to oranges.
- The MF program took a building-specific approach. MF program and evaluation used different modeling software. Were poor evaluation results due to calibration of model or modeling software differences?

Availability of Resources to Complete Whitepaper

Are enough people able and willing to contribute to the development of this white paper? List subcommittee members here.

- White paper champion: Abhijeet Pande
- This topic is one of high interest by subcommittee members and those who attended the subcommittee meeting on April 8th: Vrushali Mendon, Armen Saiyan, Richard Ma, Abhijeet Pande, Mudit Saxena, George Beeler, Jeremiah V, Henry Liu, Chris Rogers, Eric Noller, Dave Hanna,

Value/Potential Impact

Rate the impact on the CA EE/IDSM industry (high, med, low) and describe. Is the impact commensurate with level of effort/costs required?

- Could increase market penetration of EE measures
 - Whole building impact from bundled measures
 - Bundled EE measures support higher-level statewide goals including: decarbonization/electrification, zero net energy (ZNE), and reaching stranded savings.
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Follow Up (if proceed to develop this white paper):

Vrushali – Send studies on modeled bundles vs single measures

Abhijeet – Send LBNL beyond widgets info, potential estimates