



# Project 2 LEED Platinum Building Design & Construction (“BD&C”) of a new College for Elizabethtown University

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May 6, 2026

## 1 Site Plan

We created a detailed site plan of our proposed design for the new Elizabethtown University College of Agriculture.

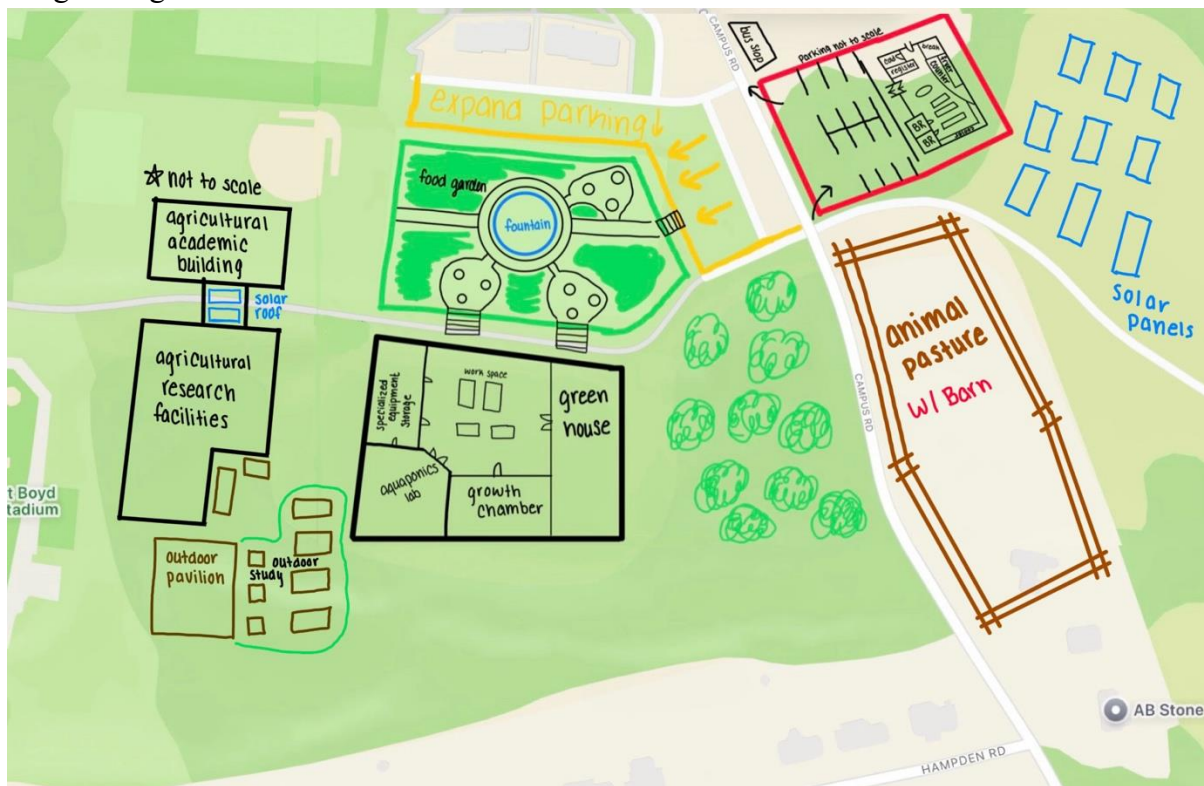


Figure 1: Site map of our entire proposed addition to create the Elizabethtown University School of Agriculture.

## 2 Architectural Modeling

We chose to create detailed exterior designs for the farm animal development area barn, connected academic and research buildings, and the experimental agriculture buildings. We chose to dive deeper into these designs to present a focus on academics and hands-on experimentation and to emphasize their importance to the success of the Elizabethtown University School of Agriculture.

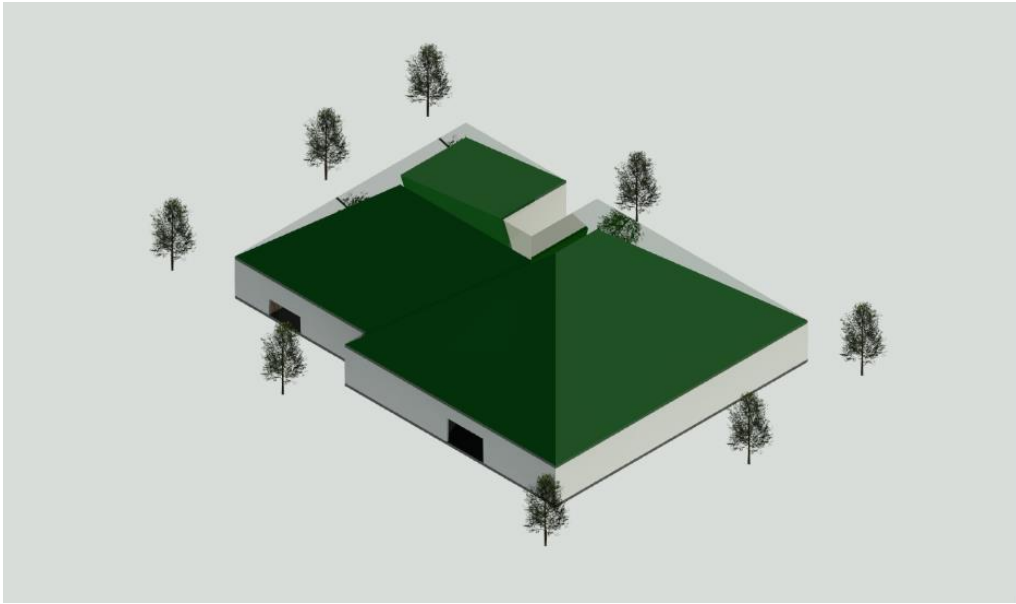


Figure 2: Revit model of the barn near the solar field which was constructed by Megan Fisher.



Figure 3: GenAI (ChatGPT) generated agriculture academic building and agriculture research facility which was produced by Gwenyth Lottero using the hand drawn sketch and a reference picture from our site analysis.



Figure 4: GenAI (ChatGPT) generated model of the experimental agriculture facility which was produced by Lily Shultz using the site design photo as a reference.

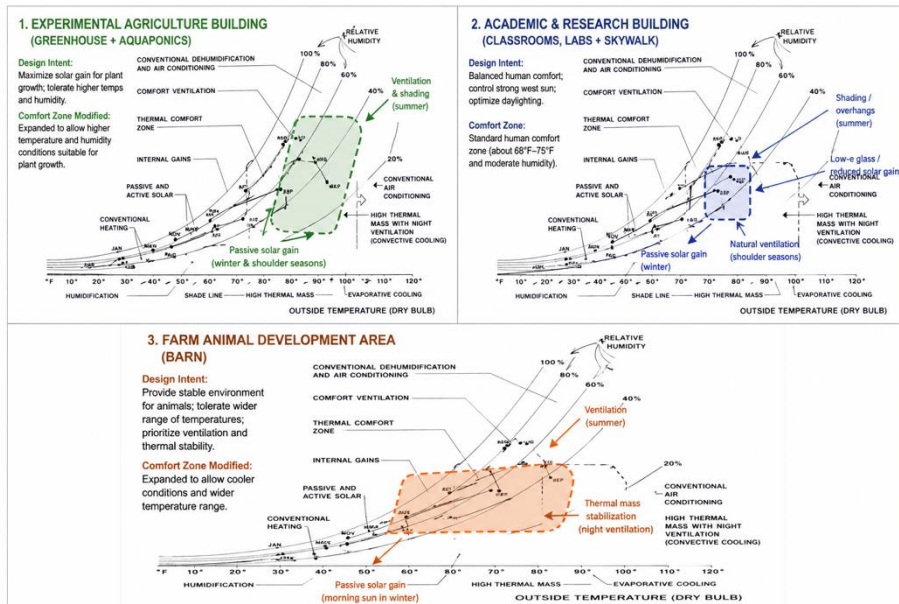


Figure 5: GenAI (ChatGPT) generated psychrometric charts based on our three detailed building designs.

We produced three different psychrometric charts basic on our three detailed building designs. Our experimental agriculture building shows an expanded comfort zone that allows for higher temperatures and humidity levels suitable for plant group. The outdoor climate falls below the zone in winter, so passive solar gain is used to increase internal temperatures. In the summer, conditions exceed the comfort range, so natural ventilation and shading strategies are used to prevent overheating. This building relies on direct solar gain and thermal mass (water in aquaponics) to stabilize temperatures and maintain a productive growth environment. The chart for the academic and research building maintains a standard human comfort zone, which requires precise control of both temperature and humidity. During colder months, passive solar heating helps bring conditions into the comfort zone. In the warmer months, especially due to western exposure, shading devices and controlled daylighting prevent overheating. Natural ventilation is effective during moderate seasons. Overall, the building balances daylight and thermal performance to maintain comfort year-round. For the farm animal development barn, the chart shows a widened comfort zone that extends to cooler temperatures and allows for greater variation. This reflects animal tolerance to environmental conditions. In winter, passive solar gain from morning sunlight provides limited heating, while thermal mass (concrete floors) helps stabilize indoor temperatures. In summer, natural ventilation is the primary strategy to reduce heat buildup. The design focuses on maintaining consistent and moderate conditions rather than tightly controlled conditions.

Our site design is driven by solar orientation, with the sun rising on the eastern edge of the site at the farm animal development area and setting on the western edge at the academic and research buildings. This solar path creates distinct conditions of light quality and thermal gain across the site throughout the day and across seasons. In the morning, the eastern side of the site receives low angle sunlight, while the western side gains higher heat gain from the afternoon sun. These conditions guided our solar design strategies applied to each building (daylight and thermodynamic performance).

The experimental agriculture building is designed to maximize solar exposure, since its primary function depends on sunlight for plant growth and ecosystem stability. The greenhouse takes advantage of the eastern and southern light, which reduces the need for artificial lighting and uses the sun as a primary energy source. Thermodynamically, the building promotes solar heat gain. With the aquaponics section of the building, the water absorbs the heat during the day and slowly releases it at night. This stabilizes the internal temperatures. Seasonally, the low-angle winter sun enhances heating since it goes further into the building, making it easier to regulate heat during the colder months.

The academic and research buildings, located on the western side of the site, must balance daylight with thermal control. These buildings experience exposure to the more intense afternoon sun. Daylighting is achieved through reflective interior surfaces that distribute natural light deeper into the classrooms and labs while minimizing the glare. The connecting glass skywalk enhances daylight penetration and visual connectivity and includes solar panels to filter light and reduce heat gain. Thermodynamically, this building focuses on limiting excessive solar heat gain. We will be using overhangs and shading devices to block the high-angle summer sun, while also allowing the low-angle winter sun to enter the building. This design promotes a necessary balance between daylighting and solar heat gain. This prioritizes occupant comfort and energy efficiency across seasonal changes.

The farm animal development barn is positioned on the eastern side of the site to take advantage of the morning sunlight while avoiding the more intense afternoon sun. This design supports effective daylighting through evenly distributed natural light, creating a comfortable environment for the animals. Thermodynamically, the barn prioritizes stability and will use materials with high thermal mass. Things like concrete flooring will absorb heat during the day and release it slowly at night, reducing temperature fluctuations. In the winter, the low-angle morning sun provides passive heating early in the day, while in the summer, the building's orientation helps prevent overheating by avoiding direct western exposure. Overall, the barn focuses on maintaining consistent interior conditions and supporting animal welfare.

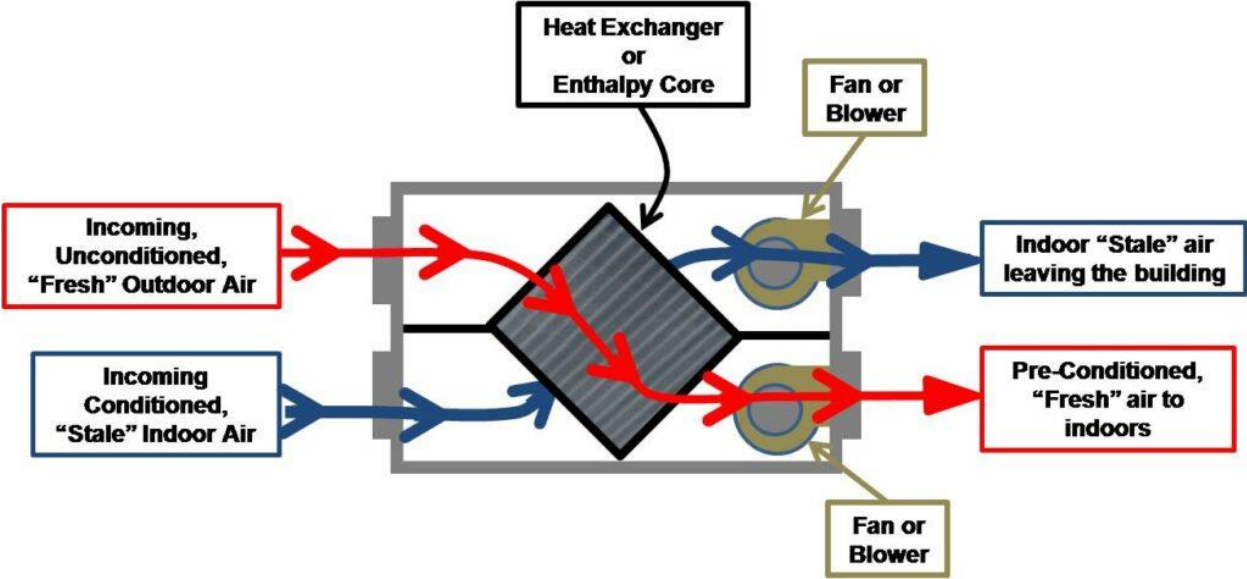


Figure 7: Section detail showing an Energy-Recovery Ventilator that would sit above the ceiling and rotate "fresh" air with "stale" air.

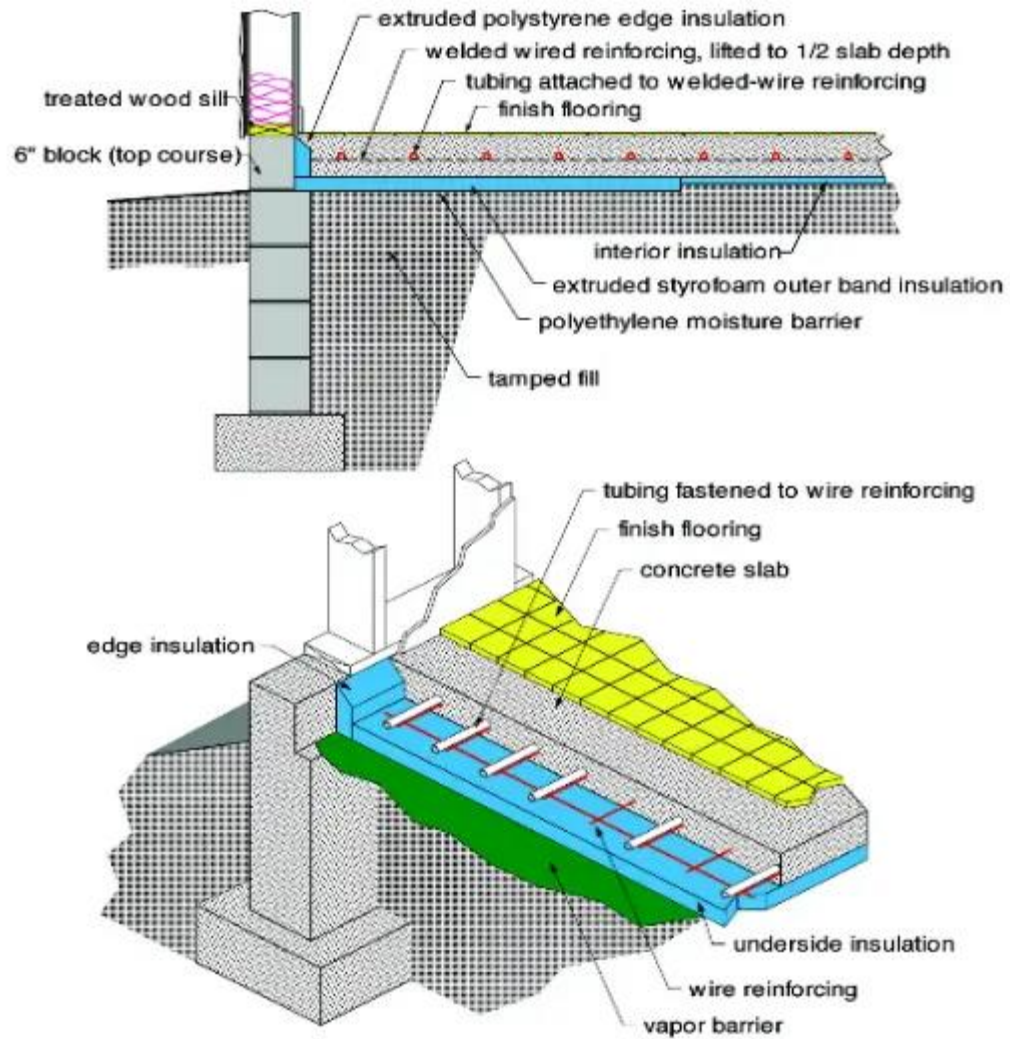


Figure 8: A floor section detail explaining the installation of a thermal comfort floor section which can be included in all the academic buildings.

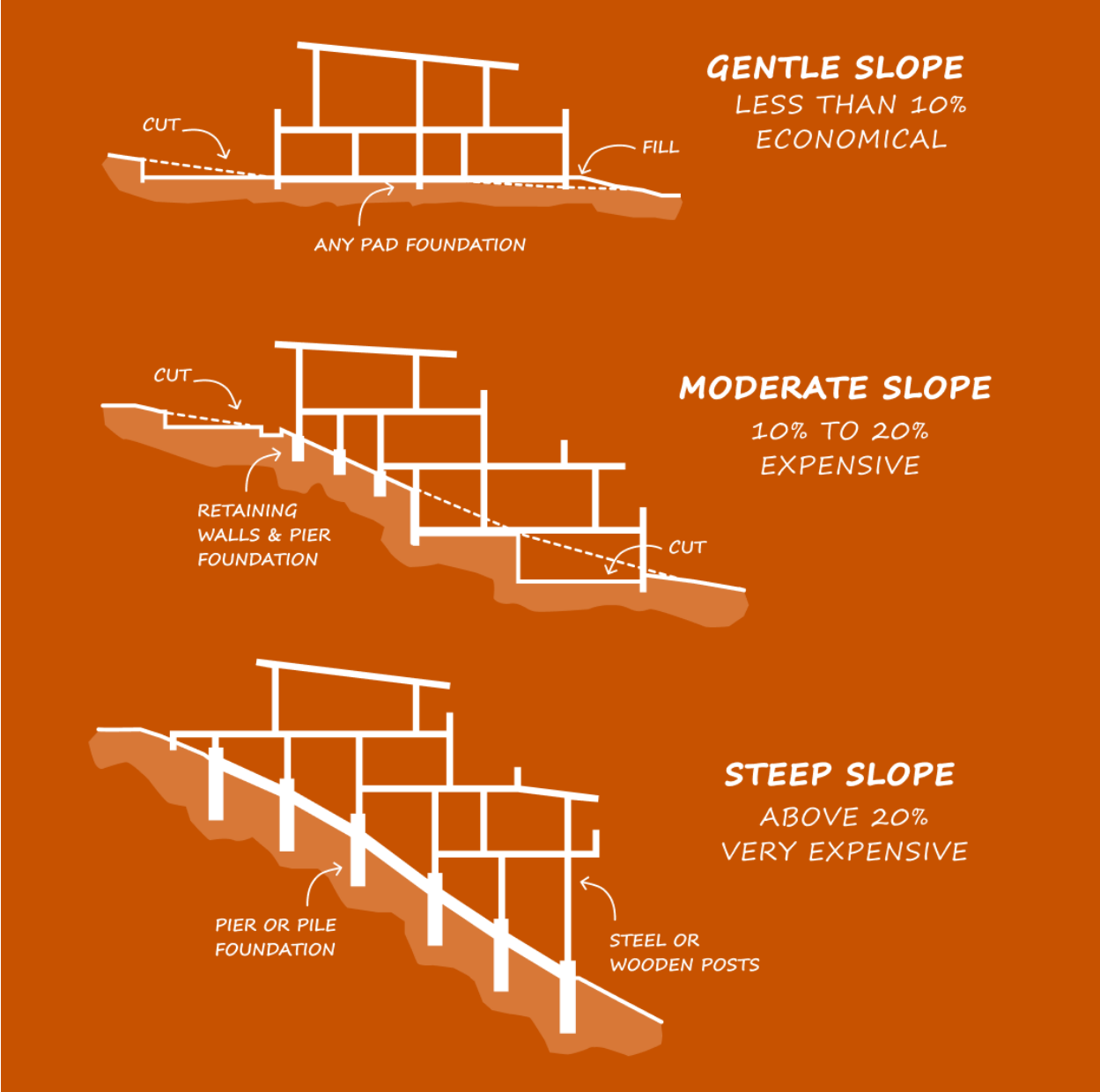


Figure 9: A detail of how the build on a slope which will come in play when construction happens for the agriculture academic building and agriculture research facility.

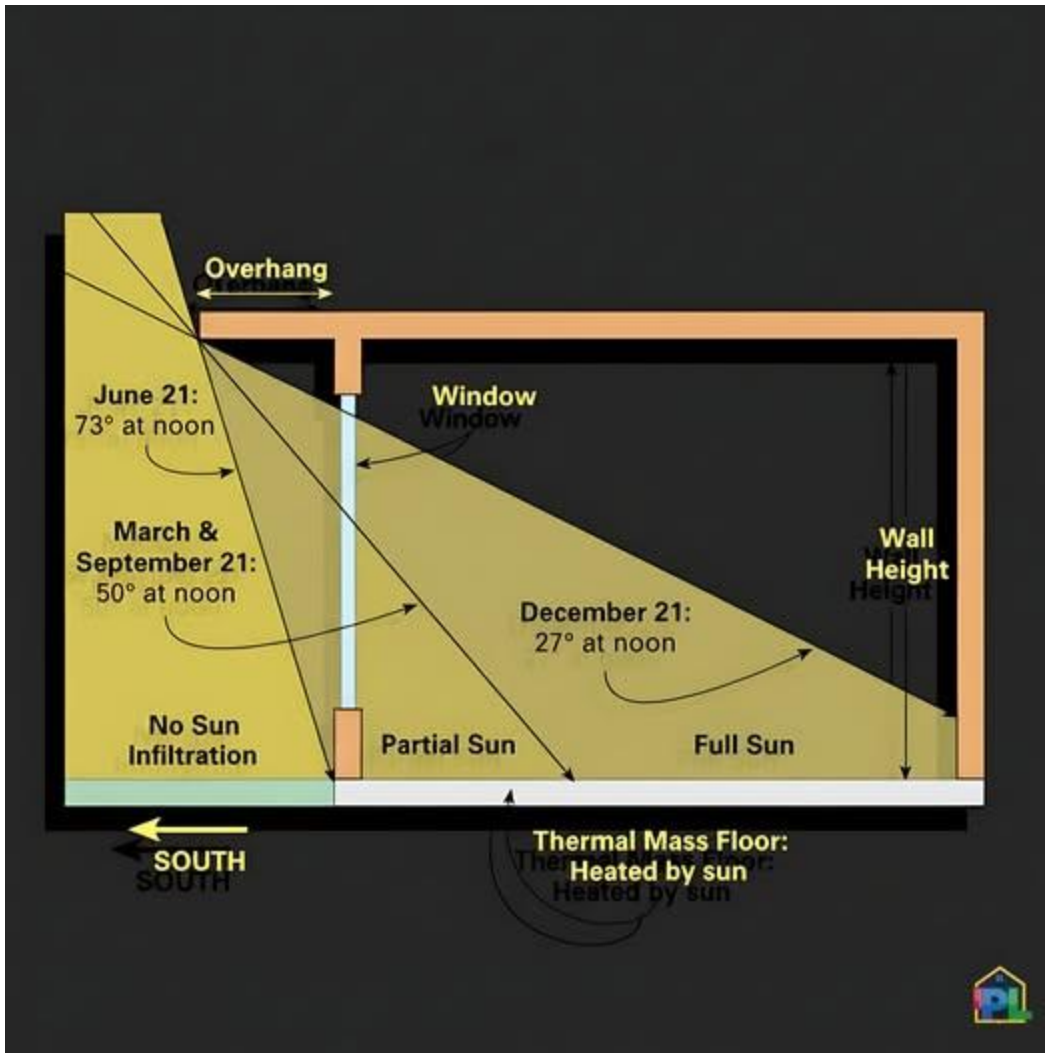


Figure 10: A detail that describes the sun angles that would come through a building with an overhang in it, which is important because some of the buildings generated have overhangs over buildings.

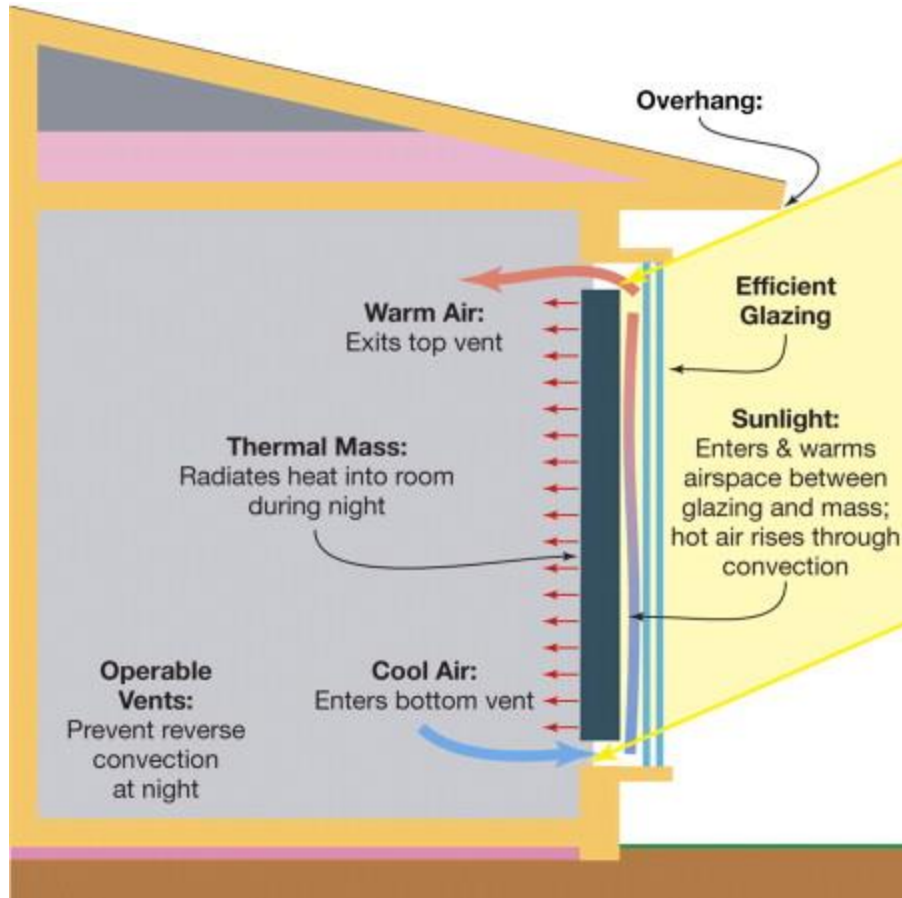
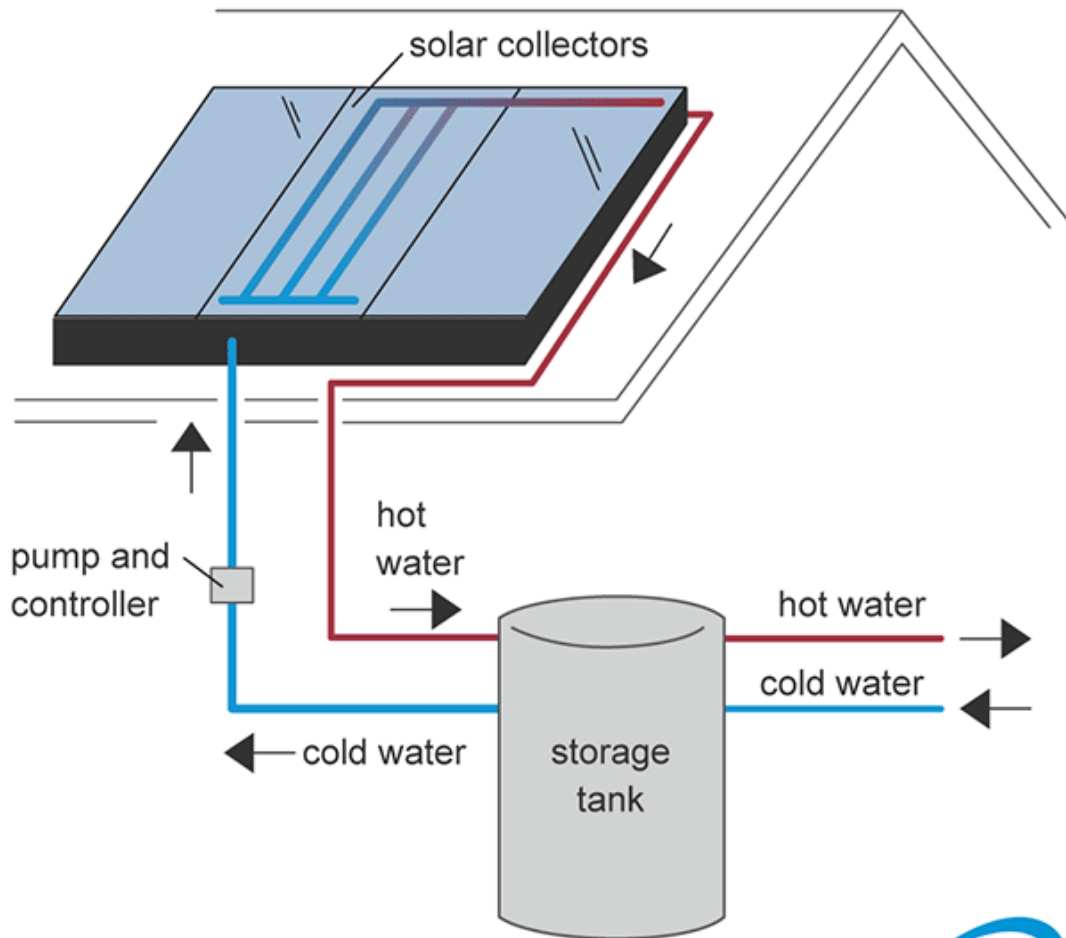


Figure 11: A detail showing how important effective glazing is when associated with thermodynamics and the heating and cooling of a building.

## Non-concentrating and concentrating solar collectors



Source: U.S. Energy Information Administration  
Note: This is a simplified diagram of a drainback-type solar water heating system.



Figure 12: A detail explaining how active solar water heating can be incorporated into the buildings on the site.

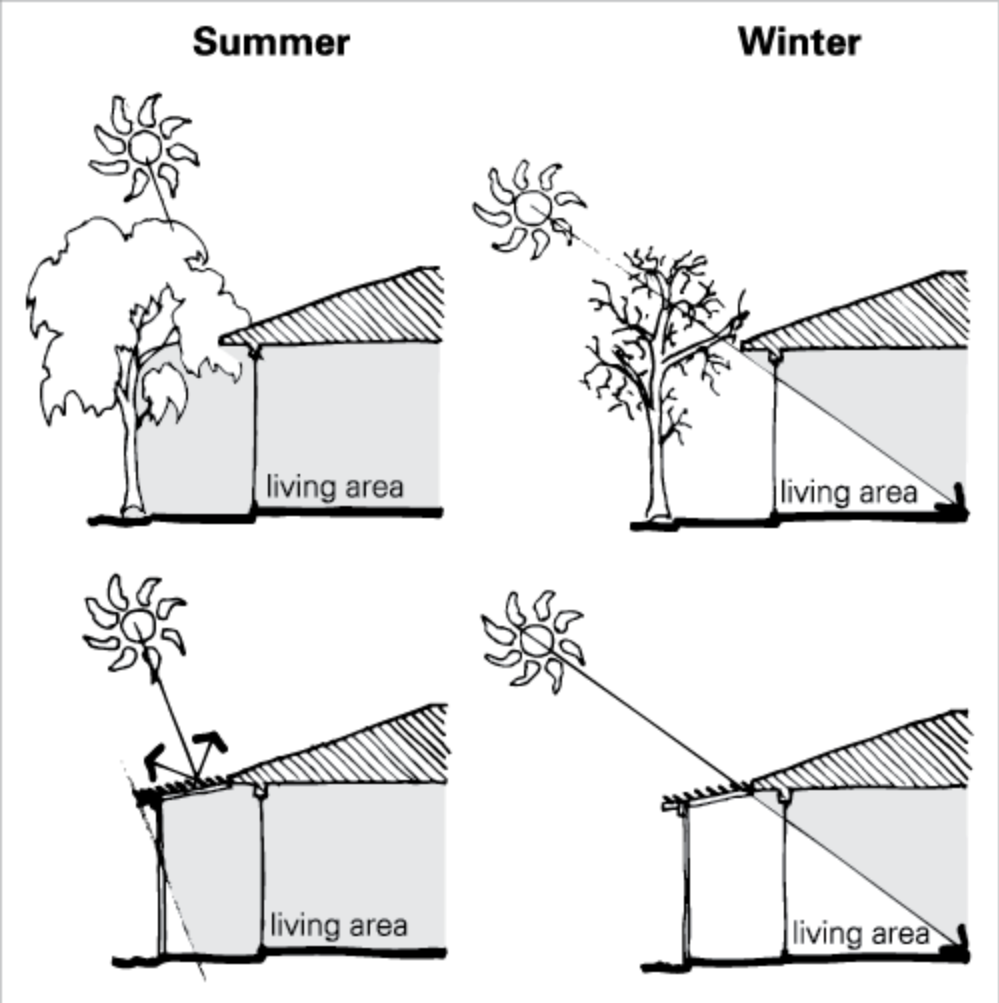


Figure 13: A detail explaining how lighting and heating effects from the sun change throughout the season which is important to keep in mind as Pennsylvania experiences the full range of seasons.

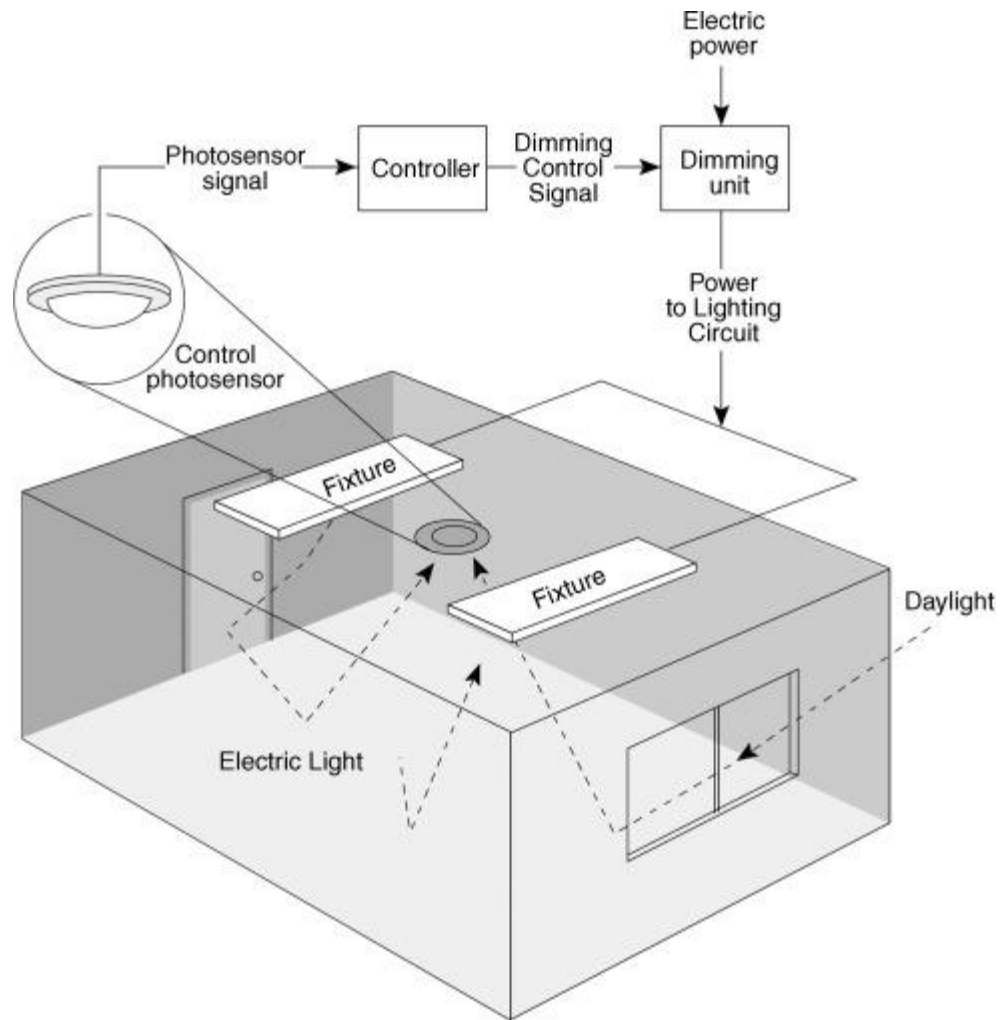


Figure 14: A detail explaining how electric light and day light interact throughout a space, which is important since all of the buildings have large windows to allow daylight in.

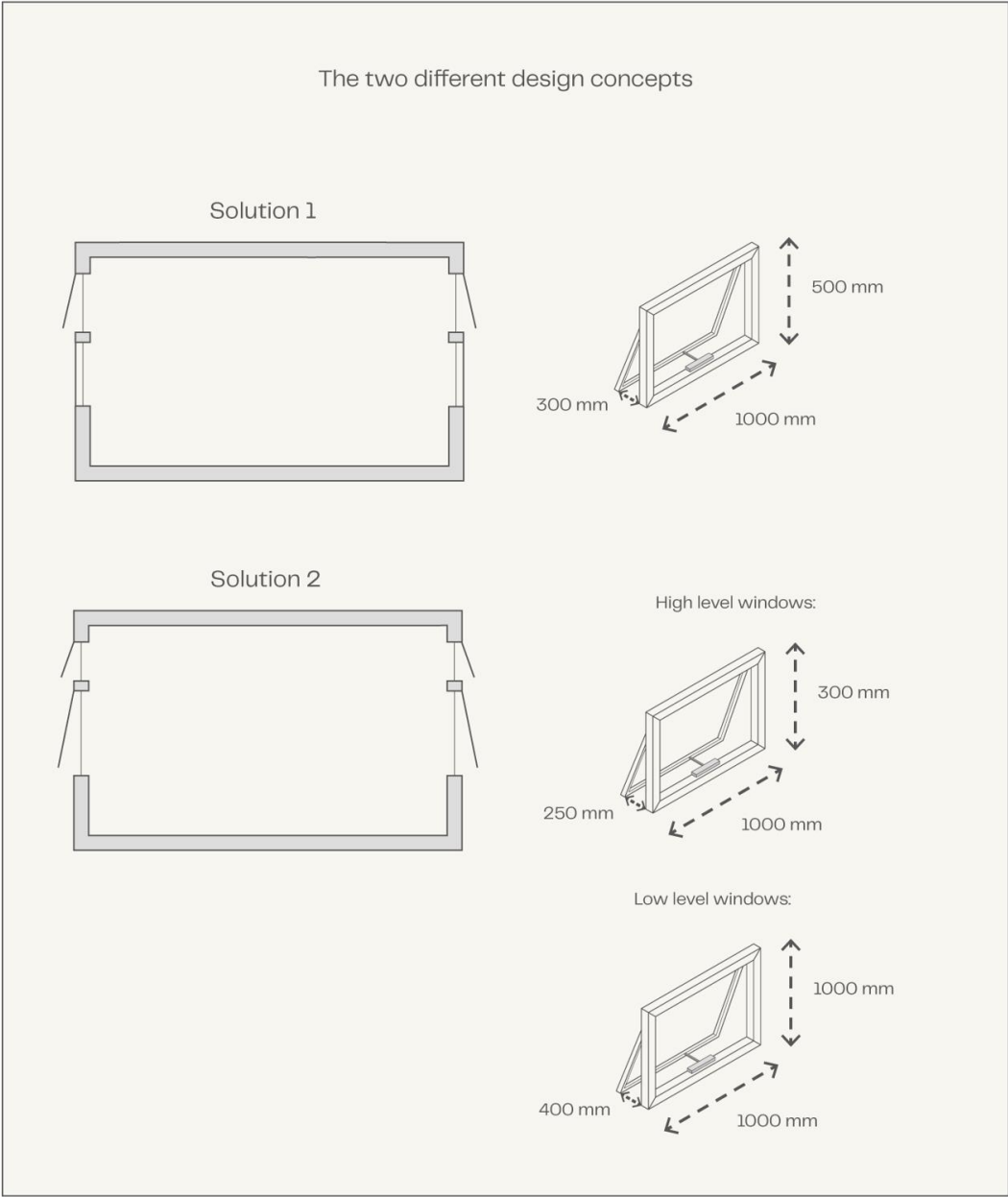


Figure 15: A detail explaining different solutions that can be incorporated into windows for natural ventilation which can be incorporated in all the windows throughout the site.

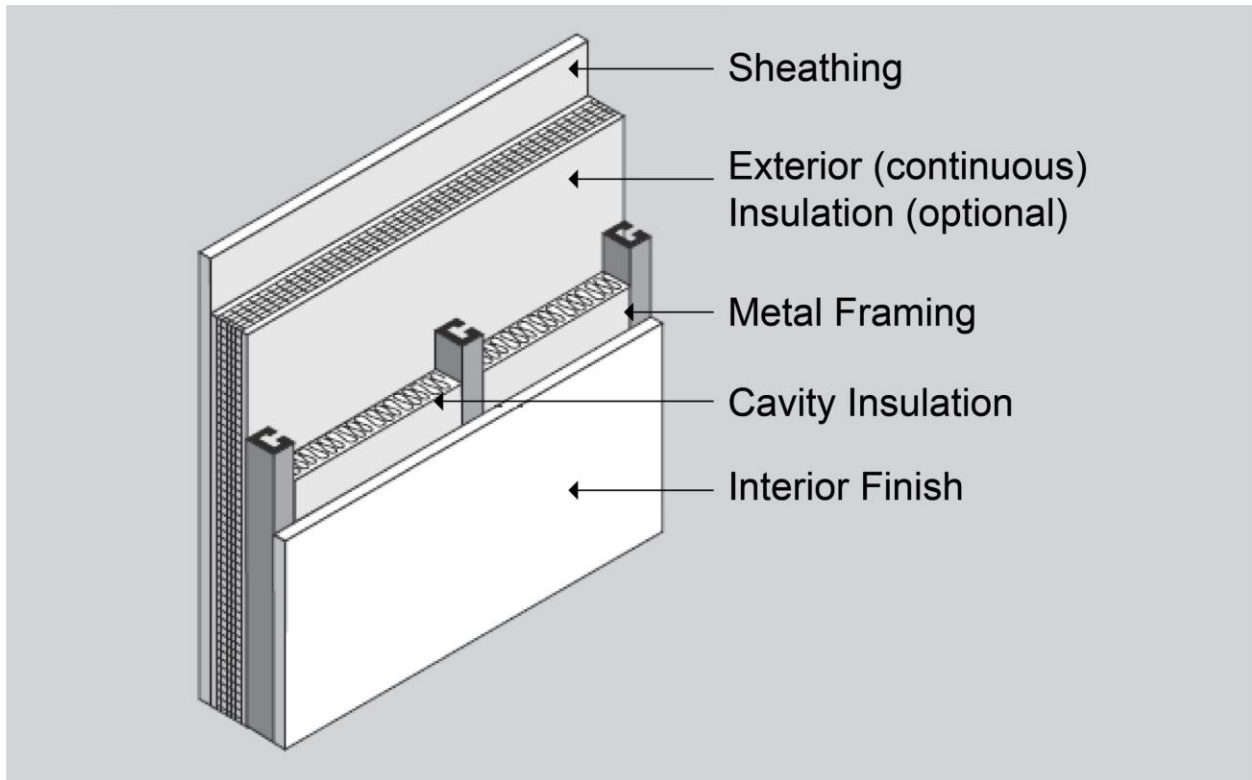


Figure 16: A detail explaining the construction and installation process of a high-performance building envelope which can be used during the construction of the site.

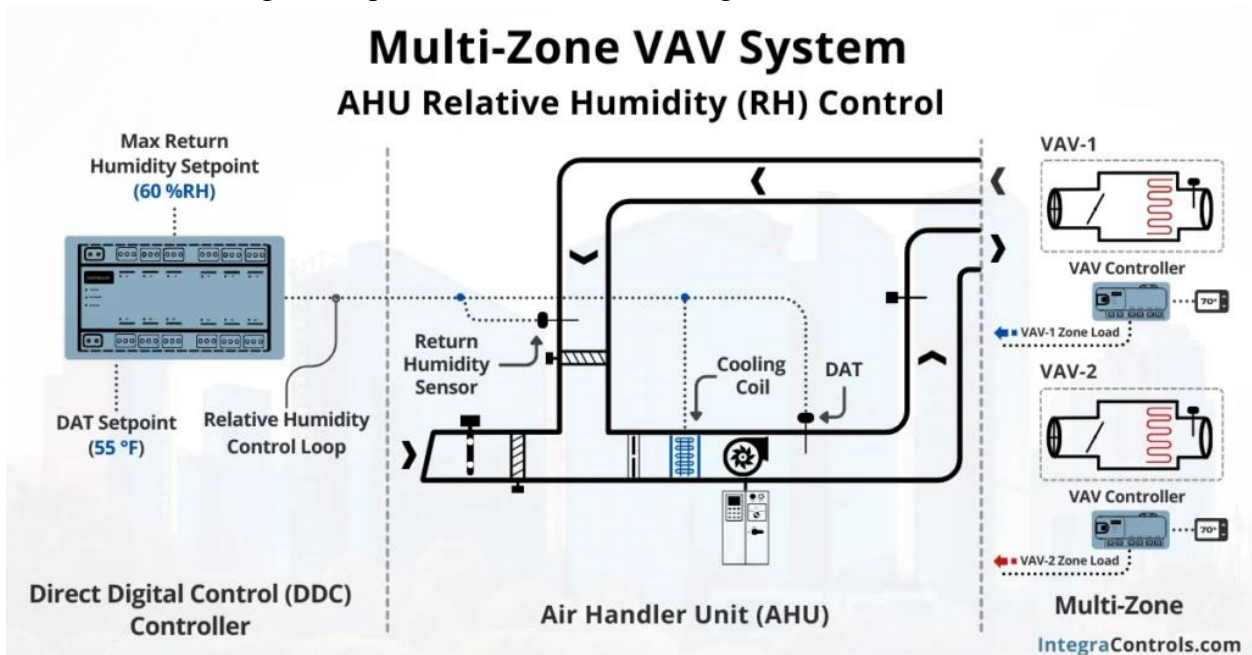


Figure 17: A detail explaining the process of a Multi-Zone VAV System which can be included in all the buildings to maintain comfort for all the people in the building.

**Premium Framed Broadband  
Absorption Panels**

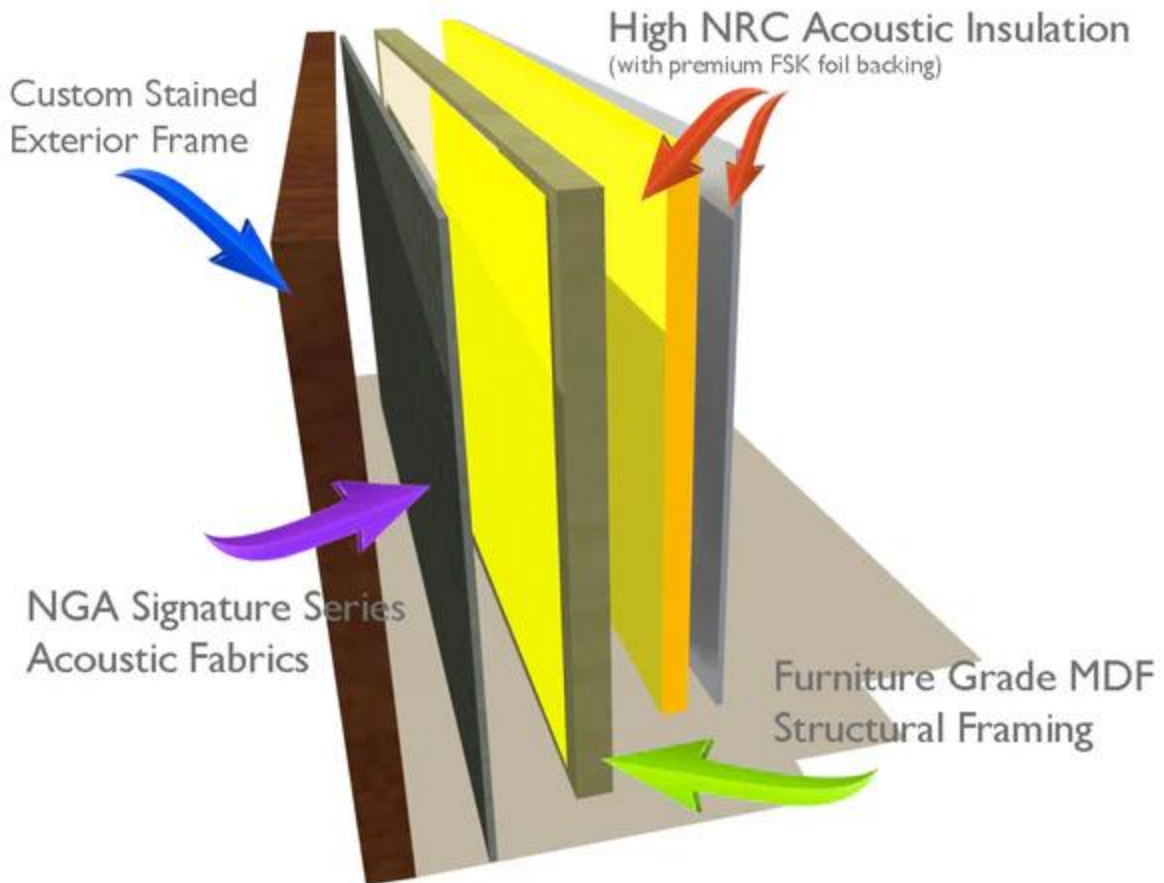


Figure 18: A detail explaining acoustic absorption panels which can be included in the buildings where animals are present so that their sounds do not disturb students.

LEED v4 for BD+C: New Construction and Major Renovation		Project Checklist		Project Name:	Date:
Y	?	N			
1					
Credit	Integrative Process		1		
<b>0 0 0 Location and Transportation</b>		<b>16</b>		<b>0 0 0 Materials and Resources</b>	
Y	Credit	LEED for Neighborhood Development Location	16	Y	Prereq
2	Credit	Sensitive Land Protection	1	Y	Prereq
2	Credit	High Priority Site	2	3	Credit
5	Credit	Surrounding Density and Diverse Uses	5	2	Credit
3	Credit	Access to Quality Transit	5	2	Credit
1	Credit	Bicycle Facilities	1	2	Credit
1	Credit	Reduced Parking Footprint	1	2	Credit
1	Credit	Green Vehicles	1		
<b>0 0 0 Sustainable Sites</b>		<b>10</b>		<b>0 0 0 Indoor Environmental Quality</b>	
Y	Prereq	Construction Activity Pollution Prevention	Required	Y	Prereq
1	Credit	Site Assessment	1	2	Credit
2	Credit	Site Development - Protect or Restore Habitat	2	1	Credit
1	Credit	Open Space	1	2	Credit
3	Credit	Rainwater Management	3	2	Credit
2	Credit	Heat Island Reduction	2	1	Credit
1	Credit	Light Pollution Reduction	1	2	Credit
<b>0 0 0 Water Efficiency</b>		<b>11</b>		<b>0 0 0 Innovation</b>	
Y	Prereq	Outdoor Water Use Reduction	Required	5	Credit
Y	Prereq	Indoor Water Use Reduction	Required	1	Credit
Y	Prereq	Building-Level Water Metering	Required		
2	Credit	Outdoor Water Use Reduction	2		
4	Credit	Indoor Water Use Reduction	6		
2	Credit	Cooling Tower Water Use	2		
1	Credit	Water Metering	1		
<b>0 0 0 Energy and Atmosphere</b>		<b>33</b>		<b>0 0 0 Regional Priority</b>	
Y	Prereq	Fundamental Commissioning and Verification	Required	1	Credit
Y	Prereq	Minimum Energy Performance	Required	1	Credit
Y	Prereq	Building-Level Energy Metering	Required	1	Credit
Y	Prereq	Fundamental Refrigerant Management	Required	1	Credit
3	Credit	Enhanced Commissioning	6		
14	Credit	Optimize Energy Performance	18		
1	Credit	Advanced Energy Metering	1		
2	Credit	Demand Response	2		
3	Credit	Renewable Energy Production	3		
1	Credit	Enhanced Refrigerant Management	1		
1	Credit	Green Power and Carbon Offsets	2		
<b>0 0 0 TOTALS</b>		<b>Possible Points: 110</b>		<b>0 0 0</b>	
Certified: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80 to 110					

Figure 6: LEED Platinum Checklist for New Construction and Major Renovations

Using the LEED New Construction and Major Renovation Checklist, the new development of Elizabethtown College is LEED Platinum which means that the development reaches 80+ points. The first section details credits associated with Location and Transportation. The major credits achieved in this section include LEED for Neighborhood Development Location, Surrounding Density and Diverse Location, and Access to Quality Transit. The credits met in this section total 22 points which exceeds the required 16 credits. The credits for LEED For Neighborhood Development Location are met because the site aims to reduce vehicle travel and promote sustainable, walkable streets and communities. The Surrounding Density and Diverse Use is achieved because the project is located within an already convinced location on campus. The Access to Quality Transit credit is met by the inclusion of walkable streets, the extension of the parking lot, and the addition of the bus stop near Wawa.

The second section talks about credits with Sustainable Sites, and the required 10 credits are met in this section. The key credits met in this section include Rainwater Management, Heat Island Reduction, and Open Space. The Rainwater Management credit is met by reducing runoff by adhering to strict industry standards. The Heat Island Reduction credit is met by the addition of green roofs on numerous buildings. The Open Space credit is met by the inclusion of the garden in the middle of the development.

The third section specifics credits in the Energy and Atmosphere area. 25 credits are met in this section with the major credits including Optimized Energy Performance, Renewable Energy Production, and Green Power and Carbon Offsets. The Optimized Energy Performance is met by reducing greenhouse gases and lower environmental damages. The renewable energy production

credit is met through the inclusion of solar panels. The solar panels also check off the Green Power and Carbon Offsets credit.

The fourth section includes the requirements associated with Materials and Resources credits. The key credits in this section include Construction and Demolition Waste Management and Building Product Disclosure and Optimization. The credits in this section had up to 11 points. The Construction and Demolition Waste Management is met because during the construction process wasted materials will be limited and site disturbance will also be limited. The Building Product Disclosure and Optimization is met by a selection of products that have long-lasting life cycles and transparent information about their sourcing.

The fifth section discusses credits associated with Indoor Environmental Quality with key credits including Daylight, Indoor Air Quality Assessment, and Enhanced Indoor Air Quality Strategies. The credits in this section total 14 in this section. The Daylight credit is met by the inclusion of windows that are oriented towards the natural path of the sun. The Indoor Air Quality Assessment is having constant testing through sensors that analyze the air quality of all of the building and automatically adjust it accordingly, which also helps meet the credits in Enhanced Indoor Air Quality Strategies.

The final section includes Innovation standards with the only two credits in this section being Innovation and LEED Accredited Professional. The credits total 6 in this section. The first credit deals with Innovation which will be met by the inclusion of different green features on all the buildings and by mixing animal needs with education and community wants. The second credit is LEED Accredited Professional which will be met by having a LEED certified individual oversee the design and construction of the Elizabethtown College expansion.