

建築思潮評析

Sustainable Design- Case Study

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- 從本學期學習《The Philosophy of Sustainable Design》的內容，衍生出一套檢視、觀摩永續建築的方法。並從案例分析來了解書本知識在實務上如何應用。
- 針對辦公建築做案例分析，探討永續議題與人的關係。

Case Study 2

MASDAR Headquarters

Adrian Smith

Location

Diagram

Space

Technology

System

Materials

Analysis

MASDAR Headquarters

Adrian Smith



建築師 Adrian Smith + Gordon Gill Architecture (AS+GG)

結構工程師 Thornton Tomasetti

機電工程師 Environmental Systems Design (ESD)

地點 Abu Dhabi, United Arab Emirates

建造期間 2008/~

樓層 7層

總樓地板面積約 135,000 m²

The world's first mixed-use, positive-energy building, using sustainable design strategies and systems to produce more energy than it consumes.

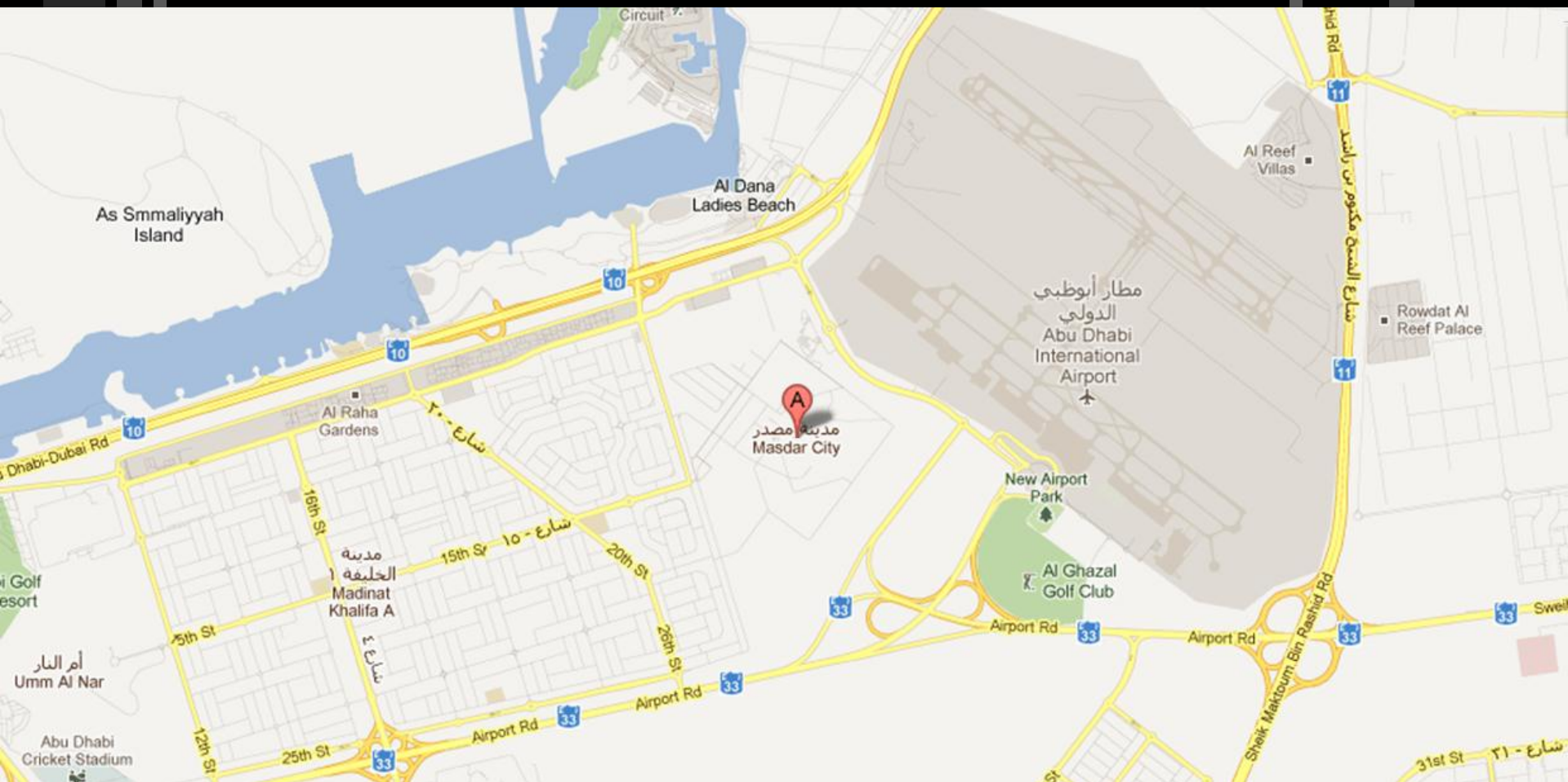
Location



Location



Location

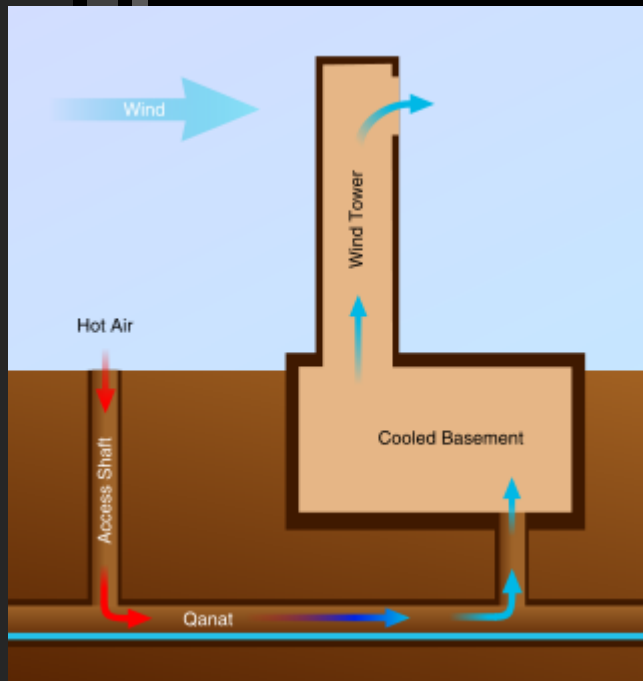


Location



Diagram

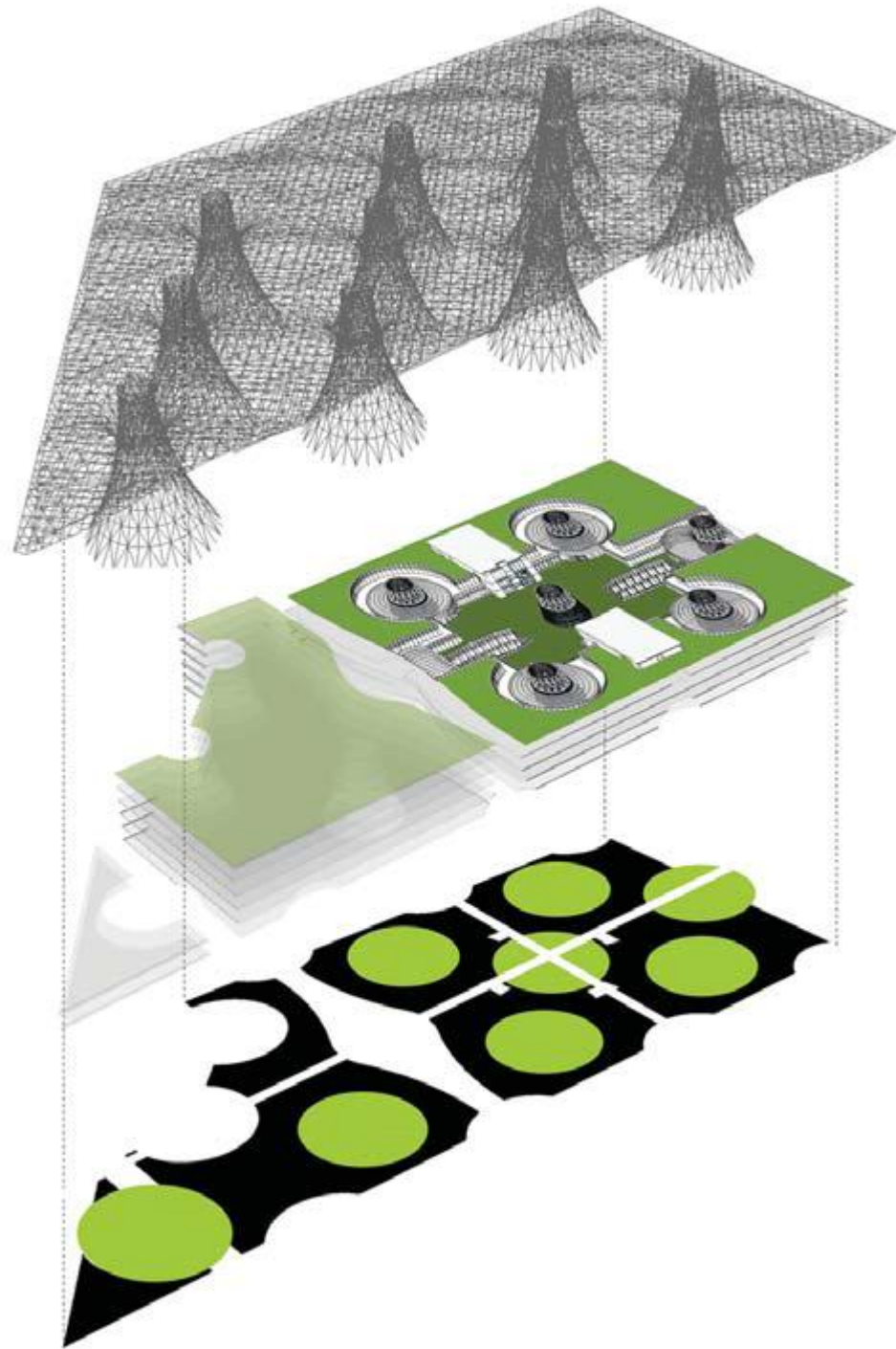
The building's form, sculpted in response to extensive environmental analysis, adapts the ancient science and aesthetics of **Arabic wind towers**, screens and other vernacular architecture, which emphasize natural ventilation, sun shading, high thermal mass, courtyards and vegetation.



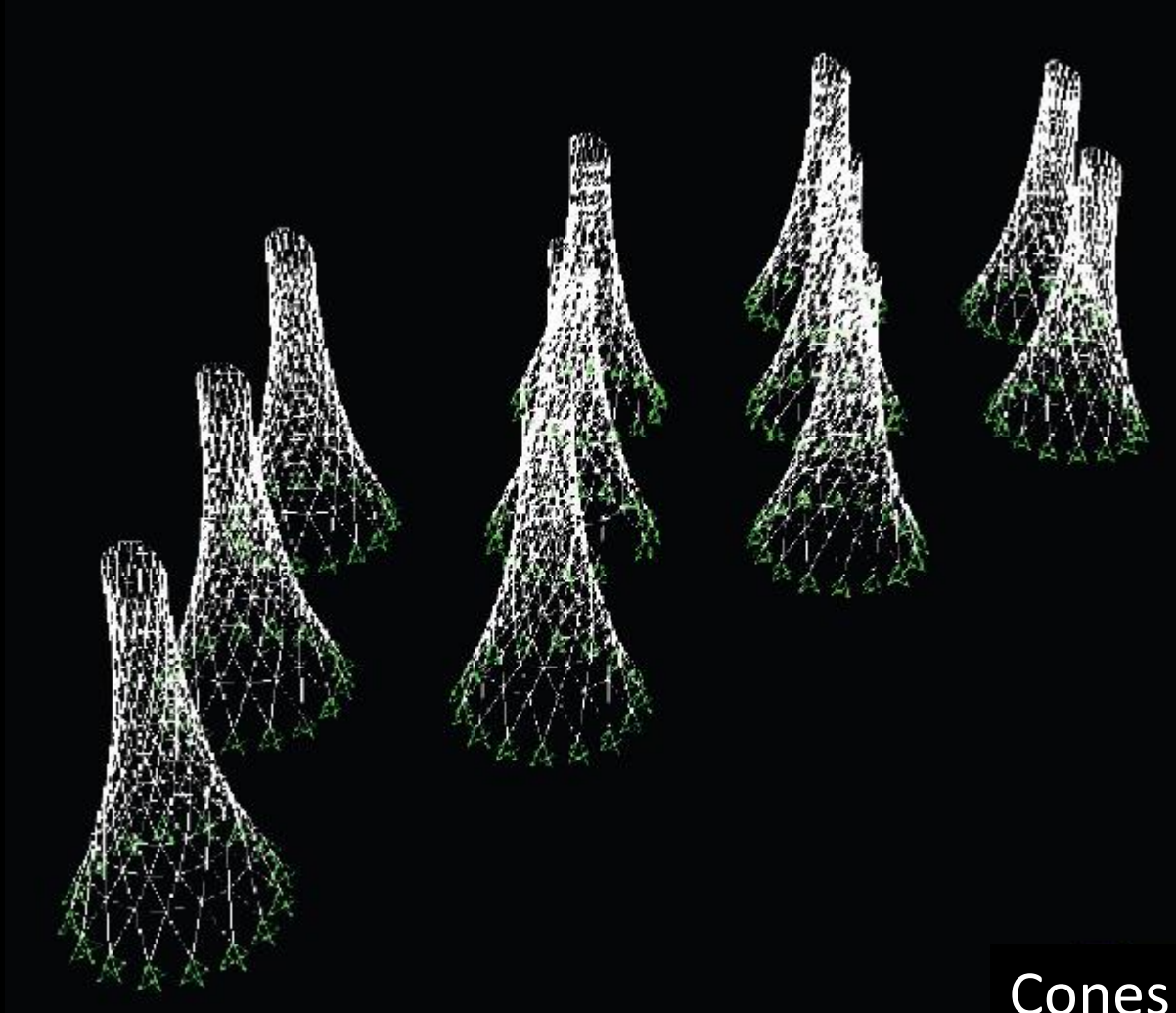
Diagram

a collection of **eleven wind cones**

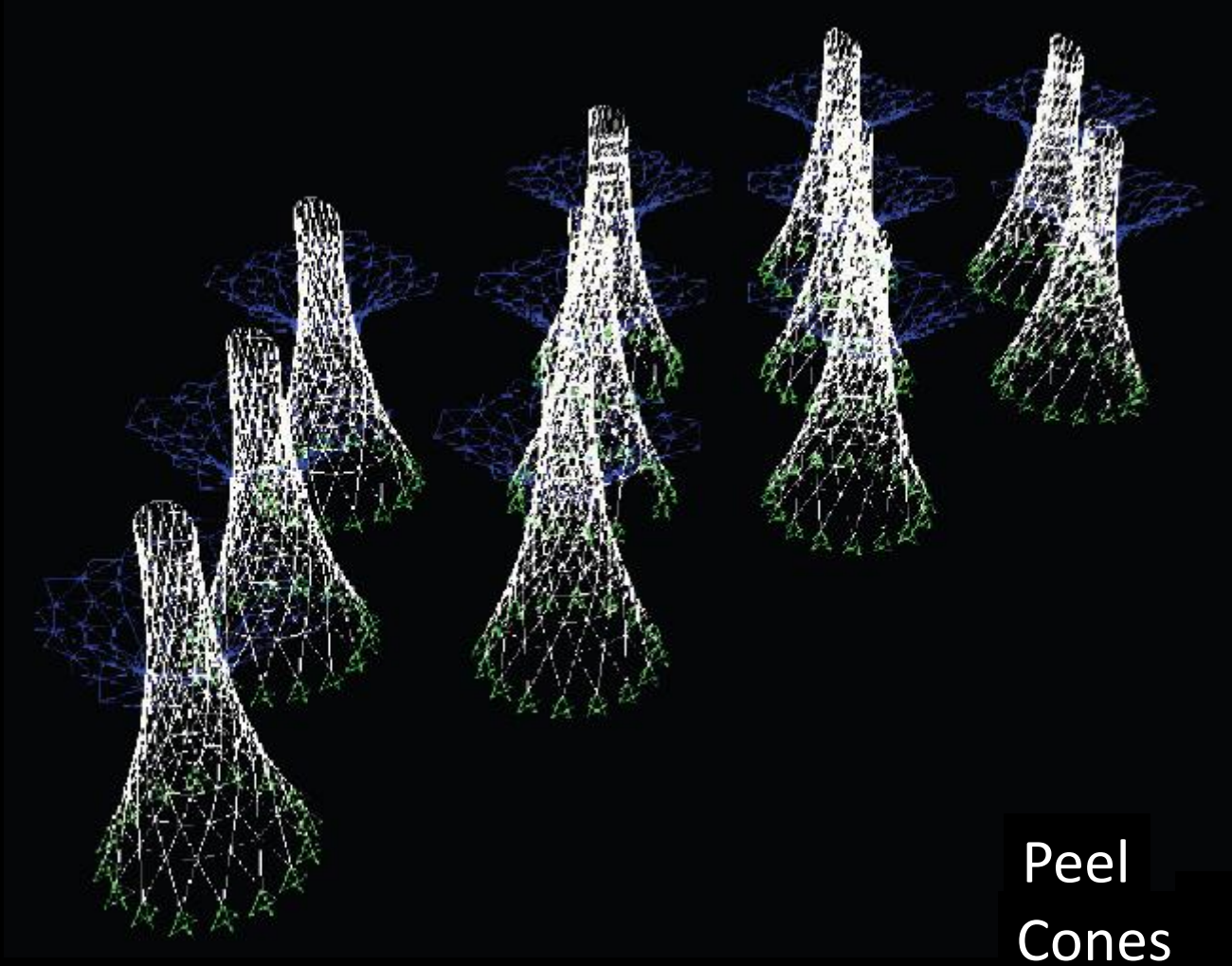
- provide natural ventilation and cooling
- form oasis-like interior courtyards and/or flexible spaces
- provide soft daylighting for the building's interiors



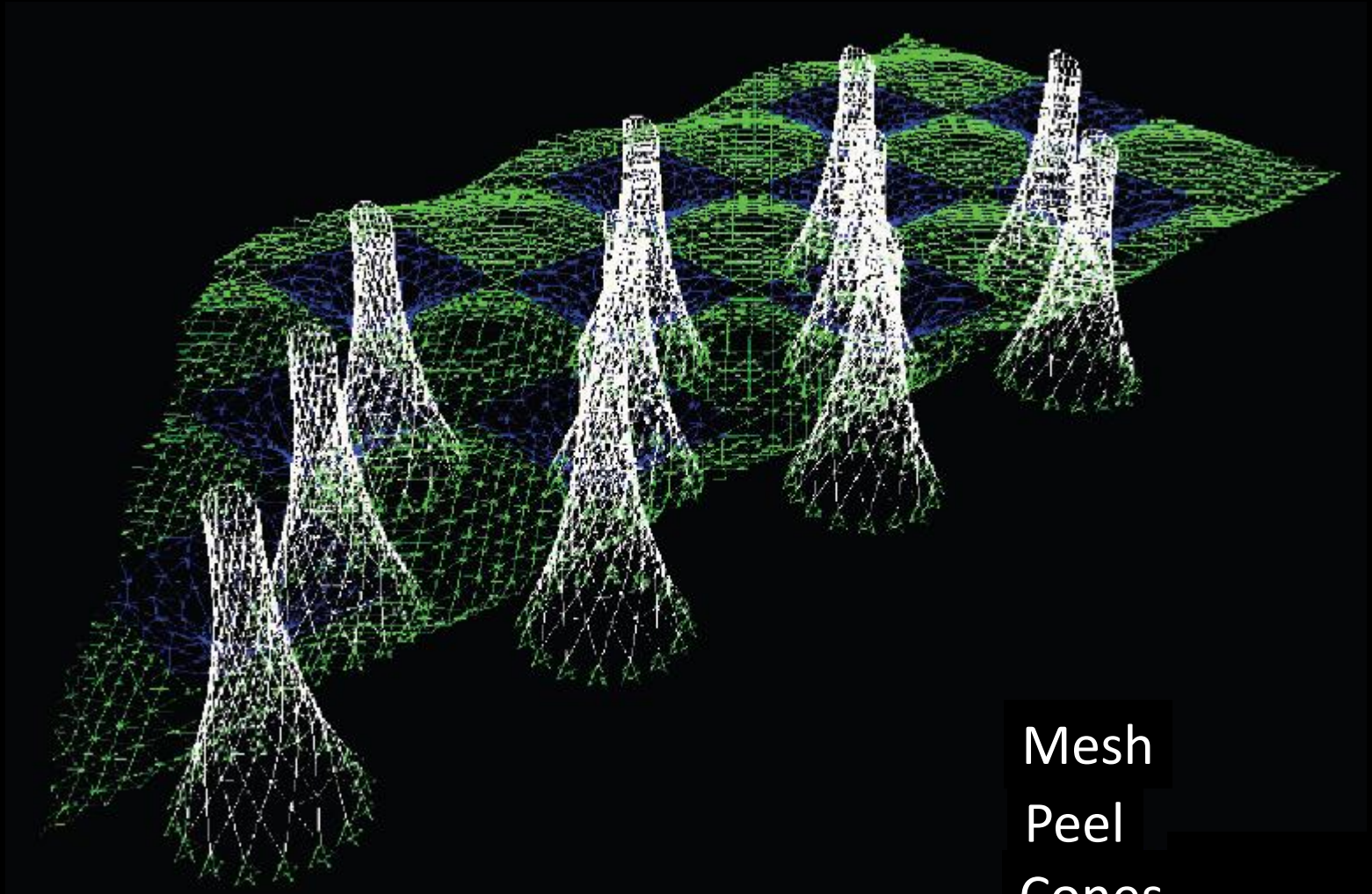
Diagram



Diagram

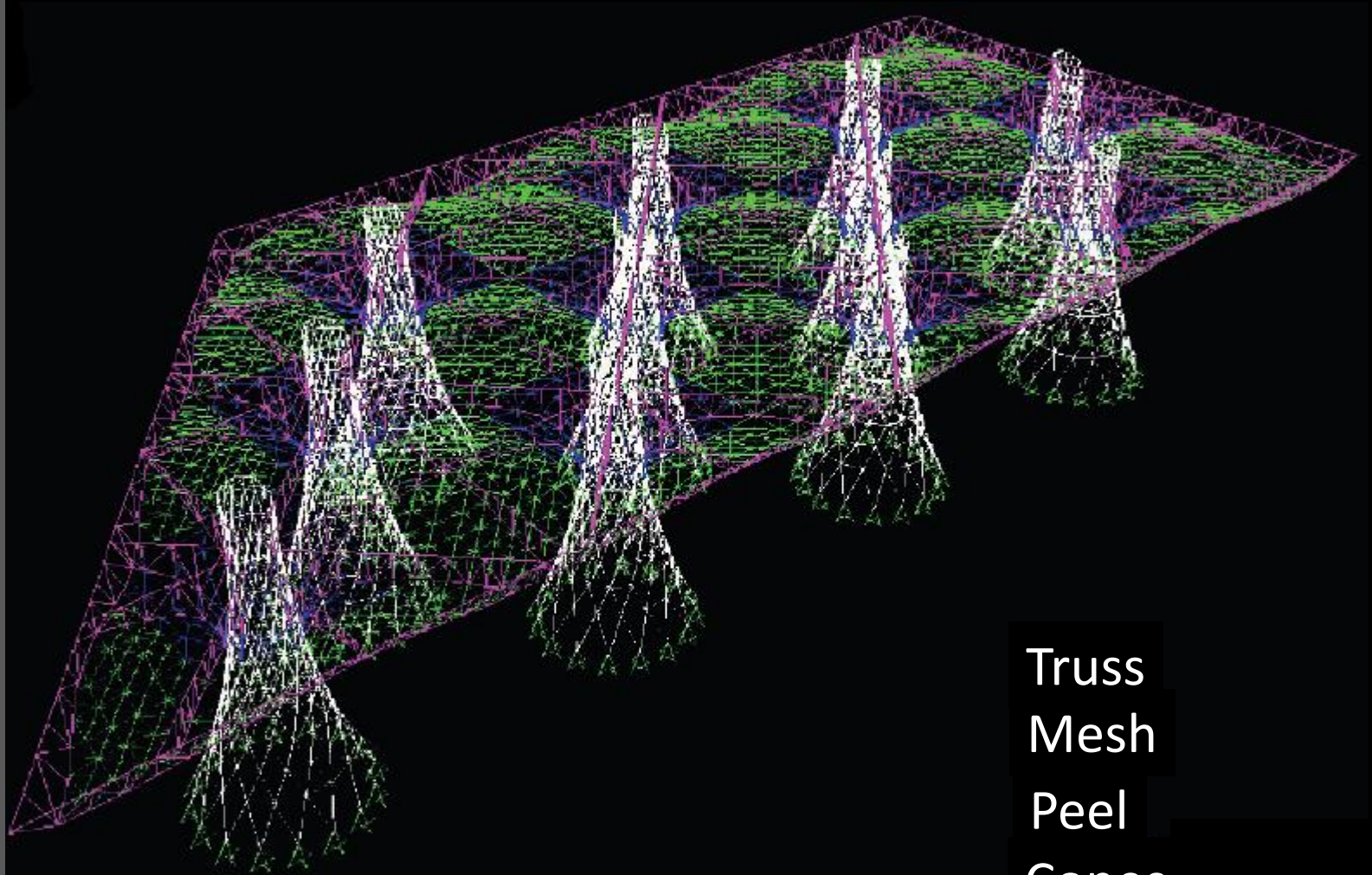


Diagram



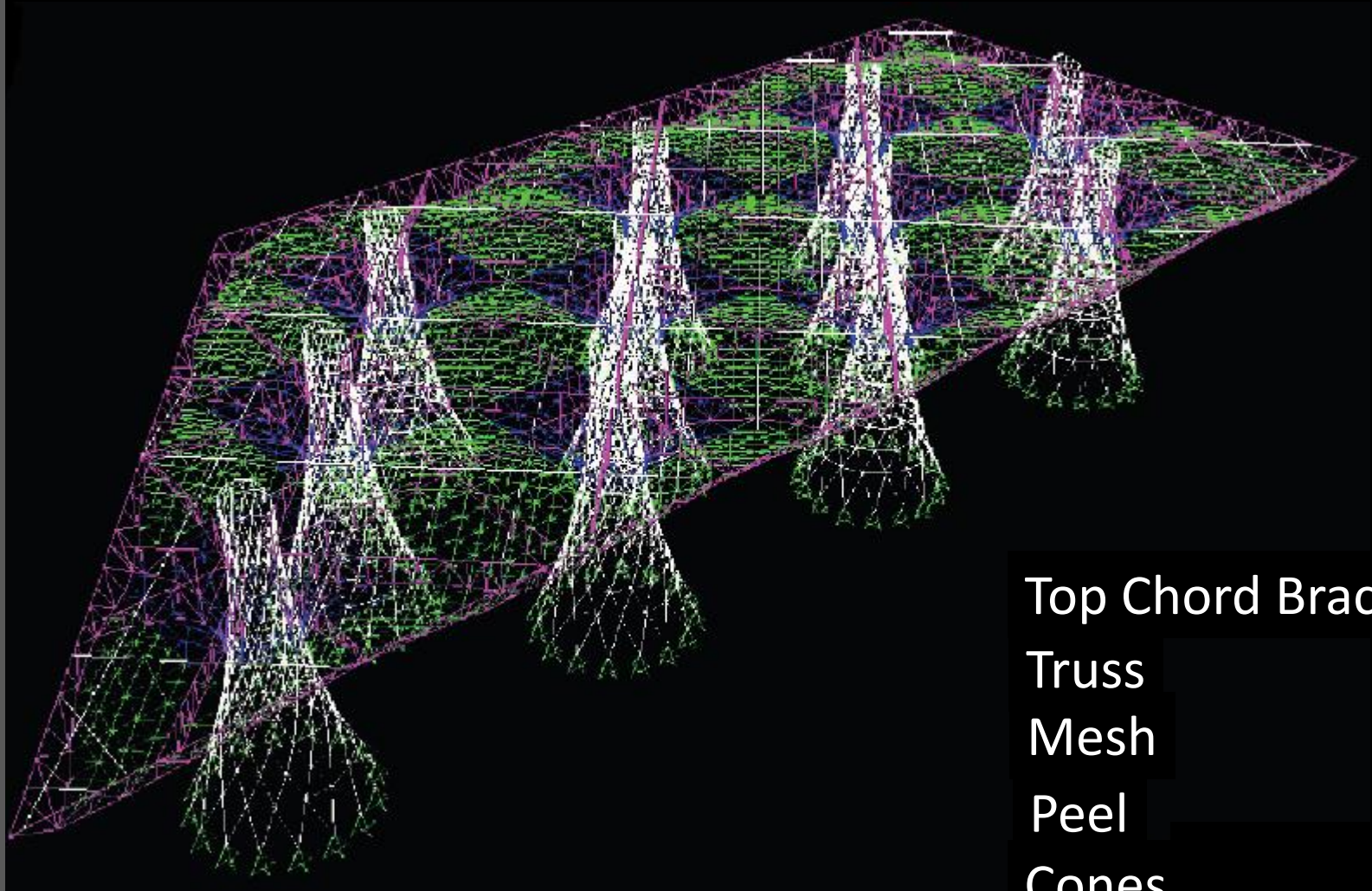
Mesh
Peel
Cones

Diagram



Truss
Mesh
Peel
Cones

Diagram



Top Chord Bracing

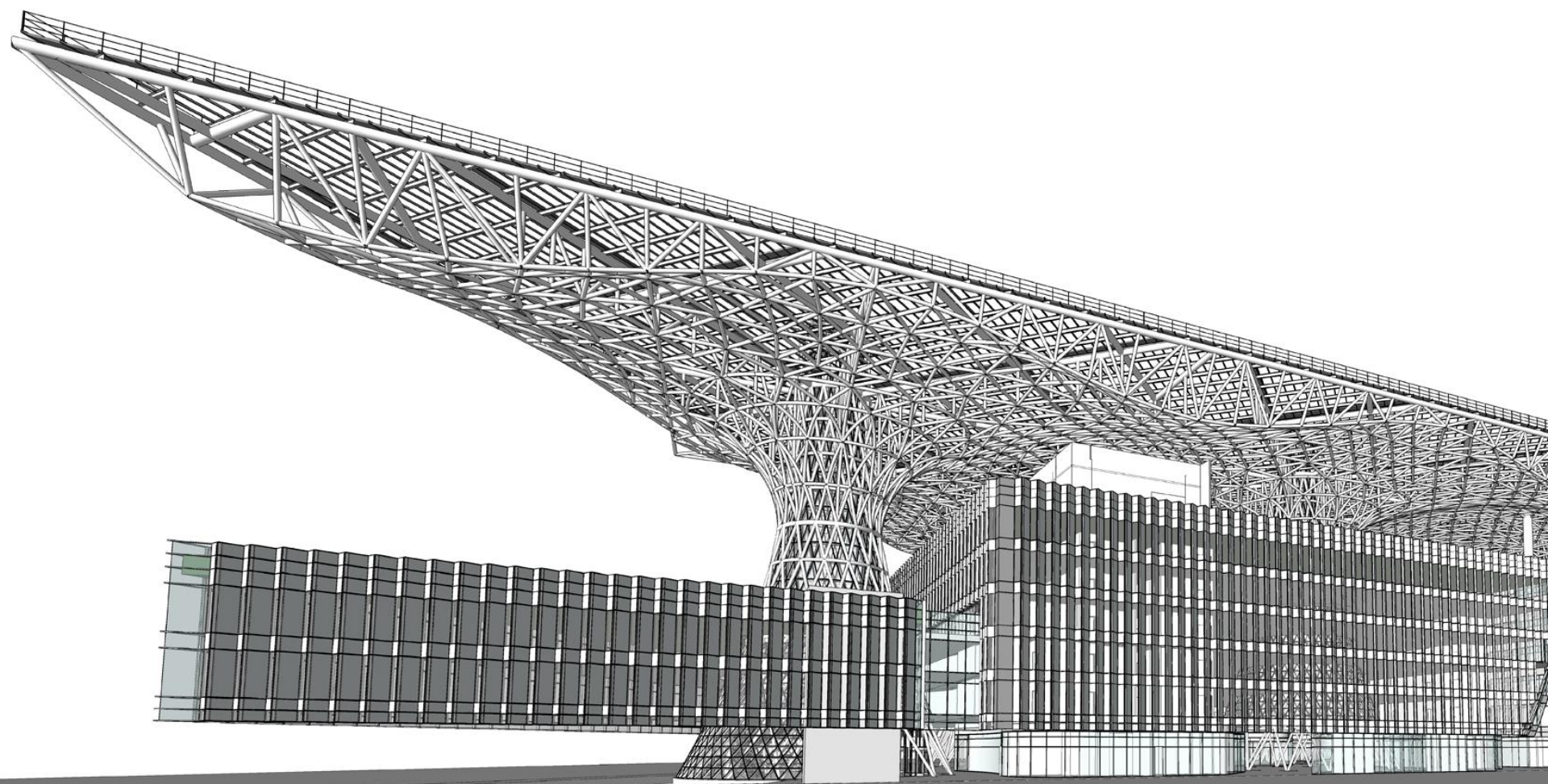
Truss

Mesh

Peel

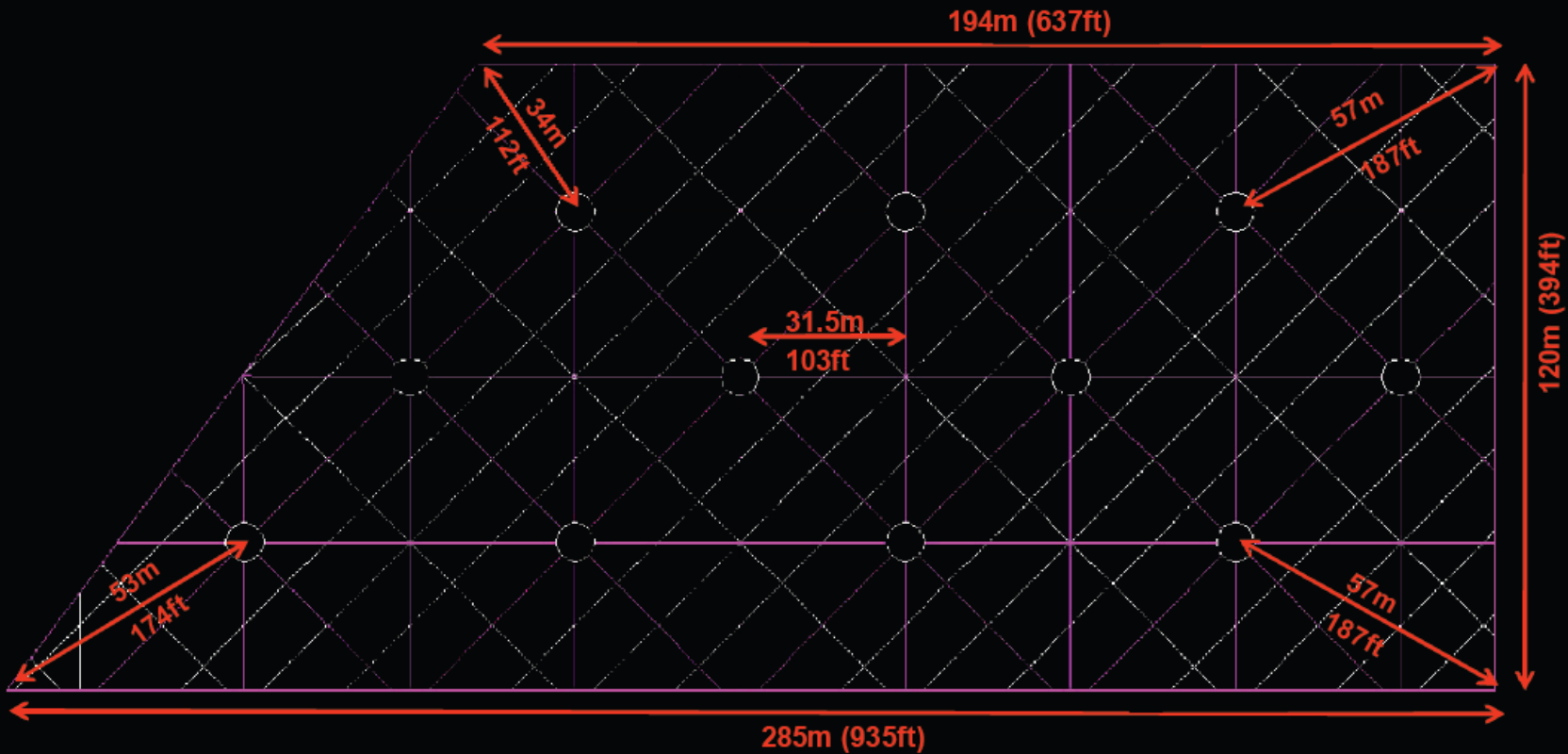
Cones

Diagram

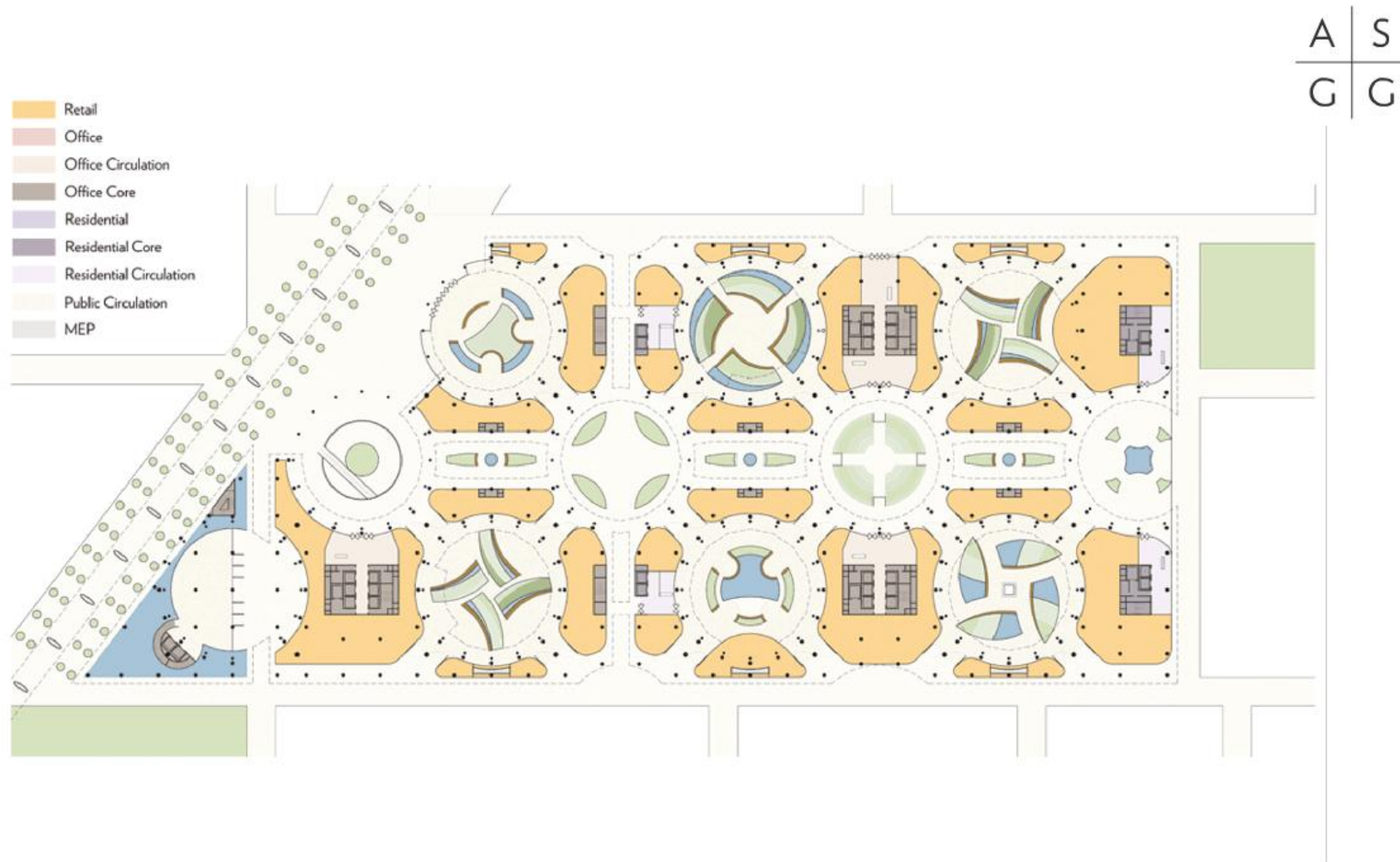


Diagram

Max Cantilever = 57 m
Upper Trellis = 7 acres



Space



Open
Shading Roof

Photovoltaic
Panels

Shaded
Roof Garden

Wind Cone

Elevator

Integrated
Workstation



Shaded
Ground Street

Underground
Pedestrian
Connection

Headquarter
Office Space

Garden
Courtyard

Ground Lobby/
Retail Space

High-Performance Wall

MRT



Technology

PV Panels

- the world's largest photovoltaic and solar-panel arrays

which will harvest 103% of the energy needed to power the building on an annual basis



Technology

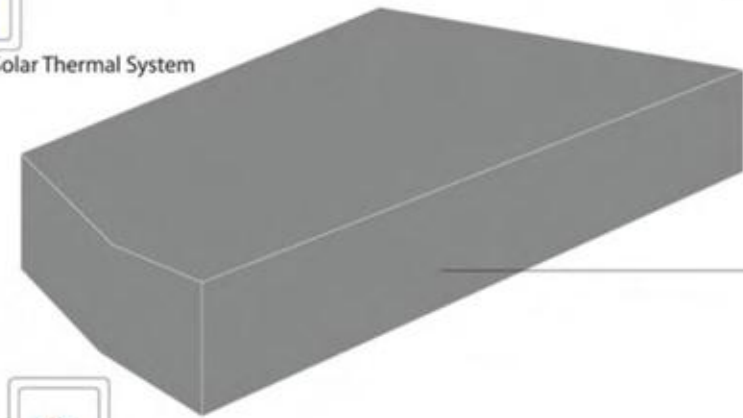
The roof canopy - Sunlighting



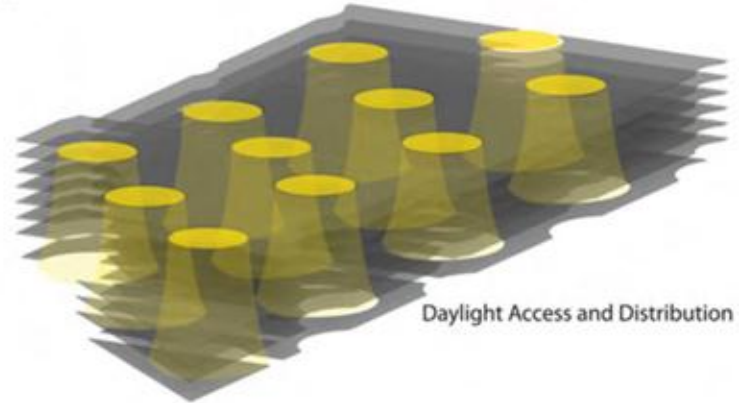
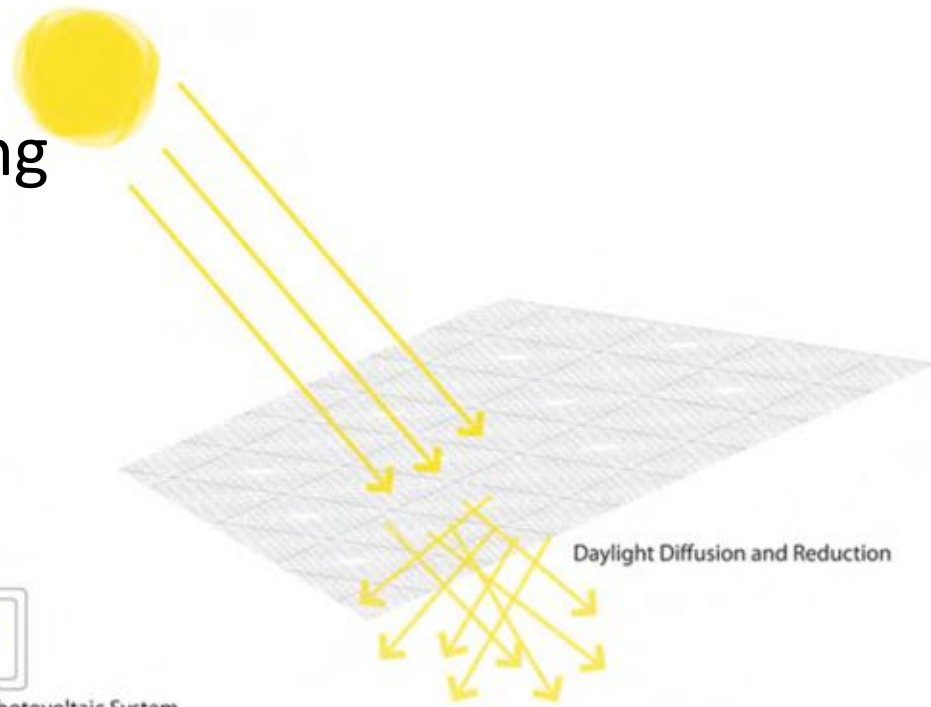
Solar Thermal System



Photovoltaic System

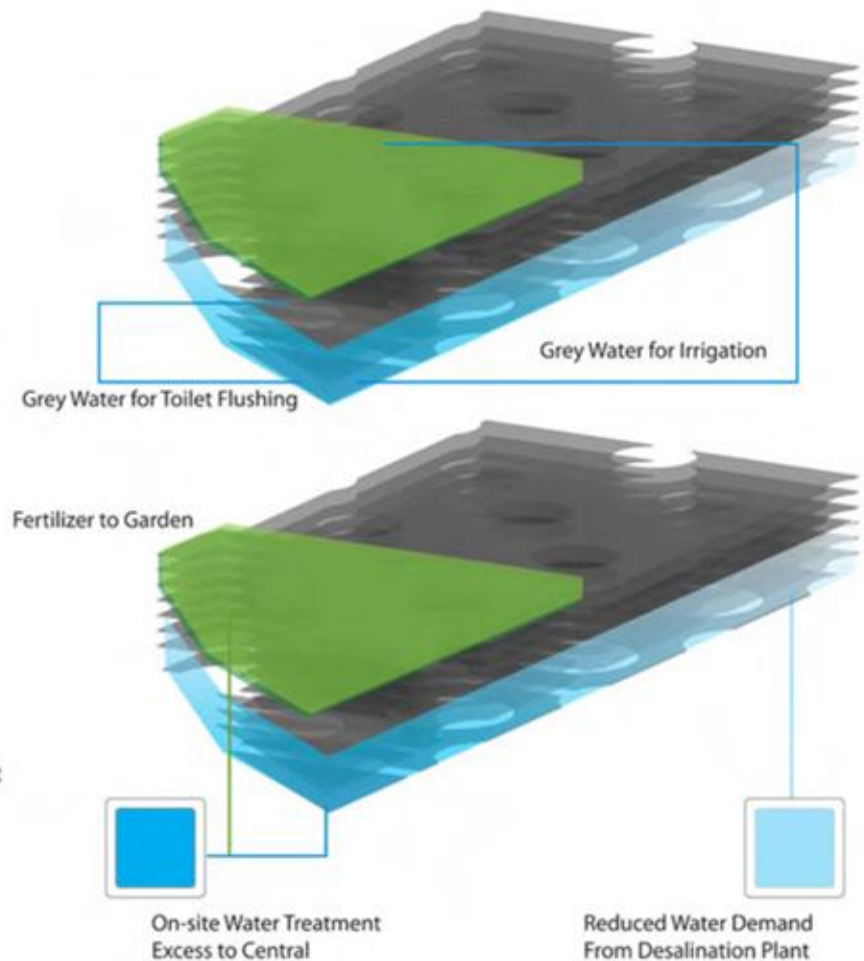
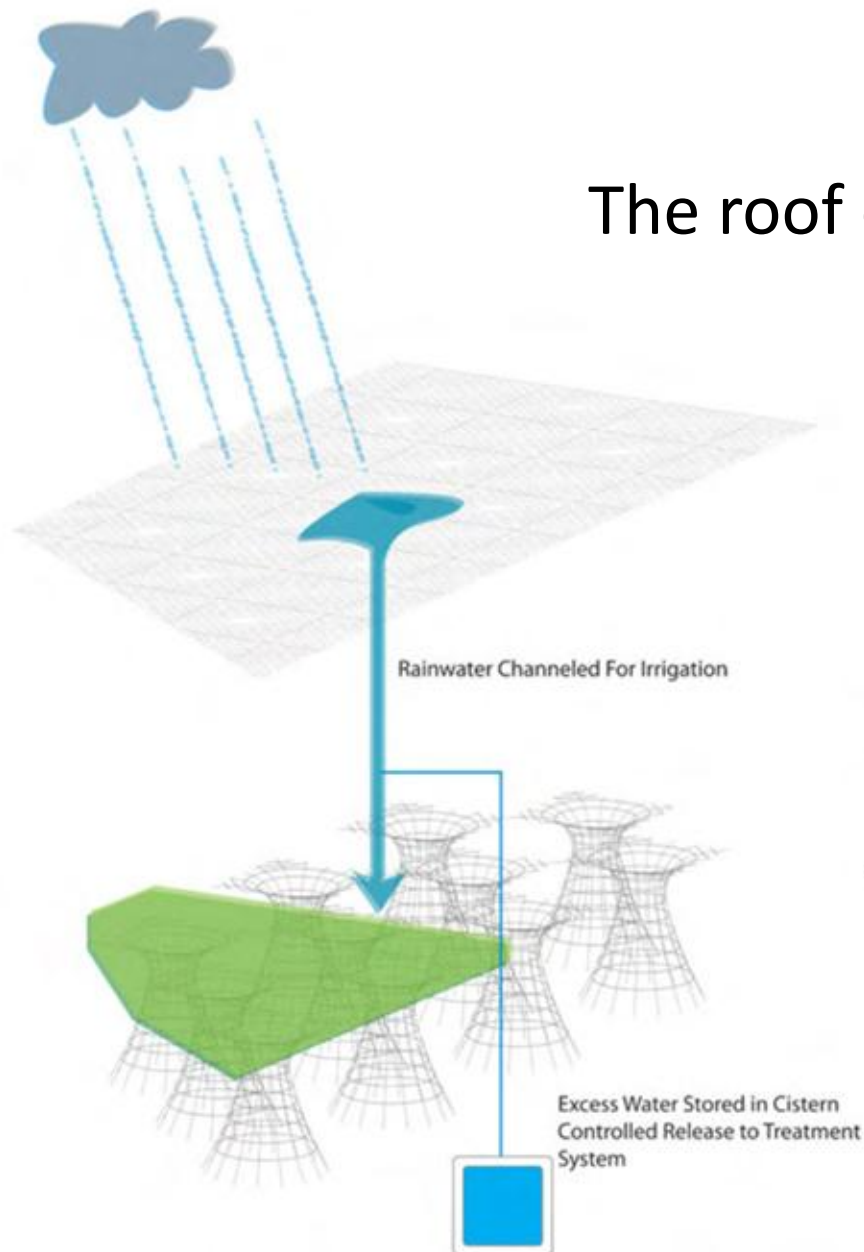


Solar Driven Cooling Solar
Driven Dehumidification



Technology

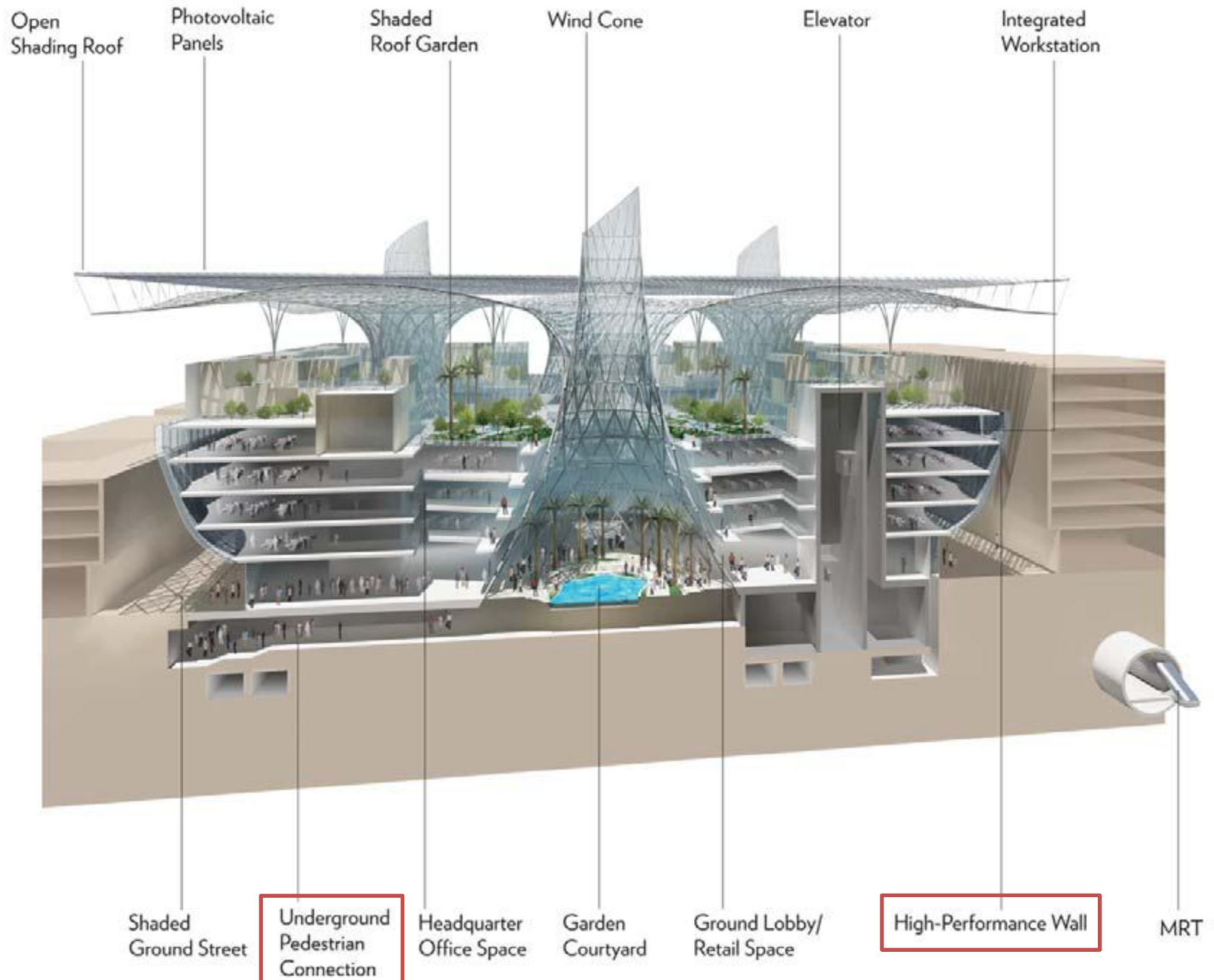
The roof canopy – water conservation



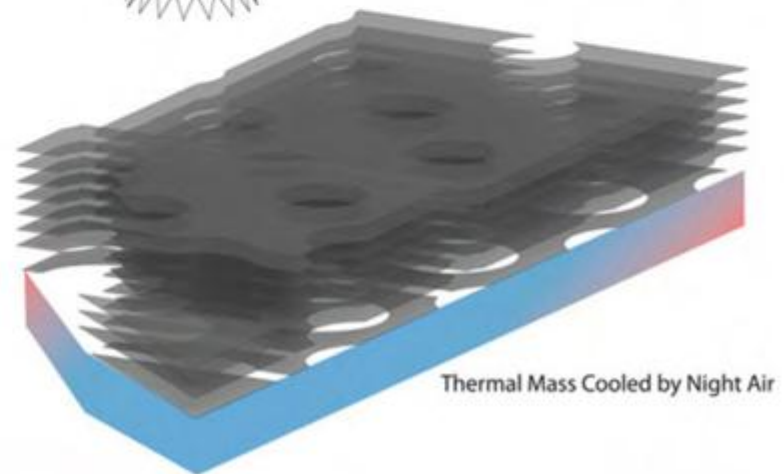
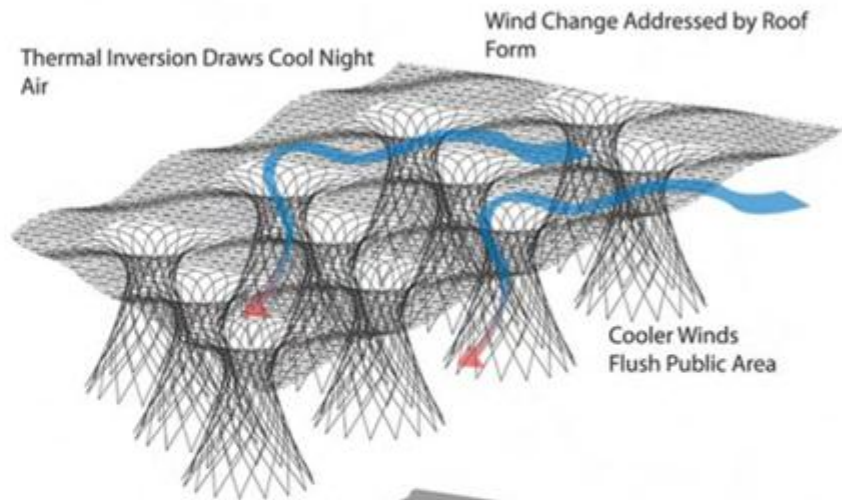
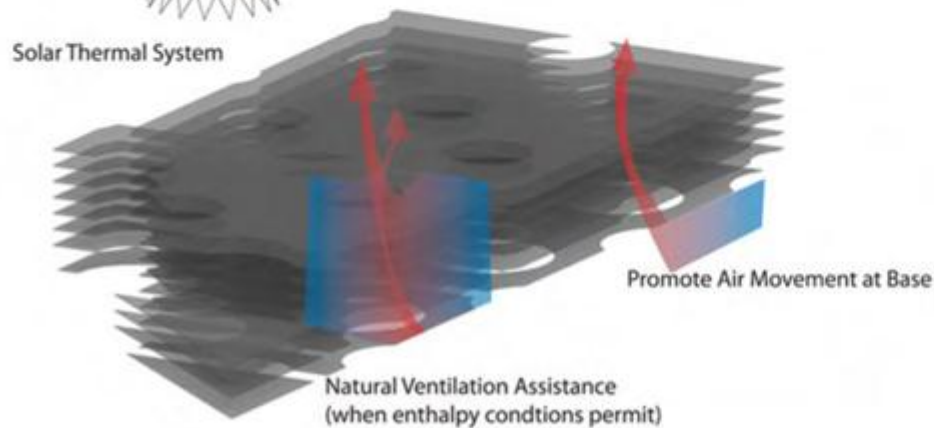
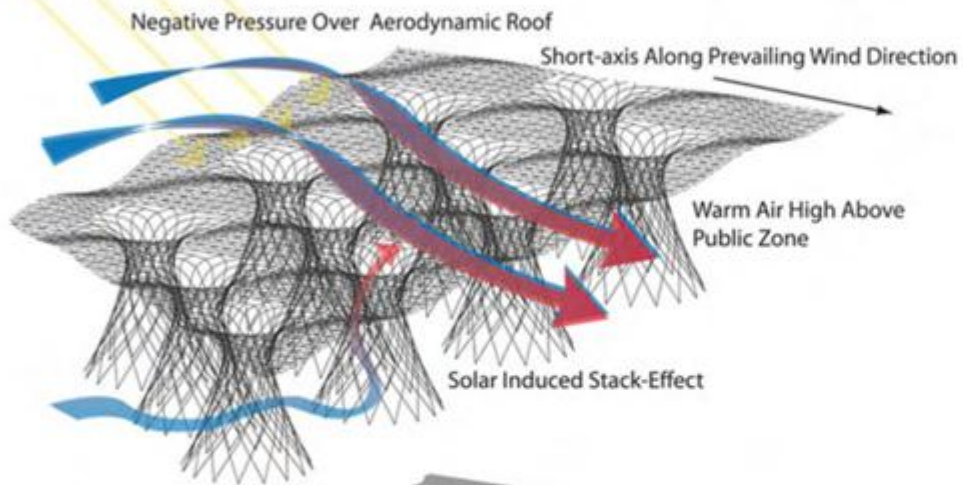
Technology

Thermal Technology

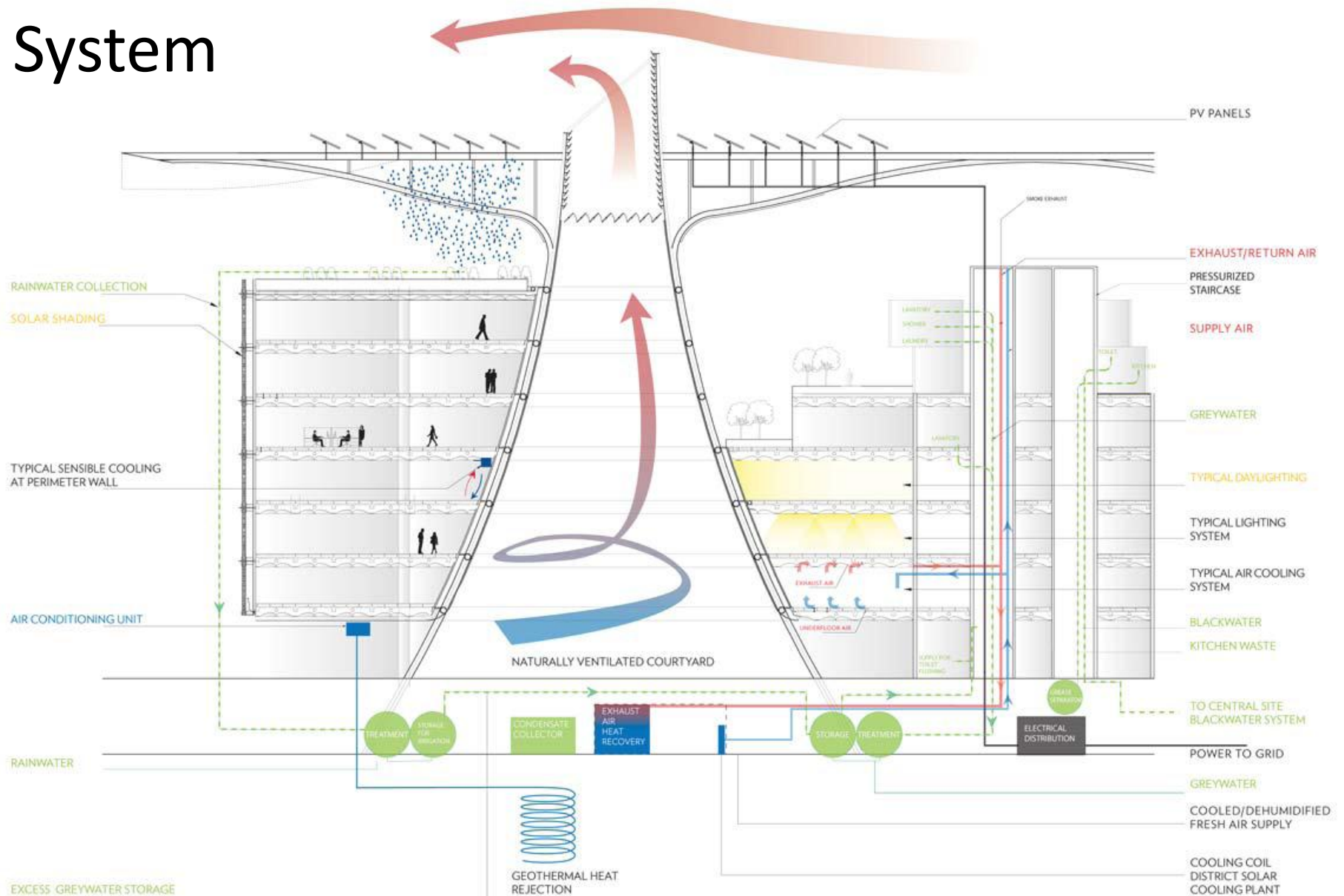
- High-thermal-mass exterior glass cladding provides solar heat blocking while remaining transparent for views.
- Earth ducts which reduce temperature of outside air and provide underground pedestrian passages that connect public garden space with the proposed mass transit system.
- Like local traditional architecture and except for exterior curtain walls, the buildings walls are to have a heavy construction of masonry with a 30% glazing ratio to achieve a high thermal mass and reduce the indoor heat gain.



Technology Wind Cones



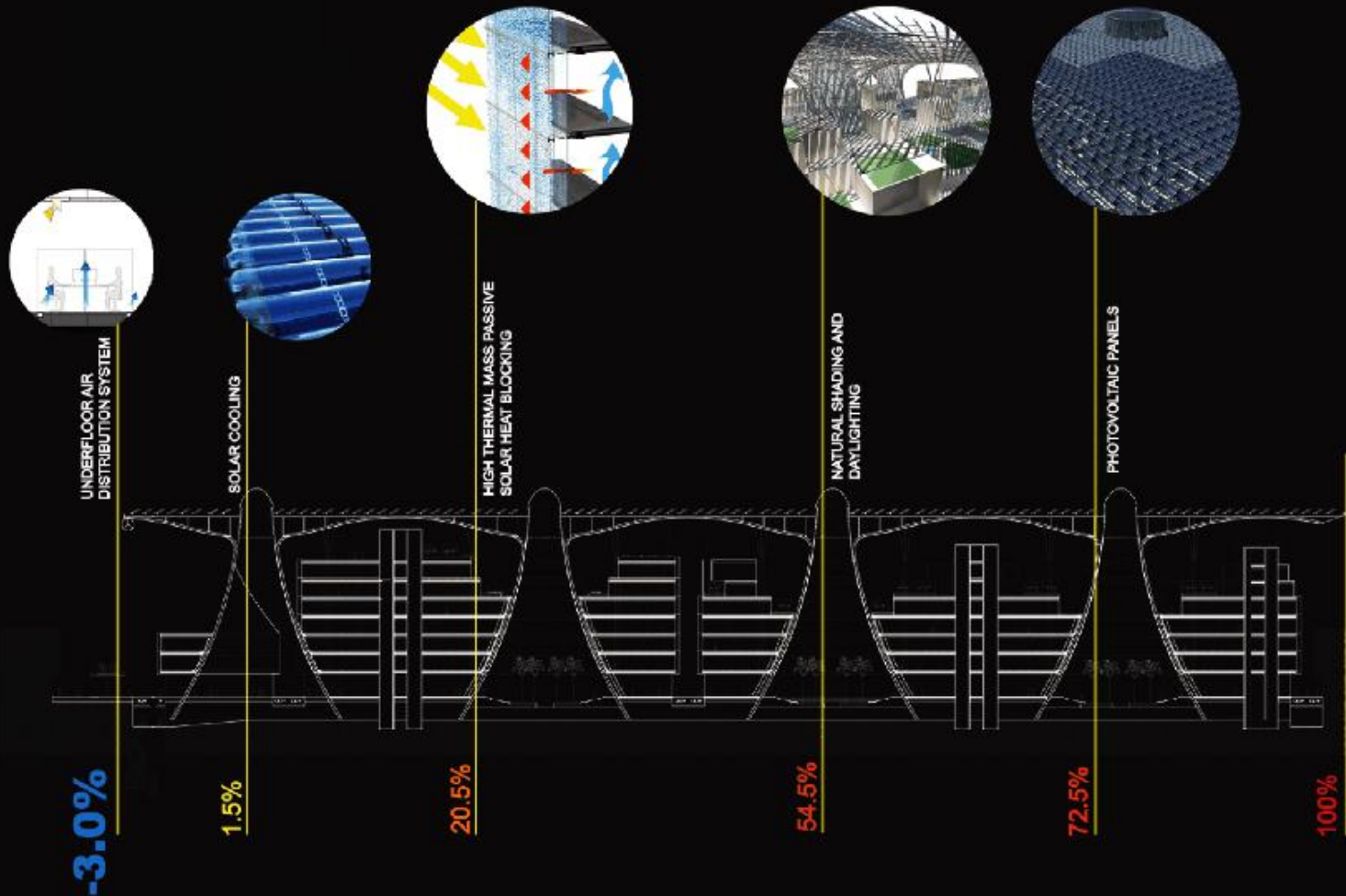
System



System

Passive design strategies alone are estimated to contribute 52% of energy savings. The remaining portion of the 103% in energy savings (including the 3% of positive energy generation) is achieved through efficient active systems (20%) and renewable energy generation (31%).

A	S
G	G



Materials

Materials used in the building were considered in terms of their environmental impact.

- Recycled materials and rapidly renewable materials were specified around the building.
- Materials were also to be sourced from locations no further than 800km from the building site.
- Flexible, modular, prefabricated materials and furniture were also specified to make the process of recycling them easier

Features

- 在同樣的極度濕熱氣候中，單位面積耗能量為世界上最低的現代A級辦公室大樓
- 世上最大與建築體整合之光電陣列系統
- 使用全球最大的太陽能驅動之冷卻及除濕系統
- 歷史上第一座可於建造過程，一面產生能源供其施工所需之建築物(透過其遮蓬光電系統之供電)

Analysis

about Sustainability

- 針對《The Philosophy of Sustainable Design》一書中永續設計之觀念 (Sustainable Design is a design philosophy that seeks to maximize the quality of the built environment, while minimizing or eliminating impact to the natural environment.), 及對未來建築The Living Building 的展望，以此為前提來分析MASDAR Headquarters。
- 從辦公建築的角度出發，歸納出
 - 空間安排 --- 商辦空間量大
 - 內庭花園空間 --- 人與自然、環境間的互動
 - 科技運用 --- 建築物愈高、量愈大，維持運作所需能源愈多
 - 地域性 --- 考慮氣候、地理人文等條件因地制宜的設計等四個項目

Analysis

		空間安排	內庭、花園	科技運用	地域性
Sustainable Design	提升建築環境品質	●	●	●	●
	降低自然環境衝擊		●	●	●
The Living Building	彈性適應性			●	
	與自然之連結	●	●		
	降低能源使用	●	●	●	●
	提升人類福祉	●	●	●	
	自然美感		●		●

Conclusion

about Sustainability

- MASDAR Headquarters充分運用科技，來提升人類福祉。建築物內主要組成，都含多種功能，如屋頂或風塔。
- 透過新開發的能源及再生能源， MASDAR Headquarters不僅零耗能，還能產生多餘能源，供周圍建物使用。
- 建築本身就像一個有機體，能源的循環彼此環環相扣。多出來的廢物輸送到城市某處集中處理。
- 藉由多生產的能源來降低對自然界的衝擊。
- 使用者對環境的自我控制程度較低。

Reference

- AS+GG
<http://smithgill.com/>
- Carboun
<http://www.carboun.com/sustainable-development/sustainable-design/masdar-headquarters-the-first-positive-energy-building-in-the-middle-east/>
- Masdar City
<http://www.masdarcity.ae/en/>