



U.S. DEPARTMENT OF ENERGY  
**SOLAR DECATHLON**



**SOLAR TEXAS**

**Texas A&M University**

**Solar Texas**

**Market Analysis Contest Narrative**

**March 28, 2023**

# Project Narrative

Solar Texas | Texas A&M University (TAMU)

## Marketing Analysis Jury

### Overview:

#### Statement of Purpose: Market Analysis

Solar Texas aims to achieve quality yet affordable housing for people in need within Brazos County, Texas. Through a partnership with Bryan/College Station Habitat for Humanity, a multidisciplinary team of students has endeavored to create a prototype of a net-zero energy home designed to be constructed to address the need for quality housing while being net-zero and affordable to economically disadvantaged families. The goal is to end the cycle of systemic poverty through the combination of sustainable building practices, financial feasibility, and energy independence.

### Target Client:

The target client for the Texas Solar project is any individual or family in need of a safe, decent, and affordable place to live. This prototype house must suit the family’s financial and economic needs. Heavy emphasis was placed on creating a structure focusing on energy efficiency to remove the burden of high-energy payments.

Bryan/College Station Habitat for Humanity has a target profile range for the families they can serve. Based on Area Median Income (AMI), B/CS Habitat for Humanity serves families in the range of 35% to 80% AMI. The area median income for Brazos County households as of 2023 is \$83,000. Based on Federal Housing Guidelines, the Texas Solar project has a maximum occupancy of 6 individuals.

Household Size	Minimum (35%) Annual	Minimum (35%) Monthly	Maximum (80%) Annual	Maximum (80%) Monthly
1	\$23,500	\$1,958	\$43,050	\$3,588
2	\$23,500	\$1,958	\$49,200	\$4,100
3	\$24,300	\$2,025	\$55,350	\$4,613
4	\$26,950	\$2,246	\$61,500	\$5,125
5	\$29,100	\$2,425	\$66,450	\$5,538
6	\$31,300	\$2,608	\$71,350	\$5,946

Figure 1: Annual income comparison to maximum and minimum allocation of salary to housing costs

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A five-mile radius around the selected site of 1613 Conlee street shows an AMI of \$53,616 as of 2022. Forecasts of the same geographic area show an increase to \$62,834 by 2027.



### Household Budget Expenditures

1613 Conlee St, Bryan, Texas, 77803  
Ring: 5 mile radius

Prepared by Esri  
Latitude: 30.68145  
Longitude: -96.38830

Demographic Summary	2022	2027
Population	93,108	97,529
Households	34,539	36,376
Average Household Size	2.48	2.47
Families	18,330	19,376
Median Age	28.1	28.4
Median Household Income	\$53,616	\$62,834

Figure 2: Household budget expenditures (Source: ESRI)

Based on data provided by the Texas Real estate association, we can see that the average cost of a house throughout the state of Texas in 2022 has risen 13.3% from 2021 to \$345,000. The median home price for the MSA of Bryan-College Station has risen 11.9% from Q3 of 2021 to 3Q of 2022 to 290,880.

### Texas housing prices grew in 2022.

- In 2022, the median home prices increased by 13.3% from \$300k to \$340k.
- While this represents a slowdown from the substantial increase of 16.2% observed in 2021, it is in line with the upward trend seen prior to 2021.

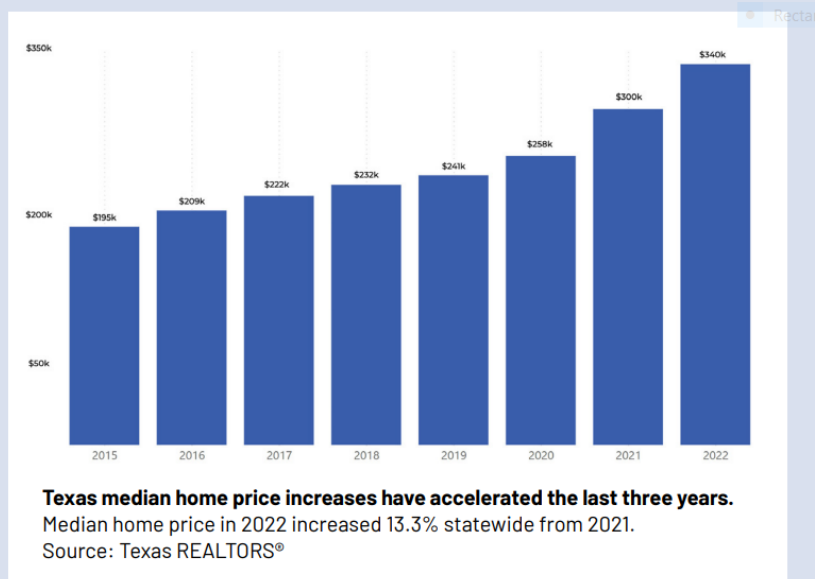


Figure 3: Texas housing price escalation 2015-2022, with a 13.3% increase since the beginning of the 2023 Build Competition

Additionally, Texas A&M's increase in student body population each year has ultimately provided exponential growth in working-wage jobs in the region. However, rapid student body growth has raised rent prices to accommodate the increase in luxury housing, pushing out the availability of affordable options for

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working-class families. Rising rent costs and new Real Estate development have put certain demographics at risk of losing their homes and being priced out of other attainable options. This increase in risk profile has exacerbated the flight of working-class families to more affordable options miles away from where they work.

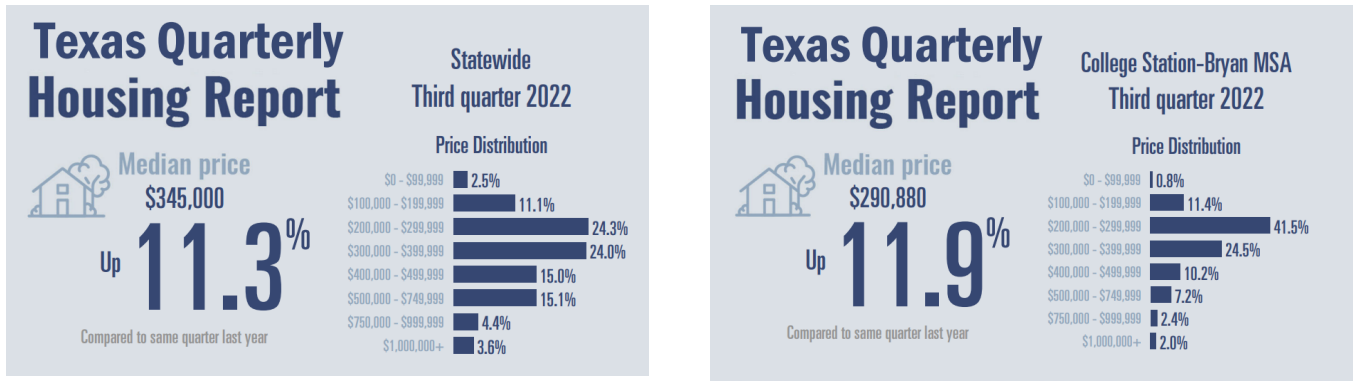


Figure 4: Statewide and regional price distribution comparison for the State of Texas and the Bryan/College Station region of Brazos County

These families are often economically vulnerable, so the opportunity to break the cycle of systemic poverty is the primary goal. The market assessment demonstrates that only 9.6% of the Bryan/College Station Motorplex’s affordable housing market is being met, leaving 90.4% of the demand unmet.

The affordable housing market of the metroplex is severely underserved

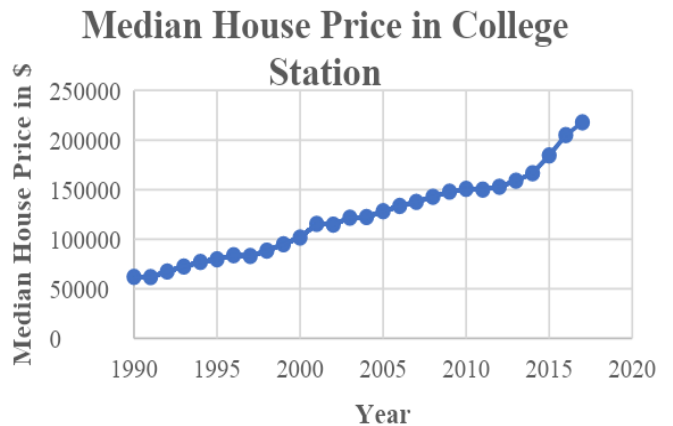
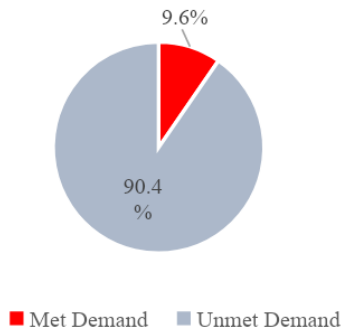


Figure 5: Images comparing the underserved affordable housing market to the median price escalation in Bryan/College Station region

**Affordability & Cost Effectiveness:**

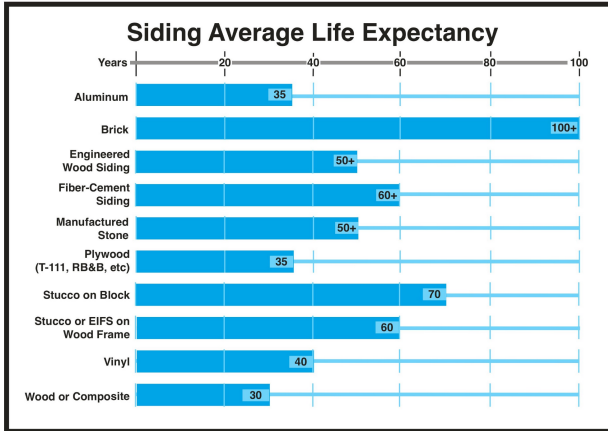
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Estimates of the upfront construction costs are \$324,000 through T&V Custom Homes. This estimated cost of construction continues to decrease steadily from gift-in-kind donations and reduced services and material pricing. These savings drive the affordability factor for the project and resonate with the fruition of the need for this project's target market.

The overall costs of maintenance for our target market client will be exceptionally lower overall than any other structure in the surrounding area. For example, using brick and stone on the exterior facade will reduce

overall exterior maintenance. Also, by using longer-lasting materials such as brick, we can avoid the environmental impact of using materials such as vinyl siding or wood-based siding products.



The Solar Texas project's affordability to our target market is complemented and sustainable by B/CS Habitat's application and mortgage lending processes. B/CS Habitat's application process ensures only qualified homeowners are approved and can afford the structure. The stringent process includes a deep dive into the applicant's financial health, current housing situation, and overall needs. Once an applicant gets approved, each

homebuyer is required to complete 500 hours of sweat equity by attending financial literacy classes, homeowner maintenance classes, volunteering throughout the community to help build their house and their neighbor's home, and support B/CS Habitat operations. B/CS Habitat's mortgage lending is structured to keep the affordability obtainable for homebuyers by providing a zero-interest 30-year mortgage.

### Market Analysis:

As demonstrated in the overview, the need for attainable housing in Brazos County is critical. As a vast underserved portion of the population in Bryan/College Station dreams of future homeownership, the uncertainty about future energy costs plays a considerable factor in the decision about future homeownership for at-risk populations. Within a 5-mile radius of 1613 Conlee Street, a total of 34,539 households will make up a diverse profile of potential beneficiaries to a project such as Texas Solar. At a brief glance, 6,481 households have someone with a disability, 9,818 households have a population age of 65 years and older, and 7,308 households are under the poverty level. These few examples show the importance of understanding the tapestry around the selected site. Each of these categories represents a possible barrier to attaining a net-zero home. Breaking these barriers will be key in establishing this prototype model and bringing the economy of scale to the area.

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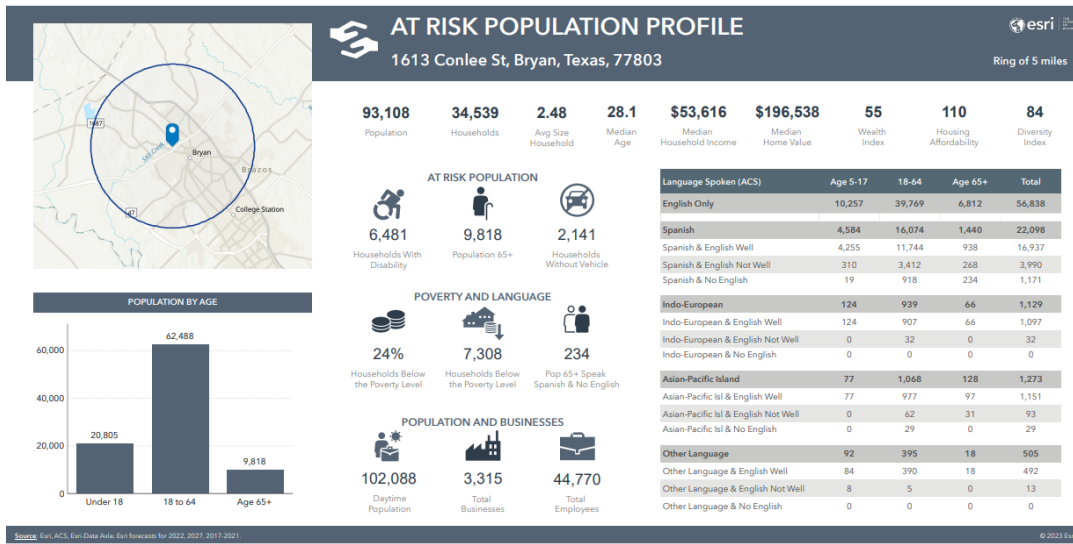
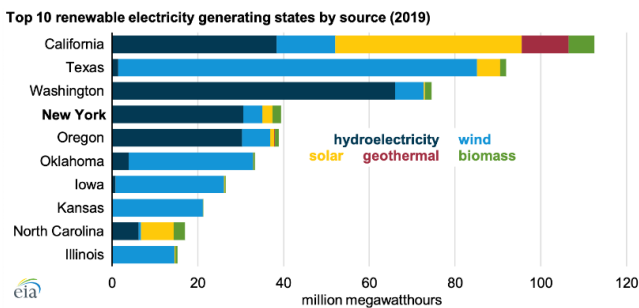


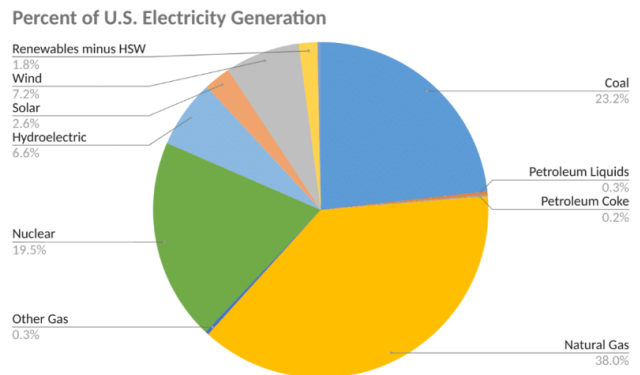
Figure 6: At-risk population profile of 1613 Conlee area (Source ESRI)

Bryan/College Station residents have been extremely receptive to the idea of saving on future energy costs. Our target client during the transition phase while residing in the house will benefit most from the savings on energy usage. During the transitional portion, while their house is under construction, the family can save utility costs and apply those savings to their future Habitat mortgage or begin a savings account for future maintenance items and investment growth. The transition to renewable energy has accelerated over the last few decades, especially in Texas. Albeit, still reliant on fossil fuels and petroleum products as a means of energy creation and economic factors, Texas is the leading producer of renewable energy solutions. Given the increased severe weather-related occurrences, this is a major impact on our target market. Systems such as ERCOT and our under-regulated power grid in Texas that has shown catastrophic failures in recent years and have completely shifted public perception concerning energy diversity and independence.

### TOP 10 United States in Renewable Energy



### 2018 Comparison of Energy Production



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Figure 7: Renewable energy production per state

**Livability:**

The *Solar Texas* house's goal is to create an inclusive and self-sustaining family experience. The project has interior and exterior communal gathering spaces serving as a family's private retreat. The *Solar Texas* team believes that creating a lifestyle of attainability within this new development is vital in order to "break the cycle." The flooring materials planned for use in the house will be certified by the Asthma and Allergy Foundation of America as asthma/allergy-friendly. The *Solar Texas* project will incorporate LID practices for development, on-site drainage, rain gardens to improve occupant comfort and psychology and extend the occupant experience beyond the structure for gardening and food growing.



Figure 8: Source: <https://livingcost.org/cost/United-states/tx/bryan>

The Solar Texas design will net positive and passive income for the target market due to the savings produced by the photovoltaic systems, energy-star rated appliances, and the highly insulated structure. On average, City of Bryan residents spend \$148 per month on electricity, which is calculated by multiplying the average monthly consumption by the average electric rate: 1,401 kWh \* \$0.11/kWh. This adds up to \$1,776 per year spent on electricity usage alone. This project will help save money by reducing monthly electric bills and putting money back into our target market's pocket and reduce the overall strain on the electrical grid for Bryan Texas Utilities by producing electricity for the grid.

EXISTING ELECTRIC BILL	10 YEAR COST	20 YEAR COST	30 YEAR COST
\$50	\$6,200	\$13,000	\$21,000
\$100	\$12,000	\$26,000	\$41,000
\$150	\$19,000	\$39,000	\$62,000
\$200	\$25,000	\$52,000	\$82,000
\$250	\$31,000	\$65,000	\$100,000

Assuming a 0.9% annual increase based on inflation and average annual electric rate increases.

Although a \$100 or \$150 electric bill might not seem like much when you pay it each month, those bills add up quickly over ten, twenty, or even thirty years: if you pay \$150 for electricity now, you'll pay over \$62,000 on electricity over the next thirty years. These utility savings directly increase the affordability of the project's target market. The Solar Texas project hopes to utilize energy efficiency and renewable energy sources as a means to present well-built, stylish, aesthetically pleasing, and eco-friendly homes to serve our target market.

Figure 9: Source: <https://www.energysage.com/local-data/electricity-cost/tx/brazos-county/bryan>

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### **Buildability:**

From a buildability standpoint, the drawings and renderings show a detailed “roadmap” for the completion of the home by any reputable contractor. The newer energy systems in place might seem daunting at first, but with a careful selection of qualified trade partners, the amount of information presented in the construction documents enables the typical construction company to complete the project.

To highlight this feature further, the construction staff of Habitat for Humanity worked with their primary and secondary trade partners to expose them to the practices and materials needed for this project. Unfortunately, the trade partners currently used by B/CS Habitat for Humanity cannot provide the needed expertise for this project. However, upon reading the provided manual and specifications, they have begun training their employees in the systems that will be used. Seeing the value of the information and the forward-thinking, the trade partners have made it a point to accelerate their learning curve.

### **Scalability:**

“Net-Zero” refers to the goal of reducing emissions to the extent possible and balancing any remaining emissions that cannot be eliminated to stop the addition of greenhouse gas emissions to the atmosphere. One of this project's goals is to drive top-of-mind and hands-on learning for net-zero housing in the U.S. Federal policies will further reduce costs through economies of scale and learning-by-doing in driving the scalability of currently competitive technologies as rapidly as possible. The Solar Texas project uses B/CS Habitat’s model throughout the construction process to integrate off-site techniques and the ability for trades to reproduce the design at scale. One major off-site technique utilized is prefabricating the framing systems and walls at B/CS Habitat’s Construction Warehouse. This enables a multitude of hands-on learning opportunities for students, trades, and community members.

### **Innovation:**

The *Solar Texas* house will rely on natural resources to provide necessary energy and comfort to the occupants. Adopting varied passive design strategies, including appropriate building form, orientation, material selection, airtightness of the building, efficient envelope, and solar panels in conjunction with smart building systems makes it possible to achieve Net-Zero energy performance and align to AIA’s 2030 Challenge for carbon-neutral designs. These strategies will considerably assist in minimizing the heating and cooling loads while adapting to the interior and exterior environment utilizing smart building systems. The *Solar Texas* project will include high-efficiency appliances, controllable LED lighting systems, energy-efficient heat pumps and thermal storage tanks, hydronic radiant systems, and an intelligent control system that optimizes indoor thermal comfort. The *Solar Texas* team plans on integrating a smart electrical panel that controls and monitors every circuit in the house using a smartphone. Incorporating this system will enable a comprehensive understanding of how the *Solar Texas* house sources, stores, and uses energy in real time.