Evaluation of Market Transformation Programs: An Introduction

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Overview

- Module 1. Evaluation principles
- Module 2. Types of program evaluations
Market Transformation: Adoption Curve

- **Early Market Adoption**: Utility Incentive Programs
- **Emerging Technologies**
- **Mainstream Market Adoption**: Diffusion of practices throughout the market
- **Building Energy Codes and Voluntary Standards (LEED, etc.)**

- **Education and Training**
- **Leverage Existing Market Initiatives**

Market Penetration

Time
Evaluation of Market Transformation Programs

Evaluation Principles
Evaluation Purposes

Program evaluations are often done for the following reasons:

1. Document stated program activities, outputs, impacts and effects
2. Provide feedback to program management
3. Determine if program is being implemented as planned
4. Assess actual program impacts and effects
5. Identify opportunities for program improvement
6. Meet a statutory or regulatory requirement
Energy program evaluation sometimes emphasizes four main principles:

1. Undertaking baseline studies and periodic data collection to understand the nature and size of the pre-program market and changes in the market over time

2. Leveraging existing program, market and customer data to minimize program evaluation costs

3. Using multiple lines of evidence to increase the credibility, validity and reliability of evaluation findings

4. Review and approval of completed evaluation studies by stakeholders
Evaluation, Accountability & Reporting

- **Internal Oversight:** Senior Management
- **External Oversight:** Energy Commission

**Evaluation**

**Clients:** Marketing, Sales, Program Delivery, Forecasting, Customers

**Peer Review**
Quantitative Evaluation

- Quantitative evaluation and reporting refers to data and analysis that is quantitative in nature.
- There is some type of metric that is related to variables of interest (number of products purchased, number of program participants, energy savings, demand savings), and data is collected through surveys, on-site measurement, metering.
- Advantages of properly planned and executed quantitative evaluation and reporting include:
  - Permit generalizations to be made about large populations on the basis of representative samples.
  - Under suitable identifying conditions they allow for causal inferences on impact of variables on outcomes.
  - Allow other researchers to confirm or disconfirm research findings.
Qualitative Evaluation

- Qualitative evaluation and reporting refers to data and analysis that is qualitative in nature.
- Emphasis is on understanding the perspectives of target participants through direct interaction or direct observation, and data is collected through observations, in-depth interviews and focus groups.
- Advantages of properly planned and executed qualitative evaluation and reporting:
  - Permits deeper understanding of customer perceptions, needs, values and decision processes.
  - Allows for interaction between hypothesis formation and hypothesis testing.
  - Generates insights that can be subsequently examined quantitatively.
Internal Validity

- According to Trochim, “Internal Validity is the approximate truth about inferences regarding cause-effect or causal relationships. Thus, internal validity is only relevant in studies that try to establish a causal relationship …for studies that assess the effects of social programs or interventions, internal validity is perhaps the primary consideration.”

- In energy program evaluation, we would like to be able to conclude that the program or treatment made a difference – it reduced peak, reduced energy, or both

- Key question: are observed changes attributable to the DSM/MT program or intervention and not attributable to some other possible cause
External Validity

- Again re Trochim, “external validity is the degree to which the conclusions in your study would hold for other persons in other places and at other times.”

- There are two major approaches to external validity: the sampling model and the proximal similarity model

- Sampling Model: (1) identify the population you would like to generalize to; (2) draw a representative sample from that population and conduct research with the sample; (3) generalize results back to the population

- Proximal Similarity Model: (1) think about different generalizability contexts and develop theory about which contexts are more like our study and which are less so; (2) place different contexts in terms of their relative similarities; (3) generalize the results of our study to other persons, places or times that are more alike
Research Designs

- Research design refers to the structure of the research elements – we use a concise notation to refer to these research elements.

- Observations or measurements are represented by an O to represent observations of different measures and/or at different times.

- Treatments or programs are represented by X with multiple X’s for multiple treatments.

- Assignment to a group is represented by a letter at the beginning of each line with R for random assignment and N for nonequivalent groups.

- Each treatment or comparison has its own line, and subscripts can be used to distinguish different groups.
Some Common Research Designs

- **Experimental study.** Participants are randomly assigned to a treatment or a control group, with pre and post measurements
  
  R: O X O
  
  R: O O

- **Quasi-experimental study.** Participants choose a treatment or comparison group, with pre and post treatment measurements
  
  N: O X O
  
  N: O O

- **Observational study.** After the treatment, participants and non-participants are measured
  
  N: X O
  
  N: O
Evaluation of Market Transformation Programs

Types of Evaluations
Four Main Types of Evaluations

1) **Process** - the how and the why → program improvement

2) **Market** - the what and the where → program improvement

3) **Impact** - shorter term direct effects → attribute to program

4) **Market Effects (Transformation)** - longer term effects → attribute to program
Some Key Evaluation Questions

- Energy program evaluations include process, market, impact and market transformation evaluations.

- For process evaluations, key issues include: (1) how satisfied are participants with the program, and (2) how effective and efficient are program activities?

- For market evaluations, key issues include: (3) how much of the market has been captured by the program, and (4) what is the remaining market potential?

- For impact evaluations, key issues include (5) what are gross impacts on energy and peak demand, and (6) what are net impacts on energy and peak demand?

- For market effects (transformation) evaluations, key issues include (7) what is the pre-program baseline, and (8) what are the market effects on energy and demand.
Process Evaluation

➢ **Purpose/Objective**
  - Improve program design, implementation, operation, and delivery

➢ **Timing** - Usually during the program

➢ **Methods**
  - Examples - interviews, surveys, review tracking system files

➢ **Key Outcomes** -
  - Documentation of program operations/logic
  - Assessment of process/operation/design effectiveness against expected or planned performance/customer satisfaction
  - Recommendations/suggestions to improve program
Market Evaluation

➢ **Purpose/Objective**
  - Assess share of the market captured and the remaining potential

➢ **Timing** – After at least one year of program activity

➢ **Methods**
  - Examples - interviews, surveys, shelf stock studies, demand and supply models

➢ **Key Outcomes** -
  - Documentation of stocking, sales and installation behavior
  - Assessment of market barriers
  - Recommendations/suggestions to improve program
Impact Evaluation

Purpose/Objective

- To estimate the energy savings caused by a program net of savings that would have occurred in the absence of the program.

Timing

- Usually at least one year after program launch.

Methods

- Data collection - program files, surveys, billing information, M&V, deemed savings.
- Engineering algorithms, statistical/econometric analysis.

Key Outcomes

- Net energy and demand savings.
- Estimates of direct program spillover.
- Estimates of free riders.
- Estimates of non-energy impacts (increased productivity, reduced GHG emissions).
Impact Evaluation - Net Effects

Net Energy Savings = Gross Energy Savings + Program Spillover - Free Riders

Net Energy Savings = Gross Energy Savings + Additional savings

Program Spillover

Free Riders

Savings not caused by program
Market Effects (Transformation) Evaluation

➢ Purpose/Objective
  - To estimate the magnitude of energy savings associated with a change in the structure or function of a market or behaviour of market participants that is caused by an EE program

➢ Timing - Usually at least one year after program launch

➢ Methods
  - Data collection - surveys, interviews, in-store research, baseline measurement
  - Engineering algorithms, statistical/econometric analysis

➢ Key Outcomes -
  - Net incremental energy and demand savings
Bringing it all together(1)

- **Energy Savings**
- **Time**
- **Program Launch**
- **Measurement**
- **Baseline (no Program)**
- **Savings we can attribute to Program**

Reliable power, at low cost, for generations. Reliable power, at low cost, for generations. Reliable power, at low cost, for generations. Reliable power, at low cost, for generations.
Bringing it all together (2)

Gross Program Savings

Direct Measured Savings (Participants)

Additional Savings

Direct/Indirect Program Spillover (Participant and Non-participant)

Energy Savings

Time

Non-Participants

Baseline (no Program)

with Program
Bringing it all together (3)

Direct/Indirect Program Spillover (Participant and Non-participant)

Savings Directly Attributable to Program

Participant Free Riders

Non-Participants

Energy Savings

Time

PS Evaluation
British Columbia has had a variety of CFL programs, including give-away, coupons, manufacturer buy downs, advertising, in-store promotions, advertising

Evaluation Objectives

- characterize the market for CFLs in BC Hydro’s service area, from both supply-side and demand-side perspectives
- assess the impact of BC Hydro’s residential CFL initiatives on energy savings (direct and incremental market effects)
- assess the impact of BC Hydro’s residential CFL initiatives on peak demand (direct and incremental market effects)
Case Study: Residential CFLs in British Columbia

Data Collection -

- Supply side – baseline and annual shelf space surveys
- Demand side - baseline and annual consumer surveys, participant surveys, and comparison group survey in North and South Dakota

Data Analysis -

- Estimation of net direct (coupon + spillover – free rider) and incremental CFL purchases in BC Hydro service area
- Energy and Demand savings calculated using standard engineering equations
Case Study: Residential CFLs in British Columbia

Direct Effects Equation - Energy Savings:

\[
\text{Energy Savings (KWh/yr)} = \text{Net CFL Purchases (#)} \times \text{Net Installation Rate (\%)} \times \text{Demand Savings per CFL (kW)} \times \text{Annual Hours-of-Use (Hours)} \times \text{Cross Effects - Energy (1-%)}
\]
Case Study: Residential CFLs in British Columbia

Market Effects - Energy Savings:

\[
\text{Energy Savings} (\text{KWh/yr}) = \left( \frac{\text{Incremental CFL purchases} (\#)}{} - \frac{\text{BC Hydro Sponsored CFLs} (\#)}{} \right) \times \frac{\text{Net Installation Rate} (\%)}{} \times \frac{\text{kW Savings per CFL} (\text{kW})}{\times} \times \frac{\text{CFL Hours-of-Use per Year} (\text{Hours})}{\times} \times \frac{\text{Cross Effects - Energy} (1-\%)}{}.
\]
### Case Study: Residential CFLs in British Columbia

<table>
<thead>
<tr>
<th></th>
<th>Installed CFLs (000)</th>
<th>Energy Savings Run Rate GWh/Yr $^1$</th>
<th>Coincident Peak Demand Savings (MW) $^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Effects</td>
<td>93.0</td>
<td>4.2</td>
<td>1.9</td>
</tr>
<tr>
<td>Market Effects</td>
<td>628.3</td>
<td>19.2</td>
<td>14.8</td>
</tr>
<tr>
<td><strong>Total Evaluated Savings</strong></td>
<td><strong>721.3</strong></td>
<td><strong>23.4</strong></td>
<td><strong>16.7</strong></td>
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$^1$ Represents annual savings for CFLs installed during the fiscal year in question, as of fiscal year end.
Reporting: Program and Evaluation Cycles

General Program Cycle

Corporate Goals → Portfolio of Programs → Detailed Program Design and Approval → Program Launch and Operation → Ongoing performance tracking and monitoring → Milestone and Final Program Assessment

General Evaluation Cycle

Corporate Goals

Baseline

Process Evaluation

Impact Evaluation

Market Effects Eval.

Program Feedback and Modifications

Detailed Program Evaluation Plans

Detailed Program Design and Approval

General Evaluation Plan
Selected References