

ILLUMINISCENT (Illuminating Crescent)

Masdar city, designed with an intent to be a sustainable community with the lowest carbon footprint, requires its landmark to be equally responsible and sensitive towards its objective, at the same time, be a **source** for public interaction.

The Concept

“Returning to the source is stillness, which is the way of nature. The way of nature is unchanging. Knowing constancy is insight” – Lao Tzu

Taking inspiration from the miracles of nature, the source of inspiration for 'Illuminiscent' is the Moon, which itself becomes a secondary source of light in the dark, reflecting the light it receives from the primary source – the Sun. Illuminiscent has been conceived as a social magnet with an aim to generate the electricity required on site and the surplus to be used for its surrounding areas.

The Illuminiscent has been designed as an experience for the visitors rather than just an activity. The space has 6 main zones – The entrance, the walkways leading to the upper level, the upper level, the main Structure, the lower level and the open area.

The Design

The journey begins from the '**Genesis**' – the entrance to the Illuminiscent. The entrance is surrounded by a charging station for around 30 pods of the Masdar City PRT (Personal Rapid Transport). Aspiring to have a low-carbon footprint, the Illuminiscent encourages the visitors to use the PRT to reach the site instead of fuel-based vehicles.

The Genesis leads the visitors onto the '**Spacewalks**' – two multi-functional elevated walkways, creating a gateway over the main road. These walkways are covered with solar panels, creating pockets along the path used for various purposes. Tourist Information Kiosks have been designed to provide the tourists a gist of Masdar City and the City of Abu Dhabi. Public Education Screens at regular intervals will keep playing visuals / statistics to educate the visitors about issues like climate change, energy conservation, etc. Flea Market Spaces along the walkways provide for commercial opportunities to the locals, while giving the tourists a flavor of the culture and regional character. The Spacewalks have Kinetic Paving which generate usable power throughout the day due to the footsteps of the visitors.

The Spacewalks take the visitors to the upper level, merging into the open area around the main structure called the '**Orbit**'. This is used as an art installation / open art exhibition / interaction area. The Orbit makes the transition from the Walkways to the main structure seamless.

At the center of the Orbit is the main structure of the Illuminiscent – '**Techno space**'. This is an exhibition pavilion for encouraging and showcasing sustainable technology innovations. The space has been designed primarily as two crescent shaped sculptural forms facing each other and forming a circular space in between. The convex outer facades of the Techno space are made up of multiple photovoltaic cells coated with a printed film, making the facade a solar mural. These cells use solar energy to generate electricity during the day and at night, the facades are illuminated internally, making them a source of light, like the moon.

A ramp going down from the Orbit guides the visitors to '**Galaxy**' – the lower level of Illuminiscent. The Galaxy houses the Cafe & seating spaces catering to the food and beverage requirement of the visitors. At the center of the Galaxy, are circular bays demonstrating Aquaponics to the visitors. Aquaponics is a system that

combines conventional aquaculture (raising aquatic animals in tanks) with hydroponics (cultivating plants in water). A few herbs / vegetables cultivated in this system can be used in the cafes surrounding the aquaponic zone demonstrating to the visitors the beauty of nature and the concept of recycling / symbiosis in a natural environment.

The open area behind the Galaxy is '**Resonance**' – a concert arena for conducting various public events. For day events, the space is partly covered with solar fabric for shade as well as to generate power to be used for the night time events.

The entire experience of the **Illuminiscent** has been designed in order to stimulate a sense of positivity among the visitors about renewable energy, low-carbon footprint and ecological balance, while creating an iconic attraction for the Masdar City.

“When the light returns to the source, it takes nothing of what it has illuminated” - Rumi

The Materials

1. Walkways

- Roof - **Thin Film Solar Panels** - Sandwiched between two panes of glass to achieve a semi-transparent appearance and at the same generating power for consumption.
- Facades – **Glass with LED screens** – Glass on the exterior coated with Thin Film Solar Cell Layers with LED screens on the interior in order to display visuals along the path.
- Floor – **Kinetic Paving on Recycled Steel & Terracotta Surface** – Pavegen, made from 95% recycled tires that flexes by 5mm when stepped on, generating up to 8 watts of kinetic energy over the duration of the footsteps.

2. Main Structure

- Base Structure – **Terracotta** – Following the theme of Masdar City, the base walls of the crescent are made up of Terracotta
- Cladding – **Thin Film Solar Panels with Solar Mural** – Solar Panels coated with a thin printed film. Murals related to the environmental awareness will be printed on the films.

3. Open Arena

- Roof – **Solar Fabric** – Fabric embedded with solar cells serving as an adjustable shelter, available for use when required, to be pulled out during the day and retracted post sunset.

4. Aquaponics

- Aquaponics is a system that combines conventional aquaculture [raising aquatic animals such as snails, fish, crayfish or prawns in tanks] with hydroponics [cultivating plants in water] in a symbiotic environment.
- In this aquaponic system, water from an aquaculture system is fed to a hydroponic system where the by products are broken down by nitrifying bacteria into nitrates and nitrites, which are utilized by the plants as nutrients, and the water is then recirculated back to the aquaculture system.
- A self-sufficient assembly of plants and animals that functions like an ecosystem, producing food for people without creating waste products.

Energy Generated

Renewable energy used	Per Day	Annually
Solar PV {Horizontal}	4446 kWh	1333800 kWh
Solar PV {Crescent}	1580 kWh	474000 kWh
Kinetic Floor	1764 kWh	529200 kWh {300 working kWh Days}
GENERATION	7790 kWh	2337000 kWh

Energy Consumed

Concert area: $20 \times 250 \times 4 = 20 \text{ kWh}$ Per Day and Considering 260 days annually.

The consumption is **5200 kWh** annually.

Landscape Lights: For 1000 sqm is $2000 \times 12 \times 0.7 \text{ diversity} = 16.8 \text{ kWh}$ per day and **13140 kWh** annually.

Car Charging: $33 \times 9 \text{ hrs} \times 365 = 108405 \text{ kWh}$ annually.

Total **126745 kWh** Annually.

Considering equal amount of consumption for miscellaneous load i.e. **126745 kWh**. So, the total consumption for onsite activities covers up to **253490 kWh** annually.

Know, the surplus energy is **2083 MWh**.

Out of which **70 MWh** per year can be used for street lighting of 1km stretch.

Hence the remaining energy of **2013 MWh** is enough to power **125 homes** per year. (Considering 45 watts for one house per day).

Environment Impact Statement

The project is power packed with two distinct technologies for clean energy generation. The sculpture itself adorned by latest of Solar Thin Film clearly standing tall and gracefully surrounded with a backdrop of a humble kinetic paving quietly contributing to the clean energy generation.

The Solar generation of the project is around 1808 MWh in a year considering the roof area of 6087 sqm and crescent area of 2156 sqm. Kinetic paving generates around 529 MWh per year. Thus, totaling to 2337 MWh of electricity generation. The project is estimated to need some 254 MWh for its operations including concert lighting, landscape accent lighting, miscellaneous loads and Navya Car Charging Facility all put together.

The surplus electricity generated shall always be fed to the grid with a priority given to “in project” consumption controlled through a smart panel for load Management. This surplus energy is also enough to power **125 Homes** and provide electricity to street lighting of 1kilometer stretch. A nominal battery storage shall be planned along with the requisite electrical infrastructure such as inverters, wiring components, over current protections etc.

The Energy Payback Time (EPBT) for Thin Films is the lowest, thus considerably improving its environmental viability. Based on research the specific energy or embodied energy of the technology can be recovered within one year. The total embodied energy of the facility can be offset by the clean energy generation as well as by supplementary onsite and off-site carbon sequestration through ecological landscaping.

Furthermore, since solar technology keeps advancing and getting better by the day, the sculpture can with time

adapt to the newer more efficient solar technologies of the coming age after the life of the thin films also symbolizing times under rapid change and the beauty in adaptation.

The project does not foresee to generate any significant GHG emissions. The project does not propose to use any refrigerants or halons for cooling or firefighting. The natural alternatives shall be considered. The operations of the project are clean and green. The environmental pollution attributed to the operational phase shall be addressed through specific mitigation measures. Waste management on site, prohibition of light trespass, quality of lighting for health wellbeing, water management shall be addressed. The carbon footprint of the project shall be mitigated majorly through the clean energy generation. Also, the activities proposed such as car charging facility shall contribute to reducing environmental pollution. Further on the social front various activities such as fitness sessions can be planned on the kinetic flooring also sending a message of staying fit and healthy (an ignored but important aspect). The construction and finishing materials in the project shall be nontoxic and meeting the health and environmental standards. The battery backup of minimal capacity shall be carefully operated with a specific protocol to increase the battery usage life. Further the battery disposal shall be done as guided by environmental norms and hoping that phase change materials or fuel cell can be used in future in lieu of batteries.