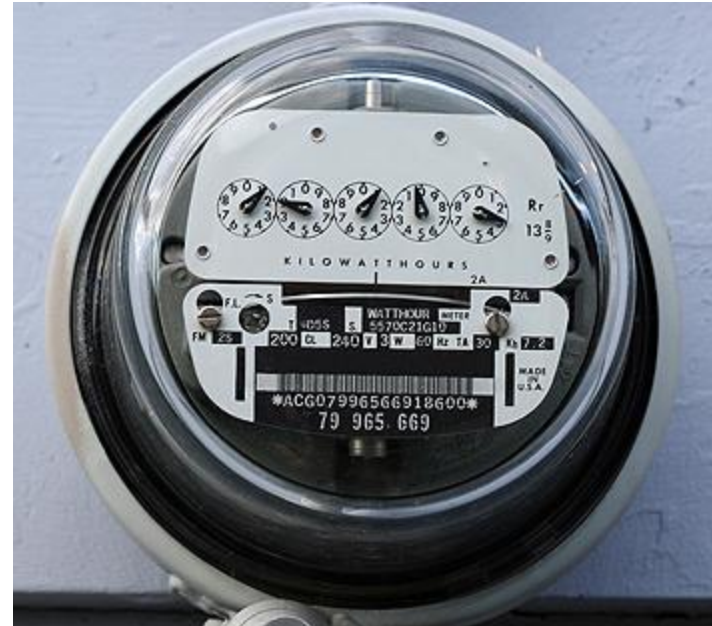
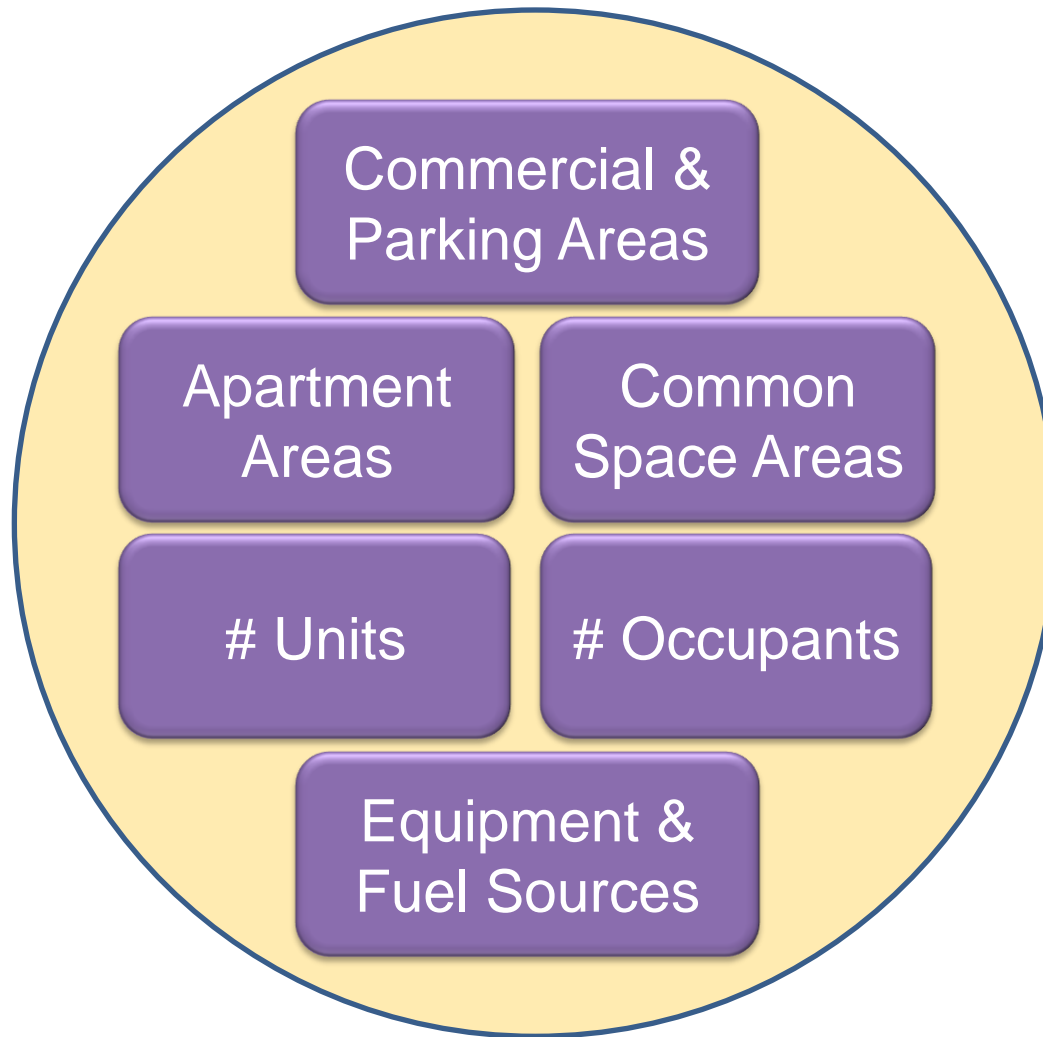


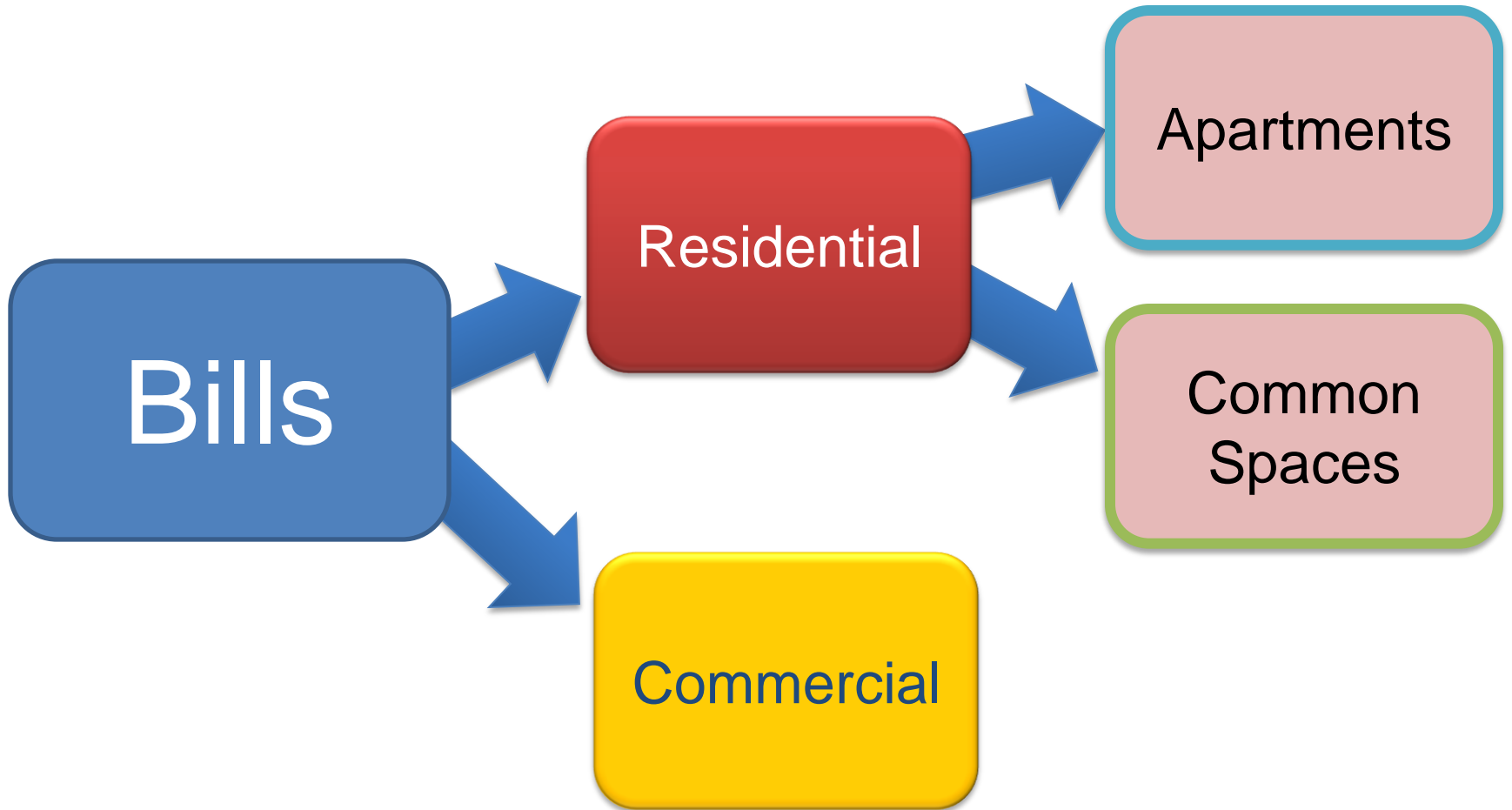
# Billing Analysis



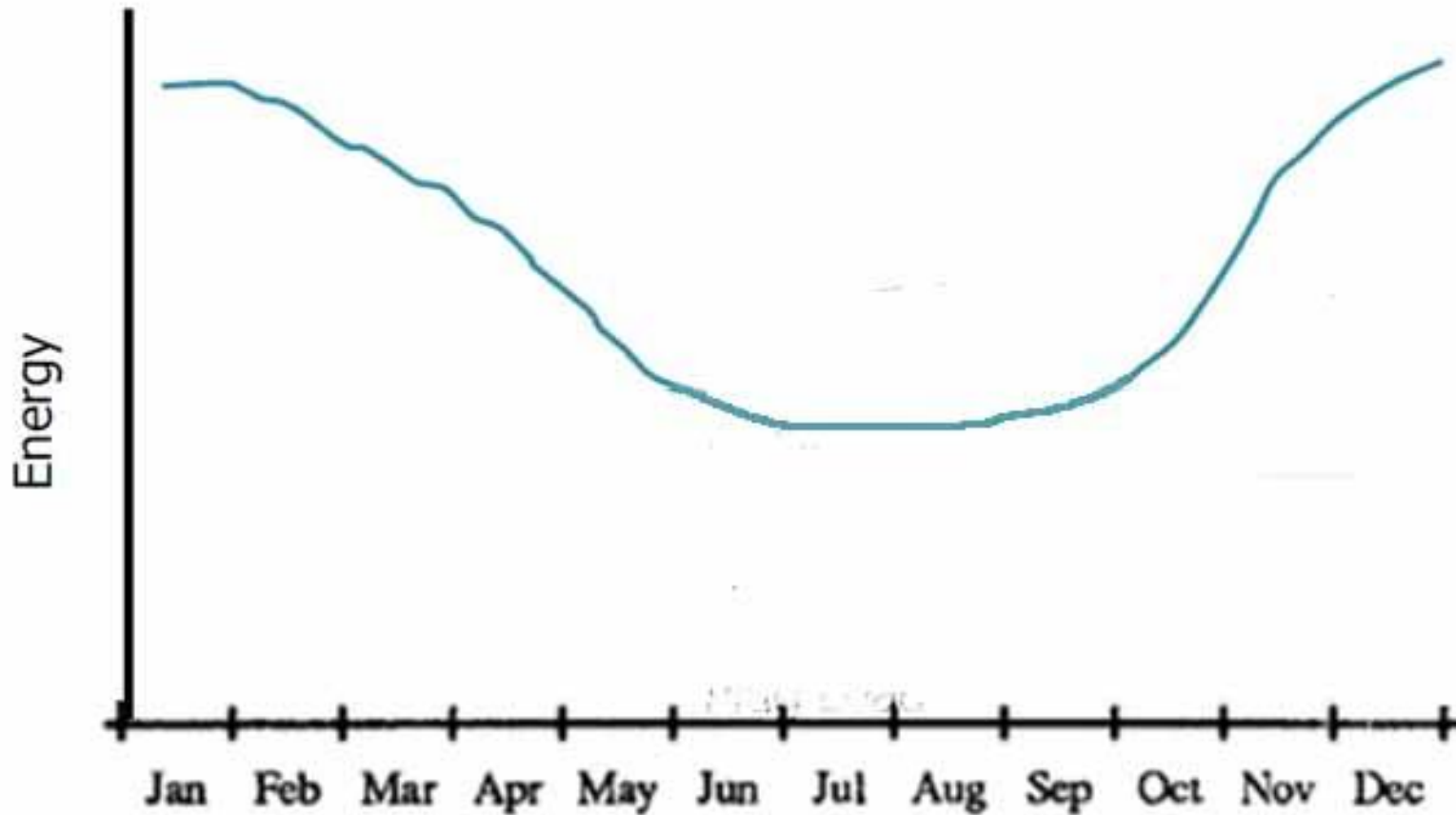
# 1. Identify Building Characteristics



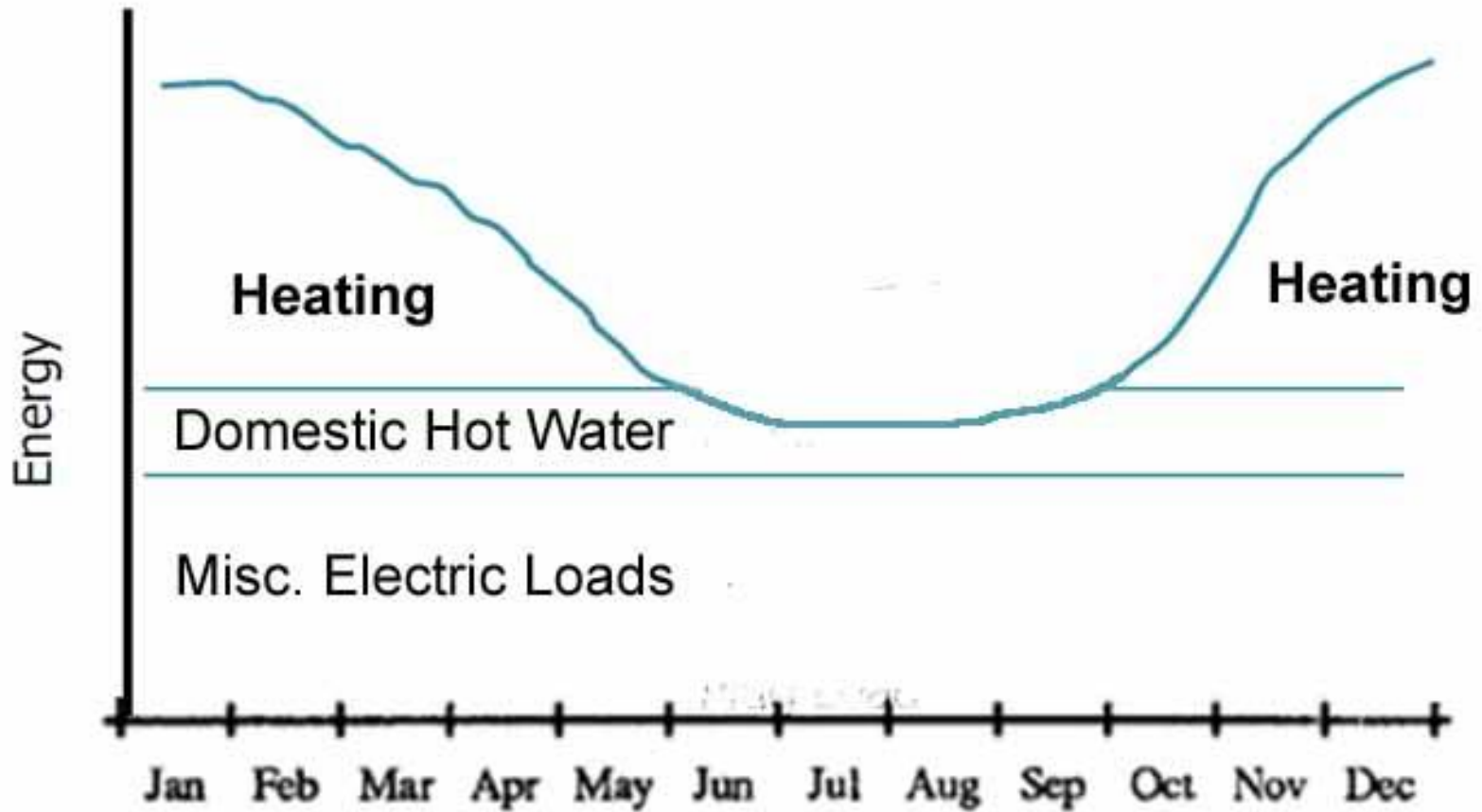
## 2. Separate the Bills



# 3. Annual Billing Profile



# 4. End Use Breakout



# The Findings



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# Mean EUI

(Site Energy, No Commercial)



12 kWh /  
ft<sup>2</sup>/yr

—

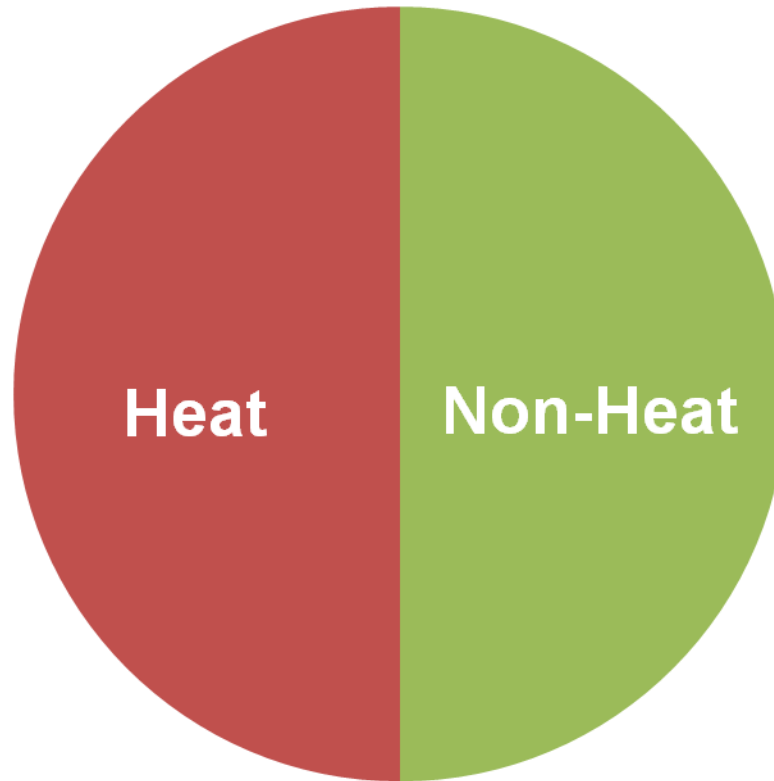
40 kBtu /  
ft<sup>2</sup>/yr

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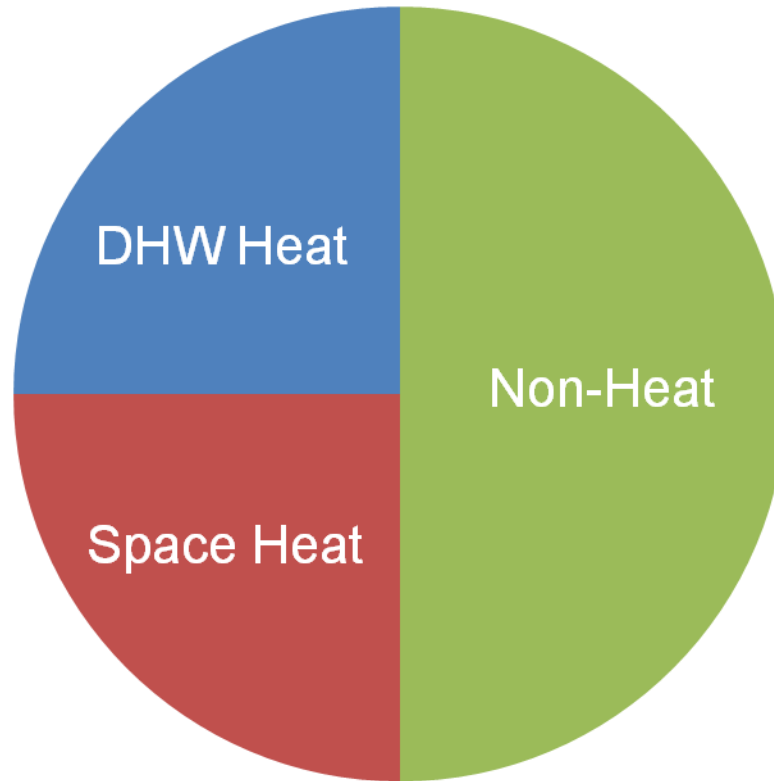
# Average Total Energy Use

## Heat vs. Non-Heat



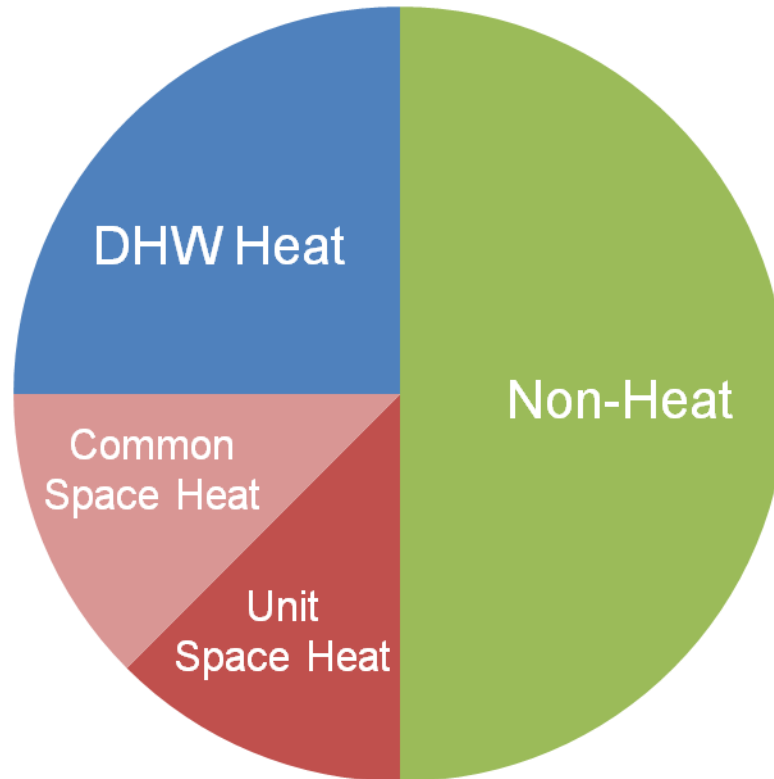
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# Average Total Energy Use



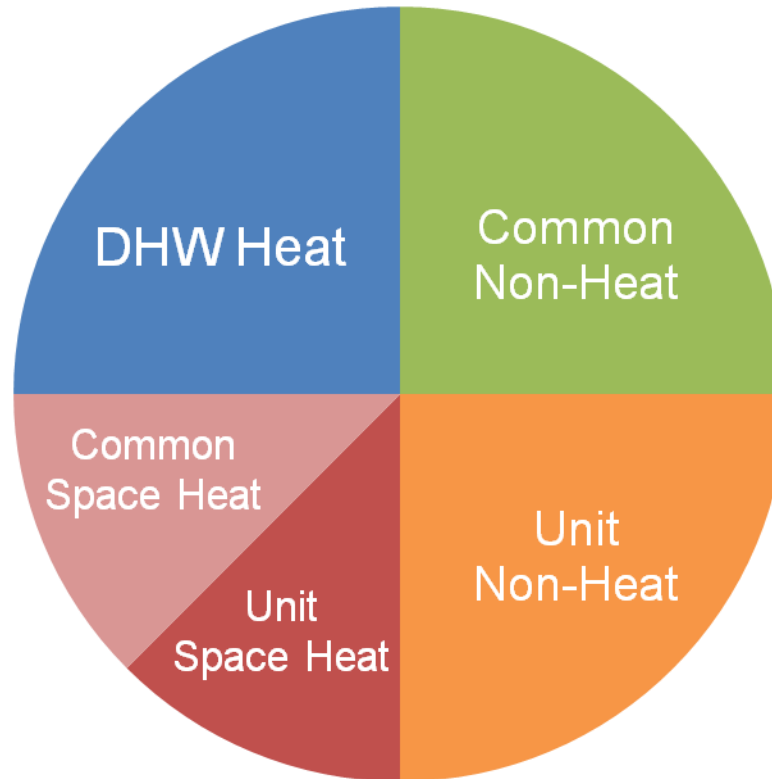
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# Average Total Energy Use



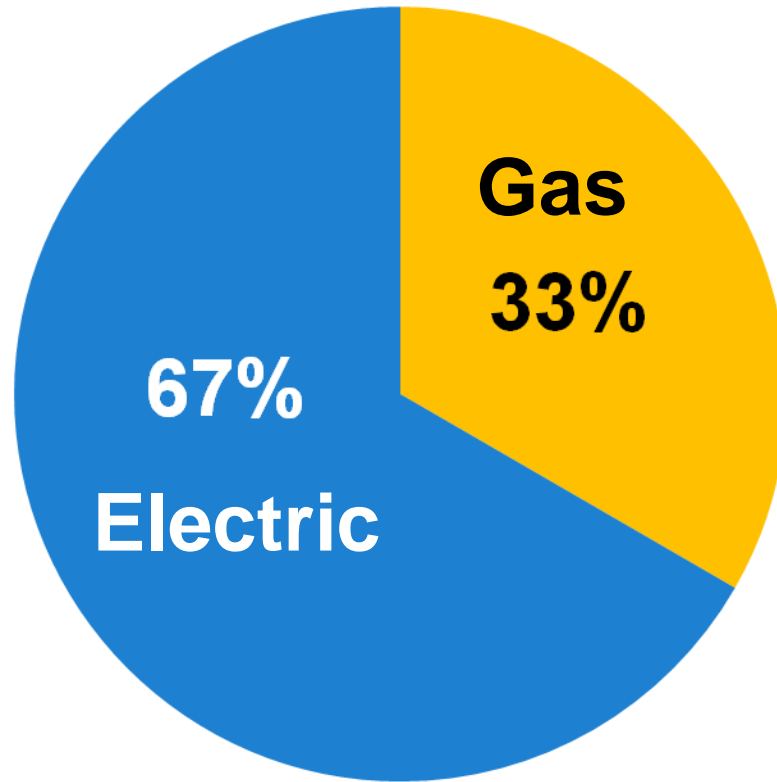
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# Average Total Energy Use



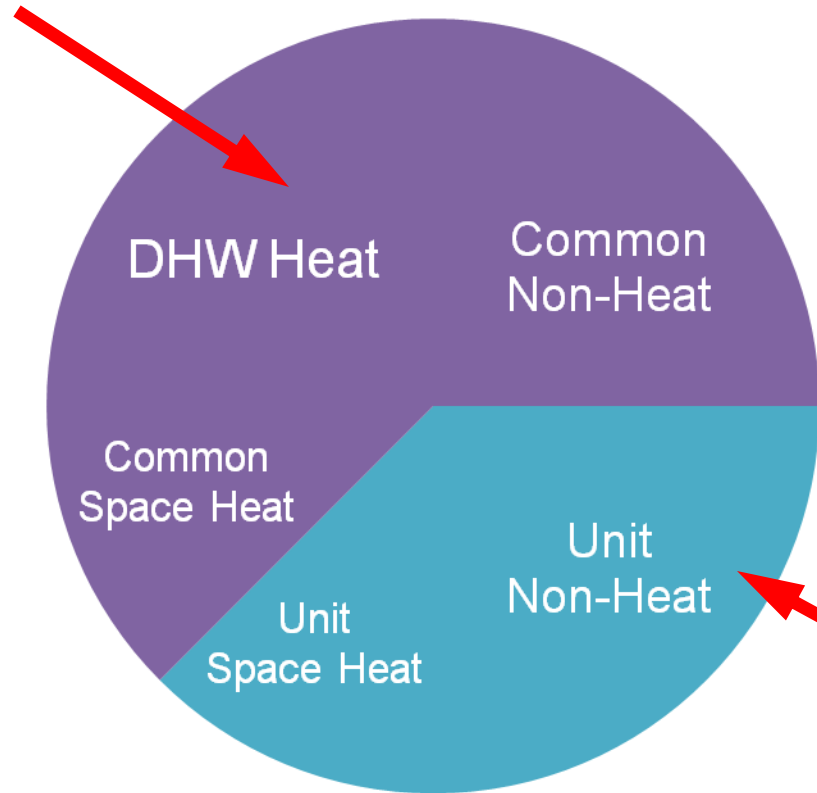
---

# Energy Source Distribution



# Who Pays the Bills?

Building  
Owner



Residents

# We have Labored Mightily....

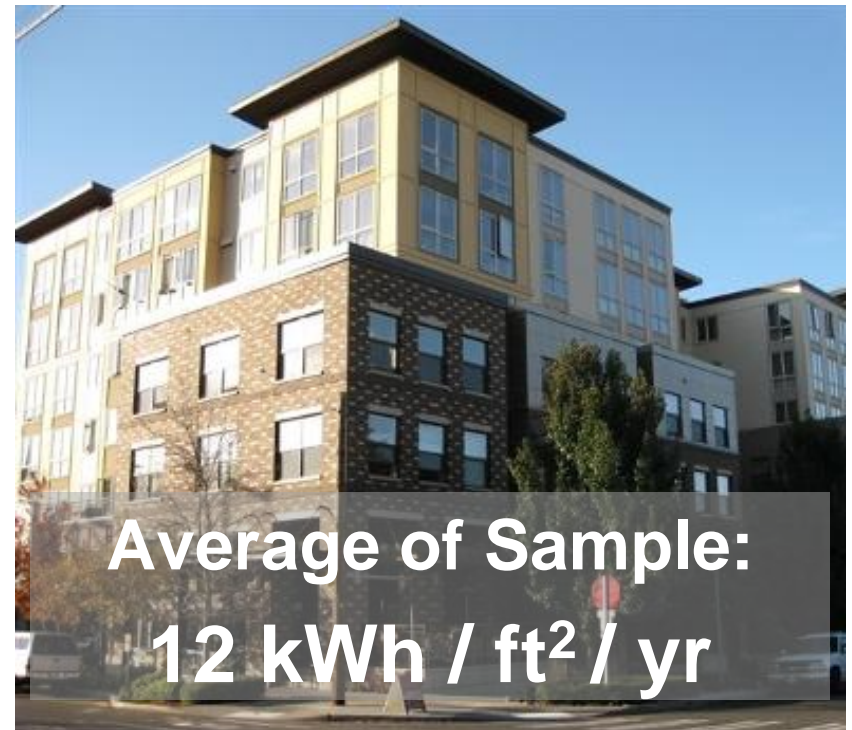
1969

Poorly Insulated

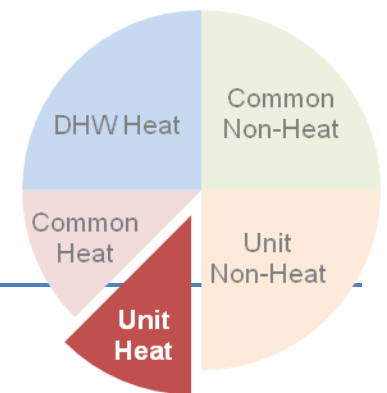
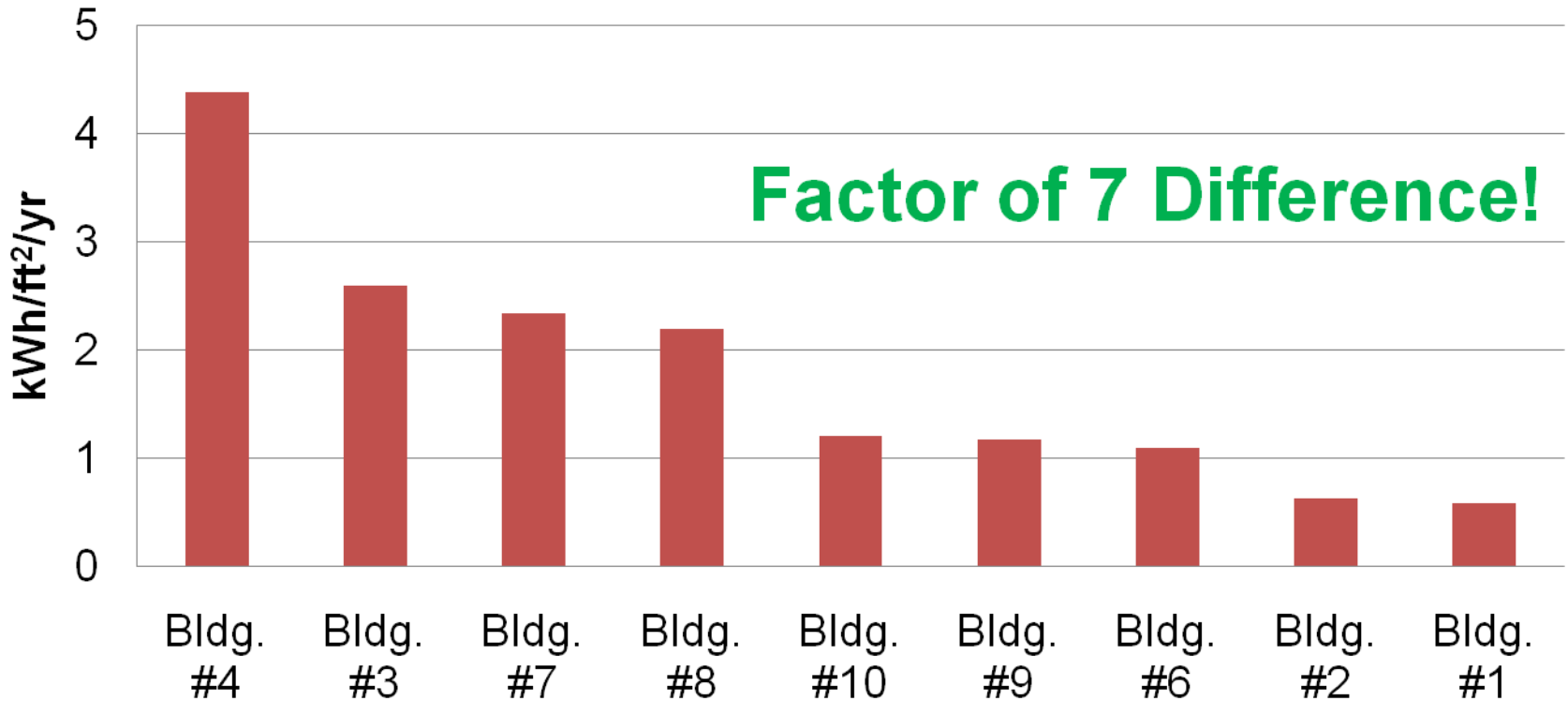


2000–2007

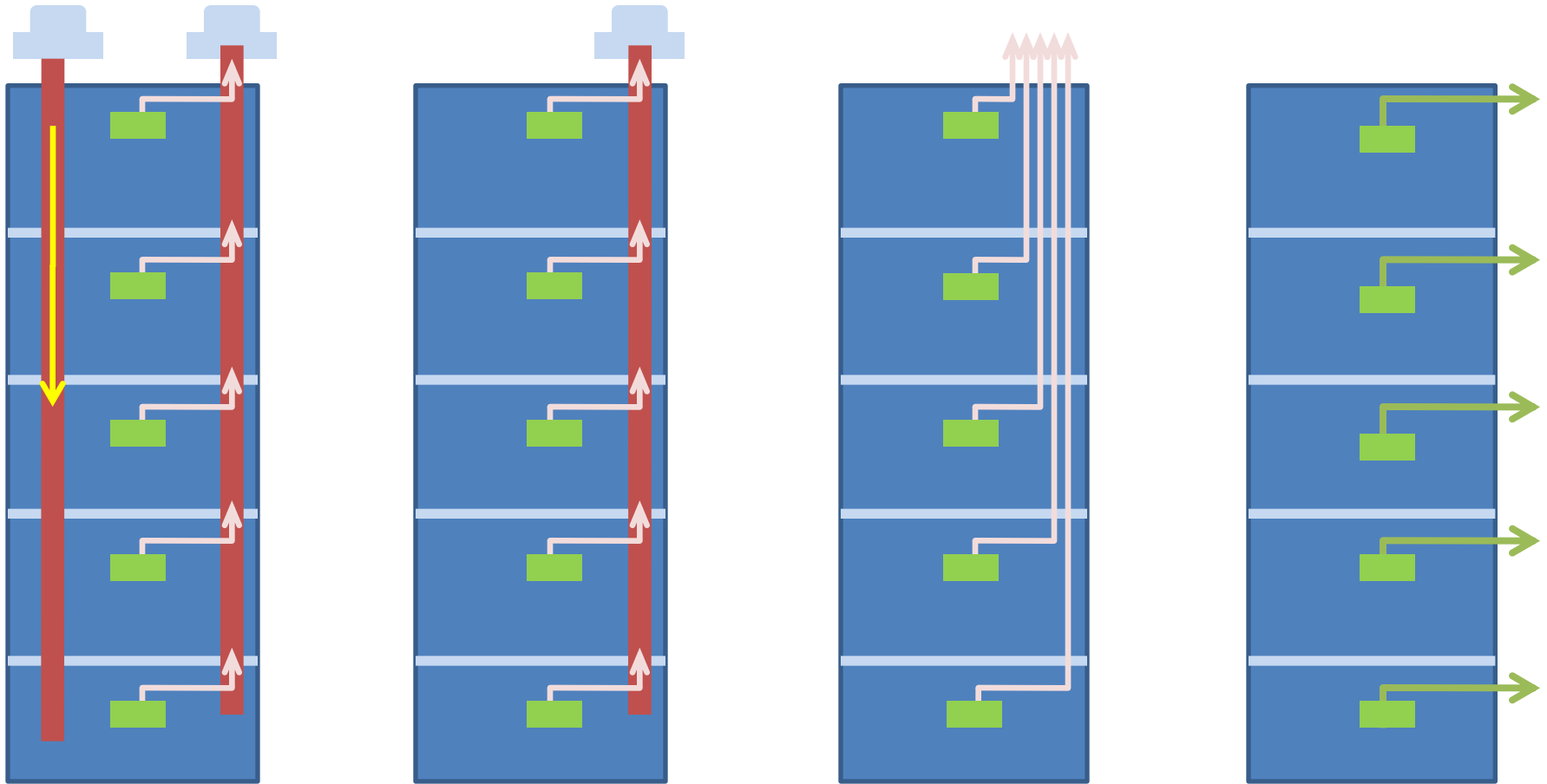
BUILT SMART



# Residential Space Heating



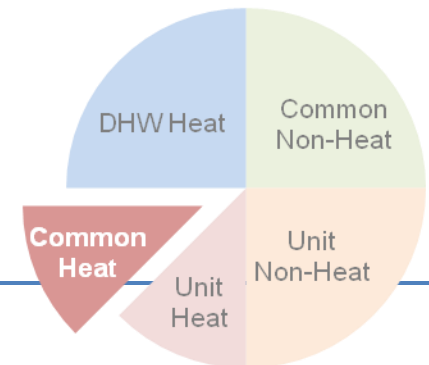
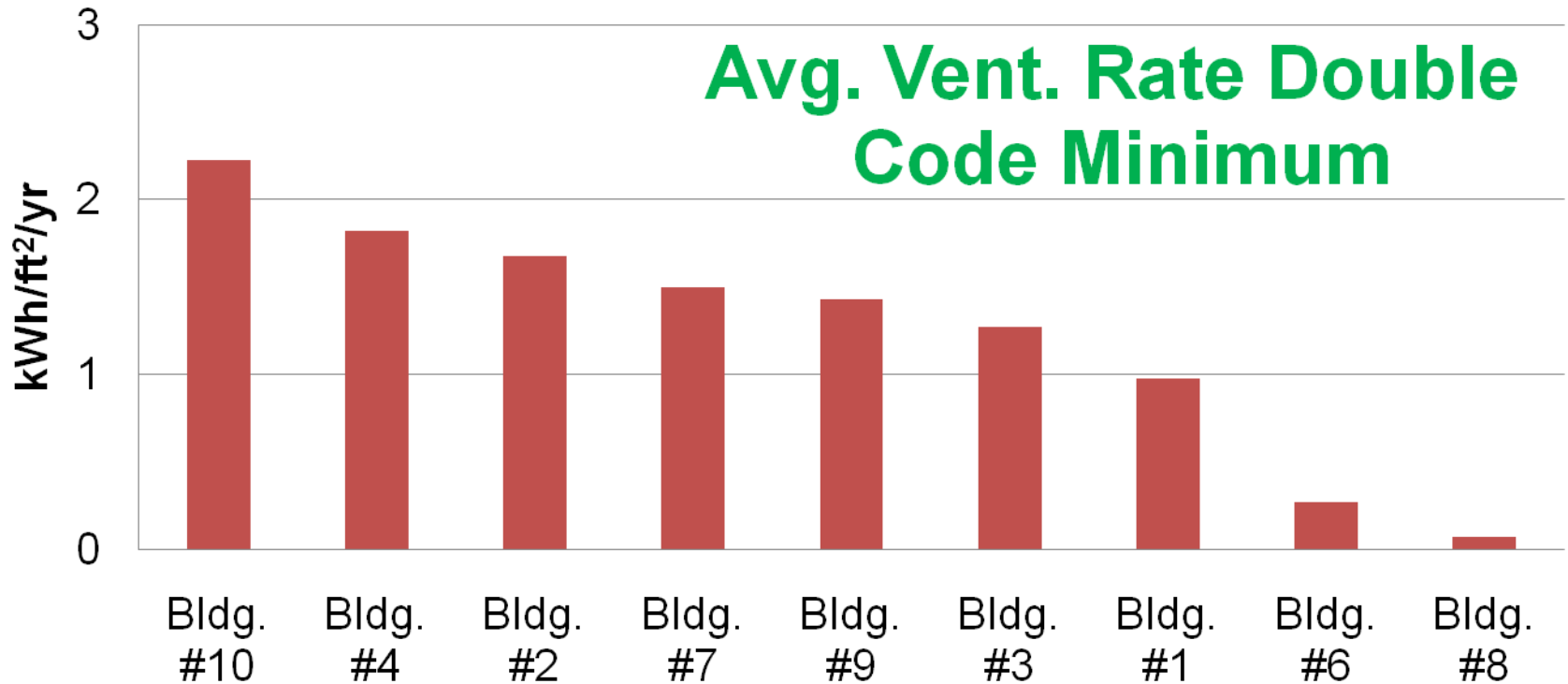
# Impacts of Unit Ventilation Design



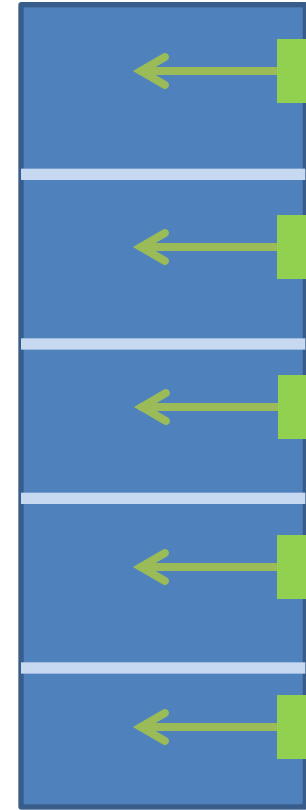
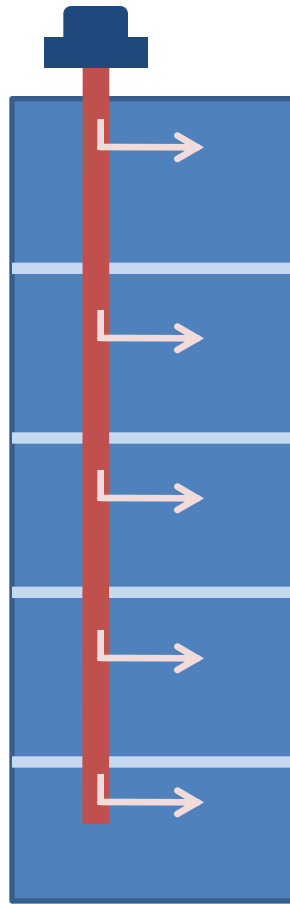
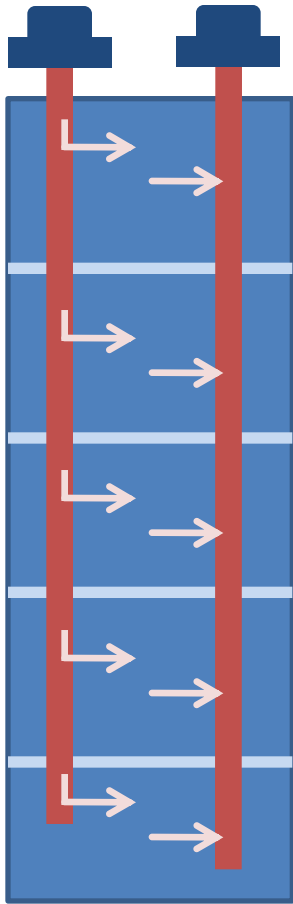
**Most Energy**

**Least Energy**

# Common Space Heating



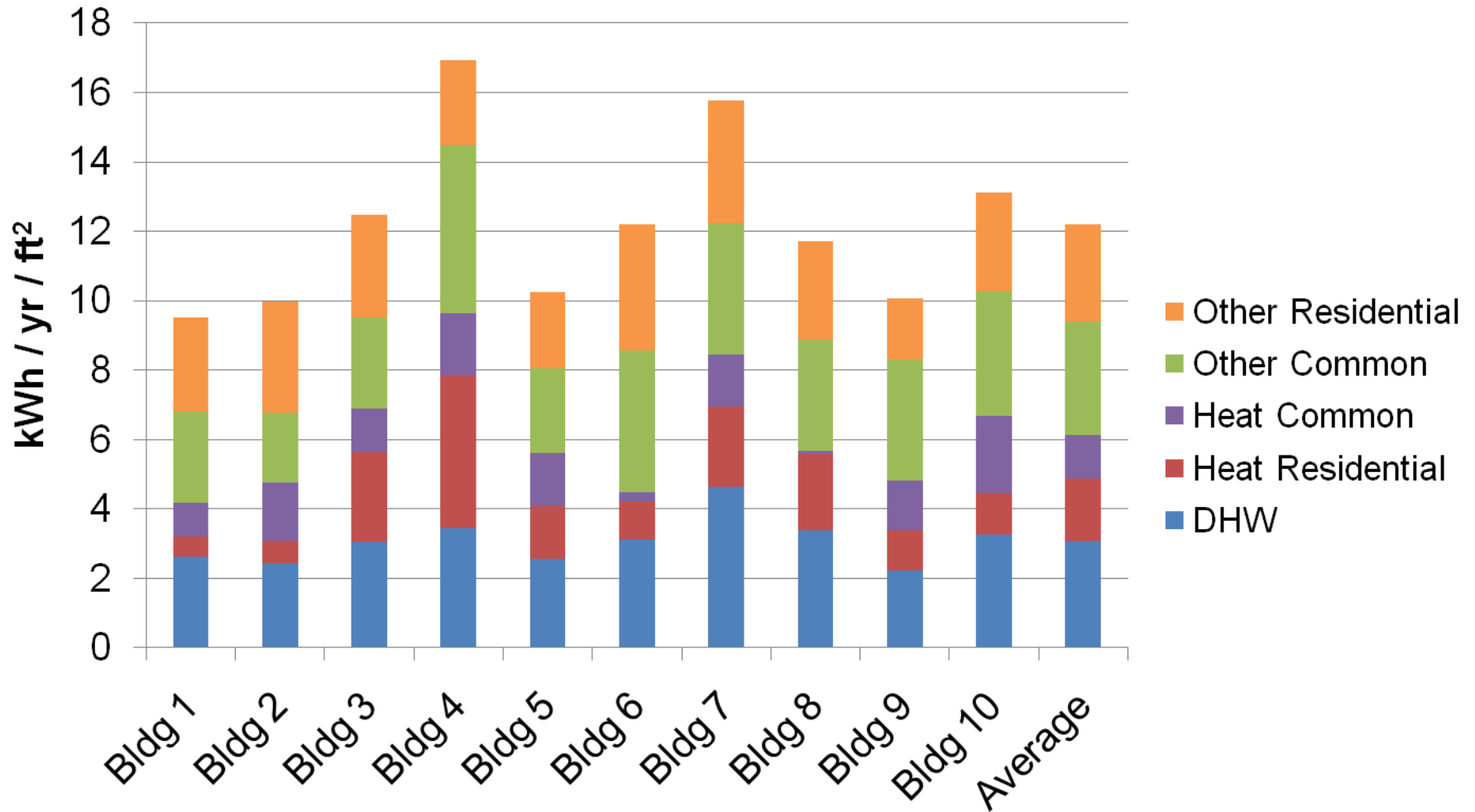
# Impacts of Corridor Ventilation Design



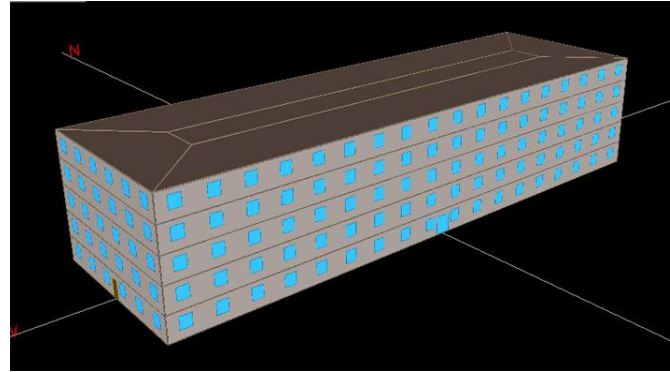
**Most Energy**

**Least Energy**

# Energy End-Use Breakdown



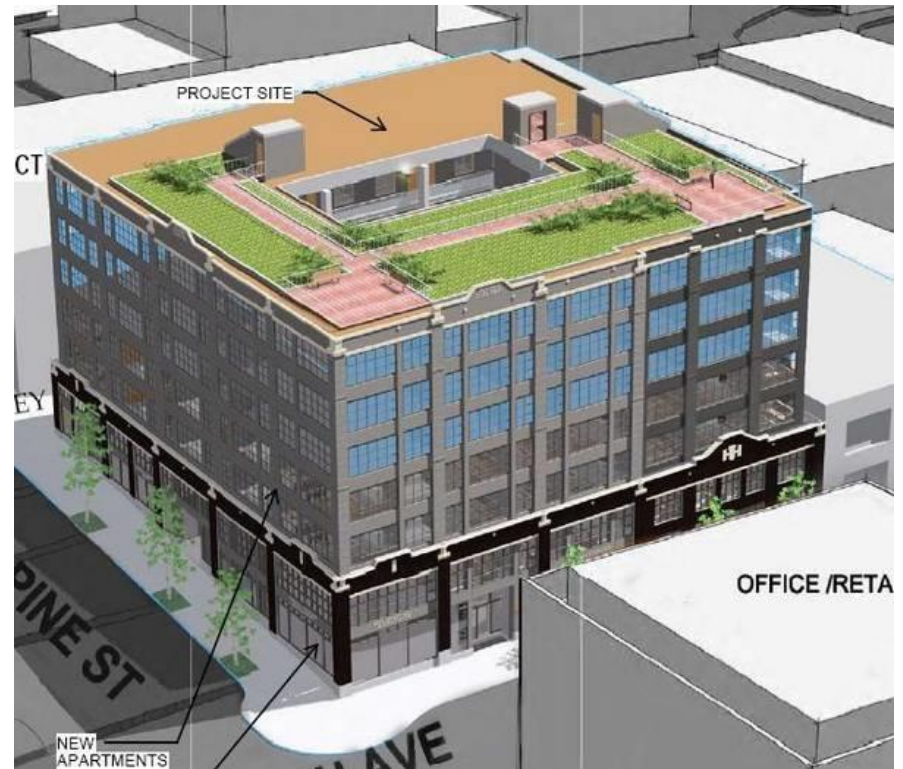
# Start By Calibrating the Energy Model



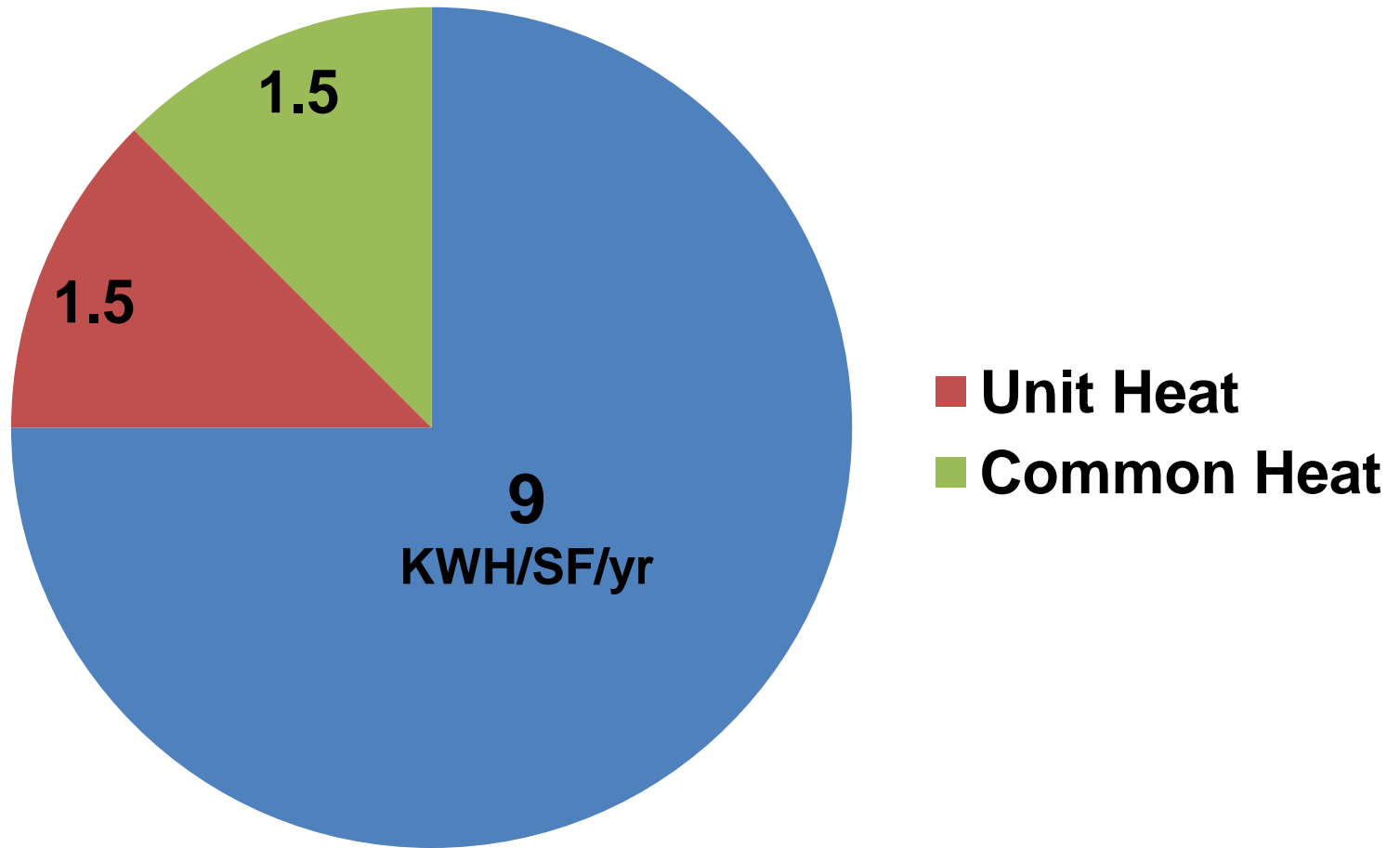
End Use	Wizard Default	Calibrated	Difference
DHW	128,500	200,676	36%
Other Common	75,532	221,464	66%
Other Residential	262,628	177,046	-48%
Heat Residential	59,080	107,880	45%
Heat Common	29,713	100,558	70%
TOTALS	555,453	807,623	31%
<b>EUI (kWh/ft2/yr)</b>	<b>8</b>	<b>12</b>	<b>33%</b>

# Low Hanging Fruit

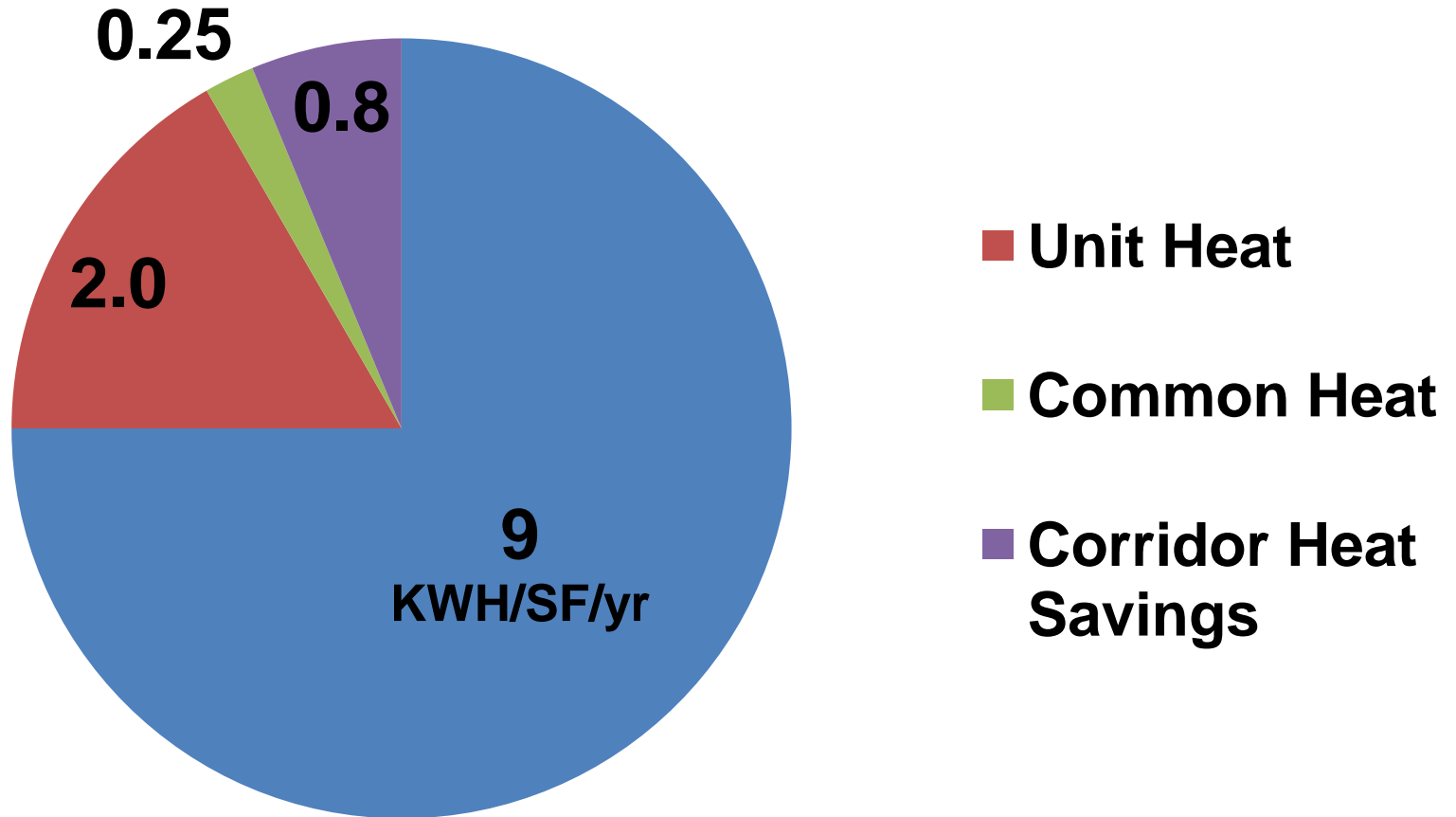
- Eliminate Heated Corridors
- EnergyStar
- Low Flow Plumbing Fixtures
- Heat Pump Water Heater



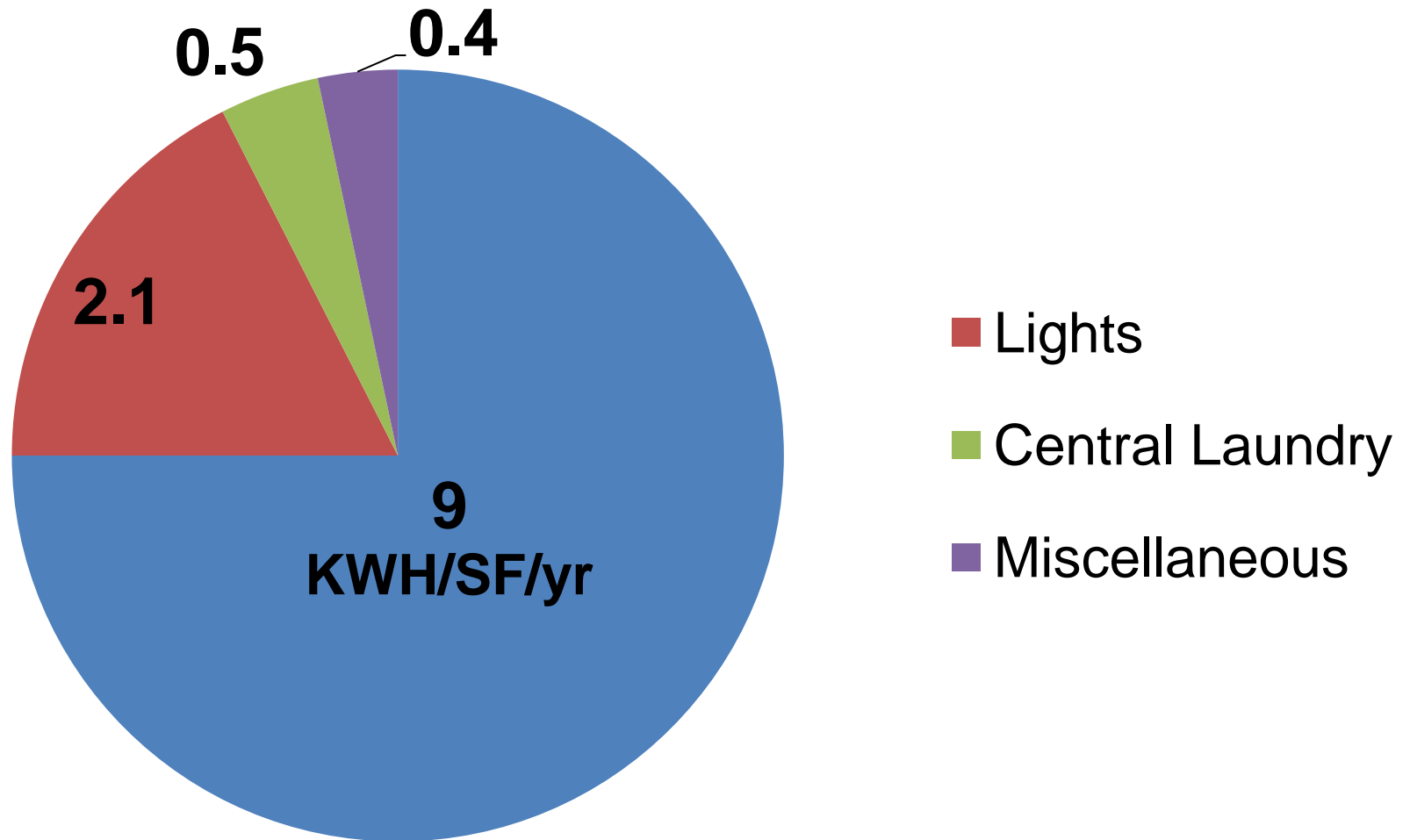
# Space Heating



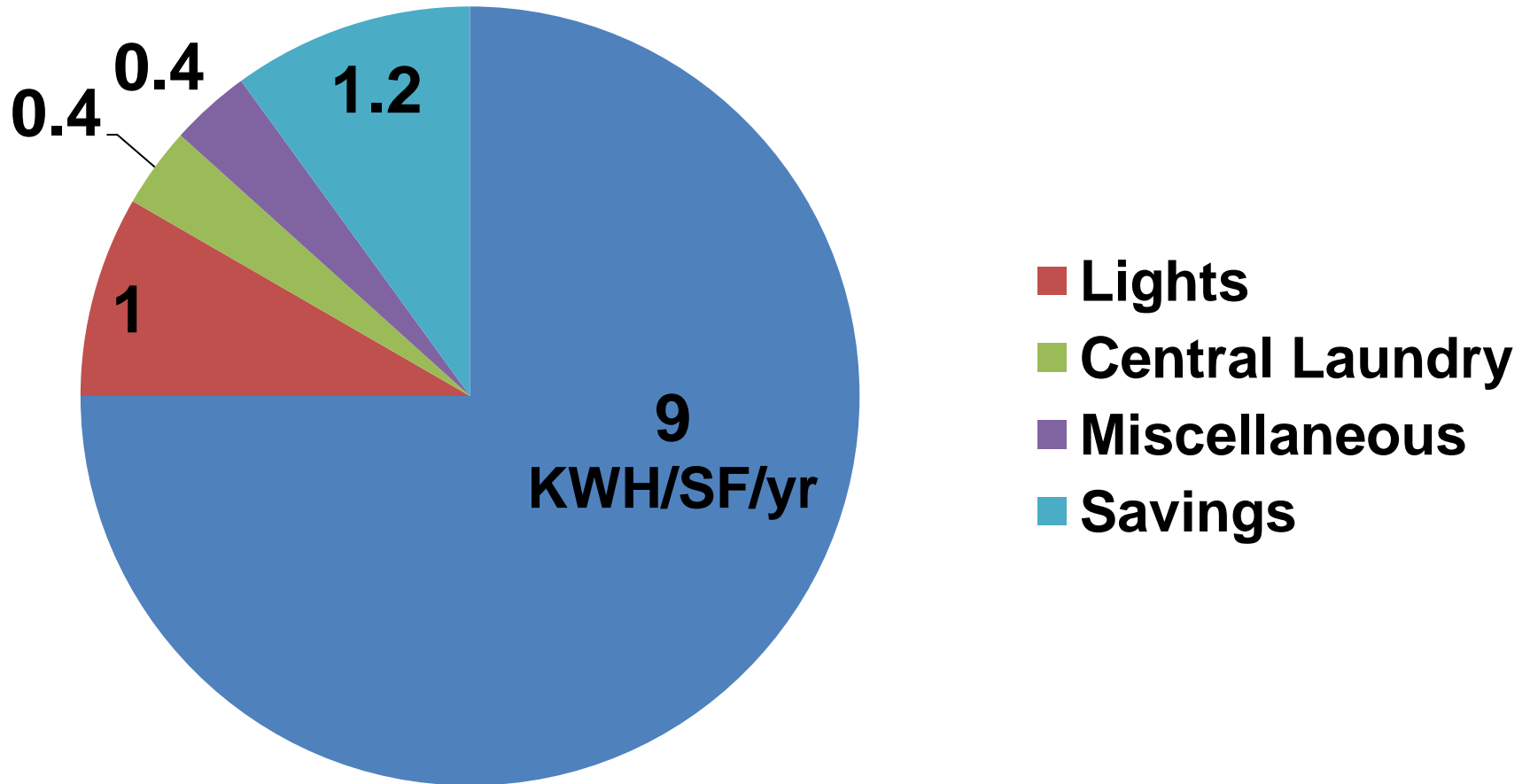
# Space Heating: Eliminate Central Corridors



# Common Area Non-Heating

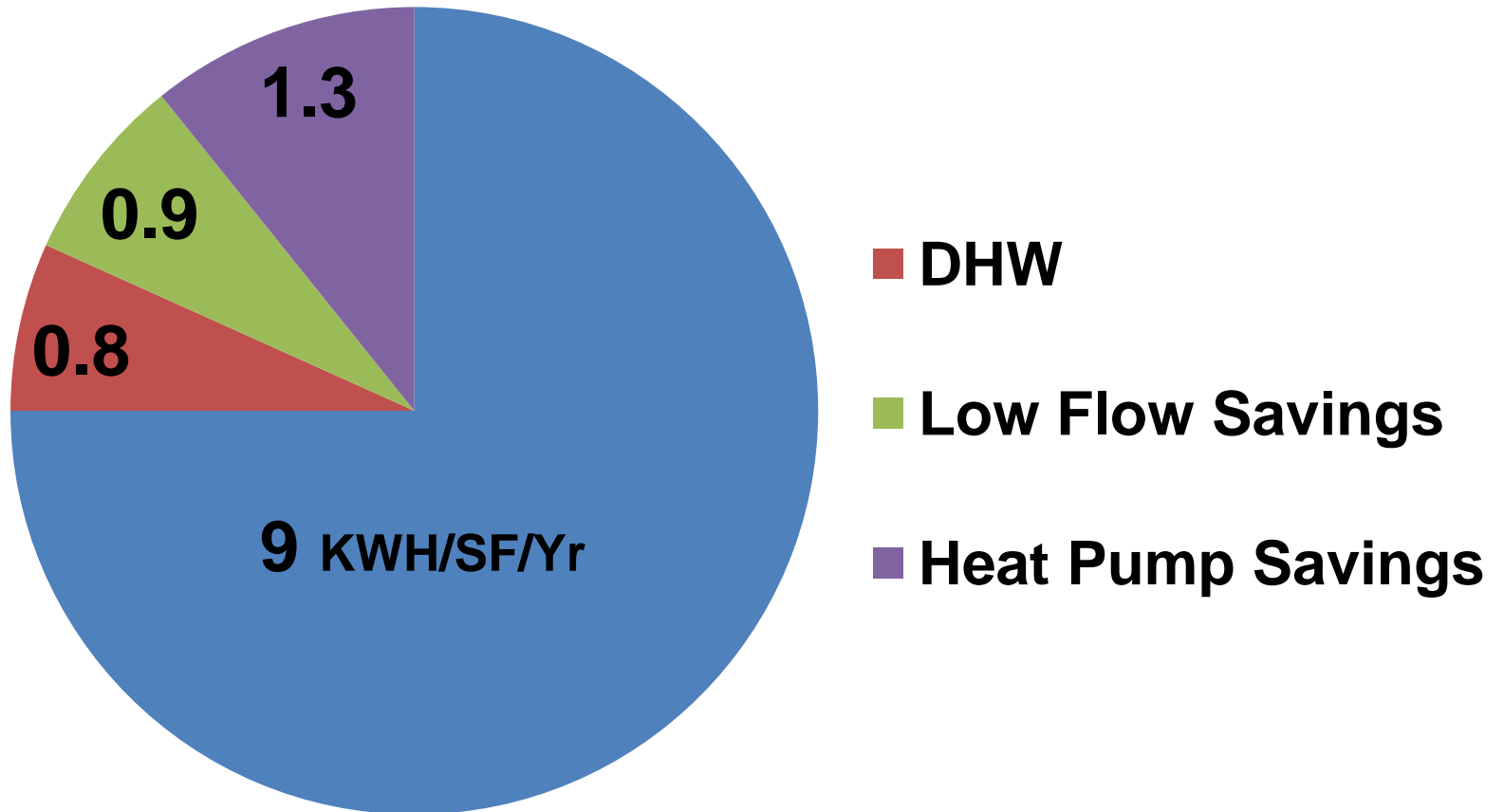


# Common Area Non-Heating: Eliminate Corridors, Efficient Laundry

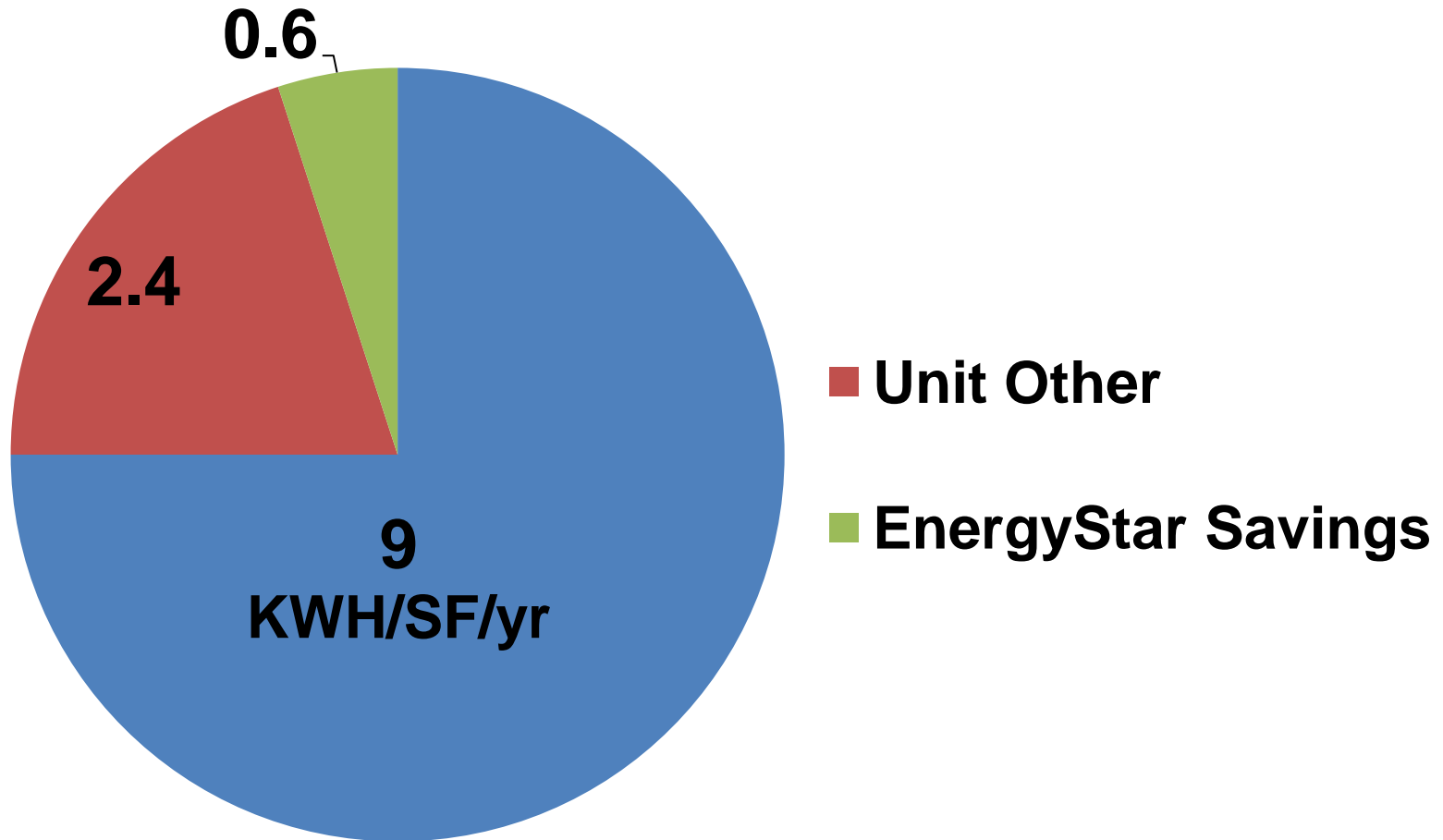


# Domestic Hot Water

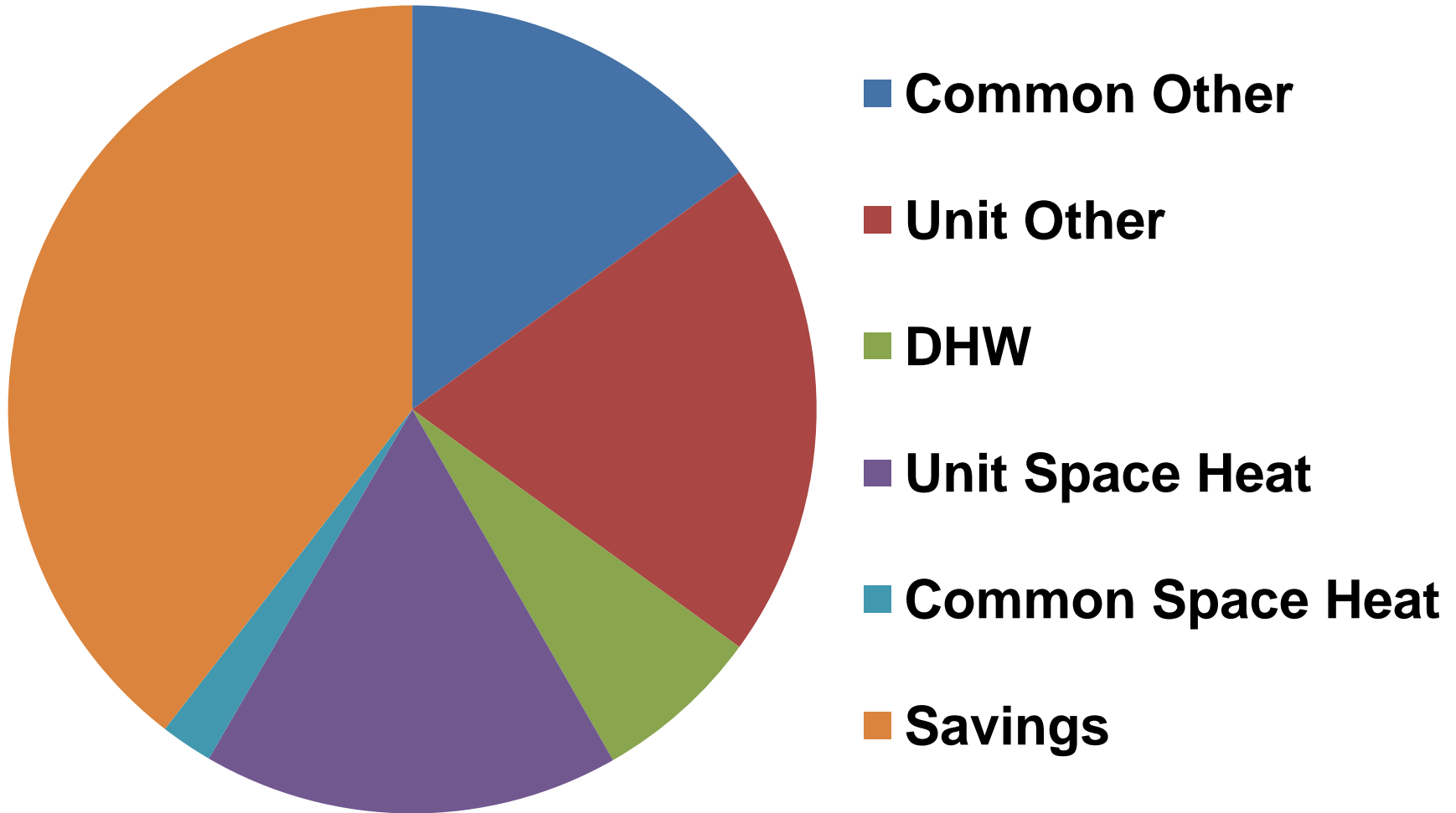
## Low Flow Fixtures, Reverse Cycle Chiller



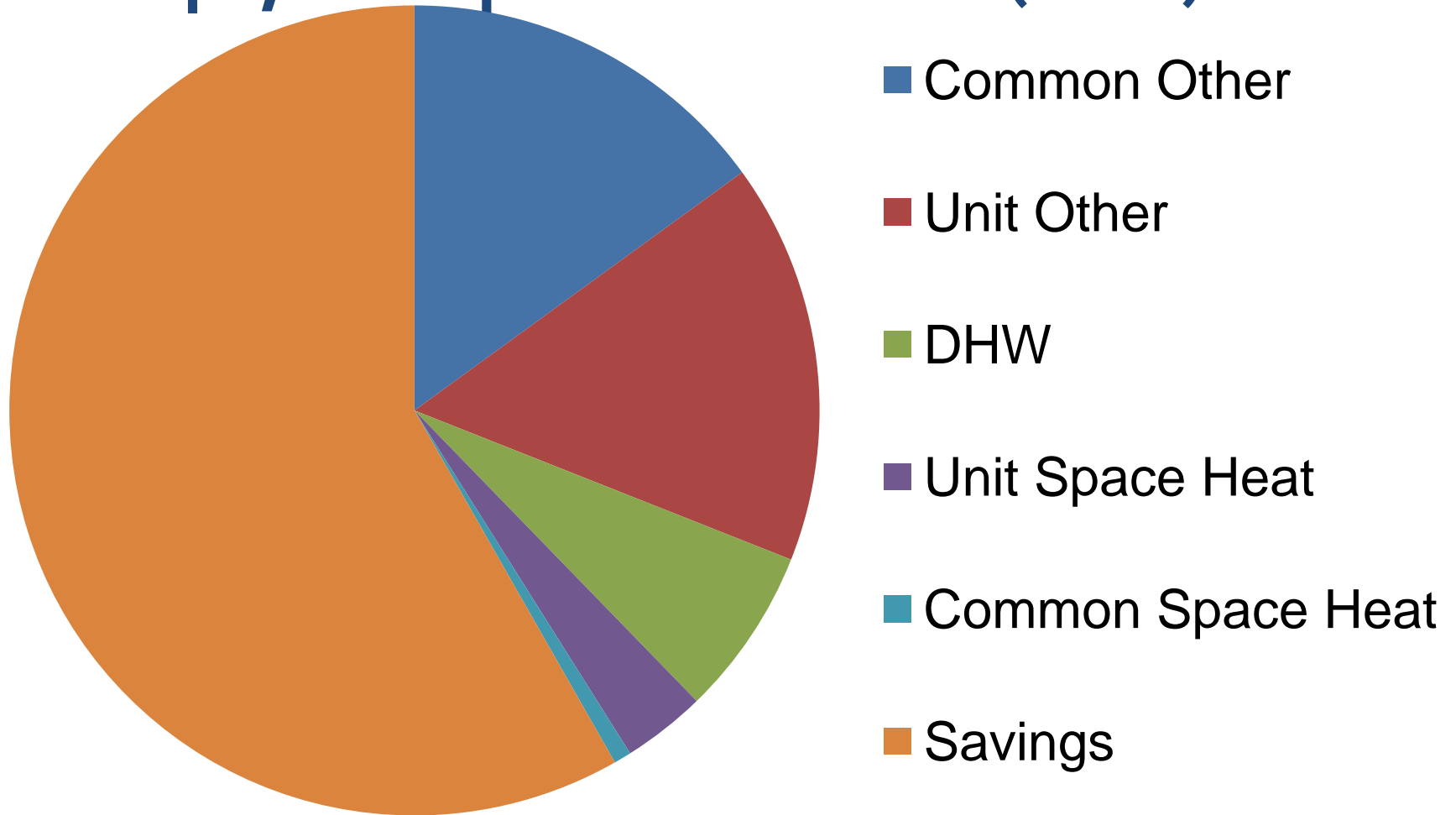
# Apartment Unit Non-Heat EnergyStar Lights and Appliances



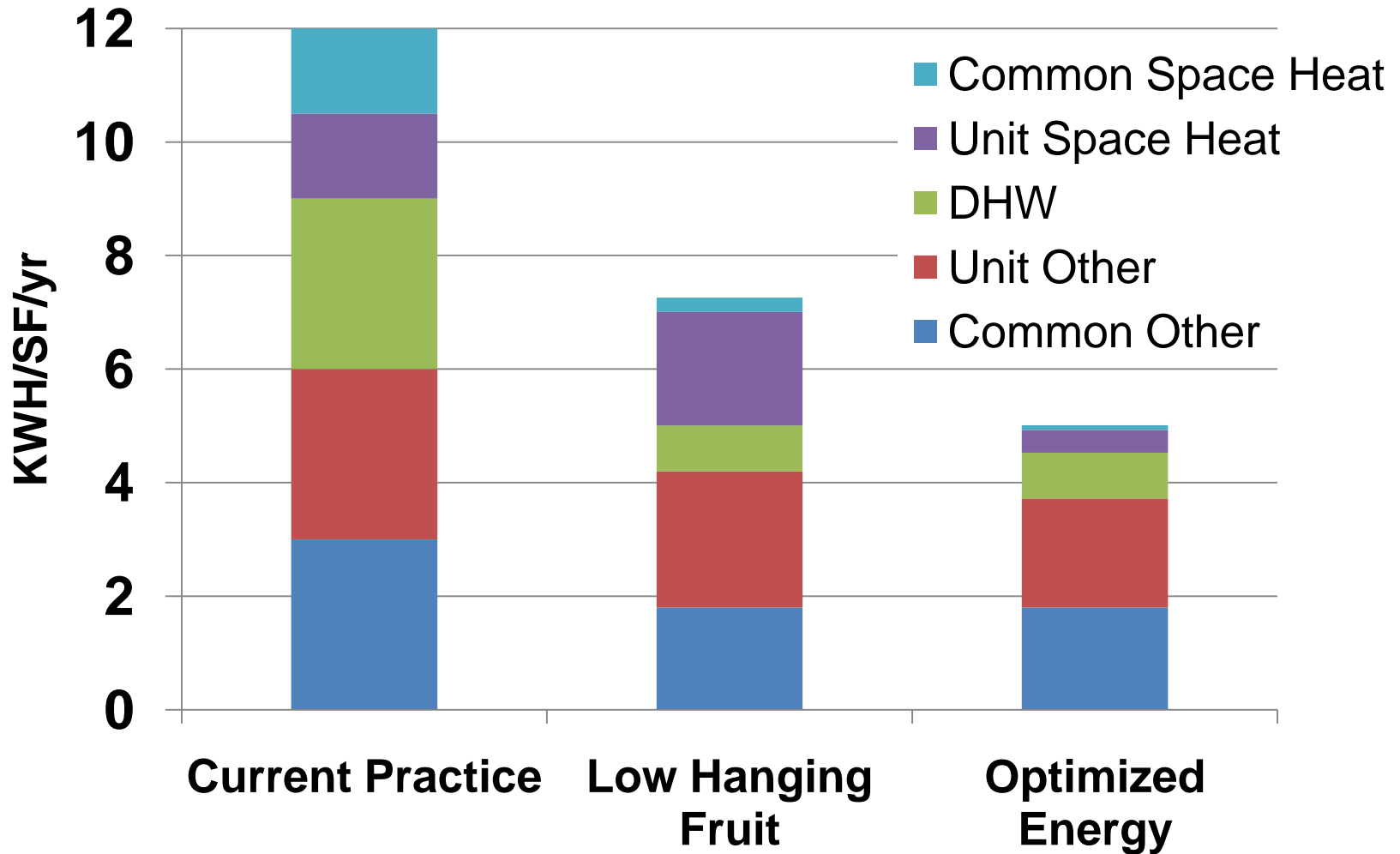
# Savings from Low-Hanging Fruit (40%)



# Low-Hanging Fruit + Envelope, Heat Pumps, Occupant Feedback (60%)



# Getting to Zero



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# Conclusions

- Common spaces 35-40% of total energy
  - Ventilation design impacts can be huge
  - DHW has moved from units to central gas
  - Overall energy use in multifamily has not changed much
  - There is still some low hanging fruit
  - EUI rules must be defined
-

# Questions/Comments:



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