Policies, Program Design, and Advocacy to Scale Up Low-Income Energy Efficiency Programs

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APPRISE

Nonprofit Research Institute

Established in 2002
Princeton, NJ

Mission

Analyze data and information to assess and improve public programs

Research Areas

Energy Efficiency
Energy Affordability

Clients

Federal Government (DOE, HHS)
State Governments
Utility Companies
Nonprofits
Presentation Overview

- LIEE Program Objectives
- Regulatory Background & Program Structure
- Low-Income Energy Burden
- LIEE Funding & Opportunities
- LIEE Barriers
- Policies & Financing Mechanisms
- LIEE Program Evaluation
- Findings & Recommendations
LIEE PROGRAM OBJECTIVES
LIEE Program Objectives

Energy Savings
- Treat high users
- Install cost-effective major measures
- Ensure high quality work is delivered

Peak Demand
- Contribute to peak demand reduction goals
- Defer new generation or transmission upgrades
- Other programs may be more effective

Cost-Effective Delivery
- Portfolio, sector, program, or measure
- Which test: TRC, UCT, SCT, RIM, PCT
- Discount, avoided costs, baseline, measure life

Households Served
- Total number
- Vulnerable, rural
- Environmental justice, climate change vulnerable

Households Served: 5
## LIEE Program Objectives

### Health & Safety
- Direct: mold, venting, CO, gas leaks
- Indirect: temperature, affordability

### Energy Affordability
- Reduce energy bills for high usage
- Energy burden statistics

### Environmental Impact
- Target dirty fuels, urban areas
- Electricity usage

### Economic Development
- Create local jobs
- Increase output

### Innovative Methods
- Test new measures or systems
- Pilot test, longer term improvements
REGULATORY BACKGROUND AND PROGRAM STRUCTURE
## Regulatory Background & Program Structure

<table>
<thead>
<tr>
<th>State</th>
<th>Key Program Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Colorado</strong></td>
<td>• LIEE required, EOC administration</td>
</tr>
<tr>
<td></td>
<td>• Community Solar Gardens, 5% LI</td>
</tr>
<tr>
<td></td>
<td>• Eligibility: 80% AMI</td>
</tr>
<tr>
<td></td>
<td>• Projected savings</td>
</tr>
<tr>
<td></td>
<td>• TRC, 25% adder for NEBs</td>
</tr>
<tr>
<td></td>
<td>• Coordination between utility and WAP</td>
</tr>
<tr>
<td><strong>Illinois</strong></td>
<td>• 1/2018: FEJA LIEE Funding utility admin</td>
</tr>
<tr>
<td></td>
<td>• Solar for All LI included, job training</td>
</tr>
<tr>
<td></td>
<td>• Eligibility: 80% AMI</td>
</tr>
<tr>
<td></td>
<td>• Projected savings</td>
</tr>
<tr>
<td></td>
<td>• Cost-effectiveness not required for LIEE</td>
</tr>
<tr>
<td><strong>New Jersey</strong></td>
<td>• Utility collaborative</td>
</tr>
<tr>
<td></td>
<td>• Eligibility: 225% FPL</td>
</tr>
<tr>
<td></td>
<td>• Periodic billing analysis</td>
</tr>
<tr>
<td></td>
<td>• Cost-effectiveness not required for LIEE</td>
</tr>
<tr>
<td></td>
<td>• Coordination between electric &amp; gas utilities, working to improve WAP coordination</td>
</tr>
<tr>
<td><strong>Pennsylvania</strong></td>
<td>• LIURP &amp; Act 129</td>
</tr>
<tr>
<td></td>
<td>• Low-income requirements</td>
</tr>
<tr>
<td></td>
<td>• Eligibility: 150%/200% FPL</td>
</tr>
<tr>
<td></td>
<td>• LIURP: Annual billing analysis</td>
</tr>
<tr>
<td></td>
<td>• Act 129: Projected savings</td>
</tr>
<tr>
<td></td>
<td>• Cost-effectiveness not required for LIEE</td>
</tr>
<tr>
<td></td>
<td>• Little coordination</td>
</tr>
</tbody>
</table>
LOW-INCOME
ENERGY BURDEN
## Energy Burden

### 2014 Residential Energy Burden

<table>
<thead>
<tr>
<th>Main Heat Fuel</th>
<th>All Households</th>
<th>Non-Low-Income</th>
<th>Low-Income</th>
<th>LIHEAP-Recipient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Individual</td>
<td>Individual</td>
<td>Individual</td>
<td>Individual</td>
</tr>
<tr>
<td>Electric</td>
<td>9.0%</td>
<td>3.2%</td>
<td>18.4%</td>
<td>17.5%</td>
</tr>
<tr>
<td>Gas</td>
<td>7.5%</td>
<td>2.9%</td>
<td>9.8%</td>
<td>17.7%</td>
</tr>
<tr>
<td>All Fuels</td>
<td>8.6%</td>
<td>3.3%</td>
<td>18.4%</td>
<td>18.8%</td>
</tr>
</tbody>
</table>

LIEE FUNDING & OPPORTUNITIES
LIEE Funding Sources

Ratepayer Funding

Department of Energy Weatherization Assistance Program
• Annual appropriations provided by Congress

LIHEAP
• Up to 15% of block grants can be used to fund WAP
• Up to 25% can be used to fund WAP with a waiver
• 48 states transferred funds to WAP in 2015
## 2015 LIEE Expenditures

<table>
<thead>
<tr>
<th>State</th>
<th>Electric Utility</th>
<th>Gas Utility</th>
<th>WAP Funding</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOE</td>
<td>LIHEAP</td>
</tr>
<tr>
<td>CO</td>
<td>$3,538,787</td>
<td>$4,380,461</td>
<td>$4,590,704</td>
<td>$6,611,666</td>
</tr>
<tr>
<td>IL</td>
<td>$13,100,000</td>
<td>$5,200,000</td>
<td>$3,462,275</td>
<td>$7,181,815</td>
</tr>
<tr>
<td>NJ</td>
<td>$11,302,113</td>
<td>$18,697,887</td>
<td>$4,308,921</td>
<td>$12,260,374</td>
</tr>
<tr>
<td>PA</td>
<td>$62,952,299</td>
<td>$19,652,964</td>
<td>$12,320,702</td>
<td>$30,371,473</td>
</tr>
</tbody>
</table>
## 2015 LIEE Expenditures per Household

<table>
<thead>
<tr>
<th>State</th>
<th>Total Spending</th>
<th>LIHEAP-Eligible</th>
<th>Under 150% FPL</th>
<th>Under 80% SMI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>$ Per</td>
<td>#</td>
<td>$ Per</td>
</tr>
<tr>
<td>CO</td>
<td>$25,621,618</td>
<td>377,050 $68</td>
<td>345,372 $74</td>
<td>803,528 $32</td>
</tr>
<tr>
<td>IL</td>
<td>$29,952,460</td>
<td>1,015,201 $30</td>
<td>964,552 $31</td>
<td>1,969,925 $15</td>
</tr>
<tr>
<td>NJ</td>
<td>$46,569,295</td>
<td>761,203 $61</td>
<td>537,445 $87</td>
<td>1,398,300 $33</td>
</tr>
<tr>
<td>PA</td>
<td>$125,297,438</td>
<td>1,050,059 $119</td>
<td>988,130 $127</td>
<td>2,097,807 $60</td>
</tr>
</tbody>
</table>
# LIEE Opportunities

## Assumptions

### Pre-Treatment Usage

- 20,000; 22,000; 25,000 kWh
- 30% use this amount or more
- 2010 WAP: 44% electric heaters >20,000

### Avoided cost

- $0.08/kWh
- Lazard’s Levelized Cost of Energy (12/2016)

### Measure Life

- 15 years; 20 years
- Mean life expectancy

### Discount Rate

- 5%
- LBNL 2017

### Electric Reduction

- 20%
- LIEE evaluation research

### NEB Adder

- None, 25%
- 25% NEB adder used in Colorado

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## Potential Savings and Cost-Effective Spending

On High-Use Electric Heat Homes

<table>
<thead>
<tr>
<th>Pre-Treatment Usage</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20,000; 22,000; 25,000 kWh</td>
<td>30% use this amount or more 2010 WAP: 44% electric heaters &gt;20,000</td>
</tr>
<tr>
<td>Avoided cost</td>
<td>$0.08/kWh</td>
<td>Lazard’s Levelized Cost of Energy (12/2016)</td>
</tr>
<tr>
<td>Measure Life</td>
<td>15 years; 20 years</td>
<td>Mean life expectancy</td>
</tr>
<tr>
<td>Discount Rate</td>
<td>5%</td>
<td>LBNL 2017</td>
</tr>
<tr>
<td>Electric Reduction</td>
<td>20%</td>
<td>LIEE evaluation research</td>
</tr>
<tr>
<td>NEB Adder</td>
<td>None, 25%</td>
<td>25% NEB adder used in Colorado</td>
</tr>
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</table>
## LIEE Opportunities Calculation

### Potential Savings and Cost-Effective Spending On High-Use Electric Heat Homes

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Scenario</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1</td>
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<tr>
<td>Pre-Treat kWh</td>
<td>20,000</td>
</tr>
<tr>
<td>Avoided Cost</td>
<td>0.08</td>
</tr>
<tr>
<td>Measure Life</td>
<td>15</td>
</tr>
<tr>
<td>Discount Rate</td>
<td>5%</td>
</tr>
<tr>
<td>Savings</td>
<td>20%</td>
</tr>
<tr>
<td>NEB Adder</td>
<td>0</td>
</tr>
</tbody>
</table>

### Calculations

<table>
<thead>
<tr>
<th>Calculations</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>kWh Saved/yr</td>
<td>4,000</td>
<td>4,000</td>
<td>4,000</td>
<td>4,400</td>
<td>4,400</td>
<td>4,400</td>
<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
</tr>
<tr>
<td>kWh Saved/life</td>
<td>41519</td>
<td>49849</td>
<td>49849</td>
<td>45670</td>
<td>54834</td>
<td>54834</td>
<td>51898</td>
<td>62311</td>
<td>62311</td>
</tr>
<tr>
<td>Max spending</td>
<td>$3,321</td>
<td>$3,988</td>
<td>$4,985</td>
<td>$3,654</td>
<td>$4,387</td>
<td>$5,483</td>
<td>$4,152</td>
<td>$4,985</td>
<td>$6,231</td>
</tr>
</tbody>
</table>
**LIEE Opportunities Calculation**

### Annual Number of Electric Heating LIEE Jobs With Average Spending of $5,000 per Home

<table>
<thead>
<tr>
<th>State</th>
<th>Total Electric Spending</th>
<th>Potential Jobs with Current Budget</th>
<th>Budget Needed to Serve 10% Of High-Use Electric Heaters</th>
<th>150% FPL</th>
<th>80% SMI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Budget</td>
<td>% of</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Needed</td>
<td>Current</td>
</tr>
<tr>
<td>CO</td>
<td>$8,849,498</td>
<td>1,770</td>
<td></td>
<td>$15,887,850</td>
<td>180%</td>
</tr>
<tr>
<td>IL</td>
<td>$16,595,738</td>
<td>3,319</td>
<td></td>
<td>$32,410,200</td>
<td>195%</td>
</tr>
<tr>
<td>NJ</td>
<td>$16,272,902</td>
<td>3,255</td>
<td></td>
<td>$13,975,650</td>
<td>86%</td>
</tr>
<tr>
<td>PA</td>
<td>$75,759,952</td>
<td>15,152</td>
<td></td>
<td>$39,531,600</td>
<td>52%</td>
</tr>
</tbody>
</table>
LIEE BARRIERS
### LIEE Barriers

<table>
<thead>
<tr>
<th>Economic</th>
<th>Transactions Costs</th>
<th>Social Costs</th>
<th>Health &amp; Safety</th>
<th>Data &amp; Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up-front investment</td>
<td>Application</td>
<td>Home tenure</td>
<td>Mold &amp; moisture</td>
<td>Data needed to determine best practices are not available</td>
</tr>
<tr>
<td>Landlord/ tenant split incentive</td>
<td>Landlord permission</td>
<td>Trust</td>
<td>Asbestos</td>
<td>Who is served/ not served</td>
</tr>
<tr>
<td>Asymmetric cost-effectiveness testing</td>
<td>Ready the home</td>
<td>Scheduling</td>
<td>Knob &amp; tube wiring</td>
<td>Services provided</td>
</tr>
<tr>
<td>Low-income baseline</td>
<td></td>
<td>Language barriers</td>
<td>Pests</td>
<td></td>
</tr>
<tr>
<td>Utility disincentives</td>
<td></td>
<td>Literacy</td>
<td>Clutter</td>
<td></td>
</tr>
<tr>
<td>Raided funds</td>
<td></td>
<td>Immigration status</td>
<td>Structural issues</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Neighborhoods</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recruiting/ training employees</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
LIEE POLICIES AND FINANCING MECHANISMS
Offerings/Delivery Models

- Public Utility and Electric Cooperative Programs
  - 25% of U.S. electric consumption, but not regulated
  - Some have implemented EE programs to delay power plant investments
- Heat Island Reduction Programs: community investments in cool roofs and pavements, pervious pavements, tree planting
- Community Solar: multiple subscribers purchase power and receive credit on the bill, low-income carve-outs
- School-Based Energy Education Programs: broad reach to low-income and disadvantaged

Program Funding

- Ratepayer & WAP
- LIHEAP: crisis replacement of unsafe heating; Assurance 16 education and advocacy; transfer to WAP
- Rate case & merger settlements
- GRID Alternatives Model: no cost solar to low-income through coordination of state funds, other grants, equipment donations, volunteers, and job trainees
Policies & Financing

Financing

• On-Bill Lending
• Pay as You Save: charges remain with the meter
• Property Assessed Clean Energy (PACE): assessment on property owner tax bill
• Energy Saving Performance Contracts: ESCO coordinates and is paid from energy savings

Utility Incentives

• Cost recovery: should be equivalent to cost recovery on supply side investments
• Decoupling: removes connection between utility revenue and sales volume
• Energy Efficiency Resource Standards: requires specified consumption reduction
• Energy Efficiency Spending Requirements
• Performance Incentives: financial rewards for measured energy savings

Other Models

• Building Codes: new construction standards
• Green Leases: may help overcome split incentive, include environmental aspects
• Green Banks: finance energy efficiency and other clean energy, work with utility programs
LIEE EVALUATION
LIEE Evaluation Purpose

Measure Program Impacts

- Energy usage
- Energy bill affordability
- Economic impacts
- Environmental impacts
- Health, safety, & comfort
- Cost-benefit analysis

Assess Potential Improvements

- Goal achievement
- Efficiency
- Effectiveness
- Equity
- Targeting
- Participant Satisfaction

Meet Regulatory Requirements
LIEE Process Evaluation

Evaluation Questions

• How is the program designed?
• How is the program implemented?
• Why is the program achieving or not achieving its goals?
• How can the program be improved?

Evaluation Activities

• Background research: Document review & interviews
• Participant and nonparticipant surveys
• On-site research: observations and inspections
Evaluation Questions

• How much energy was saved?
• How much energy did individual measures save?
• How do savings vary by pre-treatment usage, housing type, measure package, contractor, home characteristics?

Evaluation Activities

• Program data analysis: Characterize participants, homes, services
• Usage impact analysis: Energy usage billing data
• Payment impact analysis: bills, subsidy, affordability, payment
• Realization rate analysis: comparison of usage estimates to projections
• Cost-effectiveness testing
• Performance measurement
FINDINGS & RECOMMENDATIONS
## Findings & Recommendations

### Goals

- Relate to mission
- Concrete & specific
- Outcomes
- Measurement
- Challenging, achievable

### Management

- Provide consistent policy
- Coordination: WAP management, electric & gas coordination
- Utility management: customer data
- Agency management: customer acceptance

### Measures

- Comprehensiveness
- Based on usage
- Health and safety
Findings & Recommendations

Data

- One database for the program
- Computerized data collection
- Only include fields with an identified purpose

Energy Education

- Partnership model
- Identify opportunities
- Customer follow-up

Quality Control

- Third-party inspector
- Assess missed opportunities and work quality
- Provide additional education
## Findings & Recommendations

### Rate Design, Cost Recovery, & Utility Incentives

- Minimize percent of bill that is fixed
- Cost recovery equivalent to supply side
- Decoupling and performance incentives
- Specific LIEE targets and use utility billing analysis to measure savings

### Funding & Costs

- LIEE funds may be less likely to be raided if they are not in a separate fund
- Low-income unlikely to participate in cost-sharing
- On-bill repayment may generate participation for moderate-income
- Provide credit enhancements, terms as long as payback, increased incentives, shared risk for energy savings

### Evaluation

- Third-party evaluator
- Conducted on regular bases
- Billing analysis and process evaluation
- Performance measurement

### Cost-Effectiveness Testing

- Balanced
- Low-income baseline
- Measure prioritization
Further Research

Utility Incentives
- Best strategies
- How do decoupling, EERS, and performance incentives best work together?

Financing
- Will low-to-moderate income take advantage of financing?
- Which methods have greatest potential for low-income?

Raided Funds
- How to provide greatest assurance of continued access to dedicated LIEE funding?

Coordination
- Most successful models for funding coordination?

Health & Safety Investments
- What is the right level of investment?
- How can necessary funding be made available?
Further Research

Non-Energy Impacts

• What level can be expected? What NEB adder is most appropriate?

Innovative Methods

• Which new approaches achieved significant savings and should be replicated?

Environmental Justice

• Are LIEE programs reaching this population?
• If not, how can this be improved?

LIEE Savings

• What level of savings can be achieved through various models?
• More studies comparing billing analysis to random control trials and TRM are needed.

Relative LIEE Savings & Cost-Effectiveness

• Compare LIEE and market-rate energy savings and cost-effectiveness
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