ARCHITECTURE AT ZERO 2023

A Design Competition for Decarbonization, Equity, and Resilience in California

COMPETITION CHALLENGE

Agriculture Center in Allensworth, CA

CHALLENGE

The Architecture at Zero 2023 competition challenge is to design a teaching and innovation farm lab, connecting the history of California's first Black town, to its present aspiration to become a destination for sustainable agriculture.

All entrants will design the TAC Teaching & Innovation Farm Lab. Graduate students and professionals will also design housing for farm students on the site.

ELIGIBILITY

Architecture at Zero is a design competition for decarbonization, equity and resilience, open to students and professionals worldwide. It serves to engage the fields of architecture, design, engineering and planning in the pursuit of sustainable design.

Win $25,000

*Prize money will be awarded at the discretion of the Jury.

AIA California

Allensworth Progressive Association, Allensworth, CA

Southern California Edison

PG&E

SoCalGas, A Sempra Energy utility

SDGE, A Sempra Energy utility

California Architectural Foundation

The American Institute of Architecture Students

DEADLINE: JUNE 15, 2023, 6:00 PM PST

TABLE OF CONTENTS

ARCHITECTURE AT ZERO 2023

A Design Competition for Decarbonization, Equity, and Resilience in California

COMPETITION OVERVIEW

Up to $25,000 in total prize money will be awarded to student and professional winners at the discretion of the Jury.

Fees:
There is no fee for student entries.
Students must submit a valid student ID from the 2022 or 2023 academic year.

Professional entry fee: **$325 per entry**

There is no limit to the number of entries that an individual or firm may submit; however, each must be submitted separately with separate payments.

OVERVIEW OF SUBMISSION REQUIREMENTS

1. Entrants will create an overall site plan to accommodate the competition program. Entrants are encouraged to highlight any energy efficiency, renewable energy, energy storage, and carbon reduction strategies or systems shown.
2. Entrants will design the building(s) in detail, demonstrating how the design will result in lower carbon emissions and embodied carbon, and addressing the requirements of the California Title 24 Building Energy Efficiency Standards.
    a. High school and undergraduate students are to submit a site plan and design for the Teaching & Innovation Farm Lab ONLY.
    b. Graduate students and professionals are to submit a design and site plan for the Teaching & Innovation Farm Lab AND housing for farming students.
    c. In order to indicate how the building design will result in lower carbon emissions, entrants will provide required documentation and may also include supplementary documentation.
3. Entrants are asked to describe how this project will build resilience. Entrants will be asked to complete a table outlining the inclusion of climate adaptation strategies and indicate on the site plan or section aspects of design strategies that support resiliency.
4. Entrants are asked to consider how their design addresses equity for the community. Entrants are asked to write a short essay and indicate on the site plan or section aspects of design strategies that support equity.

Winners will be announced on July 14, 2023 at an online event. Details to be announced.

ARCHITECTURE AT ZERO

COMPETITION PROGRAM 2023

BACKGROUND

The Architecture at Zero 2023 competition program is to design a teaching and innovation farm lab, connecting the history of California's first Black town to its present aspiration to become a destination for sustainable agriculture.

All entrants will design the Teaching & Innovation Farm Lab. Graduate students and professionals will also design housing for farm students on the site.

ABOUT ALLENSWORTH, CA

The story of Allensworth begins with the story of its founder, Colonel Allen Allensworth. An Army chaplain and educator, he was born into slavery in Louisville, Kentucky in 1842. At the age of 12 he was sent away for violating the law that that prohibited the education of slaves. In 1862, he fled slavery to join the Union Navy and was honorably discharged. He would receive a doctorate in Theology and become chaplain to the 24th Infantry, one of the US Army's four Black regiments. He would retire as a lieutenant colonel in 1906, the first African American to achieve such high rank.

Grounded in the belief of Black self-reliance, Colonel Allensworth and Professor William Payne purchased 800 acres along the Santa Fe railroad line to establish an independent, self-sufficient colony. In 1909, California's first town to be founded, financed, and governed by Black Americans would begin to rise.

In the following years, a school, library and church would serve to form the heart of the town, welcoming Black Americans from around the US. Yet the need for water would threaten plans for the growing community. Unable to raise funds to drill wells or improve the existing water system, by 1914 the water table was dangerously low.

Later that year, Santa Fe Railroad moved its rail stop from Allensworth, seriously damaging the local economy. A month after that, Colonel Allensworth was killed by a motorcyclist as he crossed the street. Poor crop yields, drought and a failing water supply would become insurmountable obstacles for the community and many residents left the town.

In the 1960's, arsenic was found in the water supply and by 1973, the town no longer even appeared on maps. The town remained home to a handful of families and individuals throughout the 20th century.

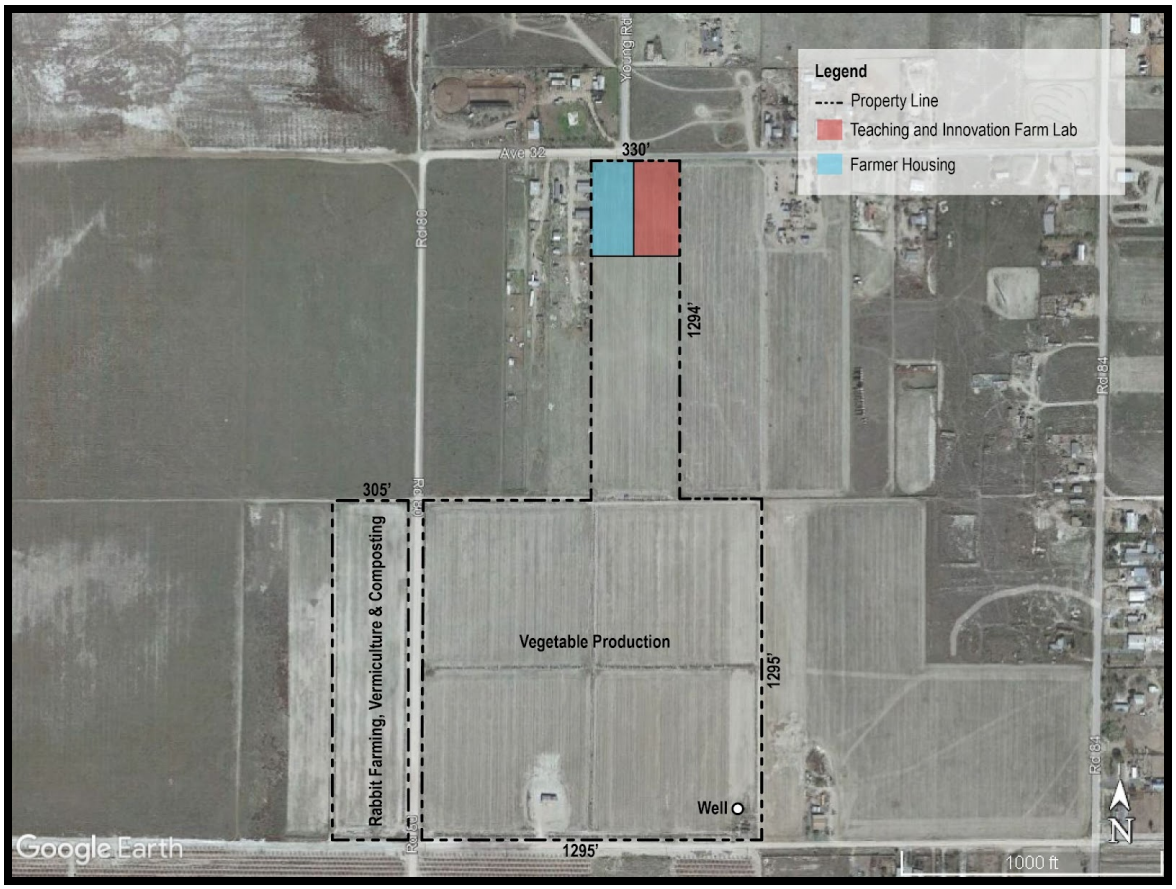
Yet, true to the courage and resolve of its founders, the town survived and persevered, earning the well-deserved title “The town that refused to die.”

In 1974, the California Department of Parks and Recreation purchased land to create Colonel Allensworth State Historic Park. Today, a collection of historic, restored, and reconstructed early 20th-century buildings—including the Allensworth house, Allensworth School, Baptist church, and library—showcase the dreams of the visionary pioneers. Today about 70,000 people visit the park annually.

COMPETITION SITE

The competition site is close to the state park and is under the jurisdiction of the Allensworth Progressive Association. The State of California recently provided funding to create a Teaching & Innovation Farm Lab and housing for farming students.

While funding has been secured for this project, competition winners are not guaranteed to be chosen to design the final project.



The competition site is located at the intersection of Young Rd and Avenue 32 in Allensworth, California. The property owned by the client is indicated. However, the built portion of proposals should remain within the areas highlighted in the northern portion of the site. This area is approximate, and teams have flexibility with the placement of their proposal on the site, with the exception that the Teaching and Innovation Farm Lab must be on the eastern half of the shaded area, and the Farmer Housing must be on the western half of the shaded area.

FARMING IN ALLENSWORTH

Allensworth lies in the Central Valley of California, one of the most productive agricultural regions on the planet, providing more than half of the fruits, vegetables, and nuts grown in the United States. More than 7 million acres (28,000 km^2) of the valley are irrigated via an extensive system of reservoirs and canals.

Farmers and farmworkers are the cornerstone of the larger food sector, which includes the industries that provide farmers with fertilizer and equipment; farms to produce crops and livestock; and industries that process, transport, and distribute food to consumers. Despite the dominance of agriculture in the area, Allensworth and many communities in the Central Valley are food “deserts” with no place for residents to purchase fresh food and vegetables.

The presence of arsenic in the soil and groundwater has led the Allensworth farming plan to focus on growing leafy vegetables such as lettuce and kale which store arsenic in their roots, not in the part of the plants that we eat.

The extreme lack of water in the town will be addressed through the recently funded plan for a new well and 500,000 gallon storage tank.

Image of current site conditions.

COMPETITION DESIGN PROGRAM

The Teaching & Innovation Farm Lab will house multiple micro- projects that synergistically and operationally support one another, while allowing for each project to act as an independent revenue generator/profit center for the Allensworth community. These Micro-Projects include: Rabbitry, Vermiculture & Vermicompost, Crop Production and a beginning Farmer Training Program.

ALL COMPETITION ENTRANTS WILL DESIGN THE TEACHING AND INNOVATION FARM LAB BUILDING. THE PROGRAM FOR THIS BUILDING IS:

1 Produce market + convenience store	800 sq ft
1 Multi-purpose room	300 sq ft
2 (500 sq ft.) conference training rooms	1000 sq ft
4 offices	600 sq ft
Storage space	500 sq ft
Restrooms	500 sq ft
1 commercial kitchen for catered events	300 sq ft
***Total sq. footage:**	**4000 sq ft**

GRADUATE STUDENTS AND PROFESSIONALS MUST ALSO SUBMIT A DESIGN FOR FARM AND GUEST HOUSING:

Farmer Housing Building:

12 total bedrooms:	
10 bedrooms of 144 sq ft.	1440 sq ft
2 bedrooms of 168 sq ft.	336 sq ft
12 bathrooms of 48 sq ft.	576 sq ft
1 shared kitchen dining area	348 sq ft
Total sq footage:	**2700 sq ft**

Air conditioning is required.
Residents prioritize natural light in their living spaces.

ADDITIONAL SITE REQUIREMENTS:

Height limit: One story for bothe buildings.
Parking: 20 parking spaces are required on site.
All buildings and site plans should incorporate best practices for accessibility and follow American with Disabilities Act (ADA) standards.

TECHNICAL CHALLENGE

CALIFORNIA CONTEXT

Building decarbonization is a key strategy to achieving California's aggressive climate goals. California's Fourth Climate Change Assessment highlights the potential impacts from climate change on California. In 2020, California experienced record-shattering wildfires with widespread smoke and intense, dangerous heat events.

Projects designed and constructed in California must meet certain energy use requirements in the building code. California's Building Energy Efficiency Standards (Title 24) focus on reducing energy used in new construction and existing buildings. The requirements for the latest version of this Title 24, and numerous other resources, can be found at Energy Code Ace: https://energycodeace.com/ Building energy codes are still fundamentally based on energy use predicted by energy models.

Entrants to this competition are asked to demonstrate or explain how their design meets the minimum performance standards for buildings in California. This does not require a code compliance model, but may be satisfied with an explanation of the requirements for building systems and how the design meets those requirements. Additional resources and training will be highlighted on the Technical Resources Page on the competition website.

TECHNICAL CHALLENGE ENERGY DEMAND TARGETS

Energy Use Intensity (EUI) is a metric that is used to compare the energy consumption of buildings by accounting for Conditioned Floor Area (CFA). It is defined as annual energy consumption divided by conditioned floor area and is most commonly expressed in the units of kBtu/sf-yr.

EUI = Annual Energy Consumption (kBtu) / CFA

Following the first foundation of zero carbon building policies -- energy efficiency -- participants should use the following site EUI targets as a starting point for the competition, before accounting for on-site generation.

- Teaching and Innovation Farm Lab (School) - less than **20 kBtu/sf-yr** [1]
- Farmer Housing (Low-Rise Multifamily) - less than **15 kBtu/sf-yr** [2]

INTEGRATION OF RENEWABLE ENERGY SOURCES AND STORAGE

Renewable generation is distinct from load reduction, and both are components of a successful low carbon design. Solar photovoltaics (PV) are expected to be the primary source of renewable energy for this challenge. PV with integrated battery storage systems are strongly encouraged.

---

[1]Advanced energy design guide for K-12 school buildings : achieving zero energy. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., The American Institute of Architects, Illuminating Engineering Society, U.S. Green Building Council, U.S. Department of Energy. Atlanta : ASHRAE, 2018.
[2] Advanced energy design guide for multifamily buildings : achieving zero energy. ASHRAE, The American Institute of Architects, Illuminating Engineering Society, U.S. Green Building Council, U.S. Department of Energy. Peachtree Corners: ASHRAE, 2022.

BUILDING ENERGY MODELING AND SIMULATION

Participants are encouraged to use building energy modeling and simulation tools to optimize their designs to meet the EUI goal. For modeling to be a valuable part of the design process, the team must always ask:

- “Do these results make sense?”
- “What are the implications for the building design?”

More information about available simulation tools and resources are provided on the Competition Website under **Technical Resources**.

DECARBONIZATION, RESILIENCE AND EQUITY CHALLENGES

DECARBONIZATION CHALLENGE

In addition to energy efficiency and renewable generation, designers should consider the carbon impact of their fuel choice. One of the primary strategies for achieving zero carbon buildings is electrification of the building’s end-uses.

Zero carbon or low carbon buildings also need to be good grid citizens. The specific time that energy is used during the day or year (the “load shape”) can have a substantial impact on the overall carbon emissions.

Carefully reducing loads through efficiency and equipment selection has an impact, and loads can be further reduced or shifted through demand response strategies, load shifting strategies, and inclusion of energy storage.

The operational carbon emissions of buildings are generally determined by multiplying the energy use by an emissions factor. The emissions factor varies by fuel, time of year, and time of day, so a number of different strategies must be used to reduce the total carbon emissions of the project, including electrification, energy efficiency, and load shifting.

An “Energy and Emissions” excel spreadsheet tool is provided as part of the downloadable Competition Packet. This will visualize results for both energy and emissions from an annual, monthly, and hourly perspective. Note that hourly simulation results are required to output hourly emission load shapes using the spreadsheet.

There is also increasing attention being paid to embodied carbon that stems from the associated emissions from material production and construction practices. Teams should consider strategies for reducing embodied carbon in their submission.

Additional information and resources regarding decarbonizations can be found on the competition website on the Carbon, Resilience, & Equity Resources Page.

REQUIRED DOCUMENTATION

1. Entrants should indicate on the site plan and section drawings how and where the submission has considered decarbonization (operational and embodied).
2. Entrants must submit completed documentation of load shapes and emissions.
3. Accurately address and describe the decarbonization strategies utilized within the project.

OPTIONAL DOCUMENTATION

1. Entrants also have the option to submit an essay of 250 words or less about how the submission takes decarbonization into consideration. Possible topics to address include:
    - Strategies for reducing embodied carbon from materials and construction
    - Discussing how these strategies influenced the design process

RESILIENCE CHALLENGE

For the purposes of the Architecture at Zero competition, resilience is described as “the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events.”

The most acute challenges to the resilience of Allensworth’s residents are limited fresh water and air quality. Extreme heat and drought due to climate change are also important factors to consider. Also, ironically, farmworkers may find it difficult to access fresh fruit and vegetables from local stores as much of the harvested food is sent for packaging and processing off site.

Air Quality:

Air quality is a chronic and serious issue in the Central Valley for a number of reasons. Smog and wildfire smoke from other areas of the state can settle in the region for weeks and months, often resulting in some of the worst air quality in the U.S. High rates of asthma and lung disease impact the lives of children and adults. In addition, there are concerns about "pesticide drift" and leaching in the Central Valley of California. Residents can experience risk of contamination from pesticides when living in proximity to pesticide application sites.

Climate Change and Drought:

Most of California's precipitation falls in the winter as snow. Due to climate change, this is expected to change, resulting in more frequent rainfall events and less frequent snowfall events. It has been projected that the Sierra Nevada mountain snowpack will experience a 25% to 40% reduction from its historic average by 2050. Rising temperatures have resulted in more precipitation falling as rain instead of snow, and snowmelt occurring earlier in the spring.

In addition, the combination of higher temperatures, periods of low precipitation, and the potential higher reliance on groundwater supplies may cause a drop in groundwater tables and a concentration of groundwater contaminants. This is currently the situation in Allensworth, where there is usually less precipitation than surrounding communities.

Higher intensity storm events may lead to more surface runoff, and less infiltration and groundwater recharge. Additionally, more precipitation falling as rain rather than snow, could also mean more surface water runoff, and less infiltration and recharge. Less recharge would lead to more concentration of contaminants and poorer groundwater quality. In an effort to recharge groundwater aquifers, increased application of storm water and/or treated wastewater injection may alter groundwater quality.

Extreme Heat:

In August, 2020, temperatures in the Central Valley soared to 116 degrees Fahrenheit, breaking previous records. Climate scientists expect that extreme temperatures will continue in the future.

Entrants should discuss how their project addressed resilient design considerations. See the Carbon, Resilience, & Equity Resources page on the competition website for additional resources and information.

- When thinking of how to help mitigate high temperatures:
    - *Can the project enhance insulation of homes?*
    - *Can the project install cool roofs?*
    - *Can the project provide a community cooling center?*

- When thinking of drought or extreme precipitation events:
    - *Can the project set up an ongoing mechanism to conserve water?*
    - *Can the project plant native, drought-tolerant vegetation?*

- When thinking of wildfires:
    - *Can the project involve fire hazard prevention work to mitigate wildfire threats to communities?*
    - *Can the project include a backup power source to operate in case of emergency power shutoff?*

REQUIRED DOCUMENTATION

1. Entrants should indicate on the site plan and section drawings how and where the submission has considered resilience.
2. Entrants must submit a completed Climate Adaptation Assessment Matrix that accurately addresses and describes the resilient design strategies utilized within the project. This table asks specific questions pertaining to the inclusion of various adaptive strategies, such as:

OPTIONAL DOCUMENTATION

1. Entrants also have the option to submit an essay of 250 words or less about how the submission takes resilient design into consideration. Possible topics to address include:
    - Reflecting on the research conducted into climate hazards
    - Addressing thoughts and interests concerning the resilient strategies chosen
    - Discussing how these strategies influenced the design process

EQUITY CHALLENGE

Equitable design takes into account social vulnerabilities, acknowledges experiences, opportunities, and barriers among different groups of people, and helps strengthen communities by engaging local social and cultural contexts.

Designing for equity means maximizing positive impacts across multiple scales by creating productive spaces and systems for the individual, the community, the environment, and global sustainability. Marginalized groups often face higher risks of climate vulnerability as well. Access to resilient spaces and resources are essential to mitigate those risks.

By dismantling barriers to elevate individuals to an even playing field, equitable design can create inclusive and empowering environments. While often used interchangeably, equity and equality mean different things and lead to different results. When we treat everyone equally, we treat everyone the same, but when we treat everyone equitably, we focus on individualistic needs. Equity asks us to acknowledge that everyone has different needs, experiences, and opportunities. The fourth aspect of this competition requires submitters to reflect on the question of equity. Be sure to submit an essay of no more than 250 words, on how your design process was influenced by your research and consideration of issues of equity.

As previously stated, one of the most visible issues to equity in the community is the difficulty of farm workers to access fresh fruit and vegetables from local stores, since most harvested food is sent for packaging and processing off site.

Twenty First Century Development[3] provides a detailed framework to gauge how influential and in depth design interventions are in terms of equitable benefits to the community. This framework is based on guidelines and principles developed by The Living Building Challenge.[4] These resources can be used as references to understand the role that equity can play in architectural design. Entries for this competition should comprehensively address issues of equity. A brief descriptive narrative that

[3] Development Matrix - Twenty First Century Development
[4] The Living Building Challenge 4.0 Basics

reflects on your research into equity and the local context, and how your findings were integrated into the design should be included as part of the submission. Key moments where equity comes into the design and programming should also be noted within the site plan and section drawings.

Entrants should discuss how their project addressed equitable design considerations. See the Carbon, Resilience, & Equity Resources page on the competition website for more information. Specific questions which you may address include:

- What challenges did you face in designing for a community with a complex history?
- What challenges did you face in designing housing for farming students?
- If you or your team are from outside California, how might these challenges be the same or different for your community?
- Did your work on this project contribute to your understanding of equity?

REQUIRED DOCUMENTATION

1. Entrants should indicate on the site plan and section drawings how and where the submission has considered equitable design.
2. Entrants must submit a brief essay (no more than 250 words) about how the submission addresses equitable design considerations, such as those listed above. Specific questions that you might address include:
    - What strategies did you use to promote an environment that is culturally and linguistically responsive?
    - What challenges did you face in designing for families from different cultural and linguistic backgrounds?
    - What challenges did you face in designing housing for farmers, and what questions did you ask yourself throughout the design process?
    - If you or your team is from outside California, how might these challenges be the same or different for farmers in your community?

SUBMISSION REQUIREMENTS

Note that this competition uses an electronic submission process.

The following is the list of the work products to be included in the submission. A full list of entry requirements can be found **here.**

- All submissions must be in a PDF booklet containing the required elements detailed below.
- Format size should be letter sized (8 1/2 x 11 inches or A4) in either a landscape or portrait format.
- If you are submitting more than one perspective drawing please number the pages 4A, 4B etc.
- All required elements must be included or your entry will not be accepted.
- **File size must not exceed 40 MB.**
- **Please do not include names of the team or firm on any part of the entry.**

Number and label all pages after the cover page.

Cover	Title page
Page 1	Project Narrative
Page 2	Site Plan
Page 3A	Floor Plan: Teaching & Innovation Farm Lab (all entrants)
Page 3B	Floor Plan: Farming Student and Guest Housing (Graduate students + professionals only)
Page 4	Perspective Drawing
Page 5	Illustrated Sections
Page 6	Mechanical System Summary
Page 7	Annual End Use Summary
Page 8	Monthly End Use Energy Consumption Bar Chart
Page 9	Hourly Load Shapes for Energy and Emissions
Page 10	Details of Renewable Energy Systems
Page 11	Storage Systems
Page 12	Decarbonization Strategies
Page 13	Climate Adaptation Assessment Matrix
Page 14	Equity Essay
Optional:	*Supplemental Energy Information. This should not exceed 20 pages.*

JURY CRITERIA FOR EVALUATING SUBMISSIONS

The names and bios of Jury members are on the competition website.

Entries are weighed individually, not in competition with others. Jury decisions will be based solely on the materials submitted.

The evaluation process of each entry has two phases.

PHASE 1: TECHNICAL REVIEW PANEL

Complete entries are screened by a Technical Review Panel that examines all submitted energy metrics. The panel uses the following rating system:

- This submission provides documented, defensible energy metrics to support the design of this entry, including how the design addresses requirements of the California Title 24 Building Energy Efficiency Standards.
- This submission does NOT provide documented, defensible energy metrics to support the design of this entry

The results of the Technical Review Panel's evaluation and comments are shared with the Jury during their later review of all entries.

PHASE 2: REVIEW BY ARCHITECTURE AT ZERO JURY

Jury members will "score" all entries using the following criteria:

Energy Strategy **30 points**	**How does the submission incorporate energy reduction and performance in the design of the building?** Defined as: Does the design include a realistic strategy for including sufficient energy efficiency measures to approach Zero Net Energy? - Failure to describe the strategy adequately will result in a lower score. - Compelling and complete energy calculations: 20-30 points - Narrative indicates possibility of defensible energy calculations but energy documentation is incomplete or unclear: 1-20 points - No energy documentation: 0 points
Decarbonization Strategies **20 points**	**How does the submission incorporate decarbonization design principles in the design of the building?** Defined as: Does the design include a realistic strategy for including sufficient energy efficiency measures and renewable energy sources to achieve decarbonized building operations? Does the submission adequately describe its strategy to reduce embodied carbon? - Failure to describe the strategy adequately will result in a lower score. - Compelling and complete carbon calculations: 10-20 points

	- Narrative indicates possibility of defensible carbon calculations but decarbonization documentation is incomplete or unclear: 1-10 points - No decarbonization documentation: 0 points
Resilience Strategies 20 points	**How well does the entry respond to resilience?** Defined as: How well does the design promote resilience for residents of the project? - For the purposes of this competition, we define resilience as: designing not just for typical or current climates but also considering future climate changes and incorporating "the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events". - Successful entries will consider ways to provide the building and occupants with back-up power or incorporate passive design strategies. - Entrants should indicate how the project engages resilience in the submitted drawings and in a completed Climate Adaptation Assessment Matrix.
Equity Strategies 20 points	**How well does the entry address equity for residents of the project?** Defined as: Does the design take into account social vulnerabilities, acknowledge experiences, opportunities, and barriers among different groups of people, and help strengthen communities by engaging local social and cultural contexts? - When considering equity in the design process, entrants should consider how the project contributes to the health and happiness of the occupants, what impacts the choice of energy source could impose, and how including access to various resources could benefit the community. Consider the lifespan of the building and the longer term impacts of design choices, such as system durability and maintainability, on the residents. Designs should attempt to capture and engage the local culture and specific community that they serve. - Entrants should indicate how the project engages equitable design in the submitted drawings and in a short essay.
Form 10 points	**What is the Form of the project?** Defined as: Form is the visible shape and configuration of the project. - The jury will consider how the project's built-form manifests the stated intent through its materials, shape, spatial organization, detailing, etc. The project's form should indicate the building's relationship to its surroundings, its users and the public at large. It isn't enough to be beautiful. The focus should not be on creating a cutting edge or trendy form, but rather on a considered, appropriate design that is relevant and effective for its audience and intent.

FINAL NOTES

Neither the Technical Review Panel or Jury members know the names of submitters during the evaluation process.

Insider tip: Avoid jargon. Clear language helps the Jury better understand the design approach.

Questions?

Email: info@architectureatzero.com