

Getting to Zero:

USER ENGAGEMENT IN ACHIEVING
NET ZERO ENERGY BUILDINGS

NESEA BUILDINGENERGY 16

9 MARCH 2016

in:posse

ARROWSTREET



CITY OF CAMBRIDGE

WILLIAM RAWN ASSOCIATES | Architects, Inc.



Katherine Bubriski
Arrowstreet



Shannon Kaplan
In Posse



Samuel Lasky
William Rawn Associates



Michael Black
City of Cambridge

Learning Objectives:

1. Recognize ways in which occupant behavior will impact energy use in their projects.
2. Learn to conduct client discussions on the impact of occupant behavior on building energy use as well as determine a plan of user engagement.
3. Discover techniques to design spaces to reinforce energy saving occupant behavior using the case studies presented.
4. Through an interactive project example, perform user engagement sessions that will educate users on the impact of their energy use.



How to Engage Users to Achieve Net Zero





What Impacts the Occupants?

Schedule

Temperature

Lighting

Glare

Equipment (plug loads)



How do Occupants Think?

Schedule: I come in at time X and I leave at Y

Temperature: I am usually (hot)(cold)(ok)

Lighting: I like it (bright)(dark)(no preference)

Glare: I will (complain)(suffer in silence)

Equipment:

- I MUST have (computer, laptop, mobile phone, lamp, fan, space heater)

- I would like to have (radio, space heater, fan, personal coffee maker, (insert ridiculous request here))



How do Occupants Think?

Schedule: I come in at time X and I leave at Y

Temperature: I am usually (hot)(cold)(ok)

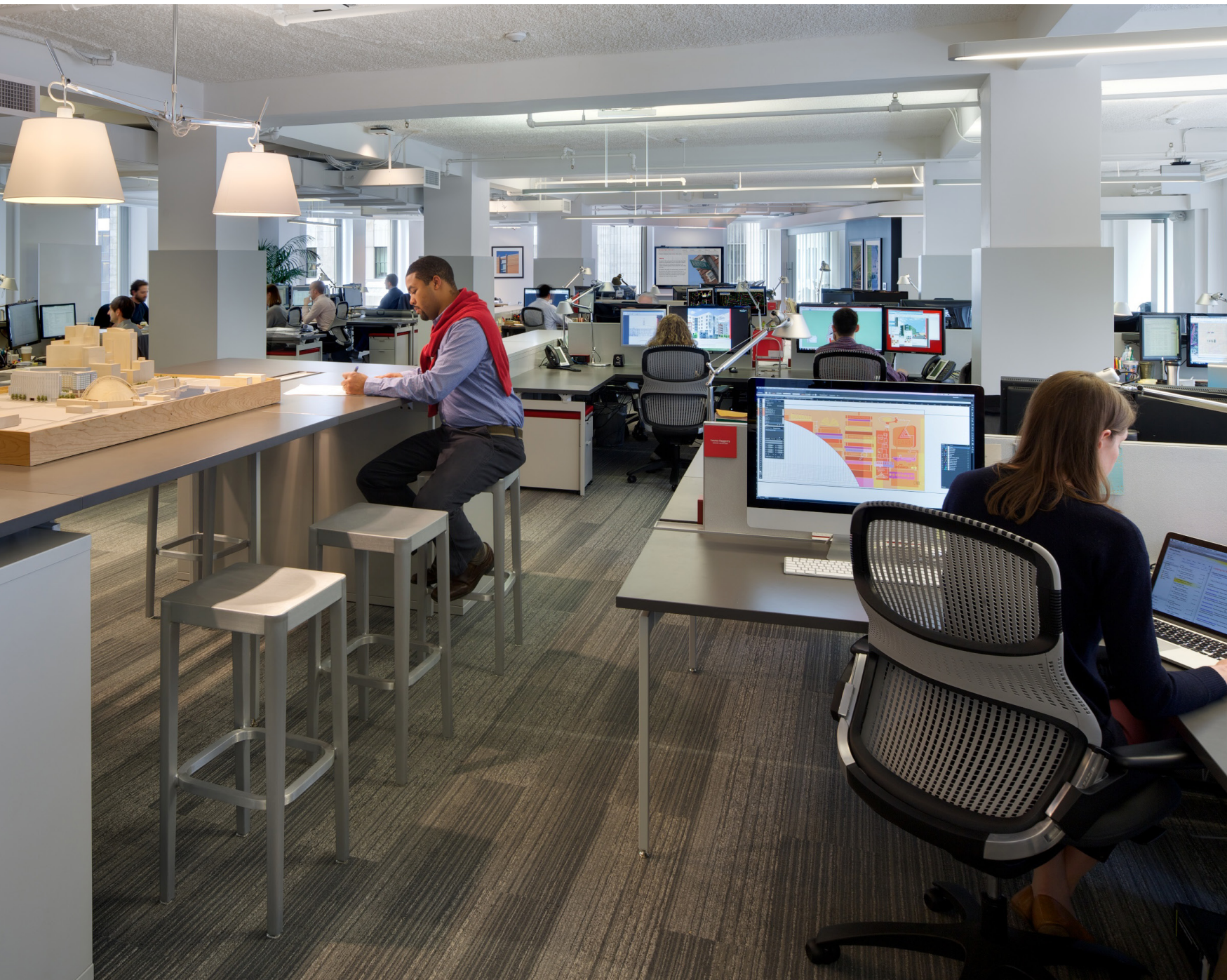
Lighting: I like it (bright)(dark)(no preference)

Glare: I will (complain)(suffer in silence)

Equipment:

-I MUST have (computer, laptop, mobile phone, lamp, fan, space heater)

-I would like to have (radio, space heater, fan, personal coffee maker, (insert ridiculous request here))



What do Occupants Want?

A comfortable space

Available whenever they want to be there

With all the equipment they need

The image is a composite. On the left, a woman in a grey blazer sits at a desk with a laptop, her arms raised in celebration. Overlaid on the left side is a Duke Energy bill for 'Intenti' with account number 9001076, due date Feb 3, 2009, and amount \$237.45. The bill includes the address 370 Laurel, Cincinnati, OH 45246. Overlaid on the bottom left is a detailed HVAC control diagram. The diagram shows two burners (labeled 1 and 2) with 'FLAME FAILURE OFF' indicators. It includes a 'SEQUENCE 2.1' and 'REQUIRED ONE' box, a 'CMBX' control unit, and a 'TEMPERATURE POC' sensor. The diagram also shows piping, valves, and a note: 'Both pumps run because there are no check valves'. The diagram is overlaid on a computer window titled 'GRAPHICS - (1)100ADDON1.BEL.GRA'.

What does the Owner/Design Team Want?

The project to use less energy

Happy occupants

Easy to maintain systems and controls



Keys to Success:

Occupants make or break the energy use

It is not about what they have to give up, it is about getting the same thing (or better!) in a different way

Do not pressure them to agree to something. If they do not really buy in, they will not stick with it after they move in.

For Net Zero, our models are only best guess predictions, so be accurate, not optimistic!

JUST ASK!

How to Get Information: In Person

If at all possible, talk to the occupants first. Educate them about what the project is trying to accomplish (NZE)

Ask for their help and ideas.

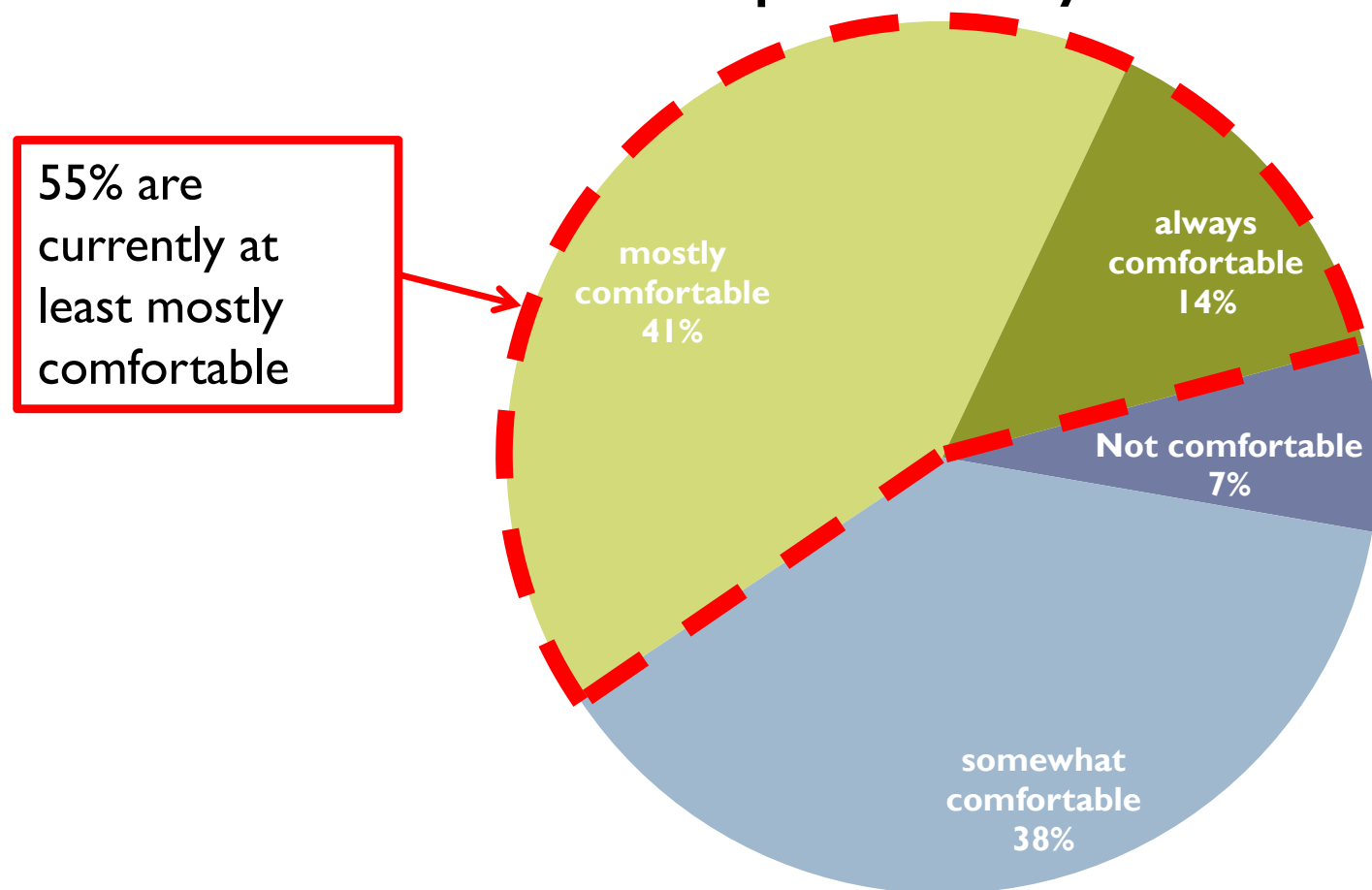
Don't come at them with already developed solutions before you even know them or their needs and challenges

Be flexible and don't be pushy.

If you think they are being stubborn keep asking why that item is important. Get to the heart of the issue then solve the real challenge with the least possible energy

▶ Simple Questions:

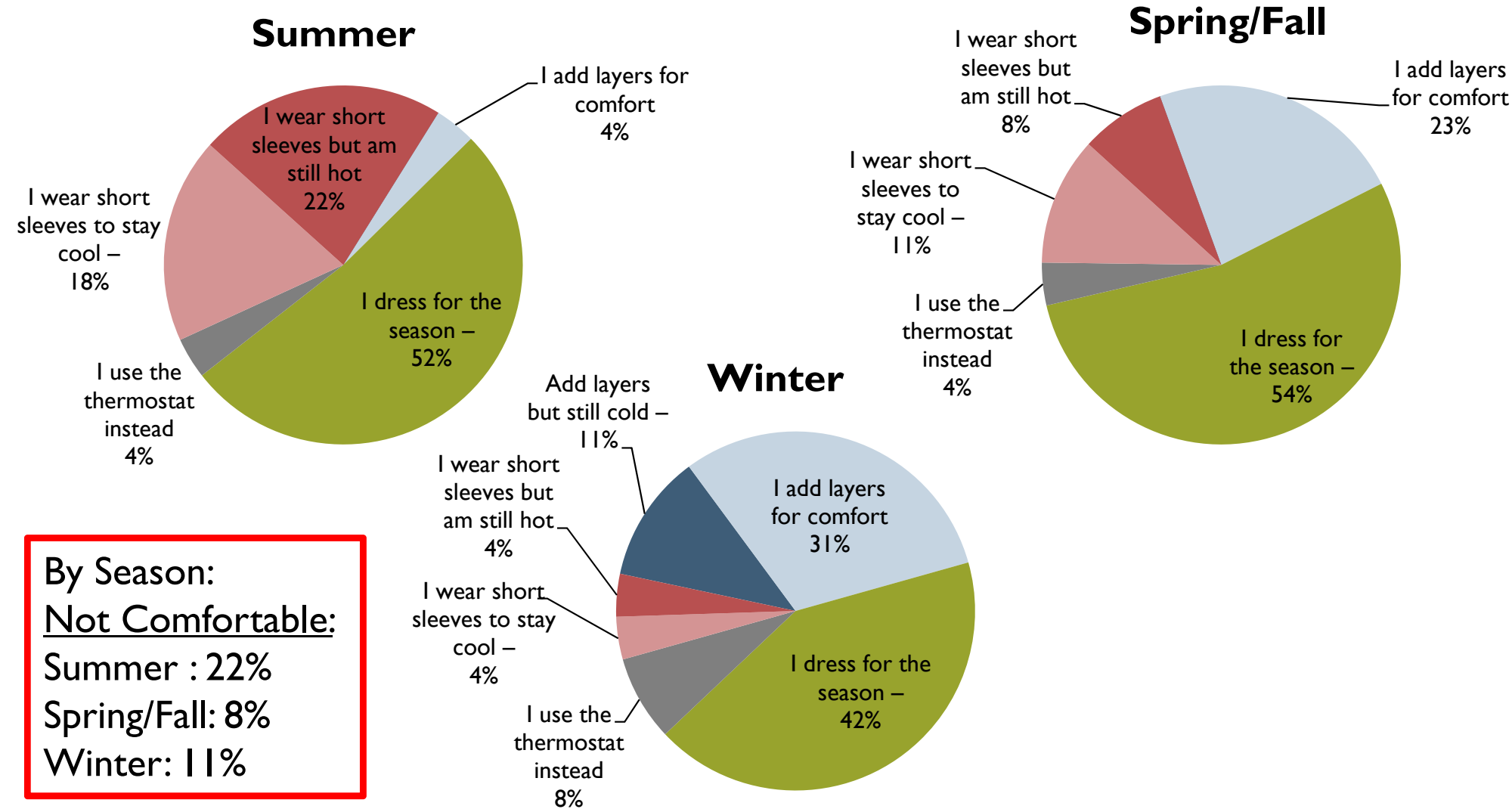
On average please rate how comfortable you are with the temperatures in your current office



How to Get Information: Surveys

1. Write your questions carefully!
2. Always test your questions BEFORE you send them out!

► Multi-Part Questions:



How to Get Information: Surveys

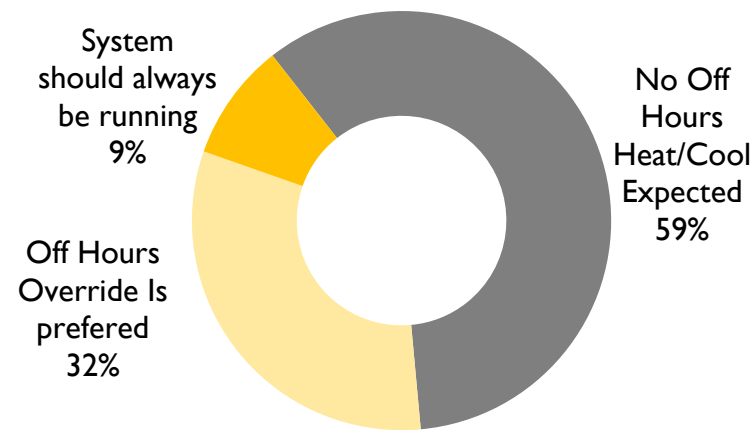
Think about what information you need first and THEN write your questions

Be careful in how you write your questions – it is easy to right a leading question. Make sure they are open.

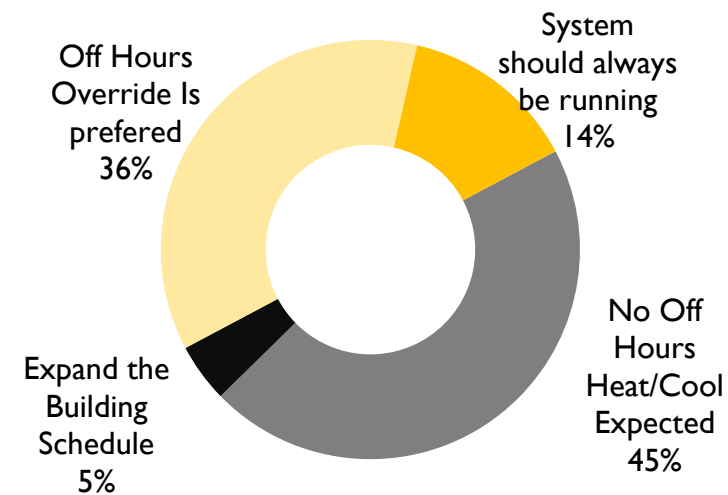
Make sure you provide good directions: On a scale of 1-10 with 10 being the highest...

► **Complex Questions: Off Hours Work Trends and Temperature**

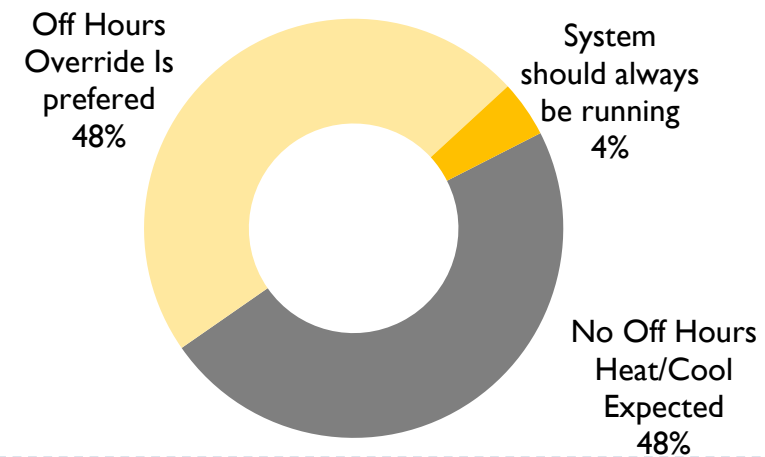
I come before 7:30 AM



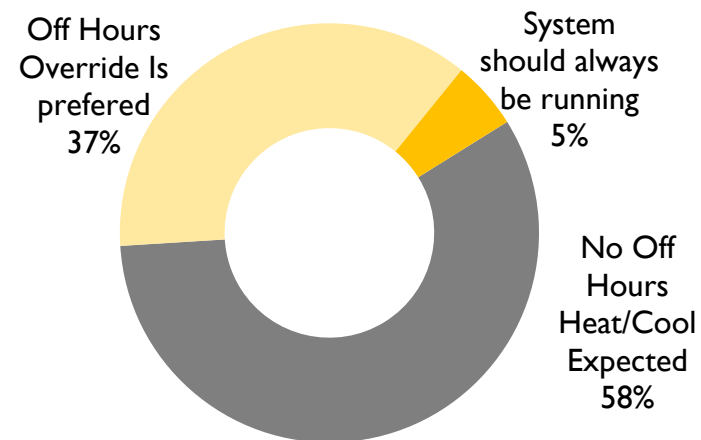
I stay after 6 PM



I work on Saturday



I work on Sunday



How to Get Information: Surveys

Complex questions...

► Summarize and Explain:

| Theme | Question | Overall Summary Results |
|------------------------|--|--|
| How We Feel | Currently how comfortable are you? | 55% Mostly comfortable 45% Often uncomfortable |
| | Comfort By Season | Summer: 38% are comfortable (On average we are least comfy in the summer) Spring: 56% are comfortable Winter: 48% comfortable |
| | Impact of Humidity | On average higher humidity makes us feel hotter |
| How We Get Comfortable | How Often do you change your thermostat? | 58% change it at least 1 time per day |
| | Where do you set your thermostat | Summer: 68-72.5 average range Winter: 66.5-71.5 average range |
| | Opening windows | 55% open windows for temperature control 57% only leave them open for a few hours |
| | Varying clothing | Most occupants vary their clothing to stay comfortable However in summer, 22% are still too hot |
| | Other means of temperature control | 52% use other means to be more comfortable. These are split between warming up and cooling down. |
| After hours | When do you work after hours and what kind of temperature control do you expect? | Most off hours are worked on weekday evenings While 50% are ok with no heat/cool during this time, 35% would prefer to have an override for temporary control |

What to do with the Information?

Once you have collected your information, you need to sift through it and process it.

Look for common themes and outliers

Clean up the information and then SEND IT BACK. Occupants want to see the results.

Relate the results to the specific changes you are suggesting.

Confirm it is acceptable with the occupants before moving forward.

► Summarize and Explain:

Plan For Lombardo Temperature Controls Based On Survey Results

- Thermostat Locations:
Each private office will have a thermostat. Open office areas will have a thermostat per open area grouping.
- Temperature Range:
The temperature range will be set to the following:
Summer: 74 deg. Winter: 68 deg. Thermostats will allow +/- 2 deg.
- Humidity:
The system will remove humidity in the summer to make sure the relative humidity is no higher than 60%.
Lower humidity will help the building feel cooler.
- Windows:
The windows will not open in the building. Open windows mess up the thermostats and humidity control. If the heating/cooling system is still running, they also result in wasted energy. Shading will be provided on the windows to prevent extra heat from the sun during the summer. This will help keep spaces cooler too.
- After Hours:
There will be override switches for each heating/cooling unit and they will need to be activated by zone.
Overrides will provide heating and cooling for a period of 1 hour each time it is activated.



Occupant Engagement

It takes **TIME**

It does not happen quickly.

It needs to be scheduled early in the project

It can be frustrating at times

It can be rewarding at times

It can make a huge difference

It can get the occupants excited!

It can get them mad or anxious

It can make the difference in Net Zero Energy

Determine the Energy Needs of an Office

Take 5 minutes to think of questions you would ask the users



Determine the Energy Needs of an Office

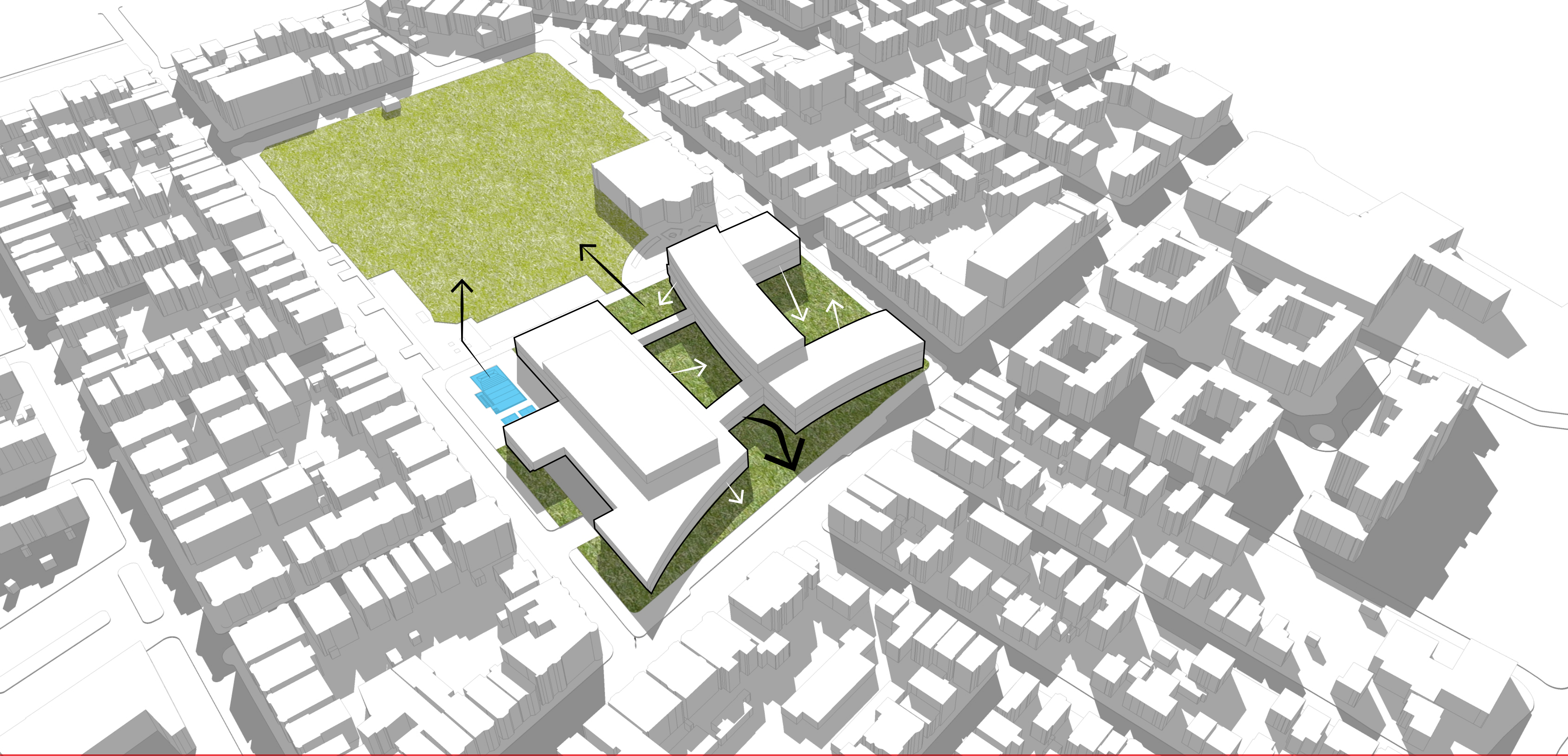
Take 5 minutes to think of questions you would ask the users

Pair up with the person next to you. One person is the designer the other is the client of a office project.

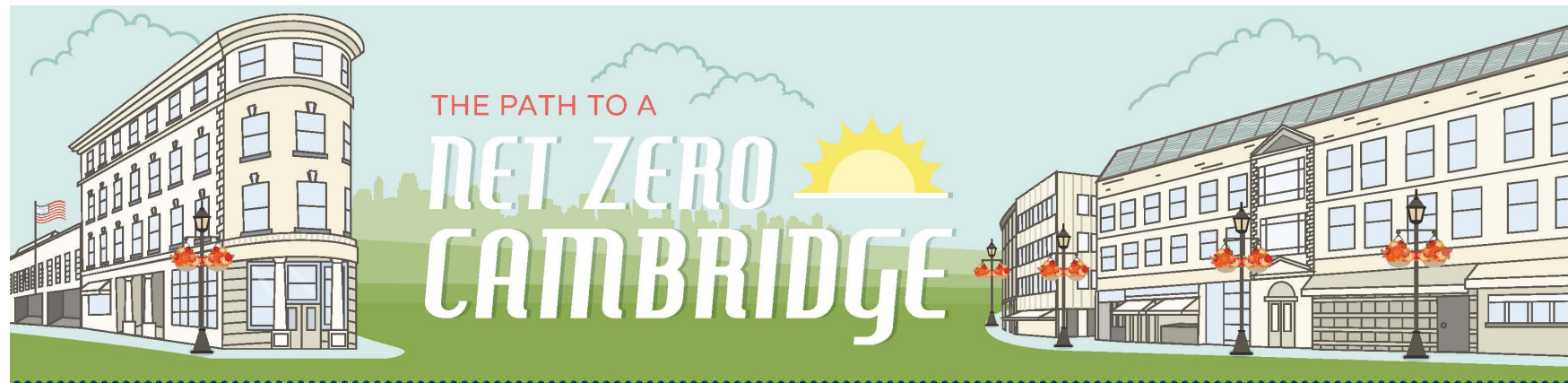
Ask questions to determine energy needs for the office and define ways to reduce energy.

Take turns being the designer.





King Open/Cambridge St Upper School & Community Complex



1

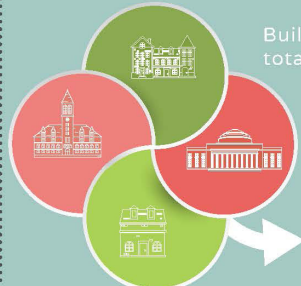
THE CLIMATE IMPERATIVE

Climate change poses a growing set of risks and challenges to cities.



Combating climate change needs to **start locally**

Buildings generate over 80% of Cambridge's total greenhouse gas emissions.



That is why it is Cambridge's aim to achieve **NET ZERO EMISSIONS** from buildings.

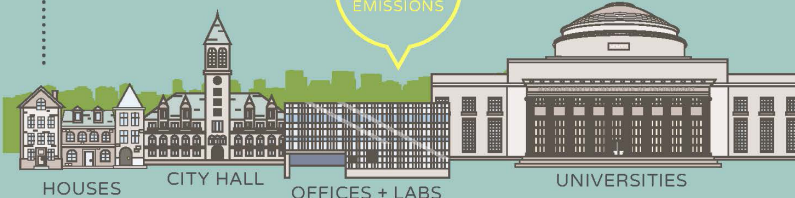
Residents, universities, businesses and the City are collaborating to address the immediacy of the climate imperative.

2

WHAT IS NET ZERO?

A community of buildings for which, annually, all greenhouse gas emissions produced through building operations are offset by carbon-free energy production.

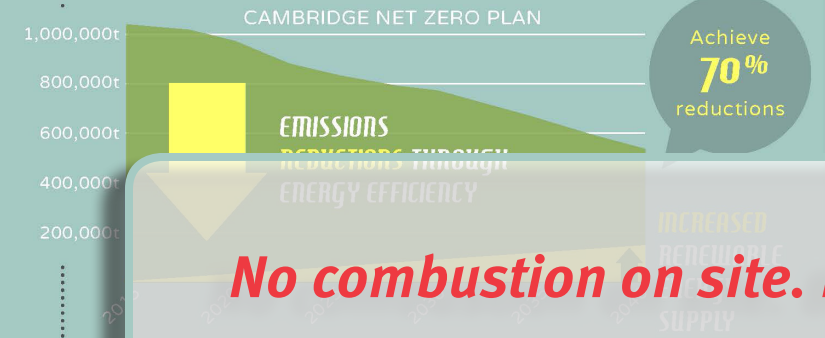
THE TARGET:
Net zero annual emissions from buildings citywide.



4

THE 25-YEAR NET ZERO STRATEGY

The net zero action plan aims to cut energy demand significantly, and replace fossil fuels with renewable energy.



No combustion on site. Building systems fully electric.

5

ACTION PLAN

ENERGY EFFICIENCY IN EXISTING BUILDINGS:

Reduce energy use in buildings through retrofits and improved operations.

NET ZERO NEW CONSTRUCTION:
Require low carbon new construction.

LOCAL CARBON FUND:
Option to invest in a net zero community.

RENEWABLE ENERGY SUPPLY:
Replace fossil fuels with low carbon energy.

ENGAGEMENT AND CAPACITY BUILDING:
Industry training and community involvement.



Cambridge Net Zero Policy

Net Zero Emissions

Lead by example



Project Overview

- Two Schools, Public Library, Community Programs, Outdoor Pool & Administrative Offices
- High hours of operation
- 35 different user groups
- 266,000 SF



Getting to Net Zero

How We Think About Things

How We Make Choices

How We Engage Occupants and Community

Making Energy a Part of the Agenda

Steps at Each Phase





How We Gathered Information

On-site observation

Storytelling - walk me through your day

Imagine - what would you like to do in your new space

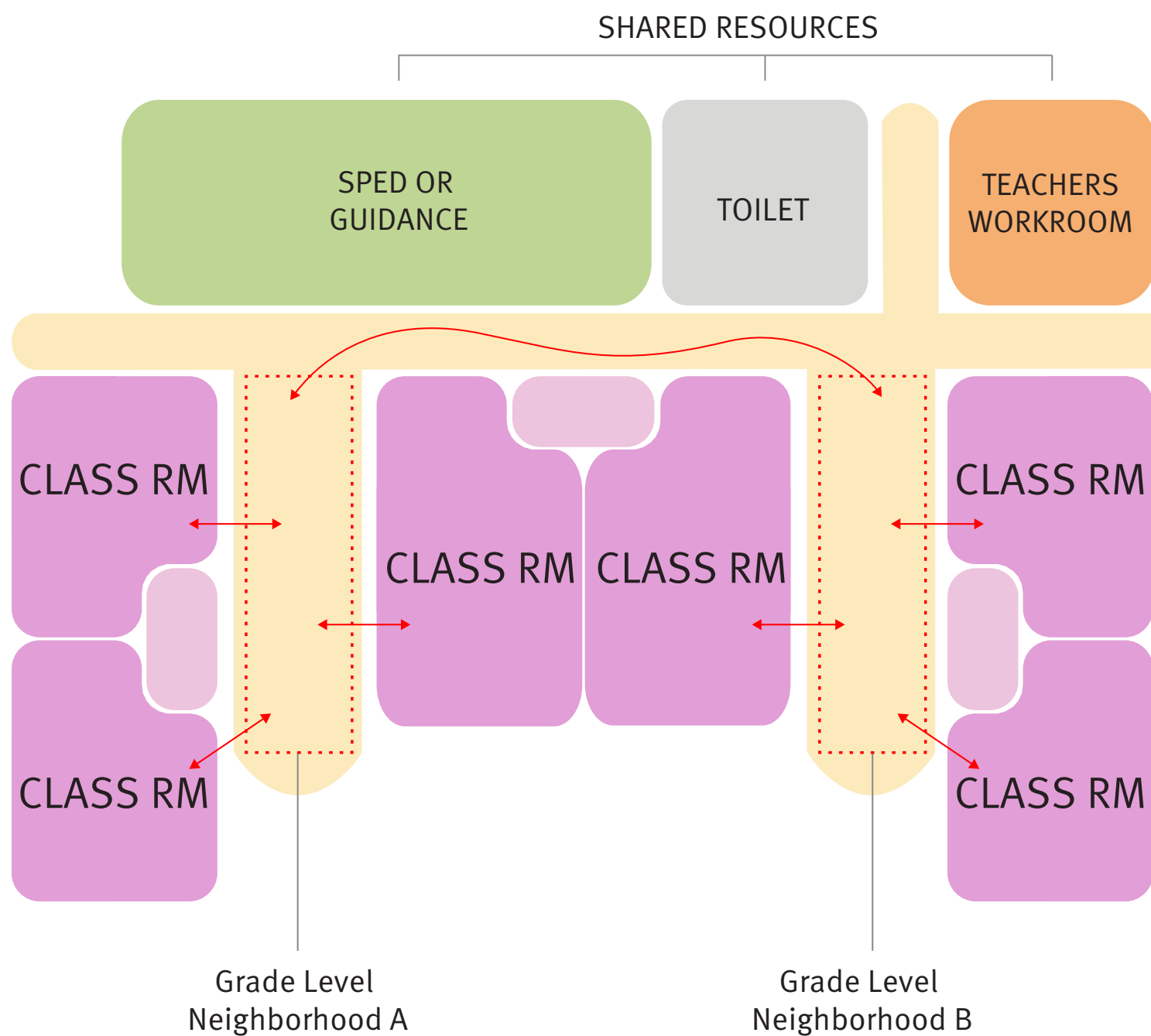


How We Engage Users

Be positive - Gains not Losses

Develop a sense of ownership

Understand user needs, create solutions that meet needs and use less energy



Design to Support Positive User Behavior

Create an environment that encourages collaboration.

Centralize work rooms to reduce equipment. Locate them so that they are used once the building is in operation.

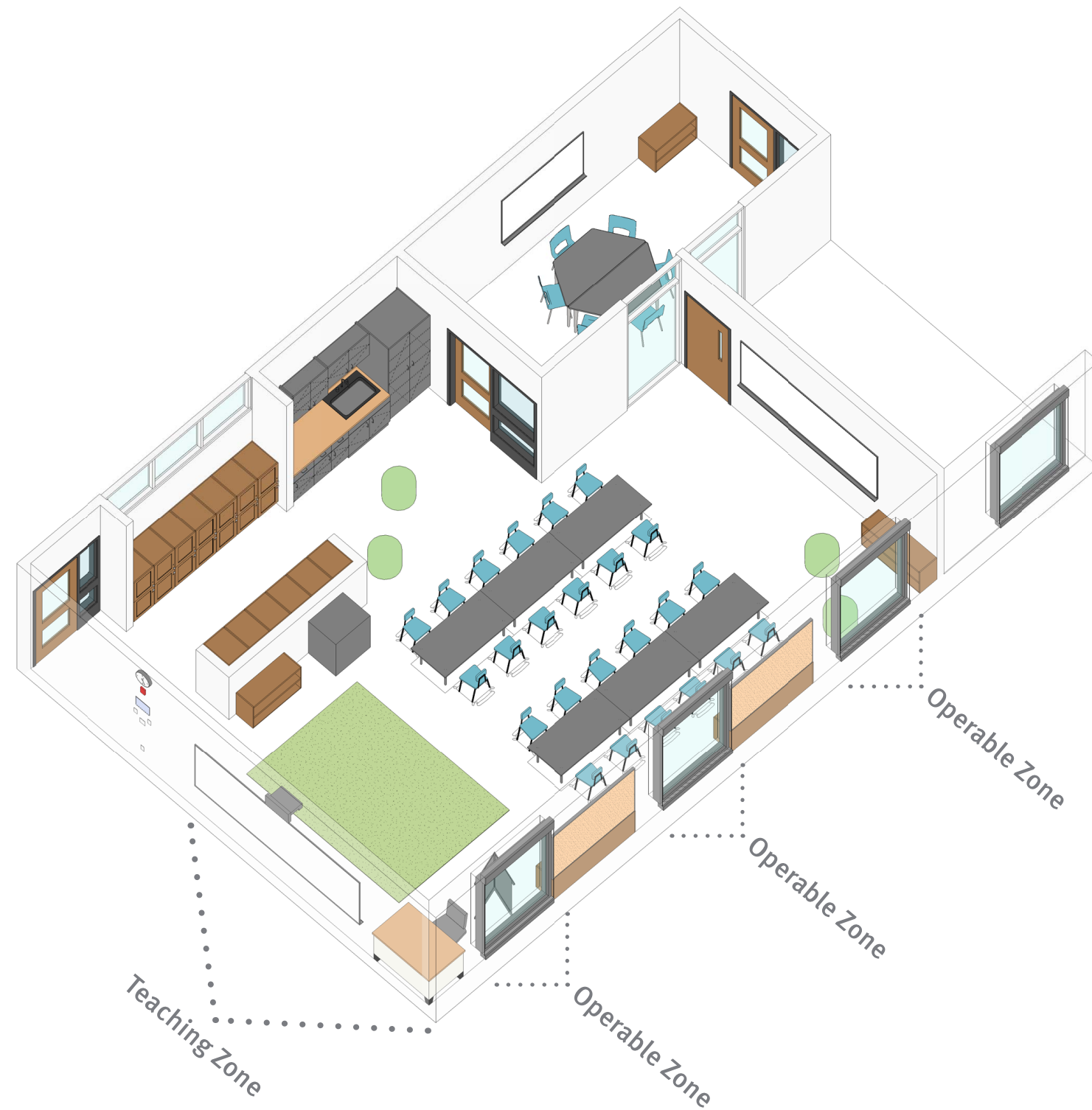
Transparent Learning Design

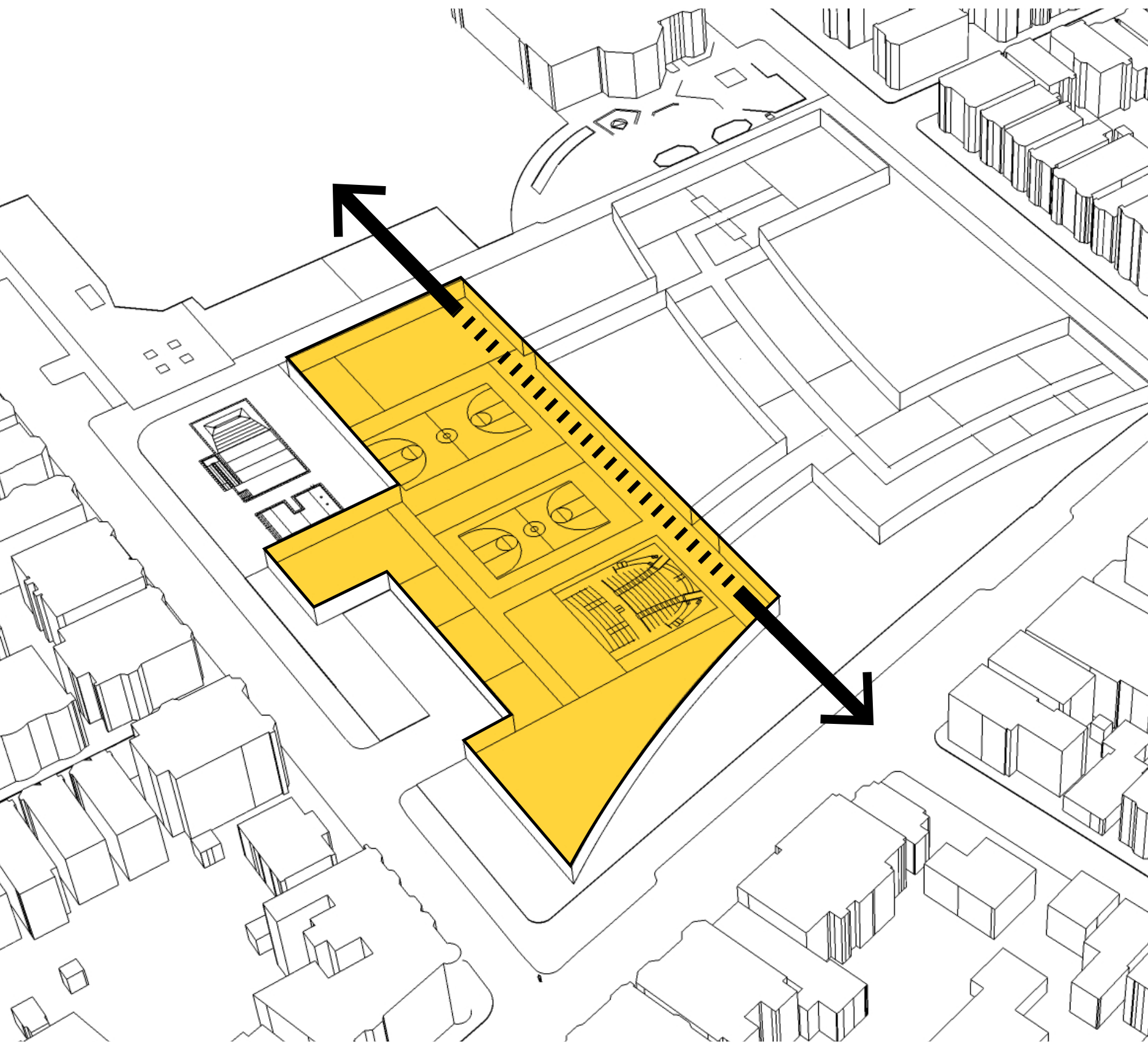
Provide metering to support curriculum and encourage friendly competition.

Design to Support Positive User Behavior

Locate system controls for ease of use

Balance manual and automatic controls





Design to Support Positive User Behavior

Separate spaces that have different use hours into distinct areas



City Perspective

How does a net zero project differ from other projects

What challenges are faced

What leads to success



Q & A