

HGA



WOLF RIDGE Lakeview House

Passive Cooling
Behavior Study

May 2025





Executive Summary

study overview

Wolf Ridge's campus includes Lakeview House, a faculty resident designed to the Living Building Challenge standards which utilizes passive cooling.

Anecdotal observations from Wolf Ridge's administration indicated residents may not be taking full advantage of the cooling system and all its components.

HGA and Wolf Ridge embarked on a study to explore the frequency, barriers, and enablers of opening and closing windows and the use of the exhaust fan at Lakeview House. The study utilized a mixed-methods approach including a resident questionnaire, window audit, and resident workshop.

Findings fell into four main themes:

- Knowledge of the building ethos and cooling system,
- Satisfaction with the building's indoor environmental quality,
- Cooling behavior patterns in private and shared areas,
- Barriers: people-centric and building-centric.

Findings stress the importance of:

- Providing education of the cooling system, especially to short-term summer residents
- Building the desired habits through education and repetition
- Removing perceived barriers (building, social, personal).

When proposing strategies that can encourage cooling behaviors, participants mainly shared ideas that inform residents of desired behaviors and provide feedback on their usage through gamification. This approach is generally assumed to work for users who are motivated to adopt a proposed behavior, but may not be as effective if users are unmotivated or resistant.

Key Findings

for future projects

PROCESS

Engage users early and often. Apply a user-centered and/or participatory process, informed by Design for Sustainable Behavior, to elicit insights from user group representatives at various points in the design process:

- **Pre-design:** elicit feedback from a representative user group on the design of the cooling system both mechanical and behavioral components. This can reveal any tensions between ingrained habits or needs and the desired behaviors crucial to the success of the system. User insights can also confirm or correct assumptions on how people would feel or interact with the mechanical system if such interactions are required.
- **Pre-design:** based on context and desired cooling behaviors, co-create, with representative user group, strategies that can support and encourage cooling behaviors.
- **Post-occupancy evaluation (POE):** apply a mixed-methods approach, similar to this study, to identify what's working well, what can be improved, and how. POEs at multiple points in time might help reveal any emerging issues with the cooling system, behavior assumptions, or any rebound effects that require additional design strategies to address.

BUILDING

Designers to consider ways in which building elements can support or hinder desired cooling behaviors for example:

- **Privacy and noise control often prioritized in bedrooms.** A cooling system that requires opening bedroom doors at night will cause a conflict between personal needs and desired cooling behaviors. Consider transom windows and model long-term benefit compared to up-front cost of window.
- **Building layouts and space location impact sense of empowerment.** Avoid placing cooling system controllers (e.g., fan switch) in semi-private zones to empower all residents to interact with the system equally.
- **Windowsills can be used to display plants or personal objects.** Narrow sills crowd access to window levers and can limit their use.

STRATEGIES

Strategies that inform and allow users to control their actions were preferred over those that determine behaviors by this study's participant group.

Examples of informative and persuasive strategies shared in this study can serve as a starting point for owners and designers exploring similar approaches:

OWNER

INFORM

- Incorporate desired behavior **education** into initial building welcome and training.
- Consider the **messaging and delivery** of education and instructions (e.g., visual, short, and digital guides, instructions and knowledge delivered by fellow residents).
- **Remind** of desired behaviors at strategic and specific times (e.g., send out reminders of cooling process before hot weeks).
- Incorporate **signage** as a strategy and place strategically at decision/action points (e.g., by a switch that needs to be turned on or off based on ambient conditions).
- **Address potential tensions between inherit and desired behaviors** through education and repetition.

PERSUADE

- Provide **real-time feedback** on performance and leverage competition and **gamification** to encourage desired behaviors.

DESIGNERS

INFORM

- Collaborate with owner to identify decision and action points in a building and use design elements to accommodate and accentuate planned **signage**.
- **Integrate signage** strategy into the overall building design so it does not feel like an afterthought or applique.
- Design-in **visual and/or audible feedback** to indicate systems are working as designed (e.g., small light bulb turns green to indicate exhaust fan is working).

PERSUADE

- **Strategically locate screens** to allow for individual and group access.



STUDY BACKGROUND

**WOLF RIDGE, LAKEVIEW HOUSE,
& DESIGN FOR SUSTAINABLE
BEHAVIOR**



Buildings at Wolf Ridge are “another teaching tool to help visitors understand their effect on the planet, and ultimately how to become better stewards of the land.”⁽¹⁾

Peter Smerud | Wolf Ridge Executive Director

Wolf Ridge

an environment for learning

Wolf Ridge Environmental learning Center (WRELC), established in 1971, is the largest accredited residential environmental learning center in the United States. Recognized nationally and internationally, Wolf Ridge welcomes over 12,000 visitors annually to its year-round programming.

The center’s programming aims to leave visitors with lifelong memories that change behaviors and interactions with the environment for generations to come.

WRELC delivers its mission by offering visitors and students stimulating educational experiences that strengthen their knowledge, connection, and commitment to the natural environment.

In addition to lessons taught in indoor and outdoor classroom, several of WRELC’s buildings are built to serve as educational tools for environmental awareness and stewardship.

HGA and Wolf Ridge collaborated on two buildings created with that educational purpose in mind - the Margaret A. Cargill (MAC) Lodge and the Lakeview House. The latter is a staff dormitory for graduate students learning and teaching at WRELC both annually and seasonally.

⁽¹⁾ “Wolf Ridge Environmental Learning Center Earns Highest Environmental Certification in the World.” *HGA*, October 26, 2021. <https://hga.com/wolf-ridge-environmental-learning-center-earns-highest-environmental-certification-in-the-world/>.



Lakeview House

a community and home

Lakeview House, the first of the two collaborations between HGA and WRELC, served as a pilot for the MAC lodge. Although the faculty housing is not Living Building Challenge (LBC) Certified, it was designed to meet LBC standards.

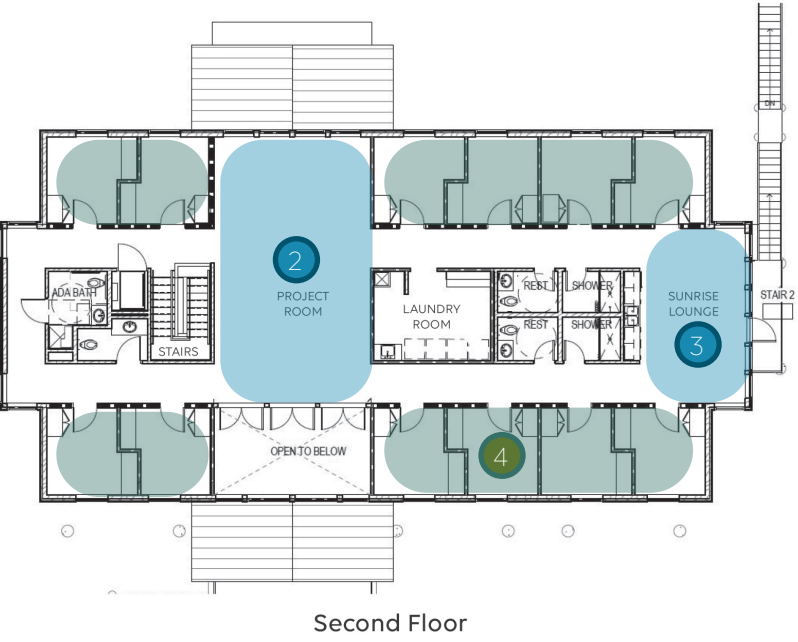
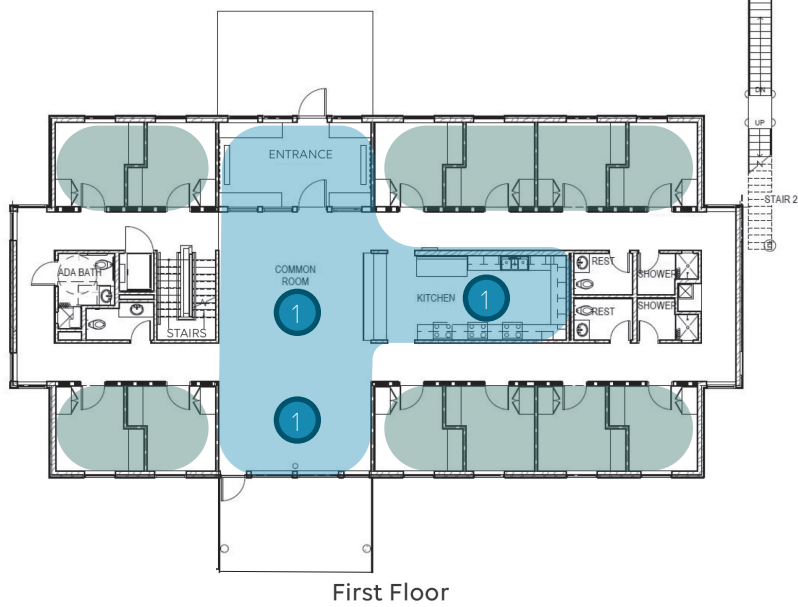
Designed with intentionality, the two-story home is nestled within the surrounding vegetation and capitalizes on the splendid views of the 2,000 acre campus and nearby Lake Superior.

Designed to encourage community and interaction, Lakeview House offers a variety of social gathering spaces of different sizes within its efficient footprint. The kitchen opens up onto community dining which flows into a double height living room that serves as the heart of

the home with its spectacular views and access to a spacious deck.

Overlooking the living room on the second floor is the projector room which, in addition to offering cozy movie nights, serves as a multi-purpose area for learning and socializing. The Sunrise Lounge, brought to life by plants of all species and sizes, is a quiet smaller social area in a more secluded part of the house.

Twenty four identical (mirrored) rooms line the exterior of the building and serve as individual sleeping quarters. In their personal rooms, residents can customize elements of their furniture to make their private space more comfortable and homey.



1 Kitchen, dining, Living



3 Sunrise Lounge



2 Projector Room



4 Bedroom

Lakeview House

community-based cooling

Residents at Lakeview receive a **house manual** that explains, in detail, all aspects of the house and its rules and guidelines. Within the section dedicated to “Lakeview Energy Use: How to Guide,” residents can find detailed instructions on keeping the house cool during summer months:

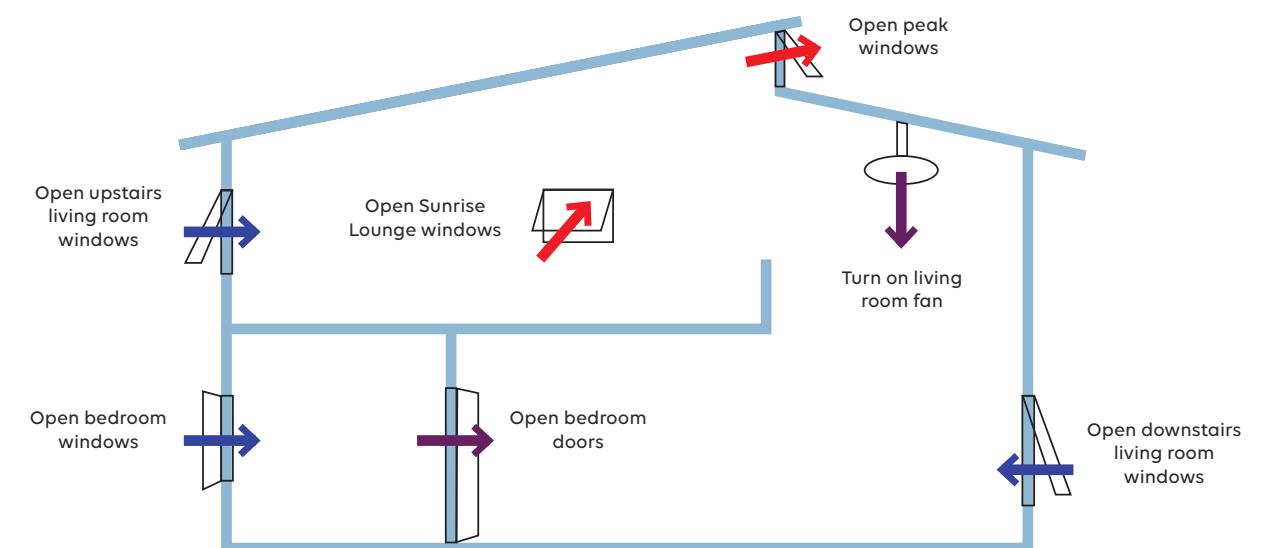
“To use the fan assisted cooling, in the evening as temperatures begin to cool after a hot day, a large exhaust fan above the sunrise lounge turns on to create a tremendous negative pressure within the very tight building. This causes cool night air to be sucked into the building. Residents should close common areas windows, open all the bedroom windows, and leave their bedroom door cracked open. This allows cool night air to be pulled into bedrooms. If all bedrooms do this with the assistance of the exhaust fan, the entire volume of air is exchanged in the building in 12 minutes. Come morning, occupants should close all the windows and close south facing blinds, thereby trapping all the cool air within.” (p.40-41)

The success of the cooling system depends, in large part, on the cooperation of all residents to ensure windows in shared and private areas are operated as intended.

In this study, HGA partnered with WRELC to explore the extent to which residents are able to adhere to the individual and social behavior patterns essential to the function of the cooling system.

“There’s a lot of community built into [the cooling system], because if a few people are not in on how to keep it cool, the whole place will get warm.”

Lakeview House Resident (workshop)



For cooling, “Lakeview house uses a ‘fan assisted chimney effect’ in combination with a tightly sealed and well insulated building.”

Lakeview House Manual (p.35)

Sustainability, Design, and Behavior

designing for change

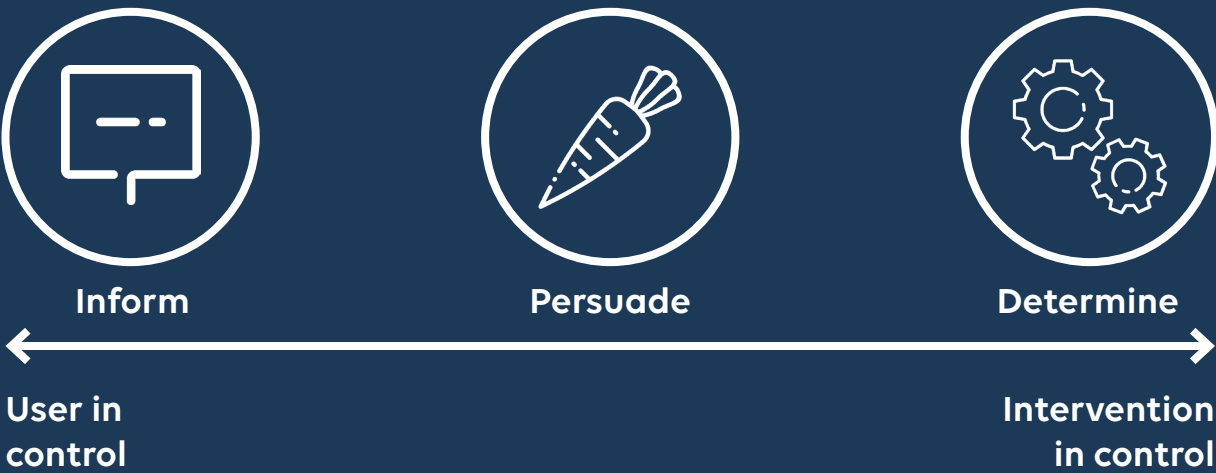
Design for Sustainable Behavior (DfSB) is a field that uses an understanding of behaviors, attitudes, norms, and barriers (e.g., knowledge, cost) to propose designs that can encourage desired pro-environmental behaviors.

DfSB strategies are organized on an axis with strategies on one end informing users of their usage through reminders and signs, followed by strategies that persuade them through affordances and constraints, and finally those that determine behavior through restraining or automating behaviors.^{2,3}

Lakeview House was an early adaption of LBC and successfully created a well-designed and insulated building. But even the best designed buildings can suffer gaps in performance compared to intended or predicated use and resource consumption. Occupants' behaviors and choices are one of the factors that can cause this gap.

Currently, Wolf Ridge informs residents of desired behaviors through the house manual but does not provide further information or exert influence. Because the cooling system at Lakeview relies on residents adopting prescribed behaviors, DfSB's framework and insights are arguably relevant to exploring the prevalence of desired behaviors, the elements influencing occupant choices, and guiding recommendations for Wolf Ridge and similar projects. As such, insights from DfSB were incorporated into the study as appropriate.

(2) Johannes Zachrisson and Casper Boks, "Exploring Behavioural Psychology to Support Design for Sustainable Behaviour Research," *J. Design Research* 10, no. 1/2 (2012): 50-66, <https://doi.org/10.1504/jdr.2012.046139>.
(3) Debra Lilley, "Design for Sustainable Behaviour: Strategies and Perceptions," *Design Studies* 30 no. 6 (2009): 704-20, <https://doi.org/10.1016/j.destud.2009.05.001>.



DESIGN FOR SUSTAINABLE BEHAVIOR STRATEGIES

(Adapted from Lilley,³ Zachrisson & Boks²)



LAKEVIEW HOUSE

OVERVIEW OF FINDINGS &
RECOMMENDATIONS

Study Aim & Methods

exploring barriers & enablers

STUDY AIMS

- Capture frequency of desired cooling behaviors (opening and closing windows, doors, and exhaust fan use).
- Understand potential barriers to desired cooling behaviors.
- Engage occupants to explore strategies for removing barriers and supporting desired behaviors.

METHODS

The study used a mixed-methods approach including a **survey** and follow-up **workshop** that explored:

- Knowledge of the house's sustainability ethos and features
- Evaluation of the indoor environmental quality, and personal comfort
- Residents' cooling habits and intentions
- Reflections and ideas for encouraging desired cooling behaviors.

Additionally, WRELC's operations director completed a **window audit** throughout the study period to capture the state of each window at multiple times each day.

Finally, an HGA researcher walked through the house and conducted a physical traces **observation** "systematically looking at physical surroundings to find reflections of previous activity" left there consciously or unconsciously by users to infer designer intentions, how people use and feel about the space, and how it meets users' needs.⁴

TIMELINE

The study was conducted over two months from July - August, 2024 during the summer months where the behaviors would be most required. The audit occurred over 4 weeks, the survey was open for about 2 weeks, and the 2.5 hour workshop was held in July.

(4) John Zeisel, *Inquiry by Design : Environment/Behavior/Neuroscience in Architecture, Interiors, Landscape, and Planning* (New York: W.W. Norton & Company, 2006), 159.



Overview of Findings

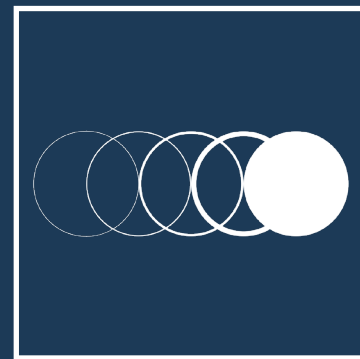
themes

- Data from the four methods were analyzed and synthesized into five themes:



SATISFACTION

- Dissatisfaction with indoor environmental quality mainly stemmed from the house being too hot (mainly in the summer but in the winter too for some bedrooms).
- **Bedrooms:**
 - Participants suspected/shared residents' in rooms on the south side of the house were probably more dissatisfied with heat.
 - Hot air can be trapped in rooms during the day if windows are closed making rooms too hot in some cases even at the end of the day.
- **In common areas:**
 - The entry vestibule can smell badly and requires ventilation.
 - Cooking generates additional heat, and the kitchen also lacks proper smoke ventilation.



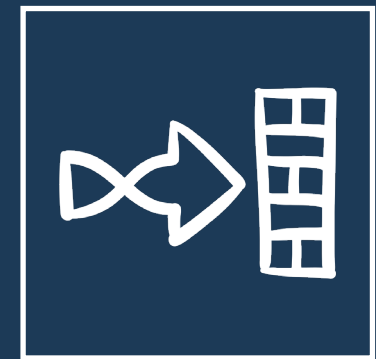
BEHAVIORS

- **Personal Spaces:**
 - Of the three cooling behaviors required in bedrooms only one regularly occurred:
 - Opening bedroom windows at night occurs regularly for almost everyone.
 - Closing windows during the day occurs rarely to sometimes.
 - Cracking bedroom door open at night rarely to never occurred according to vast the majority due to privacy and acoustics priorities.
- **Shared Spaces:**
 - Windows are rarely to sometimes opened or closed, and can stay in one position for an extended time. The audit confirmed this.



KNOWLEDGE

- Knowledge of the building's sustainable ethos and commitment to Living Building ethos was prevalent among the majority of respondents.
- Knowledge of the cooling system components varied particularly regarding the exhaust fan's existence and functionality.
- A majority of respondents accurately described when to open and close their bedroom windows.
- Some knowledge of the cooling systems was lost over the pandemic.
- Most recommendations to encourage desired cooling behaviors generated by residents included an educational component.



BARRIERS PEOPLE-CENTRIC

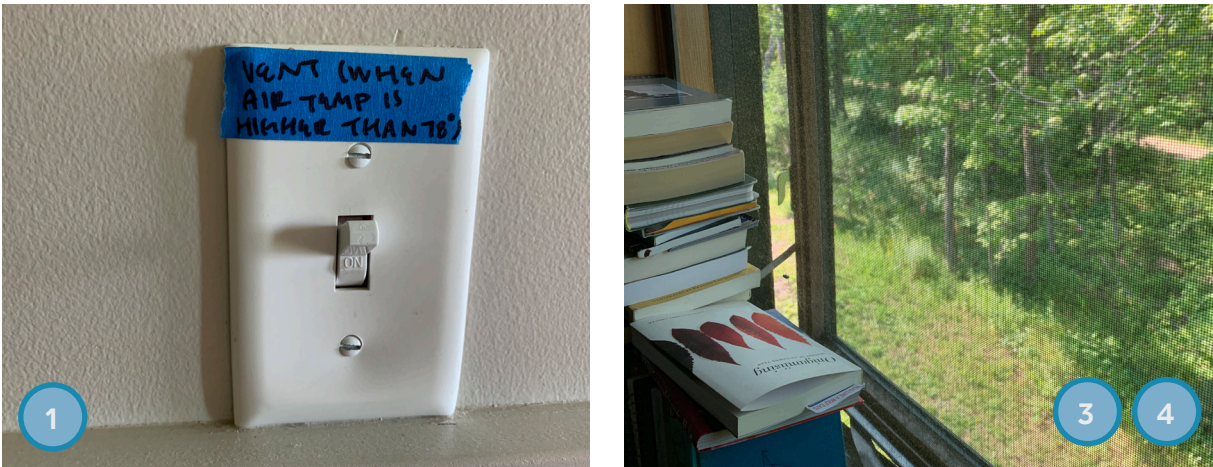
- **Social Dynamics:** The exhaust fan's switch placement in the Sunrise Lounge and the social dynamics of the lounge (i.e., feels more private and secluded) impacts sense of empowerment to interact with it.
- **Seniority:** Summer residents felt less empowered to explore/control the fan's function compared to long-term residents, due to lack of knowledge, limited use of Sunrise Lounge, or fear of making a mistake.
- **Habits:** Personal habits, (e.g., opening the window despite the hot air outside to tempt a breeze) presents a barrier to closing windows during the day.

Overview of Findings

themes



- 1 The **Exhaust fan** switch was not located in a prominent area, with no clear instructions, and the researcher could not determine if it was working. Residents echoed that sentiment in the workshop.
- 2 The **building layout** and preferred assignments of adjacent rooms likely contributed to the feeling that the Sunrise Lounge was a semi-private space.
- 3 Windows were easy to operate; however, **plants and personal objects** on sills blocked access.
- 4 **Window openings** were limited and narrow. Some residents jerry-rigged windows to open wider and bedroom doors to stay open.
- 5 Most residents added small **personal fans** in their rooms to help with cooling.



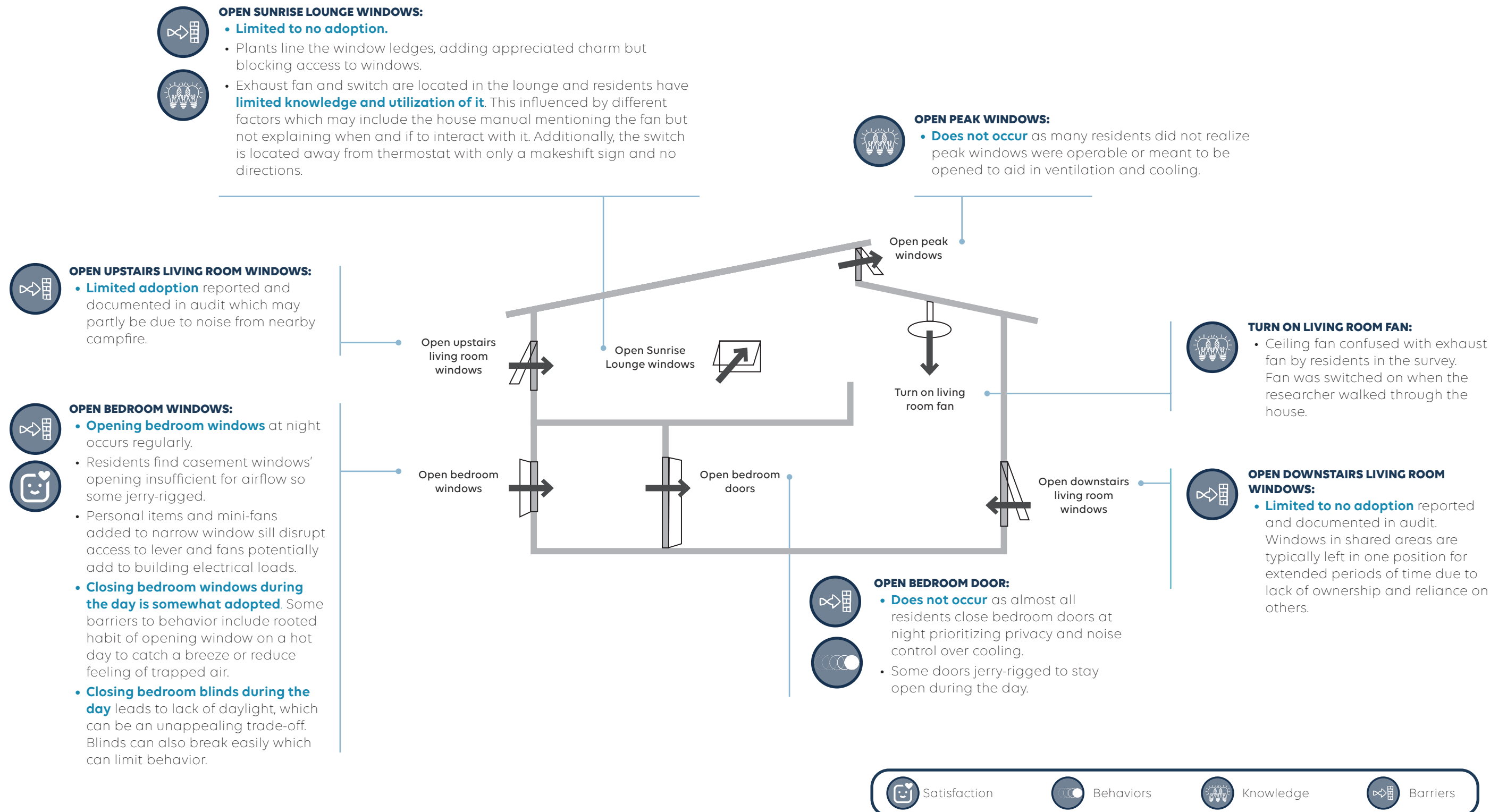
Right: Sunrise Lounge location at end of 2nd floor corridor, flanked by 2 rooms, gives it a semi-private feel and sense of dedication to rooms closest to it. Those rooms are also often occupied by senior residents adding to the feeling of privacy.



Overview of Findings

linking insights to cooling instructions

Insights are presented below as they relate to the cooling instructions provided to residents.



Overview of Findings

opportunities

Residents were introduced to Design for Sustainable Behavior (DfSB) and its strategies and **were asked to propose ideas that would encourage cooling behaviors in two settings; a fictional classroom and Lakeview House.**

Their ideas for Lakeview were analyzed, synthesized, and organized along the DfSB Axis of Influence (inform, persuade, and determine).

The vast majority of ideas fell into the inform end of the spectrum. These strategies assume the users are motivated and have a positive attitude towards the desired behavior.⁵ A few ideas included feedback which falls under inform but can also lean towards persuade. One feedback idea adds an element of normative feedback (comparing usage to others) which can be classified as a persuasive strategy,⁶ effective for those with a positive or non-specific attitude.⁷

(5) Johannes Zachrisson and Casper Boks, "Exploring Behavioural Psychology to Support Design for Sustainable Behaviour Research," *J. Design Research* 10, no. 1/2 (2012): 50-66, <https://doi.org/10.1504/jdr.2012.046139>.

(6) Dan Lackton, David Harrison & Neville Stanton, "Making the user more efficient: design for sustainable behaviour," *International Journal of Sustainable Engineering* 1, no.1 (2008): 3-8

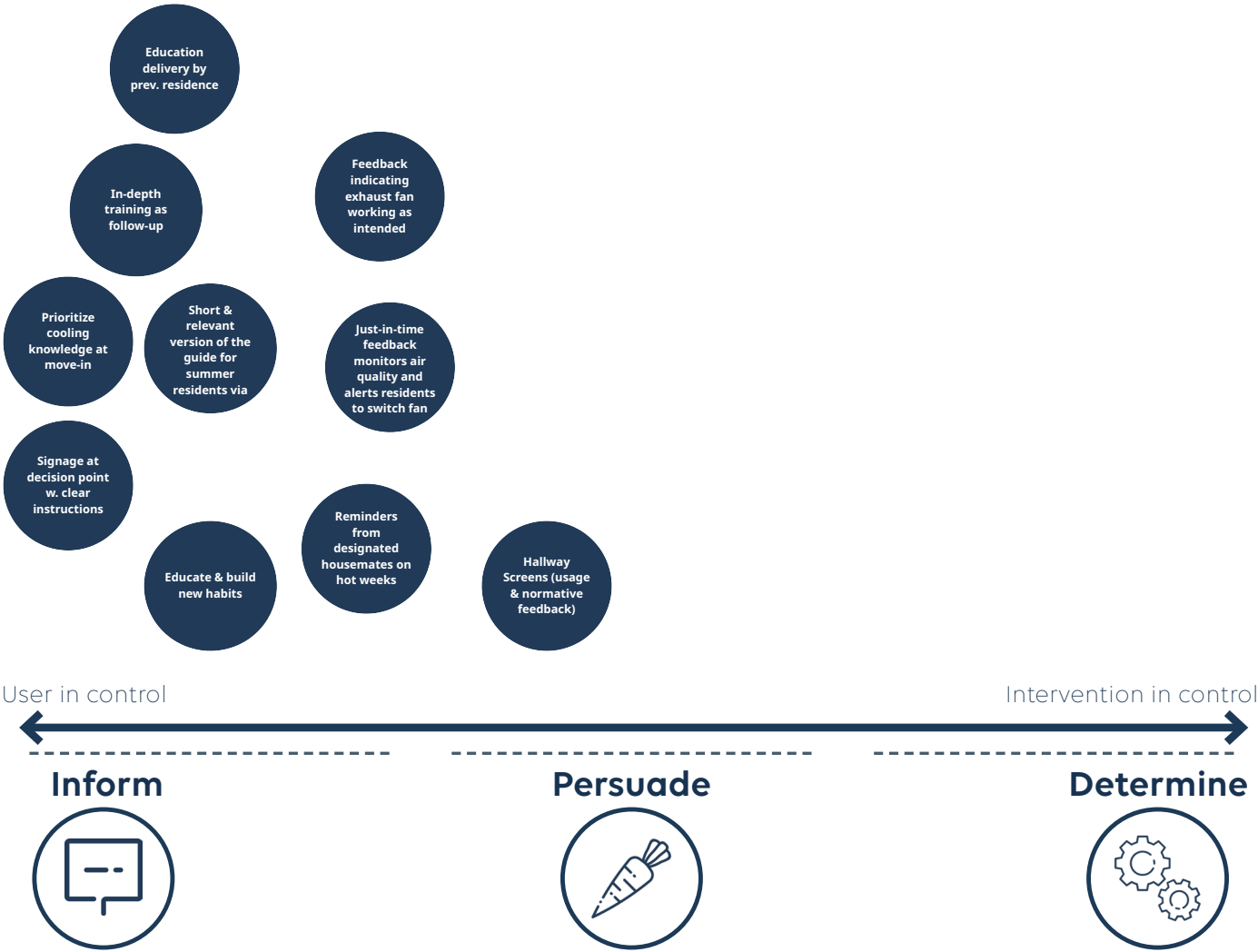
(7) Zachrisson & Boks, "Exploring Behavioural Psychology," 50-66

RESIDENT IDEAS ARE SHARED BELOW ORGANIZED UNDER THREE CATEGORIES:

- Information Strategies
- Persuasive Strategies
- Building Strategies & Personal Choices

On the next page, **resident ideas shared during the workshop are incorporated with HGA recommendations.** Ideas are organized based on the effort (e.g., cost, time) Wolf Ridge would need to implement the ideas.

Additionally, ideas are organized based on how they would be applied (i.e., to people's behaviors or to the building).



Recommendations

low to high effort

INFORMATION STRATEGIES		PERSUASIVE STRATEGIES	BUILDING STRATEGIES AND CHOICES	
Education		Eco and Normative Feedback	Building	Choices
PEOPLE BEHAVIORS	• Prioritize introducing cooling system and desired behaviors during the first welcome tour. • Protect sense of "home" by assigning delivery of knowledge to existing residents.	• Reinforce and remind of cooling procedures ahead of hot weeks.		
	• Create a tailored abridged version of the house guide, especially for summer-residence. • Create home-like cooling instruction signage and place at decision points.			• Administer survey before move-in to capture resident preferences (cooler room vs. room with a view) for room assignment consideration.
	• Use education and reminders to build new habits and overcome ingrained ones. • Test strategies like education and assigning responsibility to improve use of shared windows.			
BUILDING DESIGN			• Provide sturdier bedroom blinds. • Allow windows to open wider if complies with safety. • Standardize bedroom doors to hold-open or auto-shut.	
			• Add additional ceiling fans • Add shelves for personal and communal items.	
	• Confirm exhaust fan is working and provide feedback to indicate it is on or off. • Connect Lakeview to WRELC weather data so residents can switch fan off if there's smoke or allergens.	• Add hallway level feedback screens for usage and social feedback.	• Add transom above bedroom doors for air flow and privacy. • Locate exhaust fan switch near thermostat to inform actions. • Exhaust kitchen heat directly to outside.	

LOW EFFORT

HIGH EFFORT

LOW EFFORT

HIGH EFFORT

Recommendations

illustrations

The passive cooling system was designed based on a belief that even in the midst of a warming climate and higher humidity, humans can accept non-refrigerant based air conditioning if the indoor sleeping temperatures and humidity match outdoor conditions in northern climates. Therefore, to create maximum cooling and personal comfort for sleep, in the evening as daytime temperatures and humidity diminishes, the **house manual** explains:

*"Residents should **close** common areas windows, **open** all the bedroom windows, and leave their bedroom door cracked open (...) Come morning, occupants should **close** all the windows and close south facing blinds, thereby trapping all the cool air within."*

However upon closer examination, one finds some ambiguity in the house manual, for example: the manual's accompanying illustration (top right) does not specify if these are the evening or morning instructions. Also, the text above calls for **closing** shared windows in the evening and morning which contradicts the illustration directing residents to open shared windows. Additionally, neither the text nor the illustration in the house manual indicate how residents should interact with the exhaust fan.

To address this, WRELC could consider updating the house manual and adding more details as shown in the blue text below:

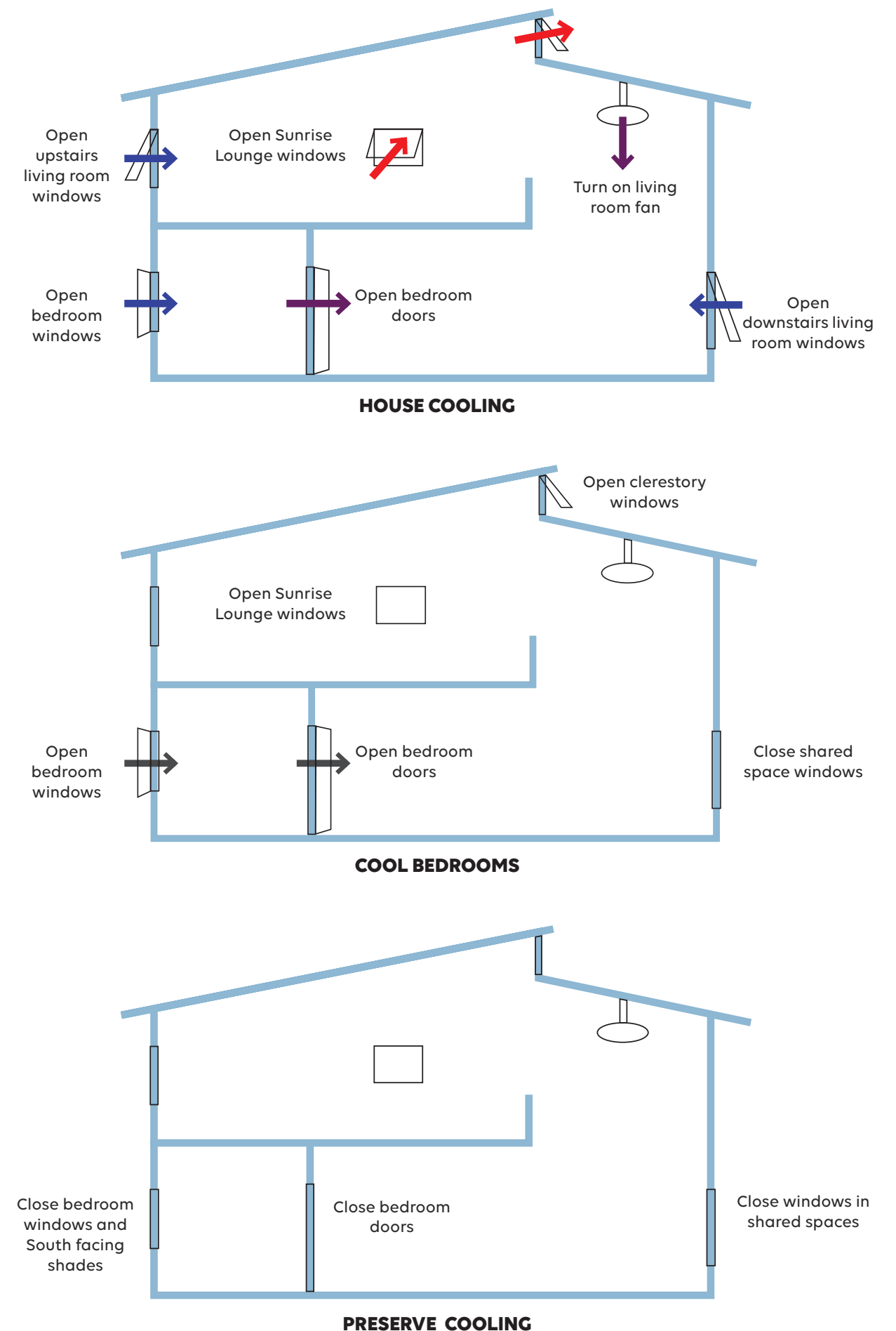
*"Residents should **close** common areas windows **on lower levels**, **open** all the bedroom windows **and upper level***

*exhaust windows (Sunrise Lounge and upper clerestory windows in 2nd level commons area), and leave their bedroom door cracked open. Leaving bedroom doors ajar allows negative pressure created by the natural chimney effect of the upper level windows, and/ or the use of the whole building exhaust fan, to pull cooler night air through the bedroom sleeping areas and commons areas, to the outside. (...) Come morning, occupants should **close** all the windows and close south facing blinds, thereby trapping all the cool air within."*

Additionally, illustrations can be updated (right) to reflect the following:

- Provide three illustrations one for whole house cooling, the second for personal space/bedroom cooling (evening), and third for preserving cool air (morning)
- Ensure written instructions are accurately reflected in illustrations
- Incorporate instructions regarding the exhaust fan including when to interact with it and how in text and illustrations

Instructions can also be replaced by a short video emailed to residents and/ or shared through group chats ahead of hot months to remind of, and encourage, desired communal behaviors.





LAKEVIEW HOUSE

APPENDIX

Survey, workshop, observation, and
audit findings.



SATISFACTION

TEMPERATURES

Air temperature during the day and night were the least satisfactory indoor environmental qualities. During the summer, South facing rooms in particular are favored for their views and daylight, however they can trap in a lot of heat during the day reaching temperatures like 75-78 degrees. *"Even with ... blinds closed, window closed, door open, I still come back and it's still like 75 degrees in my room."*

The South side can also be too hot in the winter because the heat automatically kicks in at a certain temperature point making some rooms too hot. One participant suggested allowing rooms to turn off heat to them completely and turn back on as needed to combat this.

In addition to being too hot, the house might struggle to heat up at times during particularly cold winters.

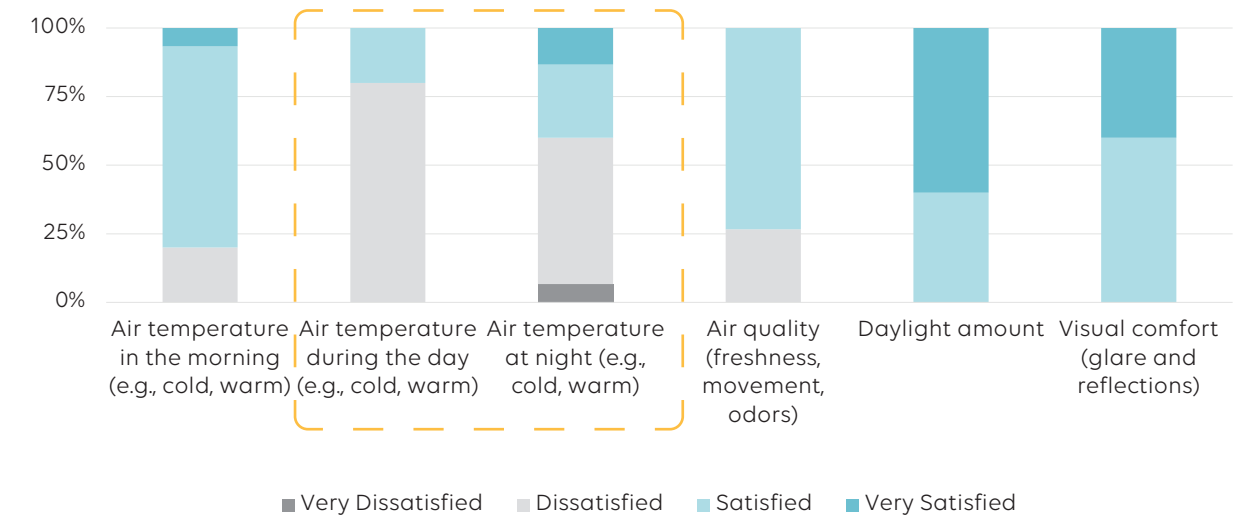
VENTILATION

Entry: currently has zero ventilation which leads to stuffiness and smells. An operable window would be appreciated.

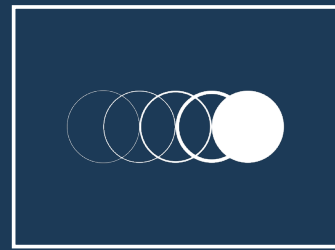
"wish the boot room had openable windows." (survey)

Kitchen: appliances, stove, and light produce a lot of heat. Smoke from cooking is hard to exhaust and requires a cross-breeze from opening front and porch doors.

Overall, how satisfied are you with the following aspects of the indoor environmental quality at Lakeview House.



Above: Heat map in response to survey question click on any areas where the building is typically warmer or stuffier than you would like.



BEHAVIORS

Residents opened windows in both private and shared areas, more so in personal spaces.

PERSONAL SPACES

Survey showed almost all participants open their window at night. However, 31% rarely to never close windows in the morning to trap the cool air. During the workshop a couple explained when they wake up the temperature is still nice outside so they leave the window open and forget to close it before leaving the house for 12 or more hours a day, as one person shared:

"I'll leave my room when it is still cool in the morning and I won't come back to my room until it's like starting to cool down at night so I don't feel a strong urge to ... deal with the window and deal with the shades cause the shades are ... super finicky as well but like I've got plants there and it's just a whole thing."

The biggest barrier to opening windows in the bedroom is that the window does not open wide enough, air quality at times, and potential outside noise (from campfire).

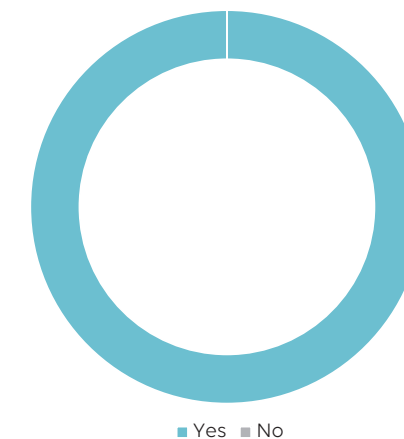
"the window barely opens - I'd really like to be able to open my window more than two inches!" (survey)

Only one person indicated they regularly to every day leave their door cracked open at night to allow air to circulate. Both privacy and noise control were cited as reason prohibiting this behavior.

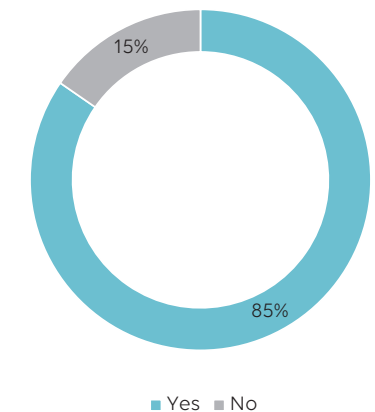
SHARED SPACES

Opening the window in shared areas when it feels stuffy or uncomfortable occurs regularly to every day. Closing windows however rarely occurs for the most part. In describing the dynamics around shared windows, a workshop attendee explained: *"with the community windows it's a lot of: I'm going to open the window to let the breeze in and just keep it open and then they just stay open for days and days and days and then someone closes them and they stay closed for days and days and days until someone's like, I'm gonna let the breeze in."*

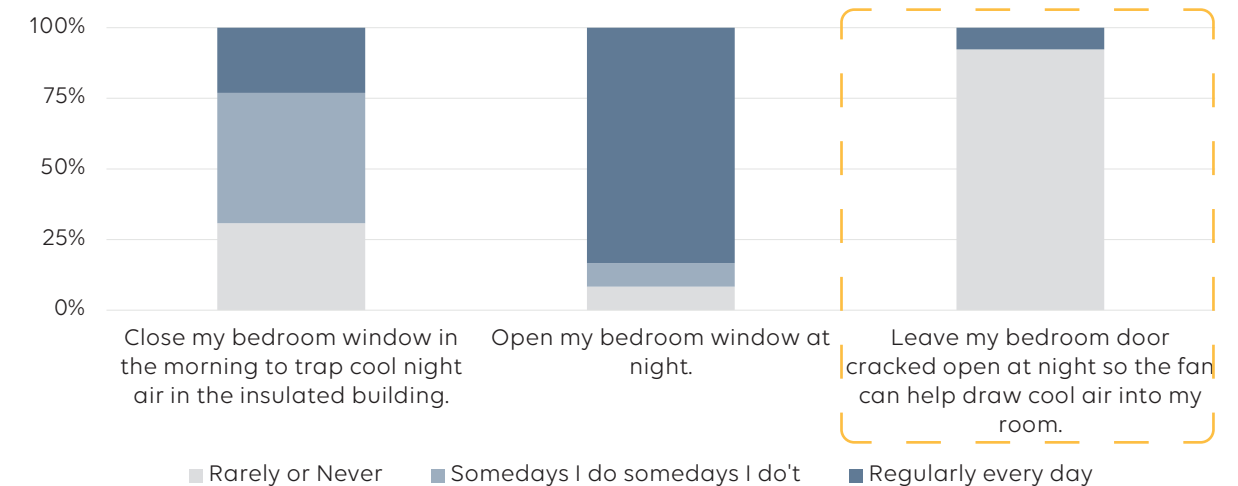
Do you ever open windows in your bedroom at Lakeview House?



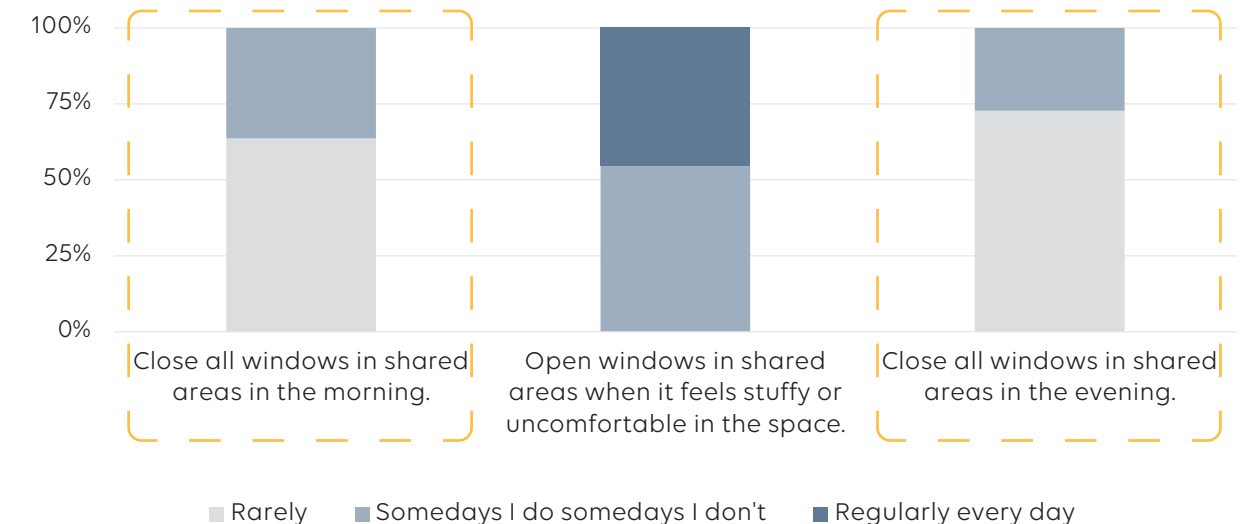
Do you ever open the window(s) in shared areas at Lakeview House?



Opening/Closing Bedroom Windows



Opening/Closing Shared Windows





KNOWLEDGE

OVERALL KNOWLEDGE

Research participants demonstrated knowledge of the building's sustainability.

The group was not aware clerestory windows in the projector room were operable and were excited to learn it. One person mentioned they'd heard from a past resident that they opened those windows but believes knowledge about the windows, and parts of the system, was lost over the pandemic.

Residents recognize the importance of everyone knowing how to use the cooling system as one stated: *"there's a lot of community built into it, because if a few people are not in on how to keep it cool, the whole place will get warm."*

KNOWLEDGE OF FAN

Half the respondents indicated they did not know of the exhaust fan. That number may be higher as some survey respondents thought the question was referencing a ceiling fan as revealed in the workshop.

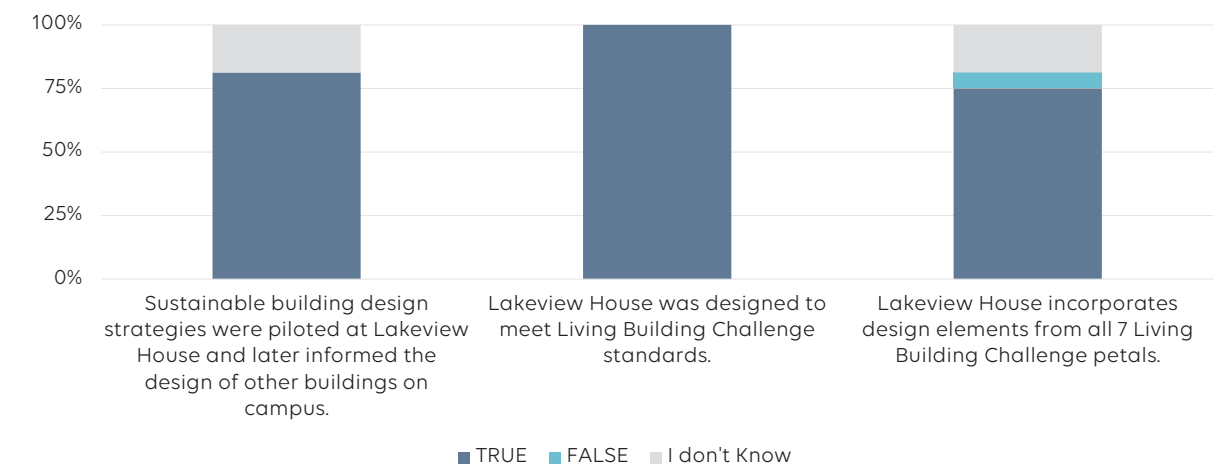
Summer residents expressed lower knowledge of the fan and its purpose and function.

People noted a difference in house training/knowledge between year-long and summer residents where the latter receive less of a *welcome to the house* training and are expected to figure things out by asking others.

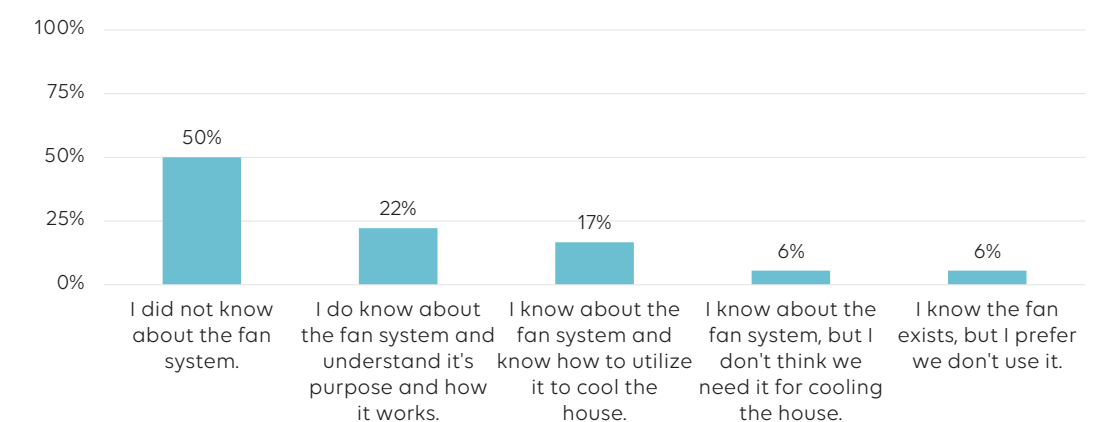
One respondent who knew of the fan and its purpose and process well, did feel the 78 degree threshold for it to kick on meant *"it's already SO warm in our house."* The group also discussed the value of being able to switch the fan off (e.g., allergies or forest fires). That was valuable insight to those who did not know of the fan and they expressed a desire for that to be shared more widely.

There is a clear opportunity to improve knowledge around the fan as even long term residents, although understood its functionality, stated they *"have not seen in action or heard in action"* and generally thought *"It's hard to know if it's working or not"* and had experienced *"times when it should have been working"* but they didn't *"think it's working."* Even standing right under the exhaust fan, they couldn't tell if it was on.

Please indicate if each of the following statements regarding the Lakeview House is true or false.



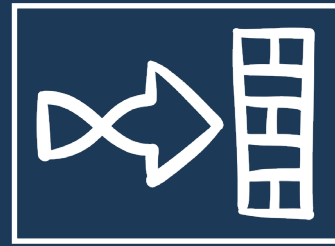
Please select all the statements you agree with from the list below regarding the fan system that assists in cooling the Lakeview house.



"I was talking to some people too, who I think took the survey, and thought that it was just talking about ... one of the ceiling fans."

"That was me! I was like yeah I feel empowered to turn on the *ceiling* fan!"

Lakeview House Residents conversation | workshop



BARRIERS

Majority of respondents did not think their housemates knew how to operate the cooling system. Lack of knowledge was an important barrier to achieving desired behavior, particularly regarding the exhaust fan.

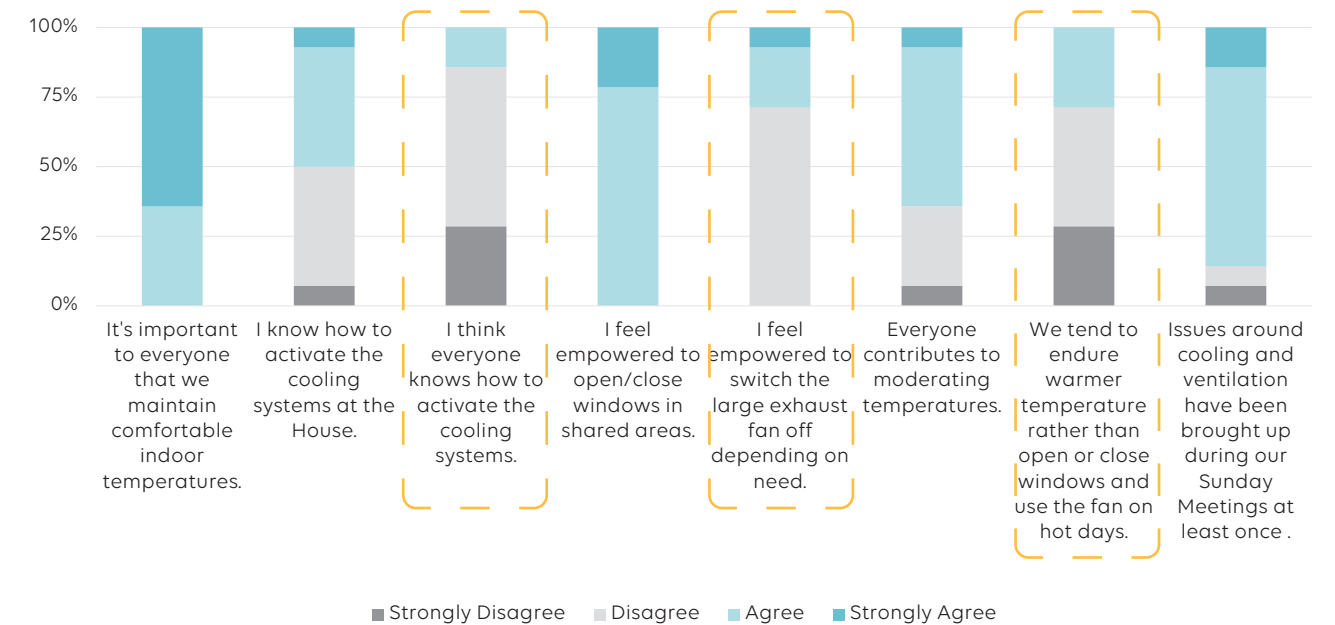
Majority (71%) did not feel empowered to switch off/on the large exhaust fan. The exhaust fan's switch placement in the Sunrise Lounge and the social dynamics of the Lounge (i.e., feels more private and secluded) impacted sense of empowerment to switch the fan on or off.

The plants lining the Lounge's window sills are part of what make it "enjoyable" but they also block access to the window handle so some might avoid opening windows there because they *"don't want to harm people's plants."*

Summer residents feel less empowered to explore/control the fan's function as one seasonal resident explained: *"I am pretty low on the totem poll as far as like knowing about the house ... and I am on the first floor, so I am ... not spending any time at all in the Sunrise Lounge anyway, so it's just not something that I am gonna do, where I am gonna like go into a space that isn't really like my social community space and do something that I don't know about, because I am new, and I don't want to do something wrong."*

Personal belief and habits, like opening a window when it's hot to tempt in a breeze, are deeply ingrained for some individuals and would require education to break those habits and create opposite ones required to cool Lakeview.

To what extent do you agree or disagree with the following statements.





Observations took place on July 25th, archival weather data from wunderground.com show weather high was 77 and low 55 degrees. Observation notes were captured on the plans (right). Additional reflection and synthesis summarized below:

FAN: Location was secluded, instructions on make-shift label unclear. Researcher could not determine if it was on/off.

IEQ: House did feel stuffy. It was not a hot day and researcher felt relatively comfortable walking slowly in the house. Some areas were clearly hotter than others. Best ventilation and breeze were in living room. In the projector room, despite nice breeze outside, it did not make its way into the house even when sanding right at window.

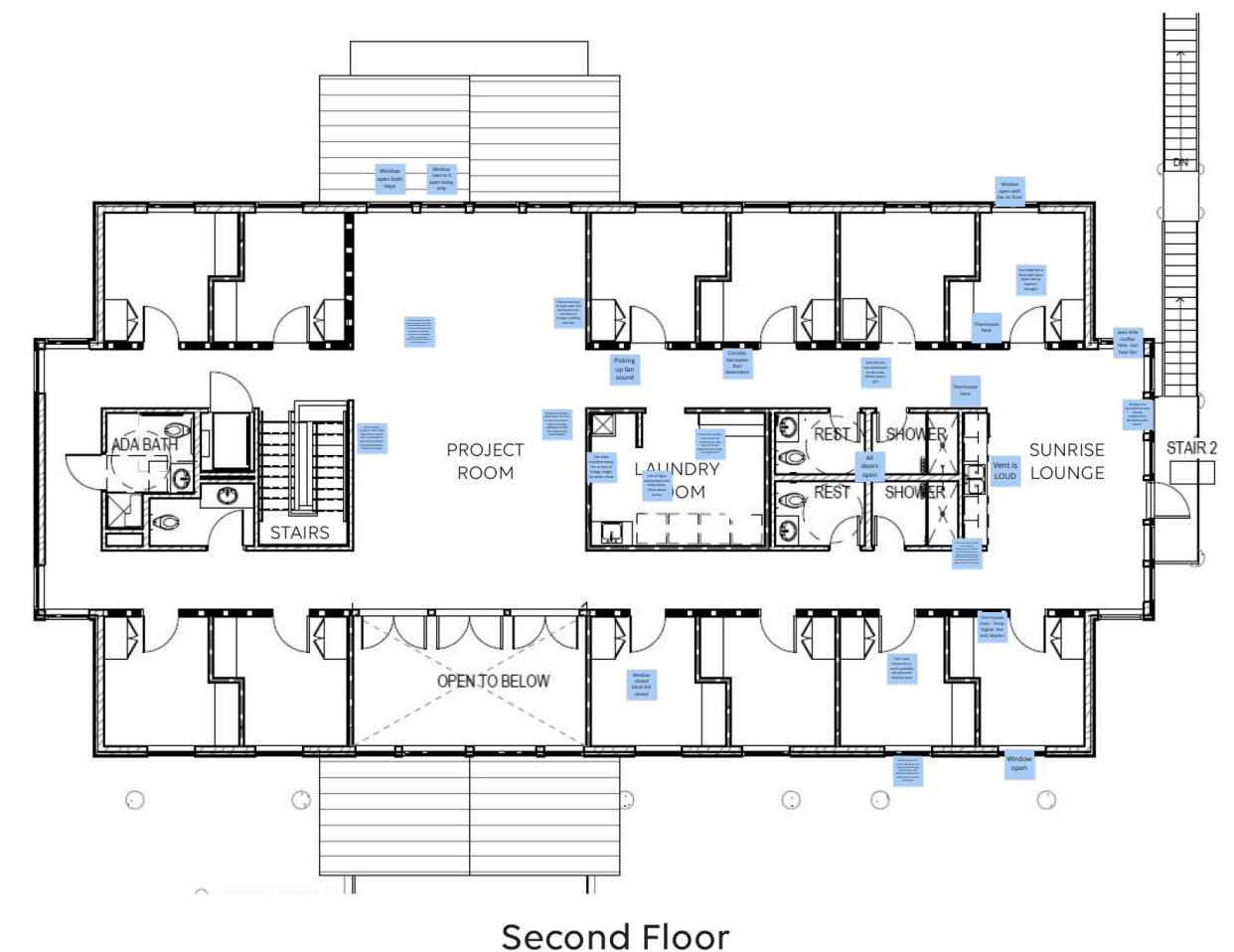
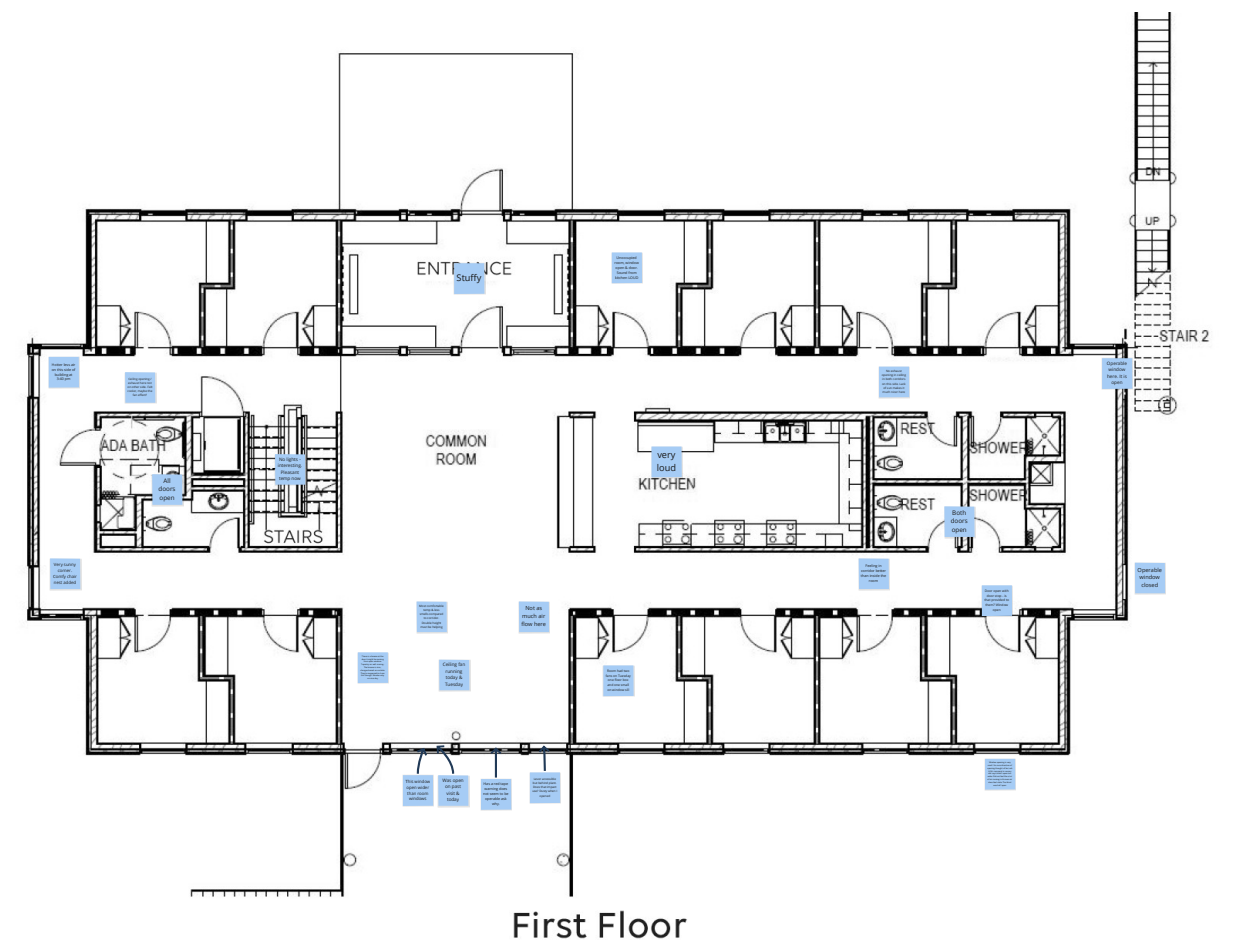
VENTILATION BEHAVIORS:

some windows in the house were left open - no clear pattern emerged. Some rooms left their doors open. Most rooms explored by researcher had a min. of one fan, mostly turned on. Some had 2 fans. Only one room had shades half-way drawn down.

SUNRISE LOUNGE did feel like a semi-private space to researcher and the plants blocking windows were observed.

WINDOWS: easy to open and close - except when blocked by plants or personal items (individual rooms and sunrise lounge). windows in projection room left closed and stick was not within sight. Some windows were manipulated to open wider.

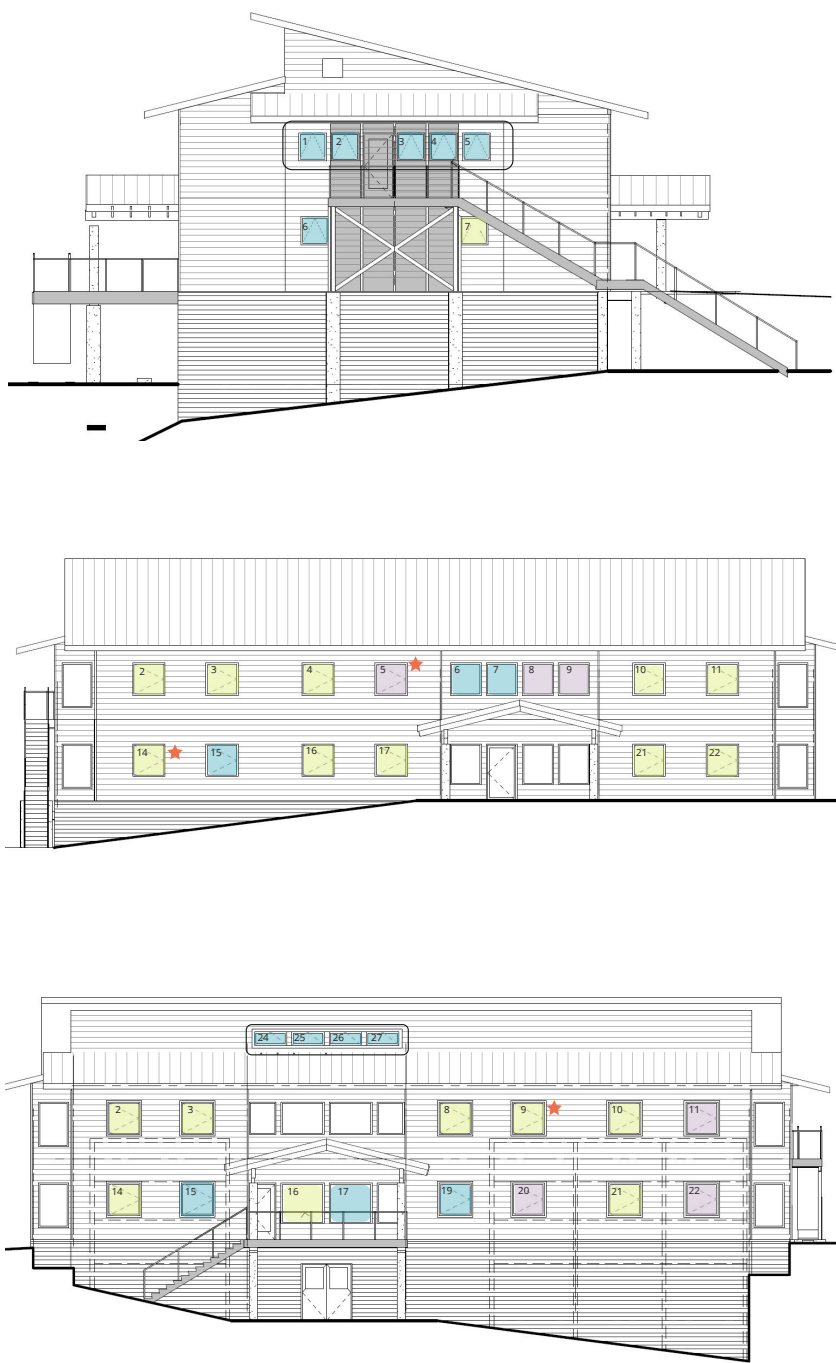
KNOWLEDGE: social interactive signs + instructional signage was scattered around the house although none of the observed related to heating / cooling.



Window Audit

Wolf Ridge conducted a four week window audit recording whether windows were opened and closed three times a day. Additionally, the walk through checked to see if the exhaust fan was switched on.

Data is summarized below and color coded to show position of each window majority of the time (open more than 50% of the time, closed more than 50% of the time, or a 50/50 split).



- Closed Majority of Time
- Open Majority of Time
- Open/Closed - either 50/50 or close to that





Thank you to Lakeview Residents

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