Exploring Deep Savings:
A Toolkit for Assessing Behavior-Based Energy Interventions

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Is Feedback Effective?

- 100+ studies conducted since 1976
- Total n = 256,536 (mean 119/study)
- Mean r-effect size = .1174 ($p < .001$)
- Average energy savings: 9%

Significant variability in effects
(from negative effects to over 20% savings)

Is Feedback Effective?

It depends…

Moderators identified in meta-analysis

• Study population (WHO?)
• Study duration (HOW LONG?)
• Frequency of feedback (HOW OFTEN?)
• Feedback medium (WHAT TYPE?)
• Disaggregation (WHAT LEVEL?)
• Comparison (WHAT MESSAGE?)

Methodological Limitations

1. Not naturalistic
   - Participants generally recruited to participate
   - May be different from “active adopters”

2. Not comparative
   - Most studies tests one type of feedback (vs. control)
   - Very few studies isolating or combining variables

3. Not testing mediation
   - DV is energy use, but studies rarely test possible mediators to explain effectiveness

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If you build it,

Will they come?
Does it work?

Program x \rightarrow Outcome y

Does program x lead to outcome y?
Questions remain…

What is going on here?

What is the program?

How do we measure outcomes?

Does program x lead to outcome y?
A theoretical approach

Program x

Hypothesis / Theory

Outcome y

Clearly defined and operationalized

Metrics tested for reliability & validity

Does program x lead to outcome y?

How and for whom does program x lead to outcome y?
How and For Whom?
How and for Whom?

- Intervention
- Experience
- Knowledge (changes)
- Attitudes (changes)
- Behaviours (changes)
- Impact (kWh)

For Whom? (moderation)
- Context
- Knowledge (pre)
- Attitudes (pre)
- Behaviours (pre)
### Stanford Binet Intelligence Scale

<table>
<thead>
<tr>
<th>Category</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genius</td>
<td>Over 140</td>
</tr>
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<td>Very Superior</td>
<td>120 - 139</td>
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<td>Dull</td>
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<tr>
<td>Borderline Deficiency</td>
<td>70 - 79</td>
</tr>
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<td>Moron</td>
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Toolkits in other fields

**Stanford Binet Intelligence Scale**

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![Bar chart comparing Control Group and Experimental Group performance across different areas]
How awesome is our blog content?

- Out of this world awesome
- Pretty awesome
- I enjoy it a lot
- I like it
- I don't like it
Question Bias

Closed Ended Question:
How much time do you spend studying?
A) 1-8 hrs  B) 9-18 hrs  C) > 18 hrs

Open Ended Question:
Tell me about your study habits....
Question Bias

or
Psychometrics

- Theory and technique of measurement: knowledge, abilities, attitudes, traits
- Construction and validation of instruments: questionnaires, tests, assessments
Psychometrics

Psychometric Properties

1. Factor Structure
2. Reliability
3. Criterion Validity
4. Sensitivity

Factors within the environment
Factors within the test
Factors within the respondent
Our Project

IEA DSM Task 24

Consultation

Feedback

Initial concept paper

Methods review

Toolkit

Pilot testing

Member country testing

SCE Psychometric testing

PG&E Field testing (scheduled)

Report for IEA Karlin et al., 2015

2013  2014  2015  2016
Methodological Review

- Literature search conducted to identify all studies between 2003 and 2013
  - 315 behaviour-based energy intervention studies identified

- Review of four key criteria resulted in 230 papers excluded from analysis
  - 85 behaviour-based energy intervention studies retained

- Coding sheet developed and each study coded according to the same criteria

<table>
<thead>
<tr>
<th>Intervention Type</th>
<th>Measures</th>
<th>General Info</th>
<th>Data Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commitment</td>
<td>Context</td>
<td>Year published</td>
<td>Surveys</td>
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<tr>
<td>Audits</td>
<td>Behaviour</td>
<td>No. of participants</td>
<td>Interviews</td>
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<tr>
<td>Workshops</td>
<td>Attitudes</td>
<td>Qualitative data</td>
<td>Focus Groups</td>
</tr>
<tr>
<td>Media Campaigns</td>
<td>Knowledge</td>
<td>Quantitative data</td>
<td>Participants</td>
</tr>
<tr>
<td>Feedback</td>
<td>User Experience</td>
<td>Qualitative data</td>
<td>Type of Data</td>
</tr>
<tr>
<td>Incentives</td>
<td>Specific Scales</td>
<td></td>
<td>When Collected</td>
</tr>
</tbody>
</table>

Data Collection Methods Used

- Other: 11
- Focus Group: 9
- Interview: 25
- Survey: 62

Instruments Provided?

Toolkit Development
Energy Cultures Frameworks

Have

Think

Do
**Toolkit Development**

- **Insulation**
- **House structure**
- **Heating devices**
- **Energy sources**

**Material Culture (Have)**
- What type of dwelling do you live in?
- Which of the following appliances do you own? (Space heater, dishwasher, central AC, etc.)
Toolkit Development

**Beliefs (Think)**

*Environmental Concern*
- I consider myself to be an environmentalist

*Norms (Personal and Social)*
- I feel a strong personal obligation to conserve energy.
- Most people are not willing to make changes or sacrifices to protect the environment.

*Efficacy (Performance and Response)*
- I can think of at least one thing that I can do to decrease my energy usage.
- If I conserve, it will have a positive societal impact.

*Motivation*
- How much does each of the following factors affect your household energy use? (Environmental impact, cost of energy bill, convenience, etc.)

*Behavioral Intention*
- During the next six months, I intend to (limit time in shower, turn off lights when not needed, etc.)

**Expected warmth levels**

**Maintaining traditions**

**Social expectations and aspirations**

**Environmental concern**
Toolkit Development

Behaviors (Do)
- How frequently do you: (Limit time in shower, turn off lights when not needed, etc.)

- Turning on heater
- Drawing curtains
- Putting on jersey
- Maintaining heating technologies
Toolkit Development

Control Group

Energy Culture at start

Think

Do

Have

Energy Culture at end

Natural changes

Treatment Group

Energy Culture at start

Think

Do

Have

Energy Culture at end

User experience
Technology interaction

Intervention
Toolkit Development

User Experience (UPscale)
Ease of Use
• I feel very confident interpreting the information provided to me.
• A person would need to learn a lot in order to understand this _____________.
Engagement
• I do not find this _____________ to be useful.
• I think that I would like to use this _____________ frequently.

Energy Culture at start
- Have
- Think
- Do

User experience
Technology interaction

Energy Culture at end
- Have
- Think
- Do

Intervention
Next Steps

1. Psychometric testing (SCE)
2. Local field testing (PG&E / SCE)
3. Member country review
4. Global field testing
5. Wide scale adoption? 😊
Thank you!
(comments and suggestions welcome)

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