

# DOE SOLAR DECATHLON – FINAL REPORT

## 1. ACCOMPLISHMENTS:

Team Orange successfully designed and constructed a house driven by new design concepts and technical innovations that harmonize with Southern California's lifestyle and respect its cultural heritage. The basic elements of our 2015 proposal can be summarized as follows: Increased emphasis on the passive solar design concept, with a visually stimulating design that enhances the Southern California lifestyle; Use of design and construction techniques to create a market-ready home for an efficient and affordable lifestyle; Integrated use of new technology to create a behavior-adaptive smart home; A zero net energy house complying with the Living Building philosophy; and compliance with all DOE Solar Decathlon requirements.

### Key Attributes

1. **Golden Poppy Design** embraces the sun and drives drought resilience
2. **Innovative technology** pushes the limits of energy efficiency
3. **SoCal Market Appeal** inspires indoor/outdoor, multigenerational living
4. **Drought Tolerant and Edible Landscape** that both beautifies and sustains

Team Orange County is not only the home team in this year's competition, but also the only team in Southern California. Comprised of a hundred students across four schools, Team OC is the largest team the Solar Decathlon has ever seen. We engage a public research institution (UC Irvine), a private school (Chapman), and two community colleges (IVC and Saddleback). Inspired by the California state flower, the golden poppy, our home – Casa Del Sol – embraces four principles in design: learn from the Golden Poppy, use innovative technology to enhance energy efficiency, appeal to a Southern California market, and develop drought resistant infrastructure.

### A. Engineering: Innovative Technology

Team Orange County's Casa Del Sol is an innovative, solar powered, net zero energy building. Smart grid ready, our home utilizes a bidirectional inverter to make use of both AC grid power, and DC power generated from solar panels. Our innovative inverter is able to directly use DC power from solar panels to charge our electric vehicle. A sub wet-bulb evaporative chiller and heat pump both chill water that runs in our home's ceilings to provide air conditioning. To increase efficiency, the heat pump rejects its waste heat into

our hot water tank. Additionally, the heat pump can provide ducted heating and cooling when needed. Solar thermal collectors not only heat our hot water, but also help to provide heat for our dryer. Appropriate building materials have been selected to promote good indoor air quality, low carbon footprints, and environmental sustainability-all of which is produced within socially just manufacturing facilities. PEX piping has been used over that of PVC to promote use of cleaner building materials.

## **B. Architecture: Golden Poppy Design**

The California State flower opens and closes as it adjusts to the light of the sun, a method emulated by Casa Del Sol in order to promote the indoor-outdoor California lifestyle. Pivot panels connect our outdoor living room to our surrounding neighborhood, and accordion kitchen windows open to a spacious deck for outdoor dining. As we are in the northern hemisphere, the sun hangs in the southern sky. To protect residents from the sun and moderate solar heat gain, southern shading elements have been placed over windows and living spaces as seen in the tensile structure above. Unsheltered windows on the western side of our home open to cool, prevailing ocean winds. This serves to naturally ventilate living spaces. A brise soleil is built up on the eastern side to protect occupants against warm, violent Santa Ana winds, which often strike in October; we shall see the brise soleil on the other side of the detached studio.

## **C. Market Appeal: Southern California**

A contemporary take on Southern California's historic modern architecture, our home meets the growing needs of multigenerational households. The incorporation of the studio serves to address lifestyle changes as we look to house elderly parents, children returning home, to be used as an office, guesthouse, or acts as a possible rental. Despite our country's slowing population birth rate, the urban population of Southern California is expected to continue to grow. Our studio responds to the need for increased housing stock by promoting multigenerational living and neighborhood walkability while still preserving residential character. In addition to meeting multigenerational demands, Casa Del Sol is also competitively priced with Orange County's real estate market.

## **D. Landscape: Drought Tolerant and Edible**

Like the poppy, Casa Del Sol is drought resistant. This notion of water resilience is more relevant than ever as Southern California faces increasingly dry conditions. In SoCal residential housing, landscaping uses the most water. To mitigate this demand, Casa Del Sol recycles its wastewater and uses rainwater catchment to water a garden filled with drought resistant plantings. The back porch is host to an edible garden to compliment the outdoor dining experience.

## **OUTCOMES**

The Team placed 9<sup>th</sup> overall and 2<sup>nd</sup> in the Engineering category. Team Orange County was not only the home team in the competition, but also the only team in Southern California. Comprised of a hundred students across four schools, Team OC was the largest team the Solar Decathlon has ever seen. We engaged a public research institution (UC Irvine), a private school (Chapman), and two community colleges (IVC and Saddleback). More than 50 students have completed OSHA training.

The home was purchased by Mr. Frank Berry. He has access to several Irvine Company properties that the Irvine company considers un-suitable for residential or commercial development. Frank is the owner of Southwinds Creative Design Development LLC (<http://southwindscdd.com/>) which owns Legends Design Environment (the construction company) and The Nursery, LLC. remain on the grounds of the Orange County Great Park. He has agreed to use the home to highlight advanced energy technologies and will showcase the four universities involved. The home is currently under construction.

We completed a website and documentary. The documentary was assigned a space in the internationally recognized Newport Beach Film Festival and the documentary was shown to an audience of more than 100 people.

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