**Nexus leaf**

**Context**

**Falaj** UAE’s traditional irrigation technology

A Falaj is a gently sloping underground channel to transport water from an [aquifer](https://en.wikipedia.org/wiki/Aquifer) or [water well](https://en.wikipedia.org/wiki/Water_well) to surface for [irrigation](https://en.wikipedia.org/wiki/Irrigation) and drinking, acting as an underground [aqueduct](https://en.wikipedia.org/wiki/Aqueduct_%28water_supply%29). Falaj [irrigation](https://en.wikipedia.org/wiki/Irrigation) is an ancient system of [water supply](https://en.wikipedia.org/wiki/Water_supply) from a deep well with a series of vertical access shafts. This simple yet incredibly ingenious technology has for generations and to this day sustain life in an otherwise ruthlessly barren environment.

**Al Ain Oasis** The source of life

Al Ain which means ‘spring’ in Arabic is an oasis that dates back 4,000 years ago to the region's inhabitants who began taming the desert and has been an essential source of livelihood for generations .The site is shaped by a complex shared water supply, based on both wells and falaj, with an extensive system of shaded pathways that wind through some 147,000 date palms. The flow of cool water coupled with the generous shade cast by the dense canopies generates a unique microclimate. In the context of the harsh desert sun, the oasis is like a scene straight out of a fairy-tale, well worthy of its stature as a UNESCO World Heritage site.

**Abu Dhabi weather** Hot and Humid

The climate of the UAE is subtropical-arid with hot summers and warm winters. The climate is categorized as desert climate with average maximum temperatures that reach above 45 °C during the summer months. Due to its coastal location and the Persian Gulf southeastern wind known as Sharqi, average relative humidity reaches 70%. A common characteristic of the desert climate is the sharp temperature oscillation between daytime and nighttime, up to 15° C. Combined with high relative humidity, the drop of temperature causes water vapor to [condense](https://en.wikipedia.org/wiki/Water_vapor#Condensation) to form liquid water,­ resulting in a thick mist that frequently engulfs Abu Dhabi.

**Masdar City** Urban thoroughfares

Masdar city master plan is dissected by 2 continuous urban corridors indicated as green pedestrian thoroughfares. Considering Abu Dhabi's arid conditions, sustaining vegetation on an urban scale demands significant water resources, which amount to high energy demands. Moreover, movement and activities in such climatic conditions requires intensive architectural attention so as to ensure sufficient comfort to the inhabitants of the new city and provide them with sustainable high quality urbanism. The completion site is located at the gateway to the new city en route to its urban public center. In order to follow through with the urban vision a sustainable water supply strategy must be considered.

Inspired by the rich cultural heritage of the United Arab Emirates as manifested by the ingenious adaptation to the hostile prevailing conditions, we suggest to face the challenges of the future by learning from the wisdom of the past.

**Proposal**

**Nexus Leaf**

The Nexus Leaf serves as a hub for energy and water generation that uses the natural environment in a sustainable way to support the local community.

The energy is provided by the sun, with help of solar panels mounted on the front face of the Leaf. The panels are manufactured by Oxford PV, which uses a tandem approach: the bottom layer is a regular silicon solar panel, which captures the longer wavelengths of light, whereas the top layer is made of perovskite, which captures the shorter wavelengths of light, and allows the longer wavelengths to pass through. In that way, the panels utilize a broader part of the spectrum, and can reach a higher efficiency than regular commercial solar panels – about 30% efficiency, compared to 18% efficiency for regular commercial panels.

The Nexus Leaf has enough surface for 171 m2 of solar panels. Considering the panels efficiency (30%), the standard estimate for UAE of 5.84 average peak sun hours per day, and 25% of general losses, the Leaf generates:

 Which means that for a year, the energy output of each Leaf is:

During peak sun hours, the system produces roughly 40kW of electrical power.

Water generation is provided in two ways – one passive, which uses the available dew and harvests it using a meshing ­­that is fitted on the backside of the Leaf.

The other is an active Atmospheric water generator system produced by Watergen, which actively converts the humidity in the air to clean, potable water. Half of the electrical output of the Leaf's solar panels is dedicated to power the water generation system, which enables each Nexus to produce an estimated 2,700 liters of water every day.

The excess electricity, roughly 110kW/day per Leaf, is sent to the national grid.

We plan to construct 10 Nexus Leaves at the competition site, which could produce 2,240kWh each day, of which 1,120kWh are intended for use by the surrounding buildings, in addition to 27,000 litres of drinking water.