



ComEd Residential and C&I Saturation/End-Use, Market Penetration & Behavioral Study

March 20, 2013



Research Objectives

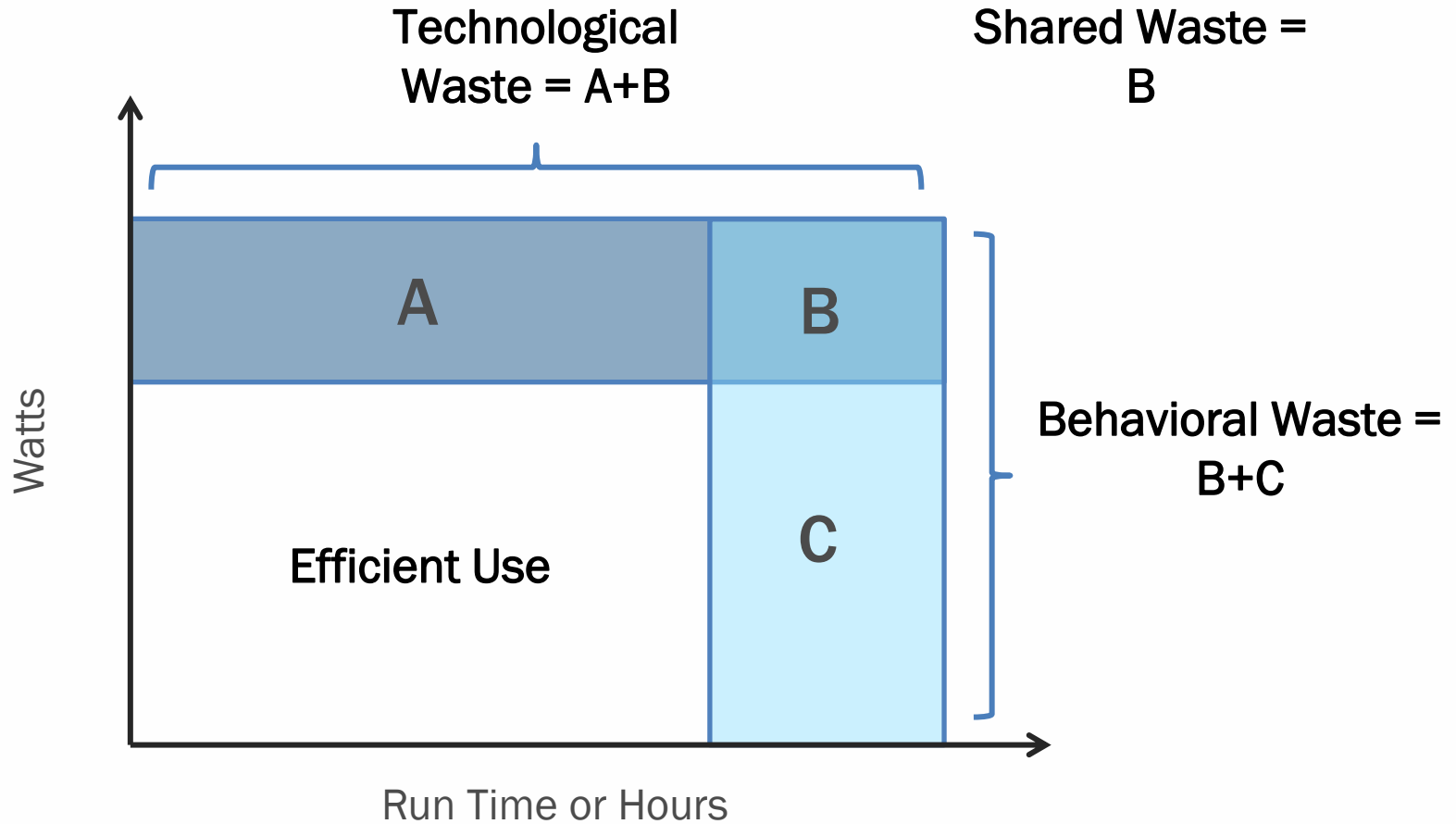
- Support ComEd's program planning and gap identification efforts
- Provide a comprehensive assessment of usage and waste at the end-use level
- Develop energy use profiles by end-use and segment that quantify:
 - Current usage
 - Energy waste due to inefficient technologies
 - Energy waste due to inefficient customer behaviors
 - “Efficient” energy usage



Methodology

- End-uses included in usage and waste analysis:
 - Residential
 - Lighting
 - Cooling
 - Electric Space Heating
 - Electric Water Heating
 - Major Appliances
 - Electronics & Computing
 - Commercial & Industrial
 - Lighting
 - Cooling
 - Ventilation
 - Refrigeration
 - Motors
 - Office Equipment
- Extensive primary data collection and metering
- Determination of efficient technologies and behaviors for each end-use
- Enhanced engineering analysis to assess energy usage and waste

Conceptualizing Usage and Waste

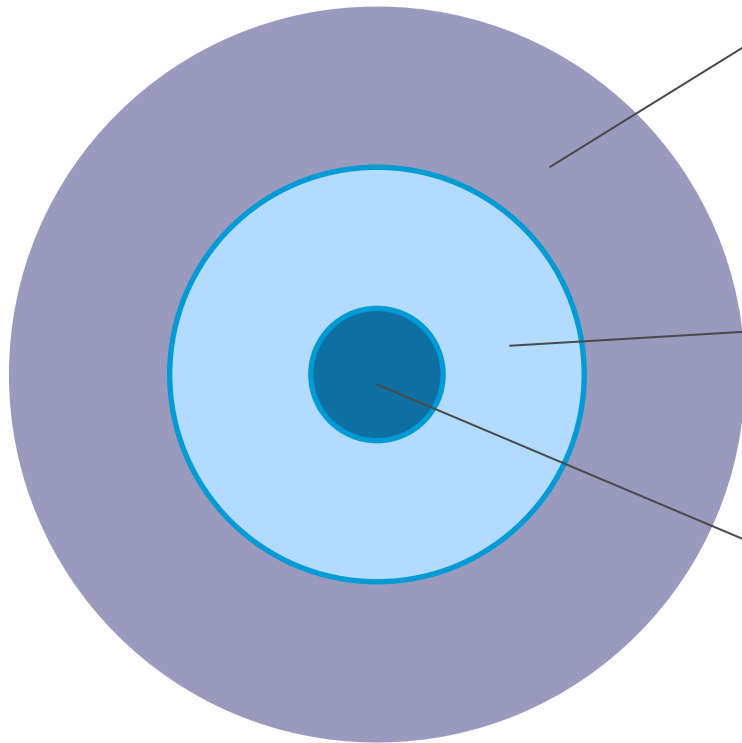




Residential Study

Residential Primary Data Collection

June - October 2012



Mail Survey: 4,414 completes

- Penetration/saturation
- Behavioral/operational practices

In-Home Audits: 297 completes

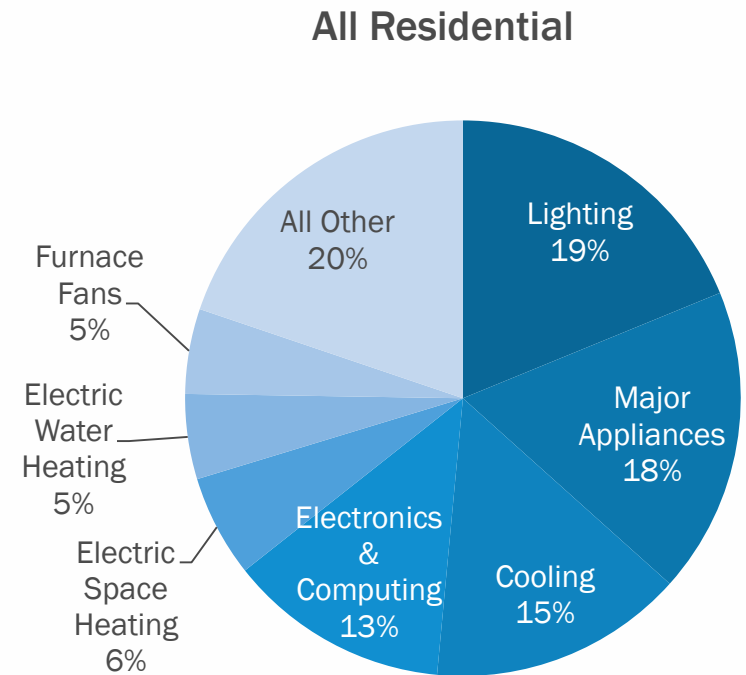
- Penetration/saturation
- Equipment technical specifications

Monitoring: 140 completes

- Current logging on all circuits
- Lighting /occupancy
- Temperature and humidity

Residential End-Use Profile: Current Usage

	All Res.	Single Family	Multi-family
Lighting	19%	21%	13%
Major Appliances	18%	17%	20%
Cooling	15%	15%	12%
Electronics & Computing	13%	12%	17%
Electronic Space Heating	6%	4%	14%
Electric Water Heating	5%	3%	12%
Furnace Fans	5%	5%	3%
All Other	20%	23%	7%
TOTAL	100%	100%	100%



Residential Usage and Waste Summary

Annual GWh for ComEd Residential Customers¹

	<i>EFFICIENT USAGE</i>	<i>TOTAL WASTE</i>	<i>% WASTE</i>
Lighting	1,320	4,208	76%
Cooling	1,553	2,715	64%
Appliances	2,639	966	27%
Electronics	1,737	997	36%
Space Heating	1,672	216	11%
Water Heating	1,084	379	26%
Miscellaneous ²	3,933		n/a
Other ²	5,754		n/a



¹ Values sum to total 2011 GWh for in-scope residential customers

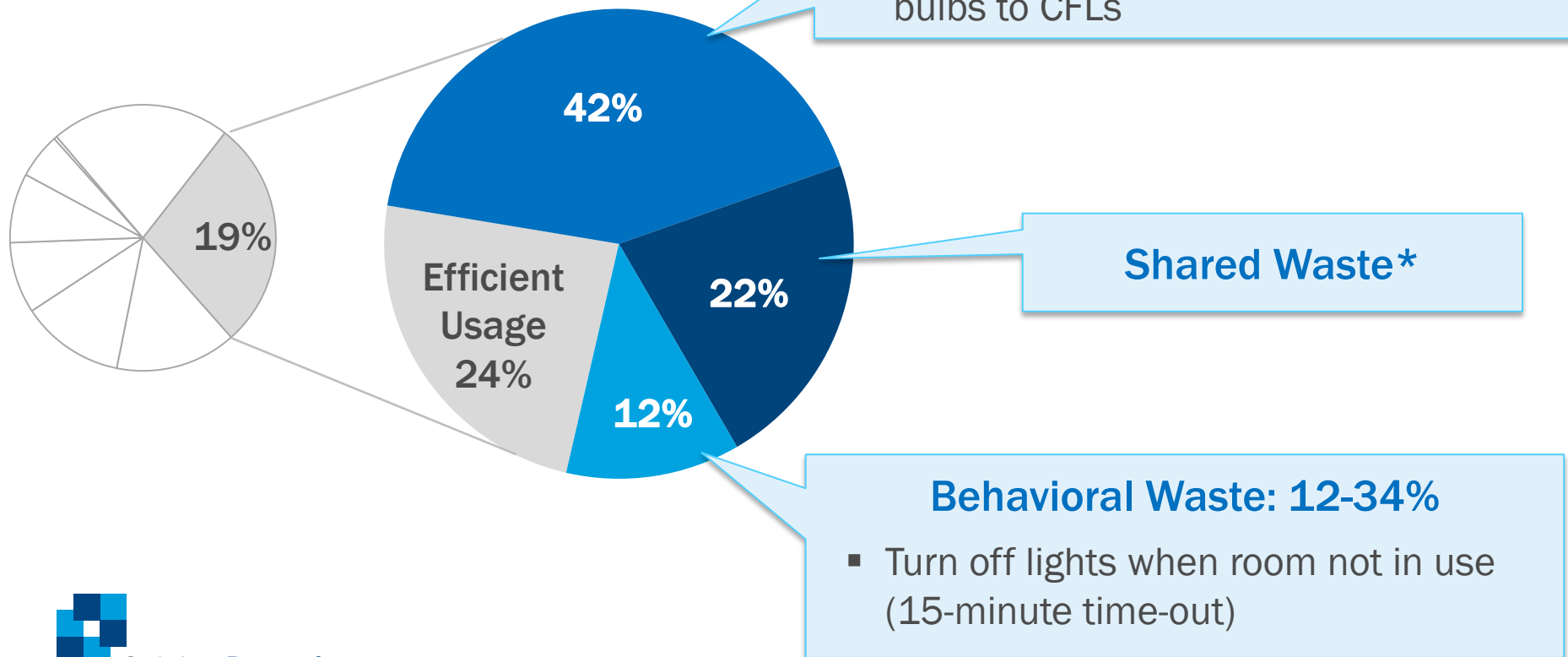
² Total current usage, waste not estimated

Residential Lighting Usage and Waste Results

Penetration: 100%

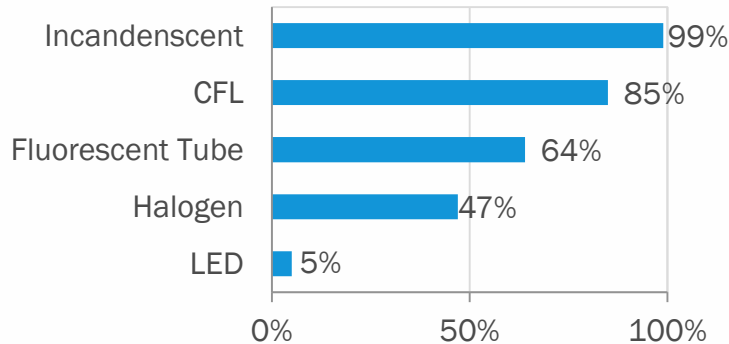
Current Usage: 5,528 GWh

Current Waste: 4,208 GWh



Residential Lighting Highlights

Penetration by Bulb Type



	Single Family	Multi-Family
Incandescent	100%	98%
CFL	90%	75%
Fluorescent Tube	72%	49%
Halogen	50%	40%
LED	7%	3%

- Lighting technology waste is high due to high socket saturation of incandescents
- Socket saturation of CFLs still relatively low
- Very few homes have LEDs

- Single family homes have higher CFL penetration but lower socket saturation compared to multi-family homes

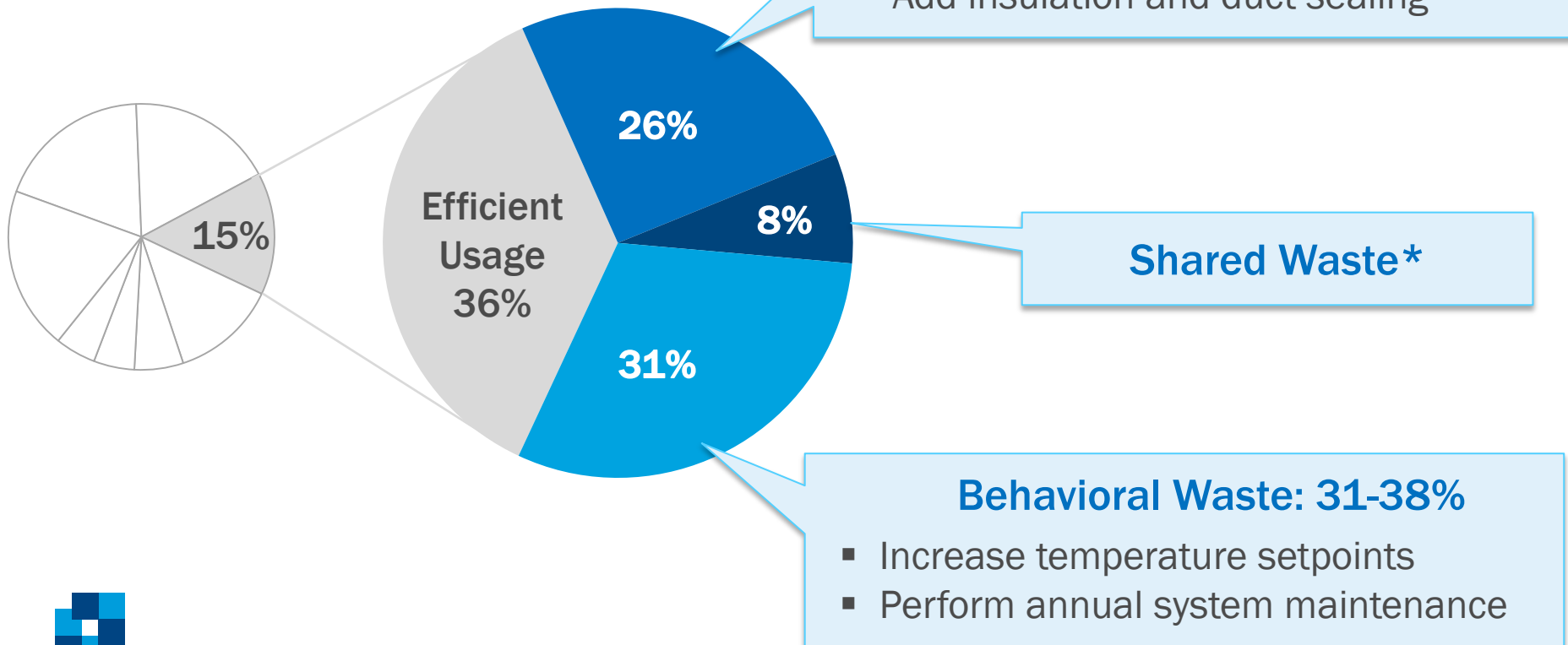
	All Res.	Single Family	Multi-family
Mean number of light bulbs	57	73	29
% incandescent bulbs	63%	65%	56%
% CFLs	23%	20%	27%
% fluorescent tubes	7%	8%	6%
% halogen	6%	4%	8%

Residential Cooling Usage and Waste Results

Penetration: 97%

Current Usage: 4,268 GWh

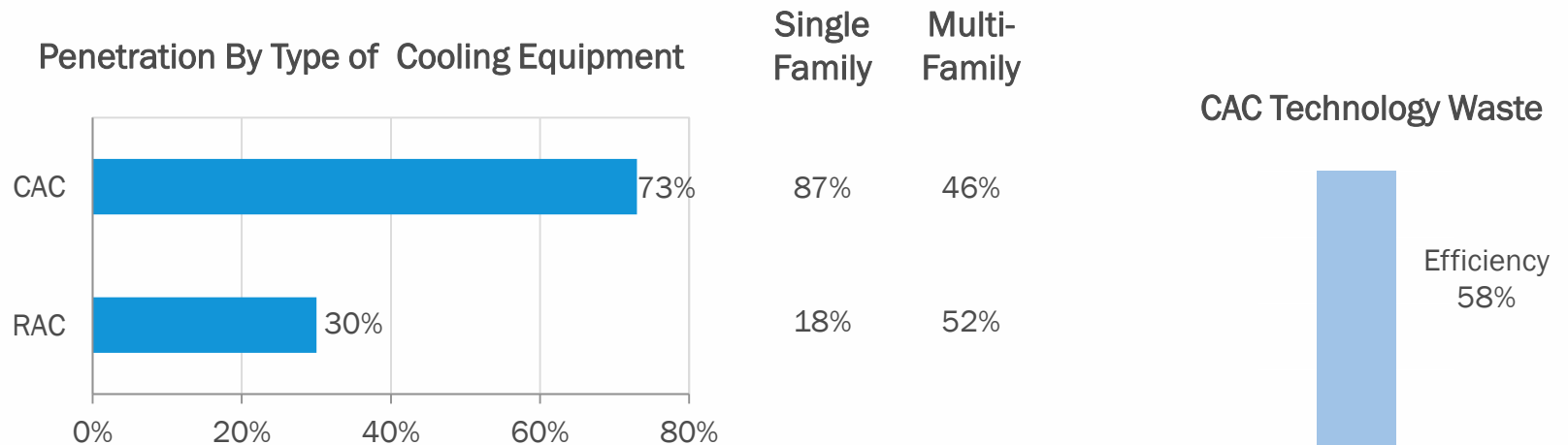
Current Waste: 2,715 GWh



Opinion **Dynamics**

* Either technology or behavioral waste, depending on which is addressed first

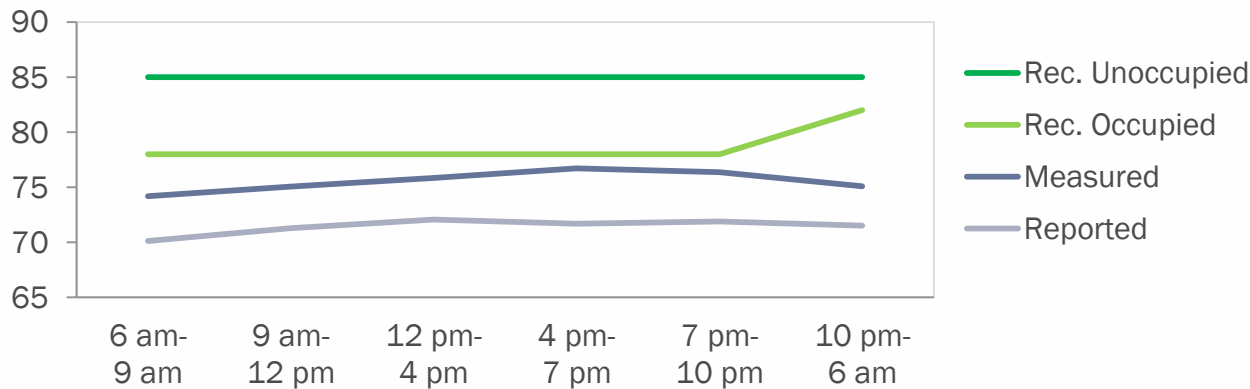
Residential Cooling Highlights: Technology Waste



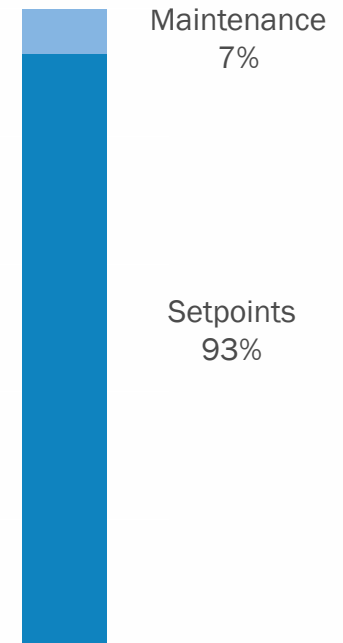
- 73% of households have CAC
- CAC represents 94% of cooling usage
- Upgrading to efficient units presents largest opportunity for technology savings
- Estimated categories of waste are interactive

Residential Cooling Highlights: Behavioral Waste

CAC Setpoints: Reported, Measured, and Recommended



CAC Behavioral Waste



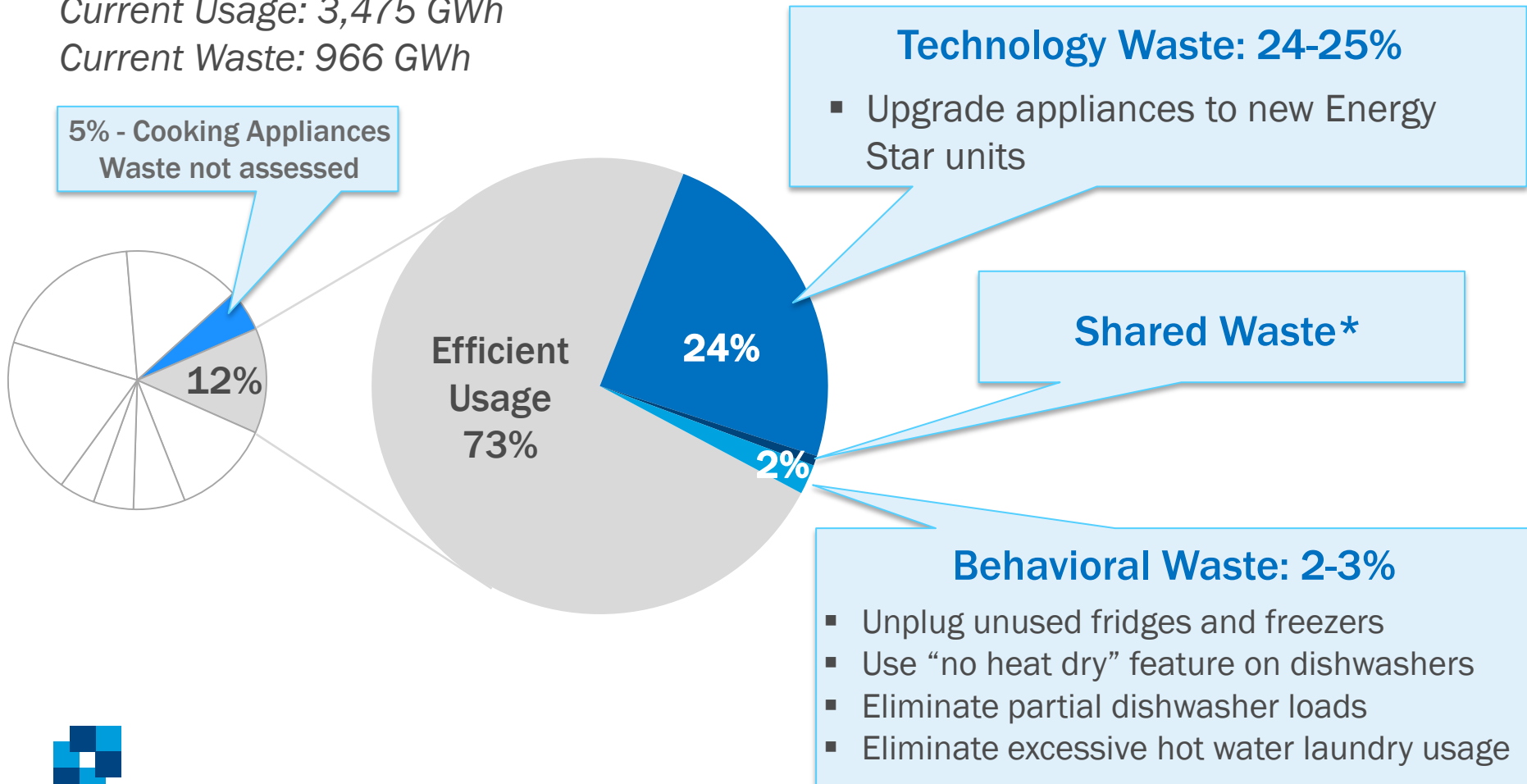
- Significant opportunities for savings from increasing setpoints
- But recommended setpoints are high
- Measured setpoints are higher than self-reported
- Estimated categories of waste are interactive

Residential Appliance Usage and Waste Results

Penetration: 100%

Current Usage: 3,475 GWh

Current Waste: 966 GWh

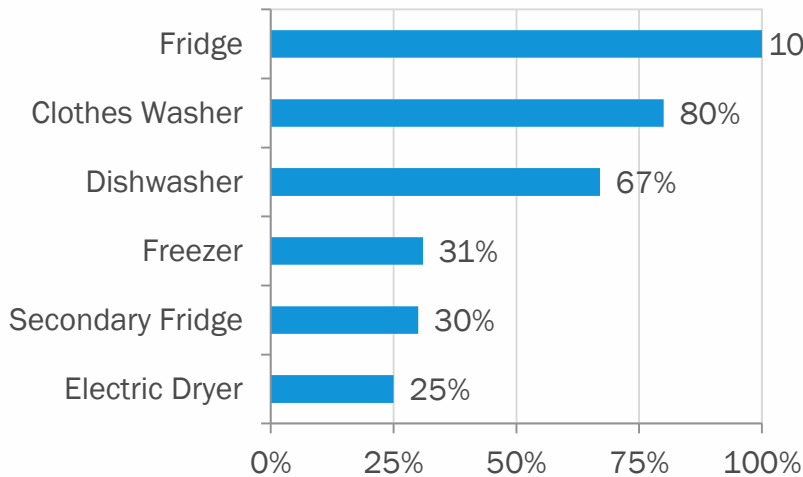


Opinion **Dynamics**

* Either technology or behavioral waste, depending on which is addressed first

Residential Appliance Highlights

Penetration by Appliance Type

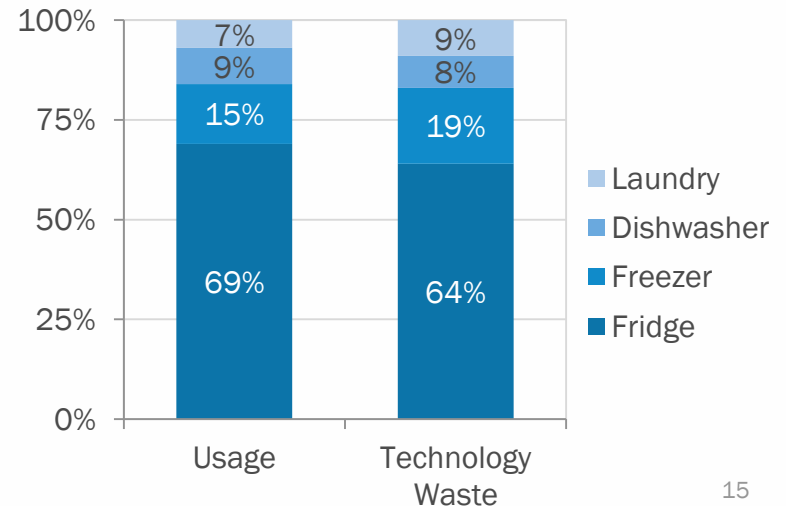


Single Family Multi-Family

- Relatively low incidence of electric dryers
- 42% of single family homes have secondary fridge

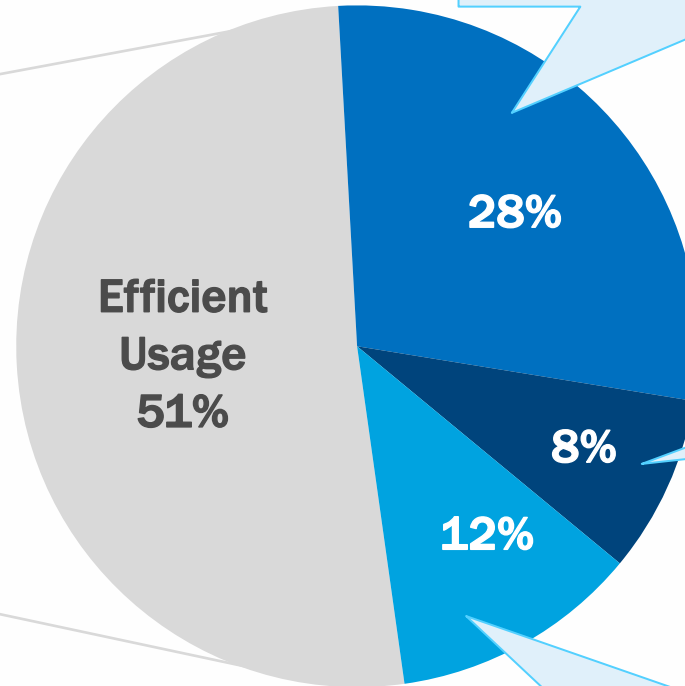
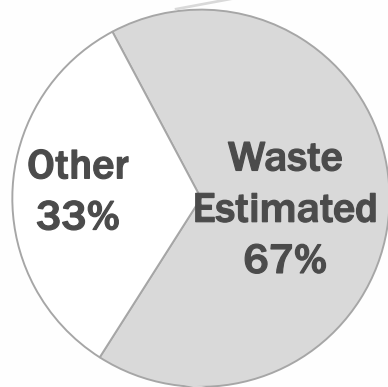
- Few units meet current Energy Star standards
- Freezers tend to be older and less efficient than fridges

Contribution to Appliance Usage and Waste



Residential Usage and Waste Summary

Energy Use Classified
in Baseline Study



Technological Waste: 28-37%

Shared Waste*

Behavioral Waste: 12-20%

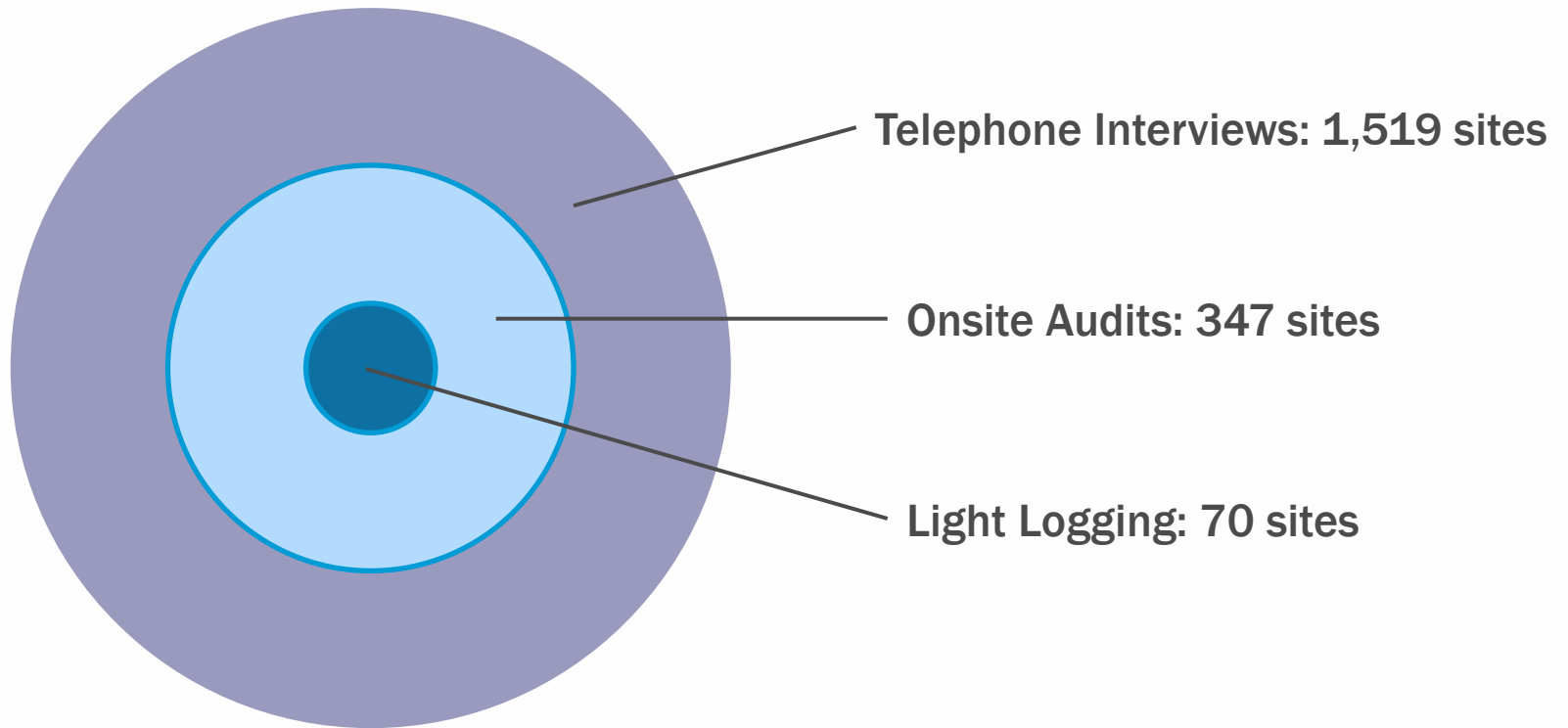




Commercial & Industrial Study

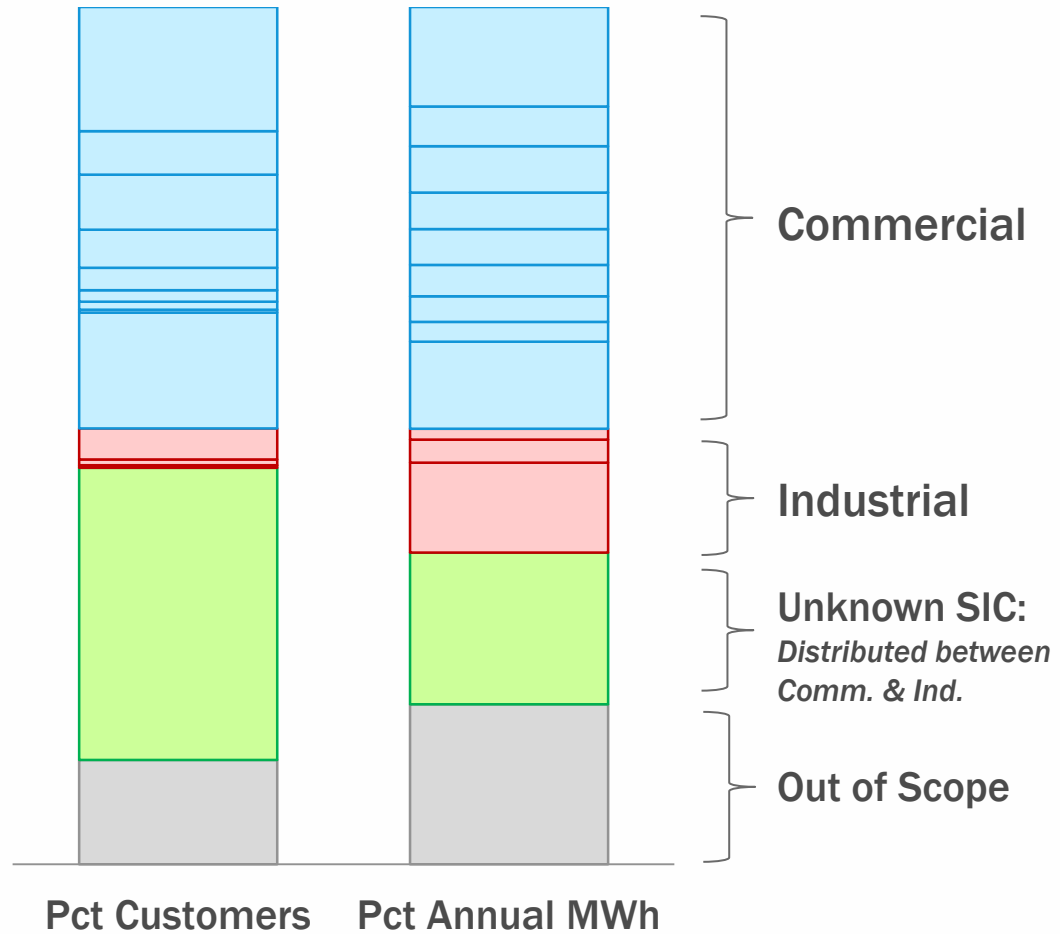
C&I Primary Data Collection

July – November 2012



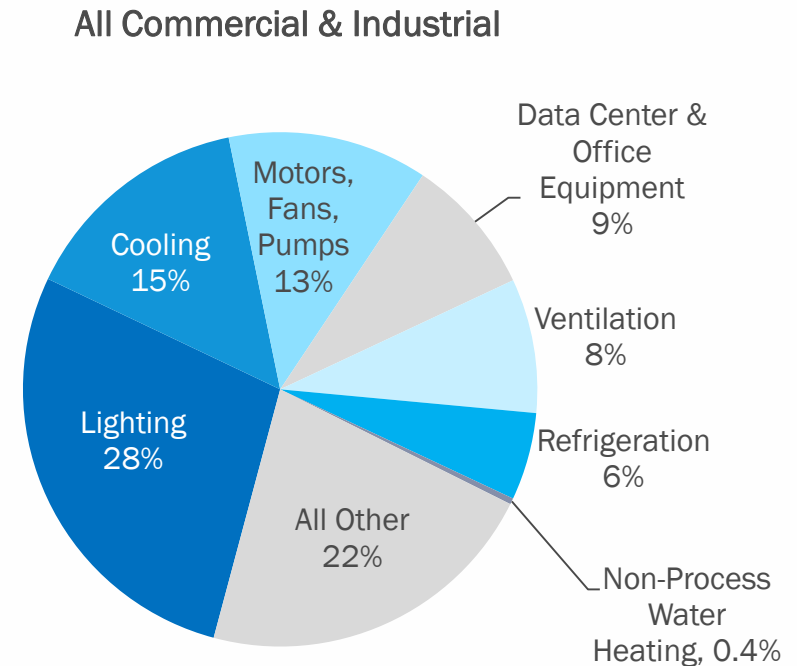
ComEd Commercial & Industrial Customers

- Office Buildings
- Health Services
- Retail
- Food Service
- Warehouse
- Grocery/Convenience
- Education
- Lodging/Hospitality
- Other Commercial
- Less than 100 kW
- 100-400 kW
- Greater than 400 kW
- Unknown Sector
- Out of Scope



C&I End-Use Profile: Current Usage

	All C&I	Comm. Total	Industrial Total
Lighting	28%	31%	17%
Cooling	15%	15%	11%
Ventilation	8%	9%	7%
Motors, Pumps	13%	6%	36%
Refrigeration	6%	6%	1%
Data Center & Office Eqpt	9%	10%	3%
Non-Process Water Heating	0.4%	0.4%	0.2%
All Other	22%	22%	25%
<i>TOTAL</i>	<i>100%</i>	<i>100%</i>	<i>100%</i>



C&I Usage and Waste Summary

Annual GWh for ComEd Commercial & Industrial Customers¹

	<i>EFFICIENT USAGE</i>	<i>TOTAL WASTE</i>	<i>% WASTE</i>
Lighting	4,581	6,346	58%
Cooling	3,605	2,159	37%
Ventilation	2,940	368	11%
Motors ²	4,739	185	4%
Office Eqpt ³	1,415	1,981	58%
Refrig.	1,264	892	41%
All Other	8,689		n/a



¹ Values sum to total 2011 GWh for in-scope C&I customers

² Includes motors, fans and pumps

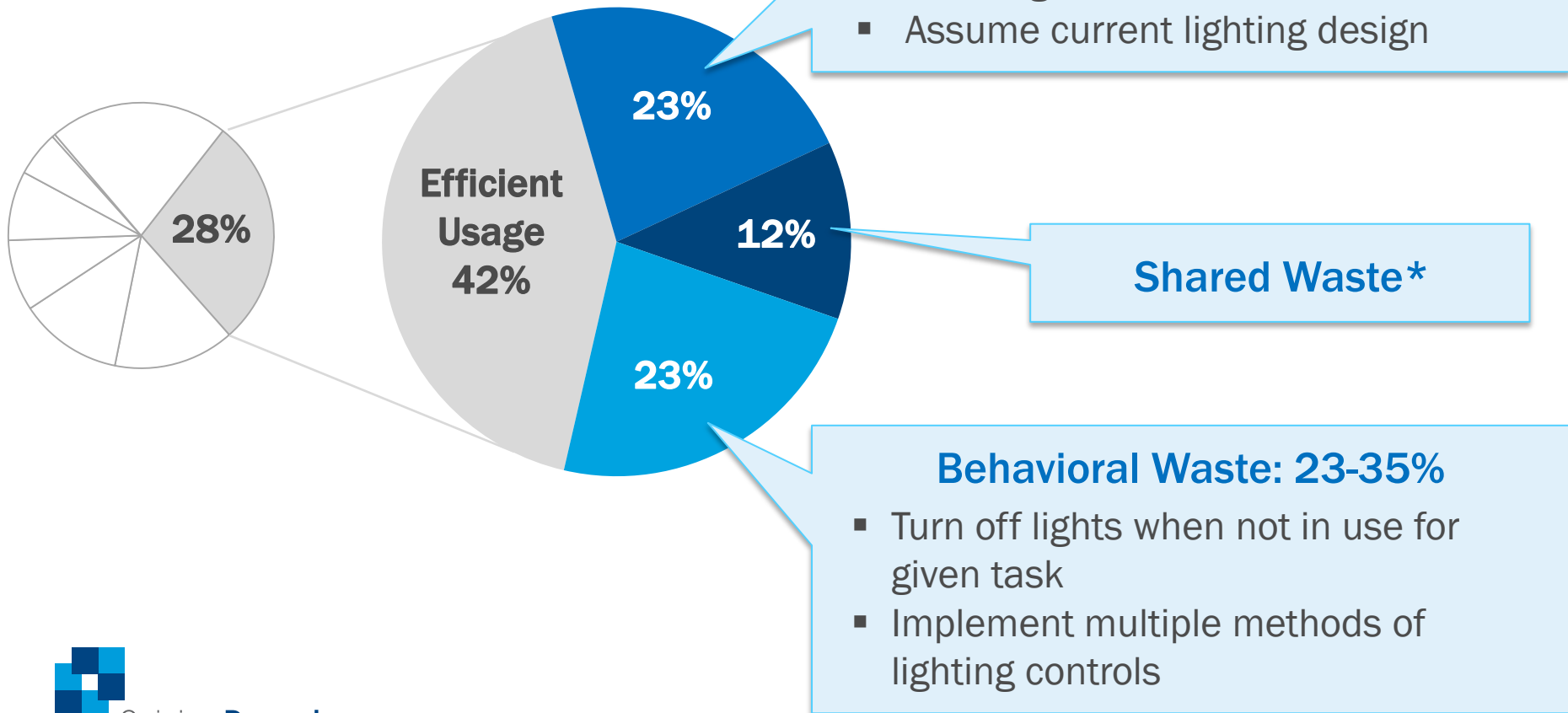
³ Includes computers, imaging equipment, servers, TVs, cash registers

C&I Lighting Usage & Waste Results

Penetration: 100%

10,926 GWh Current Usage

6,356 GWh Current Waste

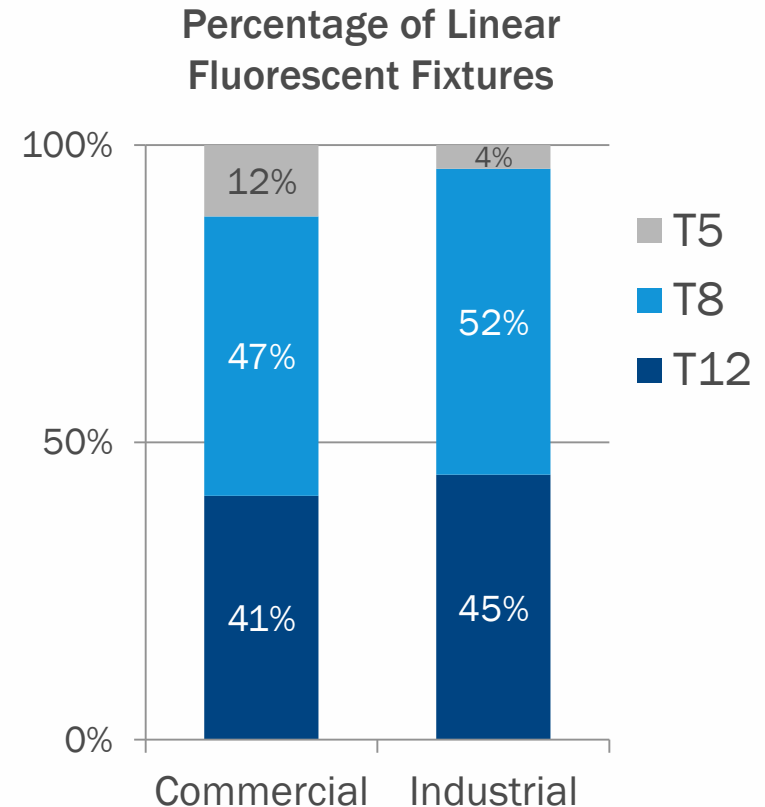


Opinion **Dynamics**

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Lighting Technological Waste Highlights

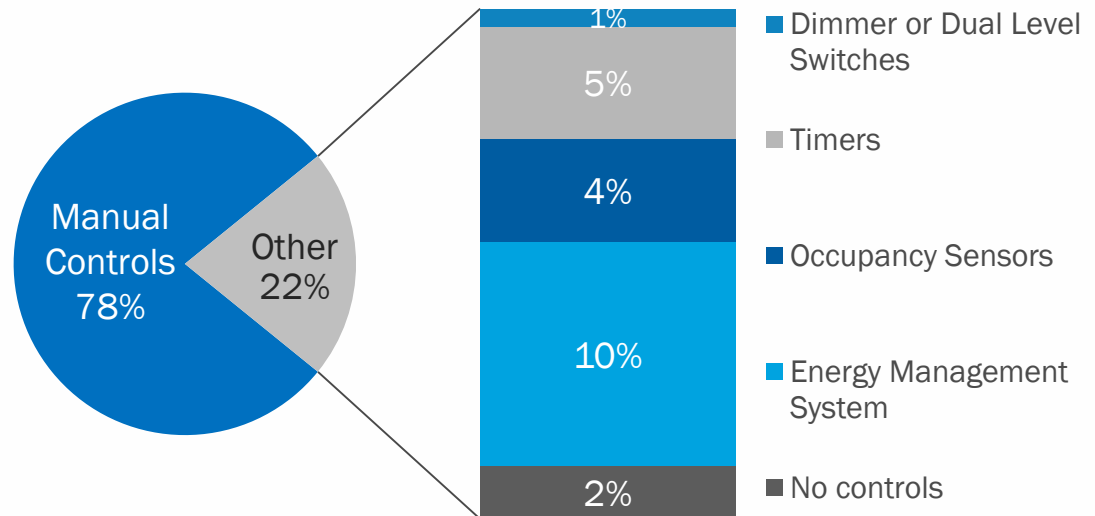
- T12s are common
 - Penetration of T12s is higher than T8s
 - Saturation of T8s slightly higher than T12s
- Technological waste highest in industrial and lodging segments
 - Industrial: Driven by metal halides and T12s
 - Lodging: Driven by incandescents and T12s



Lighting Behavioral Waste Highlights

- 30% waste from leaving lights on when space is not occupied (allowing for 15-minute time-out)
- Behavioral waste also highest for industrial and lodging segments
- High penetration of manual controls

Percentage of Light Fixtures with Control Types

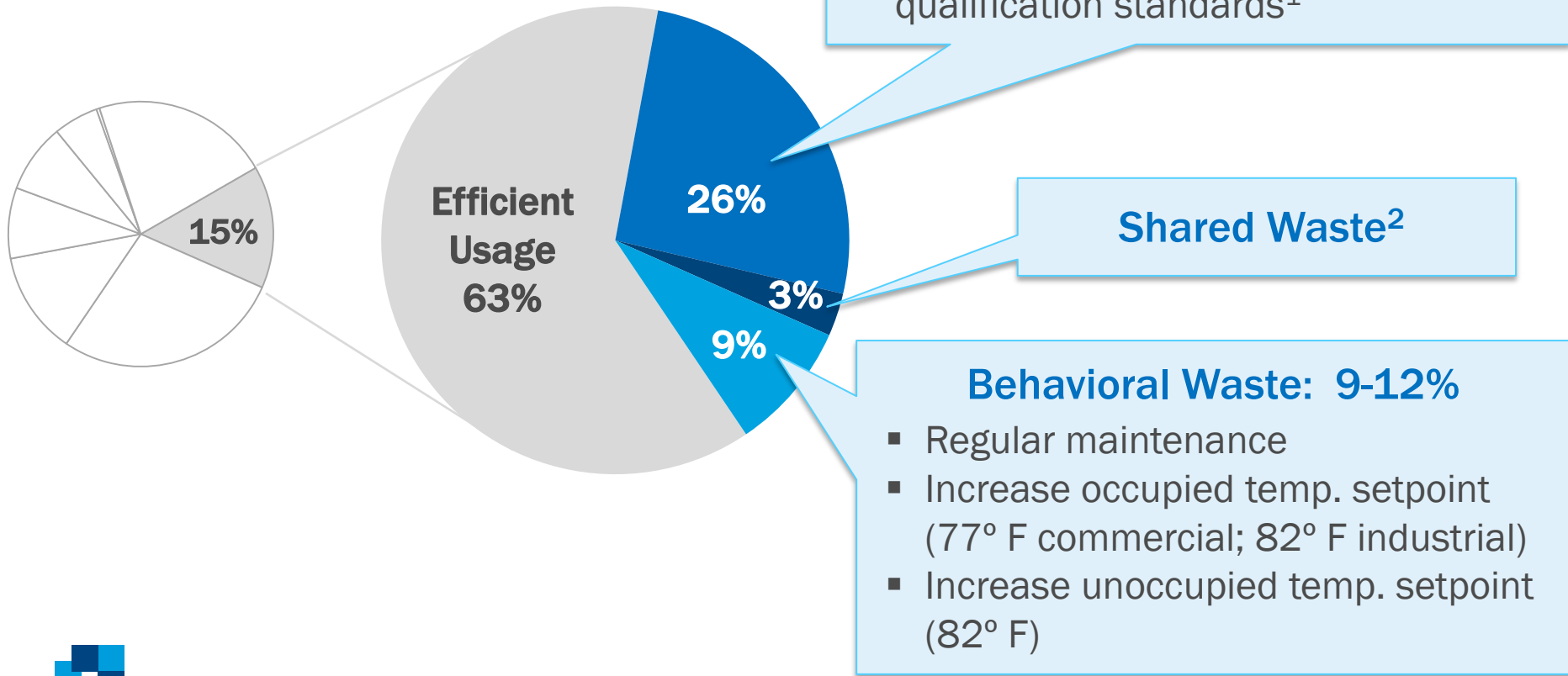


C&I Cooling Usage & Waste Results

Penetration: 64%

5,764 GWh Current Usage

2,159 GWh Current Waste



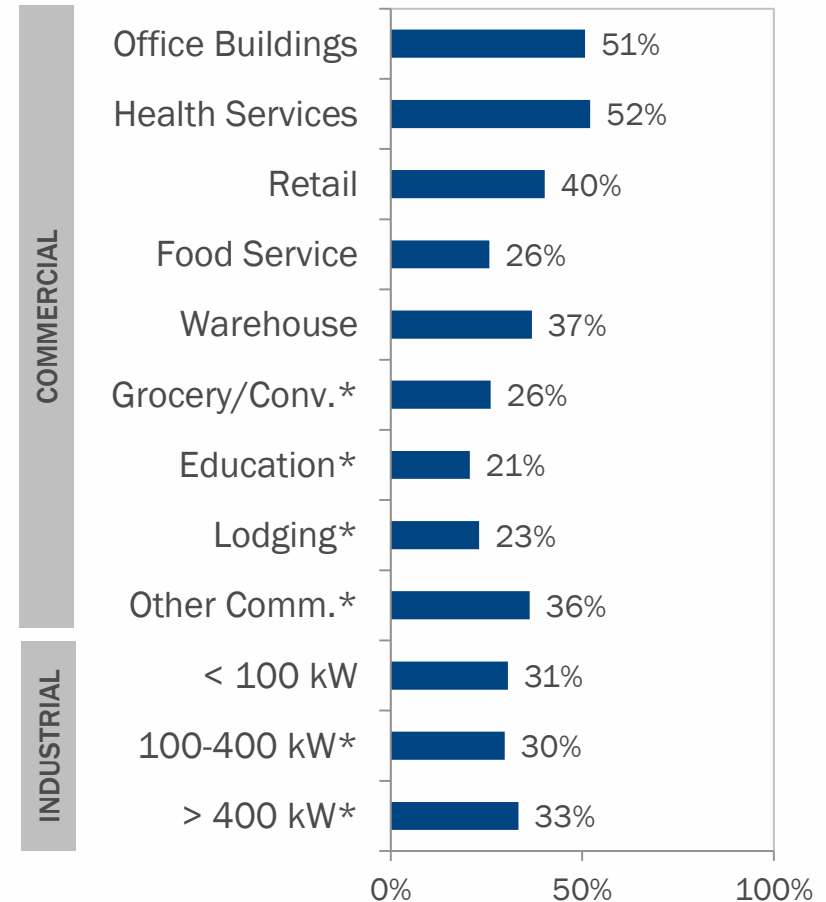
¹ Chiller and Room AC high-efficiency based on ComEd incentive standards. Split and packaged guidelines: 15 SEER for systems below 5.4 tons, 12.2 EER for system 5.4-20 tons, 10.6 EER for systems above 20 tons

² Either technology or behavioral waste, depending on which is addressed first

Cooling Technological Waste Highlights

- Average age of Packaged and Split AC systems is 12 years (14 among Industrial)
- Technological waste higher for Warehouse, Industrial <100 kW, Food Service, and Grocery/Convenience

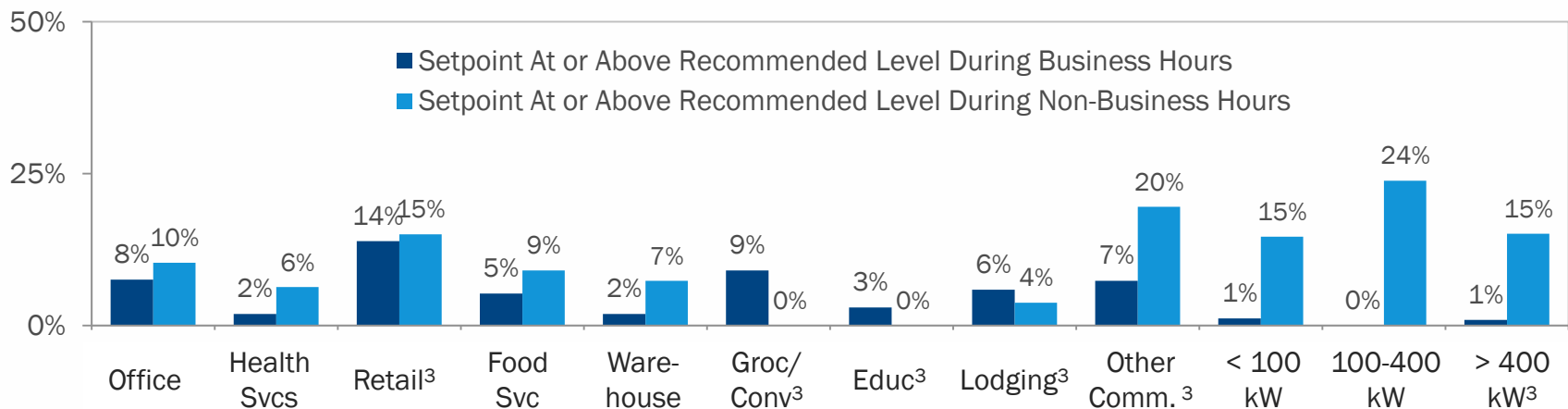
% Customers with packaged/split systems with average age of 15 years or more



Cooling Behavioral Waste Highlights

- Majority of customers are not using recommended setpoints
- Majority of central air systems are in use while business is closed (though may be set back)
- Regular maintenance is common (80% of C&I customers)

Percentage of Customers with Cooling Setpoint At or Above Recommended Levels^{1,2}



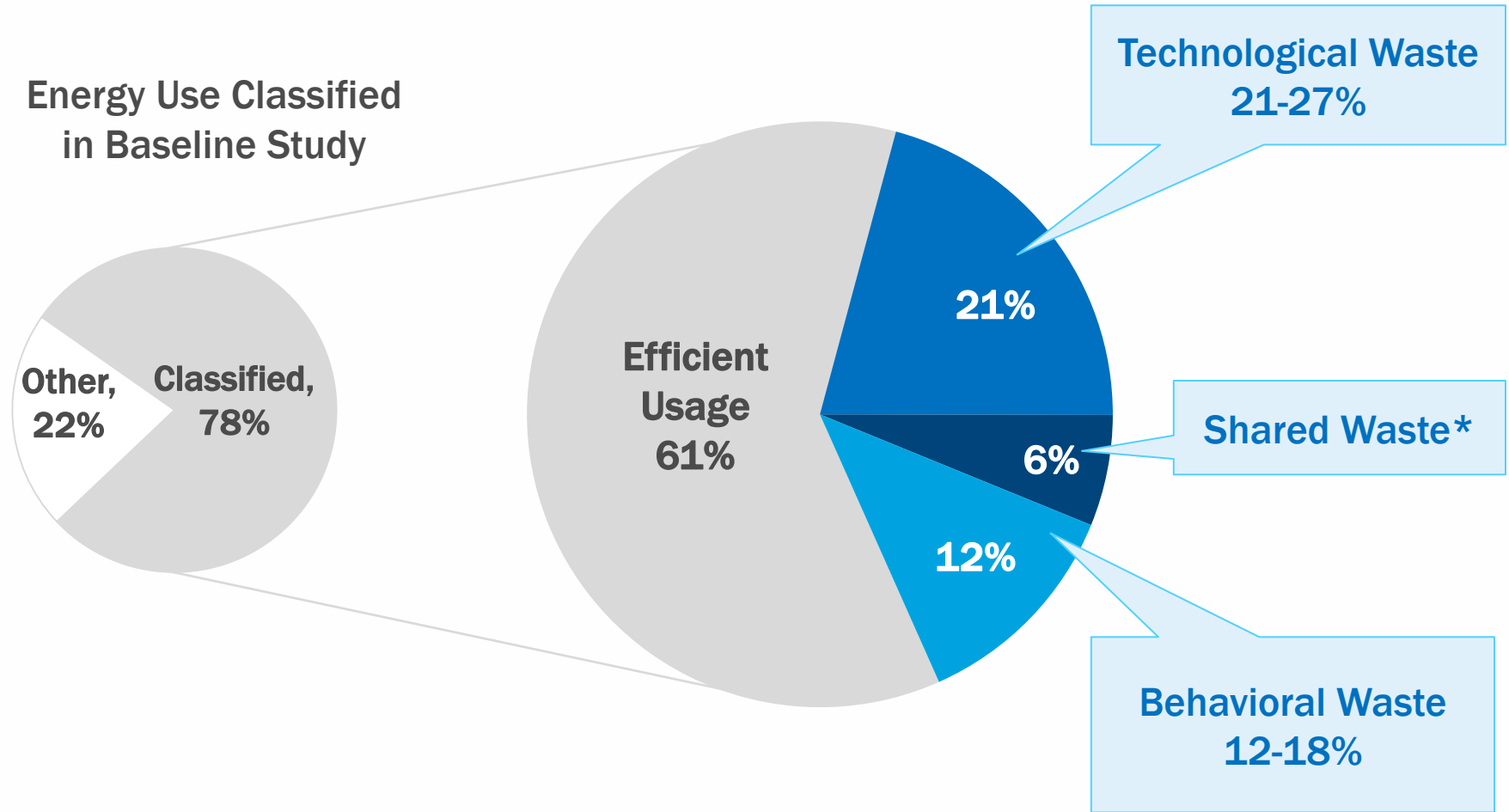
¹ Based on ASHRAE 55-2004 comfort range.

² Figure refers to central cooling only (chillers, split and packaged units)

³ Sample size less than 30 for average setpoint during non-business hours (Sample size is at least 30 for setpoints during business hours)

C&I Usage and Waste Summary

Energy Use Classified
in Baseline Study



Upcoming Potential Study

- Leverage primary data collection from baseline study
- Additional primary data collection activities:
 - Payback acceptance surveys
 - Trade ally interviews
- Schedule: Residential
 - Draft achievable potential results completed
 - Report available around 4/15
- Schedule: C&I
 - Draft achievable potential results completed by 3/31
 - Report available around 4/30

