King Abdullah Petroleum Studies & Research Center (KAPSARC)

Master Plan

Riyadh, Saudi Arabia

Built area: 2.05 million sq. ft. / 190,451 sq. m.

Site area: 494 acres / 200 hectares

Completion: 2013

Annual EUI: 45 kBTU/sf/yr = 57% Energy Reduction from Average Residential
The project occupies a prominent location between downtown Riyadh and King Khalid International Airport. Directly adjacent to Princess Norah Bint Abdulrahman University, the site occupies two square kilometers (2.7KM long & 0.75KM wide). Highly visible by air and ground, the project is a symbol to the world of Saudi Arabia's commitment to a sustainable alternative energy future.
The development of the neighborhood block and roadway circulation began with a simple rectilinear site layout. Existing site topography revealed a wadi, or stormwater trench, that became the organizing structure of the site. The geometry of the neighborhood streets were then influenced by existing site topography to employ the natural drainage patterns of the site and take advantage of directional winds. North-South connectors were curved to avoid uncontrolled vistas off the site and to take advantage of shade opportunities for pedestrian connections.
‘Desert Bloom’ concept diagram as a landscape strategy for open space, defined public place and a circulation of energy and sustainability within 1st and 2nd phase housing.
The Place of Renewal marks the Community Entrance into the Site and is highlighted by ‘Managed Wetlands’ for water purification and the creation on a beautiful landscape feature.
The place of immersion is the landscape central green area that connects community to the Research and Development Facilities on the competition site.
The ‘Place of Worship’ is the landscape central green area that holds the community Musalla/Mosque program as its main feature and anchoring element. Its Ceremonial location is “central” to the majority of residential housing and it is in close proximity to Western side of the Community Center area.
worship
apartment courtyard with view to community mosque
1. dining hall / community spaces
2. apartment building / library at ground floor
3. apartment building / retail at ground floor
4. supermarket
5. recreation center
6. natatorium
7. plaza
residential park with townhouses
▲ villas bordering central park

▲ residential block with townhouses

▲ townhouse plans and block elevation
Eight different types of residential housing categories were developed. Within each category, multiple options were created to achieve a variety one expects for this type of development.

The types - apartments, townhouses, houses, and villas - are distributed throughout the KAPSARC community.
<table>
<thead>
<tr>
<th>Residential Type</th>
<th>Lot Size</th>
<th>Target Area</th>
<th>Phase 1</th>
<th>Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Villa</td>
<td>35m x 30m</td>
<td>900qsm</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>6 Bedroom Villa</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Bedroom Villa</td>
<td>35m x 30m</td>
<td>700qsm</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>4 Bedroom Villa</td>
<td>35m x 30m</td>
<td>625qsm</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>4 Bedroom House</td>
<td>24.5m x 30m</td>
<td>500qsm</td>
<td>35</td>
<td>8</td>
</tr>
</tbody>
</table>

Lot Size: 35m x 30m
Lot Size: 28m x 30m
**3 Bedroom House**

- Lot Size: 21m x 30m
- Target Area: 400qsm
- Phase 1: 17
- Phase 2: 222

**3 Bedroom Townhouse**

- Lot Size: 14m x 30m
- Target Area: 325qsm
- Phase 1: 85
- Phase 2: 85

**2 Bedroom Townhouse**

- Lot Size: 14m x 30m
- Target Area: 250qsm
- Phase 1: 8
- Phase 2: 0

**Apartment**

- Phase 1: 59
- Phase 2: 289
KAPSARC is the first and largest project outside of North America to achieve LEED for Homes certification, as one of the instigators of the LEED-Homes International Pilot Program. All villas have been awarded LEED for Homes Gold certification and all the multi-family and community amenity buildings have been awarded LEED-NC Platinum.

In addition, the project is targeting to be the first LEED ND (Neighborhood Design) project in the Middle East.

The community is organized in a dense, walkable, mixed-use configuration with buildings spaced closely to shade one another and the pedestrian spaces between. Traditional Saudi Sikkas (cut-throughs) provide pedestrian shortcuts through the site. Design of the public buildings were seen as an extension of the landscape forms, with the central park flowing over the buildings to create sculptural roof forms and protective canopies for pedestrians.
The public realm was judiciously landscaped using 100% reclaimed water to provide a comfortable microclimate for pedestrian and cycling activity and recharge the water table. Internal bus and shuttle routes also carry residents from home to the research center and from campus into the city.

In Phase 1 wastewater is treated in the Sewage Treatment Plant shared with the adjacent university. In Phase 2 wastewater will be treated at KAPSARC campus in a constructed wetland. 100% of wastewater from the KAPSARC campus is treated to tertiary standards and returned for non-potable uses, such as irrigation, cleaning and makeup.

**42%**
Percent reduction of regulated potable water

**70%**
Percent of rainwater from maximum anticipated

WATER
Solar energy is abundant in Saudi Arabia. But before relying on renewable energy, it’s critical to reduce demand. All homes and amenity buildings are designed to be as energy efficient as possible, employing high performance thermal envelopes, mechanical systems, lighting and equipment.

Daylight and heat gain control are an integral part of the building architecture, filtering solar radiation as well as providing privacy with louvers and the more traditional mashrabiya. Strategies such as sensors and controls, energy recovery ventilation and natural daylighting augment efficient envelopes and systems.

Solar energy is harvested through rooftop solar thermal hot water panels and a 5.8 MW solar farm at the west end of the campus. The solar farm is built with room for expansion as the KAPSARC community grows, positioned to be Net Zero Energy at full build out. Current solar energy meets 35% of demand, demonstrating Saudi Arabia’s movement from fossil fuels towards its alternative energy economy.