

California Behavioral Definition: Review and Recommendations

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Executive Summary

The current definition of behavior-based programs in California limits the energy savings that can be achieved by restricting programs to employ: 1) Comparative energy usage, 2) Randomized control trials, and 3) Ex post measurement. We review and synthesize recent publications within the energy social science community and identify three primary ways to improve this definition: 1) Clarify the range of target behaviors available for intervention, 2) Increase the types of strategies available for testing, and 3) Expand the list of evaluation approaches for estimating savings. Applying these suggestions, we put forth a suggested framework, based on the California behavior straw proposal (2013), which would require behavior-based programs to identify target behaviors; deploy interventions with social science-based strategies, messages and mediums; and measure savings using valid research (including statistical) methods to infer causality. A broader framework will allow for more creative, innovative and iterative approaches to behavioral program design, which in turn will increase energy savings achieved through these programs.

I. Introduction

Recent legislation in California (e.g., AB32, SB 350) has created an environment in which investor-owned utilities (IOUs) are both mandated and incentivized to engage consumers in demand-side management. While the IOUs have successfully utilized programs such as appliance codes, rebates, and direct install programs to reduce energy use in California, the energy savings that can be achieved through these programs is decreasing as the state becomes increasingly energy efficient. As a result, behavior-based programs are increasingly regarded as promising strategies to capture previously untapped energy savings.

California has been a leader in advancing the use of behavioral interventions to curb energy use, however, the state's current definition of behavior programs is narrow. In 2009, the state of California restricted behavior-based programs to comparative energy usage disclosure programs and adopted a policy to measure and count savings using experimental design methodologies contained within the California Evaluation Protocols and only credit behavior programs on an ex post basis (D. 10-04-029). This decision was upheld in 2012, and defined behavior-based programs as those that use comparative energy usage disclosure, ex post measurement, and experimental design at a minimum for 2013-2014 (D. 12-11-015). Senate Bill (SB) 488 defined comparative energy usage as "a program pursuant to which an electrical corporation or gas corporation discloses information to residential subscribers relative to the amount of energy used by the metered residence compared to similar residences in the subscriber's geographical area", limiting the definition to Home Energy Reports. However, this definition was automatically repealed on January 1, 2016, opening the path for a new definition.

The current definition of behavior-based energy programs provides an important starting point to identify what counts as "behavioral" while addressing perceived risks of double counting, persistence uncertainty, and the division of ratepayers advocates' concerns of "daunting, costly, and controversial" measurement (D. 10-04-029, p. 38). However, as the need for demand-side savings grows, so too does the need for new approaches to behavioral program design. While the reported 1-3% savings for home energy reports are promising, social science research has identified numerous behavioral strategies beyond comparative energy use that can also drive energy efficiency behavior. McKinsey & Company found that behavioral interventions could lead to 16-20% reductions in U.S. residential energy use (Frankel et al, 2013). We believe a broader framework will allow for more creative, innovative and iterative approaches, leading to additional savings and a more engaged population.

Since 2009, evaluators have been working with California utilities to refine the definition of behavior, resulting in several outputs including webinars, papers and a straw proposal with an expanded definition. With the *2013-2014 Residential Behavior Market Characterization Study* recommending to expand the definition of behavior programs and the open Energy Efficiency proceeding R.13-11-005, now is the time to revisit and offer an evidence-based approach to the CPUC definition of behavior to ensure that all possible savings can be captured (Opinion Dynamics, 2015).

This working paper presents a framework to approach behavior-based programs and capture the full range of behavior-based savings based on the Straw Proposal for EE Behavior Programs for 2015-17 (2014) which was a new definition of behavior-based programs developed by California IOUs and the Commission's Energy Division staff but never formally approved.

II. Towards A Behavior Framework

Since the current regulatory definition was adopted, researchers and evaluators have worked to expand and refine it, resulting in several webinars, papers and a straw proposal suggesting an expanded definition. Many stakeholders have pointed out that the definition of behavior programs should: include strategies including but not limited to comparative energy use, be tested using research designs including but not limited to randomized control trials, and measure savings using techniques including but not limited to ex post calculations (Illume Advising et al., 2015; Ignelzi et al., 2013; Mazur-Stommen & Farley, 2013; Todd et al., 2012). This dialogue and resulting publications identify several opportunities for improvement to allow for more creative, iterative programs and application of behavioral insights for greater energy savings. Three recommendations are discussed here, and broken down into three sections clarifying the range of target behaviors available for intervention, increasing the types of strategies available for testing, and expanding the list of evaluation approaches for estimating savings.

1. Clarify the range of target behaviors available for intervention

Informal definitions of “energy behavior” are often limited to habitual home decisions, such as turning off lights when leaving a room. However, the social science community defines energy behavior much more broadly, to include a wide range of behaviors. The International Energy Agency Demand Side Management (DSM) Program Task 24 states that, “it is important not to confuse influences on behavior, means of behavior change, or the purpose of behavior change, with what it is that is being changed...” (IEA, p.10).

A clearer presentation of what is meant by “energy behaviors” would expand the programmatic opportunities and further clarify the range of behaviors that a behavior-based intervention can target. Karlin et al. (2014) review past definitions of energy behavioral “dimensions” and find that the common distinction between “behavior” and “efficiency” is, in fact, a false dichotomy, such that the former is typically defined as including behaviors that are frequent and low-no cost and the latter including those that are infrequent and costly. However, these two variables present a 2x2 matrix which, when broken out, exposes at least three (if not more) possible behavioral categories (see figure).

	Low Frequency	High Frequency
Low Cost	Maintenance	Curtailement
High Cost	Efficiency	(n/a)

Further dimensions of energy conservation behaviors that have been proposed over the past three decades include:

- Dividing curtailement into temperature adjustments and minor curtailements (Black et al., 1985; Stern & Gardner, 1981)
- Dividing efficiency into high- and low-cost purchases and improvements (Nair, Gustavsson, & Mahapatra, 2010; Opinion Dynamics, 2011; Stern & Gardner, 1981)
- Distinguishing equipment from building envelope (Opinion Dynamics, 2011)
- The addition of a “maintenance” or “management” category (Kempton, Darley, & Stern, 1992; Kempton et al., 1984; McKenzie-Mohr, 1994; Stern, 1992; Van Raaij and Verhallen, 1983)
- Introducing the dimensions of WEMAD (Weatherization, Equipment, Maintenance, Adjustments, and Daily behavior; Dietz et al., 2009)

This research both suggests that identifying relevant dimensions of behavior is an important component in the framework and identifies additional elements or variables neglected by the curtailement/efficiency dichotomy. Research is ongoing to delineate the most useful dimensions and should be continued so that any definitions or dimensions of energy behavior are both more accurate and more inclusive of the types of specific actions on the part of end users that behavioral programs can address.

2. Increase the types of strategies available for testing

The current definition of behavior limits program strategy to comparative energy usage disclosure programs and expanding this definition has been discussed at great length in recent years. The California IOU Behavior Straw Proposal (2013) states that behavior-based energy interventions are those that “deploy one or more of the following behavior intervention strategies: a) Commitment, b) Feedback, c) Follow through, d) Framing, e) In-person and trusted community messenger interactions, f) Rewards or gifts, g) Social norms, and h) other approved methods” (p. 1). The Straw Proposal expands the definition from one to seven strategies and adds a caveat that “other approved methods” can be considered. Subsequent work has categorized intervention strategies into schema or taxonomies to “eliminate the confusion caused by the fact that typological categories tend to overlap” (Mazur-Stommen & Farley, 2013, p. vi) as well as presenting interdisciplinary lists of behavioral theories that can be applied to strategies (Ignezi et al., 2013).

There are many promising strategies and expanding the definition to include them is a vital and important step forward. However, social science-based is constantly evolving based on new research and limiting behavioral programs to a fixed list or taxonomy unnecessarily restricts the energy savings that could be generated by distinguishing and combining programmatic elements systematically.

Defining behavioral programs as a discrete set of strategies distracts from the key elements that successfully influences behavior. A behavioral intervention is comprised of various elements: namely the general approach or *strategy* taken, the *message* used in communications, and the *medium* used to reach end users (see examples on page 7). We believe a framework for behavioral programs that recognizes the distinction between these elements (strategy, message and medium) will be more effective in supporting behavioral programs that produce reliable savings and meet California’s energy goals than a definition that lists intervention strategies that may or may not actually be messages or mediums.

3. Use a range of reliable research methodologies to infer causality

The current definition of behavior requires that programs are evaluated using randomized control trials (RCT) and ex post measurement. While the RCT is certainly the “gold standard” for inferring causality of a treatment or intervention, there are limits to the types of programs that can be tested via RCT. This methodological restriction thus limits the types of behavioral programs that can be offered. Additional methods have been widely accepted in social science for decades for estimating the impact of behavioral interventions in fields varying from health to education. Specifically, quasi-experimental methods are considered a reliable alternative form of measurement when randomization is not feasible (California IOU Straw Proposal, 2013; Illume Advising, 2015; Todd et al., 2013).

With the availability of frequently sampled smart meter data, measured or “pay for performance” savings can also be calculated for interventions in real-time in addition to ex post and ex ante approaches. Evaluations and methodologies should be designed to be sensitive to the risk of double-counting, and steps should be put in place to try to distinguish behavior savings from any technology-related savings that might already be claimed through a deemed measure program. Todd et al. (2013) define evaluability “in the sense that energy savings impacts must be: quantified through accepted industry methods... and quantified in a manner that allows comparisons across programs (i.e., average percent saving).”

III. Revised Behavioral Framework

The proposed framework below presents a modified version of the CA IOU Behavior Straw Proposal (2013) that addresses the three points above - clarifying the range of target behaviors available for intervention, increasing the types of strategies available for testing, and expanding the list of evaluation approaches for estimating savings.

1. Behavioral Program Framework

Behavior-based energy programs use social science to develop interventions that influence energy related behaviors (elimination/reduction of kW, kWh or Therms). These approaches, in the absence of or complementing other rebated or measure-based programs, employ a range of reliable research methodologies to infer causality, estimate savings, and attribute savings across multiple programs as applicable, and avoids double counting by distinguishing behavioral savings from any technology-related savings that will be claimed through a deemed measure program or some other means.

These programs require the following steps:

1. Specify the range of behaviors the program is seeking to change. Energy saving behaviors may include a variety of different types of actions from changes in technology settings to technology maintenance practices as well as reducing or avoiding the use of technologies and (potentially) the choices to acquire more efficient technologies that result from a particular behavioral intervention (referred to as program lift).
 2. Deploy one or more **program intervention(s)** to encourage customers to engage in the target behavior(s) based on applied social science. Program interventions are comprised of:
 - a. Strategies, including but not limited to:
 - i. Commitment
 - ii. Feedback
 - iii. Reminders [to encourage follow through]
 - iv. Incentives
 - v. Modeling
 - b. Messages, including but not limited to:
 - i. Social norms
 - ii. Loss aversion
 - iii. Perceived benefits
 - iv. Choice frame (i.e., default setting)
 - c. Mediums, including but not limited to:
 - i. In-person / trusted messenger
 - ii. Direct mail / email
 - iii. Website / social Media
- See next page for strategy, message, and medium definitions.*
3. Measure savings via a **research design** that uses accepted industry methods and allows comparisons across programs to infer causality of programs and/or program components.

2. Behavioral Intervention Strategies Definitions

Steps	Variable	Description
Intervention Strategies	Commitment	Encourage individuals or firms to commit to executing a specific action. The act of stating one's intentions and planning for action can increase motivation, learning, and follow through.
	Feedback	Energy use information is given to the customer frequently (e.g., in real time, daily or weekly), particularly compared to a benchmark.
	Reminders	Reminders of prior commitments can increase follow through.
	Goal-setting	The process of setting a goal and creating a plan to reach it can help move people from intention to action, and increase follow through.
	Incentives	Monetary or non-monetary rewards or gifts in recognition of achievement or intention to act can positively reinforce behaviors and/or encourage reciprocity on the part of the receiver.
	Modeling	Demonstrating a behavior can foster a social norm and encourage reciprocity on the part of the receiver.
	Competition or Gamification	Incorporating game mechanics such as points and levels can increase motivation and follow through.
Message Framing	Social norms	Information about the behavior of one's social group.
	Loss aversion	Information about deadlines and potential losses if an action is not taken.
	Identity	Messages that emphasize a salient personal identity (e.g., religion, gender, values).
	Personalization	Efforts to personalize/customize information or provide personalized assistance can improve outcomes.
	Choice presentation	How options are presented to a viewer, including the default setting, and the number or order of choices.
Medium	In-person / trusted messenger	Direct outreach from another person.
	Direct mail / Email	Paper or email delivered to the person's home or inbox.
	Website / Social Media	Publicly available; hosted on website or social media.
	Groups / Institutions	Communicated through an existing community group or institution, such as a school, church, or place of business.

3. Examples based on current and potential IOU offerings:

The following examples apply the expanded definition to four behavior-based energy programs. Only the first program is acceptable in both the current and proposed expanded definition. By expanding the definition, the latter three could be added as “Energy Conservation Behavior Programs”.

Example 1 - Home Energy Report

1. Identify target behavior(s):
 - Efficient maintenance / management of appliances and/or building envelope
 - Efficient use of home appliances, lighting, HVAC systems, and/or electronics
2. Deploy program intervention:
 - Strategy: Feedback
 - Message: Social Norms
 - Medium: Mail / email
3. Measure savings via research design:
 - Randomized control trial with ex-post measurement

Example 2 - Home Energy Check-up (SW Residential Universal Audit Tool)

1. Identify target behavior(s):
 - Purchase and installation of efficient appliances, lighting, and/or building envelope upgrades
2. Deploy program intervention
 - Strategy - Commitment
 - Message - Social Norms
 - Medium - Website
3. Measure savings via research design
 - Ex-ante savings calculation with measured participation

Example 3 - School program

1. Identify target behavior(s):
 - Purchase and installation of efficient appliances, lighting, and/or building envelope upgrades
 - Efficient maintenance / management of appliances and/or building envelope
 - Efficient use of home appliances, lighting, HVAC systems, and/or electronics
2. Deploy program intervention
 - Strategy - Competition, Planning Prompts
 - Message - Identity, Social Norms
 - Medium - Groups / institutions, In person/trusted messenger
3. Measure savings via research design
 - Quasi-experimental design with ex post and/or measured savings via smart meter

Example 4 - Observability to increase program participation (Yoeli et al., 2013)

1. Identify target behavior(s):
 - Enrollment in SmartAC program
2. Deploy intervention
 - Strategy - Public Commitment, Rewards, Feedback
 - Message - Social norms, Loss aversion
 - Medium - In person, Direct mail/email
3. Measure savings via research design
 - Experimental design measured programmatic lift over traditional outreach approaches

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