Appliance Recycling Program Impact Evaluation

Volume 2: Appendices
Work Order 35

California Public Utility Commission, Energy Division

Prepared by KEMA, Inc.
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A.1   Metering Protocols

Appliance Recycling - Long-term Metering in coordination with the CLASS study
Metering Process
1. Determine Eligibility - Record Logger ID
2. Put metal ends of temp probes in fresh and frozen compartment(s)
a. Need 15 minutes to stabilize
b. Record temperatures with U-Shuttle (see directions in U-Shuttle box)
c. Remove probes. Do not forget to retrieve these and take with you.
3. Unplug refrigerator/freezer from wall.
4. Plug black box of meter into wall with provided power cord.
5. Plug refrigerator/freezer into black box.
6. Launch Hobo meter using U-Shuttle (see directions in U-Shuttle box)
7. Attach clip to exterior temp probe using twist tie from meter cords
8. Attach clip with temp probe to side of refrigerator/freezer or in out of way near unit.
a. Location should be inconspicuous, and avoid direct sunlight/liquid/heat exposure.
b. Do not place temperature probe near refrigerator coils.
9. Stack the HOBO logger on top of the black box, or however the devices fit behind/near the appliance
a. Location should be inconspicuous, hide it as much as possible.
10. Record Install time
11. Provide incentive card to customer with signature.

Selling the Customer on Metering

After a unit is flagged as eligible

1. Introduce the metering topic:

> *In addition to participating in the CLASS study, we have another study that is going on right now. I can see that your (refrigerator/freezer) is eligible for this study. We're installing meters to track the energy used by refrigerators and freezers over time. Participating in this study will give you two additional $50 gift cards for each refrigerator metered. Here's a handout that describes this study in more detail.*
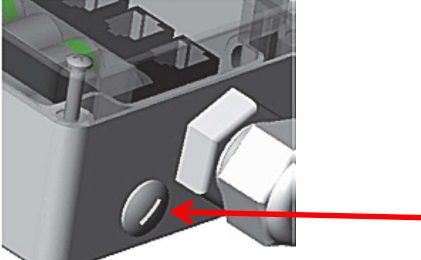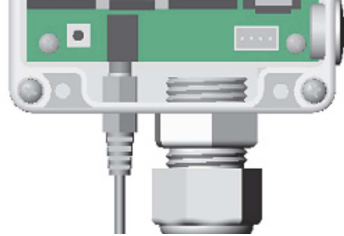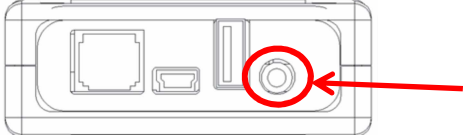
2. Give customer the Refrigerator Metering FAQ sheet

3. Once the customer has had a chance to review the FAQ, if they're interested in participating, show them the meter and get their agreement, then install the meter.

Some points to emphasize in discussions with the customer:
- Meters will be in place for a year.
- They will get one $50 gift card now, and a second $50 gift card when the meter is picked up for each refrigerator/freezer metered.
- The meter won't hurt their appliance and doesn't use electricity.
- The data will be used for research and planning purposes only, no marketing or sales involved.
- It's hands off –they never need to bother with the meter, or do anything—it just sits there.

A.2 Launching ARP Loggers Using the U-Shuttle

Instructions	Pictures or U-Shuttle Display
1. Unscrew white plastic cap from logger	
2. Plug in 1-ft grey communication cable into logger data port	
3. Plug other end into the 1/8' port on the U-shuttle	
4. Press "ESC" once to turn on the Shuttle	
5. Wait 3 seconds until screen reads as it is to the right	(Y) Find Device (N) Shuttle Info
6. Press "YES" once	(Y) Find Device (N) Shuttle Info
7. Press "NO"	HOBO is Stopped DF: XX%, Bat:100%
8. Press "NO" again	Sensors Found:2 Show Sensors?
9. Press "NO" a third time	Read Out HOBO? HOBO is Stopped
10. Press "YES"	Restart HOBO?
11. Press "YES again to verify start of HOBO	Are You Sure?

Instructions	Pictures or U-Shuttle Display
12. Press "NO" when asked to change batteries	Change Battery? Stopped, Bat:100%
13. Press "NO" again	Sensors Found:2 Show Sensors?
14. Logger is now launched	HOBO Launched Remove Device(s)

A.3   Fridge-Freezer Temperature Measurement Protocol

Tools

2 x Onset Temperature Smart Sensors (S-TMB-M002)	1 x Onset U-Shuttle

Instructions	
1. Place the steel tip of the temperature sensors into the fridge and freezer compartments	
2. Ensure that the steel tip is not resting against any surfaces or any items in either compartment	
3. Close the doors so the temperature probe is held in place, not resting against anything	
4. Allow probes to remain in compartments for a **full 15 minutes** before taking readings – the longer the probes sit in the compartments, the better	

U-Shuttle Button Press	U-shuttle Display
A. Turn on U-Shuttle by Pressing "ESC" once	**(Y) Find Device** **(N) Shuttle Info**
B. Plug in one of the temperature probes into the U-Shuttle	

C. Press "YES" to Find Device	**(Y) Find Device** **(N) Shuttle Info**
Instructions	
D. Press "YES" to Confirm US Units	**Sensors Found: 1** **US Units?**
E. Record Temperature reading	**12-bit Temp** **T=XX.XXF**
F. Press "ESC" and remove sensor from U-Shuttle	**Complete,** **Remove Device(s)**
Repeat the above steps for the other temperature sensor	
If the temperature reading does not seem accurate, press the "YES" button 3 times to obtain a refreshed temperature reading (do this after Step D if needed)	

B.   Climate Zones from CLASS Study

DNV GL analyzed the climate zone Cooling Degree Days that are associated with the 2009 RASS to group T24 climate zones into climate zone groups. These CDDs are presented in Column D of Table 1.

Table 1 shows that there is a substantial difference in Cooling Degree Days between Climate Zone 15 and the other zones.

- CZ 15 has over twice the amount of CDDs than the second highest zone, CZ 13. Because of this, CZ 15 was placed in its own group ("Desert").

- The second group, "Inland", groups CZs 8 through 14. These CZs have CDDs between 700 and 2,000 approximately.

- The third group, "Mild", groups the remainder of the climate zones: CZs 1 through 7 and CZ 16. These range between 0 and 470 CDDs.

Table 1: Climate Zones for CLASS Stratification
Sorted by Descending Cooling Degree Days

A	B	C	D
Climate Zone Group	**T24 Climate Zone**	**2009 HDD (65°F Base)**	**2009 CDD (65°F Base)**
Desert	15	950	4,015
Inland	13	2,355	1,930
Inland	14	3,107	1,769
Inland	11	2,841	1,325
Inland	10	1,799	1,268
Inland	9	1,487	948
Inland	12	2,812	792
Inland	8	1,551	720
Mild	7	1,430	470
Mild	2	3,232	426
Mild	6	1,669	321
Mild	4	2,512	283
Mild	16	5,593	255
Mild	3	2,792	38
Mild	5	2,704	34
Mild	1	4,149	0

C. Participant Survey

C.1 Survey Instrument

California Public Utilities Commission
Appliance Recycling Program Impact Evaluation
Residential Participant CATI Survey
March 27 2013

Survey house instructions

Programming Notes

Database variables

Needed variables
- Name
- Address where units were picked up
- Phone(s)
- Utility
- Appliance Var – text describing all appliances recycled
- Month
- Year
- Ref_qty – number of refrigerators recycled
- Frz_qty – number of freezers recycled

Introduction

I1.   May I speak with [contact name]?

Good [morning/afternoon]. My name is _____ and I'm calling on behalf of the California Public Utilities Commission. We are talking to customers who had refrigerator or freezers disposed of through [PG&E's/ SCE's/ SDG&E's] appliance recycling program.
[IF NEEDED: The survey takes about 10 minutes.]

[IF NEEDED: I'm calling from Discovery Research Group, an independent research firm.]

Our records show that on [Prefill Date] you disposed of a [ApplianceVar] through the [SCE/PG&E/SDG&E] recycling program. Are you the person who is most familiar with this disposal?

1	Yes	INTRODUCTION
3	No (not right person)	I2
-98	Don't know	I2
-99	Refused	TERMINATE

I2. **You or someone in your house may have called [SCE/PG&E/SDG&E] or signed up on the Internet. You may have been disposing of a refrigerator or freezer because you had an extra one or because you bought a new one. Do you remember signing up for this program??**

1	Yes	INTRODUCTION
3	No (not right person)	I3
-98	Don't know	TERMINATE
-99	Refused	TERMINATE

I3. **Is there someone else in your household who might know?**

1	Yes [RECORD FIRST AND LAST NAME]	INTRODUCTION
2	No (person not available) [RECORD FIRST AND LAST NAME]	I4
-98	Don't know	TERMINATE
-99	Refused	TERMINATE

I4. **May I please speak to that person?**

1	Yes [Transfer to new contact or Record Name- if not available establish a good time for a call back]	INTRODUCTION
2	No	
-98	Don't know	THANK AND
-99	Refused	TERMINATE

Verification

V1. **Our records show that you had [IF REF_QTY > 0: [REF_QTY] refrigerator(s)] [IF FRZ_QTY > 0: (and) [FRZ_QTY] freezer(s)] picked up for recycling in [MONTH] of [YEAR]. Is that correct?**

1	Yes	V2
2	No	V1a
-98	Don't know	V2
-99	Refused	V2

V1a. **Can you tell me the correct information?** [ALLOW RESPONDENT TO ANSWER IN HIS/HER OWN WORDS, THEN SELECT THE APPROPRIATE RESPONSE BELOW. IF RESPONDENT IS UNSURE, PROMPT WITH: Was there one refrigerator? What about the other one?]

1	A refrigerator	
2	A freezer	
3	Two refrigerators	V2
4	A refrigerator and a freezer	
5	Two freezers	
6	Incorrect year [Record correct year]	
7	No Refrigerator or Freezer was picked up	THANK & TERMINATE
-77	Other [SPECIFY]	V2
-98	Don't know	
-99	Refused	THANK & TERMINATE

V2. **These units were picked up from [ADDRESS] for recycling on [MONTH] of [YEAR]. Is that correct?**

1	Yes	V3
2	No	V2a
-98	Don't know	V3
-99	Refused	V3

V2a. **What address were they picked up from?**

	[RECORD CORRECT ADDRESS]	
-98	Don't know	V3
-99	Refused	

V3. **Was the address where the appliance was picked up… (READ RESPONSES)**

1	Your primary residence	R1
2	A second home	R1
3	A property that's rented out	R1
4	A business	R1
5	Something else (specify)	R1
98	Don't know	R1
99	Refused	R1

Refrigerator

[IF ref_qty = 1]
Now I'm going to ask you some specific questions about the refrigerator that was picked

up and recycled.

[IF ref_qty > 1] [LOOP Refrigerator block of questions <ref_qty> times, once for each unit – Max # loops = 3 times]

Now I'm going to ask you some specific questions about each refrigerator that was picked up and recycled. Let's start with the [first / second / third] refrigerator.

R1. **Why did you decide to get rid of your refrigerator?**

1	Got a new unit and didn't need the old one	
2	It wasn't working well	
3	I didn't use it very often – very little stored in it	
4	I didn't use it very often – not plugged in and running	**R2**
5	It used too much energy	
6	Other [SPECIFY]	
-97	(DO NOT READ) [Don't know]	
-98	(DO NOT READ) [Refused]	

R2. **When it was in use before recycling, did you use this refrigerator as your main refrigerator or as an extra or spare refrigerator?**
(Interviewer Note: A main refrigerator is typically in the kitchen; a spare is usually kept someplace else and might or might not be running. If the person recently bought a new main refrigerator and is just waiting for the old one to be picked up, it should be classified as "main")

1	Main	
2	Extra or spare	
-97	[Don't know]	
-98	[Refused]	R3

R3. **At the time of the pick-up, how old was the refrigerator?**
RECORD YEARS, ROUND TO NEAREST HALF YEAR

2	[RECORD YEARS _____ (0-99, HALF = 0.5)]	R4
-97	[Don't know]	R3a
-98	[Refused]	R3a

R3a. **If you don't know exactly, was it…?**
(READ OPTIONS BELOW BUT STOP WHEN/IF RESPONDENT CONFIRMS ONE OF THE AGE RANGES)

1	More than 30 years old	R4
2	20-30 years old	
3	15-20 years old	
4	10-15 years old	
5	5-10 years old	
6	1-5 years old	
-97	[Don't know]	
-98	[Refused]	

R4. **How long had you owned it?**
(Interviewer Note: record months if less than one year, else record years)

1	[RECORD MONTHS] (range 1-11)	R5
2	[RECORD YEARS] (range 1-99)	
-97	[Don't know]	
-98	[Refused]	

[IF R2 = 2, ASK QUESTIONS R5-R6]

R5. **How long had it been used as an extra or spare refrigerator?**
(Interviewer Note: record months if less than one year, else record years, If respondent is confused, reinforce that "how long had it been a spare when you decided to get rid of it".)

1	[RECORD MONTHS]	R65
2	[RECORD YEARS]	
-97	[Don't know]	
-98	[Refused]	

R6. **In the year before being picked up, how much was your refrigerator used? [Read Responses]**

1	Kept it running all the time	R8
2	For special occasions only	R7
3	During certain months of the year only	R7
4	Never plugged in or running	R8
-77	Other [SPECIFY]	R7
-97	Don't know/Don't remember	R8
-97	Refused	R8

R7. **If you were to add up the total time it was plugged in and running, typically how many months in a year would that be? [IF NEEDED: Your best estimate is okay.]** (GET NEAREST MONTH)

	MONTHS ___ (0-12)	R8
-97	[Don't know]	
-98	[Refused]	

[END Questions for Spare refrigerators]

R8. **What was the condition of this refrigerator?**

1	It worked and was in good condition	R9
2	It worked but needed minor repairs like a door seal or handle	
3	It worked but had mechanical problems or needed major repairs	
4	Or, it didn't work	
5	Other [SPECIFY]	
98	Don't know/Don't remember	
99	Refused	

R9. **Based on the way the unit you recycled was working, do you think this unit would have continued to work for around…**
[IF NEEDED: if respondent has difficulty picking an answer, prompt for their best estimate
(e.g. if they say "5 years" would that be "at most 5 years" or "at least 5 years")]

1	Less than a year	R10
2	A year or two more	
3	2-5 years	
4	5-10 years	
5	Over 10 years	
-77	Other (SPECIFY)	
-97	[Don't know]	
-98	[Refused]	

R10. **Where was your refrigerator located when it was being used?**

1	Kitchen	R11
2	Garage	
3	Porch/Patio	
4	Basement	
5	Not applicable (didn't use it)	
-77	Other (SPECIFY)	
-97	[Don't know]	
-98	[Refused]	

R11. **Was that space heated or air conditioned?**

1	Both heated and air-conditioned	R12
2	Neither, unconditioned area like a garage or porch	
3	Heating only	
4	Air-conditioning only	
-97	[Don't know]	
-98	[Refused]	

R12. **Did you replace this recycled refrigerator with another?**

1	Yes	R13
2	No	
-97	[Don't know]	R19
-98	[Refused]	

R13. **Is the replacement refrigerator currently being used as your main refrigerator or as an extra or spare?**

1	Main refrigerator	
2	Extra or spare refrigerator	R14
-97	[Don't know]	
-98	[Refused]	

R14. **Was the replacement brand new or used?**

1	Brand new	R19
2	Used	
-97	[Don't know]	R15
-98	[Refused]	

R15. **How old is the replacement refrigerator?**

1	[Record Years]	R16
-97	[Don't know]	R15a
-98	[Refused]	

R15a. **If you don't know exactly, was it…?**
[READ OPTIONS BELOW BUT STOP WHEN/IF RESPONDENT CONFIRMS ONE OF THE AGE RANGES]

1	More than 30 years old	
2	20-30 years old	
3	15-20 years old	
4	10-15 years old	R16
5	5-10 years old	
6	1-5 years old	
-97	[Don't know]	
-98	[Refused]	

R16. **Where did you get this replacement refrigerator?**

1	Free – from a person (friend / family / neighbor)	R17
2	Free – from a person on Craigslist / newspaper ad / email forum	
3	Free – some other way (SPECIFY:___)	
4	Got it from another location (e.g.- office, second home, rental unit)	
5	Kept it from previous owner (came with the house)	
6	Purchased – from a person (friend / family / neighbor)	
7	Purchased – from a person on Craigslist / newspaper ad / email forum	
8	Purchased – from a used appliance dealer	R18
9	Some other way (SPECIFY:___)	R17
-97	[Don't know]	R18
-98	[Refused]	

R17. **If you had not been able to get this replacement refrigerator from an individual, what would you have done?**

1	Purchased a new unit from a retailer	R18a
2	Purchased a used unit from a retailer	R18
3	Not purchased a replacement	R18a
98	Don't know	R18
99	Refused	R18

R18. **If you had not been able to find a used unit with the price or features you needed, what would you have done?**

1	Purchased a new unit from a retailer	R18a
3	Not purchased a replacement	
98	Don't know	
99	Refused	

[IF R16 was 6, 7 or 8]
R18a. **Why did you choose to get a used refrigerator instead of a new one?**

1	Couldn't afford a new refrigerator	R19
2	It was cheaper / save some money	
2	Could get a larger unit/more features for same price	
3	Other (specify)	
98	Don't know	
99	Refused	

R19. **If the program had not picked up your old refrigerator, what would you most likely have done with it? (READ)**

1	Gotten rid of it	R19a
2	Kept it	R21
-97	(DO NOT READ) [Don't know]	R19a
-98	(DO NOT READ) [Refused]	

R19a. If you had to discard it on your own, when would you have gotten rid of the refrigerator? (DO NOT READ)

1	Around the same time as when appliance was picked up by the program	R20
2	Later – After the date the program picked up my appliance	R19b
3	Earlier – I had to wait until the program could pick it up	
-97	(DO NOT READ) [Don't know]	R20
-98	(DO NOT READ) [Refused]	

R19b. Taking into consideration the challenge of getting rid of a refrigerator, how many months later do you think you would have gotten rid of the refrigerator if the program had not picked it up when it did?

1	[Record Months]	R20
2	Actually might have kept it instead	R21
-97	(DO NOT READ) [Don't know]	
-98	(DO NOT READ) [Refused]	

R20. How would you have gotten rid of it?
[PROMPT FOR RESPONSE – READ OPTIONS IF NEEDED]

1	[Took to Landfill or recycling center yourself]	
2	[Hired someone to take it away for disposal]	[END REF]
3	[Donated to charity]	
4	[Removed by installer of new unit]	R22
5	[Sold to private individual (friend, family, neighbor, stranger)]	
6	[Sold to used appliance dealer]	
7	[Gave to a used appliance dealer]	[END REF]
8	[Gave it to a private individual (friend, family, neighbor, stranger – includes left it when you moved or installing it in a second unit/rental home)]	
9	Left it on the curb, free to take	
10	[Kept it]	R21
77	[Other (specify)]	
-97	[Don't know]	[END REF]
-98	[Refused]	

R21. If you had kept the refrigerator would it have been plugged in and running full time, stored unplugged, or used occasionally (for example: during holidays?)

1	Plugged in and running	
2	Store it unplugged	
3	Use it Occasionally	[END REF]
-97	(DO NOT READ) [Don't know]	
-98	(DO NOT READ) [Refused]	

R22. **What retailer did you buy your replacement unit from?**
[PROMPT FOR RESPONSE – READ OPTIONS ONLY IF NEEDED]

1	[Sears]	
2	[Home Depot]	
3	[Lowes]	
4	[Costco]	
5	[Wal-Mart]	[END REF]
6	[Best Buy]	
7	[Local appliance store]	
77	[Other (specify)]	
-97	[Don't know]	
-98	[Refused]	

Freezer

[IF frz_qty = 1]
Now I'm going to ask you some specific questions about the freezer that was picked up and recycled.
[IF frz_qty = 2] [LOOP Freezer block of questions twice, once for each unit]
Now I'm going to ask you some specific questions about each freezer that was picked up and recycled. Let's start with the [first / second] freezer.

F1. **At the time of the pick-up, how old was the freezer?**
RECORD YEARS, round to nearest half year

2	[RECORD YEARS _____ (0.5-99, HALF = 0.5)]	F2
97	Don't remember	F1a
98	Don't know	F1a
99	Refused	F1a

F1a. **If you don't know exactly, was it…?**
(READ OPTIONS BELOW BUT STOP WHEN/IF RESPONDENT CONFIRMS ONE OF THE AGE RANGES)

1	More than 30 years old	
2	21-29 years old	
3	16-20 years old	
4	11-15 years old	F2
5	6-10 years old	
6	1-5 years old	
-97	[Don't know]	
-98	[Refused]	

F2. **How long had you owned it?**
(Interviewer Note: record months if less than one year, else record years)

1	[RECORD MONTHS] (range 1-11)	
2	[RECORD YEARS] (range 1-99)	F3
-97	[Don't know]	
-98	[Refused]	

F3. **Thinking about how this additional freezer was normally used in your home, was it plugged in and running…[Read Responses]**

1	All the time	F5
2	For special occasions only	F4
3	During certain months of the year only	
4	Never plugged in or running	F5
98	Don't know/Don't remember	F4
99	Refused	F4

F4. **If you were to add up the total time it was plugged in and running, how many months in a year would that be? Your best estimate is okay. (GET NEAREST MONTH OR HALF MONTH)**

1	MONTHS ___ (0-12.0)	
2	All the time	F5
-97	[Don't know]	
-98	[Refused]	

F5. **Where was your freezer located when it was being used?**

1	Kitchen	
2	Garage	
3	Porch/Patio	
4	Basement	
5	Not applicable (didn't use it)	F6
-77	Other (SPECIFY)	
-97	[Don't know]	
-98	[Refused]	

F6. **Was that space heated or air conditioned?**

1	Both heated and air-conditioned	
2	Neither, unconditioned area like a garage or porch	
3	Heating only	F7
4	Air-conditioning only	
-97	[Don't know]	
-98	[Refused]	

F7. **Did you replace this recycled freezer with another?**

1	Yes	F8
2	No	
-97	[Don't know]	F13
-98	[Refused]	

F8. **Was the replacement brand new or used?**

1	Brand new	F13
2	Used	
-97	[Don't know]	F9
-98	[Refused]	

F9.   **How old is the replacement freezer?**

1	[Record Years]	F10
-97	[Don't know]	F9a
-98	[Refused]	

F9a.   **If you don't know exactly, was it…?**
[READ OPTIONS BELOW BUT STOP WHEN/IF RESPONDENT CONFIRMS ONE OF THE AGE RANGES]

1	More than 30 years old	
2	21-29 years old	
3	16-20 years old	
4	11-15 years old	F10
5	6-10 years old	
6	1-5 years old	
-97	[Don't know]	
-98	[Refused]	

F10.   **Where did you get this replacement freezer?**

1	Free – from a person (friend / family / neighbor)	
2	Free – from a person on Craigslist / newspaper ad / email forum	
3	Free – some other way	
4	Got it from another location (e.g.- office, second home, rental unit)	F11
5	Kept it from previous owner (came with the house)	
6	Purchased – from a person (friend / family / neighbor)	
7	Purchased – from a person on Craigslist / newspaper ad / email forum	
8	Purchased – from a used appliance dealer	F12
9	Some other way (SPECIFY:___)	F11
-97	[Don't know]	F12
-98	[Refused]	

F11. **If you had not been able to get this replacement freezer from an individual, what would you have done?**

1	Purchased a new unit from a retailer	F13
2	Purchased a used unit from a retailer	F12
3	Not purchased a replacement	F13b
98	Don't know	F13
99	Refused	F13

F12. **If you had not been able to find a used unit with the price or features you needed, what would you have done?**

1	Purchased a new unit from a retailer	
3	Not purchased a replacement	F13
98	Don't know	
99	Refused	

F13. **Why did you choose to get a used freezer instead of a new one?**

1	Couldn't afford a new freezer	
2	It was cheaper / save some money	
3	Could get a larger unit/more features for same price	F13b
4	Other (specify)	
98	Don't know	
99	Refused	

F13b. **If the program had not picked up your old freezer, what would you most likely have done with it? (READ)**

1	Gotten rid of it	F13a
2	Kept it	F15
-97	(DO NOT READ) [Don't know]	F13a
-98	(DO NOT READ) [Refused]	

F13a. **If you had to discard it on your own, when would you have gotten rid of the freezer? (DO NOT READ)**

1	Around the same time as when appliance was picked up by the program	F14
2	Later – After the date the program picked up my appliance	F13b
3	Earlier – I had to wait until the program could pick it up	
-97	(DO NOT READ) [Don't know]	F14
-98	(DO NOT READ) [Refused]	

F13b. **Taking into consideration the challenge of getting rid of a freezer, how many months later do you think you would have gotten rid of the freezer if the program had not picked it up when it did?**

1	[Record Months]	F14
2	Actually might have kept it instead	F15
-97	(DO NOT READ) [Don't know]	F14
-98	(DO NOT READ) [Refused]	F14

F14. **How would you have gotten rid of it?**
[PROMPT FOR RESPONSE – READ OPTIONS IF NEEDED]

1	[Took to Landfill or recycling center yourself]	
2	[Hired someone to take it away for disposal]	[END FRZ]
3	[Donated to charity]	
4	[Removed by installer of new unit]	F16
5	[Sold to private individual (friend, family, neighbor, stranger)]	
6	[Sold to used appliance dealer]	
7	[Gave to a used appliance dealer]	[END FRZ]
8	[Gave it to a private individual (friend, family, neighbor, stranger – includes left it when you moved or installing it in a second unit/rental home)]	
9	Left it on the curb, free to take	
10	[Kept it]	F15
77	[Other (specify)]	
-97	[Don't know]	[END FRZ]
-98	[Refused]	

F15. **If you had kept the refrigerator would it have been plugged in and running full time, stored unplugged, or used occasionally (for example: during holidays?)**

1	Plugged in and running	
2	Store it unplugged	
3	Use it Occasionally	[END FRZ]
-97	(DO NOT READ) [Don't know]	
-98	(DO NOT READ) [Refused]	

F16. **What retailer did you buy your replacement unit from?**
[PROMPT FOR RESPONSE – READ OPTIONS ONLY IF NEEDED]

1	[Sears]	
2	[Home Depot]	
3	[Lowes]	
4	[Costco]	
5	[Wal-Mart]	[END FRZ]
6	[Best Buy]	
7	[Local appliance store]	
77	[Other (specify)]	
-97	[Don't know]	
-98	[Refused]	

Attitudes, Knowledge and Awareness of Appliance Recycling Benefits

A1.   **Before you decided to dispose of your appliance, were you aware that a refrigerator or freezer in your home can cost up to $180 a year for electricity?**

1	Yes	
2	No	A2
-97	(DO NOT READ) [Don't know]	
-98	(DO NOT READ) [Refused]	

A2.   **Prior to choosing a disposal method, were you aware that the refrigerant in refrigerators and freezers is harmful to the environment if not properly disposed of?**

1	Yes	
2	No	A3
-97	(DO NOT READ) [Don't know]	
-98	(DO NOT READ) [Refused]	

A3a.   **Did you know that the appliance(s) you recycled through the program will be completely taken apart and the metals and glass recycled?**

1	Yes	
2	No	A3b
-97	(DO NOT READ) [Don't know]	
-98	(DO NOT READ) [Refused]	

A3b.   **Did you know that the coolant, motor oil and insulation that might contain hazardous material would be removed and recycled, or destroyed?**

1	Yes	
2	No	A3c
-97	(DO NOT READ) [Don't know]	
-98	(DO NOT READ) [Refused]	

A3c. **Did you know that none of the material from the units would go to a landfill?**

1	Yes	
2	No	A4
-97	(DO NOT READ) [Don't know]	
-98	(DO NOT READ) [Refused]	

A4. **I'm going to list several energy-efficient product labels or energy efficiency programs. For each, please tell me if you have heard of it.** [RANDOMIZE LABELS/NAMES OF PROGRAMS EXCEPT "ENERGY STAR Most Efficient" SHOULD ALWAYS IMMEDIATELY FOLLOW "ENERGY STAR."] **[RECORD FOR EACH: 1=YES; 2=NO; -98=REFUSED; -99=DON'T KNOW]**
a. ENERGY STAR
b. ENERGY STAR Most Efficient
c. Flex Your Power
d. Top Ten
e. Energy Upgrade California

A5. **Have you heard of a carbon footprint?**
 [IF NECESSARY: A carbon footprint is a measure of the energy you use throughout your life, either directly or indirectly. This includes but is not limited to the energy consumption in your home, your transportation, your diet, and your purchases.]

1	Yes	
2	No	A6
-97	(DO NOT READ) [Don't know]	
-98	(DO NOT READ) [Refused]	

A6. **Next, I'm going to read a list of energy-saving actions. For each action please tell me if your household has already taken the action. Did you…** [RANDOMIZE ACTIONS] **[READ EACH ACTION. RECORD** FOR EACH: 1=YES; 2=NO; 3=CAME WITH THE HOUSE; -98=REFUSED; -99=DON'T KNOW]
a ...install an attic vent to keep the attic cooler?
b ...install programmable thermostats?
c ...install ceiling fans?
d ...install motion detectors for lights?

A7. **On a scale of 1 to 7 where 1 is Strongly Disagree and 7 is Strongly Agree, please tell me how much you agree or disagree with the following two statements.**

A7a. **I compare prices of at least a few brands before I choose one.**

	[RECORD NUMBER Range = 1-7]	
-97	(DO NOT READ) [Don't know]	A7b
-98	(DO NOT READ) [Refused]	

A7a. **I do NOT feel responsible for conserving energy because my personal contribution is very small.**

	[RECORD NUMBER Range = 1-7]	
-97	(DO NOT READ) [Don't know]	A8
-98	(DO NOT READ) [Refused]	

A8. **I'm going to read you a list of 6 reasons why people might change their daily actions to save energy. Please tell me which of these would motivate you the MOST to save energy?** [READ CHOICES] [IF RESPONDENT SAYS "DON'T KNOW," PROBE: "if you had to choose from the following reasons which one would motivate you the most"] **[RANDOMIZE]**

1. Saving money
2. Maintaining Health
3. Protecting the environment
4. For the benefit of future generations
5. Reducing our dependence on foreign oil
6. Helping California lead the way on saving energy
-98. REFUSED
-99. DON'T KNOW

DEMOGRAPHICS SECTION	(unchanged from Participant survey)

D1. **How many refrigerators do you currently have in your home?**

1	[RECORD NUMBER]	
-97	[Don't know]	D2
-98	[Refused]	

[IF D1>0]
D2. **How many of those refrigerators are in use?**

1	[RECORD NUMBER: should be >= to D0]	
-97	[Don't know]	D3
-98	[Refused]	

D3. **How many stand-alone freezers do you currently have in your home?**

1	[RECORD NUMBER]	
-97	[Don't know]	D4
-98	[Refused]	

[IF D3>0]
D4. **How many of your stand-alone freezers are in use?**

1	[RECORD NUMBER: should be >= to D2]	
-97	[Don't know]	D5
-98	[Refused]	

D5. Which of the following types of housing units would you say best describes your home? Is it a… [READ CHOICES]

1	Single-family detached house	
2	Single-family attached house (townhouse, row house, excluding duplex)	
3	Duplex	
4	Building with 2-4 units	
5	Building with 5 or more units	D6
6	Mobile home or house trailer	
7	Business	
8	Other (specify)	
-97	[Don't know]	
-98	[Refused]	

D6.   How many bedrooms do you have in your home? [IF EFFICIENCY OR STUDIO APARTMENT, BEDROOMS=0]

1	[RECORD NUMBER]	
-97	[Don't know]	D7
-98	[Refused]	

D7.   How many years have you lived in your home? [ROUND TO NEAREST HALF YEAR; USE 0.5 FOR 6 MONTHS OR ½ YEAR]

1	[RECORD NUMBER]	
-97	[Don't know]	D8
-98	[Refused]	

D8. About when was your home first built?

1	Before the 1970s	
2	1970s	
3	1980s	
4	1990-1994	
5	1995-1999	D9
6	2000s	
-97	[Don't know]	
-98	[Refused]	

D9.   Including yourself, how many people currently live in your home year-round?

1	[RECORD NUMBER]	
-97	[Don't know]	D10
-98	[Refused]	

D10. **Including yourself, how many of the people currently living in your home year-round are in the following age groups?**

1	Less than 18 years old	D10a. RECORD NUMBER	
2	18 to 24	D10b. RECORD NUMBER	
3	25 to 34	D10c. RECORD NUMBER	
4	35 to 44	D10d. RECORD NUMBER	
5	45 to 54	D10e. RECORD NUMBER	D11
6	55 to 64	D7f. RECORD NUMBER	
7	65 or older	D7g. RECORD NUMBER	
-97	[Don't know]		
-98	[Refused]		

D11. **Do you own or rent your home?**

1	[Own / Buying]	
2	[Rent / Lease]	
3	[Occupy rent-free]	
-77	Other (specify)	D12
-97	[Don't know]	
-98	[Refused]	

D12. **Have you remodeled your home in the past 5 years?**

1	Yes	
2	No	
-97	(DO NOT READ) [Don't know]	D13
-98	(DO NOT READ) [Refused]	

D13. **What is the highest level of education you have completed?**
(READ ONLY IF NEEDED)

1	No schooling	
2	Less than high school	
3	Some high school	
4	High school graduate or equivalent (e.g., GED)	
5	Some college	
6	College degree	D14
7	Graduate degree	
8	Post-Gradute	
-97	[Don't know]	
-98	[Refused]	

D14. **How would you describe your race?**
(DO NOT READ; RECORD UP TO 5 RESPONSES)

1	White	
2	Black or African American	
3	American Indian or Alaskan Native	
4	Asian	
5	Pacific Islander	D15
6	Spanish, Hispanic or Latino	
7	Other (SPECIFY)	
-97	[Don't know]	
-98	[Refused]	

D15. **Are you Spanish, Hispanic or Latino?**

1	Yes	
2	No	
-97	(DO NOT READ) [Don't know]	D16
-98	(DO NOT READ) [Refused]	

D16. **What was your household income from all sources in 2011, before taxes? Was it . . . .?**

1	**Less than $20,000 per year,**	
2	**$20 to less than $30,000**	
3	**$30 to less than $40,000**	
4	**$40 to less than $50,000**	
5	**$50 to less than $60,000**	
6	**$60 to less than $75,000**	
7	**$75 to less than $100,000**	D17
8	**$100 to less than $150,000**	
9	**$150 to less than $200,000**	
10	**More than $200,000**	
-97	[Don't know]	
-98	[Refused]	

D17. **What is the primary language spoken in your home? (DO NOT READ LIST)**

1	**English**	
2	**Spanish**	
3	**Mandarin**	
4	**Cantonese**	
5	**Tagalog**	
6	**Korean**	D
7	**Vietnamese**	
8	**Russian**	
9	**Japanese**	
10	**Other (SPECIFY)**	
-97	[Don't know]	
-98	[Refused]	

D18. **RECORD GENDER [DO NOT ASK.]**

1	Male	END_1
2	Female	END_1
-97	[Don't know]	END_1

THANK & TERMINATE

END_1. **Those are all of the questions I have for you today. Thank you for your time.**
[READ IF NECESSARY] If you have any questions about this survey, please call Peter
Franzese at California Public Utilities Commission (insert number here)

D. Non-participant Acquirer/Discarder Survey

California Public Utilities Commission
Appliance Recycling Program Impact Evaluation
Residential Nonparticipant CATI Survey
October 2013

Survey house instructions

1. **Text in** bold **should be read.**
2. **Text in brackets [Green text] are instructions for interviewer, clarifying details for the interviewer's knowledge, or answer choices and should NOT be read routinely.**
3. **Text in carrots < > are database variables that should be filled in on a case-by-case basis.**
4. **Text in double-carrots << >> are larger blocks of text that will change on a case-by-case basis depending on database variables.**
5. **Text in [Red Brackets] is major programming instruction.**
6. **Unless specifically noted, do NOT read answer choices. [Don't know] and [Refused] should NEVER be read.**

Programming Notes

Code multiple response questions as a series of variables that have a 0 or 1 value. One variable for each answer option. For example, R5_1 = 1 if the respondent answers "internet" to R5. R5_1 = 0 if the respondent does not answer "internet. Make separate 0/1 variables for the [Don't know] and [Refused] options as well.

Database variables

Variable	Definition
	(Unless otherwise noted, the database can contain more than one of each variable per respondent)
cont1, cont2, ... contx	Contact name(s).
Program	The name of the utility program
Address	Address where equipment was picked up / recycled
Phone	Phone number
CATI_Strata	The strata each participant is assigned to

Introduction

I5. **May I speak with [contact name]?**

Good [morning/afternoon]. My name is _____ and I'm calling on behalf of the California Public Utilities Commission. We are conducting a survey about refrigerators and freezers. **[IF NEEDED: The survey takes about 15 minutes.]**

[IF NEEDED: I'm calling from Discovery Research Group, an independent research firm.]

Do you or your household own any refrigerators or freezers in your home? **[Interviewer note: We want to confirm the refrigerators/freezers are not owned by a landlord but by the participant household.]**

1	Yes	I2
2	No	Thank and Terminate (TT_NQ)
-98	Don't know	
-99	Refused	

I6. **Has your household disposed of a full sized refrigerator or stand-alone freezer in the last five years?** **[IF NEEDED: By "disposed of," I mean sell it, give it away, or have it hauled away.]**

1	Yes	I3
2	No	I4
-98	Don't know	
-99	Refused	I5

I7. **Did you have the appliance(s) picked up through your electric company's appliance recycling service?** **[IF NEEDED: Your electric company offers an incentive to pick up and recycle old working refrigerators and freezers. A contractor would have picked the appliance up at your home and you would have received a check from the utility later in the mail.]**

1	Yes (picked up by recycling program)	I4
2	No (not picked up by recycling program)	
-98	Don't know	
-99	Refused	

I8. **Has your household acquired a "new to you" full-sized refrigerator or stand-alone freezer since June of 2008?** **[IF NEEDED: by "acquired" I mean any way of getting a "new to you" appliance, whether purchased or free. A unit you already owned being moved from a second house or office into your house, or an appliance present in the home when you moved in would not be considered "acquired".]**

1	Yes	I5
2	No	End section
-98	Don't know	I6
-99	Refused	

I9. **Were any of the appliances used when you acquired them?**

1	No, all were brand new	End Section
2	Yes, one or more was used when I got it	
-98	Don't know	
-99	Refused	

I10. **Is there someone else in your household who might know more about any changes in your appliances in the past few years?**

1	Yes	I7
2	No	THANK & TERMINATE (TT_DK)
-98	Don't know	
-99	Refused	

I11. **May I please speak to that person?**

1	Yes **[Transfer to new contact or Record Name- if not available establish a good time for a call back]**	I2
2	No	THANK & TERMINATE (TT_DK)
-98	Don't know	
-99	Refused	

[NOTE TO PROGRAMMER: Based on the answers to the screening questions above, we need to assign variables that will be used to determine which sections of the survey will be asked, and to determine if this caller should continue in the survey or terminate with one of the termination codes.

IF I2=2/DK/Ref, then discarder = 0;
Else IF I2=1,
       IF I3 = 1/DK/Ref, then discarder = 2;
       IF I3 = 2, then discarder = 1;

IF I4 = 2/DK/Ref, then acquirer = 0;
IF I4 = 1, then:
       IF I5 = 1/DK/Ref, then acquirer = 2;
       IF I5 = 2, then acquirer = 1;

* set strata
Strata 1 – discarders – target completes = 800
Strata 2 – acquirers – target completes = 300

IF discarder = 1 AND acquirer = 0, then strata = 1
IF acquirer = 1, then strata = 2;

IF strata=1 AND strata1 target complete, then terminate (TT_disc)
IF acquirer=2, then terminate (TT_new)
IF acquirer=0 AND discarder=2, then terminate (TT_arp)
IF acquirer = 0 AND discarder = 0, then terminate (TT_none)
]

[IF discarder = 1, ask Discarder Section]

Discarder Section

D1. **How many refrigerators or freezers have you disposed of since June of 2008, including units you replaced?**

1	None	End Section
2	One	
3	More than one (Record number, 2-20)	D2
-98	Don't know	
-99	Refused	

D2. **How many were *refrigerators* that *worked* at the time of disposal?**

1	None	
2	One	
3	More than one (Record number, 2-20)	D3
-98	Don't know	
-99	Refused	

D3. **How many were *freezers* that *worked* at the time of disposal?**

1	None	
2	One	
3	More than one (Record number, 2-20)	D4
-98	Don't know	
-99	Refused	

[IF D1=2, then do
    If D2=2, then SET ApplianceVar = "Refrigerator"
    Else IF D3=2, then SET ApplianceVar = "Freezer"
    Skip to D5
Else IF D1=3, ask D4]

D4. **The next few questions will focus on the appliance you disposed of most recently. Was that appliance a refrigerator or freezer?**

1	Refrigerator [SET ApplianceVar = "Refrigerator"]	
2	Freezer [SET ApplianceVar = "Freezer"]	D5
-98	Don't know	
-99	Refused	

D5. **Do you recall the year when you disposed of this [ApplianceVar]?**

1	RECORD YEAR (e.g. 2008) Valid range 2008-2013	
-98	Don't know	D6
-99	Refused	

D6. **Why did you decide to get rid of your [ApplianceVar]?**

1	Got a new unit and didn't need the old one	
2	It wasn't working well	
3	I didn't use it very often/at all	
4	It used too much energy	**D7**
5	Other [SPECIFY]	
-98	(DO NOT READ) [Don't know]	
-99	(DO NOT READ) [Refused]	

D7. **What was the condition of this [ApplianceVar] just before you disposed of it? Would you say… [READ LIST]**

1	It worked and was in good condition	D8
2	It worked but needed minor repairs like a door seal or handle	
3	It worked but had mechanical problems or needed major repairs	
4	Or, it didn't work	
5	Other [SPECIFY]	
-98	Don't know/Don't remember	
-99	Refused	

D8. **Based on the way the [ApplianceVar] was working, do you think this unit would have continued to work for around…**

1	Less than a year	
2	A year or two more	
3	2-5 years	
4	5-10 years	
5	Over 10 years	D9
-77	Other (SPECIFY)	
-98	[Don't know]	
-99	[Refused]	

D9. **At the time you got rid of it, approximately how old was the [ApplianceVar]?**
 (READ OPTIONS BELOW BUT STOP WHEN/IF RESPONDENT CONFIRMS ONE OF THE AGE RANGES)

1	More than 30 years old	
2	20-29 years old	
3	15-19 years old	
4	10-14 years old	D10
5	5-9 years old	
6	Less than 5 years old	
-98	[Don't know]	
-99	[Refused]	

[IF ApplianceVar = "Freezer", SKIP TO D12]

D10. **When it was in use before you decided to dispose of it, did you use this refrigerator as your main refrigerator or as an extra or spare refrigerator?**
(Interviewer Note: A main refrigerator is typically in the kitchen; a spare is usually kept someplace else and might or might not be running. If the person recently bought a new main refrigerator and is just waiting for the old one to be picked up, it should be classified as "main")

1	Main	D15
2	Extra or spare	
-98	[Don't know]	D11
-99	[Refused]	

[IF D10 = 1,SKIP TO D15]

D11. **How long had it been used as an extra or spare refrigerator?**
(Interviewer Note: record months if less than one year, else record years, If respondent is confused, reinforce that "how long had it been a spare when you decided to get rid of it".)

1	[RECORD MONTHS]	
2	[RECORD YEARS]	D12
-98	[Don't know]	
-99	[Refused]	

D12. **What were the main reasons you needed this [ApplianceVar]?**
(Accept multiple)

1	I have a large family and/or need extra space for food storage	
2	I buy in bulk at warehouse/bargain stores (Costco, Sam's Club, etc.)	
3	I need/like separate storage for beverages	
4	I need extra storage for special events/holidays	
5	Hunting/fishing needs	D13
6	Medical storage	
7	Other (SPECIFY)	
-98	[Don't know]	
-99	[Refused]	

D13. **In the year before you disposed of it, how much was your [ApplianceVar] used? [Read Responses]**

1	Kept it running all the time	D14
2	For special occasions only	D13a
3	During certain months of the year only	
4	Never plugged in or running	D14
-77	Other [SPECIFY]	D13a
-98	Don't know/Don't remember	D14
-99	Refused	

D13a. **How many months was the [ApplianceVar]plugged in and running?**

	[RECORD VERBATIM]	
-97	[Don't know]	D14
-98	[Refused]	

D14. **Would you say that the [ApplianceVar] you disposed of was typically….? [READ LIST]**

1	Empty	
2	About a quarter full	
3	About half full	
4	About three-quarters full	D15
5	Mostly or completely full	
-98	[Don't know]	
-99	[Refused]	

[IF ApplianceVar = "Freezer", SKIP TO D15a]

D15. **What type of unit was it? [READ LIST]**

1	Side-by-side	
2	Top Freezer	
3	Bottom Freezer	
4	Single Door	D16
5	Other [SPECIFY]	
-98	[Don't know]	
-99	[Refused]	

D15a. **What type of unit was it? [READ LIST]**

1	Upright	
2	Chest	
5	Other [SPECIFY]	D16
-98	[Don't know]	
-99	[Refused]	

D16. **How did you dispose of your refrigerator?**
[READ IF NEEDED, CLARIFY TO FIT LIST BELOW. FOR EXAMPLE: Did you give it away or sell it?]

1	[Threw away / Took to Landfill / removed by hauler]	
2	[Took to recycling center]	
3	[Donated to charity]	
4	[Taken by installer of new one]	
5	[Sold to used appliance dealer]	
6	[Sold to someone you knew (friend / family / neighbor)]	D16a
7	[Sold on Craigslist / newpaper ad / online forum]	
8	[Gave to someone you knew (friend / family / neighbor)]	
9	[Gave away on Craigslist / newpaper ad / online forum]	
-77	[Other (specify)]	
-98	[Don't know]	
-99	[Refused]	

D16a. Why did you choose that option?

1	Least expensive option	
2	Easiest option	
-77	[Other, specify_____]	D16b
-97	[Don't know]	
-98	[Refused]	

[Ask D16b IF D16 = 5,6,7,-77,   else SKIP TO D16c]
D16b. How much money did you get for your [ApplianceVar]?
[RECORD Dollars, ENTER $0 IF RESPONDENT SAYS "NOTHING" OR "Free"]

1	[RECORD Dollars _____ ($0-$9999)]	D16c
-98	[Don't know]	
-99	[Refused]	

[Ask D16c IF D16 = 1,2,3,4,-77,   else SKIP TO D17]
D16c. How much did you pay to get rid of it?
[RECORD Dollars, ENTER $0 IF RESPONDENT SAYS "NOTHING" OR "Free"]

1	[RECORD Dollars _____ ($0-$9999)]	D17
-98	[Don't know]	
-99	[Refused]	

D17. After disposing of this [ApplianceVar] was the total number of [ApplianceVar]s in the house…

1	Decreased (disposal without replacement)	EndSection
2	The Same (got a replacement for this unit)	D18
-98	[Don't know]	EndSection
-99	[Refused]	

D18. **Was the replacement brand new or used?**

1	Brand new	EndSection
2	Used	
-98	[Don't know]	
-99	[Refused]	

[IF acquirer = 1, ask Acquirer Section]

Acquirer Section

AQ1. **The next few questions will focus on the used appliance you most recently acquired. Was that appliance a refrigerator or freezer?**
[IF NEEDED: by "acquired" I mean any way of getting a "new to you" used appliance, whether purchased or free.]

1	Refrigerator [SET ApplianceVar2 = "Refrigerator"]	AQ2
2	Freezer [SET ApplianceVar2 = "Freezer"]	
-98	Don't know	
-99	Refused	

[IF [ApplianceVar2] = [ApplianceVar], continue, else SKIP to AQ3]
    [IF D18=2, ask AQ2, else Skip to AQ3]

AQ2. **Is this the replacement [ApplianceVar] you just mentioned or another [ApplianceVar]?**

1	Same one	AQ4
2	Different one	AQ3
-98	[Don't know]	
-99	[Refused]	

AQ3. **Was this [ApplianceVar2] replacing another [ApplianceVar2] or was it adding to the number of refrigerators and freezers in your house?**

1	Replacement	AQ4
2	Added another to the house	
-98	[Don't know]	
-99	[Refused]	

[IF [ApplianceVar2] = "Refrigerator", ask AQ4, else SKIP to AQ5]

AQ4. **Is the refrigerator currently being used as your main refrigerator or as an extra or spare?**

1	Main refrigerator	
2	Extra or spare refrigerator	AQ5
-98	[Don't know]	
-99	[Refused]	

AQ5. **Approximately how old was the used [ApplianceVar2] when you got it?**
[READ OPTIONS BELOW BUT STOP WHEN/IF RESPONDENT CONFIRMS ONE OF THE AGE RANGES]

1	More than 30 years old	
2	20-29 years old	
3	15-19 years old	
4	10-14 years old	AQ6
5	5-9 years old	
6	Less than 5 years old	
-98	[Don't know]	
-99	[Refused]	

AQ6 **What features were important to you? [Do not read options. Select all that apply]**

1	Configuration	
2	Size	
3	Icemaker	
4	Color	
5	Energy Use	AQ7
6	Price	
-77	[Other, specify_____]	
-97	[Don't know]	
-98	[Refused]	

AQ7. **Where did you get this [ApplianceVar2]?**

1	From a person you knew (family / friend / neighbor)	AQ8
2	From Craigslist / newspaper ad / email forum	AQ7a
3	From a used appliance dealer	AQ9b
77	Some other way (specify)]	
-98	[Don't know]	AQ8
-99	[Refused]	

AQ7a. **Did you get it from a dealer/retailer or a private person passing along their own unit?**

1	Dealer / retailer	
2	Individual person	AQ8
-98	[Don't know]	
-99	[Refused]	

AQ8. **Did you purchase it or get it for free?**

1	Got it for free	AQ9a
2	Purchased it	AQ9b
-98	[Don't know]	AQ10
-99	[Refused]	

AQ9a. **If this free unit hadn't been available to you, what would you have done?**

1	Looked for a similar **free** unit elsewhere	
2	Purchased a similar **used** unit elsewhere	
3	Purchased a **new** unit from a retailer	
4	Not purchased a [ApplianceVar2] /stuck with what you already had	AQ10
-98	[Don't know]	
-99	[Refused]	

AQ9b. **If you had not been able to purchase this particular [ApplianceVar2], what would you have done?**

1	Purchased a similar **used** unit elsewhere	
2	Purchased a **new** unit from a retailer	
3	Not purchased a [ApplianceVar2] /stuck with what you already had	AQ10
-98	Don't know	
-99	Refused	

AQ10. **If you had not been able to find a used unit with the price or features you needed, what would you have done?**

1	Purchased a new unit from a retailer	
3	Not purchased a replacement /stuck with what you already had	End Section
-98	Don't know	
-99	Refused	

Attitudes, Knowledge and Awareness of Appliance Recycling Benefits (changes from Participant survey marked)

A1. Before you decided to dispose of your appliance, were you aware that a refrigerator or freezer in your home can cost up to $180 a year for electricity?

1	Yes	
2	No	A2
-98	(DO NOT READ) [Don't know]	
-99	(DO NOT READ) [Refused]	

A2. Prior to choosing a disposal method, were you aware that the refrigerant in refrigerators and freezers is harmful to the environment if not properly disposed of?

1	Yes	
2	No	A4
-98	(DO NOT READ) [Don't know]	
-99	(DO NOT READ) [Refused]	

A4. I'm going to list several energy-efficient product labels or energy efficiency programs. For each, please tell me if you have heard of it. [RANDOMIZE LABELS/NAMES OF PROGRAMS EXCEPT "ENERGY STAR Most Efficient" SHOULD ALWAYS IMMEDIATELY FOLLOW "ENERGY STAR."] [RECORD FOR EACH: 1=YES; 2=NO; -98=REFUSED; -99=DON'T KNOW]

a. ENERGY STAR

b. ENERGY STAR Most Efficient

c. Flex Your Power

d. Top Ten

e. Energy Upgrade California

A5. Have you heard of a carbon footprint?
[IF NECESSARY: A carbon footprint is a measure of the energy you use throughout your life, either directly or indirectly. This includes but is not limited to the energy consumption in your home, your transportation, your diet, and your purchases.]

1	Yes	
2	No	A6
-98	(DO NOT READ) [Don't know]	
-99	(DO NOT READ) [Refused]	

A6. Next, I'm going to read a list of energy-saving actions. For each action please tell me if your household has already taken the action. Did you… [RANDOMIZE ACTIONS] [READ EACH ACTION. RECORD FOR EACH: 1=YES; 2=NO; 3=CAME WITH THE HOUSE; -98=REFUSED; -99=DON'T KNOW]

a …install an attic vent to keep the attic cooler?

b …install programmable thermostats?

c …install ceiling fans?

d …install motion detectors for lights?

A7. On a scale of 1 to 7 where 1 is Strongly Disagree and 7 is Strongly Agree, please tell me how much you agree or disagree with the following two statements.

A7a. I compare prices of at least a few brands before I choose one.

	[RECORD NUMBER Range = 1-7]	
		A7b
-98	(DO NOT READ) [Don't know]	
-99	(DO NOT READ) [Refused]	

A7a. I do NOT feel responsible for conserving energy because my personal contribution is very small.

	[RECORD NUMBER Range = 1-7]	
		A8
-98	(DO NOT READ) [Don't know]	
-99	(DO NOT READ) [Refused]	

A8. I'm going to read you a list of 6 reasons why people might change their daily actions to save energy. Please tell me which of these would motivate you the MOST to save energy? [READ CHOICES] [IF RESPONDENT SAYS "DON'T KNOW," PROBE: "if you had to choose from the following reasons which one would motivate you the most"] **[RANDOMIZE]**

7. Saving money
8. Maintaining Health
9. Protecting the environment
10. For the benefit of future generations
11. Reducing our dependence on foreign oil
12. Helping California lead the way on saving energy
-98. REFUSED
-99. DON'T KNOW

DEMOGRAPHICS SECTION   **(unchanged from Participant survey)**

D1. How many refrigerators do you currently have in your home?

1	[RECORD NUMBER]	
		D2
-98	[Don't know]	
-99	[Refused]	

[IF D1>0]
D2. How many of those refrigerators are in use?

1	[RECORD NUMBER: should be >= to D0]	D3
-98	[Don't know]	
-99	[Refused]	

D3. **How many stand-alone freezers do you currently have in your home?**

1	[RECORD NUMBER]	D4
-98	[Don't know]	
-99	[Refused]	

[IF D3>0]
D4. **How many of your stand-alone freezers are in use?**

1	[RECORD NUMBER: should be >= to D2]	D4a
-98	[Don't know]	
-99	[Refused]	

D4a. **Have you considered adding an additional unit (refrigerator or freezer) to your house in the last year?**

1	Yes	D4b
2	No	
-98	(DO NOT READ) [Don't know]	D4c
-99	(DO NOT READ) [Refused]	

D4b. **Why?**

1	[RECORD Verbatim]	D4c
-98	[Don't know]	
-99	[Refused]	

D4c. **If a neighbor approached you today and offered to give you a 20 year old working refrigerator or freezer for free, would you take the unit??**

1	Yes	D5
2	No	
3	Maybe (SPECIFY)	
-98	(DO NOT READ) [Don't know]	
-99	(DO NOT READ) [Refused]	

D5. Which of the following types of housing units would you say best describes your home? Is it a… [READ CHOICES]

1	Single-family detached house	D6
2	Single-family attached house (townhouse, row house, excluding duplex)	
3	Duplex	
4	Building with 2-4 units	
5	Building with 5 or more units	
6	Mobile home or house trailer	
7	Business	
8	Other (specify)	
-98	[Don't know]	
-99	[Refused]	

D6. **How many bedrooms do you have in your home? [IF EFFICIENCY OR STUDIO APARTMENT, BEDROOMS=0]**

1	[RECORD NUMBER]	D7
-98	[Don't know]	
-99	[Refused]	

D7. **How many years have you lived in your home? [ROUND TO NEAREST HALF YEAR; USE 0.5 FOR 6 MONTHS OR ½ YEAR]**

1	[RECORD NUMBER]	D8
-98	[Don't know]	
-99	[Refused]	

D8. About when was your home first built?

1	Before the 1970s	D9
2	1970s	
3	1980s	
4	1990-1994	
5	1995-1999	
6	2000s	
-98	[Don't know]	
-99	[Refused]	

D9. **Including yourself, how many people currently live in your home year-round?**

1	[RECORD NUMBER]	D10
-98	[Don't know]	
-99	[Refused]	

D10. **Including yourself, how many of the people currently living in your home year-round are in the following age groups?**

1	Less than 18 years old	D10a. RECORD NUMBER	
2	18 to 24	D10b. RECORD NUMBER	
3	25 to 34	D10c. RECORD NUMBER	
4	35 to 44	D10d. RECORD NUMBER	
5	45 to 54	D10e. RECORD NUMBER	D11
6	55 to 64	D7f. RECORD NUMBER	
7	65 or older	D7g. RECORD NUMBER	
-98	[Don't know]		
-99	[Refused]		

D11. **Do you own or rent your home?**

1	[Own / Buying]	
2	[Rent / Lease]	
3	[Occupy rent-free]	D12
-77	Other (specify)	
-98	[Don't know]	
-99	[Refused]	

D12. **Have you remodeled your home in the past 5 years?**

1	Yes	
2	No	
-98	(DO NOT READ) [Don't know]	D13
-99	(DO NOT READ) [Refused]	

D13. **What is the highest level of education you have completed?**
(READ ONLY IF NEEDED)

1	No schooling	
2	Less than high school	
3	Some high school	
4	High school graduate or equivalent (e.g., GED)	
5	Some college	
6	College degree	D14
7	Graduate degree	
8	Post-Gradute	
-98	[Don't know]	
-99	[Refused]	

D14. **How would you describe your race?**
(DO NOT READ; RECORD UP TO 5 RESPONSES)

1	White	D15
2	Black or African American	
3	American Indian or Alaskan Native	
4	Asian	
5	Pacific Islander	
6	Spanish, Hispanic or Latino	
7	Other (SPECIFY)	
-98	[Don't know]	
-99	[Refused]	

D15. **Are you Spanish, Hispanic or Latino?**

1	Yes	D16
2	No	
-98	(DO NOT READ) [Don't know]	
-99	(DO NOT READ) [Refused]	

D16. **What was your household income from all sources in 2011, before taxes? Was it . . . .?**

1	**Less than $20,000 per year,**	D17
2	**$20 to less than $30,000**	
3	**$30 to less than $40,000**	
4	**$40 to less than $50,000**	
5	**$50 to less than $60,000**	
6	**$60 to less than $75,000**	
7	**$75 to less than $100,000**	
8	**$100 to less than $150,000**	
9	**$150 to less than $200,000**	
10	**More than $200,000**	
-98	[Don't know]	
-99	[Refused]	

D17. **What is the primary language spoken in your home? (DO NOT READ LIST)**

1	**English**	D18
2	**Spanish**	
3	**Mandarin**	
4	**Cantonese**	
5	**Tagalog**	
6	**Korean**	
7	**Vietnamese**	
8	**Russian**	
9	**Japanese**	
10	**Other (SPECIFY)**	
-98	[Don't know]	
-99	[Refused]	

D18. **RECORD GENDER [DO NOT ASK.]**

1	Male	END_1
2	Female	END_1
-98	[Don't know]	END_1

THANK & TERMINATE

END_2. **Those are all of the questions I have for you today. Thank you for your time.**
[READ IF NECESSARY] If you have any questions about this survey, please call Peter
Franzese at California Public Utilities Commission (insert number here)

E. Retail Channel of Secondary Market

E.1 Market Actor Population and Sample Design

E.1.1 Population Determination and Sample Design

To establish a population database to form the basis of the sample frame for each market actor category, we used the following steps:

1. Assembled a list of relevant SIC and NSAIC codes and sub-codes for each market actor category and purchased more than 7,600 records of businesses from iUSA using the selected codes.
2. Since said codes are not highly articulated and are sometimes misapplied, the purchased dataset required close scrutiny to remove those records that, according to their business name, were not markets actors in the secondary market for refrigerators/freezers.
3. Next, we eliminated those establishments located outside of the IOU territories.
4. For the appliance recycling centers, we removed those establishments that were IOU ARP participants.
5. Since there was no unique code for those retailers of used goods, an estimation of the proportions of retailers that sold new, only, and those that sold used and, sometimes, new, was necessary. We made pre-screening calls to non-chain appliance retailers to estimate the populations of the two subcategories.

The market actor sample design for the secondary market retail channel was established based upon achieving varying confidence levels and precision targets on par with the anticipated relative importance of each market actor category as shown in Table 2.

Table 2. Sample Design for Secondary Market Actor Interviews

Retail Channel Market Actor Category	Preliminary Population in IOU Territories	Final Target Sample, n	Target Confidence Level / Precision
Appliance Recycling	10	6	80% / 20%
Used Retailers	342	57	90% / 10%
New Retailers, only	178	10	80% / 20%
New Retail Chains	8	5	80% / 20%
Haulers	228	4	<80% / >20%
Charity & Thrift Stores	96	4	<80% / >20%
Charity & Thrift Stores, Chains	7	5	80% / 20%
Appliance Rental Companies	20	4	<80% / >20%
Auction Houses/Liquidators	468	6	<80% / >20%
Overall	1,357	101	

A representative sample was randomly selected from each market actor sample frame. For the more numerous market actors, the sample frame and sample were usually stratified by either IOU, annual sales volume, or both. This was done to improve the representation of the range of business sizes of the sample, and, ultimately, those interviewed. Since the annual sales volume was not a reliable indicator of secondary unit inventories, though, no weighting of the results from each stratum was done.

E.1.2   Interview Process

The following describes the interviewing process and preliminary analysis steps taken for each market actor category:

1. Most of the market actor category interviews were conducted by staff at DNV GL. All chain retailer and some of the independent retailer interviews were conducted by a subcontractor, Discovery Research Group, using a CATI instrument. The interviews were conducted between August of 2013 and March of 2014.
2. Upon calling those in the sample, some sample points were found to be "unqualified" if any of the following was learned by the interview attempt:
   a. Phone number was disconnected
   b. Did not handle refrigerators or freezers
   c. No longer in business

3. These targets, however, were difficult to attain for some market actors since these types of establishments are known to be difficult to reach by telephone interview. In many cases, the interviewer was able to capture a portion of the data before the interviewee declined to continue or hung up during the interview. In these cases, the interview was tracked as a "partial completion" and the responses gathered up until the call was terminated were included in the analysis.

4. Calling for a given sample stratum and/or sample was considered complete when either the target had been met for complete interviews or the sample had been exhausted (a maximum number of call attempts to each entity was set at five). Once calling was stopped, the proportion of the sample that was not qualified was determined (as described earlier) and that proportion was applied to the population to determine the estimated qualified population. The standard error of qualified population was propagated through any further analysis.

E.2 Secondary Market Actor Interview Guide

A master interview guide was created that would yield the most answers to the major research questions without becoming unduly long. Most questions included in the master guide were asked of all market actors, but those that did not pertain to a given market actor were skipped. Since the actions taken vary by market actor category, all **words in bold format** were varied as appropriate to functions of each given market actor.

List of Variables to Record:

- Market Actor Category:
- Stratum:
- Interviewer:
- Date/Time:
- Company Name:
- Contact Name:
- SiteID:

Q-number	A-number (if multiple options)	Questions	Response Options

INTRO		Hello, my name is _____ and I'm researching the used refrigerator and freezer market in California. Would you be willing to help us with this study by answering a few questions about used refrigerators and freezers?
		    [*IF NEEDED*: I'm with DNV KEMA and we're conducting this study on behalf of the California Public Utilities Commission.]
		    [*IF NEEDED:* It will only take 10 to 15 minutes.]
		    [*IF REQUESTED:* You may contact Peter Franzese, CPUC, at 415-703-1926.]
		Great! Thank you very much.
		    [*IF INTRO="NO", THANK AND TERMINATE (TT_refused).*]
			YES / NO (circle one)

Q-number	A-number (if multiple options)	Questions	Response Options
VOL-1		Do you **pick-up or sell** USED residential refrigerators and freezers?	YES / NO (circle one)
VOL-4		Do you **sell** new ones? *[IF VOL-1="NO" AND VOL-4="NO", THANK AND TERMINATE (NQ_term1).]* *[IF VOL-1="YES" AND VOL-4="NO", SKIP TO VOL-2.]*	YES / NO (circle one)
VOL-4a		(About) how many NEW fridges or freezers do you sell per month?	_____ integer
VOL-2		*[IF VOL-1="NO", SKIP to VOL-2c]* About how many USED fridges or freezers do you **pick-up or buy** per month?	_____ integer
VOL-2a		Do you turn some used fridges away? *[IF VOL-2="NO", SKIP TO VOL-2b.]*	YES / NO (circle one)
VOL-2a(i)		(About) how many per month?	_____ integer
VOL-2b		Do you take units that you know you can't re-sell? *[IF VOL-2b="NO", SKIP TO VOL-2c.]* *[IF VOL-2b="DOESN'T RESELL" AND VOL-2a="NO", SKIP TO VOL-3.]*	YES / NO / DOESN'T RESELL
VOL-2b(i)		(About) how many per month?	_____ integer
VOL-2c		*[IF VOL-2a="NO", SKIP TO VOL-3.]* Do you suggest options for those you refuse (or turn away)?	YES / NO
VOL-2c(i)		*[IF VOL-2c="NO", SKIP TO VOL-3.]* What are those (options)?	(text)
VOL-3		*[IF VOL-1="NO"AND VOL-4="YES", TT-newonly.]* *(Keep all responses up to TT-newonly to deliver in the same spreadsheet with all completes.)* Does the number of incoming USED units vary by season?	YES / NO
VOL-3a		*[IF VOL-3="NO", SKIP TO IN-1.]* How so?	(text)

Q-number	A-number (if multiple options)	Questions	Response Options
IN-1	CHANNELS BELOW	Now, I'd like to learn where you get the used fridges and freezers from? Can you tell me about what percent of used units per month come from…	
	IN-1a	Individuals	_____ %
	IN-1b	Multi-family property owners	_____ %
	IN-1c	Businesses using residential-grade units	_____ %
	IN-1d	New appliance retailers	_____ %
	IN-1e	Used appliance retailers	_____ %
	IN-1f	Haulers	_____ %
	IN-1g	Auction Houses/Liquidators	_____ %
	IN-1h	Charities	_____ %
	IN-1i	Recycling Centers	_____ %
	IN-1j	Dumps	_____ %
	IN-1k	Other	_____ %
	IN-1k(i)	*[IF "Other">0:] List other sources.*	(text)
IN-1a(i)		*[IF IN-1a > 0, ASK:]* For those that you get from individuals, do you know about what percent of those were used as their main fridge in their kitchens?	_____ %
IN-1a(ii)		*[IF IN-1a > 0, ASK:]* Do you know about what percent of those were used as extra fridge or freezer (again, from individuals)?	_____ %
IN-2		Do any USED units come from out-of-state?	YES / NO
IN-2a		*[IF IN-2="NO",GO TO IN-3.]* How many per month?	_____ integer
IN-3		Do you charge a fee for **picking up** the used fridges and freezers?	YES / NO

Q-number	A-number (if multiple options)	Questions	Response Options
IN-3a		*[IF IN-3="NO", GO TO IN-4.]* How much?	$ _____
IN-4		*[IF VOL-2b="DOESN'T RESELL", SKIP TO CON-1.]* Do you charge a fee to dispose of them if they won't be resold?	YES / NO
IN-4a		*[IF IN-4="NO",GO TO CON-1.]* *How much?*	$ _____
CON-1		What's the working condition when you acquire them used, by percent [READ CHOICES]?	
	CON-1a	Non-working	_____ %
	CON-1b	Working but with mechanical problems or needing major repairs	_____ %
	CON-1c	Working but only need minor repairs (e.g., door seals, touch ups)	_____ %
	CON-1d	Working and no repairs needed	_____ %
	CON-1e	Other	_____ %
CON-1e(i)		*Describe "other"*	(text)
CON-1DIS		Of those same groups, what percent do you dispose of? [READ CHOICES]	
	CON-1DISa(i)	Non-working	_____ %
	CON-1DISb(i)	Working but with mechanical problems or needing major repairs	_____ %
	CON-1DISc(i)	Working but only need minor repairs (e.g., door seals, touch ups)	_____ %
	CON-1DISd(i)	Working and no repairs needed	_____ %
	CON-1DISe(ii)	Other <CON_1e(i)>	_____ %
CON-2		*[IF VOL-1="NO" OR VOL-2b="DOESN'T RESELL", SKIP TO OUT-1.]* When you pick-up or buy used fridges and freezers to re-sell, what characteristics (or features) do you look for?	
	CON-2a	For instance, is AGE important?	YES / NO

Q-number	A-number (if multiple options)	Questions	Response Options
CON-2a(i)		*[If CON-2a="YES", PROBE:]* How so?	(text)
	CON-2b	Or COLOR?	YES / NO
CON-2b(i)		*[If CON-2b="YES", PROBE:]* How so?	(text)
	CON-2c	Or SIZE?	YES / NO
CON-2c(i)		*[If CON-2c="YES", PROBE:]* How so?	(text)
	CON-2d	What about configuration (such as side-by-side, top freezer, bottom freezer, french door, etc.)	YES / NO
CON-2d(i)		*[If CON-2d="YES", PROBE:]* How so?	(text)
	CON-2f	Is through-the-door water dispenser a plus to you?	YES / NO
	CON-2g	Is an icemaker a plus to you?	YES / NO
	CON-2h	Is a through-the-door ice dispenser a plus to you?	YES / NO
	CON-2i	Are any other traits important to you that I didn't mention?	YES / NO
CON-2i(i)		*List other feature(s):_____*	(text)
OUT-1		*[IF VOL-2b="DOESN'T RESELL", ASK:]* Now, I want to learn where the used appliances that you **pick up** go. Of the options that I'm going to read to you, can you please tell me about what percentage goes to each? [ONLY READ OPTIONS i, j & k. IF RESPONSE TO "Other"= a, b, c, d, e, f, g, h, then place response there. ENTER ZEROES EVERYWHERE ELSE.] *[ELSE, ASK:]* Now, I want to learn where the used appliances that you **buy or pick up** go. Of the options that I'm going to read to you, can you please tell me about what percentage is sold or given to each? [READ ALL OPTIONS, EXCEPT "Other"].	
	OUT-1a	Individuals	_____ %
	OUT-1b	Multi-family property owners	_____ %

Q-number	A-number (if multiple options)	Questions	Response Options
	OUT-1c	Businesses using residential-grade units	_____ %
	OUT-1d	New appliance retailers	_____ %
	OUT-1e	Used appliance retailers	_____ %
	OUT-1f	Haulers	_____ %
	OUT-1g	Auction Houses/Liquidators	_____ %
	OUT-1h	Charities	_____ %
	OUT-1i	Recycling Centers	_____ %
	OUT-1j	Dumps	_____ %
	OUT-1k	Other places, if any	_____ %
OUT-1k(i)		*[IF "OUT-1k">0, ASK:]* What other places do your used appliances go to?	(text)
OUT-2		*[IF VOL-2b="DOESN'T RESELL", SKIP TO MKT-1.]* How long do used fridges typically take to sell?	_____ weeks
OUT-2a		And freezers?	_____ weeks
OUT-2b		Of those that you **buy or pick-up**, what percentage are you unable to sell?	_____ %
OUT-3		What is the average selling price for used fridges?	$ _____
OUT-3a		And freezers?	$ _____
OUT-4		*[IF OUT-1a=0, SKIP TO OUT-4c.]* Do you usually know whether a customer is looking for a main fridge for their kitchen rather than a second [or extra] fridge?	YES / NO
OUT-4a		What percent are of individuals that you sell USED fridges to are...	
	OUT-4a(i)	purchasing a main fridge?	_____ %
	OUT-4a(ii)	purchasing a second fridge?	_____ %
	OUT-4a(iii)	any other uses that individual buyers mention?	YES/NO

Q-number	A-number (if multiple options)	Questions	Response Options
	OUT-4a(iv)	*[IF OUT-4a(iii) IS "NO", SKIP TO OUT-4b.]* What use is that?	(text)
	OUT-4a(v)	What percentage are used that way?	_____ %
OUT-4b		*[IF OUT-4a(ii)=0, SKIP TO OUT-4c.]* Of those buying a second fridge, what percent are…	
	OUT-4b(i)	replacing a previous second fridge?	_____ %
	OUT-4b(ii)	adding an additional fridge to their home?	_____ %
	OUT-4b(iii)	any other uses that individual buyers mention?	YES/NO
	OUT-4b(iv)	*[IF OUT-4b(iii) IS "NO", SKIP TO OUT-4c.]* What use is that?	(text)
	OUT-4b(v)	What percentage is used that way?	_____ %
OUT-4c		I'm going to list four possible reasons that buyers choose used fridges. Can you please rank them in order of prevalence, where 1=most often and 4=least often? *[RANDOMIZE options OUT-4c(i) THROUGH OUT-4c(iv).]*	
	OUT-4c(i)	New units are too expensive	1 2 3 4 (circle one)
	OUT-4c(ii)	Cheapest possible unit needed	1 2 3 4 (circle one)
	OUT-4c(iii)	More features are affordable for a used fridge (than for a new one)	1 2 3 4 (circle one)
	OUT-4c(iv)	Seeking a specific feature (such as size, color, etc.) that's hard to find on new fridge	1 2 3 4 (circle one)
	OUT-4c(v)	Is there any other reason that buyers mention that I didn't list?	YES / NO
OUT-4c(vi)		*[IF OUT-4c(v)="NO", SKIP to OUT-4d.]* What is that?	(description)

Q-number	A-number (if multiple options)	Questions	Response Options
OUT-4c(vii)		How does that fit within your ranking? *[SHOW ORDERED LIST FROM OUT-4c(i) through OUT-4c(v) TO INTERVIEWER TO READ BACK, IF NEEDED—HAVE THE RESPONDENT INDICATE WHERE THIS NEW REASON FITS INTO THE LIST.]*	0.5 1.5 2.5 3.5 4.5 (circle one)
OUT-4d		Do you know whether customers have looked at Craig's List beforehand?	YES / NO
OUT-4d(i)		Do you advertise on Craig's List?	YES / NO
OUT-5		Now, we're interested to learn how buyers decide between new and used units.	
	OUT-5a	What percent of buyers come into the store expecting to buy one type (new vs. used) AND stick with that decision?	_____ %
	OUT-5b	What percent of buyers come into the store expecting to buy one type (new vs. used) BUT change their minds and buy the other type (switched from "new to used" or from "used to new"?	_____ %
	OUT-5c	What percent of buyers haven't decided beforehand and want your help to guide them?	_____ %
OUT-6		*[If OUT-5b=0, SKIP TO MKT-1.]* Among the (<OUT-5b>) percent that change their minds, what percent switch from…	
	OUT-6a	New to used?	_____ %
	OUT-6b	Used to new?	_____ %
OUT-6c		What factors influence their changed decision?	(text)
MKT-1		Have you noticed changes to the availability [AND/OR demand] of used units in the past three years?	YES / NO
	MKT-1a	*[IF MKT-1="NO", SKIP TO MKT-2.]* What kinds of changes?	(text)
	MKT-1b	What do you think is causing these changes?	(text)
MKT-2		Are you aware of appliance recycling programs that are run by utilities?	YES / NO

Q-number	A-number (if multiple options)	Questions	Response Options
MKT-2a		*[IF MKT-2="NO", SKIP TO MKT-3.]* Have these programs had any effect on your business? (such as availability, prices or buyer behavior)?	YES / NO
MKT-2a(i)		*[IF MKT-2a="YES":]* What effects?	(text)
MKT-2b		Have these programs affected the used fridge/freezer markets in general?	YES / NO
MKT-2b(i)		*[IF MKT-2b="YES":]* What effects?	(text)
MKT-3		How do you advertise?	
	MKT-3(i)	Yellow Pages	YES / NO
	MKT-3(ii)	Website	YES / NO
	MKT-3(iii)	Craig's List	YES / NO
	MKT-3(iv)	Newspapers	YES / NO
	MKT-3(v)	Mailed Flyers	YES / NO
	MKT-3(vi)	Other	(text)
MKT-3b		Do you get walk-in business?	YES / NO
MKT-3b(i)		*[IF MKT-3b="NO", SKIP TO TERM-1.]* What percent of sales come from walk-in customers?	_____ %
TERM-1		Those are all the questions that we have for you. Thank you for your time and help today--we really appreciate it.	

E.3　Volume & Flow Analysis of Retail Channel

E.3.1　General Description

The steps taken to analyze the market volume data and the resulting flow of used units were as described below.

1. From the interview results, the average number of used units taken in by the interviewees on an annual basis was determined. This result was then multiplied by the qualified population of this market actor category. Note: No weighting of any market actor interview results was performed since the targets were relatively small and annual sales volume at each location (may have sold many other types of products) was not thought to be an accurate predictor of used refrigerator/freezer volume.
2. The standard errors of the volumes were determined and these were propagated through all subsequent analysis.
3. Next, the average of the proportions of the providers of the incoming used refrigerators/freezers was determined for each combination of the previously listed entities. These proportions were then multiplied by the annual used refrigerator/freezer volume for the qualified population to estimate the incoming volumes provided by each entity.
4. The previous step was repeated to determine the average proportions of recipients of the outgoing used refrigerators/freezers reported by each market actor category. Since many of the market actors interviewed indicated that they next sent some portion of the used units to scrapyards, junkyards, or dumps, a new market actor category was added to track where some units went next. After redistributing the units as reported by the market actors, annual volumes for each market actor were determined.
5. The final analysis step was to determine the average proportions of the outgoing used refrigerators/freezers reported going to a final destination.

E.3.2　Determination of Market Actor Populations

For each market actor, m, data were purchased from iUSA to represent the population of said market actor in California IOU territories, $N_{m,3^{rd}party}$. From the population, the quantity of unqualified sample, $n_{m,unqualified}$, and the quantity of interviewed sample, n_m, were used to estimate the qualified population of the market actor category by

$$\hat{p}_{m,qualified} = \frac{(n_m - n_{m,unqualified})}{n_m}$$

$$\widehat{N}_m = \hat{p}_{m,qualified} N_{m,3^{rd}party}$$

The unbiased variance of the qualified population for each market actor was

$$var(\widehat{N}_m) = \frac{fpc_m \hat{p}_{m,qualified}(1 - \hat{p}_{m,qualified})}{n_m \widehat{N}_m}$$

where *fpc*, the *finite-population correction* factor, typically equals

$$fpc = \frac{N - n}{N}$$

such that, as the ratio of the sample size to the population approaches zero, the *fpc* approaches one.

To allow for the propagation of the population uncertainty through the analysis to follow, the standard error was determined by

$$SE(\widehat{N}_m) = \sqrt{\frac{var(\widehat{N}_m)}{n_m}}$$

E.3.3 Determination of Annual Volume of Used Units Acquired by Market Actors

The mean of the quantities provided by those surveyed within each market actor category was

$$\bar{y}_m = \sum_{i=1}^{n_m} \frac{y_{m,i}}{n_m}$$

where the unbiased variance of the mean of the sample was

$$var(\bar{y}_m) = \frac{fpc_m}{n_m(n_m - 1)} \sum_{i=1}^{n_m} (y_{m,i} - \bar{y}_m)^2$$

and the standard error of the mean of the sample volume is

$$SE(\bar{y}_m) = \sqrt{\frac{var(\bar{y}_m)}{n_m}}$$

The mean quantity of units acquired annually by a given market actor was

$$\hat{Y}_m = \hat{N}_m \bar{y}_m$$

The combined standard error, once the standard error of the market actor population is factored in, is

$$SE(\hat{Y}_m) = \hat{N}_m \bar{y}_m \sqrt{\left(\frac{SE(\bar{y}_m)}{\bar{y}_m}\right)^2 + \left(\frac{SE(\hat{N}_m)}{\hat{N}_m}\right)^2}$$

The preceding population-level results were also used to represent the total number of used units distributed by the same market actor since hoarding of inventory by businesses is typically undesirable.

Finally, the total annual volume of the retail channel of the secondary market via the nine market actor categories interviewed[1], M, was

$$\hat{Y} = \sum_{m=1}^{M} \hat{Y}_m$$

where the combined standard error is

$$SE(\hat{Y}) = \sqrt{\sum_{m=1}^{M} SE(\hat{Y}_m)^2}$$

E.3.4   Determination of Breakdown of Units Transferred

Each market actor interviewed was asked to provide the proportion of used units they acquired from either one of four user categories: individuals, rental property owners, commercial users, and others, or from one of the market actor categories, m. Each interviewee was also asked to

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[1] The total number of market actors interviewed, M, was nine. For the transfers that occurred exclusively between market actors, the total grew to 10 because another category emerged that was not interviewed: junkyards, scrapyards, and dumps.

provide the proportion of acquired units that were then transferred to each of the same four user categories and to each of the market actor categories. For brevity, the determination of incoming quantities to a single market actor and from each source is described below. The same method was used to determine the outgoing quantities.

For a given market actor category, the incoming proportion from a given source that was provided by a given interviewee was multiplied by the total number of annual incoming units. The mean of this product was used to determine the overall proportion of units transferred between each combination of sources and destinations. The overall proportion for a given transfer combination was

$$\bar{p}_{m,m_{in}} = \frac{\sum_{i=1}^{n_{m,m_{in}}} c_{m,in} p_{m,m_{in},i} y_{m,i}}{\sum_{i=1}^{n_{m,m_{in}}} y_{m,i}}$$

Occasionally, when the sample size was small and the sum of the resulting proportions across all incoming market actors did not equal one, or 100 percent, an adjustment factor, $c_{m,in}$, was used to force the resulting proportions to add up to one. For outgoing market actors, a similar adjustment factor, $c_{m,out}$, was determined.

The variance of the proportion for each market actor was

$$var(\bar{p}_{m,m_{in}}) = \frac{fpc_{m,m_{in}} c_{m,in} \bar{p}_{m,m_{in}}(1 - \bar{p}_{m,m_{in}})}{n_{m,m_{in}}}$$

and the standard error of each proportion was

$$SE(\bar{p}_{m,m_{in}}) = \sqrt{\frac{\widehat{var}(\bar{p}_{m,m_{in}})}{n_{m,m_{in}}}}$$

The quantity of units acquired by each market actor from either one of the primary sources or another market actor category was

$$\hat{Y}_{m,m_{in}} = \bar{p}_{m,m_{in}} \hat{Y}_m$$

where the standard error of each quantity was

$$SE(\hat{Y}_{m,m_{in}}) = \hat{Y}_{m,m_{in}} \sqrt{\left[\frac{SE(\hat{Y}_m)}{\hat{Y}_m}\right]^2 + \left[\frac{SE(\bar{p}_{m,m_{in}})}{\bar{p}_{m,m_{in}}}\right]^2}$$

E.3.5   Combining Values Across Market Actors

When combining annual volumes across market actor categories, M, such as to determine the total annual quantity of units brought to the retail channel by individuals, the volume was

$$\hat{Y}_{m_{in}} = \sum_{m=1}^{M} \hat{Y}_{m,m_{in}}$$

where the standard error of the combined quantity was

$$SE(\hat{Y}_{m_{in}}) = \sqrt{\sum_{m=1}^{M} SE(\hat{Y}_{m,m_{in}})^2}$$

The overall proportion of units provided by a given source to all of the market actors was

$$\hat{p}_{m_{in}} = \frac{\hat{Y}_{m_{in}}}{\hat{Y}}$$

where the standard error was

$$SE(\hat{p}_{m_{in}}) = \hat{Y}_{m_{in}} \sqrt{\left[\frac{SE(\hat{Y}_{m_{in}})}{\hat{Y}_{m_{in}}}\right]^2 + \left[\frac{SE(\hat{Y})}{\hat{Y}}\right]^2}$$

All of the above methods were repeated for the outgoing volumes and proportions for every combination of market-actor category to market-actor category transfer and market-actor category to user category transfer.

F.   Telephone Survey & Interview Response Rates

F.1   Calculation of the Response Rates

In computing response rates and aligning results with the industry accepted standards, DNV GL leverages the response rates calculator developed by the American Association for Public Option Research (AAPOR). AAPOR encourages research industry professionals to utilize the calculator when reporting survey response rates. "AAPOR's calculator was developed as a service to the research industry and survey research professional."[2]

DNV GLs response rate calculation approach formula and final disposition categories mirrors AAPOR's. The assignment of disposition codes, by category, is typically made at the discretion of project managers, but follows AAPOR methodology.

Two methods widely adopted in the industry are provided in this report:

- Response Rate 1 (RR1), also known as the Minimum Response Rate, is calculated by dividing the number of completed surveys by the number of attempted sample points, excluding those determined to be ineligible.
- Response Rate 3 (RR3) provides an estimate of what proportion of sample points of unknown eligibility are actually eligible. This is useful when the sample includes a lot of ineligible sample points.

F.2   Response Rates of Telephone Surveys

The participant survey was conducted by Discovery Research Group using the sample frame produced by DNV GL using the ARP Tracking Data. Response Rate 1 and Response Rate 3 are shown in Table 3 and Table 4, respectively.

 In order to minimize non-response bias, DNV GL instructed the surveying firm to make up to ten attempts to contact each customer, including calling at different times of day and different days of the week. Survey instruments were also designed including measures to reduce bias, such as reading response options in a random and rotating order when necessary. The interviewers were trained to read questions *verbatim*, and offered response options only when

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[2] The American Association for Public Opinion Research. 2009. Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys. 6th edition. AAPOR. AAPOR Response Rate Calculator Overview, http://www.aapor.org/Response_Rates_An_Overview1.htm

instructed. Table 5 and Table 8 show the number of dialing attempts needed to achieve a completed survey and response rates for each survey.

Table 3: Response Rate 1 for Participant Survey

Participant Sample Description	Number	Percentage
Starting Sample	11,886	
Never Called	6,050	
Sample Used	5,836	
Not Eligible	604	
Sample-Valid or Unknown	5,232	
Complete	1,102	21%
Refused	2,325	44%
Not Completed - Eligible	862	16%
Not Complete - Unknown Eligibility	943	18%

Table 4: Response Rate 3 for Participant Survey

Participant Sample Description	Quantity	Percentage
Starting Sample	11,886	
Never Called	6,050	
Sample Used	5,836	
Known Not Eligible	604	
Estimated additional not eligible	116	
Sample-Valid	5,116	
Complete	1,102	22%
Refused	2,325	45%
Not Completed - Eligible	862	17%
Not Completed - Est. Eligible	827	16%

Table 5. Dialing Attempts for Participant Survey Completions

Number of Dialing Attempts before Reacjng Respondent	Count of Completed Surveys
1	468
2	226
3	144
4	117
5	68
6	47
7	8
8	14
9	5
10	5
Overall	**1,102**

The acquirer/discarder survey was administered to non-participants. It was conducted by Discovery Research Group using the customer data—that excluded program participants—to create the sample frame. Response Rate 1 and Response Rate 3 are shown in Table 6 and Table 7, respectively. For the non-participant survey—unlike for the participant survey—the two methods of determining the response rates yielded very different results. This is due to the fact that only those non-participants that had acquired or discarded a used refrigerator or freezer within the past three years were eligible to complete the survey. Since only a fraction of the non-participants in the sample frame were eligible, the Response Rate 3 is the more relevant means to report the response rate.

Table 6: Response Rate 1 for Acquirer/Discarder Survey

Non-participant Sample Description	Number	Percentage
Starting Sample	90,987	
Never Called	27,172	
Sample Used	63,815	
Not Eligible	30,495	
Sample-Valid or Unknown	33,320	
Complete	827	2%
Refused	172	1%
Not Completed - Eligible	0	0%
Not Complete - Unknown Eligibility	32,321	97%

Table 7: Response Rate 3 for Acquirer/Discarder Survey

Non-participant Sample Description	Quantity	Percentage
Starting Sample	90,987	
Never Called	27,172	
Sample Used	63,815	
Known Not Eligible	30,495	
Estimated additional not eligible	31,296	
Sample-Valid	2,024	40%
Complete	827	41%
Refused	172	8%
Not Completed - Eligible	0	0%
Not Completed - Est. Eligible	1,025	51%

Table 8. Dialing Attempts for Non-Participant Survey Completions

Number of Dialing Attempts before Reachjng Respondent	Count of Completed Surveys
1	374
2	181
3	85
4	66
5	35
6	40
7	21
8	8
9	11
10	6
Overall	**827**

F.3   Response Rates of Market Actor Interviews

Market actor interviews were jointly conducted staff at DNV GL and Discovery Research Group. Nine market actor categories were interviewed where the sample frame for each was produced by DNV GL using purchased business data. The resulting Response Rate 1 and Response Rate 3 tables for each market actor category are shown in Table 9 through Table 26.

Table 9: Response Rate 1 for Auction House Interviews

Auction House Sample Description	Number	Percentage
Starting Sample	66	
Never Called	9	
Sample Used	57	
Not Eligible	32	
Sample-Valid or Unknown	25	
Complete	4	16%
Refused	1	4%
Not Completed - Eligible	3	12%
Not Complete - Unknown Eligibility	17	68%

Table 10: Response Rate 3 for Auction House Interviews

Auction House Sample Description	Quantity	Percentage
Starting Sample	66	
Never Called	9	
Sample Used	57	
Known Not Eligible	32	
Estimated additional not eligible	14	
Sample-Valid	11	16%
Complete	4	35%
Refused	1	9%
Not Completed - Eligible	3	26%
Not Completed - Est. Eligible	3	30%

Table 11: Response Rate 1 for Small Charity Interviews

Charity Sample Description	Number	Percentage
Starting Sample	57	
Never Called	2	
Sample Used	55	
Not Eligible	36	
Sample-Valid or Unknown	19	
Complete	4	21%
Refused	1	5%
Not Completed - Eligible	3	16%
Not Complete - Unknown Eligibility	11	58%

Table 12: Response Rate 3 for Small Charity Interviews

Charity Sample Description	Quantity	Percentage
Starting Sample	57	
Never Called	2	
Sample Used	55	
Known Not Eligible	36	
Estimated additional not eligible	9	
Sample-Valid	10	18%
Complete	4	40%
Refused	1	10%
Not Completed - Eligible	3	30%
Not Completed - Est. Eligible	2	20%

Table 13: Response Rate 1 for Charity Chain Interviews

Charity Chain Sample Description	Number	Percentage
Starting Sample	112	
Never Called	90	
Sample Used	22	
Not Eligible	4	
Sample-Valid or Unknown	18	
Complete	9	50%
Refused	0	0%
Not Completed - Eligible	2	11%
Not Complete - Unknown Eligibility	7	39%

Table 14: Response Rate 3 for Charity Chain Interviews

Charity Chain Sample Description	Quantity	Percentage
Starting Sample	112	
Never Called	90	
Sample Used	22	
Known Not Eligible	4	
Estimated additional not eligible	6	
Sample-Valid	12	55%
Complete	9	74%
Refused	0	0%
Not Completed - Eligible	7	41%
Not Completed - Est. Eligible	9	55%

Table 15: Response Rate 1 for Hauler Interviews

Hauler Sample Description	Number	Percentage
Starting Sample	54	
Never Called	0	
Sample Used	54	
Not Eligible	22	
Sample-Valid or Unknown	32	
Complete	11	34%
Refused	11	34%
Not Completed - Eligible	9	28%
Not Complete - Unknown Eligibility	1	3%

Table 16: Response Rate 3 for Hauler Interviews

Hauler Sample Description	Quantity	Percentage
Starting Sample	54	
Never Called	0	
Sample Used	54	
Known Not Eligible	22	
Estimated additional not eligible	0	
Sample-Valid	32	59%
Complete	11	35%
Refused	11	35%
Not Completed - Eligible	9	28%
Not Completed - Est. Eligible	1	2%

Table 17: Response Rate 1 for Appliance Recycler Interviews

Appliance Recycler Sample Description	Number	Percentage
Starting Sample	112	
Never Called	65	
Sample Used	47	
Not Eligible	29	
Sample-Valid or Unknown	18	
Complete	6	33%
Refused	0	0%
Not Completed - Eligible	12	67%
Not Complete - Unknown Eligibility	0	0%

Table 18: Response Rate 3 for Appliance Recycler Interviews

Appliance Recycler Sample Description	Quantity	Percentage
Starting Sample	112	
Never Called	65	
Sample Used	47	
Known Not Eligible	29	
Estimated additional not eligible	0	
Sample-Valid	18	16%
Complete	6	33%
Refused	0	0%
Not Completed - Eligible	12	67%
Not Completed - Est. Eligible	0	0%

Table 19: Response Rate 1 for Rental Company Interviews

Rental Company Sample Description	Number	Percentage
Starting Sample	19	
Never Called	0	
Sample Used	19	
Not Eligible	14	
Sample-Valid or Unknown	5	
Complete	4	80%
Refused	0	0%
Not Completed - Eligible	1	20%
Not Complete - Unknown Eligibility	0	0%

Table 20: Response Rate 3 for Rental Company Interviews

Rental Company Sample Description	Quantity	Percentage
Starting Sample	19	
Never Called	0	
Sample Used	19	
Known Not Eligible	14	
Estimated additional not eligible	0	
Sample-Valid	5	26%
Complete	4	80%
Refused	0	0%
Not Completed - Eligible	1	20%
Not Completed - Est. Eligible	0	0%

Table 21: Response Rate 1 for Retail Chain Interviews

Retail Chain Sample Description	Number	Percentage
Starting Sample	857	
Never Called	27	
Sample Used	830	
Not Eligible	36	
Sample-Valid or Unknown	794	
Complete	27	3%
Refused	181	23%
Not Completed - Eligible	72	9%
Not Complete - Unknown Eligibility	767	97%

Table 22: Response Rate 3 for Retail Chain Interviews

Rental Company Sample Description	Quantity	Percentage
Starting Sample	857	
Never Called	27	
Sample Used	830	
Known Not Eligible	36	
Estimated additional not eligible	25	
Sample-Valid	769	93%
Complete	27	4%
Refused	181	24%
Not Completed - Eligible	742	93%
Not Completed - Est. Eligible	767	100%

Table 23: Response Rate 1 for New Retailer, Small, Interviews

New Retailer, Small, Sample Description	Number	Percentage
Starting Sample	569	
Never Called	386	
Sample Used	183	
Not Eligible	84	
Sample-Valid or Unknown	99	
Complete	30	30%
Refused	15	15%
Not Completed - Eligible	21	21%
Not Complete - Unknown Eligibility	33	33%

Table 24: Response Rate 3 for New Retailer, Small, Interviews

New Retailer, Small, Sample Description	Quantity	Percentage
Starting Sample	569	
Never Called	386	
Sample Used	183	
Known Not Eligible	84	
Estimated additional not eligible	25	
Sample-Valid	74	41%
Complete	30	40%
Refused	15	20%
Not Completed - Eligible	44	45%
Not Completed - Est. Eligible	69	33%

Table 25: Response Rate 1 for Used Retailer Interviews

Used Retailer Sample Description	Number	Percentage
Starting Sample	569	
Never Called	286	
Sample Used	183	
Not Eligible	82	
Sample-Valid or Unknown	101	
Complete	32	32%
Refused	15	15%
Not Completed - Eligible	21	21%
Not Complete - Unknown Eligibility	33	33%

Table 26: Response Rate 3 for Used Retailer Interviews

Used Retailer Sample Description	Quantity	Percentage
Starting Sample	569	
Never Called	386	
Sample Used	183	
Known Not Eligible	82	
Estimated additional not eligible	24	
Sample-Valid	77	42%
Complete	32	42%
Refused	15	20%
Not Completed - Eligible	45	58%
Not Completed - Est. Eligible	69	90%

G. Peer-to-Peer Channel of Secondary Market

G.1 Craig's List Accept/Reject Filter Terms

Table 27: Reject Filter Terms for RSS Feeds

Rejection Category	Filter Terms
Commercial	Beverage Refrigerator, Commercial, Cooler, Glass Door, Glass Doors, Hot Dog Cart, Reach In, Reach-In, Restaurant, Sliding Door, Vending Machine,
Household	Baby, Bed, Breast Pump, Cappunccino, Carafe, Coffee, Espresso, Medela, Microwave, Milk, Queen, Tv, Bbq,
Rejected After Inspection	*New Sealed Tour Beats 2013* - $120, 2.8 Cu-Ft Upright Freezer Energy Sta - $125 (Glendale), Appliances Wanted Free Removal, Bar Refrigerator, Coca Cola Fridge, Commercial Under Counter Refrigerator, For Sale 97 Cents Plus Store, Free Haul Away Washer/Dryer Refrigerator, Free Washer Dryer Fridge Pickup, Freezer/ Cold Suite For Warehouse Work, Glass Fridge Shelves, Goats, Ice Cream Chest Freezer, Ice Cream Freezer, Ice Cream Fridge, Ice Cream Refrigerator, Jack Daniels, Misc Grow/Hydro Accessories, Monster, Organic Chemistry, Peligro!! Please Read Before You Buy This Could Save You Money$$$, Raw Meats, Red Bull, Rock Star, Singer Sewing Machine, True Commercial 2 Door Display Refrigerator, Undercounter Refrigerator, Wanted Refrigerator, Washer Dryer Fridge Broken?, Wine Fridge, Wine Refrigerator,
RV	Awnings, Axle, Bath, Bathroom, Battery, Cabin, Carburetor, Class A, Cruise, Drive Train, Engine, Fifth Wheel, Fleetwood, Fuel Injected, Furnance, Generator, Heater, Hitch, Ladder, Ladder, Mallard, Mile, Miles, Motorhome, Motorhome, Mpg, Rv, Shower, Sink, Tire, Toilet, Transmission, Tub, V-8, Vanity, Winnebego,
Miscellaneous	Dorm, Wine Cooler, Dollhouse, Play, Stack, Stackable

Table 28: Accept Filter Terms for RSS Feeds

Accept Category	Filter Terms
"Refrigerator Or Freezer"	Freezer, Fridge, Frige, Refridgerator, Refrigerator, Freezer Products, Refrigerator Products,
Configuration Term	Side By Side, Side X Side, Side-By-Side, Top Freezer, Top-Freezer, Freezer On Top, French Door, Upright, Chest, Bottom Freezer, Secondary, Energy Star,
Unit Volume Term	Cu Ft, Cuft, Cubic Foot, Capacity, Apartment Sized,
Unit Features Term	Ice Maker, Water Dispenser, Through The Door, Glass Shelves, Stainless Steel, Crisper, Water And Ice, Extra Food Storage, Defrost, Works Good, Works Great, Works Great,
Unit Condition Term	Works Good, Works Great,
Brand Name	Amana Refrigeration, Anhui Only Electronic Co., Camco, Diversified Refrigeration, Franklin Industries, Frigidaire, Guangzhou Wanbao Refrigerator Co., Haier America Trading, Hefei Hualing, Hefei Meiling Co., Hisense Electric Co., Hisense Ronshen (Guangdong) Refrigerator Co., Holland Distributors, Homa Appliances Co., L G Electronics, Lg Electronics, Miele Appliances, Monogram Refrigeration, Sampo Enterprise (Tian Jin) Co., Samsung Electronics Co., Tcl Household Appliance (Qingdao) Co., True Foodservice Equipment, Wci Manufacturing, Warwick Manufacturing, Absocold, Acme, Admiral, Amana, Appliance Corporation Of America, Ariston, Avanti, Bsh Home Appliances, Beaumark, Bosch, Caloric, Capri, Catalina, Cervitor, China Refrigeration Industry Co. Ltd., Citation, Classic's 50, Coldspot-Kenmore, Columbus Products, Coronado, Crofton, Crosley, D.A.T Of America, Dacor, Daewoo Electronics, Dana-Tone, Danby, Defiance, Defiance International, Designer, Dimchae, Dwyer, Dynasty, Electrolux, Electrolux Home Products, Estate, Eterna, Eurocold, Excellence, F. G. Industries, Fisher & Paykel, Ford Aerospace, Frigidaire, Frostman, G R Manufacturing, Gaffers & Sattler, Gaggenau, Gallery, Galt, General Electric, Gerald, Gerald Industries, Gibson, Gladiator, Goldstar, Gorenje-Velenje, Gorneje Gospodinjski, Greenville Products, Hd Supply, Haier, Hamilton Beach, Harmony Is Fun, Hicon, Holiday, Hotpoint, Hupp Canada, Ignis, Ikea, Imperial, Indesit, Industrias Astral Sa, Inglis, J.C. Penney, Jade, Jenn-Air, Kelvinator, Kenmore, Kirkland, Kitchen Aid, Kmart, Kolpak, L G, Lg, Legend, Leiser S. De R.L. De C.V., Liebherr, Liebherr Hausgerate, Mc Appliance Corporation, Magic Chef, Magic Cool, Marquette, Marvel, Maytag, Maytag Appliances - Amana Refrigeration Products, Microfridge, Midea Refrigeration And Air Conditioning, Modern Maid, Moffat, Monogram, Montgomery Ward, Multibras Sa, Ningbo Hicon International, Norcold, Norge, Northland Refrigeration, Northland-Marvel, O Keefe & Merritt, O Shaughnessy Holding Company, Organizacion Mabe, Oster, Pacific By Gorenje, Panasonic, Philacor, Philco, Porfilo, Profile, Profilo Elektrikli, Quasar, Rca, Rangaire, Roper, Smeg S.P.A., Samsung, Sanyo, Sanyo E & E Corp., Sanyo Fisher, Scotsman, Scotsman Ice Systems, Shay Corp., Siemens, Signature, Signature 2000, Signature 2001, Signature 2002, Sterling Faucet, Stolle, Stolle Corporation, Sub-Zero, Summit, Sun Frost, Sunbeam, Tappan, Thermador, Traulsen, U-Line, U-Line Corp., Ultima, Viking, Viking Range Co., W C Wood, Wanbao, Welbilt, Western Auto Supply, Whirlpool, White Consolidated Ind, White-Westinghouse, Winiamando, Wood's,

G.2   Volume Analysis of Peer-to-peer channel

Table 29: Volume of Peer-to-peer Channel of Secondary Market

Description	Volume of Units	Details
RSS feeds	400,000	
RSS Sampled feeds	143,000	
Qualifying feeds	99,000	
Peer-to-peer	64,318	
Dealer	30,547	
Qualifying Peer-to-peer rate (% of sampled)	45%	=PEER-TO-PEER/SampledFeeds
Qualifying Peer-to-peer population	179,910	=45% of 400,000
Acquirers % from Peer-to-peer channel	73.69%	from Acquirer survey
Acquirers % from Retail channel	26.31%	from Acquirer survey

H. Obtaining Nameplate UEC

H.1 Details of Matching Algorithm

In order to increase the match rate, without also increasing the number of false positive matches, the evaluation team inspected the model numbers and consulted industry resources to understand how one could best match model numbers that often have slight, meaningless different (e.g. an extra space or dash). In this appendix we discuss in more detail the preparation of model numbers for a character by character match using a wildcard character (*), and the steps in the matching algorithm.

The preparation of model numbers, intended to standardize and harmonize both the pickup and master model number database, consisted of the following steps:

1. Remove all spaces from both the pick-up dataset and the industry database model numbers, and make all letters upper case.
2. Keep only alpha-numeric characters and the following special characters: '*' and '#'.
3. Convert all instances of '#' to instances '.'
4. Convert all instances of capital 'O's to instances of zeros

The next step involved creating a Cartesian product of the pick-up set and the model number database. The aim was to create a new dataset that contained all possible pairings of model numbers between the two datasets Because of the size of the datasets, creating a full Cartesian product was prohibitive. The evaluation team subsetted the two datasets and Cartesian products for model numbers that began with the same character The matching algorithm itself consisted of comparing each model number pair, iterating over the shorter of the two model numbers and comparing the two character by character. Stars (*) were considered wildcard characters. If a single character did not match, then the pair were deemed to be unmatched. The match percentage from this step is presented in the fourth column of Table 31.

The model number matching algorithm resulted in match rates that varied significantly across appliance types and IOU.

Table 30: Results of Matching Algorithm

Appliance Type	IOU	Number of Units with Model Data	Percent Exact Matches	Percent Wildcard Matches	Total Match Percent
Refrigerator	PGE	54,560	51%	28%	79%
	SCE	108,200	7%	62%	69%
	SDGE	17,761	4%	44%	48%
	All IOUs	**180,521**	**20%**	**50%**	**70%**
Freezer	PGE	6,801	12%	29%	41%
	SCE	8,224	9%	35%	44%
	SDGE	1,819	6%	21%	27%
	All IOUs	**16,844**	**10%**	**31%**	**41%**

Table 31: Proportions of Matching Model Numbers

Appliance Type	IOU	Percent with Model Number Data	Match Percent of Units with Model Data	Overall Match Percent
Refrigerator	PG&E	98%	78%	76%
	SCE	59%	69%	41%
	SDG&E	43%	48%	21%
	All IOUs	**65%**	**70%**	**46%**
Freezer	PG&E	95%	41%	39%
	SCE	52%	44%	23%
	SDG&E	41%	27%	11%
	All IOUs	**62%**	**41%**	**25%**

H.2   Imputation of Nameplate UEC for Unmatched Units

The number of missing model numbers places a ceiling on the number of units for which one can obtain nameplate UEC. Indeed, the highest possible overall match rate we can achieve, given the data is 64% of claimed units. Typically model number matching success averages 60-70%; the process utilized in this evaluation yielded a 69% match rate. Taking into account those units without any available model data, the matched units only represent 41% of program claims. Therefore, before applying the results of our metering study to the population units, the evaluation team imputed missing values for key variables.

The pattern of missing values for units (table available upon request) guided the choice of imputation method. Prior to imputation, the evaluation team conducted the following data preparation:

- Entries for size that were obviously incorrect were checked against database values for matched units. In cases where the value could be inferred, incorrect values were replaced. Otherwise the size was set to missing

- For units with an age greater than 50 years, the age was set to missing

- For units with label amps values greater than 12, the label amps were set to missing

Several studies have found that refrigerator energy use follow particular distributions. In an attempt to improve imputed values, the evaluation team plotted and examined the distribution of values within each variable for several variables of interest (such as size; nameplate UEC – for those units with model data; and amps), and performed goodness of fit tests for several distributions, including those hypothesized in previous studies[3].

None of the potential distributions above passed goodness-of-fit tests, so the analysis assumed a conditional normal distribution, consistent with prior evaluations. To generate more realistic estimates, the evaluation team assumed a normal distribution truncated with a lower bound set at 200 kWh (this kWh was the minimum value of the nameplate UEC in the databases providing refrigerator UEC). The evaluation team used PROC MI in the statistical software package SAS® to impute the value of nameplate UEC and other key variables.

The evaluation team conducted separate imputations for refrigerators and freezers. Table 32 and Table 33 present a comparison of mean values for imputed versus non-imputed key variables for refrigerators and freezers, respectively.

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[3] These distributions included log-normal, Weibull, gamma distributions

Table 32: Comparison of Tracking Data to Imputed Values for Refrigerators

Variable	Mean (S.E.)		N	
	Value from Tracking Data	Imputed Value	Units with Tracking Data	Units Imputed
Nameplate UEC	853 (0.98)	825 (0.81)	123,821	155,767
Nameplate Amps	6.7 (0.00)	6.7 (0.09)	279,053	535
Volume	19.8 (0.01)	17.9 (0.10)	278,130	1,458
Age	18 (0.01)	18.7 (0.11)	276,817	2,771

Table 33: Comparison of Tracking Data to Imputed Values for Freezers

Variable	Mean (S.E.)		N	
	Value from Tracking Data	Value Imputed	Units with Tracking Data	Units Imputed
Nameplate UEC	773 (3.06)	768 (1.69)	6,635	20,738
Nameplate Amps	5.2 (0.01)	5.4 (0.18)	27,298	75
Volume	17.2 (0.02)	16.6 (0.02)	26,499	874
Age	20.6 (0.04)	22.1 (0.39)	27,032	341

I. Annualization of Short-term Meter Data

I.1 Load Shape Regression Model

The ultimate goal of this stage of the analysis is to arrive at a plausible estimate of total annual consumption for all units recycled under the ARP. Ideally, one would have actual annual consumption values for every unit in the program, and sum these values to arrive at total consumption at the program level. The next best approach would be to select a representative sample of program units and meter those for an entire year and apply this sample estimate to the entire population. Neither of these approaches is feasible. The standard technique that has been employed in refrigerator recycling programs has been to select a sample of program units and meter these units for a short period of time—roughly two weeks—and then estimate annual consumption for these units.

The past two evaluations took two distinct approaches this annualization process. Describing and contrasting these approaches in some detail provides important context for the choices made in the current evaluation.

In the 2004-2005 evaluation, the authors used long-term metering studies conducted in the mid-1990s[4] to estimate a model of hourly consumption as a function of hourly ambient temperature, monthly indicators, and unit characteristics. The use of these meter data presents some additional drawbacks. The most significant is that the long-term metering sample came from an entirely different population of refrigerator units. These units were metered between 1990 and 1993, were brand new at the time they were metered, and included units from PG&E and SCE only. Furthermore, they included both energy efficient units as well as units that exceeded the efficiency standards at the time. The advantage of this approach is that it provides data on the actual variation in consumption over a calendar year.

In the 2006-2008 evaluation, the authors took a different approach, making use of short-term metering data to construct an average annual load shape. The distribution of short-term metering over the entire year captures seasonal changes in consumption, but the use of units that vary in age, size, vintage introduce additional error to the model.

The current evaluation team followed the 2004-2005 evaluation approach. We believe that the benefit of having actual load shapes for units outweighs the cost of using data from units that likely differ (perhaps substantially) from the population of recycled units. The remainder of this

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[4] (Dutt, et al. 1994) for units in the PG&E service territory.

section presents regression results and a brief discussion of how the evaluation team compared the modeling techniques used in the different evaluation.

Table 34 through Table 41 that follow present the full regression results. Since the full model contained nearly 200 terms (including interactions) the results are grouped by main effects, and categories of interaction terms. The model below includes the following main effects: mean watt-hours; monthly dummy variables; categorical variables for refrigerator and freezer configurations, unit use type (primary, secondary, or freezer) , and location (conditioned or unconditioned space); outdoor temperature, and volume. To capture the possibility that different months, unit volumes, unit configurations, unit locations, and use types lead to different relationships between temperature and watt-hours, the model includes interaction terms for these main effects.

Table 34: Main Effects Table

Parameter	Estimate	Biased	SE	t-Value	Pr > |t|
Intercept	-182.546	1	15.351	-11.890	<.0001
mean_wh	1.004	0	0.002	488.500	<.0001
month (1)	22.781	1	11.595	1.960	0.0494
month (2)	55.621	1	12.773	4.350	<.0001
month (3)	3.008	1	13.298	0.230	0.821
month (4)	-31.570	1	13.298	-2.370	0.0176
month (5)	-37.315	1	13.571	-2.750	0.006
month (6)	-48.061	1	13.756	-3.490	0.0005
month (7)	-103.381	1	14.082	-7.340	<.0001
month (8)	-38.763	1	14.380	-2.700	0.007
month (9)	-46.508	1	14.190	-3.280	0.001
month (10)	-55.573	1	12.066	-4.610	<.0001
month (11)	28.484	1	11.873	2.400	0.0164
month (12)	0.000	1	.	.	.
configuration (SS)	-123.153	1	18.640	-6.610	<.0001
configuration (TF)	26.070	1	14.675	1.780	0.0757
configuration (UP)	0.000	1	.	.	.
use type (F)	0.000	1	.	.	.
use type (P)	274.435	1	12.645	21.700	<.0001
use type (S)	0.000	1	.	.	.
conditioned space dummy (0)	-16.529	1	4.040	-4.090	<.0001
conditioned space dummy (1)	0.000	1	.	.	.
outdoor temperature	2.883	1	0.258	11.160	<.0001
volume	9.412	1	0.944	9.980	<.0001
R-Squared					0.552
Adjusted R-Squared					0.551

Table 35: Month-Configuration Interaction Terms

Parameter	Estimate	Biased	SE	t-Value	Pr > |t|
month*configuration (1*SS)	-0.952	1	2.422	-0.390	0.6941
month*configuration (1*TF)	1.912	1	1.579	1.210	0.2259
month*configuration (1*UP)	0.000	1	.	.	.
month*configuration (2*SS)	-6.472	1	2.486	-2.600	0.0092
month*configuration (2*TF)	-2.215	1	1.623	-1.370	0.1722
month*configuration (2*UP)	0.000	1	.	.	.
month*configuration (3*SS)	-16.039	1	2.467	-6.500	<.0001
month*configuration (3*TF)	-14.673	1	1.617	-9.070	<.0001
month*configuration (3*UP)	0.000	1	.	.	.
month*configuration (4*SS)	-16.548	1	2.534	-6.530	<.0001
month*configuration (4*TF)	-16.085	1	1.665	-9.660	<.0001
month*configuration (4*UP)	0.000	1	.	.	.
month*configuration (5*SS)	-24.373	1	2.592	-9.400	<.0001
month*configuration (5*TF)	-23.217	1	1.710	-13.580	<.0001
month*configuration (5*UP)	0.000	1	.	.	.
month*configuration (6*SS)	-23.174	1	2.711	-8.550	<.0001
month*configuration (6*TF)	-21.975	1	1.798	-12.220	<.0001
month*configuration (6*UP)	0.000	1	.	.	.
month*configuration (7*SS)	-24.629	1	2.789	-8.830	<.0001
month*configuration (7*TF)	-26.851	1	1.864	-14.410	<.0001
month*configuration (7*UP)	0.000	1	.	.	.
month*configuration (8*SS)	-6.024	1	2.747	-2.190	0.0283
month*configuration (8*TF)	-15.798	1	1.829	-8.640	<.0001
month*configuration (8*UP)	0.000	1	.	.	.
month*configuration (9*SS)	-21.059	1	2.673	-7.880	<.0001
month*configuration (9*TF)	-23.583	1	1.771	-13.310	<.0001
month*configuration (9*UP)	0.000	1	.	.	.
month*configuration (10*SS)	-20.501	1	2.237	-9.160	<.0001
month*configuration (10*TF)	-17.436	1	1.481	-11.770	<.0001
month*configuration (10*UP)	0.000	1	.	.	.
month*configuration (11*SS)	-10.313	1	2.237	-4.610	<.0001
month*configuration (11*TF)	-9.099	1	1.439	-6.320	<.0001
month*configuration (11*UP)	0.000	1	.	.	.
month*configuration (12*SS)	0.000	1	.	.	.
month*configuration (12*TF)	0.000	1	.	.	.

Parameter	Estimate	Biased	SE	t-Value	Pr > |t|
month*configuration (12*UP)	0.000	1	.	.	.

Table 36: Month-use Type Interaction Terms

Parameter	Estimate	Biased	SE	t Value	Pr > |t|
month*use type (1*F)	0.000	1	.	.	.
month*use type (1*P)	0.939	1	2.313	0.410	0.6846
month*use type (1*S)	0.000	1	.	.	.
month*use type (2*F)	0.000	1	.	.	.
month*use type (2*P)	1.127	1	2.376	0.470	0.6352
month*use type (2*S)	0.000	1	.	.	.
month*use type (3*F)	0.000	1	.	.	.
month*use type (3*P)	8.263	1	2.335	3.540	0.0004
month*use type (3*S)	0.000	1	.	.	.
month*use type (4*F)	0.000	1	.	.	.
month*use type (4*P)	9.329	1	2.378	3.920	<.0001
month*use type (4*S)	0.000	1	.	.	.
month*use type (5*F)	0.000	1	.	.	.
month*use type (5*P)	10.462	1	2.406	4.350	<.0001
month*use type (5*S)	0.000	1	.	.	.
month*use type (6*F)	0.000	1	.	.	.
month*use type (6*P)	6.905	1	2.483	2.780	0.0054
month*use type (6*S)	0.000	1	.	.	.
month*use type (7*F)	0.000	1	.	.	.
month*use type (7*P)	11.982	1	2.493	4.810	<.0001
month*use type (7*S)	0.000	1	.	.	.
month*use type (8*F)	0.000	1	.	.	.
month*use type (8*P)	9.860	1	2.502	3.940	<.0001
month*use type (8*S)	0.000	1	.	.	.
month*use type (9*F)	0.000	1	.	.	.
month*use type (9*P)	11.003	1	2.497	4.410	<.0001
month*use type (9*S)	0.000	1	.	.	.
month*use type (10*F)	0.000	1	.	.	.
month*use type (10*P)	11.497	1	2.131	5.390	<.0001
month*use type (10*S)	0.000	1	.	.	.
month*use type (11*F)	0.000	1	.	.	.
month*use type (11*P)	6.561	1	2.325	2.820	0.0048
month*use type (11*S)	0.000	1	.	.	.
month*use type (12*F)	0.000	1	.	.	.
month*use type (12*P)	0.000	1	.	.	.
month*use type (12*S)	0.000	1	.	.	.

Table 37: Month-Conditioned Space Dummy Interaction Terms

Parameter	Estimate	Biased	SE	t Value	Pr > |t|
month*conditioned space dummy (1*0)	3.422	1	2.290	1.490	0.135
month*conditioned space dummy (1*1)	0.000	1	.	.	.
month*conditioned space dummy (2*0)	3.384	1	2.350	1.440	0.1499
month*conditioned space dummy (2*1)	0.000	1	.	.	.
month*conditioned space dummy (3*0)	7.599	1	2.293	3.310	0.0009
month*conditioned space dummy (3*1)	0.000	1	.	.	.
month*conditioned space dummy (4*0)	9.734	1	2.330	4.180	<.0001
month*conditioned space dummy (4*1)	0.000	1	.	.	.
month*conditioned space dummy (5*0)	9.551	1	2.348	4.070	<.0001
month*conditioned space dummy (5*1)	0.000	1	.	.	.
month*conditioned space dummy (6*0)	11.471	1	2.409	4.760	<.0001
month*conditioned space dummy (6*1)	0.000	1	.	.	.
month*conditioned space dummy (7*0)	21.631	1	2.392	9.040	<.0001
month*conditioned space dummy (7*1)	0.000	1	.	.	.
month*conditioned space dummy (8*0)	14.967	1	2.420	6.190	<.0001
month*conditioned space dummy (8*1)	0.000	1	.	.	.
month*conditioned space dummy (9*0)	11.084	1	2.430	4.560	<.0001
month*conditioned space dummy (9*1)	0.000	1	.	.	.
month*conditioned space dummy (10*0)	9.427	1	2.094	4.500	<.0001
month*conditioned space dummy (10*1)	0.000	1	.	.	.
month*conditioned space dummy (11*0)	5.781	1	2.307	2.510	0.0122
month*conditioned space dummy (11*1)	0.000	1	.	.	.
month*conditioned space dummy (12*0)	0.000	1	.	.	.
month*conditioned space dummy (12*1)	0.000	1	.	.	.

Table 38: Configuration-Use Type and Configuration-Conditioned Space Dummy Interaction Terms

Parameter	Estimate	Biased	SE	t Value	Pr > |t|
configuration*use type (SS*P)	-10.392	1	1.191	-8.730	<.0001
configuration*use type (SS*S)	0.000	1	.	.	.
configuration*use type (TF*P)	0.000	1	.	.	.
configuration*use type (TF*S)	0.000	1	.	.	.
configuration*use type (UP*F)	0.000	1	.	.	.
configuration*conditioned space dummy (SS*0)	0.000	1	.	.	.

Parameter	Estimate	Biased	SE	t Value	Pr > |t|
configuration*conditioned space dummy (SS*1)	0.000	1	.	.	.
configuration*conditioned space dummy (TF*0)	0.000	1	.	.	.
configuration*conditioned space dummy (TF*1)	0.000	1	.	.	.
configuration*conditioned space dummy (UP*0)	0.000	1	.	.	.

Table 39: Volume-Month, Volume-Configuration, and Volume-Use Type Interaction Terms

Parameter	Estimate	Biased	Standard Error	t-Value	Pr > |t|
volume*month (1)	-0.732	1	0.546	-1.340	0.1798
volume*month (2)	-2.036	1	0.598	-3.400	0.0007
volume*month (3)	0.589	1	0.618	0.950	0.3405
volume*month (4)	1.817	1	0.618	2.940	0.0033
volume*month (5)	2.411	1	0.628	3.840	0.0001
volume*month (6)	2.112	1	0.637	3.320	0.0009
volume*month (7)	4.364	1	0.650	6.710	<.0001
volume*month (8)	1.010	1	0.670	1.510	0.1319
volume*month (9)	2.667	1	0.670	3.980	<.0001
volume*month (10)	3.248	1	0.565	5.750	<.0001
volume*month (11)	-0.439	1	0.563	-0.780	0.4359
volume*month (12)	0.000	1	.	.	.
volume*configuration (SS)	1.697	1	1.096	1.550	0.1216
volume*configuration (TF)	-6.125	1	0.947	-6.470	<.0001
volume*configuration (UP)	0.000	1	.	.	.
volume*use type (F)	0.000	1	.	.	.
volume*use type (P)	-11.466	1	0.634	-18.090	<.0001
volume*use type (S)	0.000	1	.	.	.
volume*conditioned space dummy (0)	0.000	1	.	.	.
volume*conditioned space dummy (1)	0.000	1	.	.	.

Table 40: Outdoor Temperature interacted with Month, Configuration, Use Type, Conditioned Space Dummy, and Volume

Parameter	Estimate	Biased	Standard Error	t-Value	Pr > |t|
outdoor temperature*month (1)	-0.783	1	0.223	-3.500	0.0005
outdoor temperature*month (2)	-1.315	1	0.239	-5.490	<.0001
outdoor temperature*month (3)	-0.295	1	0.231	-1.280	0.2009
outdoor temperature*month (4)	0.316	1	0.221	1.430	0.1526
outdoor temperature*month (5)	0.330	1	0.218	1.510	0.1307
outdoor temperature*month (6)	0.329	1	0.212	1.550	0.1205
outdoor temperature*month (7)	0.801	1	0.212	3.780	0.0002
outdoor temperature*month (8)	0.533	1	0.218	2.450	0.0144
outdoor temperature*month (9)	0.410	1	0.220	1.870	0.062
outdoor temperature*month (10)	0.555	1	0.206	2.690	0.0071
outdoor temperature*month (11)	-0.784	1	0.212	-3.700	0.0002
outdoor temperature*month (12)	0.000	1	.	.	.
outdoor temperature*configuration (SS)	0.773	1	0.283	2.730	0.0062
outdoor temperature*configuration (TF)	-0.615	1	0.222	-2.770	0.0056
outdoor temperature*configuration (UP)	0.000	1	.	.	.
outdoor temperature*use type (F)	0.000	1	.	.	.
outdoor temperature*use type (P)	-3.436	1	0.205	-16.740	<.0001
outdoor temperature*use type (S)	0.000	1	.	.	.
outdoor temperature*conditioned space dummy (0)	0.187	1	0.072	2.580	0.0098
outdoor temperature*conditioned space dummy (1)	0.000	1	.	.	.
outdoor temperature*volume	-0.157	1	0.015	-10.460	<.0001

Table 41: Three-Way Interaction Terms

Parameter	Estimate	Biased	Standard Error	t-Value	Pr > |t|
outdoor temperature*volume*month (1)	0.025	1	0.010	2.380	0.0173
outdoor temperature*volume*month (2)	0.049	1	0.011	4.380	<.0001
outdoor temperature*volume*month (3)	0.005	1	0.011	0.420	0.6765
outdoor temperature*volume*month (4)	-0.016	1	0.010	-1.560	0.1189
outdoor temperature*volume*month (5)	-0.014	1	0.010	-1.330	0.1823
outdoor temperature*volume*month (6)	0.003	1	0.010	0.260	0.7957
outdoor temperature*volume*month (7)	-0.019	1	0.010	-1.890	0.0583
outdoor temperature*volume*month (8)	-0.011	1	0.010	-1.030	0.3045
outdoor temperature*volume*month (9)	-0.015	1	0.010	-1.390	0.1646
outdoor temperature*volume*month (10)	-0.028	1	0.010	-2.940	0.0033
outdoor temperature*volume*month (11)	0.024	1	0.010	2.350	0.0188
outdoor temperature*volume*month (12)	0.000	1	.	.	.
outdoor temperature*volume*configuration (SS)	0.041	1	0.017	2.490	0.0128
outdoor temperature*volume*configuration (TF)	0.116	1	0.014	8.180	<.0001
outdoor temperature*volume*configuration (UP)	0.000	1	.	.	.
outdoor temperature*volume*use type (F)	0.000	1	.	.	.
outdoor temperature*volume*use type (P)	0.136	1	0.010	13.290	<.0001
outdoor temperature*volume*use type (S)	0.000	1	.	.	.
outdoor temperature*volume*conditioned space dummy (0)	0.000	1	.	.	.
outdoor temperature*volume*conditioned space dummy (1)	0.000	1	.	.	.

After fitting the model, the evaluation team sought to compare the modeling approaches used in the different evaluation cycles. In order to do this, we simulated short-term metering data for units generated from our long-term meter sample. These short-term meter data sets were created by extracting a two week portion of the annual metered data from a long-term metered unit in each month and estimating annual UEC using the different annualization methodologies.

We then applied each annualization approach to the hypothetical short-term metered units and compared this to the actual UEC of the long-term unit. In order to make a valid comparison across evaluation models, we applied the parameter estimates of each model to TMY temperature data to generate the load shapes used to expand the hypothetical short-term consumption profile.

Figure 1 below presents a graphical summary of the estimates generated by each modeling approach. The flat line represents the actual average 12 month UEC for all long-term metered units in the sample. The remaining curves represent the seasonal bias of each model. For example, if one were to draw a vertical line at July 01, the points at which it crosses each curve would give you the annualized UEC estimated by each model based on a "hypothetical" sample of units metered during the period July 01-July 15. As expected, the naive annualization overestimates the actual annual UEC, due to the higher than average consumption that occurs during the summer months. Analogously, a vertical line drawn at January 01 shows the underestimation of annual UEC that would occur if the same sample was instead metered from January 01-January 15.

Figure 1: Comparison of Seasonal Annualization Model Bias
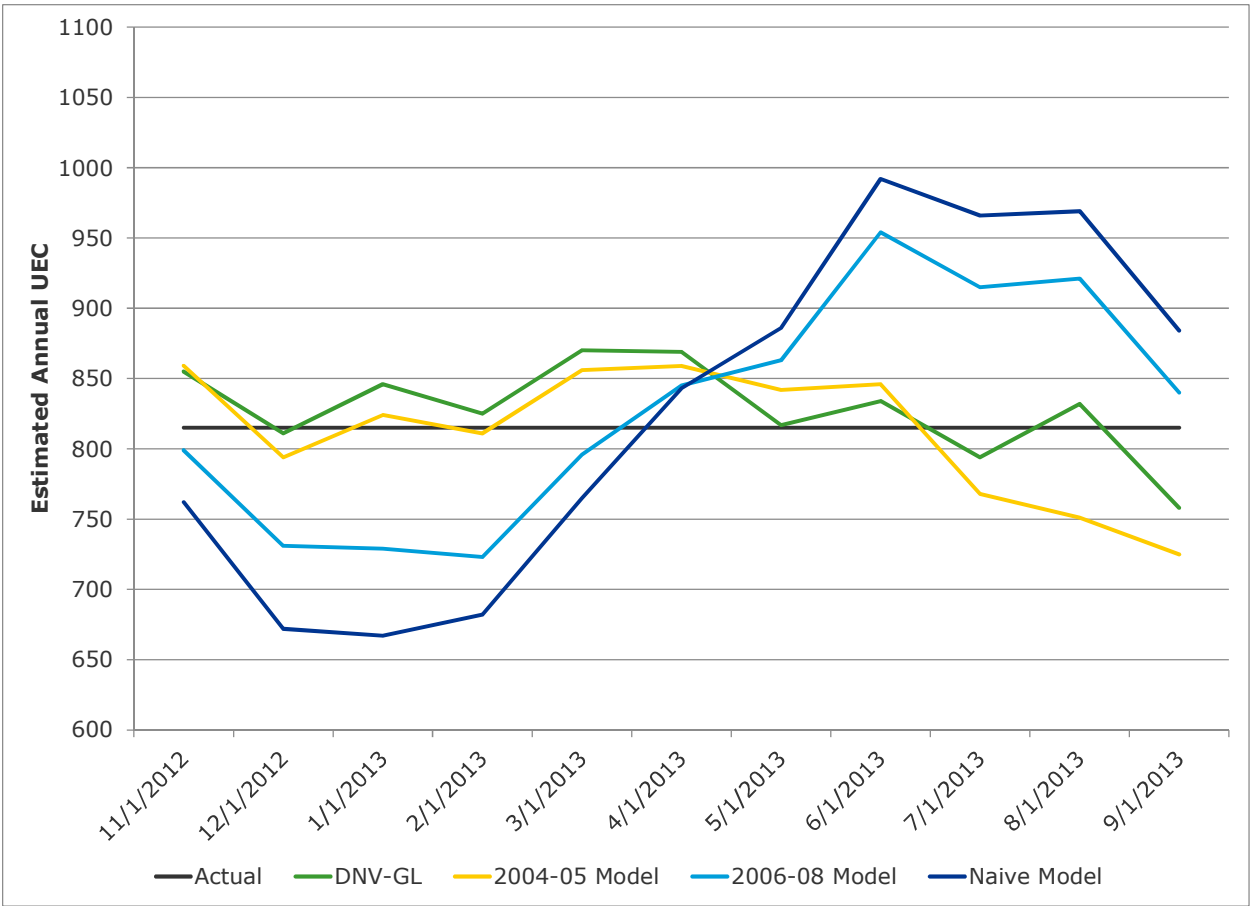
This comparison is not without its own drawbacks. First, the fact that the test dataset is a subset of the data that was used to estimate the DNV GL model means that this model will necessarily be closer to the actual average UEC for the units. Furthermore, the annualization methods from prior evaluations were applied to current long-term metered data (instead of being applied to long-term metered data from the same time period as prior evaluations). A better test of external validity would have applied the 2013 modeling techniques to a set of long-term metered units from the previous evaluation years. Unfortunately the lack of long-term metered data from prior evaluation cycles prevents this exercise. Finally, rather than re-estimating the short-term model from the 2006-2008 report, the evaluation team applied the model parameters provided in previous reports to the simulated short-term data. Strictly speaking, this represents an "apples to oranges" comparison, since the data used in the current evaluation includes units not used in the model of previous evaluations. However, this is not significant issue, since the current short-term unit dataset is comprised largely of units metered in the previous evaluations.

Nevertheless, what this comparison does suggest is that a model based on actual long-term metered data, that includes monthly effects is robust. In particular, the relative agreement between the 2004-2005 model and the DNV GL model, despite the fact that the former was based on data from units that were metered "as new" and nearly 20 years ago, suggests that this type of model can be used in other evaluations of refrigerator consumption.

J.   Error Propagation for Gross and Net Savings

J.1   Response Proportions and Standard Errors

For each response category, r, to each question asked during both of the CATIs conducted for this evaluation, the Participant Survey and the Nonparticipant Acquirer/Discarder Survey, the sample response proportions were determined as follows:

$$p_r = \frac{n_r}{n_{question}}$$

where the unbiased variance of the proportion is

$$var(p_r) = \frac{p_r(1 - p_r)}{(n_{question} - 1)}$$

and the standard error of the proportion is

$$SE(p_r) = \sqrt{var(p_r)}$$

When combining proportions by adding them, the combined proportion is

$$p_{x+y} = p_x + p_y$$

where the standard error of the combined proportion is

$$SE(p_{x+y}) = \sqrt{SE(p_x)^2 + SE(p_y)^2}$$

When determining the proportion of a proportion, as is often done when creating a decision tree or disposition path, two proportions are multiplied

$$p_{xy} = p_x p_y$$

where the standard error of the proportion of the proportion is

$$SE(p_{xy}) = p_{xy}\sqrt{\left[\frac{SE(p_x)}{p_x}\right]^2 + \left[\frac{SE(p_y)}{p_y}\right]^2}$$

When multiplying the proportion of a disposition path by the appropriate unit energy consumption (UEC) value for the relevant IOU and rate of usage, the resulting energy consumption is

$$\widehat{UEC}_{IOU,Usage} = p_x \widehat{UEC}_{IOU,Usage}$$

where the standard error of the resulting energy consumption for this path is

$$SE\left(\widehat{UEC}_{x_{p_x}}\right) = \widehat{UEC}_{x_{p_x}}\sqrt{\left[\frac{SE(\widehat{UEC}_x)}{\widehat{UEC}_x}\right]^2 + \left[\frac{SE(p_x)}{p_x}\right]^2}$$

This process is replicated for the baseline UEC, depending upon the relevant IOU and rate of usage.

J.2   Savings Estimate Precision

The following documents the assumptions and methodology used for calculating the precision for the statewide savings estimate.

G = Gross Savings
N = net savings
UEC_{kc} = full-year usage, disposition path k, condition c
U_{kc} = part-use factor, disposition path k, condition c
p_k = proportion of disposed units that end up in ultimate disposition path k
F_k = free rider factor for disposition path k, either 0 or 1
Conditions c
      b = baseline, no program
      w = with program
Gross savings
      $G = \Sigma_k\, p_k\, (UEC_{kb}\, U_{kb} - UEC_{kw}\, U_{kw})$
Net savings
      $N = \Sigma_k\, p_k\, (UEC_{kb}\, U_{kb} - UEC_{kw}\, U_{kw})F_k$

Assumptions and observations:
      The part-use factors are all either deterministically 0 or 1 or else are proportions close to 1 estimated from survey data, so we ignore this contribution to variance.
      F_k is deterministically 0 or 1 for each path, so contributes nothing to variance.

Together these points mean that we have 2 sources of variance, that due to UEC and that due to the proportions p_k. As an approximation, then, we calculate the variance of the gross or net savings as

$$Var(G) \simeq Var(G|\mathbf{UEC, U}) + Var(G|\mathbf{p})$$
$$Var(N) \simeq Var(G|\mathbf{UEC, U, F}) + Var(N|\mathbf{p})$$

(Where the bold indicates the vector of values across k and c)

That is, the variance of the savings estimate is approximately the sum of 2 components:

$Var(G \text{ or } N|\mathbf{UEC, U})$ = the variance due to p_k if all the other factors are known

$Var(G \text{ or } N|\mathbf{p})$ = the variance due to UEC_{kc} if all the proportions are known.

Variance due to errors in proportions p_k

Even though the proportions p_k all come from the same combinations of surveys, there are so many of them we treat the p_k as approximately independent. Hence

$$Var(G|\mathbf{UEC, U}) \simeq \Sigma_k Var(p_k)(UEC_{kb}U_{kb} - UEC_{kw}U_{kw})^2$$
$$Var(N|\mathbf{UEC, U, F}) \simeq \Sigma_k Var(p_k)[(UEC_{kb}U_{kb} - UEC_{kw}U_{kw})F_k]^2$$

Variance due to errors in UEC

To estimate the variances due to uncertainty in UEC, we consider the following. All the UEC values come from application of the same regression model to the average unit characteristics of units in that path. So these all have a similar variance coming from a similar source. For many of the channels the with-program term is 0. As a very broad approximation, for gross savings we assume that variance of the weighted average of differences in these UEC values is on the order of the variance of the model evaluated at the population average. To see this, note that if the with-program condition were always UEC_{kw} = 0, and if all the usage factors U were 1, gross savings would simply be a weighted average of UEC values on different paths, and these UEC values are similar and result from evaluating the same model at similar average values. Hence the variance of that weighted average of UECs would essentially be the model variance, with the model evaluated at an average point. The usage factors are all close to 1, so this assumption isn't bad. The UEC_{kw} values are not all close to 1, but essentially what we have is still a weighted combination of evaluations of the model.

The same logic applies to the net savings variance due to the UEC model. In fact, the SE is likely lower for net than for gross: for an individual path, the variance is either the same for gross and net savings (F = 1) or is 0 for net savings (F = 0). Nonetheless we use the model variance at a central value for both gross and net savings.

Variance in statewide gross and net savings

The statewide gross and net savings are the sum of the values for the 3 IOUs. These values are not independent because again the same UEC model is used for all of them. Hence, the error due to UEC will be similar for the state as a whole as it is for any single

IOU. The error due to proportions will be lower than for any single IOU, because the estimated proportions are based on larger samples for the statewide value. As a conservative approximation, we apply the average of the standard errors for PG&E and SCE as the statewide SEs.

K. Relationship of Survey Questions to Counterfactual Actions

As mentioned in the report, the table of counterfactual actions was built up from a variety of questioned answered across several of the surveys administered by the evaluation team. These responses were combined to create a decision tree that was used for the counterfactual actions in the absence of the program. Figure 2 below shows which survey and survey questions provided responses that were used to build this decision tree.

Figure 2: Counterfactual Action Decision Tree

Action	Source	Destination	Source	Usage	Source	What purchasers of the used equipment would have done in the absence of available units	Source	Unit would have been replacing existing or adding a unit to the house	Source
Keep In Use	Participant Survey (q. R19, R20, R21)								
Keep Unused	Participant Survey (q. R19, R20, R21)								
Direct Destroy	Discarder survey (q. D16)								
P2P channel	Discarder survey (q. D16)			Primary	Acquirer Survey (q. AQ4)	Looked for a similar free unit elsewhere	Acquirer Survey (q. AQ 9a, AQ9b)		
						Purchased a similar used unit elsewhere	Acquirer Survey (q. AQ 9a, AQ9b)		
						Purchased a new unit from a retailer	Acquirer Survey (q. AQ 9a, AQ9b)		
						Not purchased a unit /stuck with what you already had	Acquirer Survey (q. AQ 9a, AQ9b)	Replacing existing	Acquirer Survey (q. AQ 3)
								Adding a unit	Acquirer Survey (q. AQ 3)
				Secondary	Acquirer Survey (q. AQ4, AQ7, AQ7a, AQ8)	Looked for a similar free unit elsewhere	Acquirer Survey (q. AQ 9a, AQ9b)		
						Purchased a similar used unit elsewhere	Acquirer Survey (q. AQ 9a, AQ9b)		
						Purchased a new unit from a retailer	Acquirer Survey (q. AQ 9a, AQ9b)		
						Not purchased a unit /stuck with what you already had	Acquirer Survey (q. AQ 9a, AQ9b)		
retail channel	Discarder survey (q. D16)	Individuals	Sec Mkt InterviewsSec Mkt Interviews (q. OUT-1)	Primary	Acquirer Survey (q. AQ4, AQ7, AQ7a, AQ8)	Purchased a similar used unit elsewhere	Acquirer Survey (q. AQ 9a, AQ9b)		
						Purchased a new unit from a retailer	Acquirer Survey (q. AQ 9a, AQ9b)		
						Not purchased a [ApplianceVar2] /stuck with what you already had	Acquirer Survey (q. AQ 9a, AQ9b)	Replacing existing	Acquirer Survey (q. AQ 3)
								Adding a unit	Acquirer Survey (q. AQ 3)
				Secondary	Acquirer Survey (q. AQ4, AQ7, AQ7a, AQ8)	Purchased a similar used unit elsewhere	Acquirer Survey (q. AQ 9a, AQ9b)		
						Purchased a new unit from a retailer	Acquirer Survey (q. AQ 9a, AQ9b)		
						Not purchased a [ApplianceVar2] /stuck with what you already had	Acquirer Survey (q. AQ 9a, AQ9b)		
		Multi-Family Housing	Sec Mkt Interviews (q. OUT-1)	Primary			Assumed		
		Commercial Spaces	Sec Mkt Interviews (q. OUT-1)	Primary			Assumed		
		Other	Sec Mkt Interviews (q. OUT-1)	Primary			Assumed		
		Destroy	Sec Mkt Interviews (q. OUT-1)						

Source

	Participant Survey
	NP Discarders
	NP Acquirers
	Secondary Market Interviews

L.   Comparison of Response Groups

We looked at how our various response groups compared on a variety of questions. First we looked at the self-reported refrigerator age by program participants surveyed. This was compared to the program tracking data for those particular units, and to the program tracking data for all refrigerators recycled.

Figure 3 through Figure 5 show the response for each IOU.

Figure 3: Comparison of Refrigerator Age, PG&E
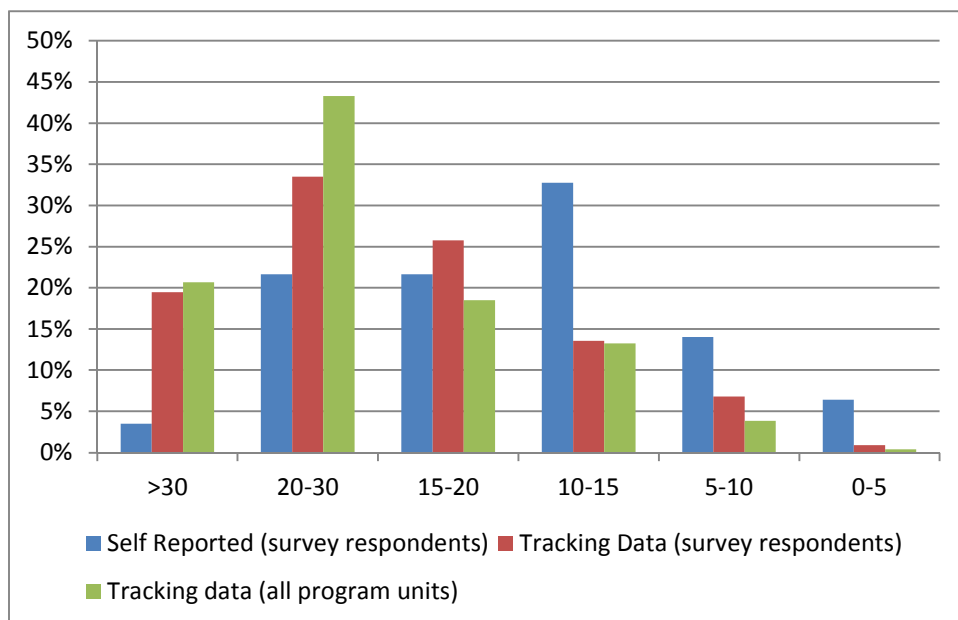
Figure 4: Comparison of Refrigerator Age, SCE
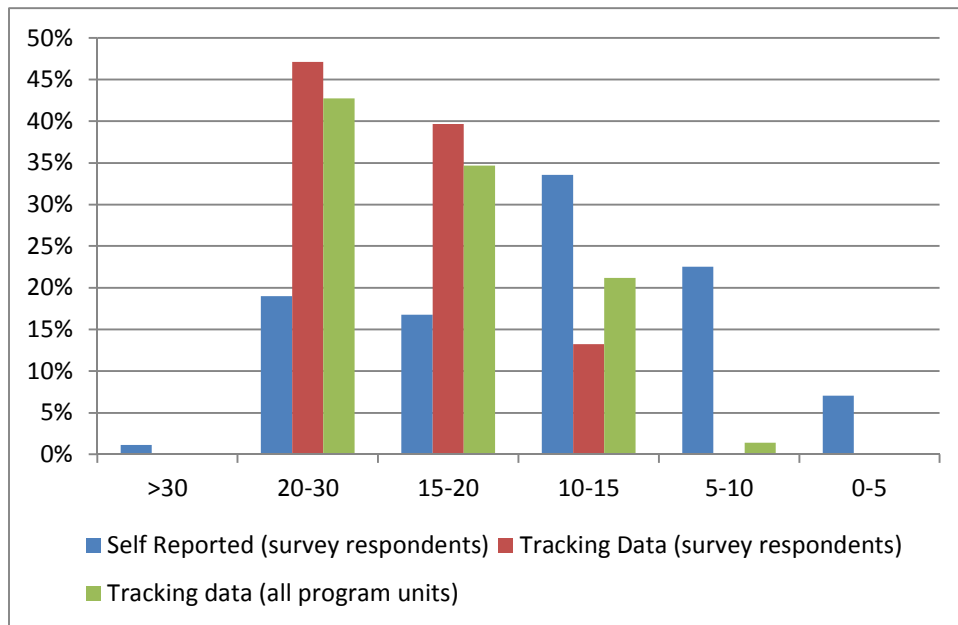
Figure 5: Comparison of Refrigerator Age, SDG&E
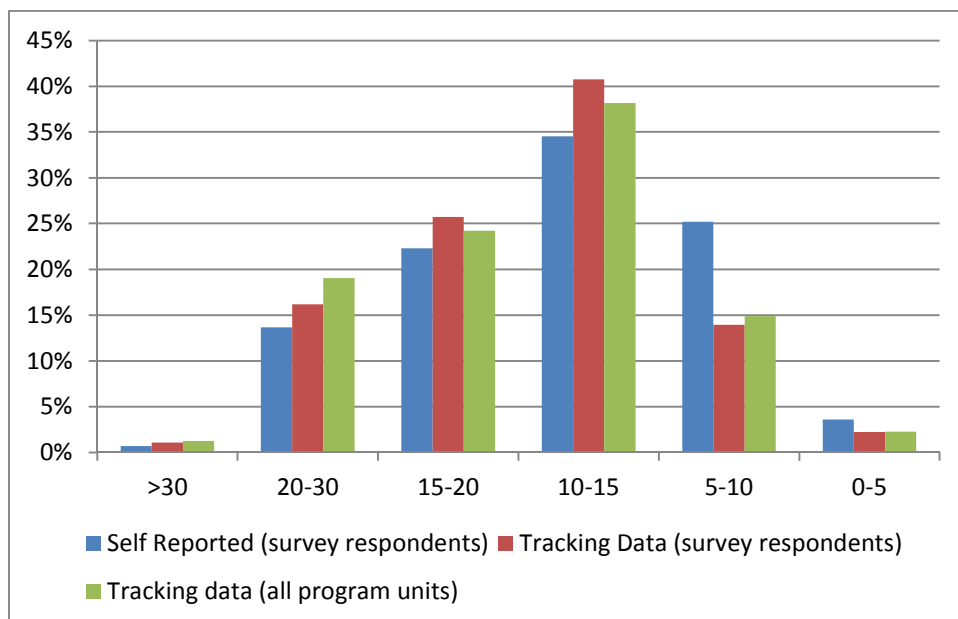
We also looked at patterns of self-reported refrigerator age across all three survey groups, program participants, non-participant discarders and non-participant acquirers.

Figure 6: Self-Reported Refrigerator Age
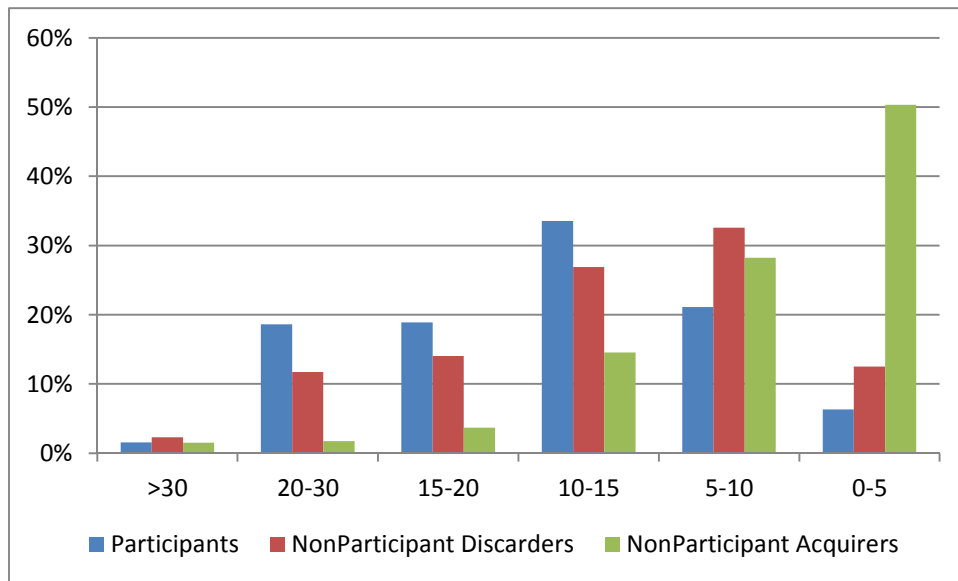
Additionally we compared our participants to our non-participants across a series of demographics, looking at non-participants as a group, and acquirers and discarders separately. We found that the different respondent groups were quite similar across the various demographic questions.

Figure 7: Housing Type
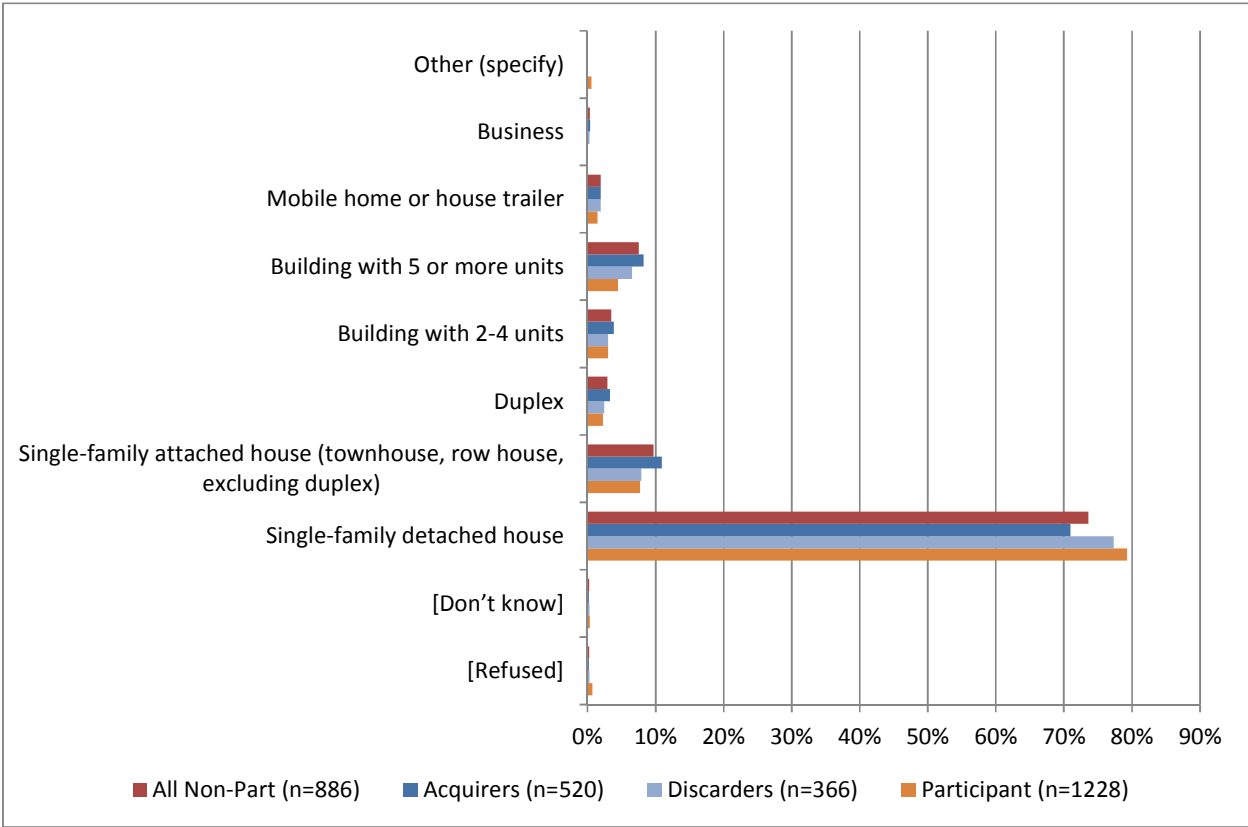
Figure 8: Number of Occupants in Home

Figure 9: Home Ownership

Categories (top to bottom): [Occupy rent-free], [Rent / Lease], [Own / Buying], Other (specify), [Don't know], [Refused]

Legend: All Non-Parts (n=886), Acquirers (n=520), Discarders (n=366), Participant (n=1228)
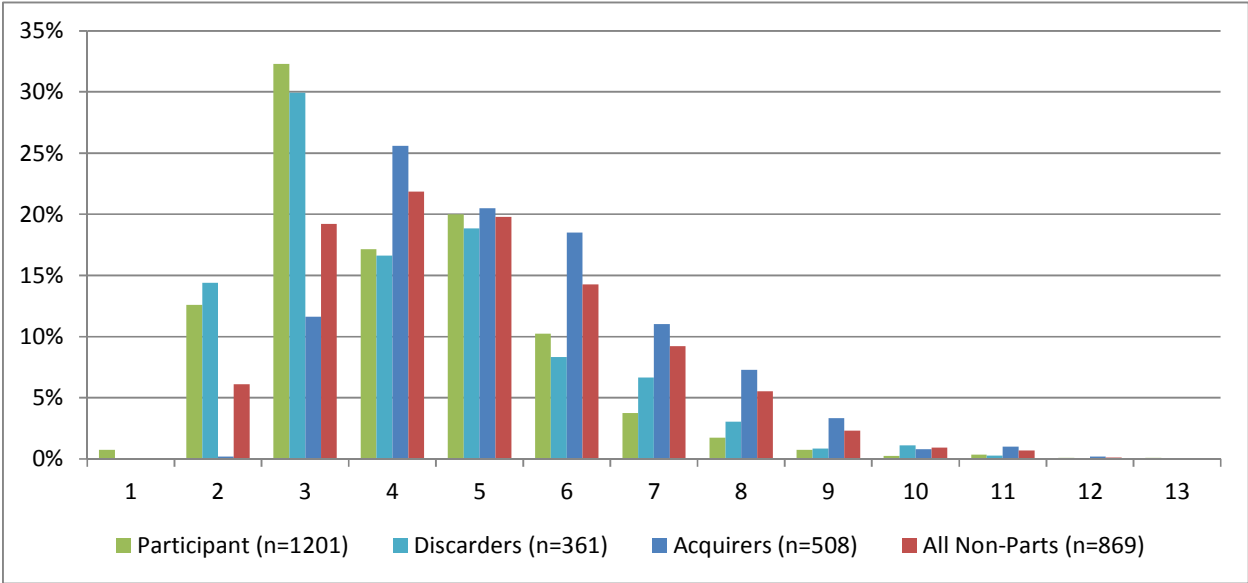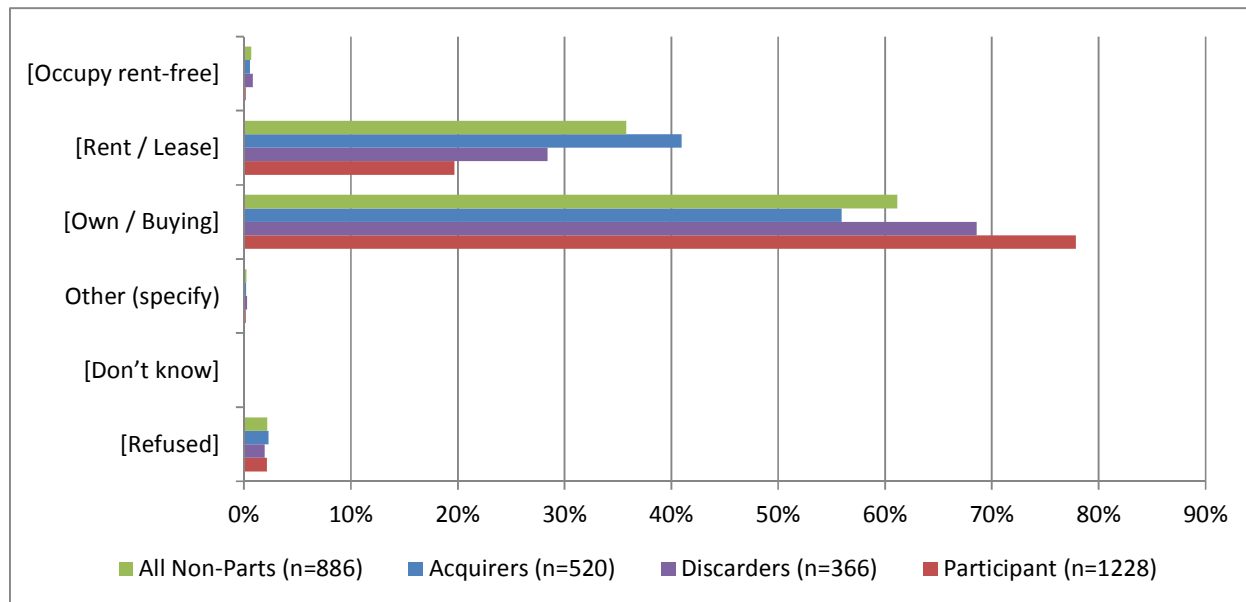
Figure 10: Education Level of Respondent

Categories (top to bottom): [Refused], [Don't know], Post-Graduate, Graduate degree, College degree, Some college, High school graduate or equivalent (e.g., GED), Some high school, Less than high school, No schooling

Legend: All Non-part (n=885), Acquirers (n=519), Discarders (n=366), Participant (n=1228)
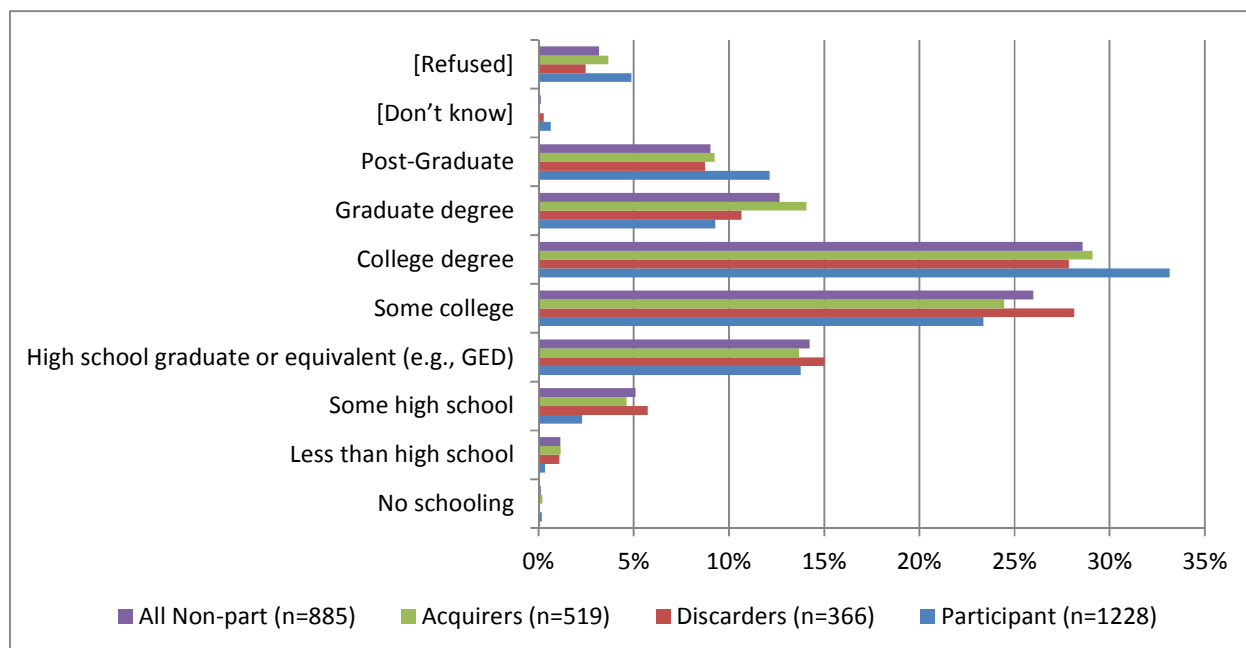
Figure 11: Race of Respondent
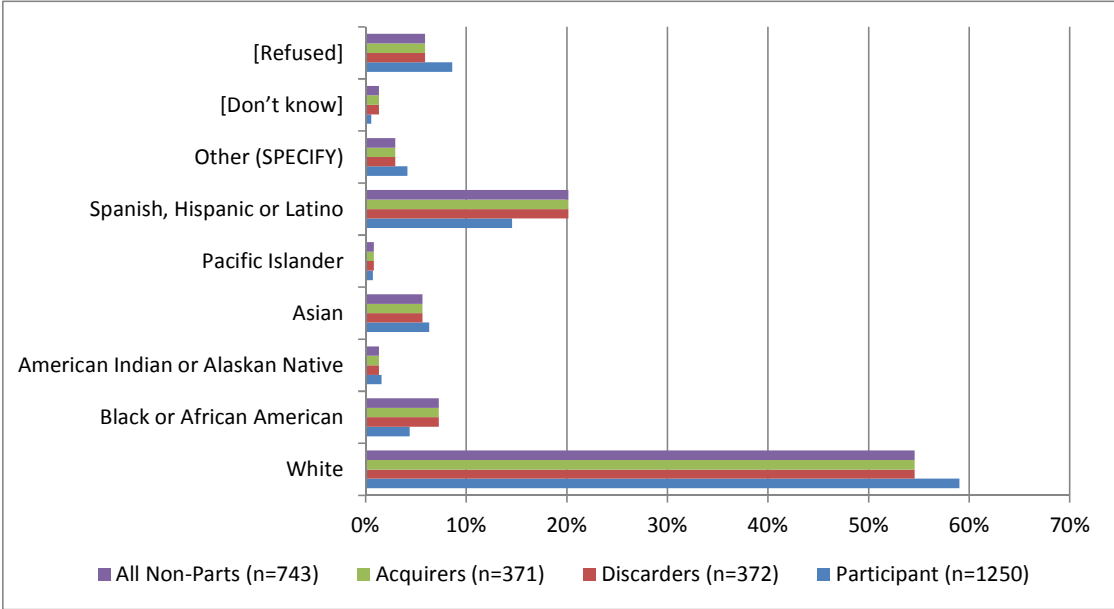
Figure 12: Household Income of Respondent
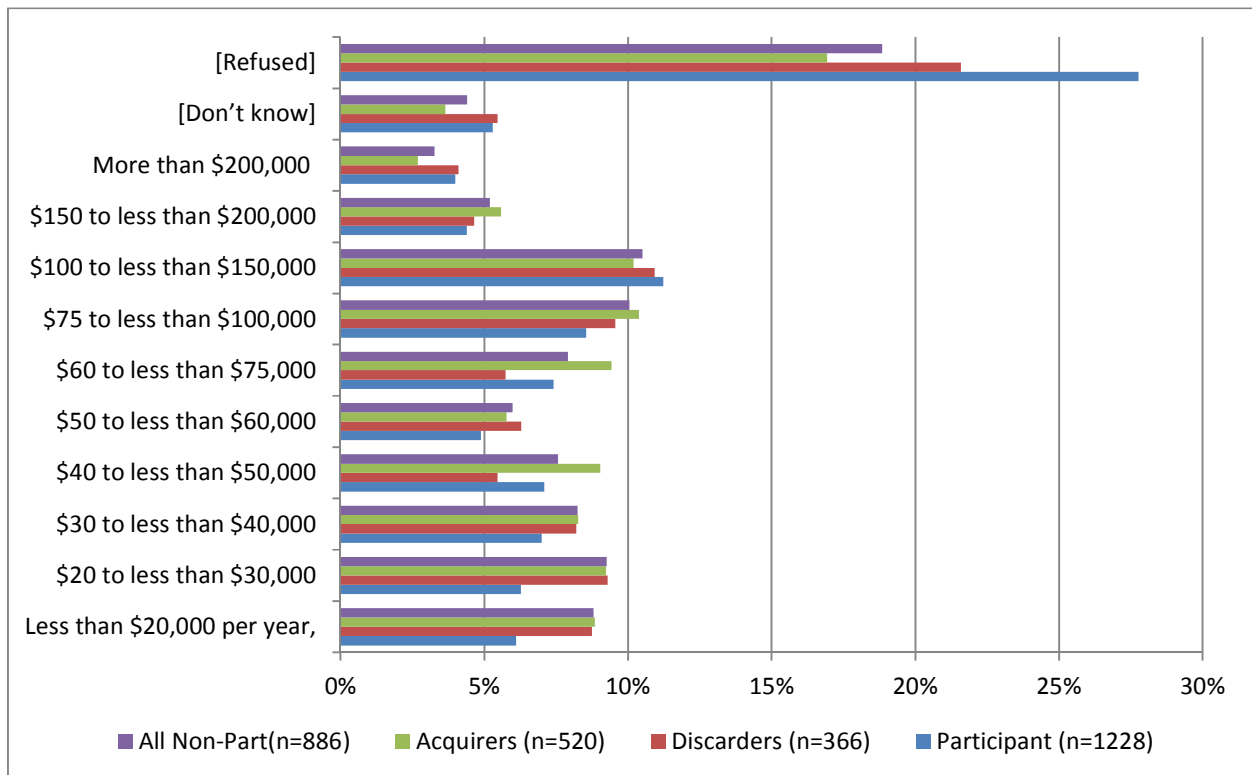
M. Public Comments on the Report

The following table provides public comments on the draft report and the corresponding responses from DNV GL.

Table 42: Responses to Comments from IOUs

Comments	DNV GL Responses
Measurement and Sampling Error	
Disposition absent the program and self-selection (p. 43): Using non-participants as a way of understanding what would have happened in the absence of the program is based on an assumption that the two groups are identical. Of course, this is never the case except in true experimental designs. In working with intact groups there is always the possibility of self-selection. Self-selection is the major threat to internal validity in such non-equivalent comparison group designs. One typically attempts to control statistically for such differences but DNV-GL was unable, for various reasons, to do so. Thus, the notion expressed on p. 43 that non-participants are a better reflection of what happens absent the program than the self-reporting of participants is an assumption, rather than a fact. It may be that there are significant differences between participants and non-participants that make the reports of non-participants different from what participants would really have done. Since the draft final report did not include any such comparisons, the IOUs requested that DNV-GL provide tables that compare participants and nonparticipants with respect to available demographic variables. DNV-GL eventually provided such tables, which showed that the two groups	There was an error in the response rates in the draft report, which has been corrected in this final report. In light of the corrected response rates, the similarity between the participants and non-participant groups increases our confidence that the samples are representative, and generalizations can be reasonably drawn between the two populations. The graphs comparing the participant and non-participant groups have been added to the report appendices.

Comments	DNV GL Responses
were surprisingly similar, a finding that is very much at odds with previous evaluations of most evaluations of energy efficiency programs . Given that they are so similar, using the information provided by the comparison groups is likely valid. However, given that the response rates discussed below are extremely low, the likelihood of non-response bias is large. This means that the results of the analysis should only be generalized with great caution to the population, from which they are drawn, i.e., the samples are not as representative as one might think.	
Response Rates: In the draft of the final report, response rates were not reported for any of the surveys. The IOUs requested that DNV-GL provide a table containing a detailed disposition of the samples for participants, non-participant acquirers, and other market actors consistent with Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys developed by the American Association for Public Opinion Research (2009)? At a minimum, the IOUs requested that the following rates should be reported: 1) Response Rate 1 (RR1) and 2) Response Rate 3 (RR3). Definitions of each are provided in the Standard Definitions. In the Final Report, DNV-GL provided such tables, which showed the following participant and nonparticipant survey response rates: Participant Survey Non-Participant Acquirer/Discarder Survey RR1 3.3% .2% RR3 3.4% .6%	Further review of the response rates revealed that the interviewing firm was providing us with the wrong data for calculating response rates. Rather than providing us with the number of respondent reached through the surveying process, we were given the number of dialings made by the computer dialing system (including non-answers and multiple dialings on the same respondent before finally being reached). Using the corrected data from the survey firm, the response rates have been recalculated as follows: Participant Survey: RR1: 21.1% RR3: 21.5% Non Participant Survey:

Comments	DNV GL Responses
By any standards, these are very low response rates. Given this, one would have expected DNV-GL to conduct some minimal analysis that compared, for each survey, whether the respondents were systematically different than the non-respondents with respect to information available for all households in the sample frame such as annual energy use, weather zone and past participation in IOU-sponsored energy efficiency programs. Since no such comparisons were conducted by DNV-GL, there is the possibility that those who responded are not representative of the populations to which any results could be generalized (i.e., this is an issue of external validity). Response rates for other market actors are substantially larger. In the Final Report, DNV-GL provided such tables, which showed the following survey response rates: Market Actor RR1 RR3 Auction Houses 16% 35% Small Charities 21% 40% Chain Charities 50% 74% Haulers 34% 35% Appliance Recycler 33% 33% Rental Companies 80% 80% Retail Chains 3% 4% New/Small Retailers 30% 40% Used Retailers 32% 42% Although there is some variation in these response rates, the overall averages	RR1: 2.5% RR3: 40.9% Full details of the response rates are presented in Appendix F of the final report To reduce non-response bias, the surveying firm was directed to call each number up to ten times at different hours of the day and days of the week. A table showing the number of attempts needed to contact respondents who completed the participant and non-participant surveys are included after the survey instruments in the report Appendices.

Comments	DNV GL Responses
for RR1 are 33% and for RR3 are 43%. Even though these response rates are higher, one would still have expected DNV-GL to conduct some minimal analysis that compared, for each survey, whether the respondents were systematically different than the non-respondents with respect to information available for all market actors. Since no such comparisons were conducted by DNV-GL, there is the possibility that those who responded are not representative of the populations to which any results could be generalized (i.e., this is an issue of external validity). However, there are other far more serious concerns with the survey results for other market actors that are discussed below.	
In the participant survey, customers are asked about the disposition of the unit in the absence of the program. Given that they have very little experience in making a decision on the disposition of a unit in the absence of the program, asking them to project what they "would have done" is difficult to answer reliably and generates additional uncertainty. To proceed to use those answers to create scenarios for weighting savings introduces additional uncertainty, which has not been appropriately defined or discussed for these energy savings calculations. In short, the current ARP disposition path table for each of the IOUs is suggesting more accuracy than it is really there.	
After reviewing the market actor interview guide, the IOUs are concerned about the possibility of substantial measurement error. For example, market actors are asked about the working condition of the refrigerators when they acquired them used. The response categories are: 1) Non-working, 2) Working	

Comments	DNV GL Responses
but with mechanical problems or needing major repairs, 3) Working but only need minor repairs (e.g., door seals, touch ups), 4) Working and no repairs needed, and 5) Other. Or, they are asked to list four possible reasons that buyers choose used fridges. They are asked to rank them in order of prevalence, where 1=most often and 4=least often? The response categories are: 1) New units are too expensive. 2) Cheapest possible unit needed, 3) More features are affordable for a used fridge (than for a new one), 4) Seeking a specific feature (such as size, color, etc.) that's hard to find on new fridge. Note that "Don't Know" and "Refused" are not listed as possible responses for these questions. Or, how would interviewees know what portion of their customers had checked Craig's List (p. 88)? Other questions are similarly challenging. How accurately are they able to report these numbers? Are they simply guessing? What percent indicated that they didn't know? Could DNV-GL report the results of their item analysis that would show the extent of "Don't Knows" and "Refusals" for each question on the market actor survey? Can they also discuss the potential for measurement error?	
Surveys in other languages: Were the surveys available in languages other than English? Approximately 33% of SDG&E customers are Hispanic or Latino, and roughly 37% of San Diego County Residents speak a language other than English at home. - reference United States Census Bureau http://quickfacts.census.gov/qfd/states/06/06073.html.	Similar to the IOU-sponsored process evaluation of the Appliance Recycling Program, the survey instruments were only administered in English. The IOUs were involved in the review and approval of the survey instruments prior to them being administered.
Sample sizes: All tables based on survey responses should show the sample sizes at some relevant level.	The report has been adjusted to include sample sizes for relevant tables.
Secondary-market survey sample design (p. 36): In Table 19, how were the	The sample design for the secondary market is outlined in the

Comments	DNV GL Responses
sample sizes for the secondary-market actors determined? Were they weighted in reference to the size of that submarket? The secondary-market survey results should be presented as more qualitative than quantitative given the many sources of uncertainty. Additional research is needed, especially for "Craig's List".	report appendices in Section E.1. The IOUs were involved in the discussion designing the sample and setting the sample sizes and reviewed the sample before calling commenced.
Process	
Changing Performance Metrics: D. 11-07-030 was not issued until July 2011, midway in the program cycle. The Program had been running for 18 months based on a program theory and logic model that clearly focused on households and was approved by the ED. To change mid-stream the metrics by which the performance of the program will be assessed is by any definition unfair. Certainly, DNV-GL should identify any positive or negative impacts occurring in the broader market and recommend changes in program and/or delivery that could address them. Keeping an eye on this broader market can also help to better understand the evolving need for such a program.	D.11-07-030 does not affect net savings, which still measure the difference between energy use with and without the program. The affect from D.11-07-030 is a shifting of market adjustments from the net-to-gross ratio to the gross savings calculation. Essentially gross savings were reduced, while the net-to-gross ratio increased.
Energy Consumption	
Confusion over the change in calculating GROSS energy savings: The report states that it has addressed gross savings "somewhat differently" (Section 0.3 – page 2), "a departure from other evaluations" (Section 0.3 page 3), "offer a reorganization" (Section 1. page 14), "in terms of the change in consumption on the grid" (Section 2.1 page 15), "the effect of moving second-hand savings into the gross savings" (Section 2.1.1 page 18, "captures the realistic potential effect of the program as it is presently structured (Section 2.1.1. page 18), "is	D. 11-07-030 states: *Energy Division believes that gross saving must be established based upon the difference between the recycled unit energy use, if left on the grid rather than being recycled, and any unit that is placed into service in place of the recycled unit. Energy Division believes that in some situations no unit is placed into*

Comments	DNV GL Responses
the consumption reduction on the grid due to the ARP given this second-hand market dynamic" (Section 2.1.1 page 18). With so much effort given to the explanation of this change in the definition of the traditional approach to Gross Savings, the IOUs request that the Report also state what would be calculated by the prior definition: "the consumption of a secondary unit UED scaled by a part-use factor." (Section 2.1.1 page 18). When such a significant change is made in the definition of Gross Savings, it would seem appropriate to state what the value would be according to the prior method of calculation, and to compare the two numbers, in order to fully inform the Report readers of the significance of this change in method.	*service in place of the recycled unit and thus the recycled unit UEC equals the savings, UES. The utilities believe the only probable case that should be considered is the case where UEC and UES are equal and that all other cases should not be considered. However, Energy Division believes that in many instances another unit is placed into service in place of the recycled unit thus causing a reduction in the savings from preventing the recycled unit from staying in service. The overall effect of the recommended Energy Division gross savings adjustment is approximately a 40% reduction in savings.)* Gross savings in this report were calculated according to this guidance. An equivalent Gross Savings can be calculated by multiplying the IOU specific full year UEC by the IOU specific part-use factor using the data present in the report.
Updated savings estimates (PowerPoint presentation): The updated gross energy savings estimates demonstrate the problem with the conceptual framework of the program implicit in the evaluation methodology used in this report. As argued by the IOUs in response to the evaluation plan in 2012, if the evaluation is trying to determine the impact of the program on the secondary market, it should consider the full impact, not only the impact on the first interaction. The evaluation is stated to be in accordance with the legal decision outlined in Appendix A. of Decision D. 11-07-030: "Energy Division	DNV GL is not sure there's any working assumption we can make that would be more defensible than the existing one of equivalence. The program participants are not a good source of information about the counterfactual, as all the responses would be purely hypothetical. Asking actual discarders and actual acquirers about actual acquisitions and actual discard actions better captures information about what happens in the absence of the program to frame the discussion of the counterfactual.

Comments	DNV GL Responses
believes that gross saving must be established based upon the difference between the recycled unit energy use, if left on the grid rather than being recycled, and any unit that is placed into service in place of the recycled unit." (Emphasis added). The full impact of the program needs to involve ALL units that are impacted by the initial transaction between the program and a customer's recycled unit and subsequent market transaction effects following the initial event.	Theoretically, if all the options are being included, the option that the program unit removal caused a LESS efficient unit to remain on the grid, thereby INCREASING the load on the grid would also be included. However, since there was no way to reasonably estimate this negative potential impact, DNV GL chose to exclude this negative impact. DNV GL believes that the evaluation process utilized best captures the program impacts.
The methodology employed seems to assume that the acquirer data collection captures all impacted transactions in the market but without any validation of this fundamental departure between the program and its evaluation. The recent update runs into this problem in estimating the savings associated with the disposition path for "Kept existing unit." The updated methodology, which assigns full savings to the cases where the acquirer is assumed to have added a unit and zero savings in the case where the acquirer would have replaced an existing unit, assumes that the acquirer would have recycled or otherwise destroyed the existing unit in the absence of the program and not have kept the other unit or otherwise transferred it, but there does not appear to be evidence to support this assumption.	
The survey does not ask the acquirers what they did with their previous appliance. For the updated assumption to be correct, it must be that the old refrigerator used the same amount on average as the unit that was picked up by the program and that the previous main appliance would have been destroyed. Both of these appear to be quite tenuous assumptions. It would be better to make some assumption about the similarity between that case	

Comments	DNV GL Responses
and some other case we have information about, as is done with assumptions that non-participants replicate the decision-making of participants under the counterfactual.	
Annual kWh Consumption: For each IOU, what is the estimated total annual part-use-adjusted kWh consumption of all participant recycled units?	This information is shown in Tables 41-44 of the report, in column D, the "Use Adjusted UEC for the Program Unit under the Counterfactual". The totals row at the bottom of these tables for this column shows the estimated part-use-adjusted kWh consumption of all participant units.
Imputing label UEC (p. 55&56): It appears that "top freezer" was the reference configuration for the five dummy variables, but that should be stated explicitly. Was ENERGY STAR not significant? What other characteristics, if any, were considered for the imputation model?	ENERGY STAR was not used because it was not present in the pickup dataset. Defrost type was considered, but made the imputation process intractable. The report was amended to explicitly state that top freezers were the reference configuration.
Annualization model (p. 41): While presenting a table with all 200+ main and interaction effects is certainly burdensome, there should be a table with at least the main effects and description of the interactions to allow the reader to see what sort of model is being used. It should include the R2 and adjusted-R2.	The table with the main effects of the regression has been added to the report. R2 and Adjusted R2 are included in this table.
Reporting	
Overall Limitations of the Study: The California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals state: All potential threats to validity given the methodology used, as presented in	A limitations section has been added to the report.

Comments	DNV GL Responses
the Sampling & Uncertainty Protocol, must be assessed and discussed. This section should also discuss the evaluator's opinion of how the types and levels of uncertainty affect the study findings. Findings also need to include information for estimation of required sample sizes for future evaluations and recommendations on evaluation method improvements to increase reliability, reduce or test for potential bias and increase cost efficiency in the evaluation study(ies), (p. 182). It would be useful if DNV-GL could provide a section in this study to talk about any and all study limitations, including the various sources of error and bias and your overall level of confidence in the final estimates?	
Uses-and-Sources Chart: It would be useful to provide a table that describes how each question in each survey is used in the calculation of gross savings and the NTGR.	This was added to the report appendices, Appendix K. Relationship of Survey Questions to Counterfactual Actions
Relative Precision: Can DNV-GL provide and discuss the relative precision for each of the net realization rates presented in Tables 62 and 63 on page 98? Per the California Evaluation Framework, the relative precision of the gross realization rate and the NTGR should be taken into account. For example, for PG&E, our calculations show a relative precision of approximately 39%, indicating a fair amount of uncertainty around the final estimate of net savings.	The realization rate is calculated by dividing the ex post value by the ex ante value. Since the ex ante value is taken from the tracking data, the precision from the "per unit" savings is carried through to the program level realization rate. A column with precision of the realization rate was added to Tables 62 and 63.
Graphical representation of methodology: It would be helpful to have a figure, similar to Figure 1, that shows the data source used in parsing out each element of the disposition. Ideally this would include the general data source as well as a specific citation (i.e. discarder survey and question numbers).	This was added to the report appendices, Appendix K. Relationship of Survey Questions to Counterfactual Actions

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Consumption by scenario (p. 66-68): In Tables 41-44, is it correct that columns B-D detail the consumption of the program appliance under the counter-factual, and columns E-G detail the consumption of a prospective replacement appliance (which may be a case of no replacement) under the counter-factual, while the "disposition path" itself is the counter-factual? If so, at the risk of making the table too complicated to format, it may make the table clearer to categorize the columns as such to make it more clear that the disposition path refers to the counter-factual action, B-D refer to the unit's consumption under the counter-factual, and E-G refer the replacement's consumption under the counter-factual.	The report has been adusted with this wording.
Regression tables (p. I-3-I-11): The R2 and adjusted-R2 at the very least should be reported with the parameter estimates.	R2 and Adjusted-R2 have been added to the main effects table for this regression in Appendix I.
Disposition data sources: In the methodology section, it would be helpful to explicitly state which questions are used in estimating elements of the disposition.	This additional effort was not pursued due to reporting time constraints, however, the information is now present in the report appendices, Appendix K. Relationship of Survey Questions to Counterfactual Actions
Table 69 error (p. 101): In Table 68, the ex-ante net unit savings for refrigerators is the same as ex ante gross unit savings.	This error has been corrected in the final report.
Size of the peer-to-peer market (p. 95): Because the size of the market is based off an assumption of the transfer rate, there is very little information content to the number and any calculations based on the number should be reported in a way that reflects the very large uncertainty associated with it.	We have revised the text to remove the transfer rate since it was not sufficiently substantiated.
Precision Estimates: In Tables 15 through 18, is the precision in the last	The precision column was calculated on the achieved survey

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column relative precision? If that is the case, this calculation was based on a standard error of some variable. What was the variable?	completes, using the following equation: $\text{Precision}=1.645*(0.5*0.5/\text{Survey Completes})^{0.5}$
Differences Across IOUs	
Differences across IOUs: In some cases the estimates for specific IOUs appear to vary widely. Unless there is a good reason to believe that these differences are real, it is possible this is due to sampling variation and small sample sizes at the IOU-cell level. Can you acknowledge the differences, discuss whether they are reasonable or not, and attempt to offer possible explanations? Going forward, better results may come from using statewide estimates for these inputs or at least using the statewide numbers as priors in a Bayesian estimate. Examples of such differences that merit explanation are provided below:	For the disposition path analysis, results were aggregated to the statewide level because we agree that there were insufficient sample sizes to justify an IOU split.
Data coverage for UEC imputation (p. 55): According to Table 29, SDG&E had much lower coverage for nameplate UEC. What are the implications for SDG&E's UEC estimates, especially given that SDG&E also has a larger discrepancy between average nameplate UEC and imputed UEC and is the only one with a lower imputed than average UEC?	This lower coverage in nameplate UEC leads to more uncertainty in this estimate that could be lowered if SDG&E had better tracking data. The magnitude of the uncertainty introduced is contained in the standard error for the estimated UEC.
Low response rate for SDG&E (p. 33): In Table 18, SDG&E had a particularly low number of completed non-participant surveys. What are the implications of this for SDG&E's savings?	None, the disposition analysis using the survey results is aggregated to the statewide level.
Imputed UEC (p. 57): In Table 32, why is SDG&E's imputed UEC so different from the average than the other utilities?	The difference in imputed UEC for SDGE is driven by the program tracking data provided by SDG&E. While, nameplate amps and unit volume are also factored into the imputed UEC,

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	the most important factor driving the difference in imputed UEC is that the mean age of units picked up for SDGE's program is significantly younger than units picked up for PG&E and SCE's programs. Younger recycled units result in lower potential savings due to federal appliance standards. Where possible model information was used to provide nameplate UEC for program units, by matching against model databases. Where model information was not available in the tracking data, or is incorrectly recorded, making a match impossible, other unit characteristics impacting energy consumption (age, volume, nameplate amps) were used to impute UEC. For SDG&E, although there was a low rate of model number matching, 98-99% of all program units had data for these characteristics, so the evaluation team is confident that the imputation regression had sufficient data to accurately impute UEC for SDG&E units despite the lack of accurate model information. Table 29 in the report contains the proportion of program tracking data with valid data for age, volume and nameplate amps. When aggregating the imputed nameplate UECs, the standard errors associated with the mean values used as inputs to the full year UEC estimate are extremely small (with relative precisions on the order of <1%). This uncertainty from the imputation process is included in the standard errors

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	presented in Table 34.
Program Tracking Data: Thank you for providing the detailed refrigerator/freezer appliance age data so that we can compare the IOUs program tracking data to participants' self-reports. While we have concerns about the reliability of self-report data and potential for non-response bias, we also have some concerns about the quality of the program tracking data. We believe further investigation is required. The IOUs will work with our recyclers and their drivers to better understand the data collection process.	We think it is a good idea that the IOUs work on improving their tracking data.
Differences Across IOUs	
Volume in secondary market (p. 96): A total volume of about 800,000 means about 8% of California homes transfer an appliance each year (with about 6% in the peer-to-peer). That high of a rate should be possible to estimate via a general-purpose survey. Do we have survey evidence to corroborate this?	We reviewed the Cadmus report for the Process Evaluation and cited in report text the volume of the overall secondary market that was presented therein.
Retail market channel (p. 79): Do the annual sales data come from Dunn and Bradstreet or some other source? Was this information available for all stores?	The data were purchased from InfoUSA.
Interactive effects (p. 8): For clarity, it bears mentioning that interactive effects here are the therm impacts of not having the recycled appliance in conditioned space.	The report has been adjusted with this text.
Data Availability: Can DNV-GL provide, in the form of SAS files, all the relevant data that were collected in this evaluation along with other documentation such as code books? Also, can DNV-GL provide links to all weighted frequencies for all surveys?	The data from the evaluation will be provided to CPUC as part of the closeout data process. Any party interested in the data from this evaluation should contact CPUC to acquire the data.

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Peak demand and interactive effects (p. 51&52): The equations for peak demand and interactive effects assume that kW/kWh is independent of free ridership. Better estimates could be possibly made by conditioning on relevant characteristics. Did interactive effects adjust for the likelihood of a unit being in conditioned space?	The peak demand and interactive effects calculation applied the average demand savings factor and interactive effects factor derived from the program tracking database. As such, it includes all assumptions made by the IOUs about climate zone and conditioned vs. unconditoned space applied by the IOUs to their program design.
Climate zone breakdown: Please provide gross and net savings parameters at the climate-zone level. This information is vital for program implementation.	There were insufficient data to effectively provide results at the climate zone level of disaggregation. In fact, for the disposition analysis, which is an important component of gross and net savings calculations, we shifted our level of aggregation from the IOU-level to the statewide level, based on IOU input that there weren't sufficient data to allow for IOU-level disaggregation.
Retailer option: Did the evaluation team have any findings regarding the "retailer option" in which the program was implemented through appliance retailers? SCE would like to have savings data for appliances recycled through the "retailer option" to understand the relative ex-post efficiency.	The survey instruments for the secondary market study did not directly probe for the "retailer option" program. No mention of this pilot program was made to the interviewers by the respondents.
PG&E Program Tracking: Need clarification for recommendation 6.2.2 "Improve the Quality of Tracking Data" concludes: "…with a unique key present in both data sets." Can the study team elaborate further the unique identifier that is missing between the implementer and program? More specifically, what isn't linked for tracking?	The IOUs provided official tracking data upon which their savings claims are based. The program implementers also provided item-level data with more detail about the units being recycled. We could not located any variable that linked, one-for-one, the items in these 2 datasets. We were generally able to match data using customer addresses, but could not exactly match units at a given address where more than one unit was

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	picked up.
	The pick up data contain unit characteristics recorded by ARCA/Jaco has a unique key for identifying program units recycled (ORDERID). The program tracking data provide through ED contains a different unique key (IOUClaimID). The values in the two columns are not equivalent, and neither dataset contains the other unique key. Since the program tracking data is created subsequent to the pick up data, it would make sense to pass the ORDERID column through along with participant data (name, address, etc.) from the pickup data, so that the final program tracking data contains both the IOUClaimID and the ORDERID columns.
Unit Energy Consumption	
Imputation (p. G-11): Why were units with ages over 50 or amps over 12 set to missing? These are both correlated with energy usage, so treating them as missing, rather than censored will bias the results as missing cases will no longer be anything close to normally distributed and the imputation will try to match the non-missing sample, as opposed to the tail of the distribution.	These units were screened out because the data were out of line with reasonable expectations. This approach adjusted results by less than 2% at the statewide level.
Lack of nameplate matching (p. 54): In Table 28, do you have any plausible reasons why SCE and SDG&E's matching rates are so low, especially for perfect matches? All of these data are collected by the program. This seems quite illogical for SDG&E given the much younger reported age of the appliances, which would seem to indicate units more likely to be in the database. Does it	We are not sure why this result ocurred. We recommend the IOUs do more checking of their tracking data to ensure inputs are accurate.

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appear the data were not collected with due diligence (i.e., Lots of typos or something else)?	
UECs: Non-metered UEC (Table 34, p. 59): For units without a match, was this the estimated UEC? If so, do the standard errors reflect the fact that this is random (due to its dependence on the sample estimate) and not a fixed regressor? Why include so many regressors with large p-values? Especially when many are already built into the nameplate UEC estimate? How does the fit compare with a more parsimonious model?	The "estimated UEC" was not randomly assigned, but imputed using program tracking data variables. The procedure used to generate parameter estimates and associated standard errors did not rely on an assumption of fixed regressors. Furthermore we believe that given the fact that the imputation rate was quite low, the uncertainty due to imputation is relatively small, compared to other sources of uncertainty. We sought to create a model that would give us the the best fit to the population, given the variables available in the population data. We examined alternative specifications, and found that more parsimonious specifications had lower adjusted R-squared values. For the purpose of generating predicted values, the issues raised regarding model specifications are valid, but not significant with respect to the goals of the model. Any uncertainty in the analysis is captured in the associated standard errors.
UEC estimates (Table 36, p. 60): Was the full-year UEC estimated by averaging the predicted value for all units, or the prediction of the average unit values? Technically, the method used to estimate the standard errors produces the standard error of the prediction of the UEC at the mean value. This treats all the regressors as fixed, which is not true for imputed nameplate UECs (and due to the log of age in the model, may deviate slightly from the mean of the individuals). It may be better in this case to simply take the standard error of the predicted values for the whole population. An even better solution would be bootstrap standard errors, using the correct bootstrap (which would include both steps in the estimation), but that would be a little more	This comment is implying at least 2 different questions: 1. What is the best way to get the UEC for a particular group? Given that we have a model of UEC that is linear in the coefficients, applying that model separately for each unit and averaging the results gives the same answer as applying the model to the average of each predictor. And the latter is what we did. a. For any nonlinear transform included in the model,

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complicated.	we took the average of the transform not the transform of the average, e.g., average(log(age)) not log(average(age)).
	
	2. What is the best way to get the SE of the UEC calculated this way? The commenter is correct that the SE reported is the SE of the model at the average of the predictors, treating that average as a known quantity. This is the primary source of uncertainty that needs to be addressed. There are potentially 2 additional sources of uncertainty not reflected in this SE.
	
	    a. If we are using the available data to represent an abstract infinite population, there is the uncertainty of the average values from our data as estimates of the infinite population. However, we have the full data set so we're not estimating the mean of an abstract population, we have the observed mean of a particular finite population. No SE for this. Even if we want to treat what we have as if it were a random sample, it would have a very small SE because our numbers are so large.
	
	    b. Some of our values are imputed, so we don't have exactly the observed mean of the full population. If the rate of imputation is small, the additional uncertainty introduced by having some imputed values is also small. This uncertainty is

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	currently captured in the standard errors presented in Table 34.
	
	    c. The commenter is not correct that it would be better to "take the SE of the predicted values for the whole population." By this I assume the commenter means to calculate each unit's UEC and then calculate the SE across those units as if they were a random sample of something. This would be incorrect as an estimate of the SE of our estimate.
	
	      i. The unit characteristics are not a random sample, and the primary uncertainty we have to capture isn't about what units are randomly observed, it's about the quality of the model. Again if we did want to treat what we have as a random sample, the SE associated with that randomness would be very small due to the large sample sizes.
	
	      ii. All the predicted values come from the same model. The SE calculated as the SE of an average of a random set of applications of the model would reflect the variability of unit characteristics, but not the uncertainty of the model itself, which affects all the individual predictions. For this reason, the SE so calculated would be very understated.

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	d. The commenter is also not correct that bootstrapping would be a better method.

      i. Again, bootstrapping would treat the observed units as a random sample which they're not, they're the full population, but if we treat the observations as if they were random the variability will get will understate the modeling error.

      ii. Bootstrapping is an approximate method that can be used to capture the combined effects of a complex process, but it's not a perfect method and tends to have systematic bias in the regression context.

      iii. Setting up the bootstrapping would be a complex process that might or might not adequately capture the imputation uncertainty.

DNV GL used the prediction of the average unit values. Although the commenter is correct, the fact is that when aggregating the imputed nameplate UECs, the standard errors associated with the mean values used as inputs to the full year UEC estimate are extremely small (with relative precisions on the order of <1%). For all intents and purposes, we can treat |

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	the mean values as fixed, even though they are not.
Market Characteristics	
Retailer haul-away: The PG&E Field Service Team meets in person with sales personnel at over 545 retail locations in our service area throughout the year and have found without exception that white goods retailers offer refrigerator haul away as an option to customers purchasing a new refrigerator. The recent ARP Retailer Pilot indicated that this is common practice. The only variation to this service is that the some retailers offer it for free and others charge a nominal fee while others may promote the utility recycling program in lieu of their standard service. During the ARP debriefing, DNV-GL has indicated that this is no longer the case, instead some retailers are no longer offering pick-up for fee or at no-charge. We are puzzled by the DNV-GL's comments. Please clarify how you came to the conclusion that many retailers no longer offered haul away to their customers? Can you point us to the data to illustrate your new finding? We would like to better understand this market shift.	We revised the table and provided additional information.
New Channel for used refrigerator sales – Craigslist: The draft report estimates that the Peer-to-Peer market of CraigsList totals 216,000 units – which nearly equals (78% of) the entire sum of units included by the programs of the three IOUs (276,000 – summarizing Table 1). This new channel for sellers and buyers of used refrigerators is a whole new sector which the IOU programs have not encompassed, to date, with any special focus or consideration. One could theorize that now instead of being encumbered by a used refrigerator (when excessed via new purchase) the owner has a new	We agree that the IOUs should always be considering their program designs in light of a changing marketplace.

Comments	DNV GL Responses
opportunity to sell that via the web marketplace. That new re-sale opportunity dramatically changes the incentive to have the unit hauled away, or participate in an IOU sponsored recycling program. The report states that it was not able to fully study this area and recommends further study. The IOUs would like to add emphasis to this point that the marketplace has changed and that, as a result, the entire program design (i.e., program logic and theory) should be re-considered in terms of channels and methods for intervention.	
Size of secondary market (p. 79&80): Conditioning the mean on the relevant stratifying variables (i.e. using a regression), rather than simply calculating cell means would probably give better estimates. In Tables 53 and 54, is the 90% Confidence Interval the length of the interval, or the half-length? It would be helpful to have the population and sample sizes in the table.	The sample sizes were provided. The confidence interval is the "half-length".
Peer-to-peer channel characteristics (Table 60, p. 97): The fact that the average price of refrigerators sold on Craigslist is $250 (i.e., selling price) seems to indicate that this is a whole different sub-market. It seems hard to believe that the average buying price for refrigerators with an average age of 18 years (the program average for SCE) would be $250 dollars, when new units are available for as little as $400-500. In the future, you might want to consider interviewing a sample of sellers or buyers to estimate the actual selling price.	The price derived from Craigslist is the asking price. It says nothing about the final price paid for a unit. Additional research would be required to develop estimates of actual selling prices via Craigslist

Additional comments were provided by Phil Sisson during the Public Comments Period. Our responses to his comments are provided in Table 43.

Table 43: Responses to Comments from Public

Comments	DNV GL Responses
Evaluation Approach: The KEMA/DVL-GL approach is broadly similar to the approach described in the DOE UMP protocol for ARPs … except that DNV-GL is loading the secondary market impacts onto the gross numbers (rather than on the net side).	This is true, but this was consistent with our research plan and with the directive of decision D. 11-07-030 which states: *Energy Division believes that gross saving must be established based upon the difference between the recycled unit energy use, if left on the grid rather than being recycled, and any unit that is placed into service in place of the recycled unit. Energy Division believes that in some situations no unit is placed into service in place of the recycled unit and thus the recycled unit UEC equals the savings, UES. The utilities believe the only probable case that should be considered is the case where UEC and UES are equal and that all other cases should not be considered. However, Energy Division believes that in many instances another unit is placed into service in place of the recycled unit thus causing a reduction in the savings from preventing the recycled unit from staying in service. The overall effect of the recommended Energy Division gross savings adjustment is approximately a 40% reduction in savings.)*
Secondary market impacts methodology: It looks like the nonparticipant survey was significantly used to inform the evaluation re transferred unit tendencies. Something mentioned in the UMP protocol is that such an approach is likely to cause a downward bias in kWh impacts because many of such people would have had inelastic demand for a used fridge. In contrast,	The non-participant survey was used to determine how used units were actually transferred during the program period, both in discard actions, and the actions of people who acquired used units. The survey did not inquire whether the transferrees would have acquired additional units (testing elasticity of demand), in fact the evaluation assumes demand is elastic and that the proportions of acquirer/discarders taking any specific action is

Comments	DNV GL Responses
UMP notes that an additional group of people who should be surveyed are persons (such as neighbors, family, friends) who were NOT offered a used unit because of the ARP's destroying them ... such demand is likely to be more elastic (so more kWh savings because of the ARP changing outcomes).	constant and ongoing. The evaluation team is not aware of any feasible approach to identifying actual persons (neighbors, family, friends) who were NOT offered a used unit. However the responses of used unit acquirers who received their unit from a neighbor/family/friend is factored into the analysis.
Secondary Market Actor Surveys: Peer-to-peer: this segment was tracked for a monthl. Not clear when--it would be good to know if done in say June (peak season?) versus dead of winter. Or where.	This not a correct statement. The transfer of used refrigerators/freezers was monitored on Craigslist for 10 months, from May of 2013 to March of 2014. Over 400,000 postings were collected during this time period.
Secondary Market Actor Surveys: We didn't see any discussion of what happens to units sold off the truck by guys who haul away units for retailers. Not a small part of the transfer market.	Although there has been anectodal reference to this segment, we were unable to substantiate a significant volume of units transferred this way in our market actor calls, and are not aware of any other study documenting findings for this segment.
Secondary Market Actor Surveys: Retail chains: it would be useful to know whether data were collected from small/regional chains versus national chains.	The majority of the retail chains interviewed were national chains, however a few were small/regional chains. Independent retailers were also interviewed as a separate market group.
Recommendations: Main thing mentioned re a program redesign was a possible vintage restriction around the 2001 era EE standards. What about: i. Alternative strategies to target retailers? ii. Alternative strategies to go after the peer-to-peer market? iii. Doing things to go after more freezers (given the higher gross and net [annual] kWh; e.g., higher incentive)?	We agree that the IOUs should always be considering their program designs in light of a changing marketplace.

Comments	DNV GL Responses
Recommendations: What about EUL? The DEER approach of 1/3 of when-new refrigerator or freezer EUL seems simplistic/antiquated in light of Weibull curves developed elsewhere that are built off of DOE RECS data. EUL revisions also may make sense in light of significant differences in average ages of units across the service territories.	A retention study to provide information about EUL was outside of the scope of this evaluation study.

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