With End of Oil in Sight, Saudi Arabia's LEED Community is Vision of Sustainable Future

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A building on the KAPSARC campus. Photo credit: HOK

Given the recent revelations that Saudi Arabia may be running out of oil, and that the U.S. is poised to surpass the kingdom as an oil producer, it is no surprise that the kingdom is looking at ways to diversify its economy and its energy future.

In 2006, the kingdom asked HOK to design the ambitious 5.5-million-square-foot King Abdullah University of Science and Technology (KAUST) to provide the kingdom's first nondenominational, coeducational university as a hub for international researchers to develop and improve alternative energy technology. The project was managed by Saudi Aramco, the kingdom's oil company, which the kingdom relies upon heavily to manage its high-profile development and construction projects. Naturally, it had to be the first LEED-certified project in the kingdom, and it became the largest LEED Platinum-certified project in the world at the time.

In 2009, the kingdom asked HOK to plan and design a residential community for a think tank dedicated to alternative energy studies, the King Abdullah Petroleum Studies and Research Center (KAPSARC). Mixed-use buildings were required to be LEED-NC Platinum; however, at that time LEED for Homes was not available outside the U.S. to certify the 191 single-family homes. HOK and Aramco worked with USGBC to open an international pilot program for LEED for Homes. Guided by a U.S.-based LEED for Homes Provider, U.S. Eco Logic/Tex Energy Solutions, KAPSARC has already seen 82 villas certified LEED Gold, with the remainder to follow shortly. This is the first and largest project to achieve LEED for Homes certification outside of North America.

Sustainable design started with the master plan. Although KAPSARC is meant to house Westerners, the climate in Saudi Arabia is not conducive to the typical sprawl of Western suburban development. To address the energy challenge, planners placed homes very close to one another, either sharing a common wall to minimize exposure or creating a narrow, shaded alley between buildings to provide comfortable pedestrian pathways through the development. In addition, the homes were designed to face a central wadi (designed along the site's original stormwater drainage patterns), with a narrow parkway to serve campus shuttle, pedestrian and cyclist activity.

One hundred percent of wastewater is reclaimed to irrigate the public space, and the campus landscape is designed not to exceed the water budget of available treated sewage effluent. Landscape materials are desert appropriate and drought tolerant; however, they do need some irrigation. This was achieved with a highly efficient drip irrigation system. Landscape is essential to provide shade and a comfortable microclimate to encourage pedestrian activity on the campus.

All homes have concrete structure and block infill to provide thermal mass, with rigid foam insulation to provide a high R-value. Each home has a solar thermal hot water panel on its roof, anticipated to provide roughly 80 percent of the annual domestic hot water loads. HOK developed strict guidelines for the performance of the exterior glazing and envelope, including a climate-appropriate window-to-wall ratio and integrated exterior shading devices. To optimize the active systems, the overhead variable-air-volume systems use advanced control strategies, and energy recovery units were included for all air handlers. A solar photovoltaic (PV) farm at the west end of the site provides KAPSARC's electricity. The fixed-axis solar array utilizes high-efficiency PV panels, which were installed in a modular fashion that can be expanded based on demand and funding. Conservative expectations for the on-site solar thermal and PV systems are 20 percent of the annual campus energy.

During construction, the LEED for Homes Provider was stationed on-site to provide green home inspections and testing for envelope and ductwork air tightness. To ensure performance, the provider had to train a multinational labor force in green construction practices. While the LEED-NC certification process has already initiated a transition in the kingdom's building sector, it is this on-site training and testing process, integral to LEED for Homes, that has been truly transformational. Aramco project managers, the general contractor, subcontractors and construction workers have all become more knowledgeable about green building. One of Aramco's project managers even became LEED for Homes accredited!

Due to be complete in 2012, the KAPSARC campus, and its predecessor, KAUST, are a harbinger of the type of development to come in the kingdom's future. Saudi Arabia will experience rapid growth for many years, but it has shown a commitment to undertaking increasingly ambitious sustainability goals. This is a smart investment for a country that sees the end of an oil-based economy in sight.

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