Emerging low-cost/high-impact improvements

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LIFE 2012 Conference

May 22, 2012

Waste is a tax on the whole people. ~Albert W. Atwood

Taitem

New ideas for low-cost/high-impact improvements

- The best hardware and application for these improvements
- How to stand out and deliver solid savings

Diverter valves

Leaking diverter valves

The problem:

The study

We surveyed approximately 130 apartments and houses

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Prevalence of leaking diverters

	Taitem Employees	DHCR Apartments	Total
Number of apartments/homes surveyed	31	100	131
Number of combined bath/showers	28	92	120
Number leaking - at least 0.1 gpm	9	36	45
Percent leaking - at least 0.1 gpm	29%	36%	34%
Maximum leak (gpm)	1.2	3.0	3.0
Average leak greater than 0.1 gpm	0.5	0.9	0.8

- 34% of the diverters leaked more than 0.1 gpm
- Largest leak was 3.0 gpm
- Average of leaks greater than 0.1 GPM was 0.8 gpm

Questions we asked

1. How much of the water leaking from the diverter is forced through the showerhead when the diverter is fixed?
2. What savings can we expect if we install a low-flow showerhead and fix a leaking diverter at the same time?
3. What kind of tub spout is the best to install?

Test: Different types of diverters

- **Amount of the leak increased as the system pressure decreased**
- **Many leaked significantly even though they were new**

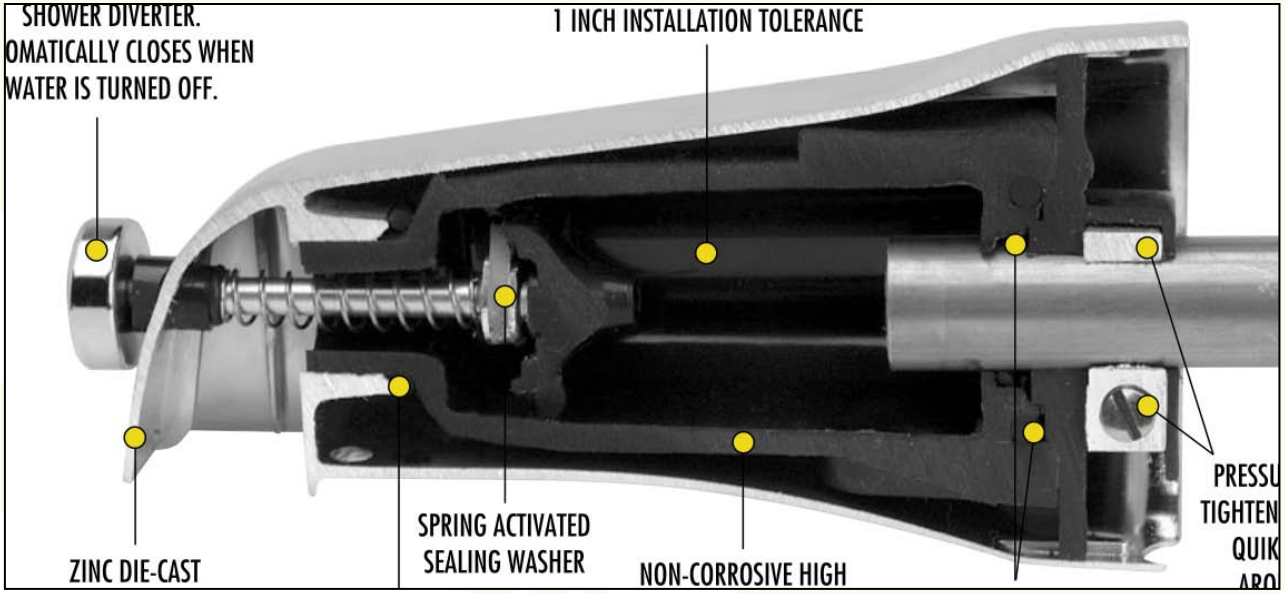



Spouts tested

Manufacturer	Model #	Diverter Mechanism	Leak rate at low pressure (gpm)
Danze	D606225	Lift	0.02
LDR	BT129/502 4250	Lift	0.00
American Standard	8888025.002	Lift	0.02
American Standard	8888055.002	Lift	0.10
Moen	391	Lift	0.00
Grohe	13 611 000	Lift	0.00
Moen	IPS 3830	Lift	0.01
Delta	RP 19820/ 33714	Lift	0.01
unknown		Lift	0.01
Kohler	389-CP/ Devonshire	Lift	0.26
Danco	34224CCB	Lift	0.03
unknown	17463CV	Ring and Spring	0.01
Delta/Brass Craft	SWD0205/ RP17453	Ring and Spring	0.03
Waxman/Spray Sensations	24501	Lift	0.01
Waxman/Spray Sensations	26629	Lift	0.02
Danco/Universal	88703	Lift	0.12
Kohler	Coralais/ 15136-S-CP	Lift	0.09
BrassCraft/OEM Mixet	SWD0411	Positive Pressure	0.00

Tub spout recommendations

Install a Positive Action Shut-Off Diverter like the Mixet by BrassCraft



Or, specify a performance standard for newly-installed diverters of a leak no more than 0.02 gpm

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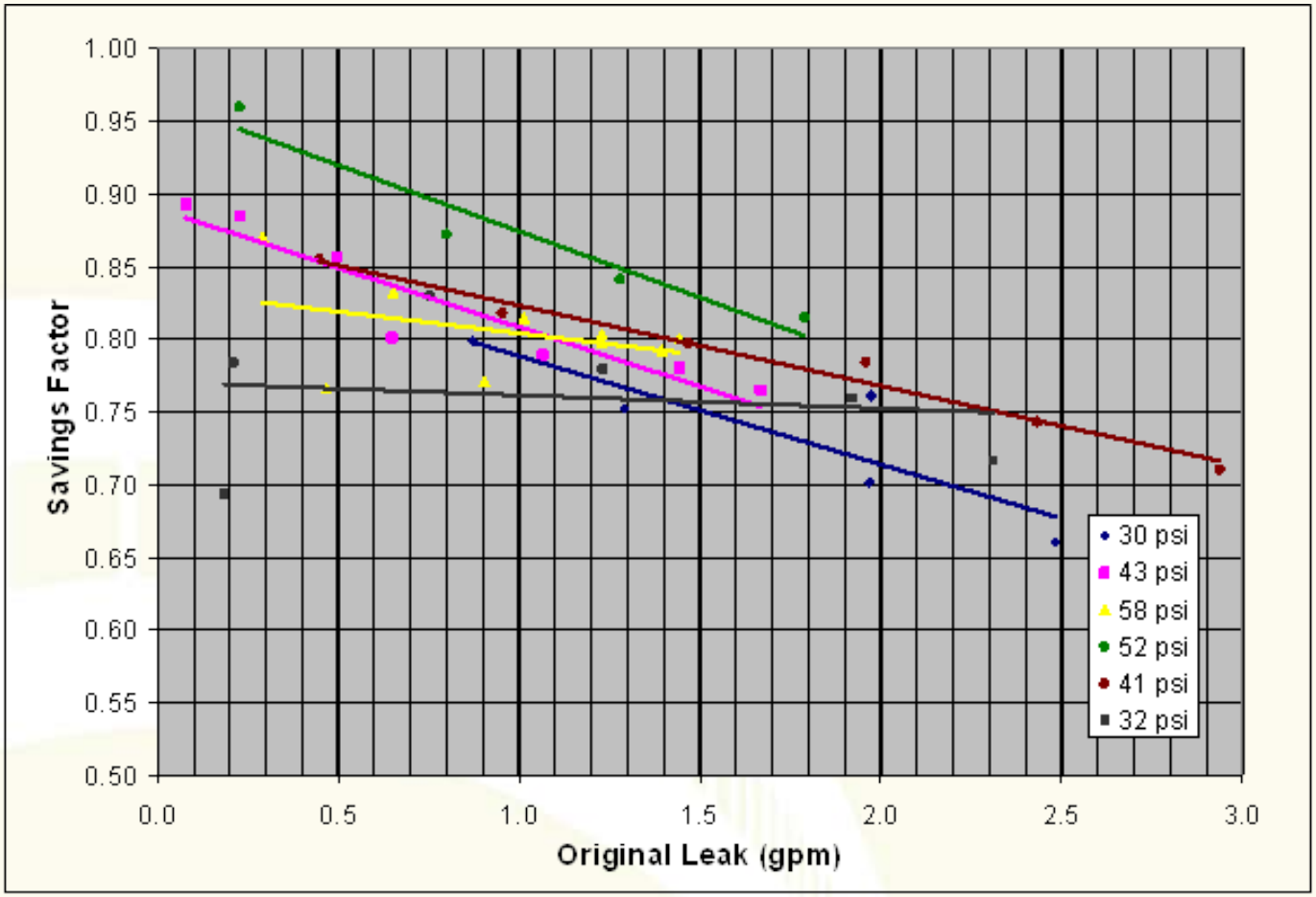
Savings factor

Almost always greater than 0.7, regardless of the showerhead, system pressure, or leak flow



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Assumptions:

Cost of electricity = $0.12/kWh, Cost of gas = $1.10/therm, Electric heater efficiency = 90%

Existing Leak (gpm)	Water Heated by Electricity		Water Heated by Gas	
	Annual Savings ($/yr)	Payback (yrs)	Annual Savings ($/yr)	Payback (yrs)
0.2	$9.20	10.9	$3.40	29.4
0.4	$18.40	5.4	$6.80	14.7
0.6	$27.60	3.6	$10.20	9.8
0.8	$36.80	2.7	$13.60	7.4
1.0	$45.90	2.2	$17.00	5.9

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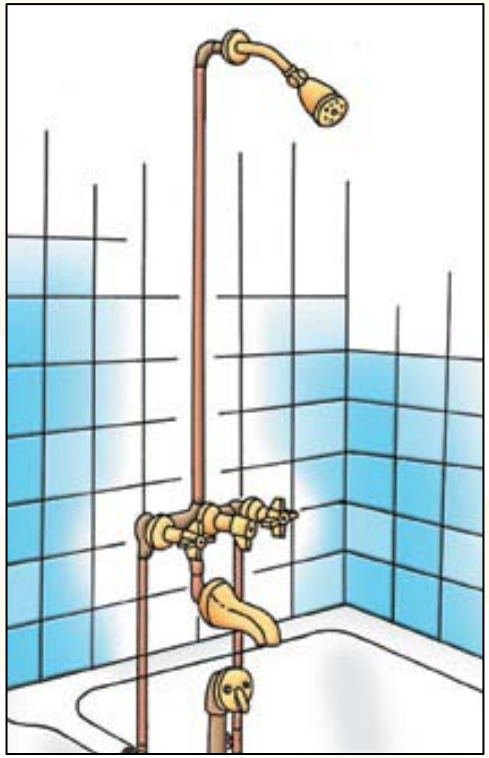
Better than low flow showerheads?



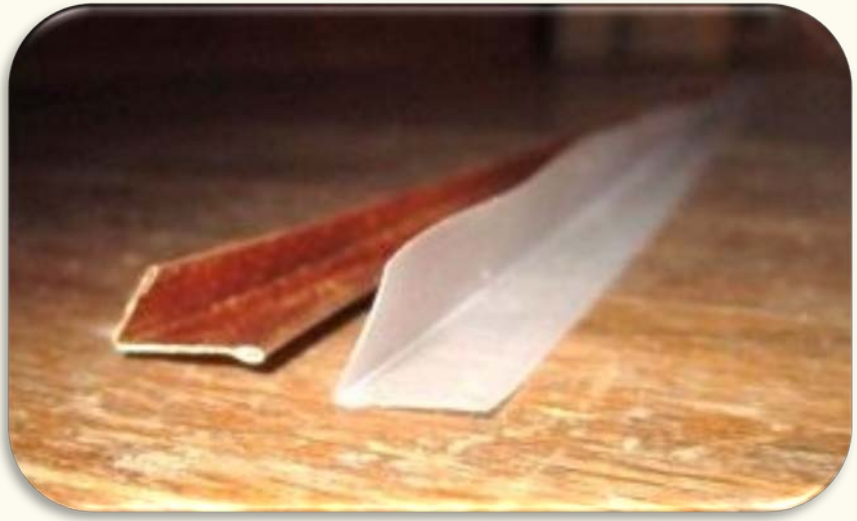
	Taitem Employees	DHCR Apartments	Total
Total Savings from Fixing Diverters (gal/yr)	11,200	78,400	89,600
Total Savings from Installing Low-flow Showerheads (gal/yr)	23,500	55,700	79,200
% More Savings from Diverters			13%

Weatherstripping

V-strip window weatherstripping

What we asked:

- How well does plastic V-strip work?
- Does it hold up over time?
- How can you tell if a window will benefit from V-stripping, ie: during an energy audit?
- Time and cost of install?
- How does it compare to metal V-strip, for savings, installation, cost, and reliability?



V-strip installation results

Plastic V-strip weatherstripping installed on wood-frame double-hung windows in six houses

- Reduced air infiltration by 5% - 13%, average of 9.2%
- Average air infiltration reduction per house = 314 CFM50
- Average air infiltration reduction per foot of V-strip installed = 1.6 CFM50

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Cost effective?

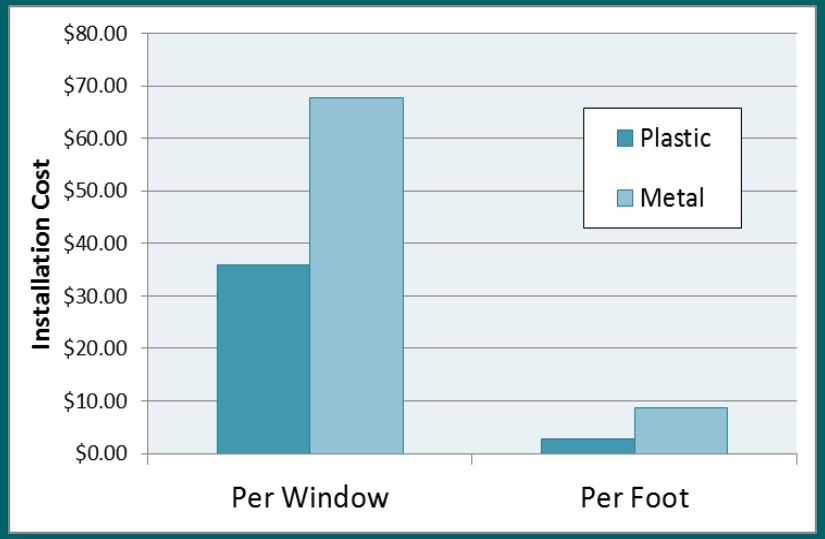
- Average installed cost = $35/window, $550/house
- Savings on average = 54.7 therms of natural gas annually (about $82/yr)

	House 1	House 2	House 3	House 4	House 5	House 6 with Plastic	House 6 with Metal
Costs	$660.43	$515.40	$421.02	$635.35	$579.22	$487.08	$762.15
Annual Gas Savings (Therms)	70.82	65.83	37.01	71.17	45.37	32.62	60.35
Annual Dollar Savings	$106.22	$98.75	$55.51	$106.76	$68.06	$48.93	$90.52
SIR	1.92	2.29	1.57	2.01	1.40	1.20	1.49

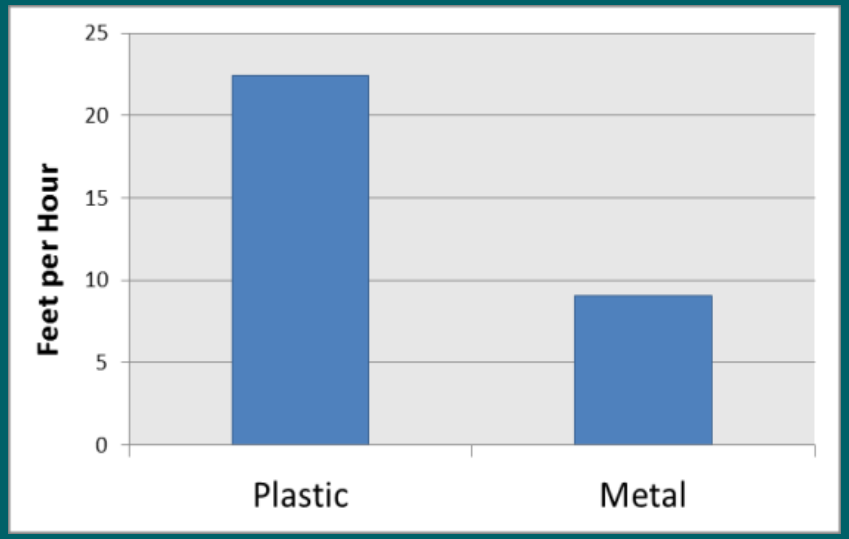
Metal vs. Plastic

- Metal V-strip reduced infiltration by 8.5%
- Plastic V-strip reduced infiltration by 4.6%

Installation cost



Installation Time



Metal V-strip = more costly, does not fit on all windows

Reliability/Durability

Failure: When sliding the lower sash up, the V-strip gets caught on the window latch on the bottom rail of the upper sash

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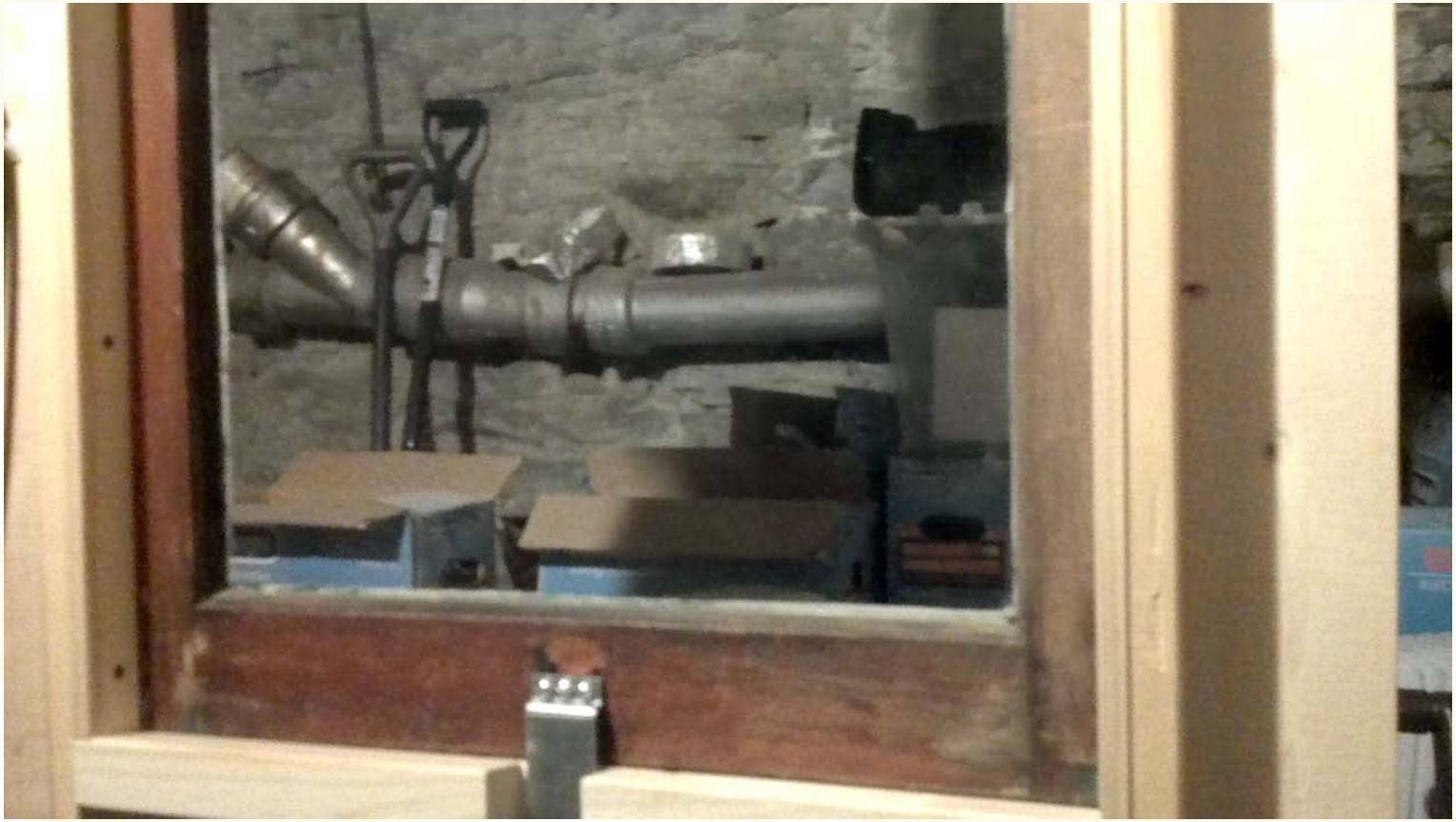
V-strip window weatherstripping



Test rig setup

Longevity test

- Opened and closed the window 15,375 times
- NO separation of V-strips from the surface
- # of cycles = about 40 years of operation

Is it harder to open the window?

We measured the force required to open and close the windows with a force gauge

Metal V-stripping

- Before - 1.5 lbs
- After V-stripping - over 44 lbs (the limit of the force gauge)

Plastic V-stripping

- Before - 21 lbs
- After - V-stripping 28 lbs

Lighting

Lighting occupancy sensors

ASHRAE Standard:

Lighting for most indoor spaces must be shut off or reduced by at least 50% within 30 minutes after space becomes unoccupied.

What we found

Energy audits for 40 high-rise residential buildings:

- lighting in stairs and corridors = **60%** of reported common area electric use

Survey of 12 occupancy sensor lighting controls

- available with off-delays from 30 seconds to 30 minutes
- most common are 5, 10, 15, 20, and 30 minutes

Monitored occupancy for corridors

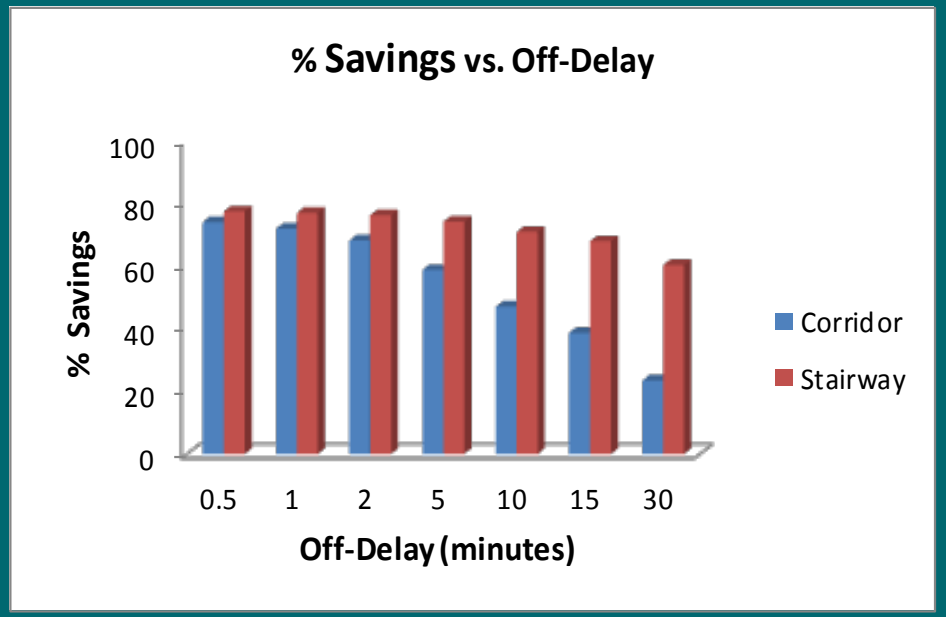
	Floors	Occupancies per Day	Average Occupancy per Day (minutes)	% Vacant
Bldg 1	15	83.0	30.4	97.9%
Bldg 2	6	92.9	29.8	97.9%
Bldg 3	5	64.5	7.3	99.5%

Monitored occupancy for stairways

	Floors	Occupancies per Day	Average Occupancy per Day (minutes)	% Vacant
Bldg 1	15	14.9	3.0	99.8%
Bldg 2	6	3.1	0.8	99.9%
Bldg 3	5	7.9	1.3	99.9%

Off delay energy savings

Off delay (min)	Corridor	Stairway
	% Savings	
0.50	74.1%	77.5%
1	72.0%	77.1%
2	68.2%	76.3%
5	58.8%	74.3%
10	47.1%	71.0%
15	38.7%	68.0%
30	23.5%	60.4%
Baseline 24 hr.	0.0%	0.0%



Duct sealing

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109 South Albany gets ‘Aerosealed’

Built: 1920’s

Size: 2,225 sq ft, heated 1,550 sq ft

Aeroseal report

- **Aeroseal upgrade cost:** $2,000
- **Annual savings:** 161 therms/yr

Overall supply sealing results

When we arrived,
YOUR DUCTS HAD:

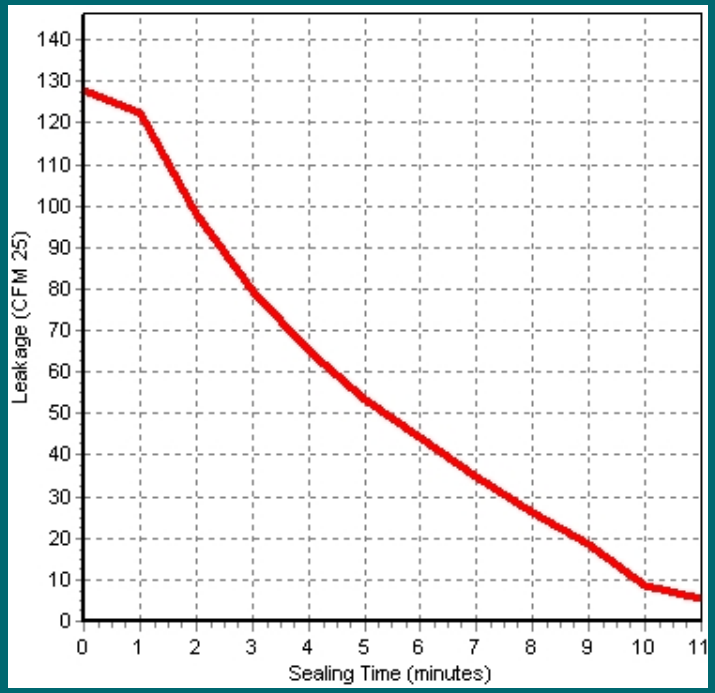
125 CFM of Leakage, equivalent to a
24 **Square Inch Hole**

After we finished,
YOUR DUCTS HAVE:

3 CFM of Leakage, equivalent to a
1 **Square Inch Hole**

This corresponds to a **97%**
Reduction in Duct Leakage

Aerosol supply sealing profile



Return ducts: **250 CFM = 47 sq in hole.**
After Aeroseal, 26 CFM = 5 sq in hole

Savings per flush

Wash your hands with clean water, then use it to flush your toilet

Toilet lid sink stats

Water consumption without the toilet-top sink	
Flow rate of lavatory faucet	0.5 gpm
Duration of flow per use	0.25 min
Water consumption per use	0.13 gallons
Uses per person per day	3
Number of people	5
Water consumption per day	**1.88 gallons**
Days used per year	260
Water consumption per year	**488 gallons**
Savings from using the toilet-top sink	**488 gallons/yr**

Room air conditioners

There are holes in our walls*

Testing of sixteen different AC and PTAC units in eleven buildings revealed that the infiltration losses through leaks and poorly-fitting installations are far greater than might be expected. The leakage area associated with the average unit was six square inches.*

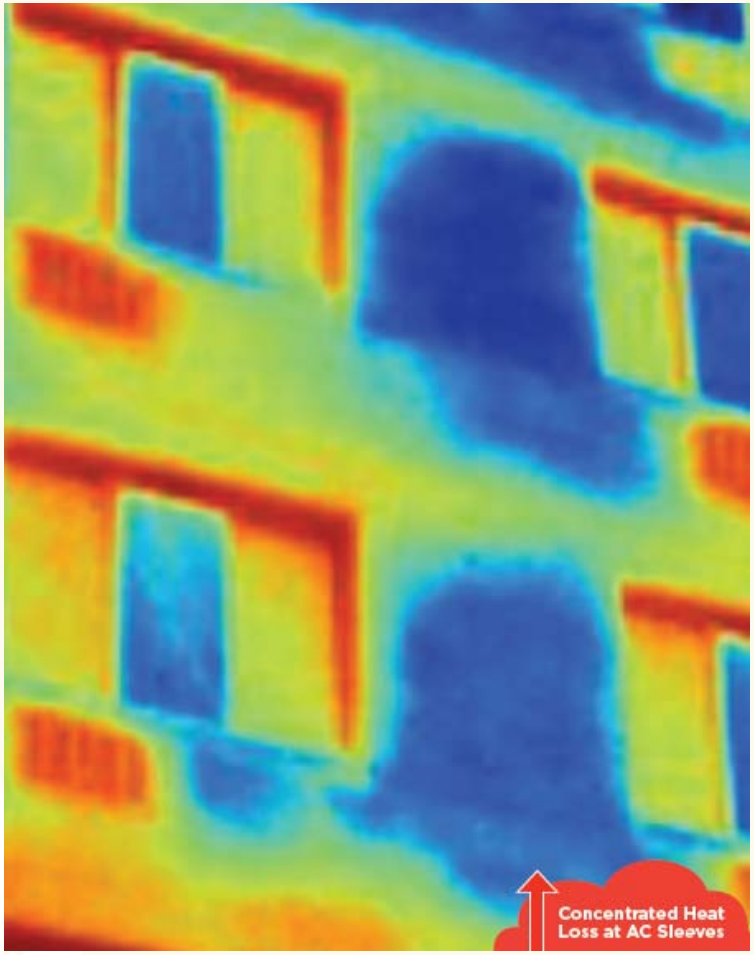
*"There are holes on our walls:" A Report Prepared for Urban Green Council by Steven Winter Associates, April 2011

Room Air Conditioner Conduction Losses

The problem:

Significant energy is lost due to air leakage around and through air conditioners that are left in place during the winter.

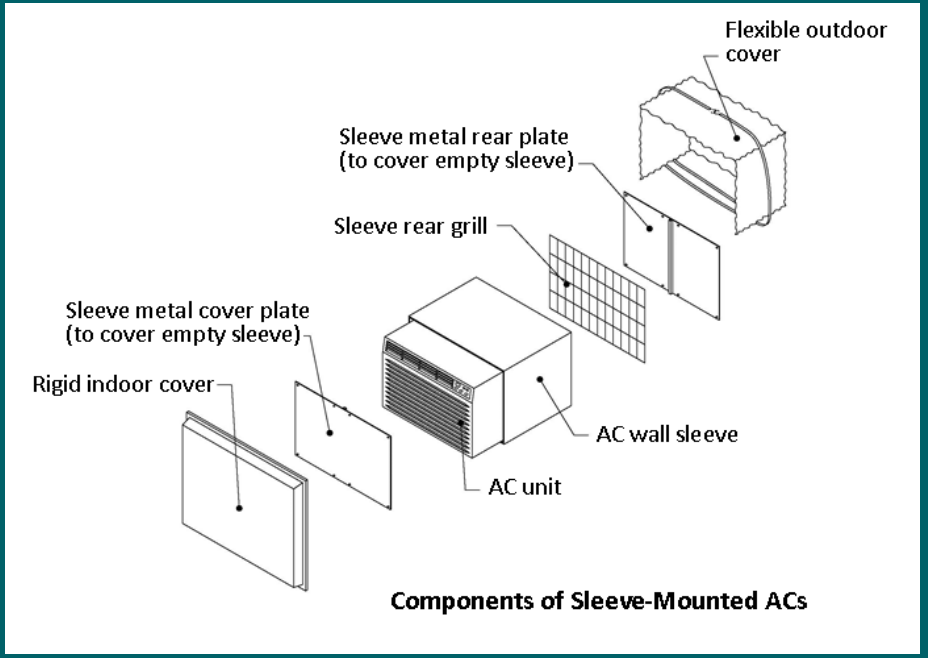
Room Air Conditioners



"There are holes on our walls:" Steven Winter Associates, April 2011

Determine the magnitude of heating loss by conduction

- Are conduction losses significant?
- Can they be reduced?
- Should an empty AC sleeve be stuffed with insulation in the winter?
- Should through-the-wall ACs be removed from their sleeves for the winter?



What we found

- **Insulating value of a typical air conditioner = R-1**
- **Roughly the same resistance to heat flow as a poorly performing window of the same size**

Cost effective measures

EMPTY AIR CONDITIONER SLEEVE

- Fill with fiberglass insulation, place a rigid, plastic cover over the indoor side of sleeve

WINDOW AIR CONDITIONER

- Remove unit, shut the window tight
- Or, install rigid cover on indoor side of AC

AIR CONDITIONERS IN SLEEVE

- Leave unit in place, install rigid indoor cover over the front of the AC unit

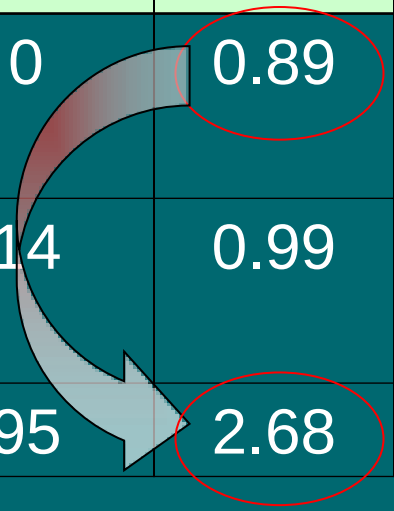
Energy savings for empty sleeve configurations

Sleeve-only Configurations	Net Heat Loss Through Sleeve BTU/Hr	BTU/Hr Savings Compared to Baseline	Equivalent R-Value	Equivalent U-Factor
Empty Sleeve (no AC or Insulation)	142	0	0.89	1.12

Leaving the empty sleeve un-insulated and installing a flexible outdoor cover = increased R-value from 0.89 to 0.99

Energy savings continued...

SLEEVE-ONLY CONFIGURATIONS	Net Heat Loss Through Sleeve BTU/Hr	BTU/Hr Savings Compared to Baseline	Equivalent R-Value	Equivalent U-Factor
Empty Sleeve (no AC or Insulation)	142	0	0.89	1.12
Empty with Flexible Outdoor Cover	128	14	0.99	1.01
Rigid Insulation Fill	47	95	2.68	0.37



Installing fiberglass batt insulation in the sleeve = increased R-value to 2.44, rigid insulation fill = increased to R-2.68

SLEEVE-ONLY CONFIGURATIONS	Net Heat Loss Through Sleeve BTU/Hr [4]	BTU/Hr Savings Compared to Baseline	Equivalent R-Value[5]	Equivalent U-Factor
Empty Sleeve (no AC or Insulation)	142	0	0.89	1.12
Empty with Flexible Outdoor Cover	128	14	0.99	1.01
Rigid Insulation Fill[1]	47	95	2.68	0.37
Rigid Insulation Fill with Flexible Outdoor Cover	44	98	2.90	0.34
Rigid Insulation Fill with Rigid Indoor Cover	20	122	6.21	0.16

Add flexible outdoor cover to rigid insulation fill = R-2.68 to R-2.90, adding rigid indoor cover to insulation increased R-value to 6.21 = tripled R-value of rigid insulation alone

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Cost savings

Improvement	Cost of Improvement	Annual Savings in Dollars	Payback in Years
Empty Sleeve with Flexible Outdoor Cover	$ 12.50	$0.89	14.0
Rigid Insulation Fill only	$ 49.90	$6.02	8.3
Rigid Insulation Fill with Rigid Indoor Cover	$118.90	$7.74	15.4
Fiberglass Batt Fill only	$ 16.80	$5.73	2.9
Fiberglass Batt Fill with Rigid Indoor Cover	$ 85.80	$7.66	11.2

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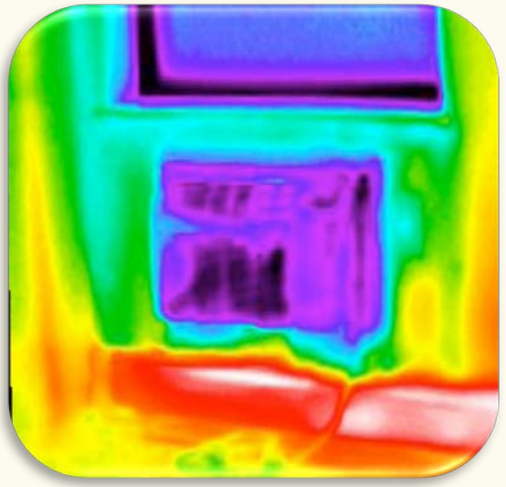
Energy savings

AIR CONDITIONER CONFIGURATIONS	Net Heat Loss Due to AC BTU/Hr	BTU/Hr Savings Compared to Baseline	Equivalent R-Value[4]	Equivalent U-Factor
AC without Cover (Baseline)	88	0	1.09	0.93
AC with Flexible Outdoor Cover	73	15	1.27	0.79
AC with Rigid Indoor Cover	58	40	1.77	0.60



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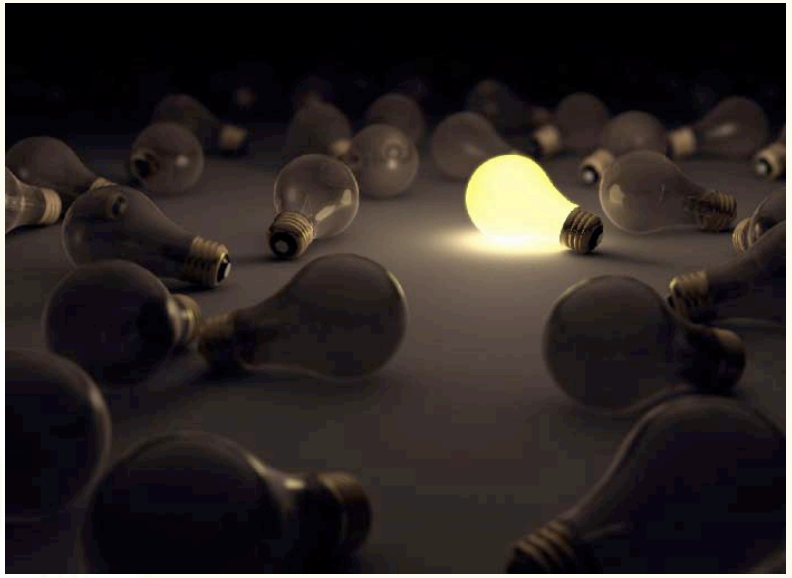
Cost savings for AC covers

Improvement	First Year Cost	Annual Labor Cost ($/year)	Install Time (per year)	Annual Savings in Dollars
AC Remains and Install Flexible Outdoor Cover (1st floor, no ladder)	$5.00	$9.67	10 minutes	$1.45
AC Remains and Install Flexible Outdoor Cover (2nd floor, with ladder)	$5.00	$19.33	20 minutes	$1.45
AC Remains and Install Rigid Indoor Cover	$69.00	$9.67	10 minutes	$2.98
AC Removed and Fill Sleeve with Fiberglass Batt	$16.80	$58.00	60 minutes	$5.73
AC Removed and Fill Sleeve with Rigid Foam and Install Rigid Indoor Cover	$118.90	$72.50	75 minutes	$7.74

How to stand out

- Ways they can stand out and make a difference…..



Recap

- Identify the issue
- Consider low impact improvements
- Install with the proper methods
- Show the building owner their savings

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The End

- Questions?

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