How Using Luminaire Level Lighting Controls Can Make HVAC Systems More Efficient

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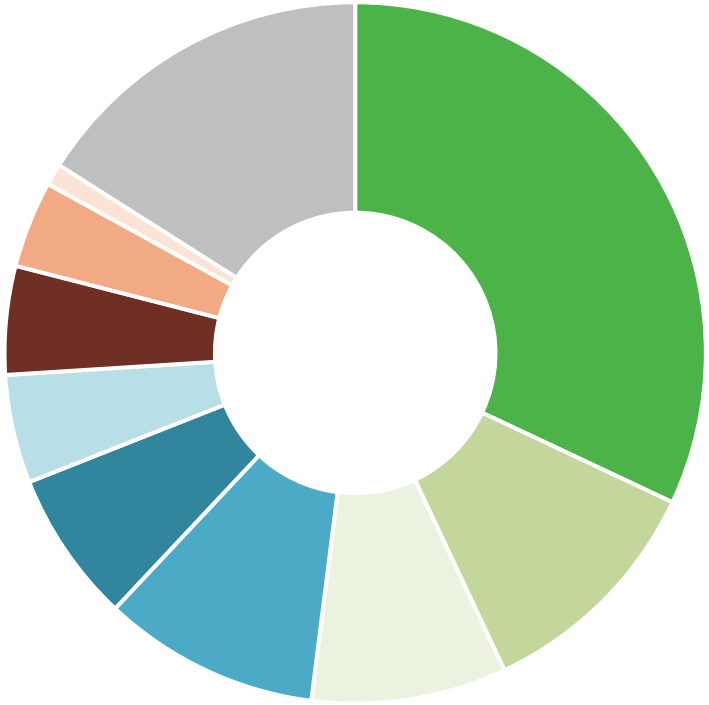
Today's Agenda

- Why LLLC and HVAC should be the next great partnership
- What is LLLC and HVAC
  - The Idea
  - The Pilot
- The Model
  - Results and Findings

Who is NEEA

The average commercial building consumes 52% of its energy operating the heating, cooling and ventilation systems.

Major fuels consumption by end use (2018)



Source: U.S. Energy Information Administration, *Commercial Buildings Energy Consumption Survey*; Note: Btu = British Thermal Units

What are Luminaire Level Lighting Controls?

Networked Lighting Control

An intelligent network of individually addressable luminaires and control devices.

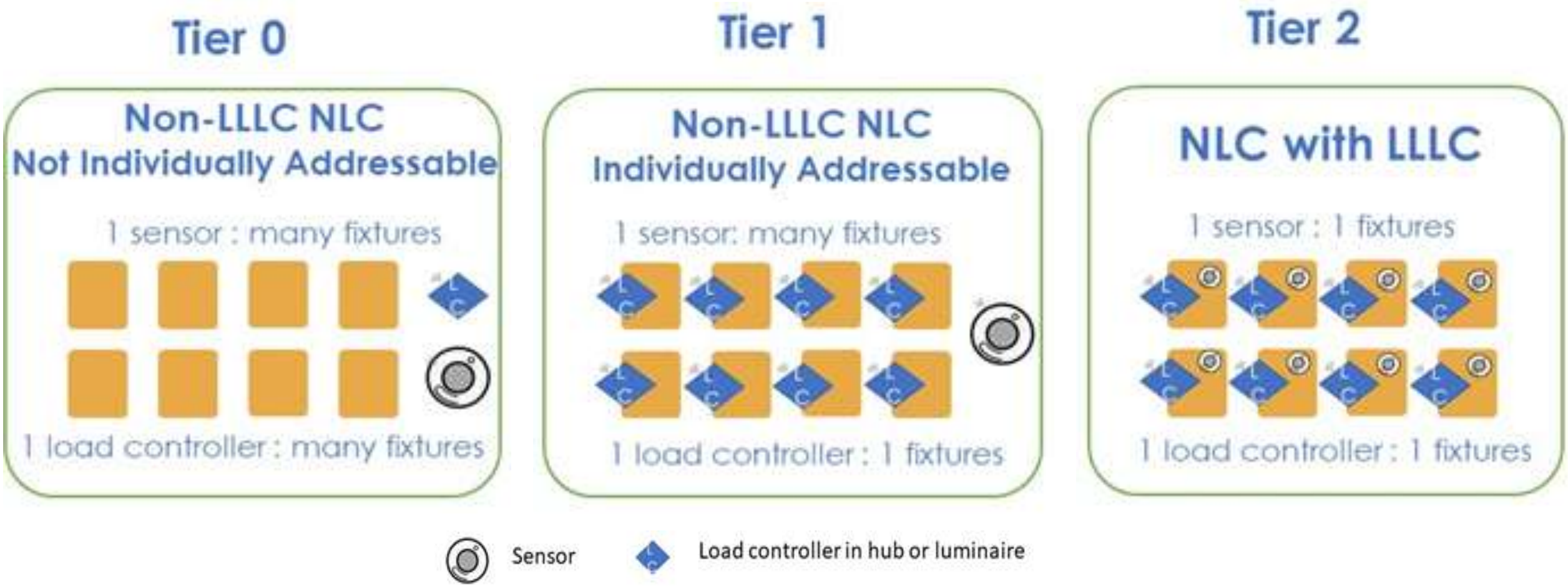
Allows for application of multiple control strategies, programmability, building-or enterprise-level control, zoning and rezoning using software, and measuring and monitoring

Defined by the Design Lights Consortium

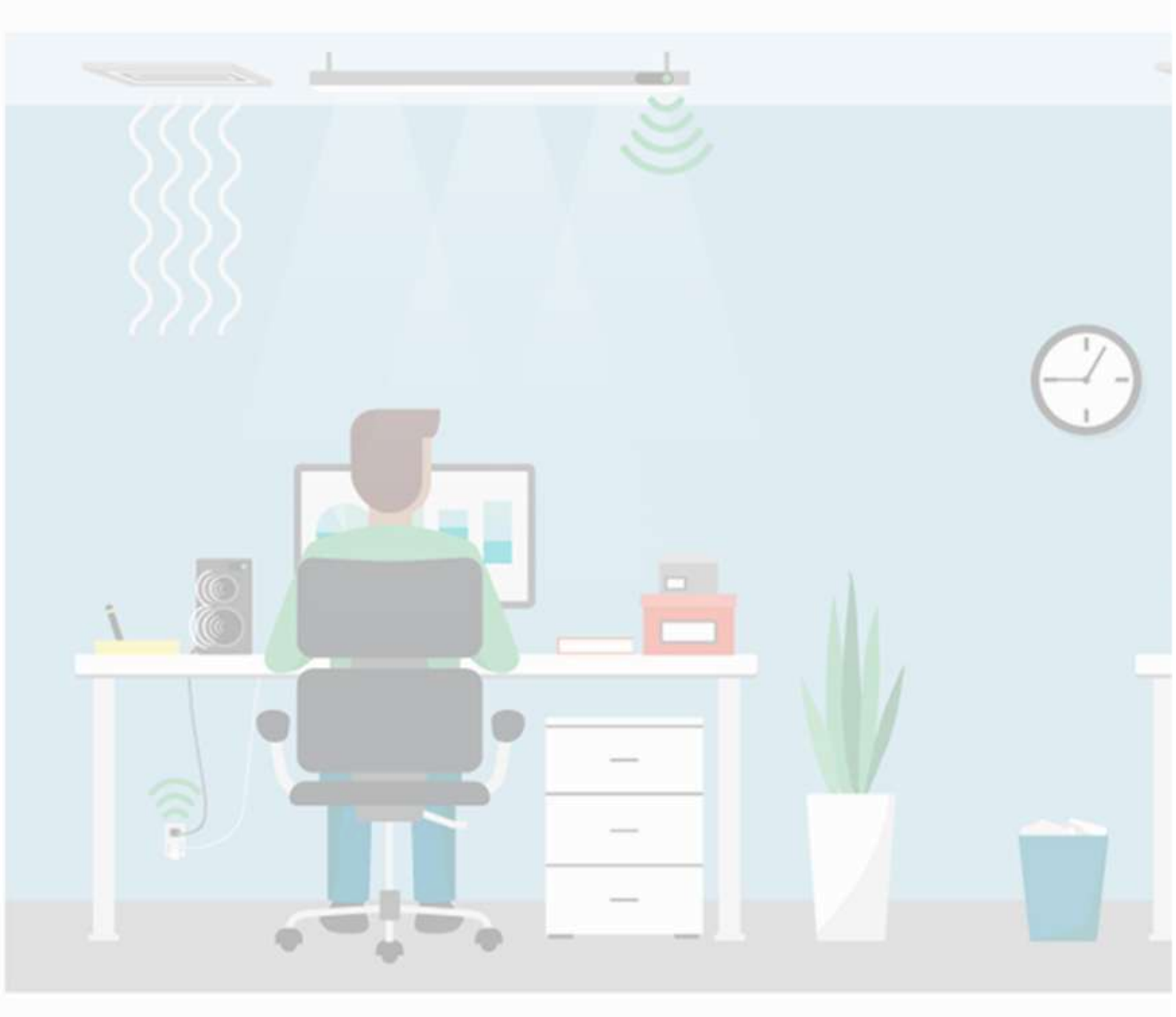
Luminaire Level Lighting Controls

Each luminaire has a networked occupancy sensor and ambient light sensor installed and directly integrated or embedded into the luminaire form factor during the manufacturing process or installed in the field

Tiers for Network Lighting Control Types

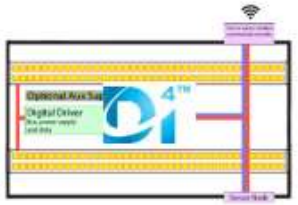


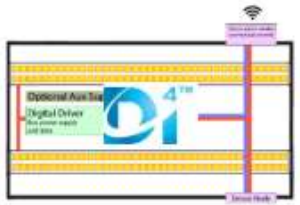
What is LLLC & HVAC Integration

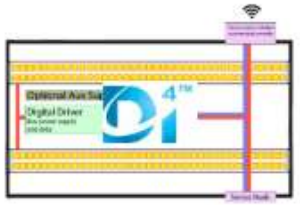


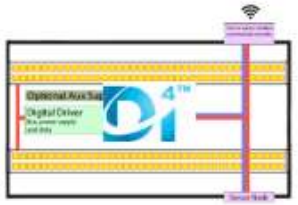
- Occupancy sensors at a granular level (a sensor in every fixture)
- LLLC provides a source of power for the occupancy sensors
- Occupancy signal from lighting can be shared with multiple other building systems, including the HVAC system
- Lighting provides a visual indication the sensor is functioning
- 5-25% energy savings from the mechanical system on top of the 50-65% energy saving from the lighting

NEEA Field Evaluation

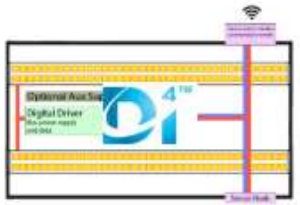

Fixture A

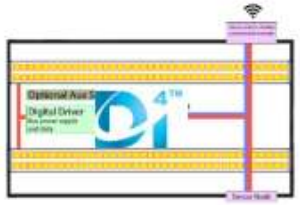

Fixture D


Fixture G


Fixture B


Fixture E


Fixture H


Fixture C


Fixture F


Fixture I

# Fixtures	HVAC
≥ 7 occupancy	Normal float
4-6 occupancy	Normal float + 1°
≤ 3 occupancy	Normal float + 2°

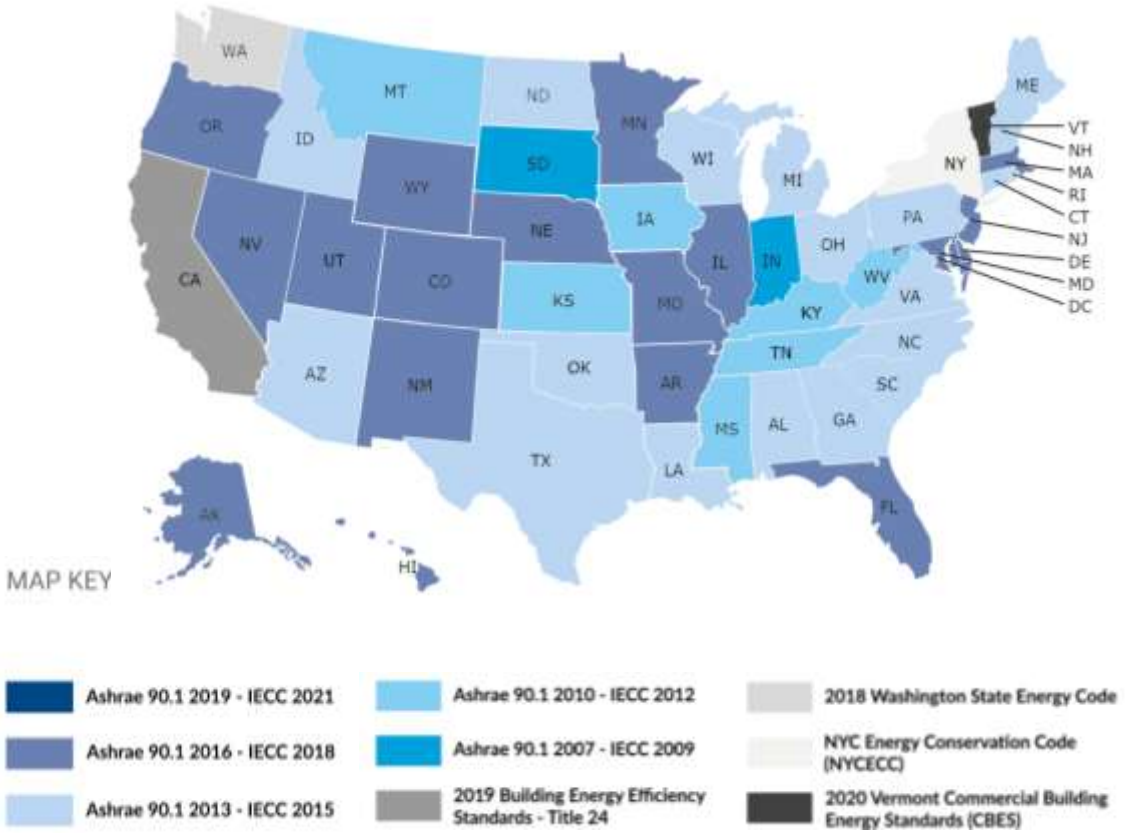
Simple

Limited HVAC changes

Some energy savings

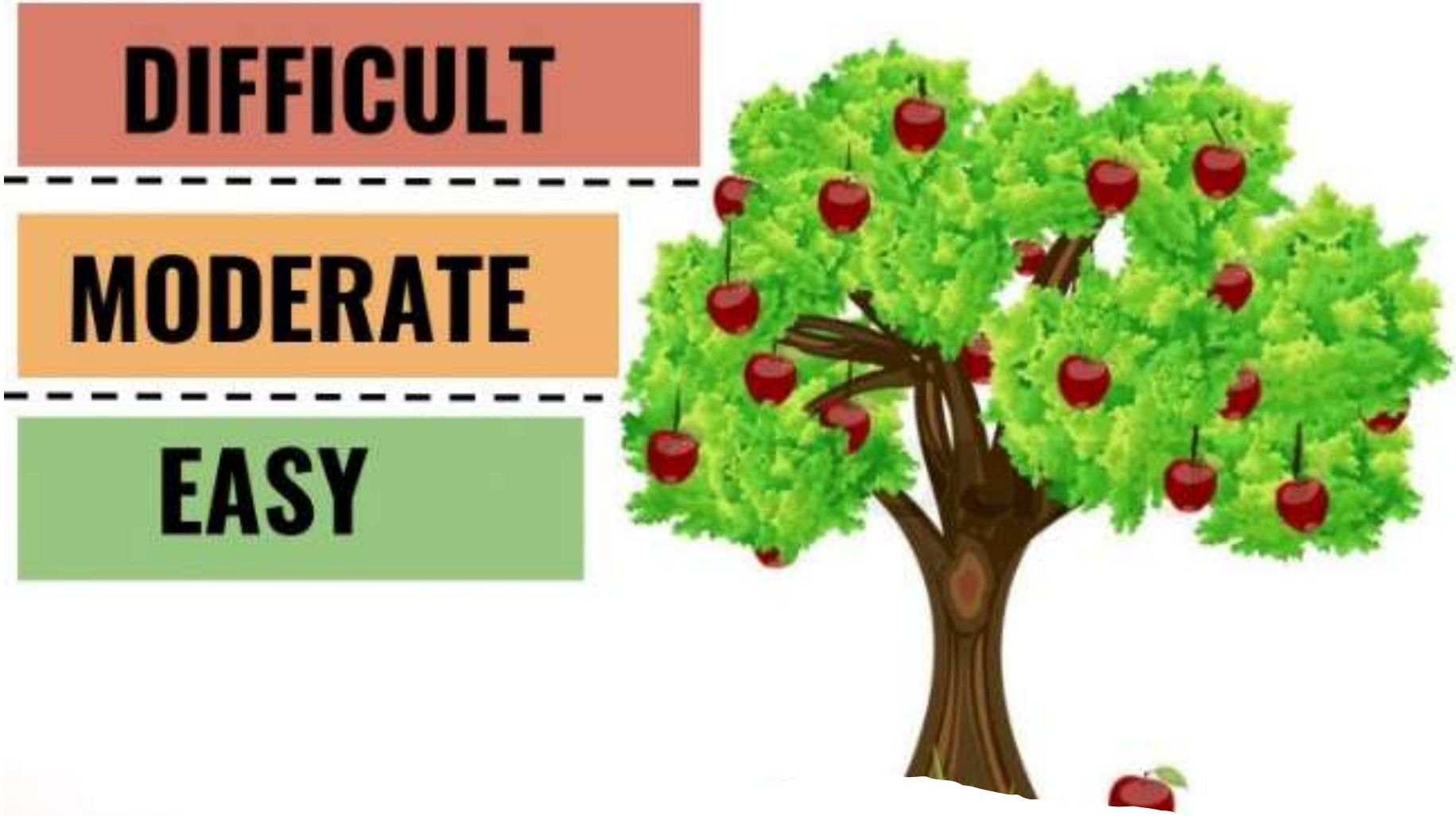
Suited to small buildings (60% of bldgs)

Energy Codes Are Primary Drivers for Integration



…and getting more stringent

- Occupancy Sensors (Lighting and HVAC)
- Occupied Standby (HVAC)
- Plug Load Controls
- Demand Response



The Low-Hanging Fruit is gone!

The Changing world of Utility Incentives

LED Fixture incentives shrinking or disappearing

Control Incentives still available

Systems becoming more valuable than Widgets

HVAC energy savings much greater than lighting incentives

Flex Load (Demand Response) becoming very important

What is the Project?

Physical characteristics

- Mid-size commercial facility (25,000 ft2)
  - 10,000 ft^2 of offices, conference rooms, lunch/break room
  - 15,000 ft^2 of warehouse and production space
- Building vintage: 2001

Project duration:

- Installation and commissioning Q3 2024
- Data gathering began late Q4 2024

Retrofit Project Details: HVAC Integration

- Hardwired thermostats replaced with wireless mesh-enabled models and connected to edge gateway
- Created 5 HVAC zones
  - RTU #1: Accounting, Administration, Sales, Open Plan East, Open Plan West, OPEE, PC, Library
  - RTU #2: Executive 31, Executive #2, Executive #3, Conference Room
  - RTU #3: Kitchen, Dining, Lounge, Restrooms
  - RTU #4 & 5: Not participating in demonstration

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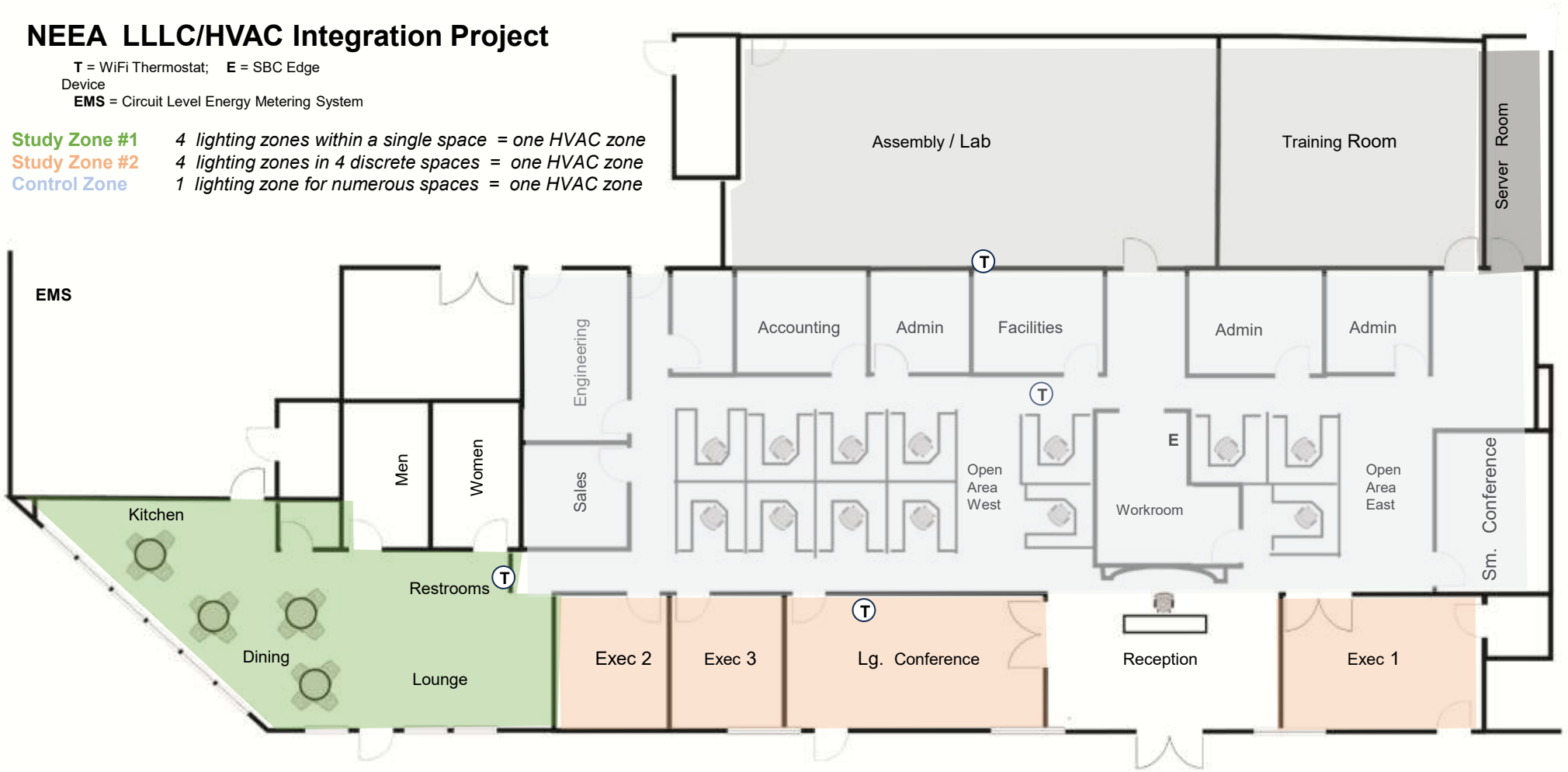
NEEA Pilot Project

NEEA LLLC/HVAC Integration Project

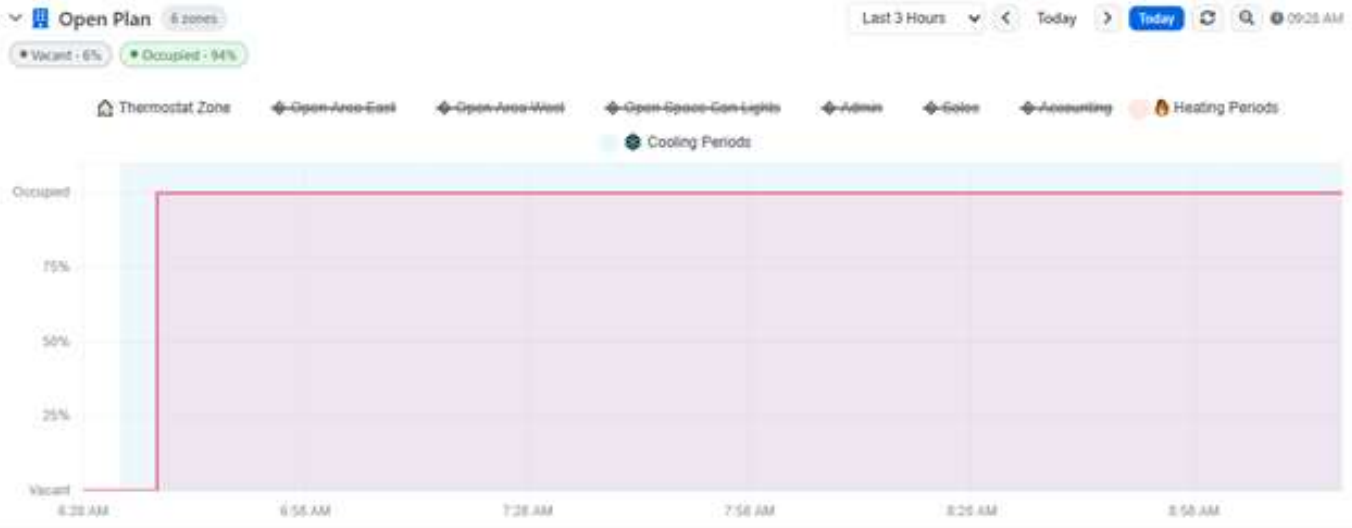
T = WiFi Thermostat; **E** = SBC Edge Device
EMS = Circuit Level Energy Metering System

Study Zone #1 *4 lighting zones within a single space = one HVAC zone*
Study Zone #2 *4 lighting zones in 4 discrete spaces = one HVAC zone*
Control Zone *1 lighting zone for numerous spaces = one HVAC zone*




Breakroom
4 zones
Vacant - 6%
Last 3 Hours
Today
Today
Thermostat Zone
Lounge
Dining
Kitchen
Restrooms
Heating Periods
Cooling Periods
Occupied
75%
50%
25%
Vacant
6:28 AM
6:58 AM
7:28 AM
7:58 AM
8:28 AM
8:58 AM

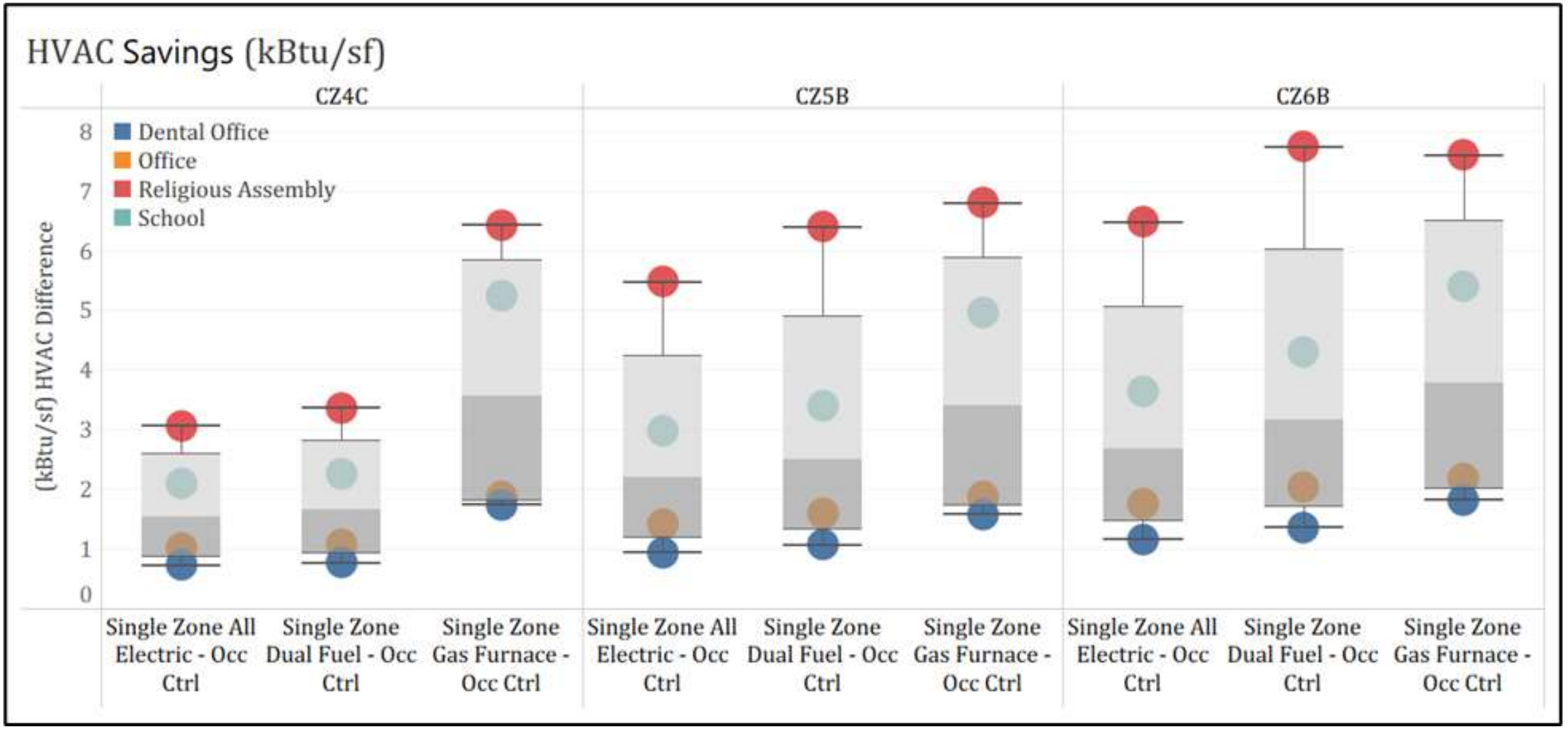

Exec Offices
4 zones
Last 3 Hours
Today
Today
Thermostat Zone
Executive #2
Executive #1
Main Conference
Executive #3
Heating Periods
Cooling Periods
Occupied
75%
50%
25%
Vacant
6:28 AM
6:58 AM
7:28 AM
7:58 AM
8:28 AM
8:58 AM


Open Plan
6 zones
Vacant - 6%
Occupied - 94%
Last 3 Hours
Today
Today
Thermostat Zone
Open Area East
Open Area West
Open Space Can Lights
Admin
Color
Accounting
Heating Periods
Cooling Periods
Occupied
75%
50%
25%
Vacant
6:28 AM
6:58 AM
7:28 AM
7:58 AM
8:28 AM
8:58 AM

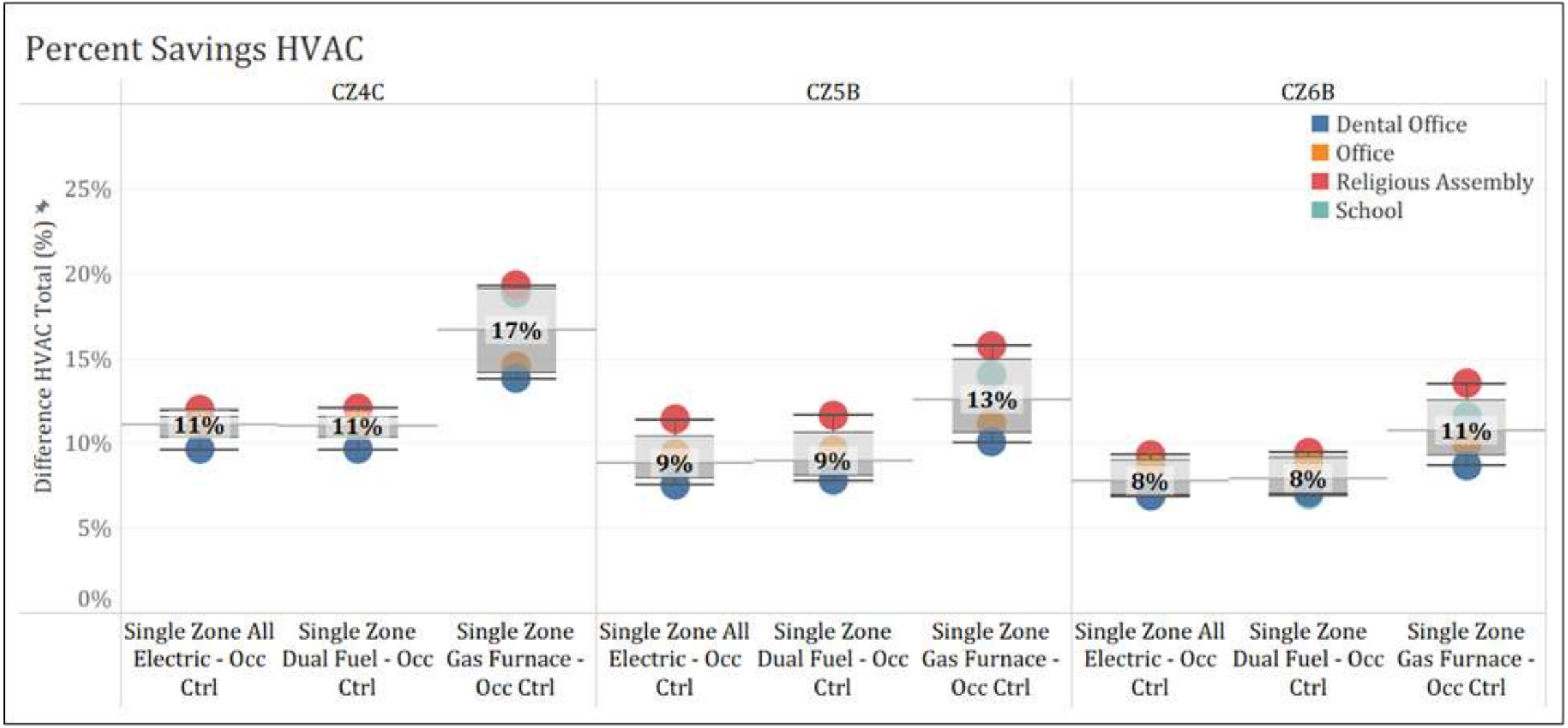
Dashboard View

LLLC & HVAC Modeling Study

LLLC & HVAC Modeling



Modeled Total HVAC Saving Percentages



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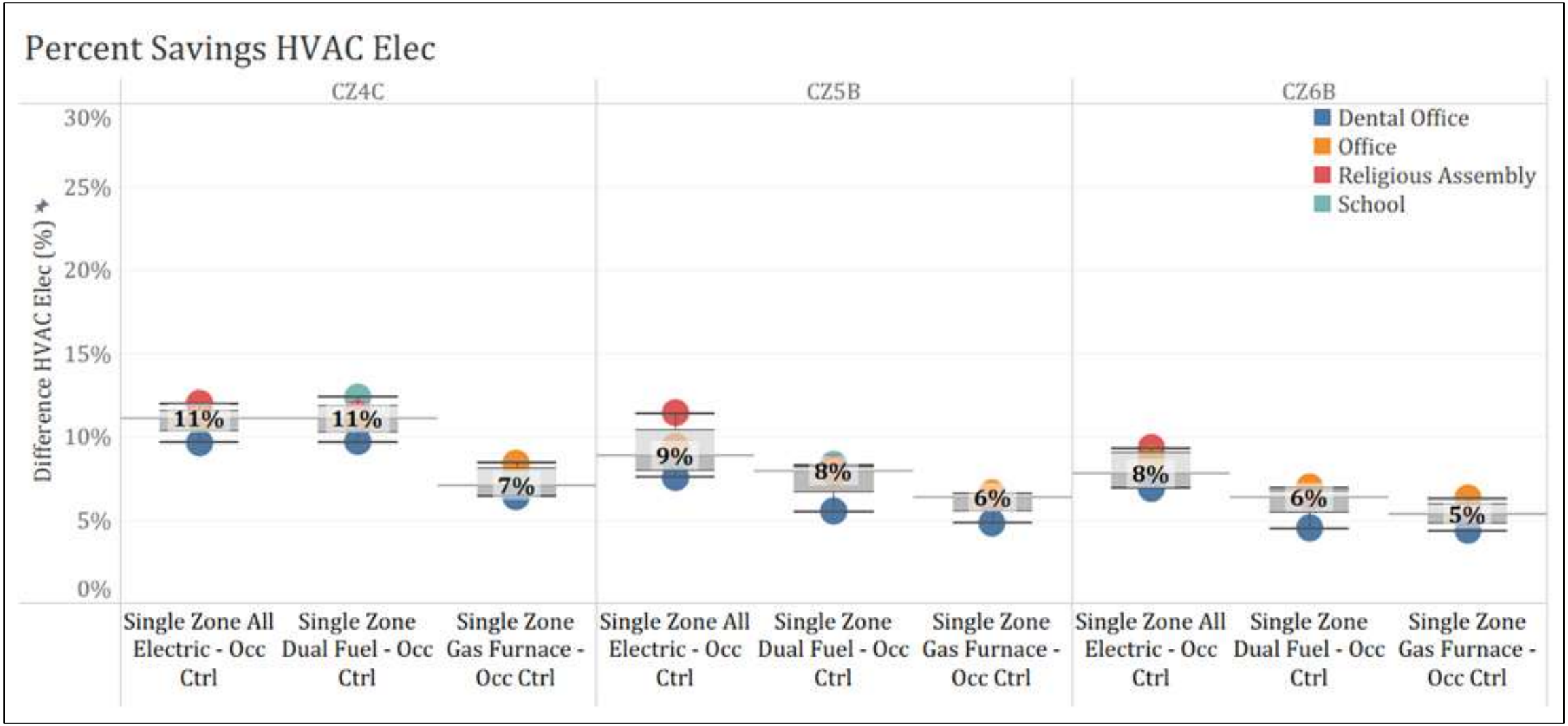
Modeled Electric Saving Percentages



Thank You!

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