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· August 15-18, 2010 · Dallas, Texas ·
· Dallas Convention Center ·

Energy & Water Efficiency in Dining Facilities

Energy & Water Efficiency in Dining Facilities

August 18, 2010

Don Fisher
PG&E Food Service Technology Center
925-866-5770
dfisher@fishnick.com

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Appliance Testing Laboratory

create standard test methods

&

"miles-per-gallon" numbers for appliances

The controlled environment "levels the playing field."

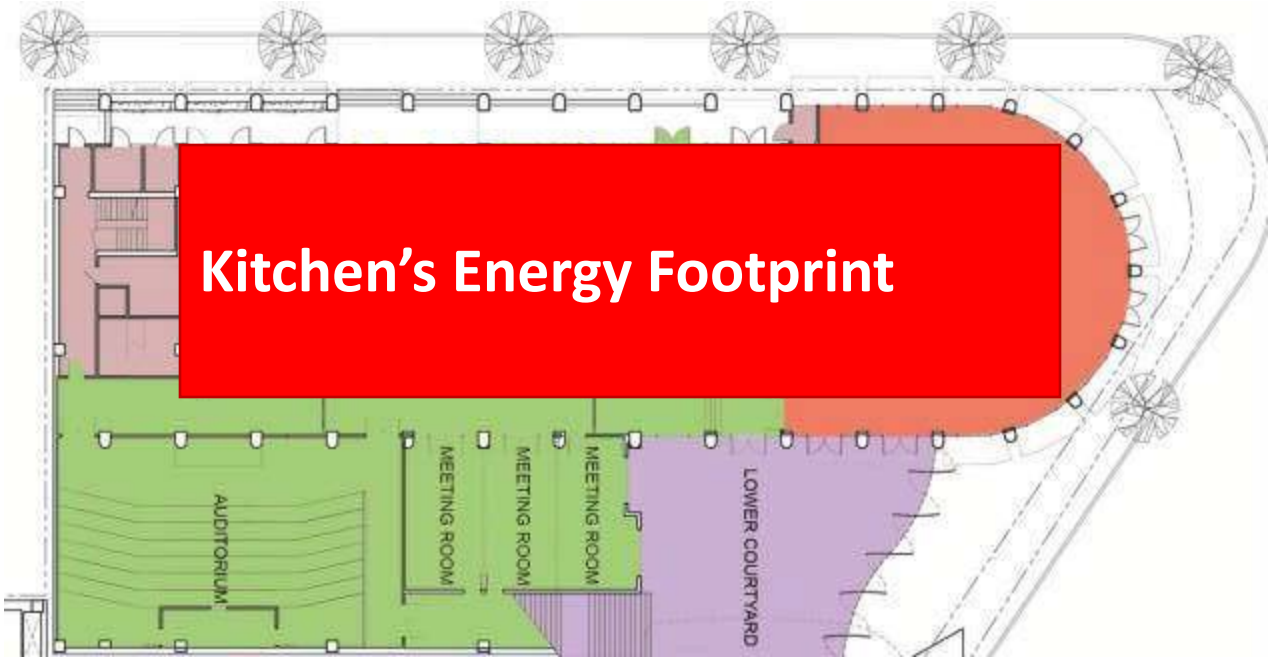
Your online toolbox

- Reports
- Energy saving tips
- Design guides
- Cost calculators
- Energy Star
- Rebates

The Dining Facility…

- Energy [and Water] Intensive!
  - about 5 times more Btu/sq. ft. than other commercial
- Long Operating hours
  - 14 to 20 hours a day typical (some are 24 h/day)
- Little or No Planning for Efficiency
- Low Equipment Turnover
  - appliances are expensive and last 5 to 40 years
- A Challenging Environment!

“Your kitchen is bigger than you realize!”



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Let's Take a Quick

Dining Facility Tour

Diversity

Down Time

Energy Guzzlers

No Overhang

Where is the exhaust duct?

Kettles “off” – Hood “on”

Low-Efficiency Burners

Blast chiller always “on” but not never “used”

The little drip…

How much is too much?

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Auto door closer no longer on “auto”

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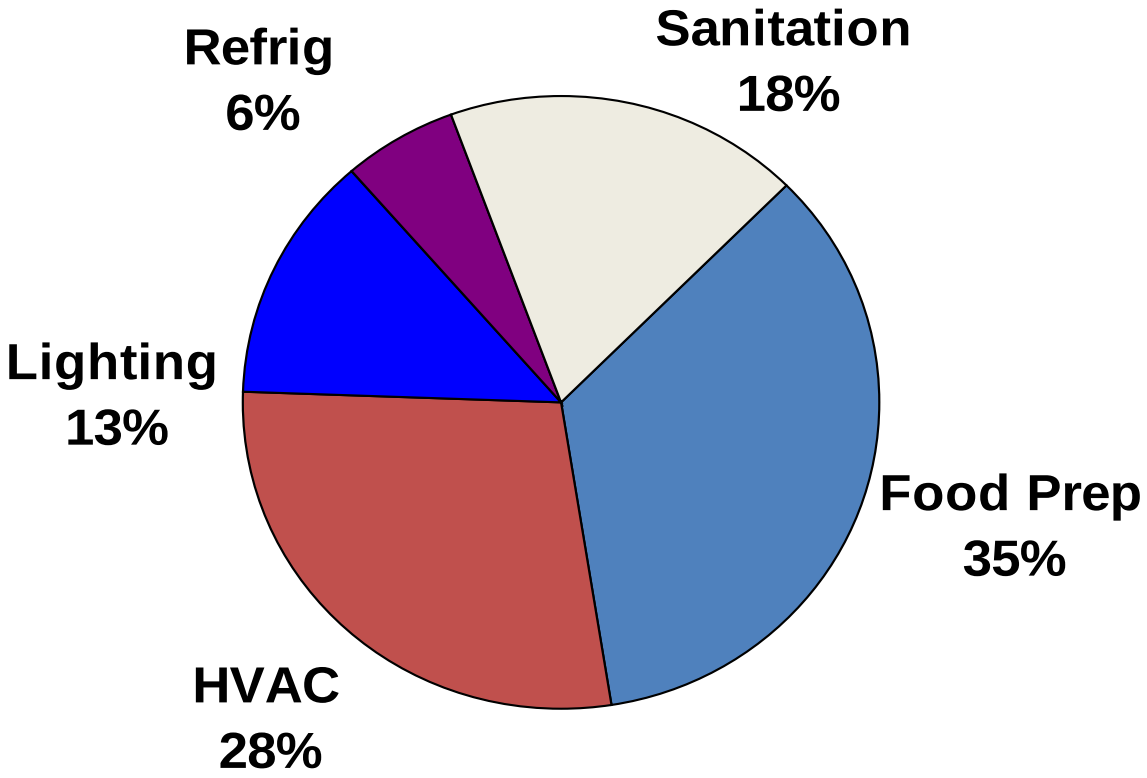
Strip curtains only work if…

Turn off the lights?

The Energy Pie…



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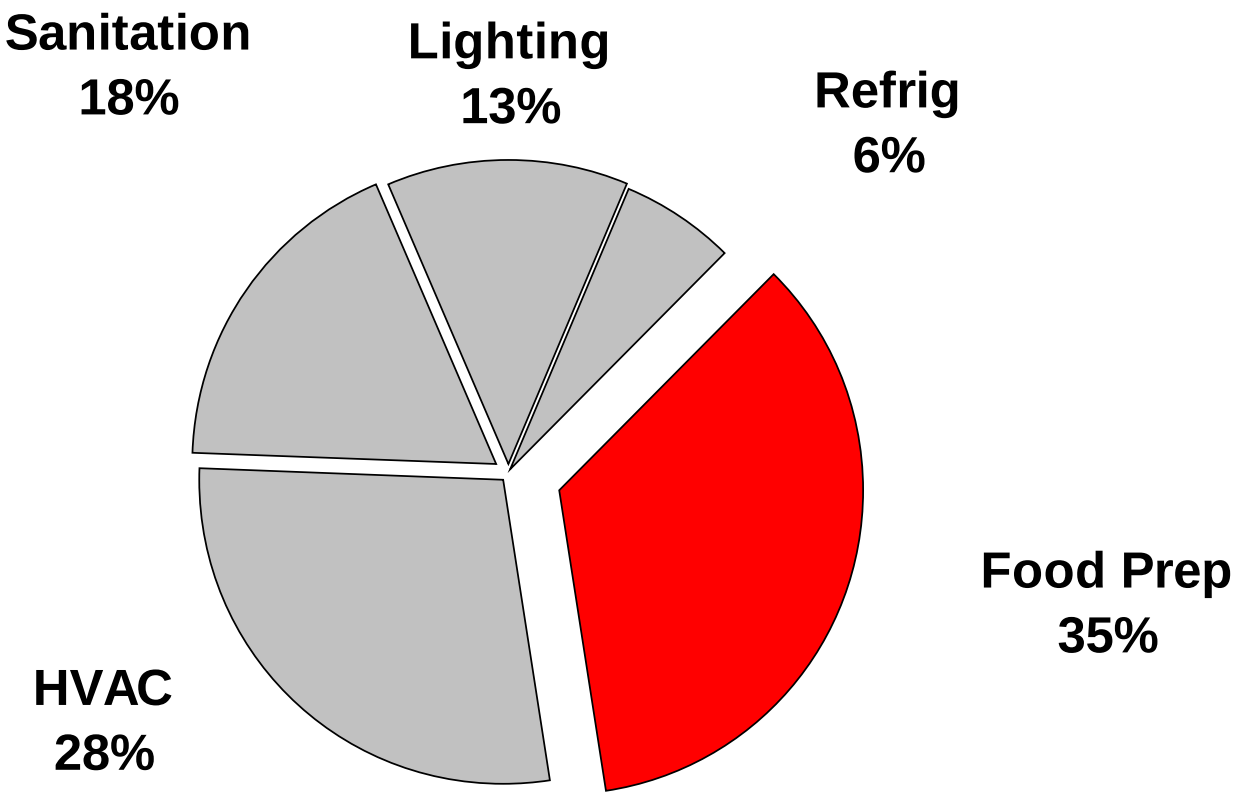

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A single appliance can consume more energy per year than your home!

=

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If your had to gas each appliance every morning, one's perspective would quickly change…

…at $1.20 per therm!

- Rated input: 144,000 Btu/hr
- Average consumption of 100,000 Btu/h
- Over a 10 hr Day
- 360 days per year
- @ $1.20/therm

100,000 Btu/h = 1 therm, so..

1 therm x 10 hr x 360 days = 3600 therms/yr

= 3600 therms x $1.20 = **$4320/yr!**

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Appliances are not created equal!

www.energystar.gov/cfs

Refrigeration

Hot Holding Cabinets

Fryers

Steamers

Griddles

Dish Machines

Ice Machines

Convection Ovens

Fryer Focus:

Question:

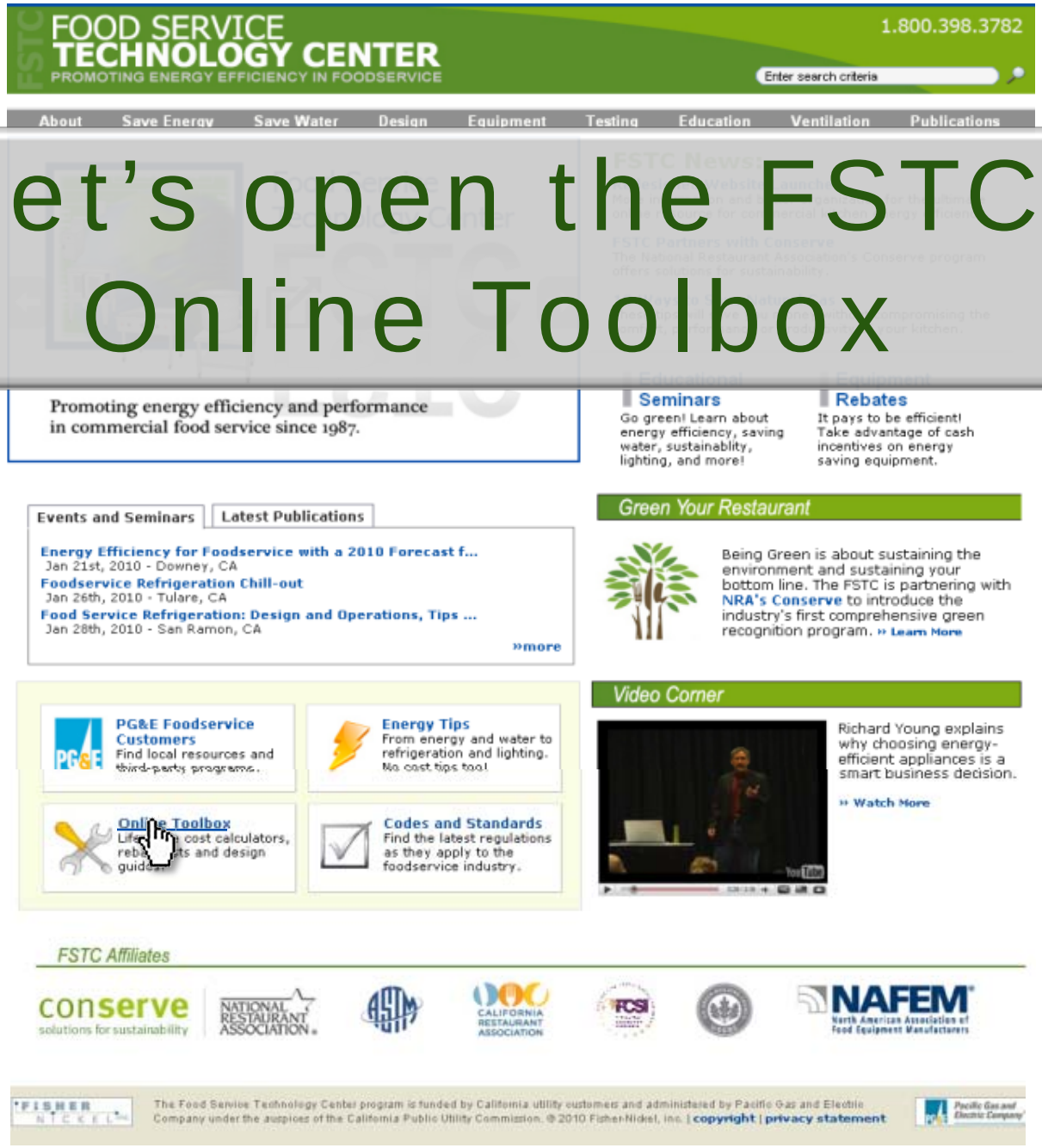
- Which is most cost effective?
- Standard Efficiency or ENERGY STAR?

Details:

- 16 hours, 125 lb per day production
- 8 year life span
- $1.20/therm gas
- Purchase price

Fryers

Let's open the FSTC Online Toolbox



Online Toolbox

These tools will help you design energy-efficiency into your operation.
Using the calculators and design guides enables you to make informed purchasing descisions. And when you're ready to buy new appliances, the rebate lists will help you specify equipment that puts money right back in your pocket.

Foodservice Equipment Rebates
Get money back when you purchase qualified high-efficiency appliances in the service territory of a California investor-owned utility. Qualifying product lists and rebate forms for Pacific Gas and Electric Company customers are right here!

Life-Cycle Cost Calculators
Calculate the total estimated cost of ownership over the lifetime of your appliance, including energy costs, purchase price and maintenance. That small difference in operating cost really adds up over the appliances useful life!

Spray Valve / Water Cost Calculator
Calculate the total estimated cost of ownership over the lifetime of your appliance, including energy costs, purchase price and maintenance. That small difference in operating cost really adds up over the appliances useful life!

Outdoor Air Load Calculator
Calculate the total estimated cost of ownership over the lifetime of your appliance, including energy costs, purchase price and maintenance. That small difference in operating cost really adds up over the appliances useful life!

Kitchen Ventilation Design Guides
Calculate the total estimated cost of ownership over the lifetime of your appliance, including energy costs, purchase price and maintenance. That small difference in operating cost really adds up over the appliances useful life!

Related Links

- Appliance Performance Reports
- LEED
- ENERGY STAR®

Life-Cycle and Energy Cost Calculators

High-efficiency equipment will continue to save energy dollars years after the initial purchase. These calculators allow you to compare the total cost of operating different appliances over their useful service lives.

Combination Ovens
- Electric Combination Ovens
- Gas Combination Ovens

Convection Ovens
- Electric Convection Ovens
- Gas Convection Ovens

Conveyor Ovens
- Gas Conveyor Ovens

Fryers
- Electric Fryers
- Gas Fryers
- Electric Large-Vat Fryers
- Gas Large-Vat Fryers

Griddles
- Electric Griddles
- Gas Griddles

Holding Cabinets
- Hot-Food Holding Cabinets

Ice Machines
- Ice Machines

Rack Ovens
- Gas Rack Ovens

Refrigeration
- Glass-Door Reach-In Freezers
- Glass-Door Reach-In Refrigerators
- Solid-Door Reach-In Freezers
- Solid-Door Reach-In Refrigerators

Steamers
- Electric Steam Cookers
- Gas Steam Cookers

Underfired Char-Broilers
- Gas Underfired Char-Broilers

Related Links
- Spray Valve / Water Cost Calculator
- Appliance Reports
- ENERGY STAR®

ASTM Test Data

End User Inputs

Gas Fryer Life-Cycle Cost Calculator [About this calculator]

User Inputs			
Fryer Performance *(Based on ASTM Standard Test Method F 1361-99)*			
Preheat Energy	14000	Btu	[Default] [Help]
Idle Energy Rate	5600	Btu/h	[Default] [Help]
Heavy-Load Energy Efficiency	55.0	%	[Default] [Help]
Production Capacity	69.0	lbs/h	[Default] [Help]
Fryer Usage			
Operating Hours per Day	16.0	h/day	[Default] [Help]
Operating Days per Year	363	d/year	[Default] [Help]
Number of Preheats per Day	1	p/day	[Default] [Help]
Pounds of Food Cooked per Day	125.0	lbs/day	[Default] [Help]
Utility Cost and Lifespan			
Gas Cost per Therm	1.200	$/therm	[Default] [Help]
Lifespan of Fryer in Years	8.0	years	[Default] [Help]
Discount Rate	3.10	%/year	[Default] [Help]
	Calculate		[Default All]

Life cycle cost calculator results:

Gas Fryer Life-Cycle Cost Calculation

Courtesy of Pacific Gas and Electric Company
Food Service Technology Center
www.fishnick.com

Standard Efficiency Fryer

Performance:		
Preheat Energy:	15000	Btu
Idle Energy Rate:	13700	Btu/h
Heavy-Load Energy Efficiency:	35.0	%
Production Capacity:	69.0	lbs/h
Usage:		
Operating Hours per Day:	16.0	h/day
Operating Days per Year:	363	d/year
Number of Preheats per Day:	1	p/day
Pounds of Food Cooked per Day:	125.0	lbs/d
Utility Cost and Lifespan:		
Gas Cost per Therm:	$ 1.200	per Therm
Lifespan of Fryer:	8.0	years
Discount Rate:	3.10	%
Other:		
Maintenance Costs per Year:	$ 250	
Initial Cost of Fryer:	$ 2200	
Results:		
Annual Energy Consumption:	1487	Therms
Annual Energy Cost:	$ 1784	per year
Lifetime Energy Cost (Discounted):	$ 12857	
Lifetime Maintenance Cost (Discounted):	$ 1801	
Initial Cost of Fryer:	$ 2200	
Total Cost:	**$ 16858**	

Gas Fryer Life-Cycle Cost Calculation

Courtesy of Pacific Gas and Electric Company
Food Service Technology Center
www.fishnick.com

ENERGY STAR Fryer

Performance:		
Preheat Energy:	14000	Btu
Idle Energy Rate:	5600	Btu/h
Heavy-Load Energy Efficiency:	55.0	%
Production Capacity:	69.0	lbs/h
Usage:		
Operating Hours per Day:	16.0	h/day
Operating Days per Year:	363	d/year
Number of Preheats per Day:	1	p/day
Pounds of Food Cooked per Day:	125.0	lbs/d
Utility Cost and Lifespan:		
Gas Cost per Therm:	$ 1.200	per Therm
Lifespan of Fryer:	8.0	years
Discount Rate:	3.10	%
Other:		
Maintenance Costs per Year:	$ 300	
Initial Cost of Fryer:	$ 3300	
Results:		
Annual Energy Consumption:	804	Therms
Annual Energy Cost:	$ 965	per year
Lifetime Energy Cost (Discounted):	$ 6955	
Lifetime Maintenance Cost (Discounted):	$ 2162	
Initial Cost of Fryer:	$ 3300	
Total Cost:	**$ 12417**	

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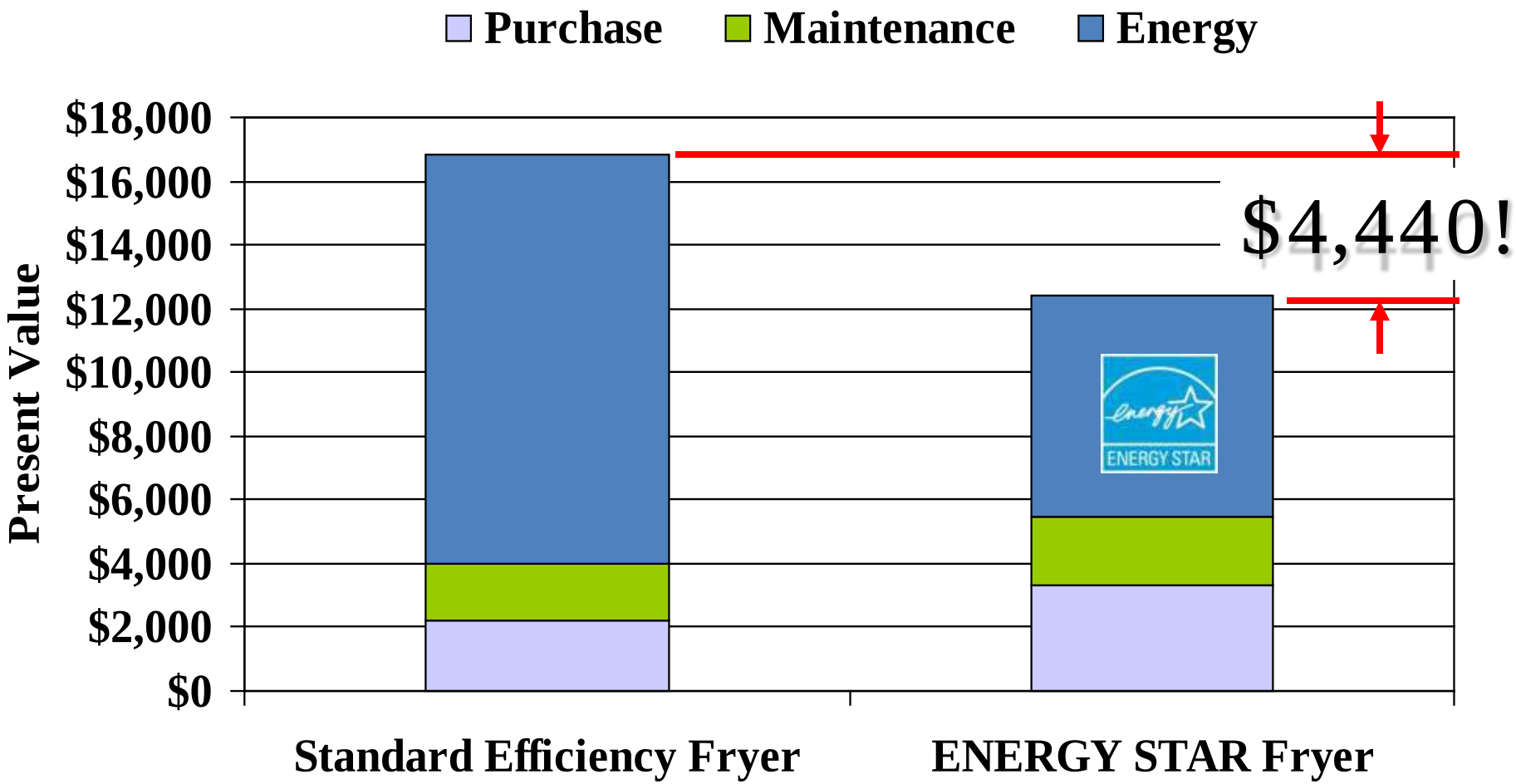
Life-Cycle Cost* vs. Purchase Cost



*Based on $1.20/therm, 16-hr/day usage, 125 lb/day food cooked, a 8-year life expectancy and a 3.1% discount rate

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Dead giveaway for an Inefficient Fryer

Cast Iron Burner

Steamer Focus:

Countertop Steamers

Question:

- Which is most cost effective?
- Steam Generator or ENERGY STAR Boilerless?

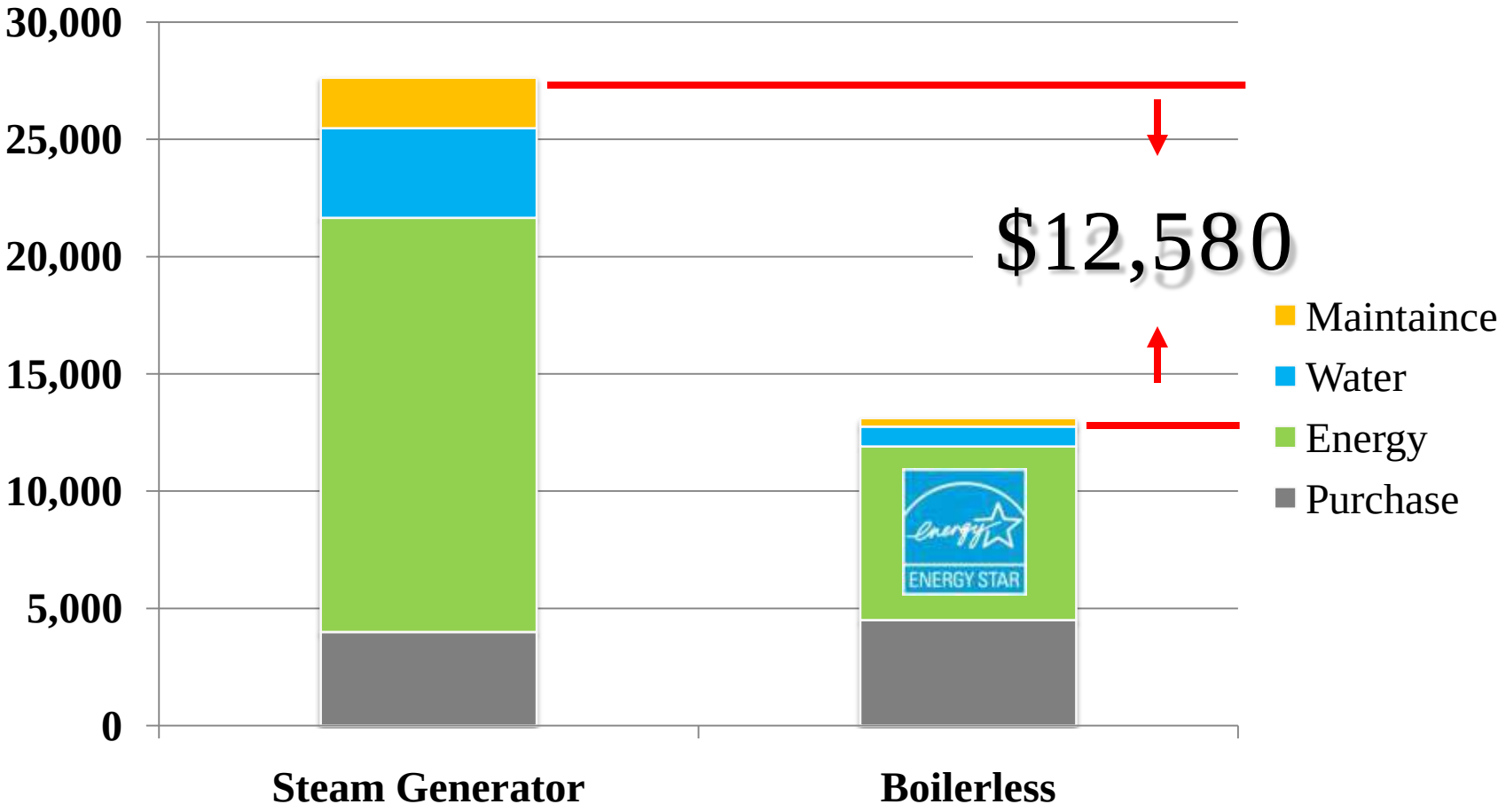
Details:

- 16 hours, 100 lb per day production
- 8 year life span
- $0.15 /kWh electricity, $5/CCF Water
- Purchase price

Boiler Based Steamer (Not ENERGY STAR)

Average Water Usage = 40 gph

Life-Cycle Cost* vs. Purchase Cost



*Based on $0.15/kWh, 6-hr/day usage, 100 lb/day food cooked, a 8-year life expectancy and a 3.1% discount rate

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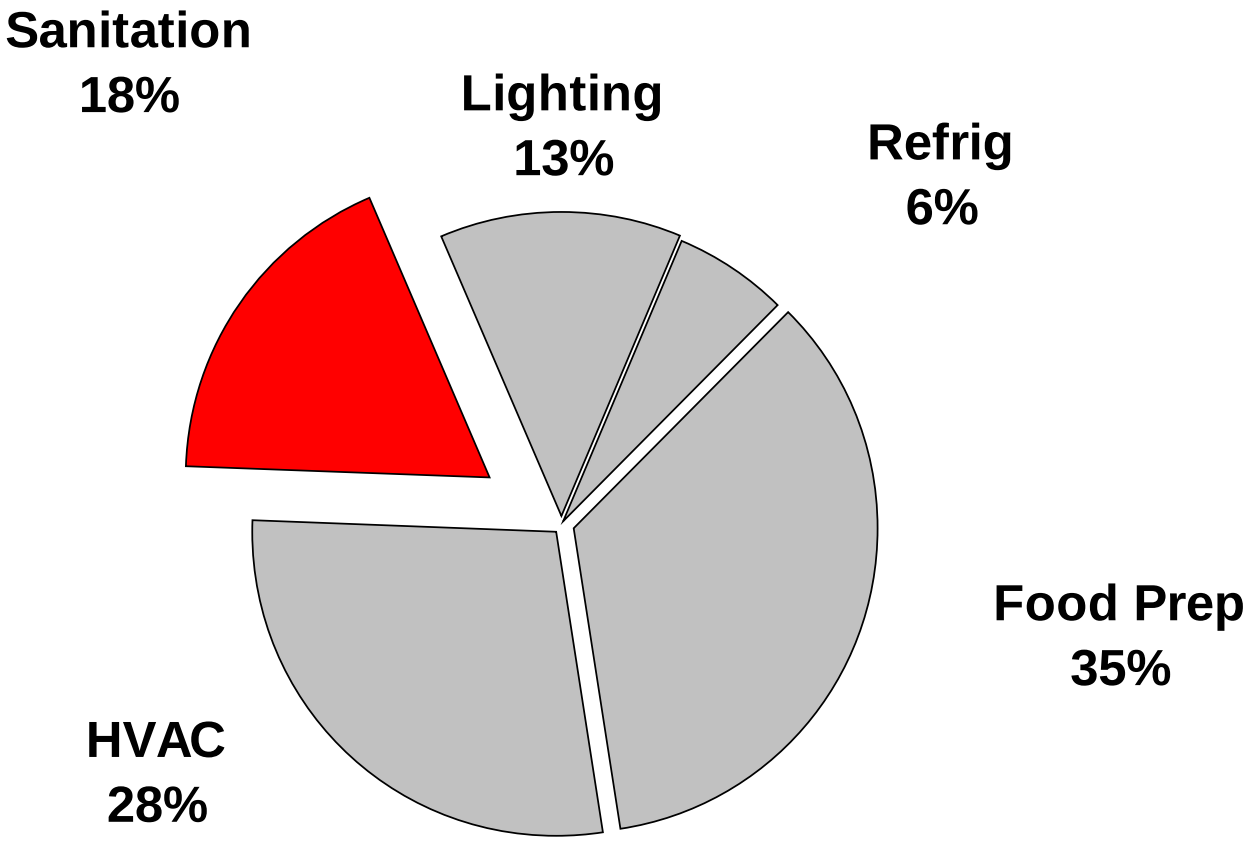

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Low-Flow Pre-Rinse Valve

Problem:
High Flow Pre-Rinse Spray Nozzle (>1.6 gpm)

Solution:
Low Flow, High Performance, Pre-Rinse Spray Nozzle (≤ 1.6 gpm)

Discussion:
High flow pre-rinse spray nozzles are simplistic in design and use large volumes of water to rinse soiled wares. Low flow, high performance nozzles are engineered to use significantly less water and still effectively clean soiled wares. Low flow nozzle design elements can include increased head pressure, optimized spray pattern and/or aeration of the water stream.

Annual Operating Cost Savings:
$100 - $600

Phantom Dish Washer!

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Hot Water Recirculation Pump Timer

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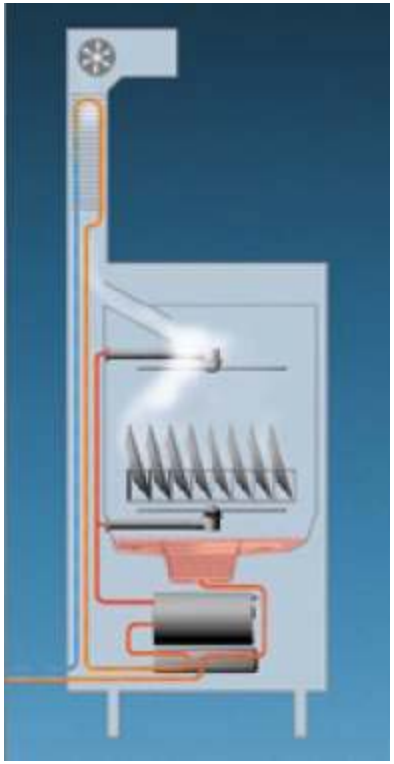
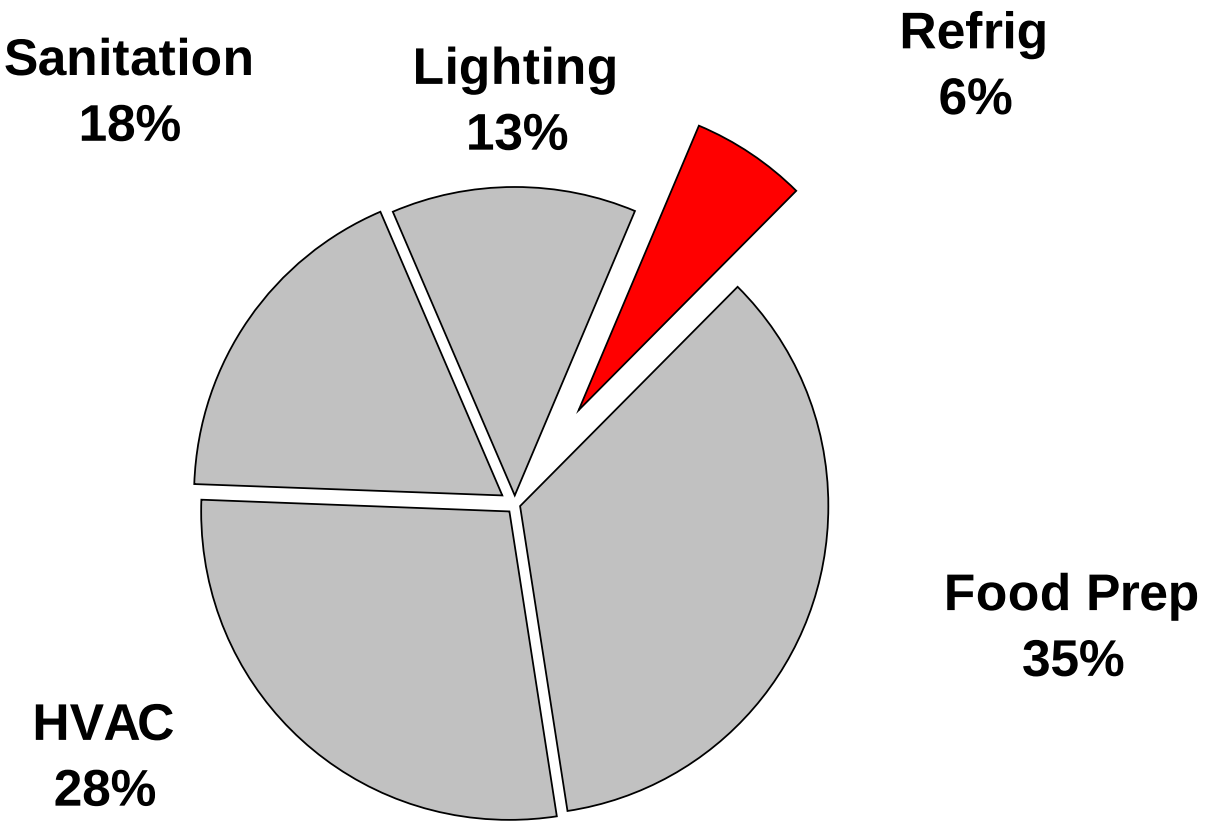
New Generation of Water/Energy Saving Energy Star Dishwashers

Water use:
0.8 gal/rack vs. 1.1 gal/rack

New Generation of Dishmachines with Integrated Heat Recovery





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Strip Curtains

Problem:
Open Walk-in Cooler & Freezer Doors

Solution:
Strip Curtains and Auto-Door Closers

Discussion:
Every time the walk-in cooler or freezer door opens, warm air infiltrates the box, increasing energy use of the refrigeration system. Plastic strip curtains reduce warm air infiltration by 75% and help maintain the safe internal temperature range during entrance. They also serve as a redundancy to the walk-in box door when it is unintentionally left ajar. An auto-door closer ensures that the walk-in box door closes securely.

Annual Operating Cost Savings:
$130 - $190

But…

High-Efficiency Evaporator Fan Motor

Problem:
Inefficient, Shaded Pole Evaporative Fan Motors

Solution:
High Efficiency Electronically Commutated Fan Motors

Discussion:
Walk-in cooler and freezer evaporative fan motors run 24/7 re-circulating air through the evaporator coils. A typical standard efficiency shaded pole motor has an energy rate of 135 W, versus 45 W for a high efficiency electronically commutated motor (ECM). ECMs also generate less heat, further reducing a walk-in box operating cost.

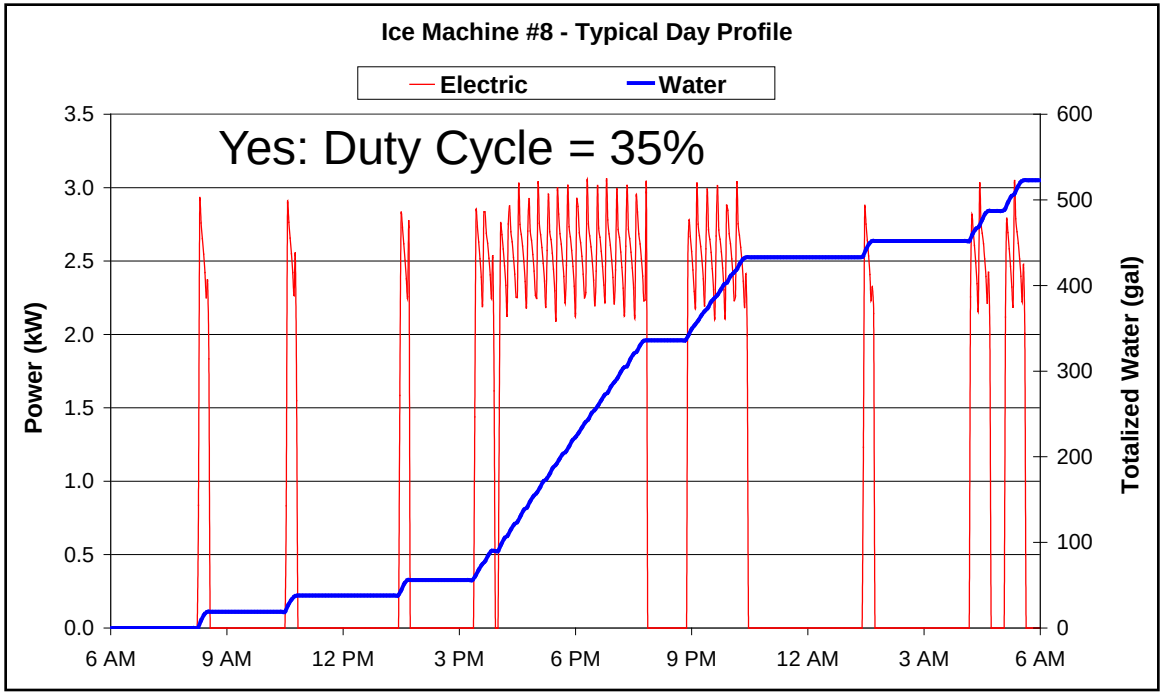
Annual Operating Cost Savings:
$100/Motor

Ice Machines

Candidates for Demand Response?

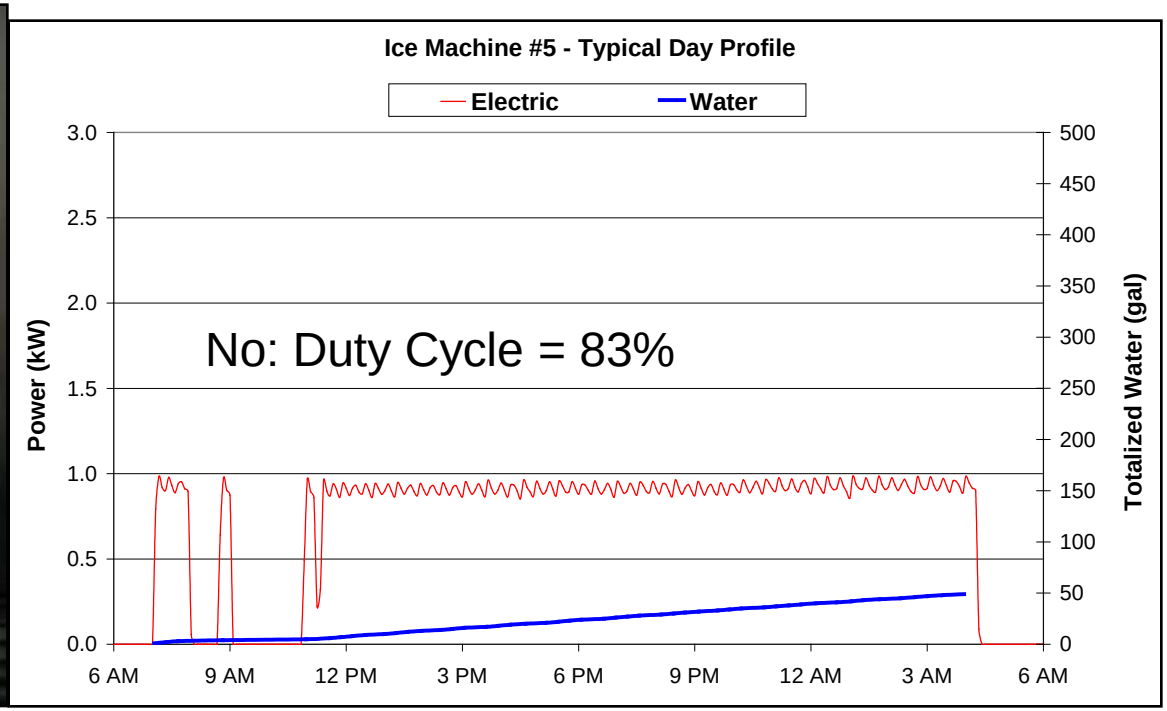
Ice machines are found in a wide variety of commercial applications: from bars, delis, and restaurants, to hotels, hospitals, and other institutional kitchens. Typically harvest ice from 200 lb/24 hr to 1600 lb/24 hr

Ice Machine Field Study

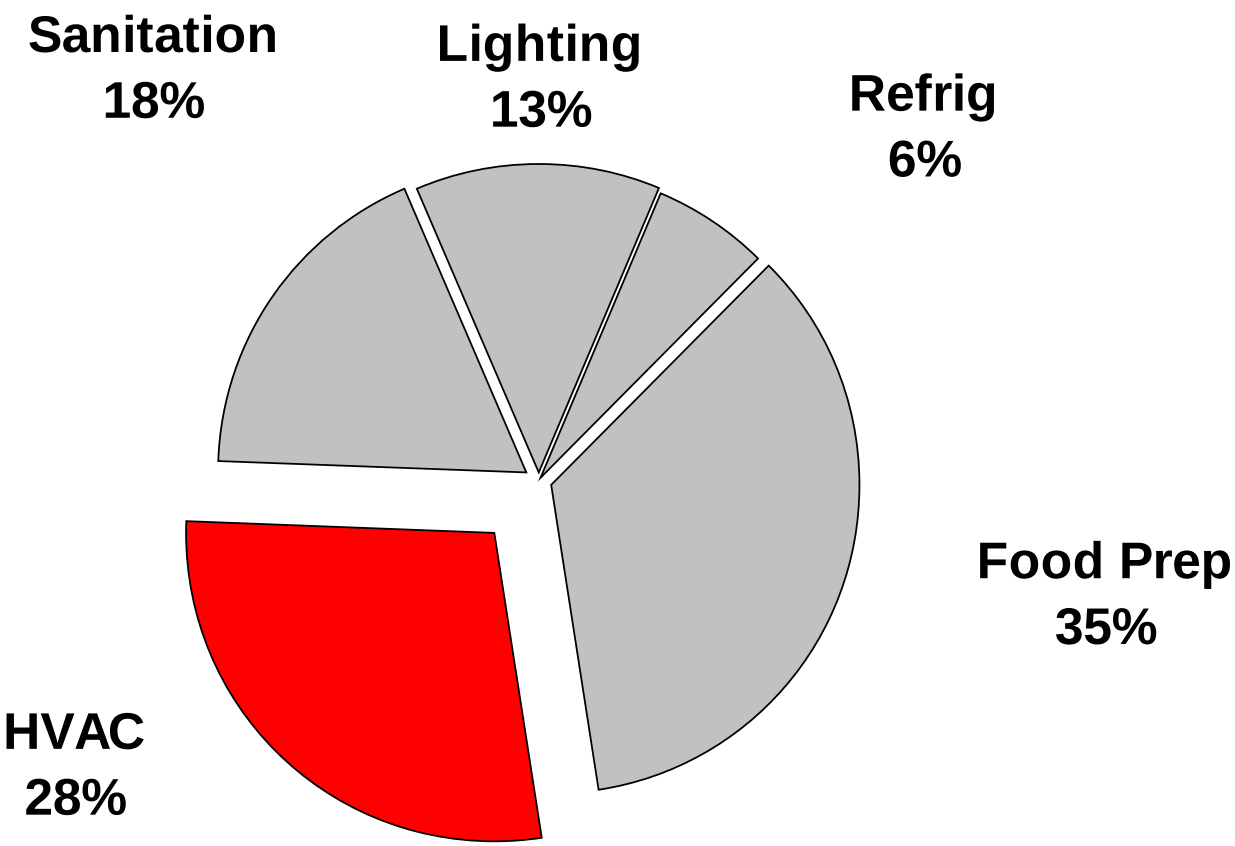


http://www.fishnick.com/publications/appliancereports/special/Ice-cube_machine_field_study.pdf

Ice Machine Field Study



http://www.fishnick.com/publications/appliancereports/special/Ice-cube_machine_field_study.pdf



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Optimize the Exhaust Hood

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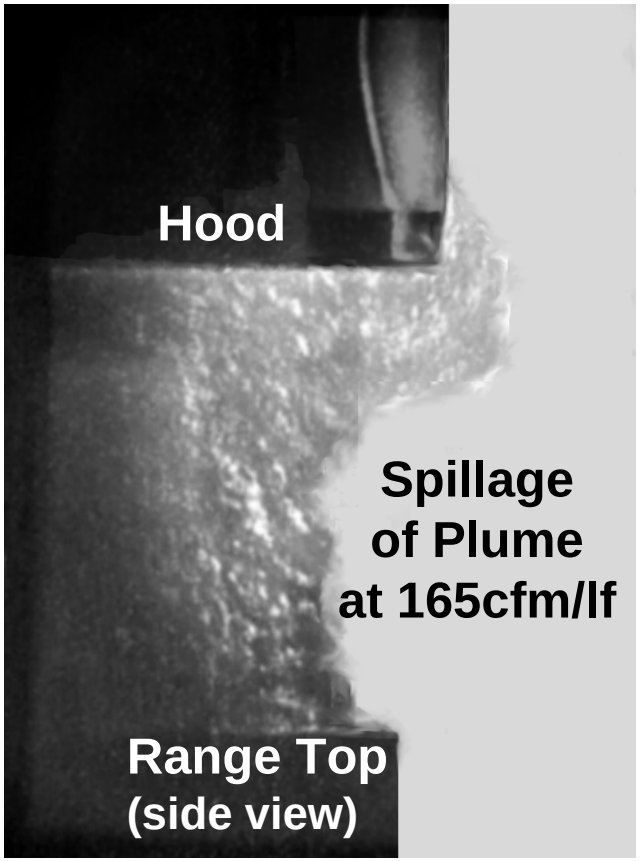
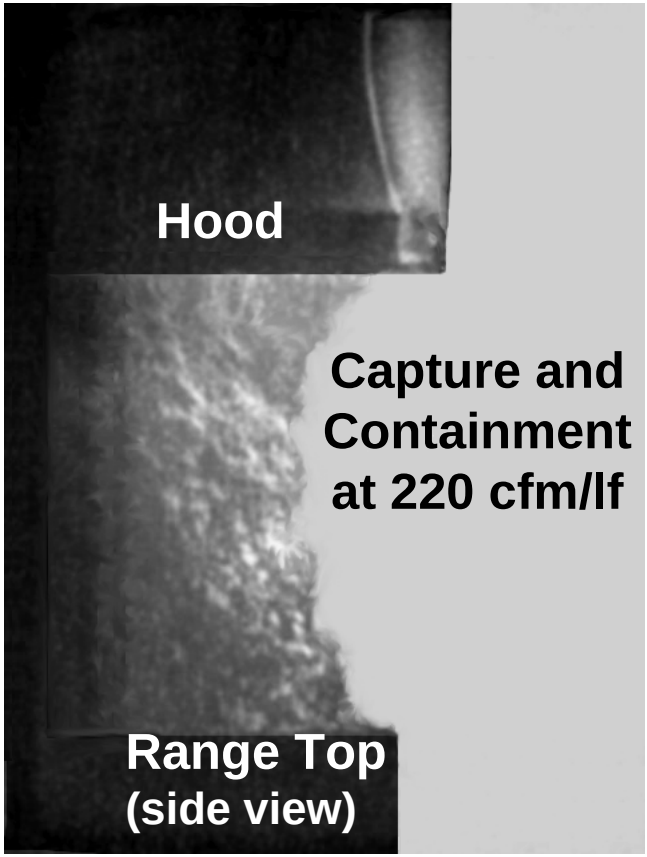
Schlieren Flow Visualization





What the Eye Sees!

8-Ft Wall Mounted Canopy Hood

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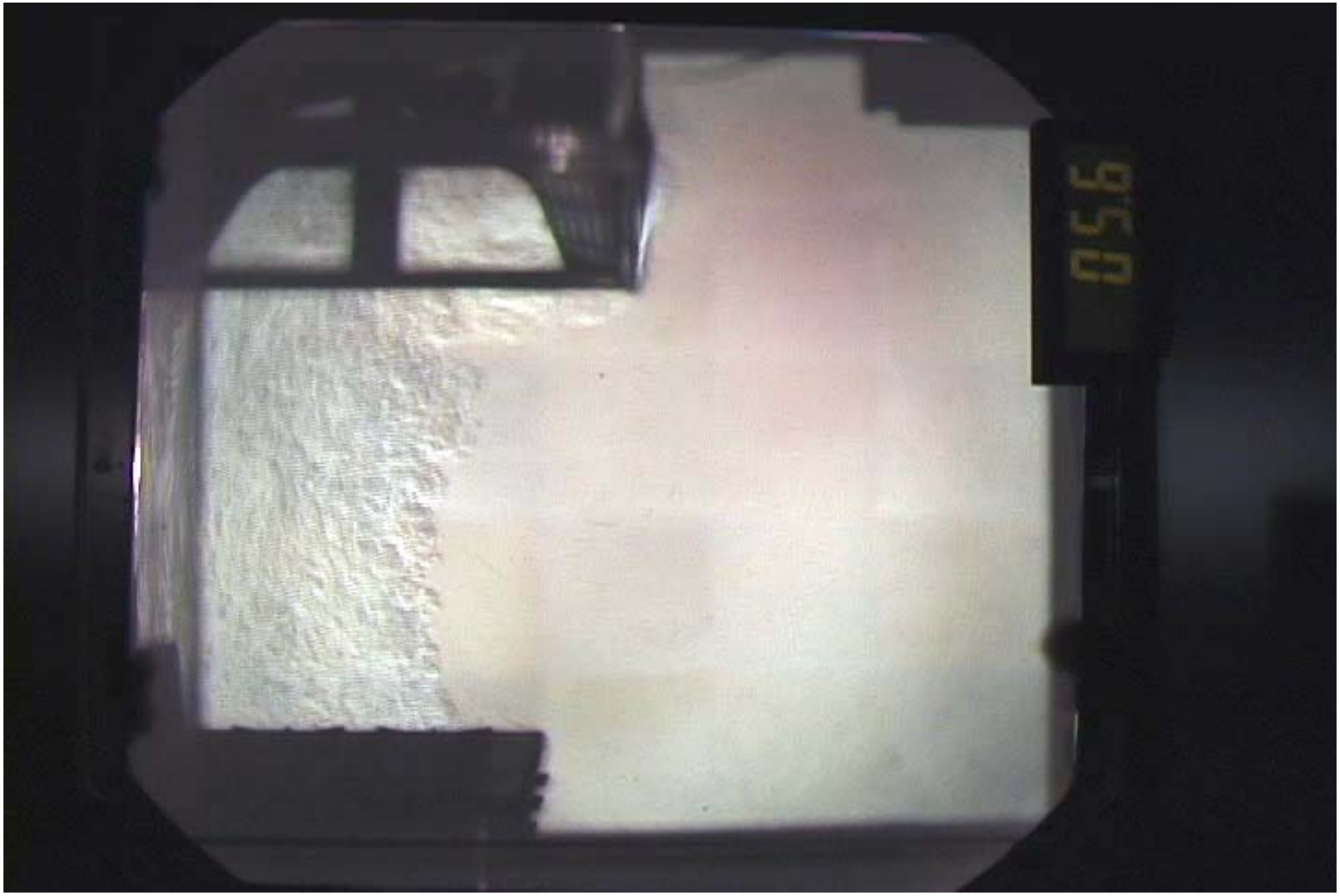
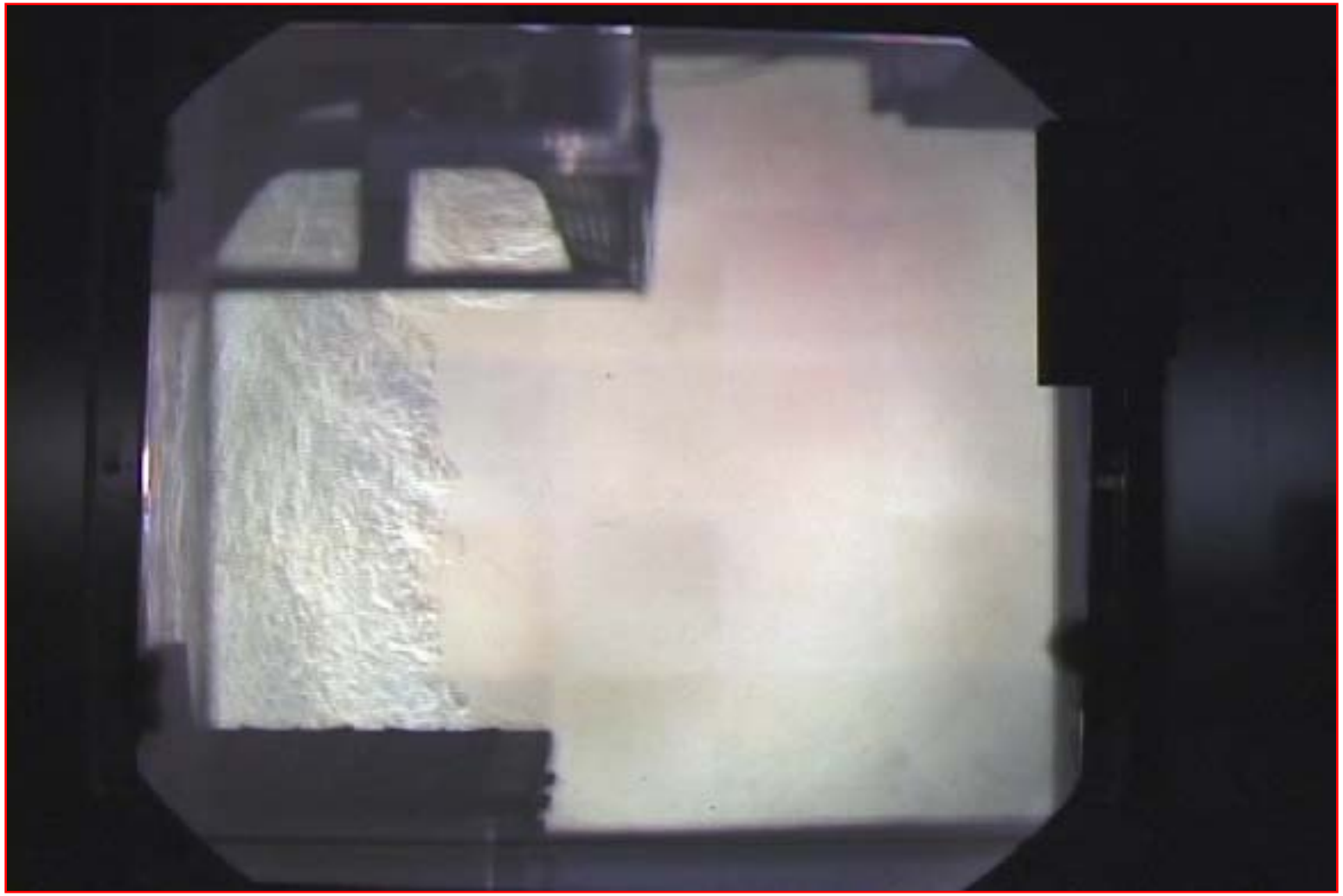
What the Camera Sees!



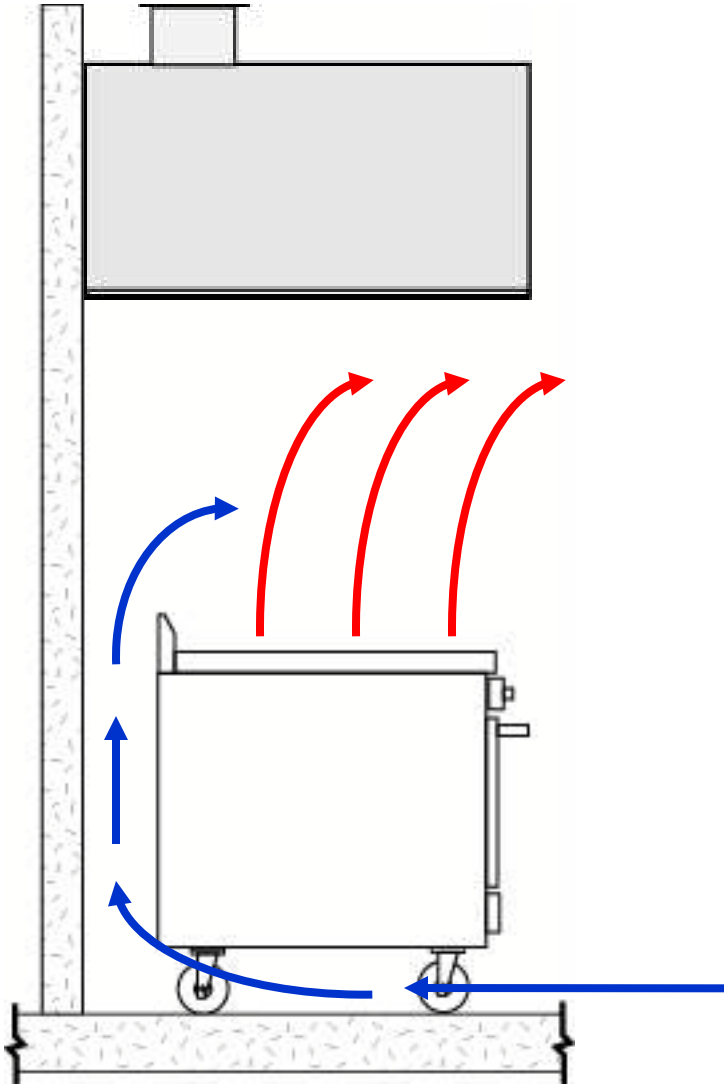
Hood Does Not Capture & Contain

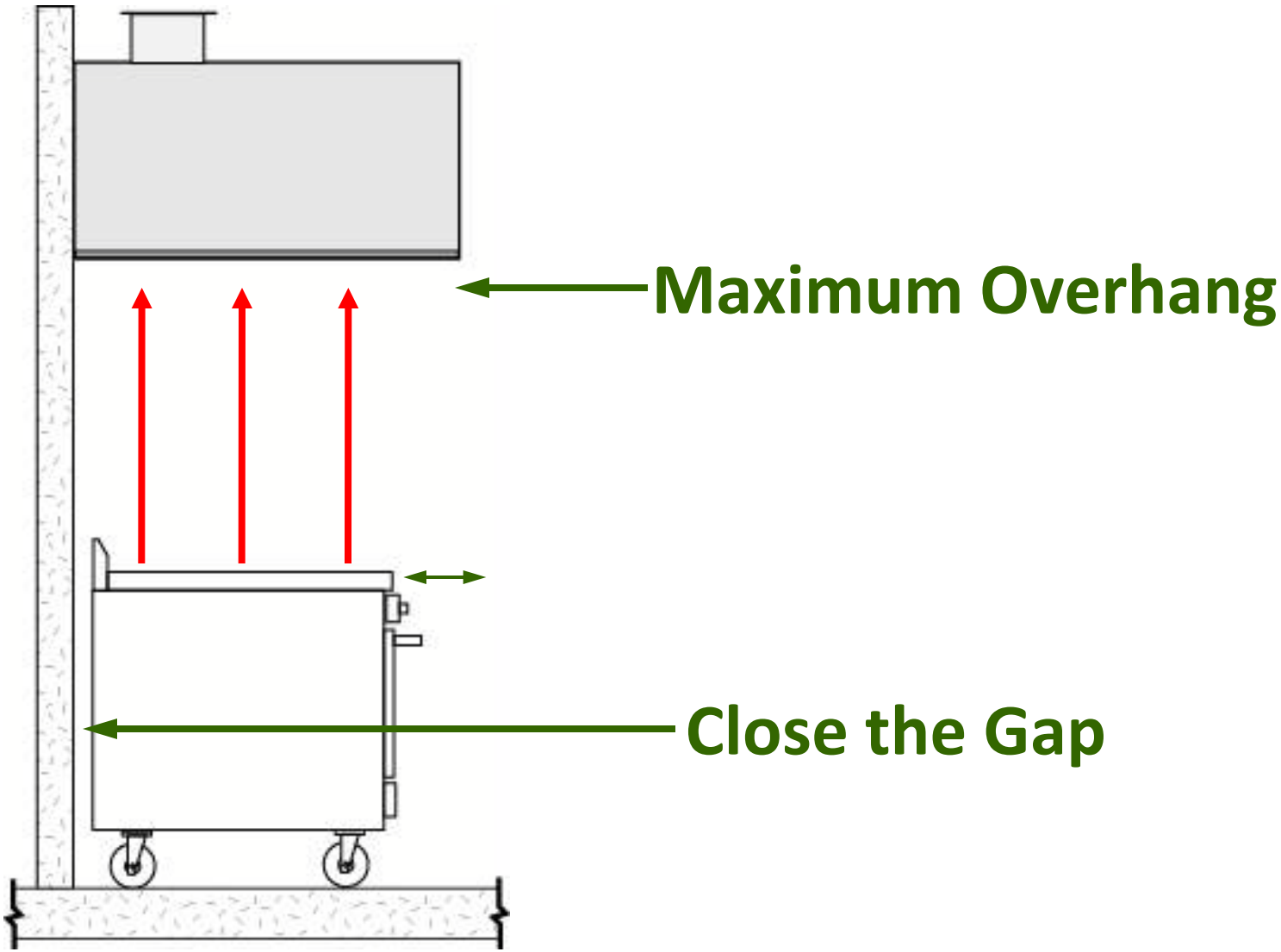
Makeup Air Introduced at Low Velocity



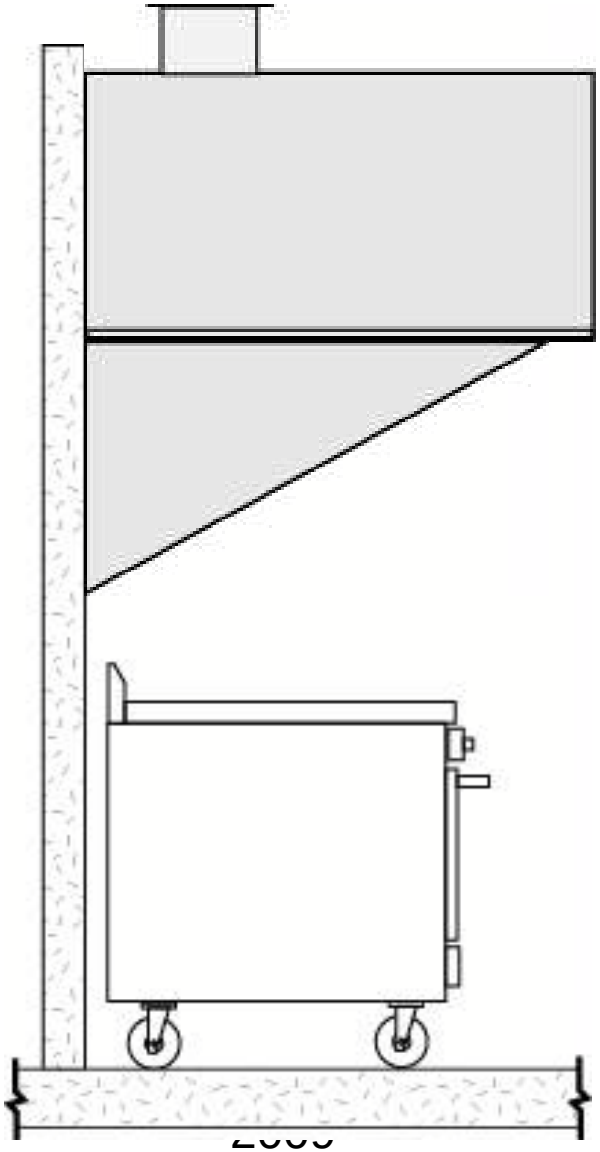
Capture & Containment (C&C) @ 1400 CFM

Push m’ Back

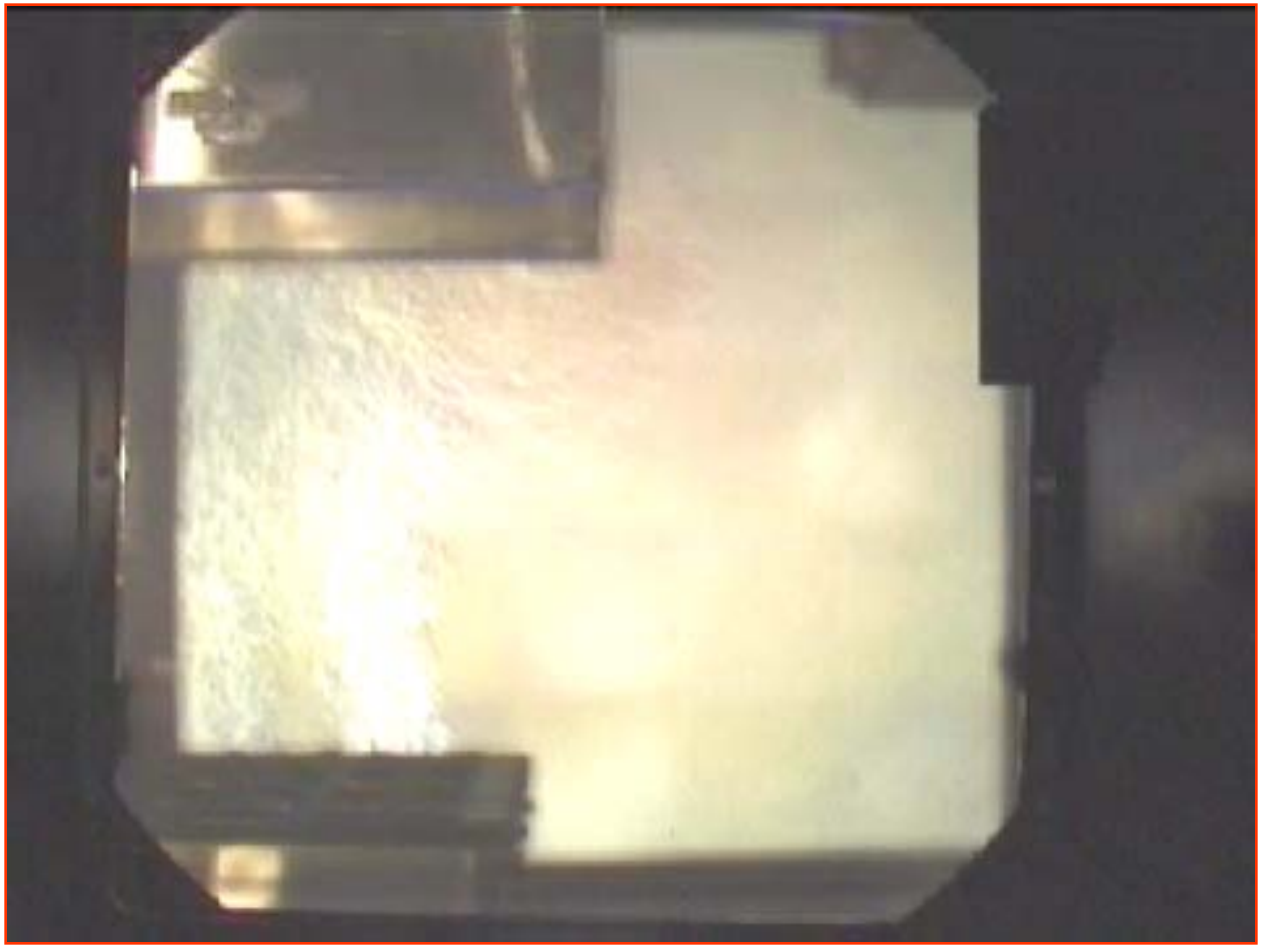



Maximum Overhang
Close the Gap

Easier said than done…



Add Side Panels



… partial end panels do the job!

Greasy ceiling tiles are a sure sign of spillage.

The Cause?

4-way diffuser in front of the hood!

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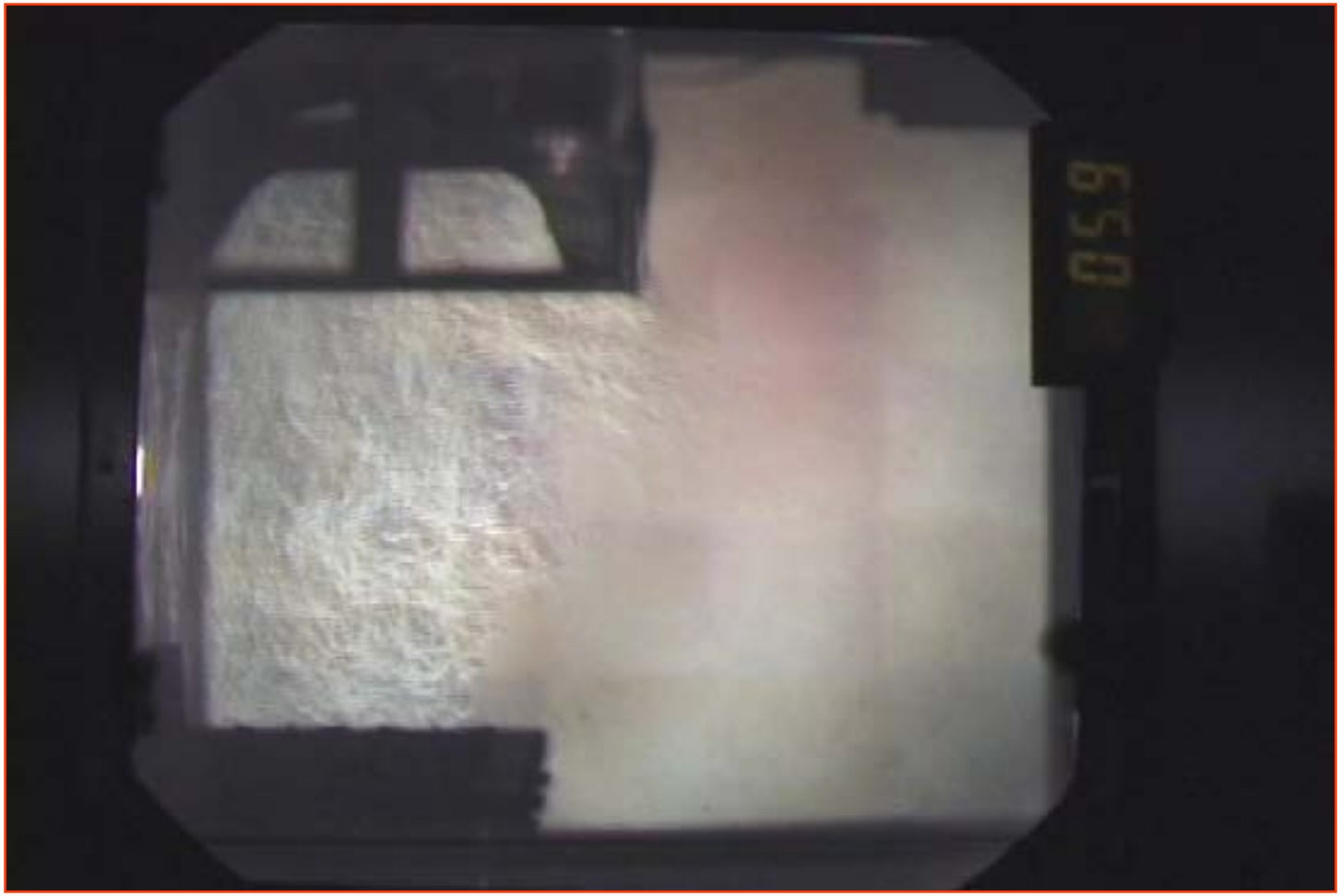
4-Way Diffuser Set-up

8-Ft Wall Mounted Canopy Hood

1400 SCFM to 4 Way



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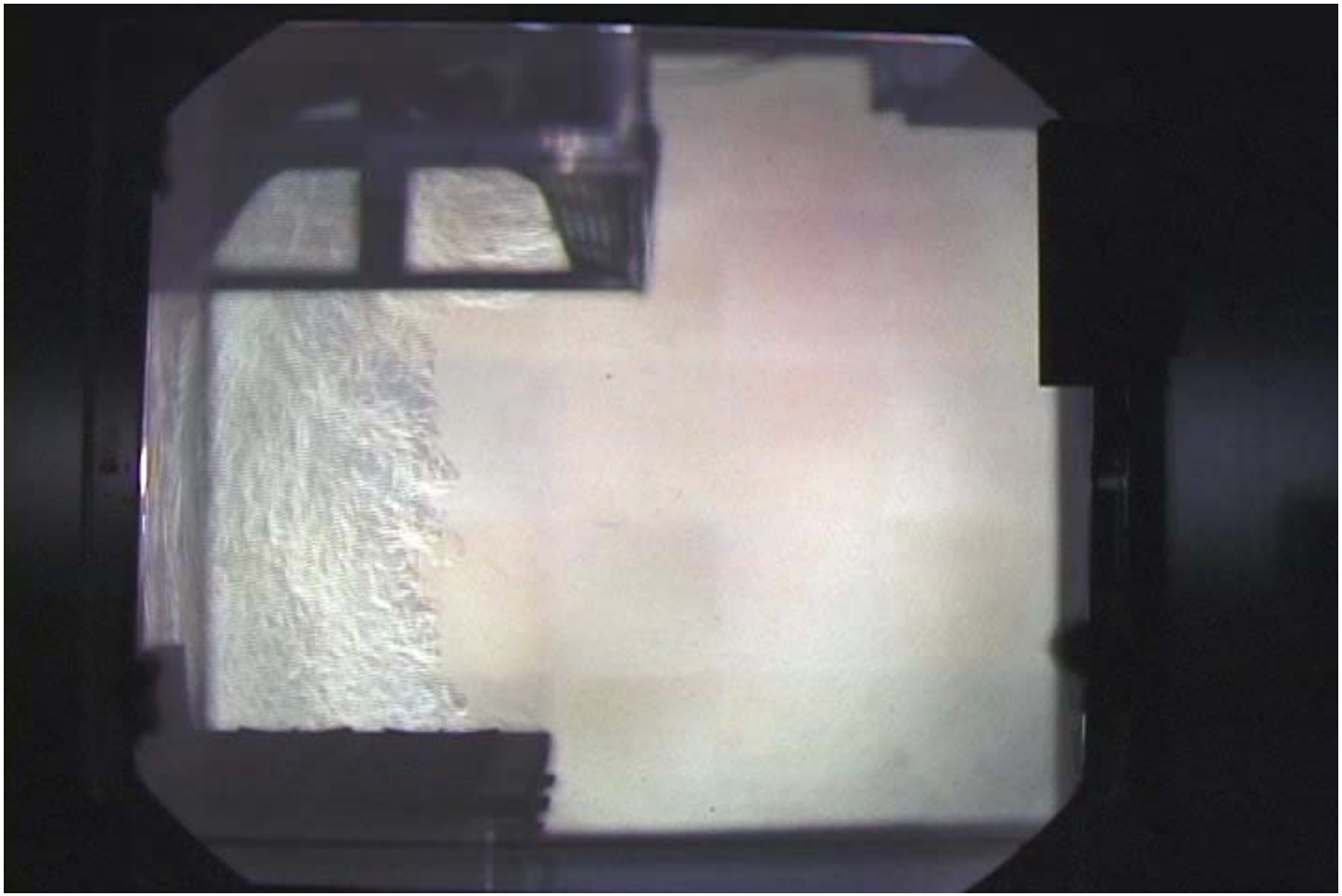
…and with low-velocity makeup air



Control that hood!

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And the final touch:

Demand Ventilation Control (DVC)

Consider variable speed drives for kitchen exhaust and makeup air fans

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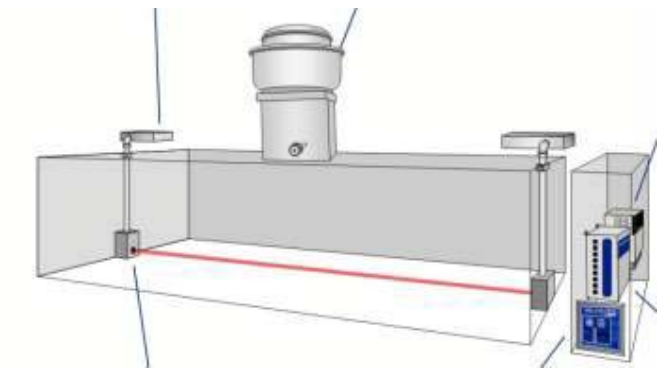
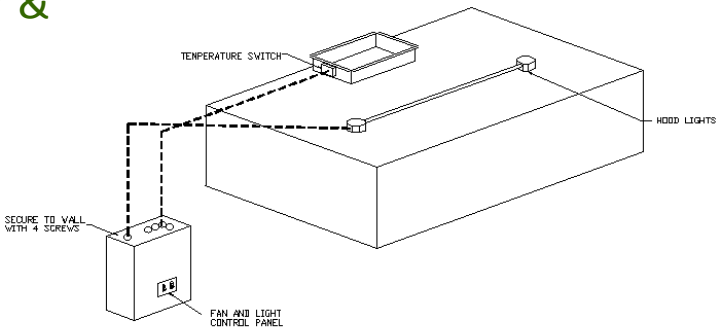
Demand Ventilation Control Technologies

Halton –
Duct Temperature Sensor &
Infrared Sensors



Melink Intellihood –
Duct Temperature Sensor & Vapor Detection



Captive Aire –
Duct Temperature Sensor

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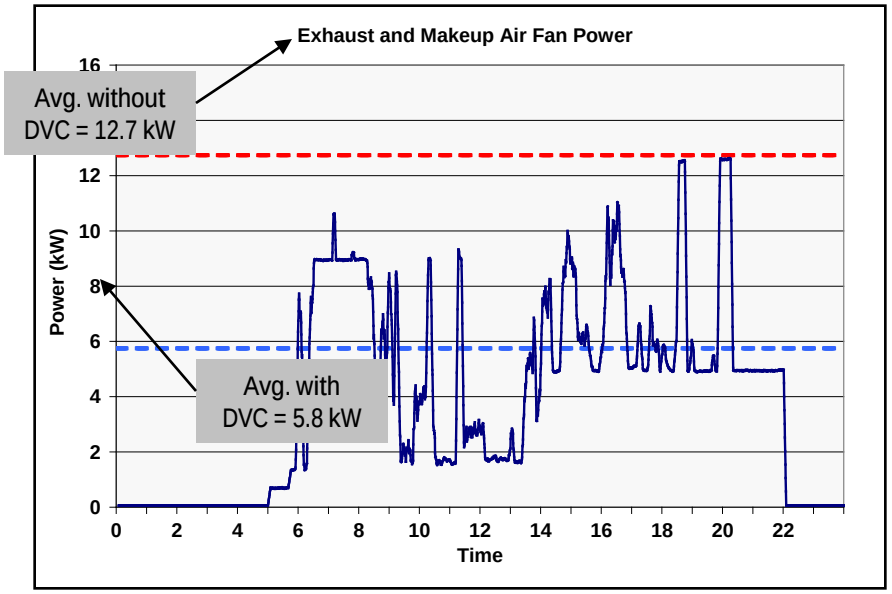
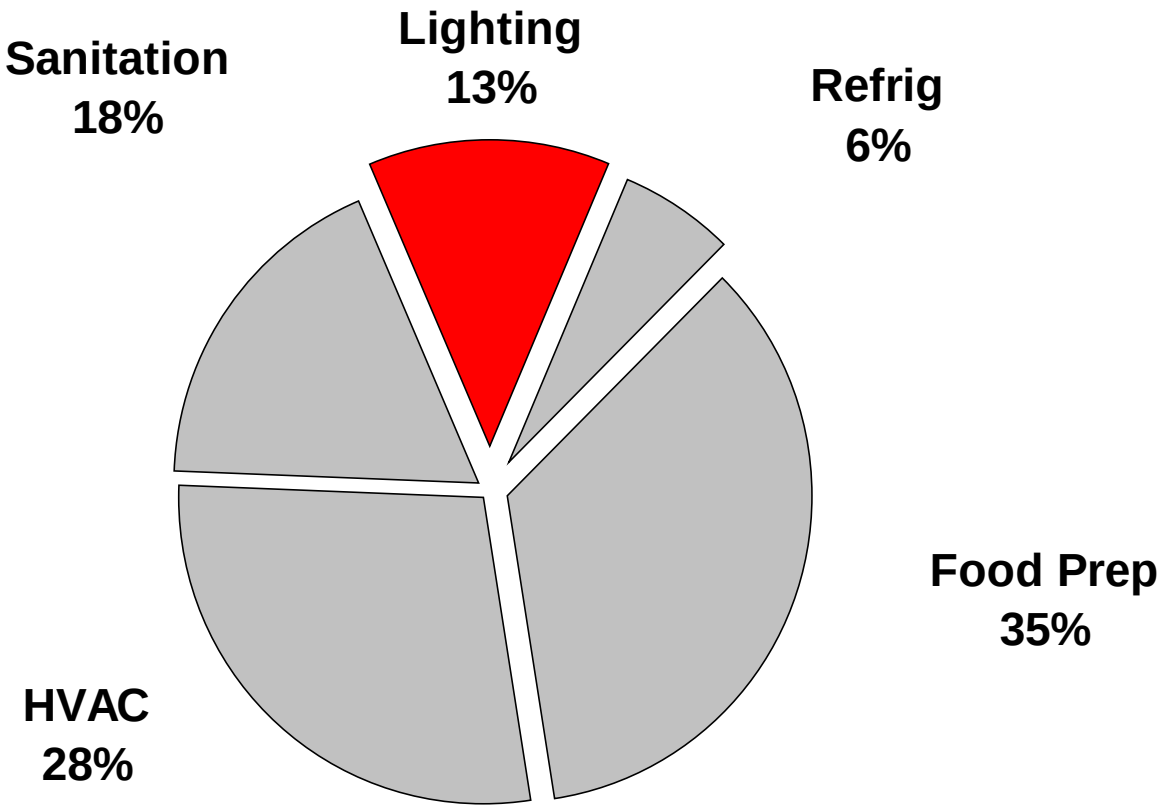
Example of Savings: U.C. Berkeley Clark Kerr Campus



Design Exhaust Ventilation Rate (cfm)	12,200
Average Fan Power Reduction (kW)	6.98
Yearly Fan Energy Cost Savings ($)	4,100
Yearly Heating and Cooling Energy Cost Savings ($)	2,350
Total Yearly Operating Cost Savings ($)	**6,450**
DVC System Installed Cost ($)	16,000
Pay Back Period (yrs)	**2.5**

Calculated using $0.115/kWh, $1.00/therm, operating 300 days per year.



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Start easy with Compact Fluorescent Lamps (CFL)

walk-ins

exhaust hoods

ENERGY STAR

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T-12s

Merchandising – do we really need the lights on?

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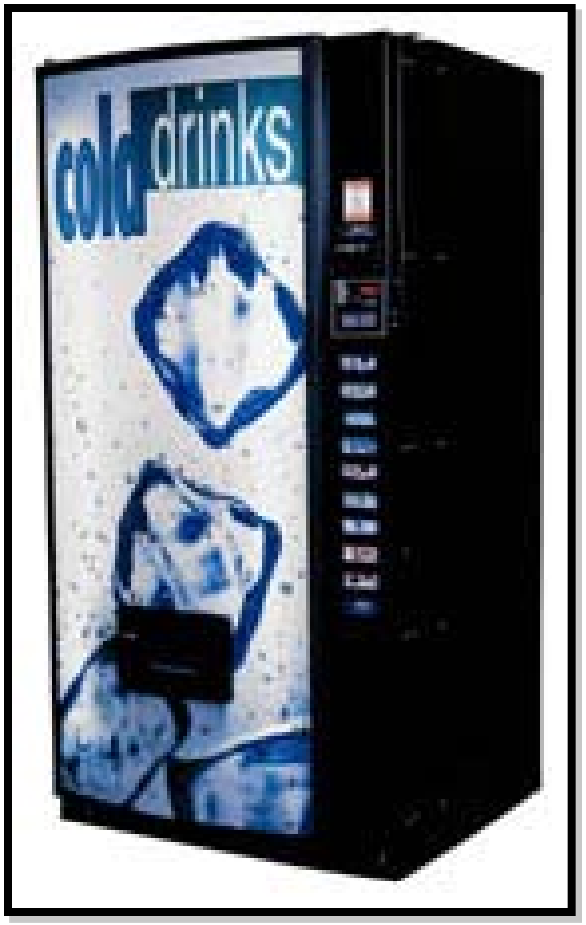
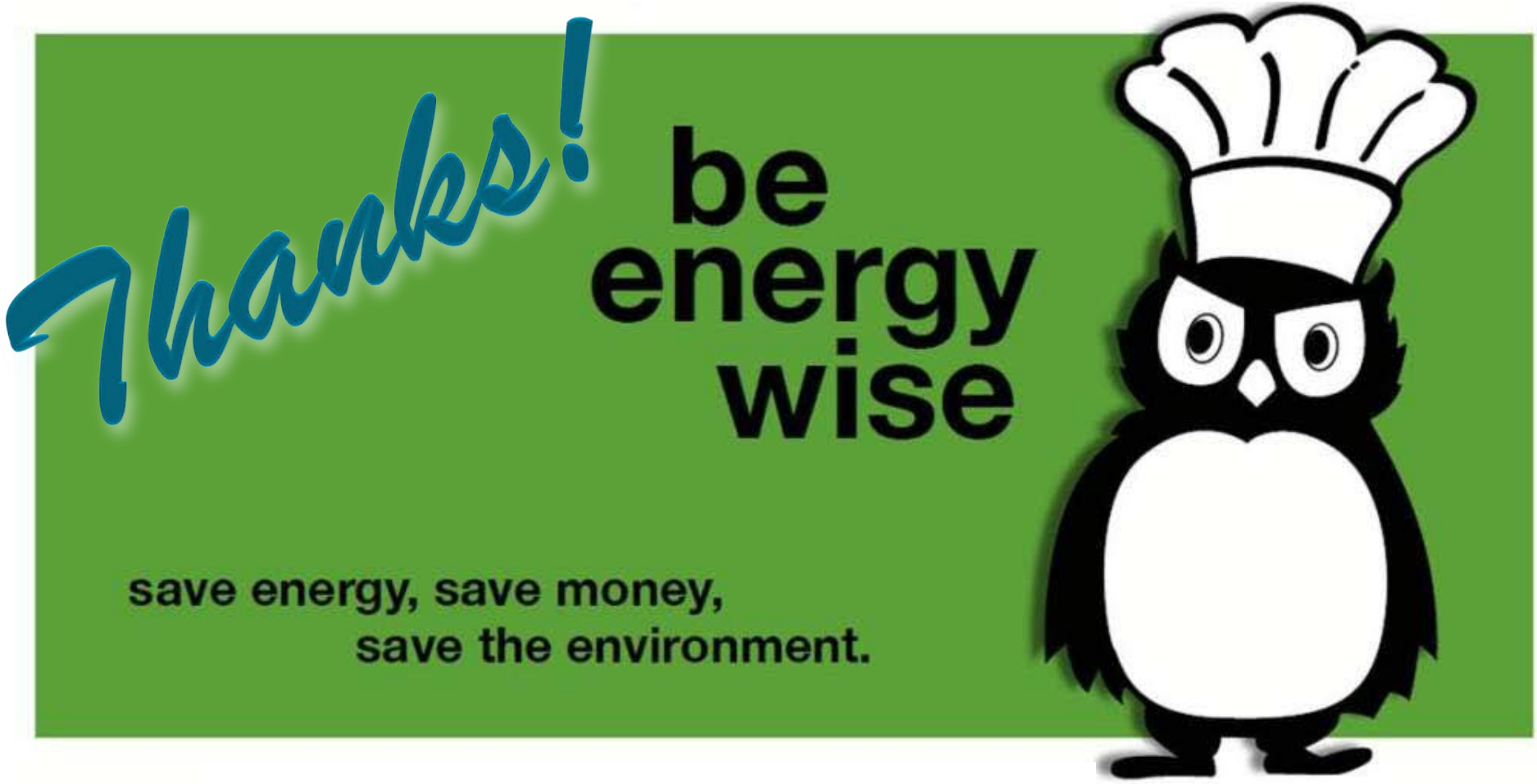
Vending Misers and Energy Star Machines





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