

# BUILDING USER INTRODUCTION



## The Health and Wellness Center

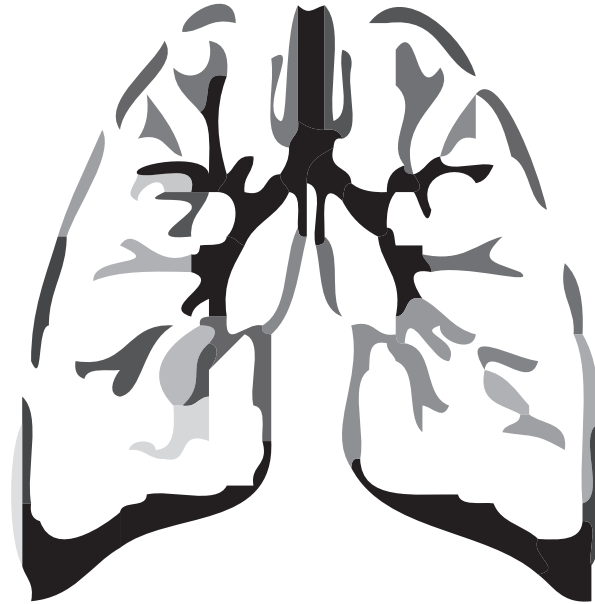


# BUILDING USER INTRODUCTION

*The behavior of those who occupy this building will have a tremendous impact upon the actual performance of the building and the resulting energy and cost savings.*

## TABLE OF CONTENTS

Why Does it Matter?	1
Willamette Valley Potential	5
Building on Precedence	9
Reducing Energy Loads	13
Drawings	19
How it Works	27





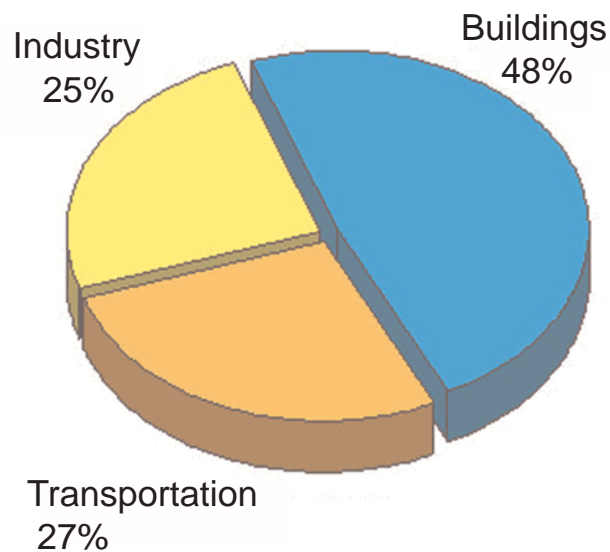




WHY DOES IT MATTER?







US Energy Consumption



Muir Glacier

August 1941

August 2004

Many scientists give us 10 years to be well on our way towards global greenhouse gas emission reductions in order to avoid catastrophic climate change.

Data from the US Energy Information Administration illustrates that buildings are responsible for almost half (48%) of all energy consumption and greenhouse gas (GHG) emissions annually; globally the percentage is even greater. Seventy-six percent (76%) of all power plant generated electricity is used just to operate buildings. Clearly, immediate action in the Building Sector is essential if we are to avoid hazardous climate change.

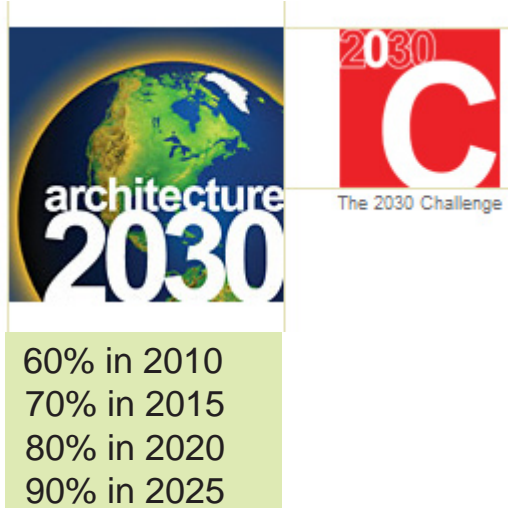
*The 2030 Challenge- Architecture 2030*

*Architecture 2030 is an environmental advocacy group formed in response to rapidly accelerating climate change. The 2030 Challenge addresses the crisis situation surrounding the 'Building Sector' as a major source of demand for energy. Stabilizing and reversing emissions in this sector is the key to keeping global warming within 1°C of today's levels.*

## WHY DOES IT MATTER?

Climate change



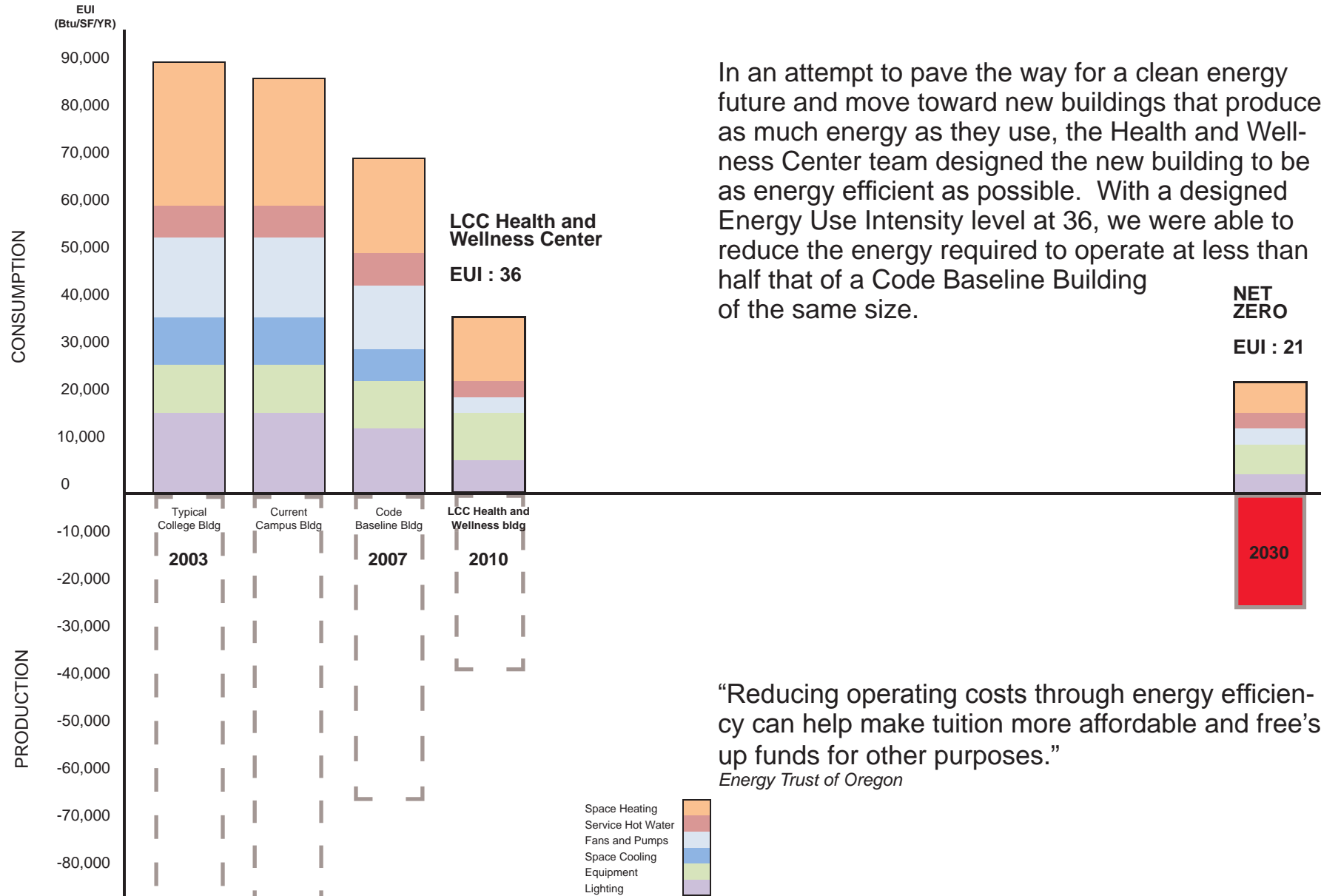


Architecture 2030 issued the 2030 Challenge, which requires each new building project or major renovation to be designed to achieve an energy consumption performance standard of 60% of the regional average for that project's building type. Every five years the standard will increase by 10%, achieving a carbon neutral building in the year 2030. Major renovations are only required to meet a 50% target throughout this timeline, but are encouraged to achieve the increased reductions.

U.S. Averages for Site Energy Use and 2030 Challenge Energy Reduction Targets by Space/ Building Type From the Environmental Protection Agency (EPA); Use this chart to find the site fossil - fuel energy targets								
				2030 Challenge Site EUI Targets (kBtu/Sq.Ft/Yr)				
Primary Space/ Building Type	Average Source EUI (kBtu/sq.Ft/Yr)	Average Percent Electric	Average Site EUI (kBtu/sq.Ft/Yr)	50% Target	60% Target	70% Target	80% Target	90% Target
Education	170	63%	76	38.0	30.4	22.8	15.2	7.6
College/ University (campus -level)	280	63%	120	60.0	48.0	36.0	24.0	12.0
Health Care Outpatient Health	183	72%	73	36.5	29.2	21.9	14.6	7.3
Clinic/ Other Outpatient Health	219	76%	84	42.0	33.6	25.2	16.8	8.4
				2005	2010	2015	2020	2025

## ENERGY USE INTENSITY

LCC Health and Wellness Building - Eugene, Oregon



## WHY DOES IT MATTER?

The path to net zero







WILLAMETTE VALLEY POTENTIAL





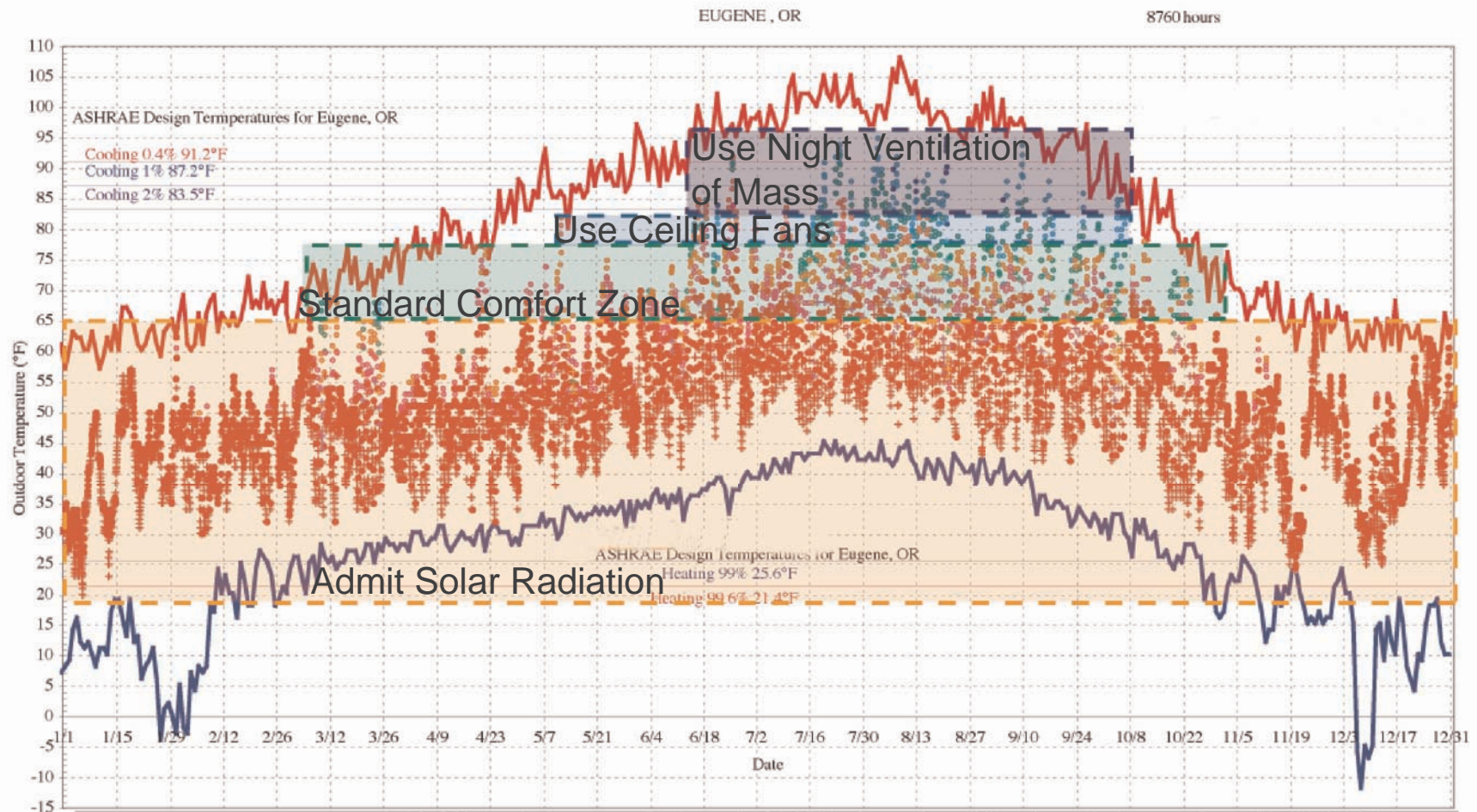




The Willamette Valley offers incredible potential. Besides being a bucolic landscape that offers a wealth of produce, it also has a temperate climate that can be a perfect base from which to make energy savings.

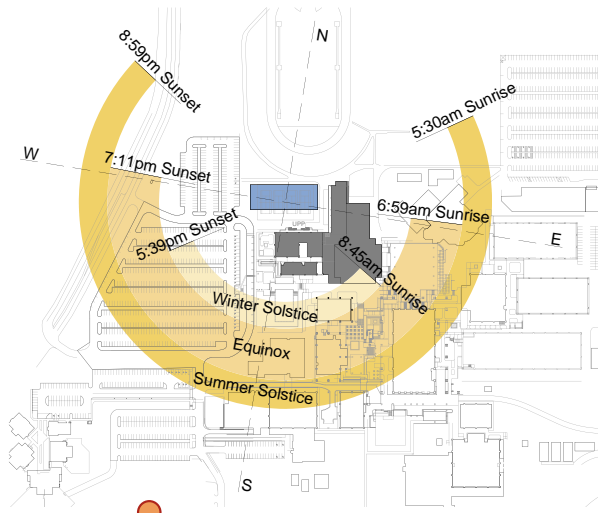
The temperature, wind speed and direction, as well as hours of daylight all become criteria that with detailed study can aid in developing a passively ventilated building that is naturally lit. The Health and Wellness Center is designed on these strategies of passive cooling/ventilating and daylighting.

Analysis of maximum and minimum temperatures for Eugene across the years 1928 to 2007 allowed the design team to understand the comfort range required for a classroom environment within this area.

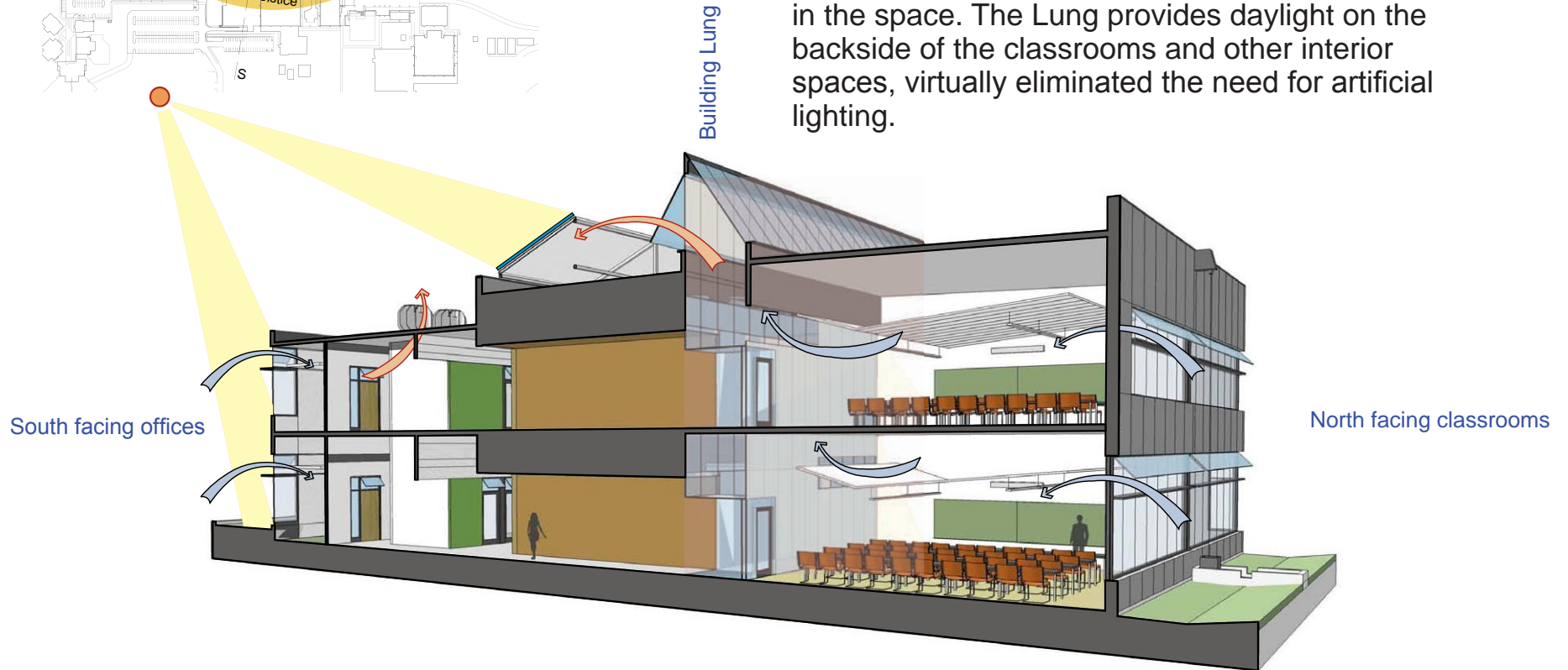


Annual Temperature and Daytime Relative Humidity

Low night time temperatures provided the opportunity to naturally keep the building cool through the means of “night flushing” during these hours and absorbing this cool energy in the building mass.

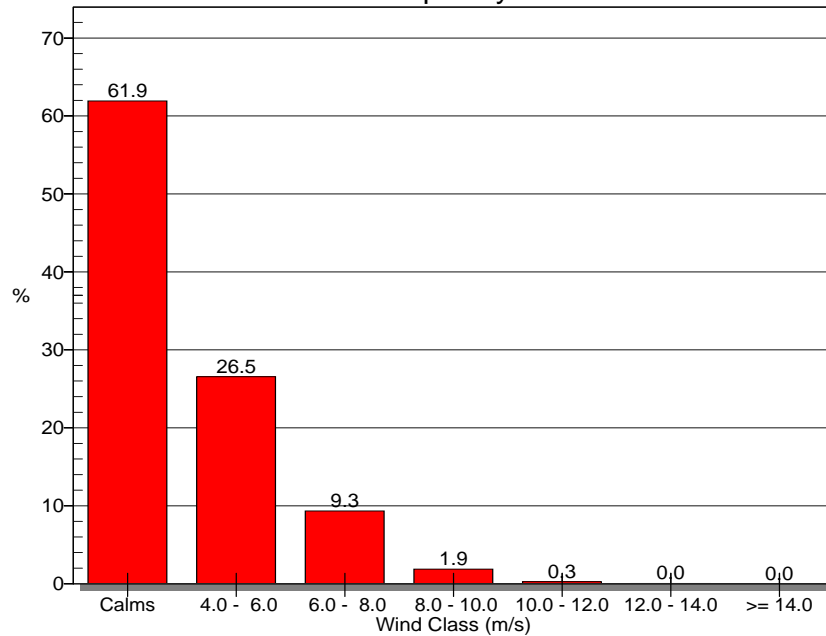


The building orientation, and the times in which the building will be in use, allowed the design team to determine which spaces can take advantage of natural light while controlling solar heat gain. Most of the large classroom spaces are located on the north side of the building since the north light is softer and easier to control for classroom type settings, while the smaller offices are located on the south and west sides since they can handle the higher heat gain due to fewer occupants being in the space. The Lung provides daylight on the backside of the classrooms and other interior spaces, virtually eliminated the need for artificial lighting.

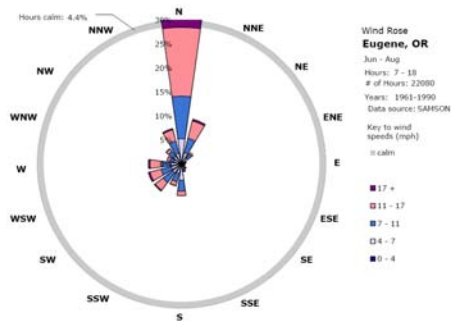




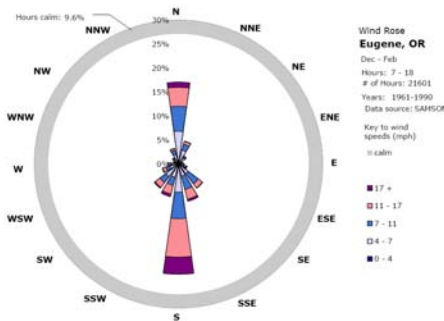
Wind Class Frequency Distribution



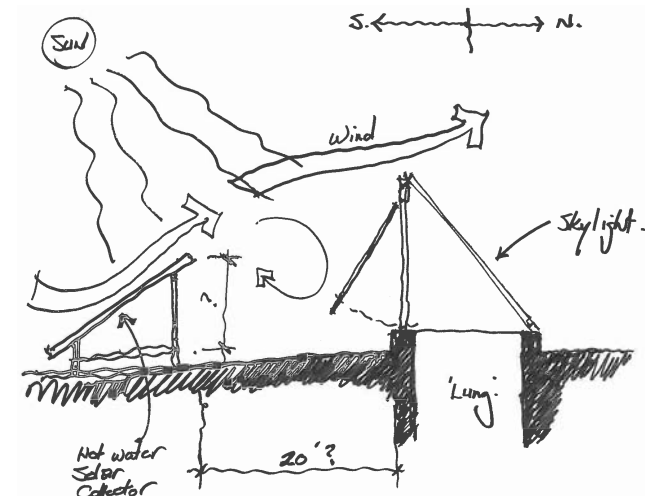
The building orientation and design was also directly influenced by our analysis of the local wind patterns. Fortunately, the primary wind direction during the warm summer months came from one direction. With the wind coming directly from the north for most of this time period we were able to design the building Lung to face away from the direct winds, which helped increase the natural stack effect. To compensate for times when the wind comes from the south we were able to design the solar panel array to serve as a deflector.



Summer wind patterns



Winter wind patterns



Wind study at building Lung

## WILLAMETTE VALLEY POTENTIAL

### Wind



BUILDING ON PRECEDENCE



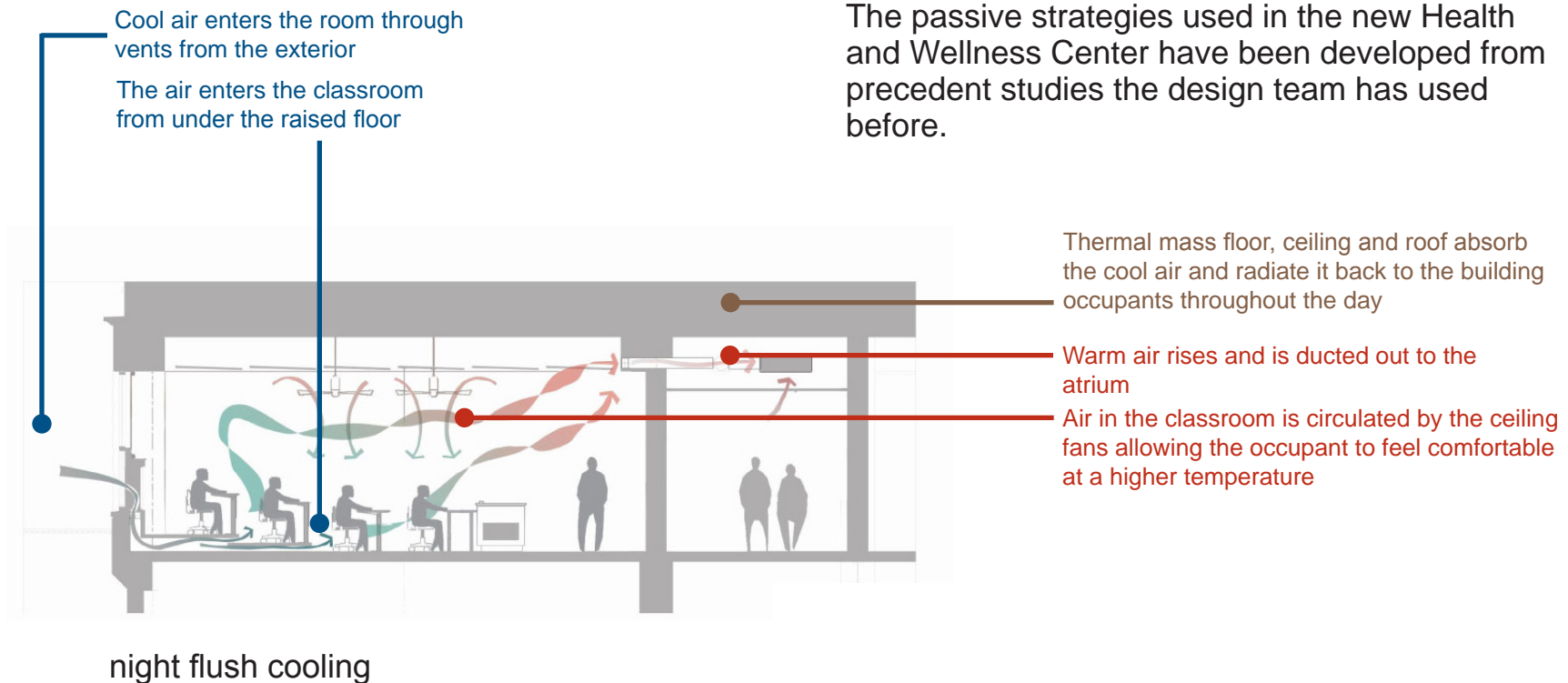




### You are not the guinea pigs!

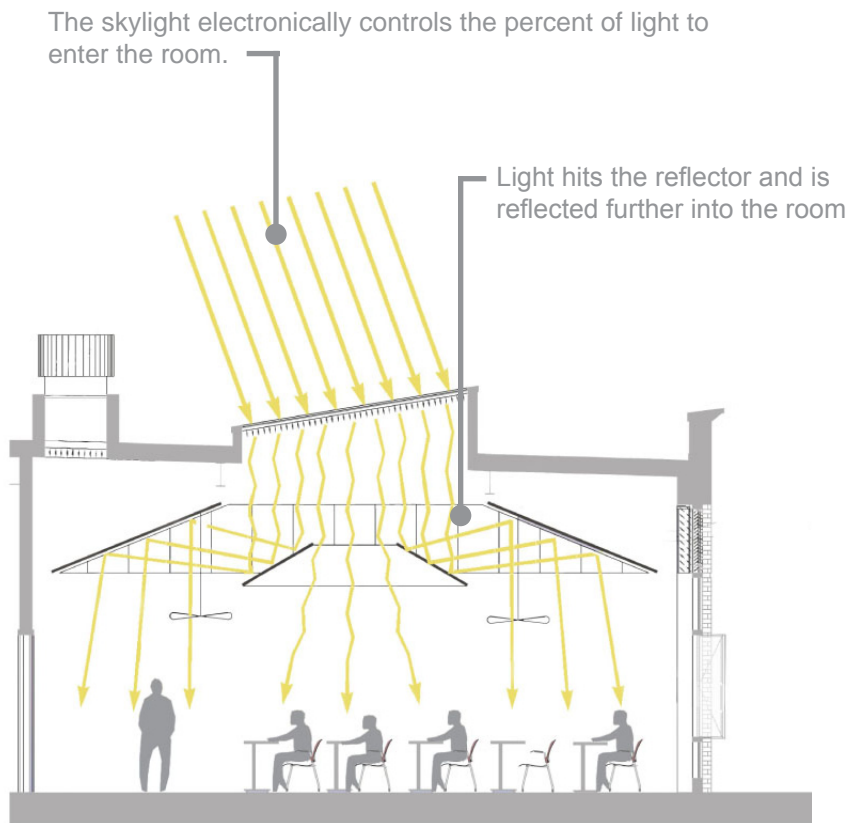
The Health and Wellness Center is not the first building to use both passive ventilation strategies and natural lighting. In fact, historically these basic strategies have been used for generations within traditional building forms.

Using these traditional methods along with modern technology allows for a higher performance. The passive strategies used in the new Health and Wellness Center have been developed from precedent studies the design team has used before.

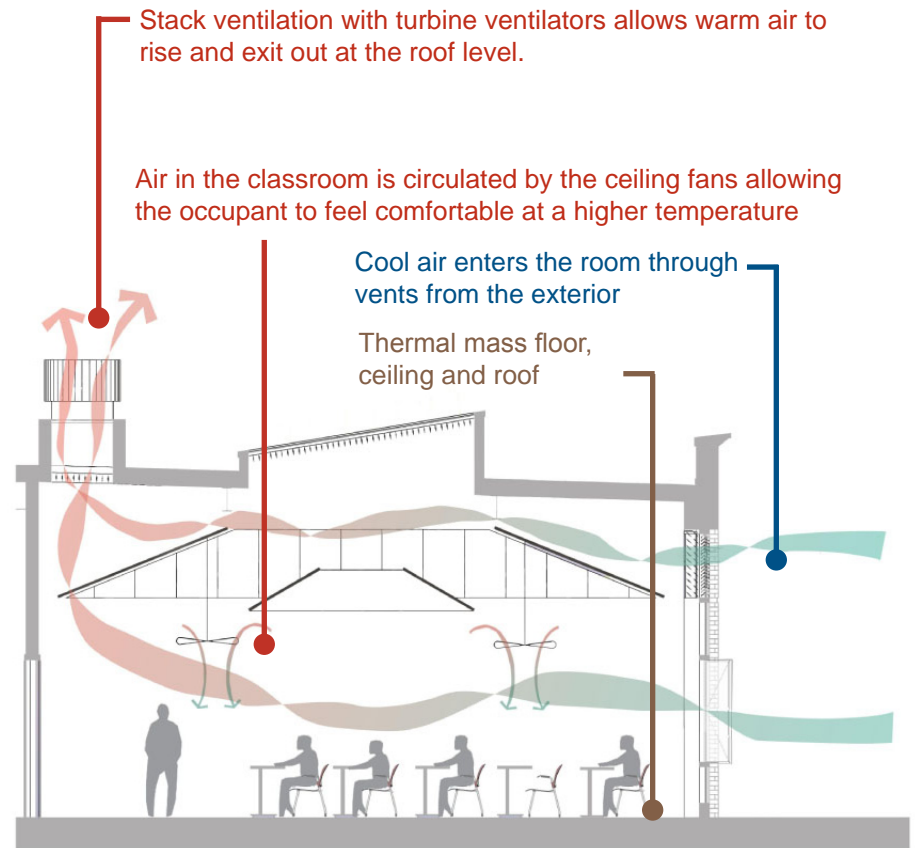


## BUILDING ON PRECEDENCE

Lillis Building Complex

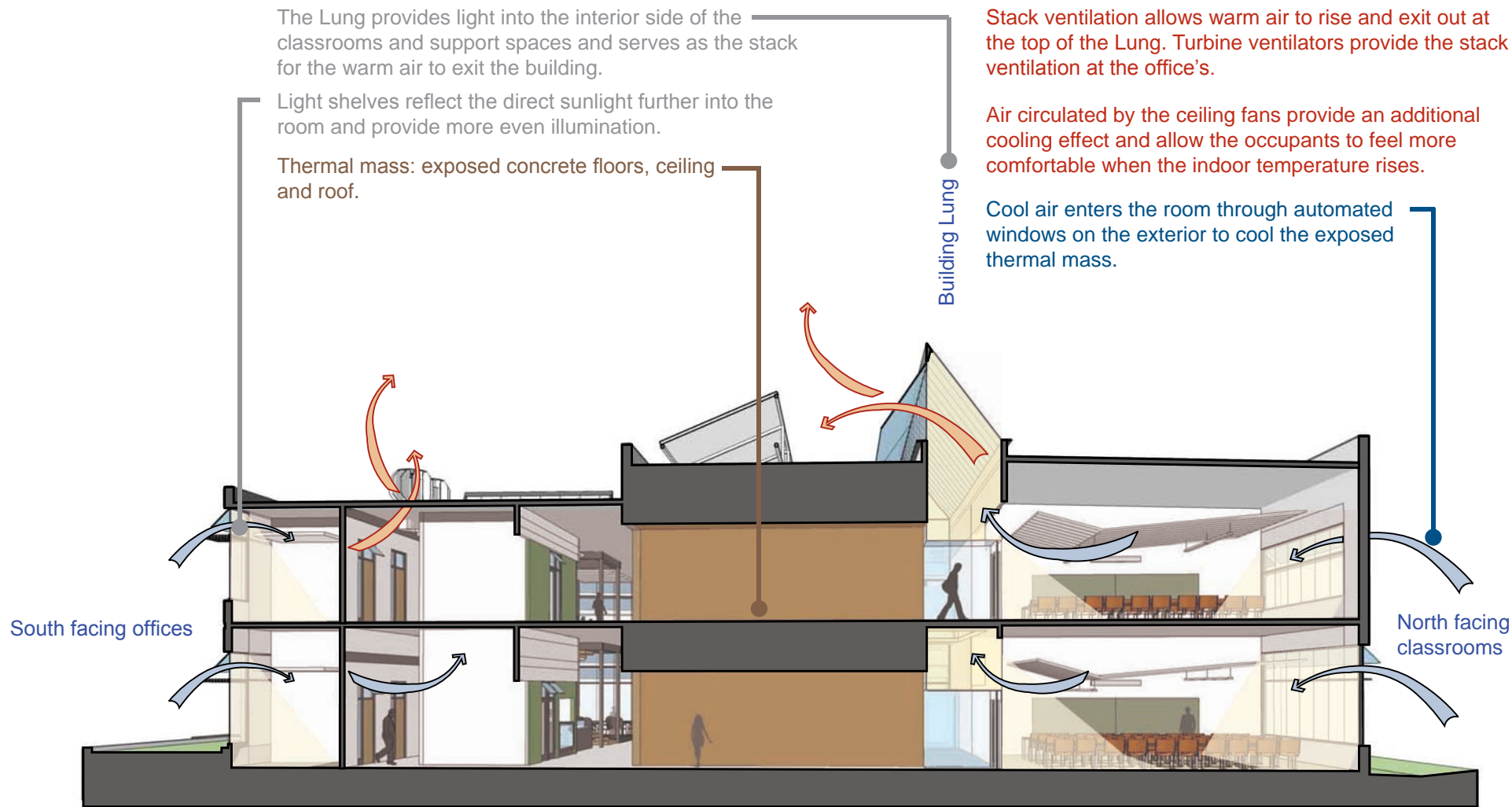


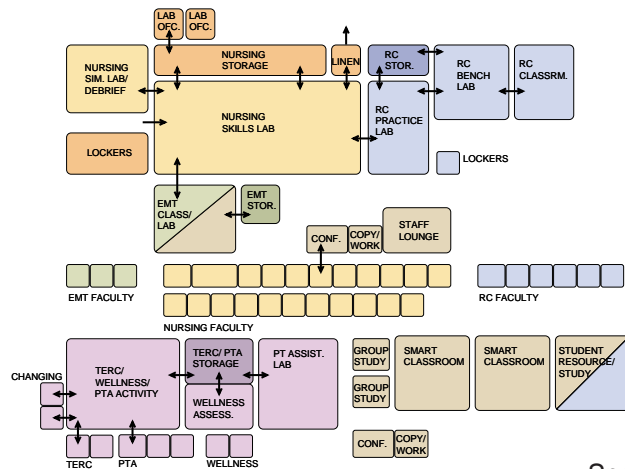
daylighting



night flush cooling







Space Adjacency



Plan Organization

For the past five years, we have approached passive design in a new and very different manner. Through a unique partnership with an academic research organization, we have moved from an intuitive approach to an objective methodology, relying on extensive computational fluid dynamics and daylighting studies. We collaborated closely with this scientific team and our mechanical engineer to develop the detailed workings of the “lung.”

We’ve determined that six essential design components must all function successfully and integrate completely to eliminate mechanical cooling: shading and orientation, mass, daylighting, night flush cooling, ceiling fans, and occupant training. This approach requires the client to trust in a new research based design methodology, the full support of the building occupants, and the enthusiastic endorsement of the facilities staff. It’s a paradigm shift in the way that people understand buildings – not as static structures, but as interactive environments.



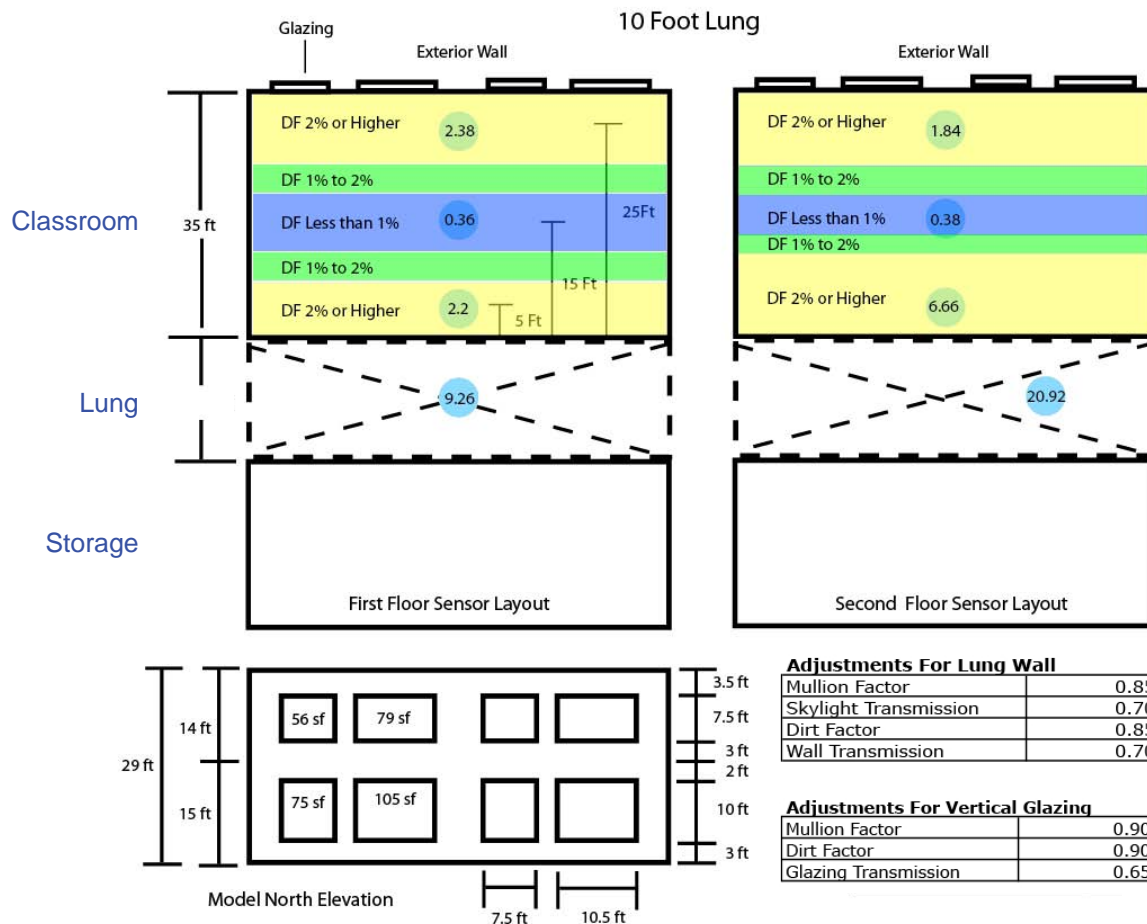


REDUCING ENERGY LOADS









Daylighting model  
Anticipated light levels at a typical  
classroom on both levels.



Daylight analysis is key to designing spaces that are energy efficient. The design team studied various options on the Lung, including width and the shape at the top to maximize the daylighting for both floors of classrooms.

## NATURAL VENTILATION MATRIX

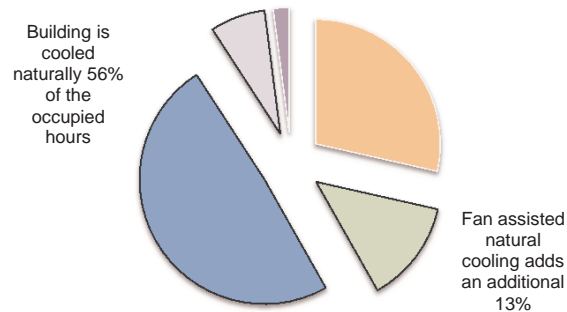
LCC Health and Wellness Building - Eugene, Oregon

Temperature (F)	12am-8am	Time Period 8am-4pm	4pm-12am	
22				Radiant Heating
27				
32				
37				
42				
47				
52				Natural Ventilation/ Passive Cooling
57				
62				
67				
72				
77				
82				Radiant Cooling
87				
92				
97				
102				
107				

### Estimated Hours During Occupancy (minus holidays and weekends)

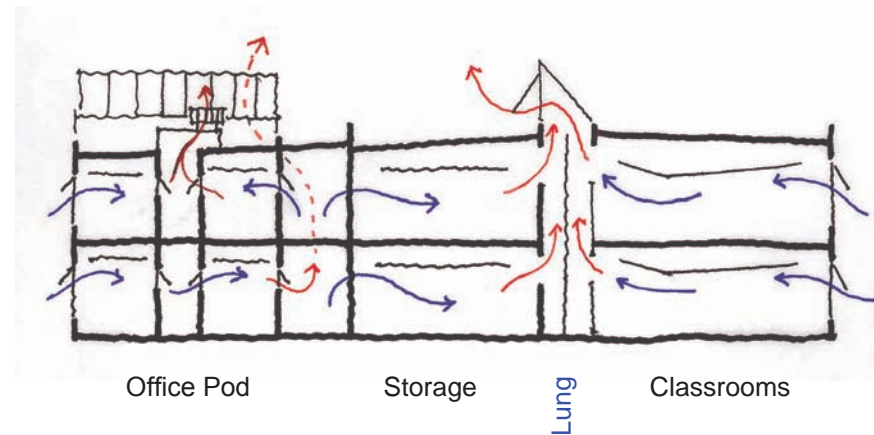
Radiant Heating	546	29%
OSA Economizer Cooling	254	13%
Night Flush	0	
<b>Natural Ventilation</b>	<b>938</b>	<b>49%</b>
<b>Passive Cooling</b>	<b>136</b>	<b>7%</b>
Radiant Cooling Available	39	2%

Total: 1,913 hours/year during occupancy



“Thermal mass can be used to absorb heat from a room during the day and then be cooled at night with ventilation.”- *Sun, Wind and Light Architectural Design Strategies*- GZ Brown & Mark DeKay

The Health and Wellness Center uses night flush to allow cool night air to enter the building through automated windows. This cool air is absorbed by the thermal mass, including concrete floors and ceiling, and radiates this cool energy back to the occupants throughout the day. This helps keep the temperature in the room lower as the outside temperature rises. During the day, when the outside air temperature is warm, the building envelope is closed and any excess heat gain is stored in the mass helping keep the interior air temperature comfortable.



## REDUCING ENERGY LOADS

Thermal Mass, Night Flush Cooling



In the Health and Wellness Center all the classrooms and offices are equipped with ceiling fans to increase air movement in the space. When the interior temperature climbs above the comfort zone, switching on the ceiling fans will extend the comfort range of the occupants. Ceiling fans and night cooling of the thermal mass keeps classrooms and offices comfortable without additional mechanical cooling and therefore saves energy. The design team has projected a 5°F increase in the comfort range resulting from the combined use of thermal mass and ceiling fans.



“Ceiling Fans increase air movement across people, making them feel as much as 4° F cooler even though the temperature in the spaces does not change.” *Natural Ventilation in Northwest Buildings- GZ Brown, Jeff Kline, Gina Livingston, Dale Northcutt, Emily Wright ESBL*



The building skin keeps out the wind and rain, lets in light and fresh air, and provides security and privacy. In the Health and Wellness Center the skin also mediates the effects of climate on the energy systems by insulating above standard code requirements. The cement board siding is part of a rain screen wall assembly that includes insulation on the outside of the stud cavity. This eliminates thermal bridging and performs at a much higher level of energy efficiency.

A radiant floor at the entry lobby and radiant ceiling panels in all the offices and classrooms keep the building warm throughout the cool winter months. In addition, the light shelf at the offices is also a radiant panel. The radiant system is connected to a efficient campus loop system, which benefits from a 1,100 sf solar hot water system on the roof. When this hot water isn't needed in the building it is used in the adjacent gymnasium showers and laundry facility. Radiant heat is more comfortable and more energy efficient than forced air systems.

## REDUCING ENERGY LOADS

### Heating

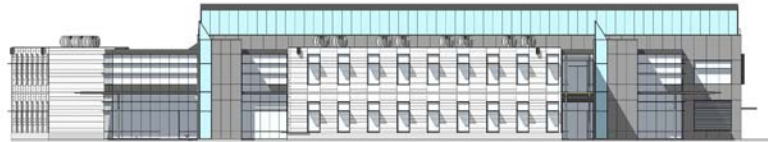




Aug. 21 - 10am



Aug. 21 - 12pm



Aug. 21 - 2pm



Aug. 21 - 4am

**South Elevation shading analysis**

Solar shading is used both internally and externally to help reduce the solar heat gain and maximize the daylighting throughout the building. For the Health and Wellness Center the design team generated computer studies for the south and west facing office windows in addition to the north facing classrooms. The analysis helped determine building orientation, window size, and window location to ensure protection from unwanted solar heat and to control glare. The interior manual shades give the occupants control over their environment and help reduce glare. The external shading provides protection from solar heat gain by shading the windows from radiant energy.



## REDUCING ENERGY LOADS

### Solar Shading

## Energy Savings

Code Base model \$35,000

Model of  
Health and Wellness Center \$18,000

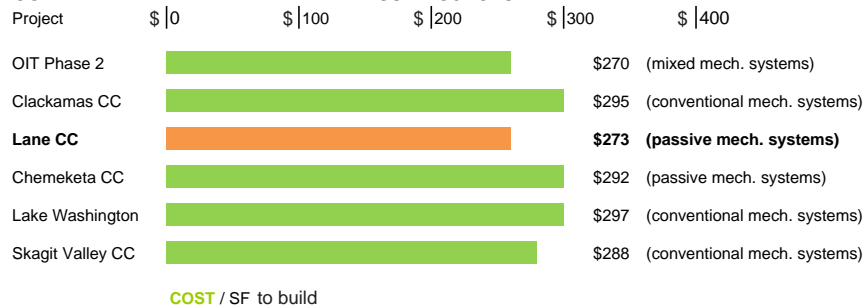
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Annual Energy Savings \$17,000

*These figures do not include energy saved by future photo voltaic power generation or energy saved by the solar hot water installation.*

## Building Construction Cost

### COMPARABLE HEALTH AND WELLNESS PROJECTS



This building costs the same as a similar building with a conventional HVAC system. This is a very significant statement. Many people believe highly sustainable features add cost, that there is a premium for green features. If the green features are additive or supplementary, this may indeed be true. We believe however, and this building demonstrates, this is not necessarily true. If the passive approach is fully integrated, if it is the basis of design, and if the client is willing to take that leap of faith to fully commit to it, then the building should not cost any more.

The foundation of our approach is load reduction. Reducing loads is the most cost effective approach to green design, whereas energy production is the most expensive. The orientation of spaces, the amount and orientation of glazing, the use of shading devices all contribute to reducing solar heat gain. Daylighting reduces internal heat gain from artificial lighting and passive ventilation reduces fan energy. Utilization of night flush reduces cooling loads. All of these contribute to eliminating the cooling system and significantly downsizing the ventilation system.

## REDUCING ENERGY LOADS

### Cost Savings





DRAWINGS





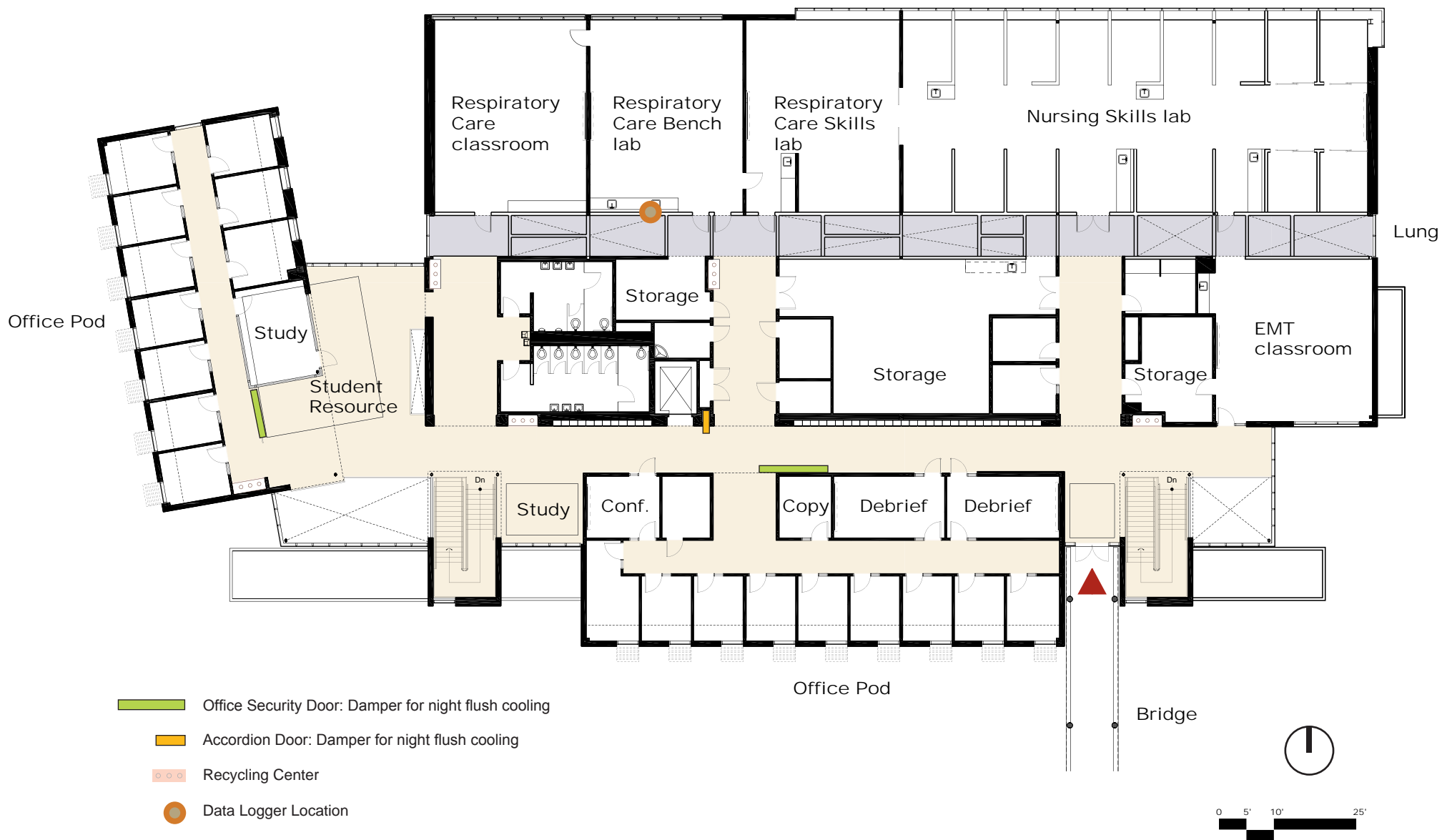






# THE HEALTH AND WELLNESS CENTER

## First Floor Plan



# THE HEALTH AND WELLNESS CENTER

## Second Floor Plan

① renewable energy

- Integrated hot water and future photovoltaic panels.  
Solar hot water supplied to gym building next door

② passive ventilation / cooling

- A two story central building 'lung' prides both natural light and cooling to interior classroom spaces. Cool air is brought into the space through the automated windows to cool the concrete mass (5), while the hot air is exhausted through the top of the 'lung'.

③ turbine ventilators

- Natural ventilation strategies are also used at the office 'pods'. Turbine ventilators on the roof provide chimneys to exhaust the hot air, while automated windows (both interior and exterior) bring in fresh air from the outside.

④ dynamic shading / lighting

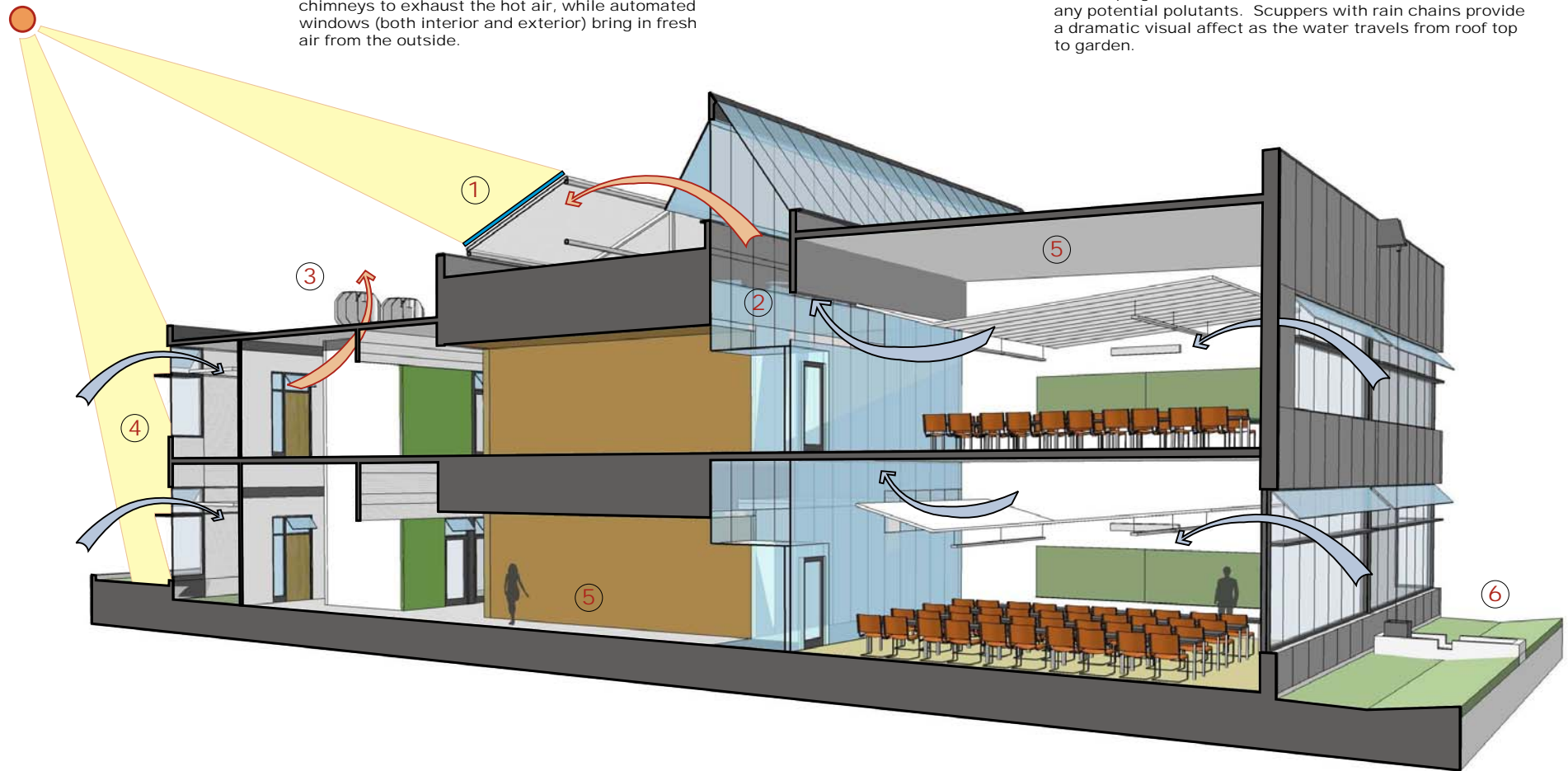
- Exterior sunshades provide solar control at south and west facing offices. Interior roller shades and light sensors provide optimal light levels throughout the building.

⑤ radiant technology

- Increased thermal mass is provided at each floor level and at the roof to reduce fluctuations in temperature. Radiant ceiling panels tied to a campus loop system provide heating throughout the building and also help reduce air-borne dust.

⑥ rain gardens

- Rain gardens along the base of the building provide natural landscaping that reduces storm water run-off and filters out any potential pollutants. Scuppers with rain chains provide a dramatic visual affect as the water travels from roof top to garden.



## THE HEALTH AND WELLNESS CENTER

### Section at Lung



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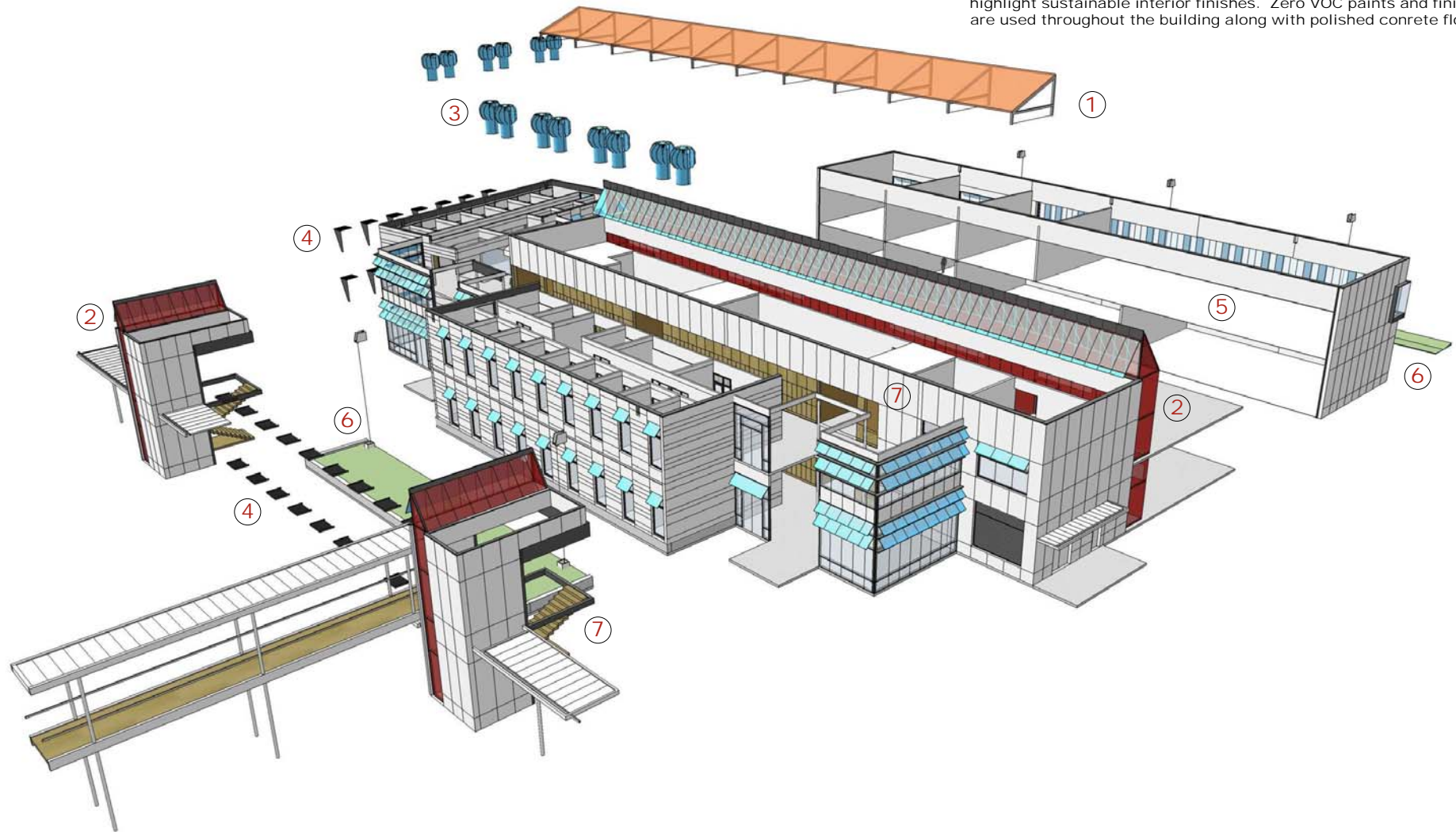
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⑦ interior finishes

- Reclaimed wood stair treads and bamboo wall panels and lockers highlight sustainable interior finishes. Zero VOC paints and finishes are used throughout the building along with polished concrete floors.

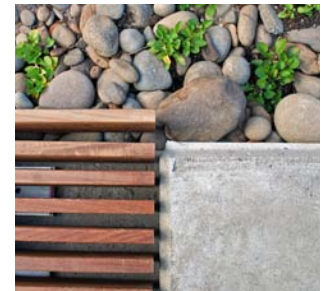




south elevation



northwest corner of building



exterior materials include: cement board siding, steel shade canopies, automated windows, ipe decking, concrete walkways with recycled glass, and solar hot water panels.





north/south building section



model view at entry lobby



interior materials include: cement board siding, bamboo wall panels, radiant ceiling panels and light shelves, automated windows, reclaimed wood stairs, polished concrete floors with recycled glass, and acrylic wall panels at the Lung.







HOW IT WORKS







## Window control

Hold up or down for desired position. Close when warmer outside than inside.



## White board light



## Fan control

Three speed settings.



## Occupancy sensor

Turns lights off when office is unoccupied.



## Humidity sensor

Collects information for use by Building Management System.



## CO2 sensor

Controls ventilation air - more when classroom is occupied, less when room is unoccupied - to save energy.



## Thermostat

The building is naturally cooled by night-flush ventilation and ceiling fan. With exposed concrete and air movement, research shows human comfort extended by 5-degrees.

## Light control

Light fixtures adjust automatically with varying daylight. Wall switch has dimming and on/off control.



Air movement and cooling from ceiling fan.

Radiant heat from ceiling panels.

Daylight control with bottom-up window shade.



Ventilation air is provided through motorized windows with control switch. Automatic operation occurs during night-flush cooling.



Skylight, translucent walls, and openings provide daylight and flow-through ventilation up through vents at the top of the shaft.

# HOW IT WORKS

## Classroom

