U.S. DEPARTMENT OF ENERGY
SOLAR DECATHLON

Building the Next Generation

SUNBLOCK
The Avenue...

University of Arizona

Multifamily Building | April 5, 2022

THE UNIVERSITY OF ARIZONA

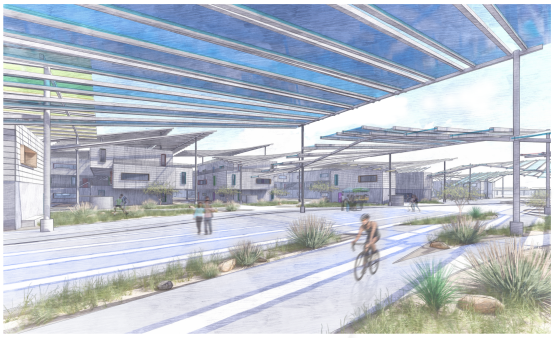
The Avenue

Project Summary

Miracle Manor is a neighborhood in Tucson, Arizona that houses many families that suffer from low income and single-parenthood. These families are vulnerable to the high crime rate and low economic opportunity that this neighborhood currently exhibits, and it is extremely important to the future of this neighborhood that we provide a safe, quality living space at an affordable price. The project proposal is for a 3 story mixed-use development located on what is currently the Sleepy Hollow RV park, dedicated to providing quality affordable housing for low-income families in the Miracle Manor neighborhood. The building will boost the Miracle Manor economy by providing a new retail district that will create more income opportunities for residents of the building, thus enhancing the social atmosphere of the neighborhood. Education and recreational spaces are also incorporated in order to provide ample after-school or summer activities for children who are living with a single parent. Additionally, achieving a Net-positive energy rating will reduce the cost of living and provide energy to the surrounding neighborhood, making utility costs more affordable for everyone. The complex will be designed in such a way as to meet the DOE Zero Energy Ready Home National Requirements.

Design Strategy

The project incorporates a prefabricated modular assembly for dwelling units in an effort to minimize cost and carbon emissions during construction. The complex is sheltered by a roof superstructure which acts as a host for OPV panels. The roof is made of recycled plastic and adaptable to future improvements when necessary. The design also uses color contrasted against white terracotta panels to induce a sense of cultural appreciation for Tucson's historic past. Delicate use of landscape creates an avenue through the community and enhances the potential for a boosted economy within miracle manor. Individual units have strategically placed windows for daylighting and natural ventilation, as well as indoor fans to improve comfortability with minimal need for HVAC.



Project Data

- **Location:** Tucson, Arizona, U.S.A
- **Climate Zone:** ASHRAE 2B (Hot, Arid)
- **Lot Size:** 17.5 acres
- **Building Size: 497,819** ft^2; 3 stories
- **Occupancy:** 360 people
- **Construction Cost:** ~$55 million
- **Energy Performance:** 7.02 kBTU
- **Average Utility Cost:** $21,279
- **Annual Carbon Emissions:** 16,273 Metric Tons

Technical Specifications

R-Values

- Wall: R-35 Roof: R-52
- Foundation: R-27.2 Windows: R-1.78

HVAC

- Trane model 25-79 kW

On-Site PV

- Organic Photovoltaic Solar Film

Partners

Industry Partners	Heliatek City of Tucson Recycle 1
Design Partner	B. Public EcoCladding

2022 Design Challenge

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Project Highlights

Architecture

Building style and material selection reflects the historical values of classic Tucson architecture. The Avenue utilizes a simple modular design contrasted with a colorful OPV roof superstructure to create a unique living space for occupants and visitors.

Engineering

The modular nature of the building construction is essential to the project's design. This allows us to efficiently assemble building parts offsite and assemble them onsite. While investigating photovoltaic strategies to harness solar energy, we engineered a roof superstructure that functions as a shading device and a solar farm.

Market Analysis

The market we aim to primarily serve experiences some financial hardship as most families within the neighborhood only make between $20,000 and $30,000 annually. With a significant percentage of families having multiple children and single parents, we see a massive opportunity for this building to provide a safer environment for after school activities and economic opportunity for some residents.

Durability and Resilience

The idea is for the design to not only withstand environmental factors, but also economical impact by maintaining a high volume of quality living spaces that help facilitate the economic stability of the community. Through use of OPV, The Avenue can create a surplus of energy that can be allocated throughout the miracle manor community.

Embodied Environmental Impact

We utilize local contractors for building materials and construction methods. Offsite modular assembly will make construction more energy efficient, potentially reducing energy consumption during the construction process by nearly 67%. The use of photovoltaics presents a more sustainable approach to solar energy and is adaptable to future innovations.

Integrated Performance

The building's performance is integrated into the design of the building through photovoltaic solar energy, forming for water conservation, and design for an efficient modular construction process. The project uses OPV solar panels as both a source of energy and shading devices, turning the harsh solar radiation of the desert into a resource instead of an obstacle.

Occupant Experience

The Avenue provides desirable, adaptable living spaces that deliver a high quality of life for all residents at an affordable price. Emphasis in resident diversity is important, ranging from single person units to multi generational housing. The complex brings an enhanced sense of security within the community and creates a desirable atmosphere on the ground level for residents and visitors to experience.

Comfort and Environmental Quality

Units are designed with critical consideration towards daylighting and natural ventilation. This ensures each resident can live comfortably without having to frequently adjust utilities, thus reducing the heating and cooling demand of the building.

Energy Performance

With an abundance of OPV panels collecting solar energy, the project not only collects enough renewable energy to supply itself, but also partially fuels the Sunblock district. With high sun exposure and solar radiation in Tucson Arizona, OPV panels will have a great long term benefit for the building by capturing solar energy and doing it sustainability.