


Energy Savings
from Refrigerators:
Still Plenty to be Had

Presented by
Stephen Bickel
D&R International, Ltd.

AESP Spring Conference
May 5, 2010

The slide features the Energy Star logo on the left, which includes a blue star and the text 'LEARN MORE AT energystar.gov'. To the right is the main title 'Energy Savings from Refrigerators: Still Plenty to be Had'. Below the title, it lists the presenter 'Stephen Bickel' from 'D&R International, Ltd.' and the event 'AESP Spring Conference' on 'May 5, 2010'. There is a small AESP logo in the top right corner of the slide.



Download the complete updated
"Refrigerator Market Profile" from
www.energystar.gov
Use Search Function for:
"Refrigerator Market Profile"

Refrigerator Market Profile | 2009
U.S. Department of Energy | ENERGY STAR

The slide shows the cover of the 'Refrigerator Market Profile | 2009' report. The cover has a dark background with the text 'NEW OPPORTUNITIES MULTIPLY SAVINGS' at the top. Below this is a 3D rendering of a refrigerator. At the bottom of the cover, it says 'Refrigerator Market Profile | 2009' and 'U.S. Department of Energy | ENERGY STAR'. There is a small AESP logo in the top right corner of the slide.

Agenda

- Energy Savings and Their Sources
 - Savings Potential
 - Key Savings Opportunities for Program Sponsors and their sources
- Program Design Considerations
 - Collaborating with retailers
 - Recycling vs. retiring

Are there really still energy savings in residential refrigerator programs?

Yes, Even When Just Looking at Retirement

Energy-Savings Potential for Refrigerator Retirement Compared to Other Common Energy Efficiency Measures

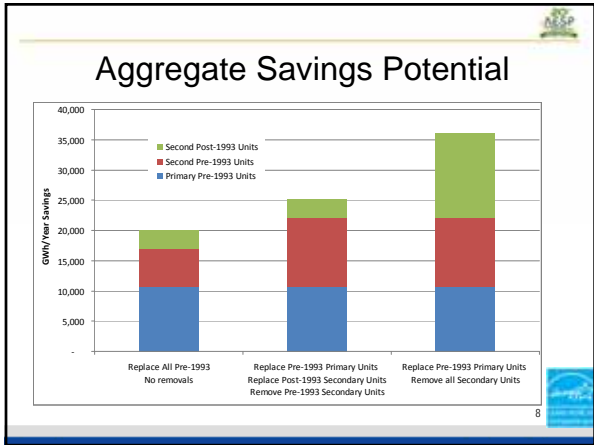
	Million Dollars Saved*	Home Manufacturers	Central HVAC, Water Heating, Air Conditioning	Residential Energy Efficiency Potential*
Refrigerators and Freezers	\$500	\$7,400	\$6,700	\$6,900-\$84
Lighting	\$100	\$12,200	\$86,000	\$50,000-\$200
Water	—	\$8,000	\$1,000	\$1,600-\$200
Program Breakdowns				
Programs	40,000	1,200,000	700,000	200,000,000
Year of Savings Potential	2010	2010	2010	2010
Potential Type	Good effective	Appropriate	Good effective	Cost effective

15-40% of lighting savings potential

Key Savings Opportunities

1. Increase ENERGYSTAR market share
2. Keep older primary units that are replaced from being reintroduced to the grid
3. Replace pre-1993 refrigerators with new units
4. Reduce the number of second refrigerators

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SEB1

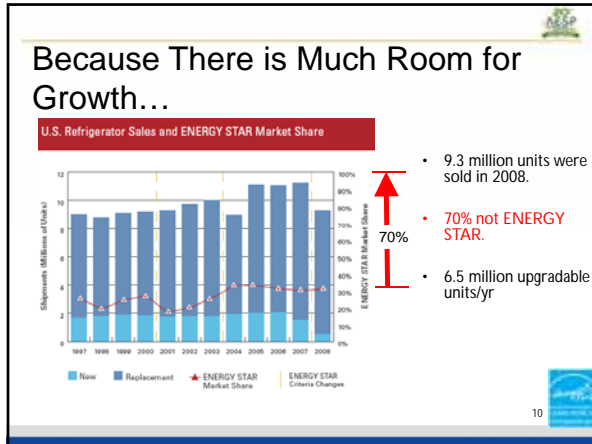
Savings Opportunity #1

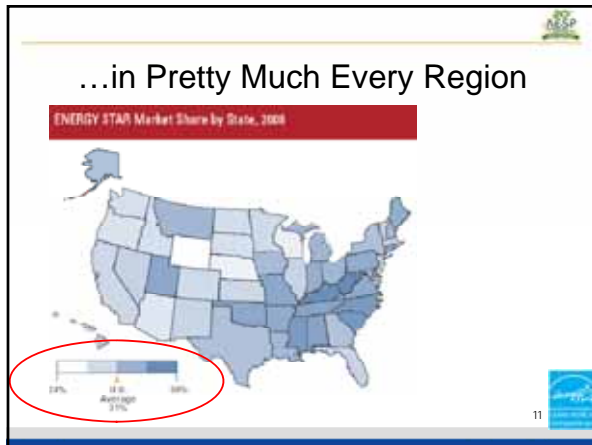
Increase ENERGYSTAR market share

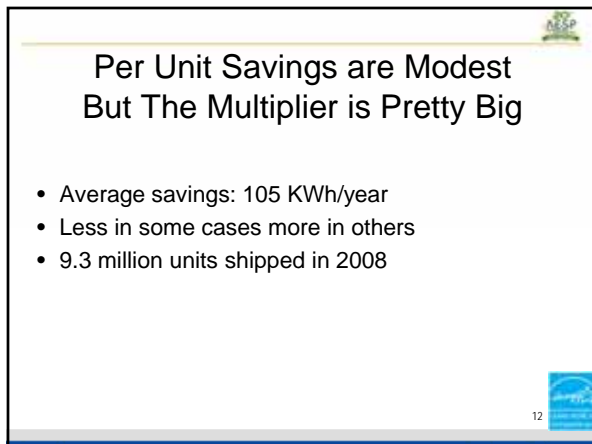
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Slide 9

SEB1 If time allows, insert cute graphic showing appliances leaving a store with current market share on left and picture with new higher market share on right. Could use E* mark and red circle slash for non-E*.
Stephen Bickel, 2/26/2010







How to do it?

Savings Opportunity #1:
Increase ENERGYSTAR market share

Retailers	Best positioned, have inherent incentive
Program Sponsors	Rebates or co-op advertising

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Savings Opportunity #2

Keep primary units
that are replaced
from being reintroduced to the grid

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Old Refrigerators Are Hard to Kill

Installed Base

Retired units:
8.7 million in
2008

44% (3.8 million units)

56% (4.9 million)

Scrapped or Recycled

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Where Do They Go? Are They Working?

Paths of Old Units Based on Studies in California and Vermont

Category	California (%)	Vermont (%)
Kept as 2nd	~45	~40
Given away	~35	~30
Sold	~15	~10
Taken by retailer	~5	~5
Disposed	~10	~10
Appliance recycling program	~5	~5
Unknown	~5	~5

Where they go

- Kept as 2nd
- Given away
- Sold
- Taken by retailer
- Disposed
- Appliance recycling (in CA)

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Bad News for Baseload and Waistlines

Percent of Homes with Second Refrigerators

Average Annual Growth: 0.2% (2000-2008)

- In 2008, 26% of households had a second refrigerator
- A second unit uses 840 kWh per year

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How to do it?

Savings Opportunity #2:
Keep older primary units that are replaced from being reintroduced to the grid.

Retailers	Best positioned, target finds them before old unit is displaced, but no incentive to deter behavior
Program sponsors	Incentivize retirement/recycling and monitor, provide communication support/training for sales staff
Recycling contractors	Can ensure decommissioning and responsible recycling at low cost

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Savings Opportunities #3 and #4

Savings Opportunity #3:
Replace pre-1993 refrigerators with new units

Savings Opportunity #4:
Reduce the number of second refrigerators

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Why 1993?

Shipment-Weighted Average Refrigerator Annual Energy Consumption and Size, 1988 to 2007

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Plenty of Pre-1993's Out There

Distribution of Refrigerators by Year of Production in the Retail Base

- In 2008, 16% were pre-1993
- ENERGY STAR qualified units use half the electricity
- More than Half (55%) are Primary Units

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How to do it?

Savings Opportunity #3:
Replace pre-1993 refrigerators with new units

Retailers	Interests align with sponsors' Brings sophisticated marketing experience and platforms to motivate owners Can convenient pick-up of old unit
Program sponsors	Offer rebates that retailers use as sales tool Bundled with bounty for replacement and recycling increases selling power and helps prevent units from returning to the grid
Recycling contractors	Can ensure decommissioning and responsible recycling at low cost

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How to do it?


Savings Opportunity #4:
Reduce the number of second refrigerators
[Hardest to accomplish]

Retailers	No incentive
Program sponsors	Must conduct or contract for outreach
Recycling contractors	Offer turnkey programs


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Program Design Considerations

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**Retailers are essential partners
for capturing much of these energy
savings**



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**Advantages and Limitations of
Partnering with Retailers**


- Retailers' goals of selling greater numbers of higher margin refrigerators, typically ENERGY STAR qualified models, align with the program sponsor's goals.
- Retailers can make retirement convenient and economical by removing the old unit when delivering the new one.
- Retailers can consolidate units for bulk pick-up by licensed recyclers.
- Have no incentive to reduce number of secondary units, to decommission units with remaining market value, or to pay for the most robust recycling.


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**Which retailers sell the most
refrigerators?**



Refrigerator Market Share by Retail Sales Channels



Year	Sears	Appliance Stores	Home Improvement Centers	Mass Merchants & Clubs	Other
2003	40	25	20	10	10
2004	38	28	22	10	10
2005	35	25	25	10	10
2006	35	25	28	10	10
2007	35	30	35	10	10



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To Recycle or Not to Recycle


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Net to Gross Can be High




Refrigerator Recycling Net to Gross Values

Program (Year)	Net-to-Gross Value
Efficiency Vermont (2006)	0.35
Sacramento Municipal Utility District (2007)	0.61
California - Universal Programs (1996-2007)	0.52 (median)
California - Statewide (2004-2007)	0.61
Connecticut Light and Power (2005)	0.30
Wisconsin Focus on Energy (2007)	0.43

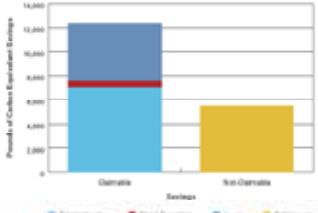


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Responsibly Recycling Refrigerators Can Double Carbon Savings




Carbon Savings Per Unit from Refrigerator Recycling





Note: This calculation of carbon savings is based on current average values for refrigerators that are made of recycling the components. See EPA.gov for more information.

- For those with CFC-11 in foam



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**State Energy Efficient
Appliance Rebate Program**

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SEB2

**State Energy Efficient Appliance
Rebate Program**

Summary of Approved Refrigerator Rebates

Number of States Offering	45
Total Rebates	51
Minimum Rebate	\$25
Maximum Rebate (Low-Income)	\$700
Median Rebate	\$100
Total Units to be Rebated	632,000
Total Rebate Funding	\$67,650,000



Find more information at www.energysavers.gov/rebates

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Recap


- Plenty of savings still available from refrigerators
 - Increase ENERGYSTAR market share
 - Keep older primary units that are replaced from being reintroduced to the grid
 - Replace pre-1993 refrigerators with new units
 - Reduce the number of second refrigerators
- Net to gross for refrigerator recycling programs can be high
- Work with retailers to increase ENERGY STAR market share, prevent return to grid, and replace pre-1993's.
- Work with recyclers to reduce the number of secondary refrigerators and ensure responsible recycling.

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Slide 35

SEB2 Create version for refrigerators.
Stephen Bickel, 2/26/2010



NEW OPPORTUNITIES
MULTIPLY SAVINGS

Download the complete updated
"Refrigerator Market Profile"

Refrigerator Market Profile | 2009

www.energystar.gov/ia/partners/manuf_res/downloads/Refrigerator_Market_Profile_2009.pdf

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Objectives

- Spend our budget
- Determine segment values
 - Cost of saved energy, opportunities
 - Which segment has the best societal value
- Prepare Case Study
 - How developed, successes and pitfalls
- Data Collection
 - Collect relevant data for measurement
 - True costs, Free Ridership, CSE, etc

Goal was to minimize intervention on program


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2 Distinct Segments

<p>Commercial Multi Res</p> <ul style="list-style-type: none"> • Property Management focused • Refrigerators only • Simple program • Short duration • Lots of Incentive <ul style="list-style-type: none"> – Incentive (max \$150.00) – Up to 25% – Supplier to recycle 	<p>Residential</p> <ul style="list-style-type: none"> • Refrigerators & Freezers • Pick up from and in, house of any (supposed) working fridge or freezer <hr/> <p>Residential Replace it</p> <ul style="list-style-type: none"> • Refrigerators & Freezers <ul style="list-style-type: none"> – Primary and Secondary (Beer) • Pick up • Provide \$75 rebate
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Commercial – What is it?

- Property Manager Focused
 - TARGET ***Bulk metered building
 - Individual metered was secondary target
- Change out old fridges for new Energy Star
- Suggest pre 1994 vintage
- Must decommission old unit
- Suppliers to provide decommissioning
 - Cheap Cheap Cheap (result)
- Incentive based on TIP (total installed price)
 - max 25%, max \$ 150.00 (prices came down)
- Incentive based on cost, energy saved, and energy used by new unit
 - We were trying to spend money

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Commercial – Why PM's ?

- Economies of scale
 - Big bang for buck
- 200 customers, 40,000 fridges available
- Typically run units till failure
 - Lots of low hanging fruit
- Foot in the door
 - Other programs follow
 - Awesome response to CFL program afterwards
 - Our credibility went through the roof


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Commercial – How we did it

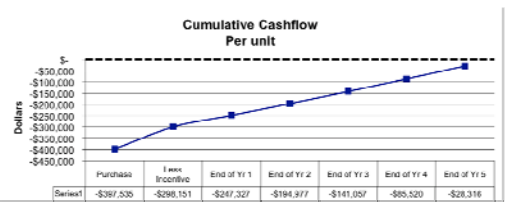
- Launched at the London Property Managers Association
- Simple Application process
 - Turn around 24 hours
- Maximum Incentive/benefits to customer
 - Low overhead
 - Included stakeholders in the process
 - Suppliers required to decommission
- Leveraged suppliers to “sell” the program
 - Trained sales staff how to propose a value proposition
- Used PM language
 - Equate to a % rental increase (regulated here)
 - Conservation via bigger better BMW's

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- Application for MURB customers
 - Customer supplies
 - Make, Model, Year and replacement cost
- Utility prepares incentive and value proposition

Cumulative Cashflow Per unit



	Purchase	Fees Incentive	End of Yr 1	End of Yr 2	End of Yr 3	End of Yr 4	End of Yr 5
Series1	-\$387,535	-\$298,151	-\$247,327	-\$194,977	-\$141,057	-\$85,520	-\$28,316


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What we learned...

- Had to interrupt the cycle of the used appliance market
 - Installation was done in exchange for old units
- Money talks, everything else is virtually meaningless
 - Environmental benefits, greening, etc
- Suppliers are typically terrible sellers of conservation
- They sell on price, not on value
 - Its a commoditized market
- Don't understand the value of energy conservation
- They need training in selling conservation
- Average payment was \$125 per unit, we believe that \$50 to \$75 per unit would be sufficient
- We would stack funding if we designed new program
 - Regular incentive fridge = \$50, Cfls \$1/unit total \$60 (10 cfls)
 - We'd pay \$60 and \$2/unit, total \$80

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What we learned...

Had to interrupt the cycle of the used appliance market
Installation was done in exchange for old units

Before

After

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Residential – 2 Streams

Retire it

- Free pick up and decommissioning
- Refrigerator
- Freezer
 - We cut out over 60 units
- Window AC
- Energy Conservation Kit


Replace it

- Fridge and/or Freezer
- \$ 75.00 Cash rebate
- Free decommissioning
- Work with retailers
- Energy Conservation Kit
 - Doubled our kwhs




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Residential – How



- Branding
- Website for customers
 - Pick up schedule
 - Buying information: Pre-qualify for sales people
 - Program information
 - NRCan tie ins (same as DOE)
- Retail – Point of Sale Materials
 - Magnets, flyers, stickers, etc.
- Retailer information and training
 - Retailer newsletters
 - Weekly visits by Chill Out Staff with materials
- Retailer delivered old unit to our facility (at their cost)
 - Price of admission into program



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Chill Out branded materials




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Chill Out branded materials




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What we learned...

- Having partners in the retail sector benefited the program immensely
- Manufacturers pitched in too, based on commercial results
- Customers related to Energy Star brand
 - not necessarily understood what it is
- Solidified our belief that all participants must make a contribution,
- NO FREE PARTICIPATION
 - Must be valuable to participant
 - Need not be cash, can be anything, time, resource or action
 - Need not be equal
- Interruption of the used appliance cycle by recycling and moving the graph forward has the highest societal value when compared to just pick up programs

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Results


Commercial	Retail
<ul style="list-style-type: none"> • <i>Wildly successful!</i> <ul style="list-style-type: none"> – Budget 1500 per year, 2 years • In 9 months <ul style="list-style-type: none"> – 11,000+ units decommissioned – From singles to 2,365 units • Dollars transferred in from other programs • 1.5 staff part time • Very low CSE (2.8 ¢) 	<ul style="list-style-type: none"> • Overwhelmed at first • Huge support from retail • Leveraging out results from commercial <ul style="list-style-type: none"> – Manufacturers bought in • Budget 3,500 units over 2 years <ul style="list-style-type: none"> – Based on some other programs • Final 5,224 (90 days)! • <i>Ran out of money</i>

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Aftermath...our landscape changed

Commercial	Retail
<ul style="list-style-type: none"> Used commercial program to launch lighting upgrade program Leveraged credibility from Chill Out 500,000 + cfls changed 14,000 Estar fixtures 4 yrs later Provincial government extending fridge money 	<ul style="list-style-type: none"> No longer allowed to run our own programs No rebates available Retire it launched by province, 2nd year <div style="text-align: center;">  </div>


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Last thoughts..

<p>Commercial Results</p> <ul style="list-style-type: none"> Amazing for dollars invested May be a one shot deal, or much smaller 2nd round 	 
<p>Retail Results</p> <ul style="list-style-type: none"> Excellent, far better than expected Leveraging stakeholders 	 
<p>Case Study to be available</p> <ul style="list-style-type: none"> Warts and all – The Good, The Bad and The Ugly Report 3rd party reviewed Chill-Out branding available for use 	  

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Contact Information

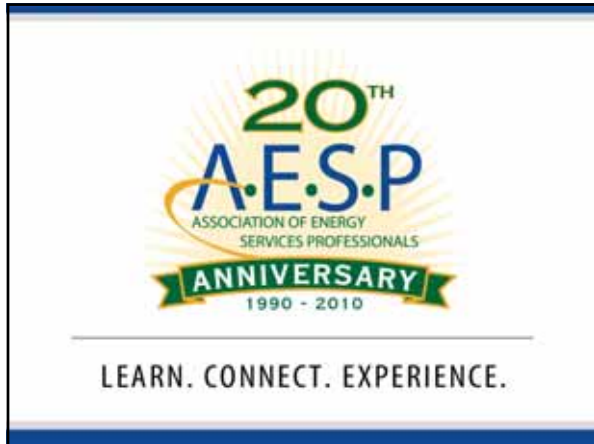
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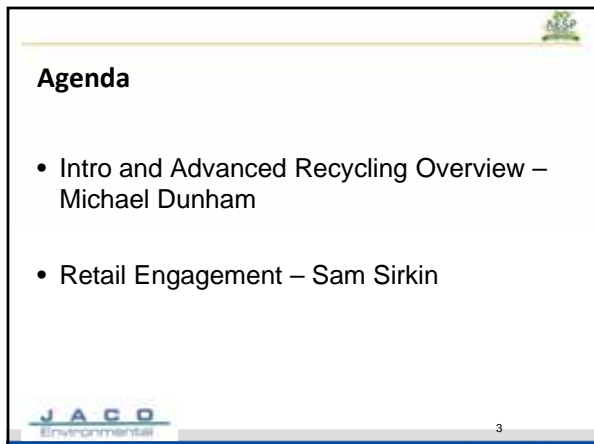


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JACO Environmental, Inc

- One of the nation's largest appliance recyclers
- Over 75 efficiency programs in 25 states delivering in over 150 utility territories
- 20 appliance de-manufacturing facilities in US and Canada
- Specialize in advanced recycling programs – mostly energy efficiency programs
- Won EPA's Stratospheric Ozone Protection Award twice (in 2004 and "Best of the Best" in 2007)

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Opening Comments

- Cost effective residential program
 - Typically exceeded only by lighting
- Huge environmental upside
 - ODS, GHG, toxics, and materials
- Customer service "Home Run"
 - Save energy
 - Free pick-up
 - Rebate/incentive
 - Environmental bonus
 - Green jobs



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Recycling



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Recycling Definition

- **Reuse**
 - Customers or retailers sell old units. EE programs seek to disrupt this transaction.
- **Basic recycling**
 - Required by law; limited enforcement of compliance
 - Removal of fluids (oil and refrigerant)
 - Shredded for metal value
 - Remaining materials land-filled
- **Advanced recycling** – 95% of materials recycled + capture of up to 5 tons of CO₂e per unit

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Environmental Benefits





- GHG/ODS capture
- Other hazardous waste
 - oil, PCBs, mercury
- Other – glass, plastic, metals
- Become EPA RAD Partner

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Advanced Recycling



- Initial processing steps
 - Catalog units (type, size, vintage, etc.)
 - Remove doors, crispers, and shelves
 - Place on conveyor belt
 - Evacuate oils and refrigerant simultaneously
 - Remove possible hazmats
 - PCB starting devices
 - Mercury switches and thermostats
 - Discern type of insulation (drill core sample)
 - Record harvested materials (refrigerant type and quantity, oils quantity, presence of hazmats)
- Units not containing CFC-11: "hull" is transported to nearby recycler/scrap yard for shredding and materials management

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Advanced Recycling

- CFC-11 units at "Stage 1" facility
 - Cut chassis into pieces manually (using saws)
 - Separate foam, metals, and plastic
 - Metals and plastic then sold to nearby recyclers
 - Seal CFC-11 foam in bags
 - Ship foam to WTE or hazmat incinerator for destruction
- Environmental permitting and recycling process certifications needed



Retail Collaboration

- Retailers promote recycling old when selling new
 - Fliers
 - Sales staff education and promotion
- ENERGY STAR incentive + recycle "bounty" increases customer cash back
- Retailers deliver new and collect old units for recycling program



Retail Engagement – 2 Levels

Level 1 - Retailer merely informs customer of program

- Develop and place retail fliers
- Outreach and training retail staff to promote
- Most programs include this element



Level 2 - Retailer promotes program then qualifies and collects old during delivery of new units

- Included on more programs



Retail Engagement – Benefits and Risks

Benefits

- Great marketing channel
- Convenience / customer service - single transaction
- Extends program sponsor retail engagement
- Bounty increases \$ available for Energy Star purchase
- Allows participation by multifamily with no room to store a unit for later pick-up
- Captures units before they become a secondary or get re-sold

Risks / Concerns

- Fear of free-ridership
 - Bias against primary units
 - Bias against retail units
- Risk of loss/confusion - managing collection/chain of custody
- Concern about program integrity with multiple program delivery channels

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Primary & Secondary = Similar Savings

Primary and Secondary have virtually same NTG factors and net annual kWh savings*

Refrigerators	Primary		Secondary	
	NTG values	Avg Per-Unit Net kWh/yr	NTG values	Avg Per-Unit Net kWh/yr
Utility Svc Territory	51.0%	840	50.5%	832
PG&E	63.5%	1,052	68.1%	1,128
SDG&E	52.9%	880	73.9%	1,229
Total	59.0%	977	62.2%	1,030

*ADM CA 04-05 Evaluation (2008)
<http://www.calmac.org/search.asp> (use the search text "SCE0219.01")

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Characterizing Primary and Secondary

Primary

- Always replaced
- No partial use – operates 100% of the time
- Slightly newer vintage
- Always in conditioned space

Secondary


- Replaced sometimes - 61% (per CA 04-05 evaluation)
- Partial use – from 0 to 100%
- Slightly older vintage
- Not always in conditioned space – garage, basement, outside

Net savings are robust for both - between 500 – 1,200 annual kWh. Variation depends upon program duration, region, evaluation.
Strong savings & TRC results regardless.

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Retail Units – Business As Usual

- Units collected by retailer during delivery are either operating or dead
- Operating units are sold into secondary market or scrapped
- Dead units are sold or scrapped
- No economic motivation to encourage recycling absent the EE programs (D&R)
- Retailers do not secure advanced recycling process absent the EE program due to cost



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Level 2 Retail Program Design


- Retailer commitment
 - Sales and logistics training
 - Set-up internal tracking systems
 - Marketing / promote program
- Program commitment
 - Train retailer staff and follow-up
 - Marketing
 - Provide financial incentive to retailer
- Utility customers enroll at store or by phone or web
- Chain-of-custody carefully maintained





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Retail Units as % of Total


Half dozen successful Level 2 programs nationwide with various national and regional retailers



Program	2009 %
ComEd	8%
Energy Trust of Oregon (ETO)	12%
Public Service New Mexico	19%
NV Energy	8%
PG&E	6%
SMUD	25%
TOTAL	10%



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Energy Trust of Oregon Process Evaluation Key Findings

- JACO and Sears worked together effectively
- Some concerns about reducing net-to-gross when working with retailers can be effectively addressed
- Continue to work with Sears and consider including one or two additional new appliance dealers
- Conduct a nonparticipant disposer survey and retailer baseline to help fully assess degree of free-ridership associated with working through appliance retailers

Reed and Bailey January 2010 http://energytrust.org/library/reports/1001_FridgeRecycling_Eval.pdf

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ETO Process Evaluation

- Number of old units returned when new purchased appeared higher than BAU
 - Over 71% of purchases from the participating retailer in ETO program included removal of an older unit
- 38% of primary fridges in the program involved retailer referral

Reed and Bailey January 2010 http://energytrust.org/library/reports/1001_FridgeRecycling_Eval.pdf

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ComEd Preliminary Retail Assessment*

- **Background/caveats** – limited participant survey in one market with a single, regional retailer pilot
- **Gross savings** - 1,826 kWh/year versus 1,895 kWh/year for non retail units.
- **Net-to-gross ratio** - 0.86. Somewhat higher than the program NTG ratio of 0.70.
- **Net kWh savings per unit** - 1,178 kWh versus 994 kWh for all program units.

**Memo on Impact Evaluation Results for ABT Appliance Recycling Pilot*, Dec 2009 Summit Blue & Itron

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Conclusion

- Primary units are okay
- Retail units are okay but need careful management
- Robust program design required and tested
- Benefits
 - Customers – allows single transaction, multifamily participation
 - Program marketing partner
 - Retailers rewarded – increases ENERGY STAR sales, market position (green) and compensation for removal
- Environmental upside

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Thank You

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