



Strategies and Challenges in Measuring Non-Energy Benefits from a Low-Income Weatherization Program

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Québec Low Income Sector: Context and Needs

- In 1996, 26% of Québécois households (~700,000) living below poverty line and ~\$6,000 in debt
- By 2007, situation improved somewhat
 - 500,000 low income households (15% of population)
- 2/3 of low income households live in older homes (<1971 stock) indicating significant potential

Program Background: Éconologis

- Administrator: Québécois Agence de l'Efficacite Energetique (AEE)
- Objective:
 - Primary: provide advice and products
 - Secondary: non-energy goals
- Target market: Québécois households with eligible income levels
 - Ranged from maximum of \$18,360 CAD for one person to a maximum of \$46,800 CAD for a household of seven
- Evaluation period: 2004-2006



Program Background (continued)

- Sub-programs:
 - (1) Personalized advice tailored to individual household needs, and weatherization measures (\$60 CAD value)
 - Hot water heating measures such as water heater blankets and low-flow shower fixtures
 - Lighting measures such as compact fluorescent and halogen light bulbs
 - Infiltration measures such as door sweeps and weather-stripping
 - Refrigerator thermometers

Program Background (continued)

- Sub-programs:
 - (2) Electronic thermostats (both programmable and non-programmable) installed by qualified electricians in housing units heated by electric baseboards with wall controls
- Eligibility: Either both sub-programs, or only sub-program #1

Program Background (continued)

- Implementation:
 - After determining eligibility, two person teams employed by participating local community organizations carried out the initial visit (90 minutes)
 - Inspection, advice, energy assessment and measure installation
 - If eligible for sub-program #2, thermostat installed during second visit

Evaluation Goals

- Comprehensive evaluation goals: Process, impact, market and non-energy benefits (NEBs)
 - Process and market evaluations assessed key elements of the program theory by examining program administration, marketing, and implementation processes
 - Impact evaluation estimated the program's annual and cumulative gross and net energy impact
 - NEBs evaluation attempted to quantify an appropriate added value for a select number of NEBs

Non-Energy Benefits (NEBs)

- Éconologis program targeted the following NEBs:
 - Comfort/Well-being
 - Reduced arrearages
 - Alleviation of hardships
 - Positive effect on utility image
 - Increased property value
 - Local economic support
 - Water savings

Overview of NEB Evaluation Approach

- Determine appropriate NEBs
- Conduct extensive literature review
- Review methods for quantifying NEBs
- Establish appropriate average values for NEBs
- Adjust average values for Québec/Économique context

Literature Review

- AEE study quantified local economic impacts from Éconologis, but other NEBs only qualitatively assessed
- ORNL WAP evaluation (2002) was comprehensive, but WAP very different than Éconologis
- SERA study utilized “comparative evaluation” approach to quantifying NEBs
- ACEEE literature review provided other examples/results

Comfort and Well Being

- **Measures**

- Improved airflow, reduced drafts and temperature swings, better humidity control, lower noise

- **Literature Review**

- Participant survey results not reliable (ORNL WAP)
- Comparative evaluation “share” equates to \$44-56 USD per year (SERA)

- **Éconologis Result**

- 90% reported improved comfort
- Perceptions likely reflect appreciation of work, advice
- Measures too temporary to affect comfort
- **NEB result not quantified for comfort/well-being improvements**

Health

- **Measures**

- Improved airflow, reduced drafts and temperature swings, better humidity control

- **Literature Review**

- Prolonged sickness can result in lost wages/employment
- \$55 USD per day (ORNL WAP)

- **Éconologis Result**

- 71% reported improvement in health
- No survey data on lost work days
- Measures too temporary to affect health
- **NEB result not quantified for health improvements**

Reduced Arrearages

- **Measures**

- Advice/measures improve ability to pay leading to reduced utility collection costs

- **Literature Review**

- Billing analysis shows \$4-110 USD per year (ORNL WAP)

- **Éconologis Result**

- 56% report improved ability to pay
- Billing data analysis revealed ability to pay remained the same and “demerits” increased
- **NEB result estimated at \$0 CAD for reduced arrearages**

Alleviation of Hardships

- **Measures**

- Advice/measures lead to:

- Avoided shut-offs/ reconnections (reduced inconvenience, reduced illness)
- Reduced mobility (forced moves due to inability to pay)

- **Literature Review**

- Avoided shut-offs/ reconnections = \$0-22 USD (ORNL WAP)
- Reduced mobility (measured as difference between # of moves before/after program, monetized by effects of school drop-out rates on long-term earning potential) = \$278 USD (ORNL WAP)

Alleviation of Difficulties (continued)

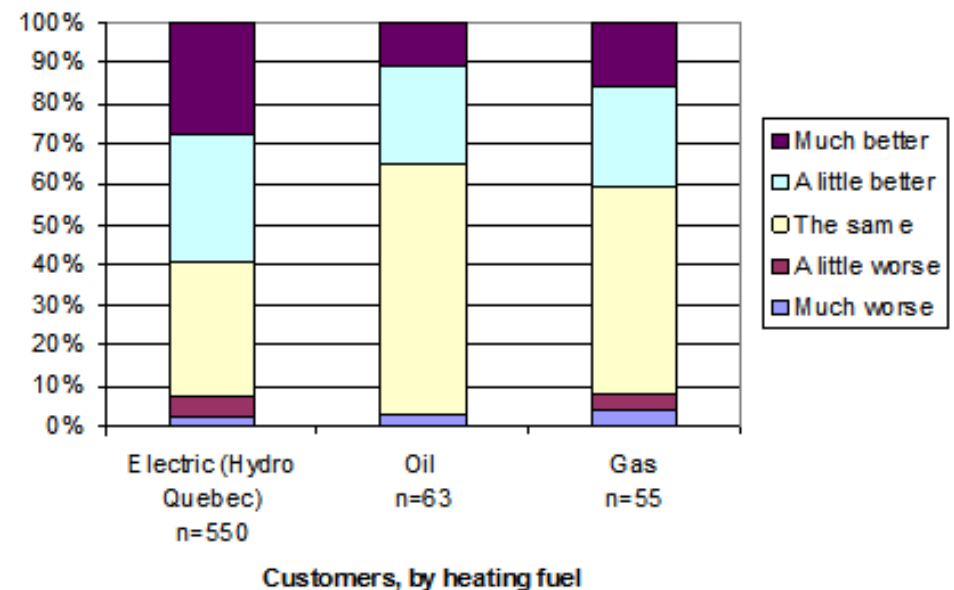
- **Éconologis Result**

- NEB result estimated at \$0 for avoided shut-offs/reconnections and reduced mobility

- Program impacts small per household, arrearage results showed no NEBs

Positive Effect on Utility Image

- “Good corporate citizens”
- Reported change in customer perception of major (heating) utility since participation:
- NEB not monetized in any studies reviewed
- NEB result not quantified for positive effect on utility image



Local Economic Support

- Économologis directly and indirectly affected local employment opportunities
- Economic NEBs typically estimated as “multiplier effect” (\$ retained within local economy)
 - Input/output models generally used
 - “Net” impact important (alternative projects may have been funded)
- NEBs range from \$115 to \$4354 per household (ORNL WAP)

Local Economic Support

- **Éconologis Result**

- \$17-\$8=\$9 added CAD/hour/employee x season = \$14,488 CAD per employee per year
- 60 employees per year x 2 program seasons = \$1,738,536 CAD
- NEB result estimated at \$1,738,539 (or \$135 per participant)
 - Low end of ORNL range, understandable given scope of program

Water Savings

Water Saving Measures	Water Use	Average Existing Fixture Water Use	Number of Measures	Annual Water Savings *
Low-flow faucet aerator	8.3 L/min	13.5 L/min	4289	244,215,660 L
Shut-off switch for shower head	7.5 L/min	15 L/min	435	36,518,250 L
Shower head with shut-off switch	4.75 L/min	15 L/min	749	92,857,825 L
Low-flow shower head without shut-off switch	9.5 L/min	15 L/min	3537	142,010,550 L
Advice: Take a five-minute shower	47.5 L/shower	15 L x 7.5 min[1] = 112.5 L/shower	174 x .733[2] = 127.5	9,074,812 L
TOTAL WATER SAVINGS:				= 524,677,098 L
TOTAL COST SAVINGS FROM REDUCED WATER USE:				= \$372,520.74 CAD
[1] Typical shower lasts 5-10 minutes				
[2] 73% of survey respondents indicated that they were given and implement this advice				
* Water savings calculated assuming the following:				
	Use per day [3]	Days of use per year	Water cost [4]	
Faucet	20 min	260 days	\$0.71 CAD/1000 liters	
Showerhead	30 min	365 days	\$0.71 CAD/1000 liters	
[3] DOE source				
[4] Environment Canada				

- NEB result estimated at \$372,521 CAD from water savings measures

Increased Property Value

- Measures
 - New windows, HVAC replacements, home repair (rare, but could happen)
- Literature
 - \$0-5500 USD (ORNL WAP)
- **Éconologis Result**
 - Most common measure was programmable thermostat, not likely to increase property value
 - NEB result estimated at \$0 CAD for increased property value

Conclusions

- \$2,111,076 NEBs estimated through this evaluation
 - Local economic impact, water savings
- Very large savings for such a small program scope
- Ultimately, AEE did not attribute NEBs to the Éconologis program
 - Plans to quantify NEBs as part of new pilot that includes more extensive home weatherization

Interested in other evaluation results?

- Process/market evaluation
- Impact evaluation

Process Evaluation Approach

- Staff interviews
 - HQD, Gaz Metro, and AEE staff (program planning and administration)
 - 17 “Program Partners” active in 2004-2006
- “Ride Alongs”
- Participant/non-participant telephone surveys
- Program data review
- Literature review

Process Evaluation Results

- Bottlenecks in program implementation tied to lack of control and organization at the administrative level, evaluation identified areas for improvement
 - Program design and planning, coordination, realization, and follow-up
- Concerns about reporting burden, consistency, quality control
 - Leads to missed opportunities yet customer satisfaction is high
- Excellent communications yet partners would like more input, greater role

Process Evaluation Results (continued)

- Seasonality results in several process issues including staff retention/training
- Partners must reapply each program cycle (and approvals are often delayed, making it hard to launch prior to heating system
- Annual training involves all relevant parties but should be more targeted toward specific needs within partner organizations, include more in-field training

Process Evaluation Results (continued)

- More localized control over marketing, coordinated with national marketing strategy
- Supplemental efforts should be made to recruit hard to reach households (workers/students, elderly, socially and/or geographically isolated groups, immigrant populations)
- Participation driven by proposed monetary and energy savings (and more often, to get the thermostat)
- Awareness and interest in participation is relatively high among non-participants (1/3 aware, 3/4 interested)

Process Evaluation Results (continued)

- Most common barrier to participation is perception that “they already know what to do to reduce energy use,” represents missed opportunity since program provides information on bill pay options and free measures
- Barriers and challenges to implementation include:
 - Organizational presentation and professionalism
 - Program eligibility verification (no weatherization within past 5 years, heating bill from distributor, income tax records from prior year)
 - Improvements in referrals to other social programs needed

Process Evaluation Results (continued)

- Implementation barriers/challenges (continued)
 - Paperwork bottlenecks including landlord consent
 - Diagnostic tool helpful but takes too long
 - Variations in focus of partner organizations, delivery of measures and retention of advice
 - Expectations of energy savings only partially perceived as “real”
 - Improved tools to assess needs (e.g., blower doors)
 - Follow-up would improve impacts

Impact Evaluation Approach

- Billing analysis using pooled, time-series, cross-sectional model
- Model included participants from July 2004 to June 2006, as well as participants post-2006 as control group
 - Post-2006 were substantially similar to participants pre-2006
- More than 12,000 participants included in the model
- Model estimated heating load and program savings separately

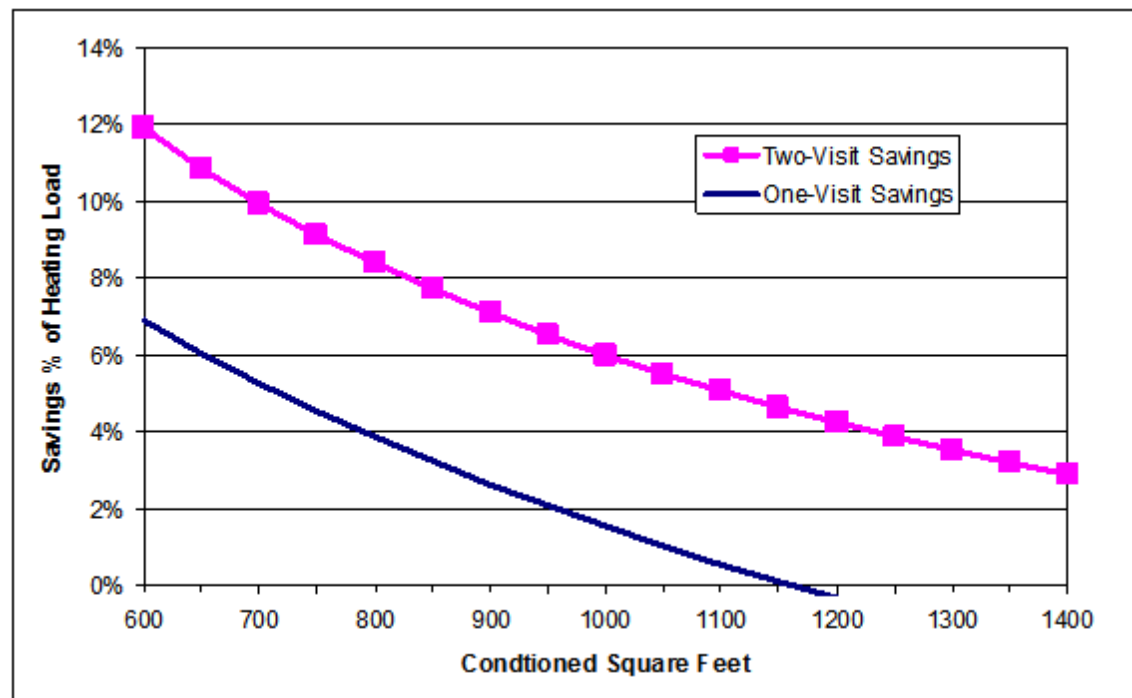
Impact Evaluation Results

	Program Savings	Annual Heating Usage	Program Savings / Annual Heating Usage
One Visit	236 kWh/yr	8,174 kWh/yr	2.90%
Two Visit	616 kWh/yr	7,990 kWh/yr	7.70%

- “Two visit” program savings estimate includes impacts from measures installed as part of first and second visits
 - Suggests thermostat savings on the order of 350 kWh/yr (or 4.8% of annual heating load)

Impact Evaluation Results (continued)

- Size of home is important driver
- As conditioned square feet of home increases, savings as a percentage of heating usage decreases.



Impact Evaluation Results (continued)

- Realization rate = 39%
 - Program assumed 20.6 GWh/yr, evaluation found 8.0 GWh/yr
 - Ex-ante estimates for “one visit” savings in line with expectations, although no documentation provided
 - Savings from thermostats assumed to be 10% which were at the very high end of the ex-post evaluation results



Questions?

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