

Program Evaluation of an Appliance Recycling Program

Evaluation Methods & Issues

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Presentation Overview

- Historical Context of Appliance Recycling Program (ARP) Evaluation
- Evaluation Methods and Issues for
 - Load Impact – Gross and Net Savings
 - Market Assessment
 - Program Process
- Data Needs and Sources

ARP Evaluations: Historical Context

Major Events:

- 1995: Spare refrigerators only
- 1999: Rules changed to allow pickups of primary refrigerators/freezers
- 2002:
 - Program offered by all IOUs in CA
 - HTR goals established
 - Minimum size set for units
- July 2004: CPUC adopted rule that appliances must have been manufactured no later than 1990
- 2006: Age restriction dropped

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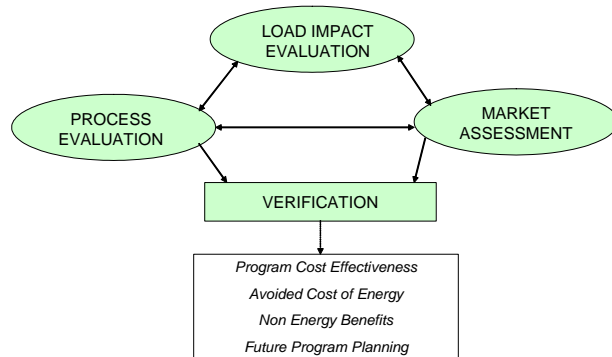
RARP Evaluations: Historical Context

Effect of Program Changes:

- Allowing pick-ups of primary units lowered NTG for program (i.e., lower NTG for primary units)
- Manufacture year restriction probably increased slightly the average UEC for appliances recycled

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Evaluation Components



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Estimating Gross Savings: Issues

- ARP is targeted at removing old, inefficient working refrigerators and/or freezers from system
- Program impact is defined by grid-level savings attributable to refrigerators and/or freezers removed from system because of ARP
- Use of DOE Lab UEC methodology vs. Insitu UEC
- Examining other “What-if” scenarios, depending on models and available population data

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Estimating Gross Savings: Approach for 2004-05 EM&V

- Unit Energy Consumption (UEC) Estimation
 - DOE Protocol Lab Metering
 - Predictive model with varying complexities involving unit characteristics available in tracking system
 - Population estimates of DOE lab UEC's
- Dual Metering
 - Adding to existing data on DOE test UECs by incorporating DOE test data from dual metering project
- Develop contingent relationship with in situ data collected in a dual metering project
 - Is there a relationship?
 - Is it contingent upon appliance characteristics and/or conditions of in-situ use?

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Estimating Gross Savings: Issues

Comparative UEC Model Results

Study	Refrigerator UEC	Freezer UEC
Athens, 1998 ('96, '97 pgms)	2,148 kWh	2,058 kWh
KEMA, 2003 ('02 pgm)	1,946 kWh	1,662 kWh

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Estimating Gross Savings: Issues

Example of "What-if" Scenarios

Scenario A: 2002 Tracking Data				
	UEC	Standard Error	Percent of Population	Percent Savings Foregone
Small	925	103	4.6%	2.2%
14+	2,009	78	95.4%	
1990+	1,722	131	14.4%	13.0%
Pre-1990	2,000	84	85.3%	
Exclude either	1,562	106	18.4%	14.7%
14+ & Pre-1990	2,048	83	81.6%	

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Estimating Gross Savings: Technical Approach

- **Step 1: Analysis of DOE Lab Test Data**
 - Incorporate UEC data from 200+ DOE lab tests from dual metering project
 - Build up from existing appliance characteristics/sample dummy/interaction term specification
- **Step 2: Analysis of DOE Lab Test/In Situ Data**
 - Use in situ and DOE lab data points from dual metering project to develop regression model that provides a basis for adjusting DOE lab to in situ estimates of appliance consumption – allowing for contingencies in the relationship
- **Step 3: Expand Models to Population**
 - Expanding models from Steps 1 and 2 to the current population in order to estimate savings and/or to test scenarios

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Estimating Gross Savings: Sources of Information

- Library of DOE Lab tests
 - n=1173 ARCA (1990's)
 - n=136 SCE (1998)
 - n=100 SCE (2003)
 - n=200 Dual Metering (2005)
 - Other DOE Lab test data
 - WAPTAC/CEC/AHAM "As new" metering
- Other Data
 - Tracking Systems data
 - RASS(2003), RLW CLASS (2000, 2005) data
 - AHAM Shipment data
 - Non participant and participant follow-up data (2002, 2003, 2004-2005)

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Estimating Gross Savings: Sources of Information

- In situ data from Dual Metering Project
 - What was monitored
 - ~ 240 refrigerators
 - 20 freezers
 - Data collected
 - Electricity use
 - Temperature in refrigerator/freezer
 - Ambient (external) temperature
 - Door openings – count and duration (using lighting logger)
 - Monitored for minimum of one week, up to two weeks
 - Full year in situ UEC extrapolated from short term metered data
- DOE Lab test data on same units

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Estimating Net Savings:

- Determine program-level savings attributable to ARP
- In particular, what proportion of grid level gross savings associated with the program's operations are truly influenced by the program's offering of
 - (a) free hauling,
 - (b) incentive dollars,
 - (c) environmentally responsible dismantling, and/or
 - (d) the program's education of customers regarding inefficiency of appliances with performance problems

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Estimating Net Savings: Issues

- Overall drop in NTG 1996-2002 programs:
0.53 to 0.35
- Rise in proportion who would have discarded without program
0.41 to 0.86
- Drop in proportion who would have continued use without program:
0.45 to 0.09
- Disaggregated NTG (2003):
 - Among primary refrigerators: .37
 - Among secondaries: .65
 - Among freezers: .73

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How NTG Estimated for ARP

What participants would have done otherwise?

Question:	Disposition without Program	How Discard	How acquired unit would be used	What acquirer would get if used not available	Part Use	Attribution	NTG	% of units
Source:	P survey	NP survey (discarders)	NP survey (acquirers)	NP survey (acquirers)	P survey			
	Kept in use				u	1	u	xx
	Kept unused				0	1	0	xx
	Discarded	Destroyed				0	0	xx
		Transferred	Main	New	1	a*	a*	xx
				Similar	1	0	0	xx
				Worse	1	0	0	xx
				None	1	1	1	xx
			Spare	New	u	a*	ua*	xx
				Similar	u	0	0	xx
				Worse	u	0	0	xx
				None	u	1	u	xx

a* = $1 - UEC_{NEW} / UEC_{OLD}$

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How NTG Estimated for ARP

Refrigerators - Base Case										
	What Participants Would Have Done with Unit without Program	Percent of Units in Program	How Would Have Discarded	Percent of Discarded Units	How Transferred Unit Would Have Been Used	What Was Done Because Transfer Wasn't Available	Percent of Units Transferred within SCE Attribution Assigned	Average Attribution A	Usage Factor U	Net-to-Gross A x U
Basis:	Participant Survey	Disposers Survey	Acquirers Survey	Acquirers Survey	Participant Survey	Participant Survey	Participant Survey	Participant Survey	A x U	
All Units								0.41		0.35
Kept Unused	4.6%						1	1.00	0.00	0.00
Kept in Use	9.0%						1	1.00	0.88	0.88
Discarded	86.4%							0.32		0.31
		Destroyed	24.8%				0	0.00		
		Transferred	75.2%					0.43		0.41
				Main				0.37	1.00	0.37
				Bought New	33.8%	0.70				
				Bought or Fixed Similar	35.1%	0				
				Bought Worse	5.2%	0				
				Acquired None	6.5%	1		0.65	0.88	0.57
				Spare						
				Bought New	5.2%	0.70				
				Bought or Fixed Similar	3.9%	0				
				Bought Worse	1.3%	0				
				Acquired None	9.1%	1				
	100%		100%				100%			

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Estimating Net Savings: Sources of Information

- Customer Telephone Survey
 - 700 participant households
 - 500 households that did not participate but that have acquired/disposed of a refrigerator in the past one or two years
 - *Identify through a random-digit dialing telephone screening survey*
 - *Only households indicating that they have disposed of / acquired a refrigerator or freezer are interviewed in full.*
- Survey data from previous evaluations

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Market Assessment:

- Document customer knowledge and attitudes related to older refrigerators and freezers
- Analyze operation of used appliance market in order to determine impact on energy savings potential for ARP
 - Estimate baseline volumes of potentially qualifying units moving through each channel
 - Identify potential to shift qualifying volume from other channels to ARP

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Market Assessment:

- Affirm/identify barriers to ARP and prevalence of these barriers
- Identify program design and/or marketing tactics that can remove barriers
- Sources of information
 - Customer surveys are primary source
 - Program documents and interviews of program managers and operational personnel are secondary sources
 - Appliance secondary market surveys

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