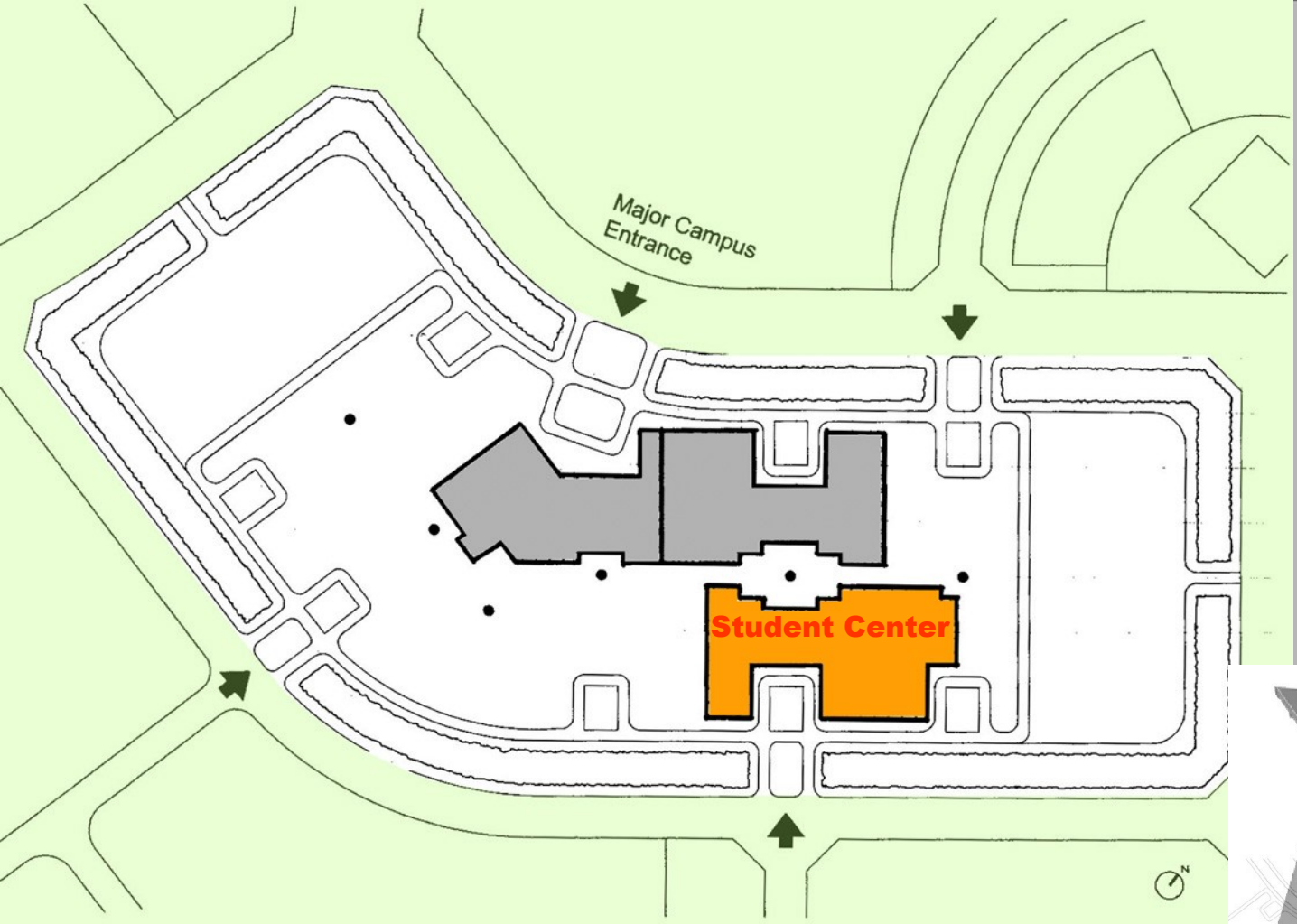
IPRO 323
ENERGY-AND ENVIRONMENT-BASED
ARCHITECTURAL RESEARCH & DESIGN

Student Center

Al-Ghurair University, Dubai, UAE

GROUP 1

Pravin Bhiwapurkar
Matt Collier
Joseph C.H. Huang
Dan Kastilahn



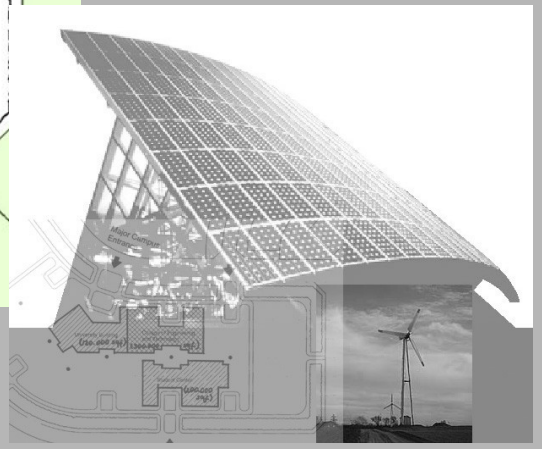
PROJECT BRIEF:

AREA:
200,000 SQ.FT/ FLOOR

PROGRAM:
STUDENT CENTER
2-STORY BUILDING WITH BASEMENT

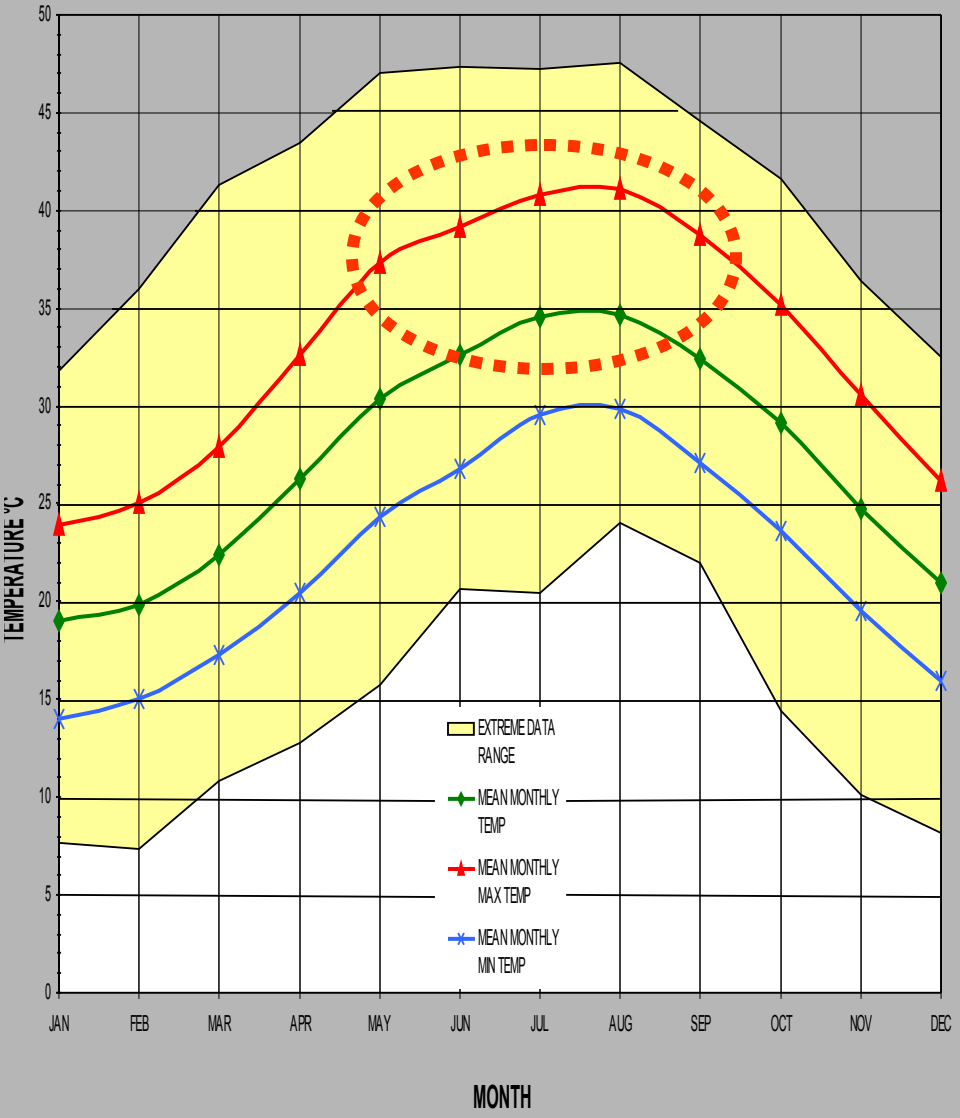
OBJECTIVE:

INTEGRATION OF BIPV & WIND TURBINE SYSTEM WITH BUILDING ENVELOPE

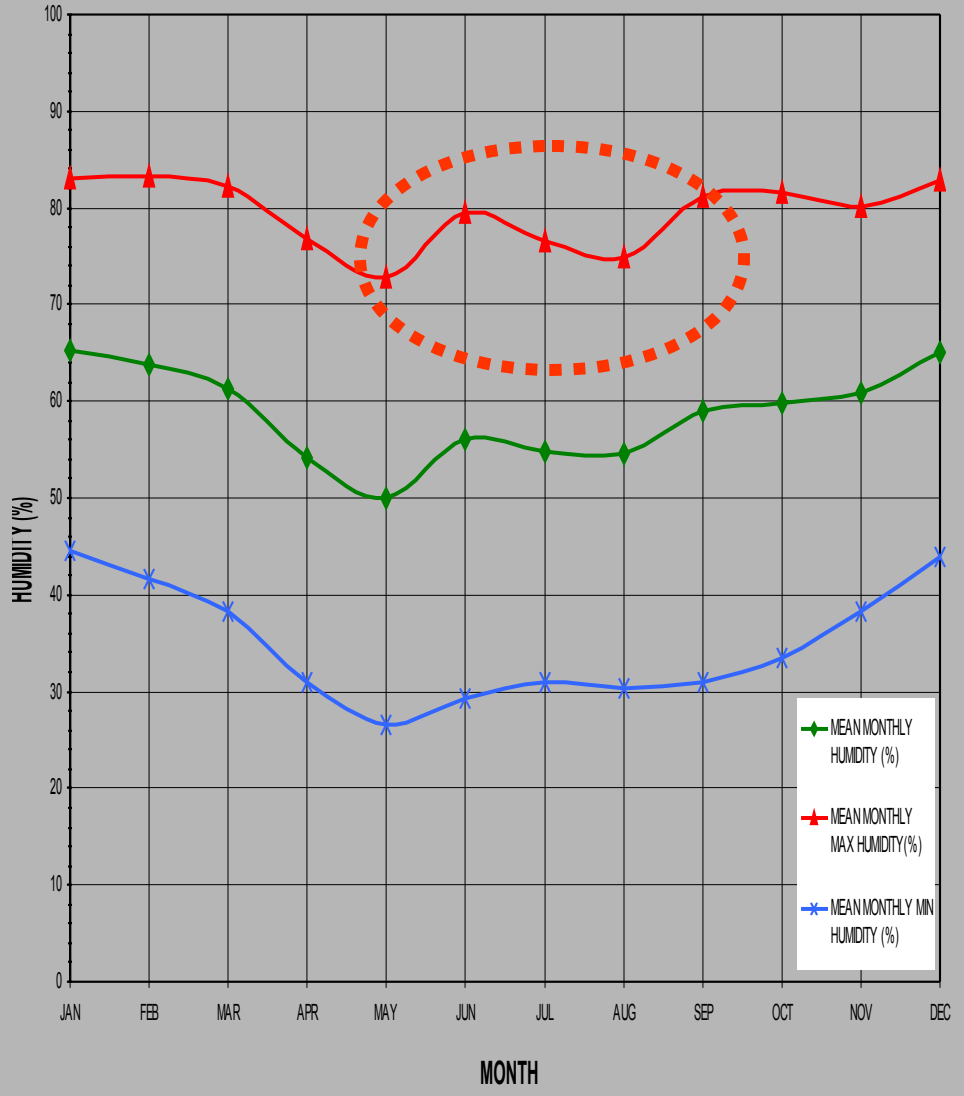


PROJECT INTRODUCTION

TEMPRETURE



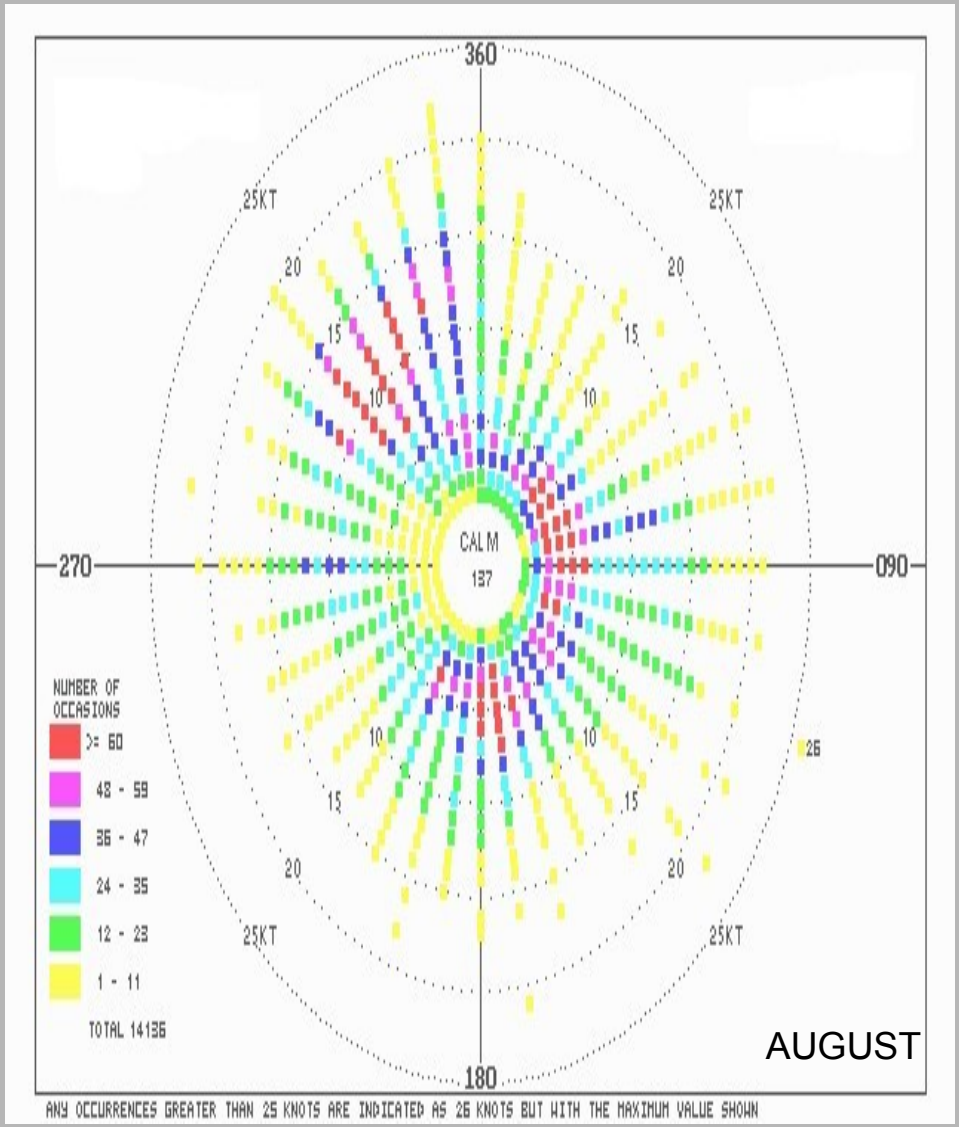
HUMIDITY

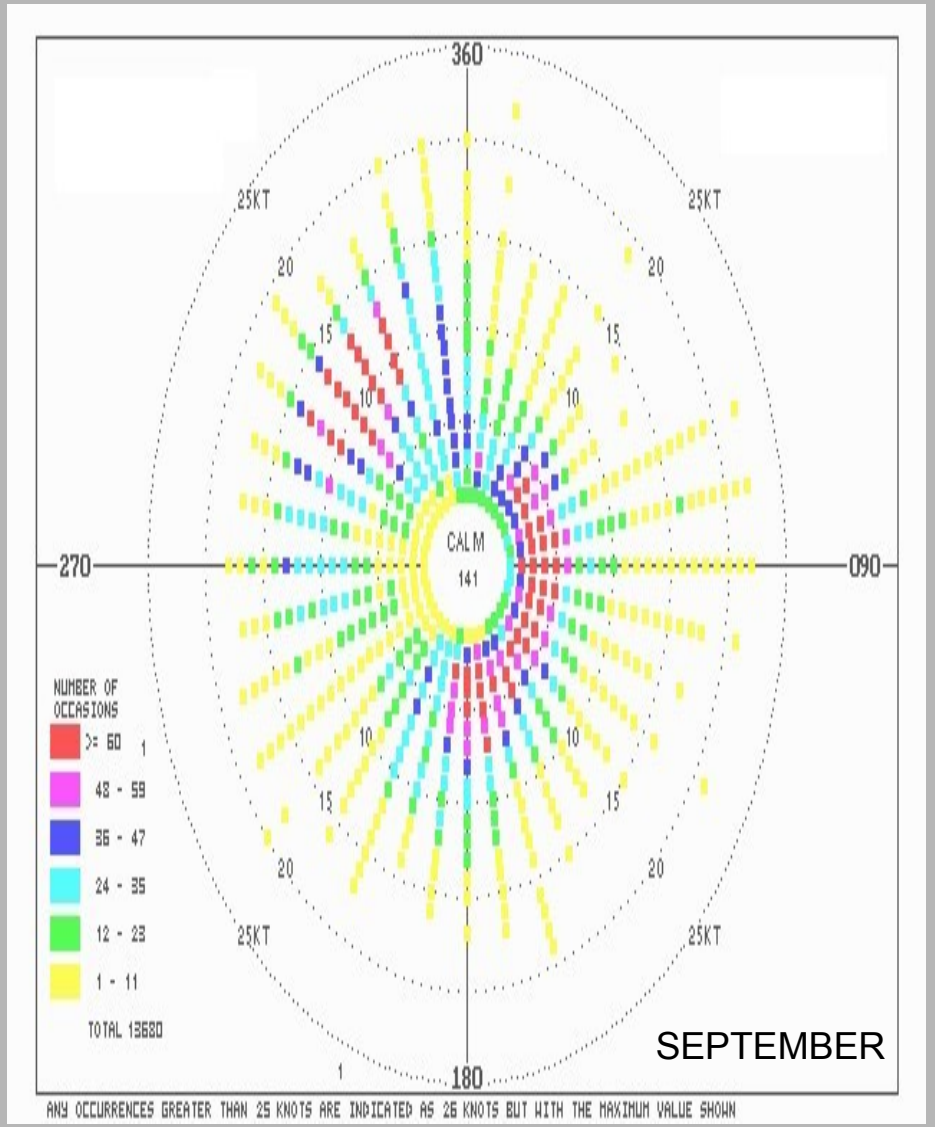


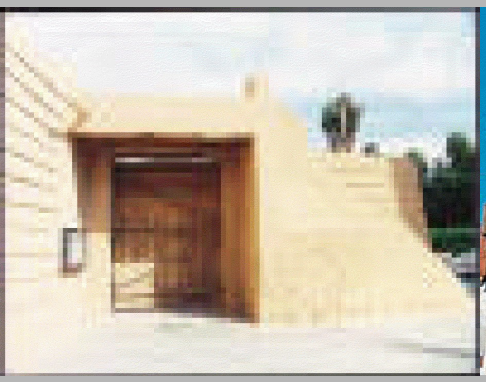
CLIMATIC ELEMENTS

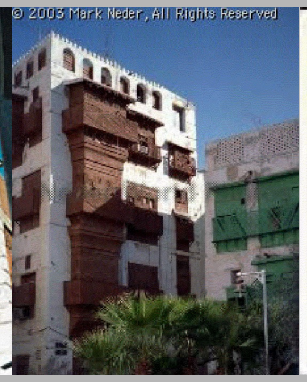
GROUP 1
BHIWAPURKAR + HUANG + KASTILAHN + COLLIER

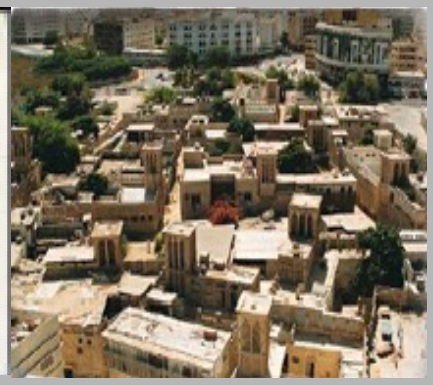
WIND MOVEMENT



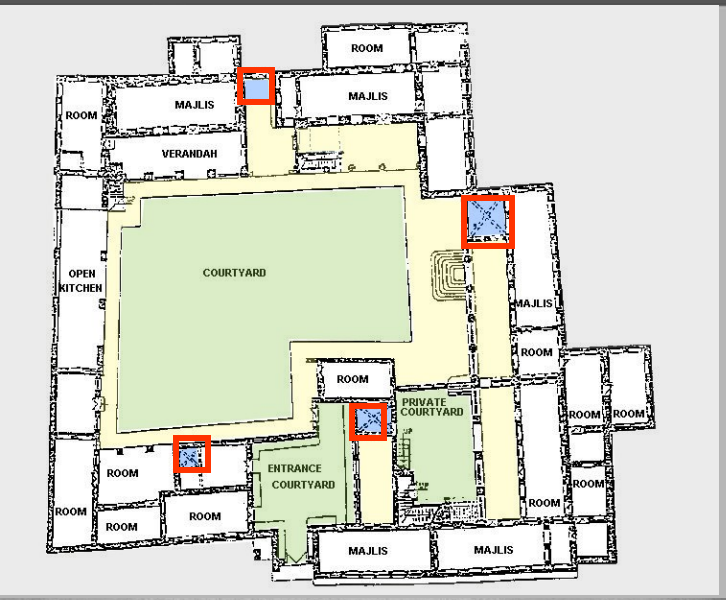


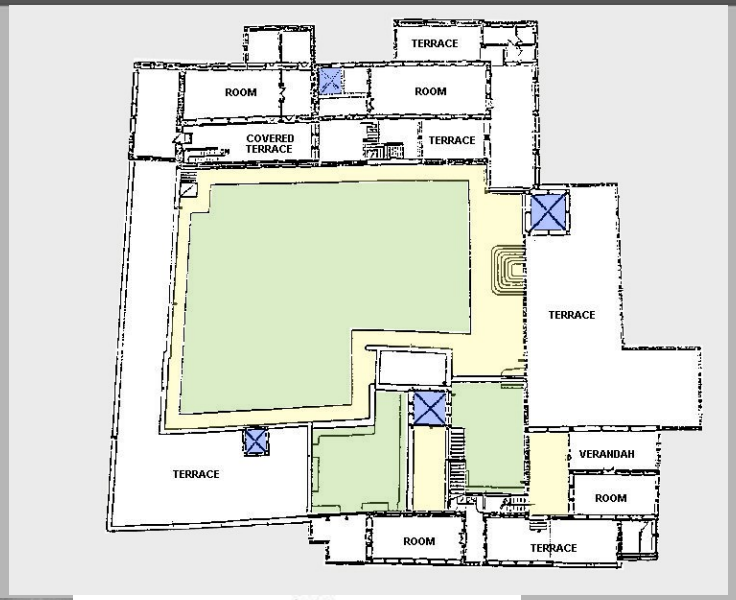


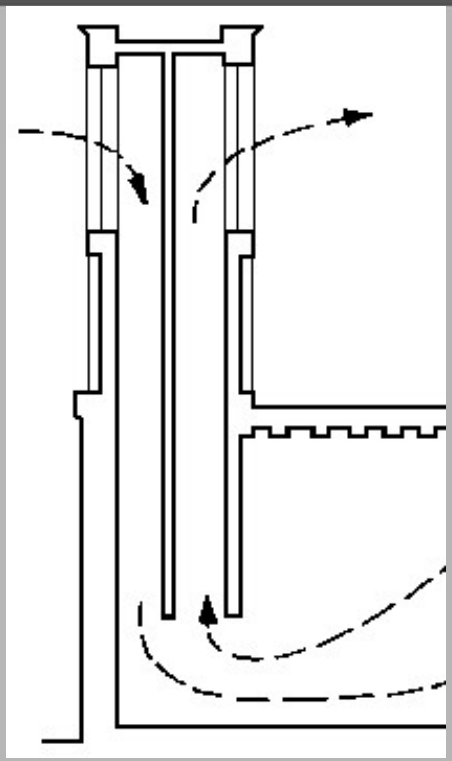


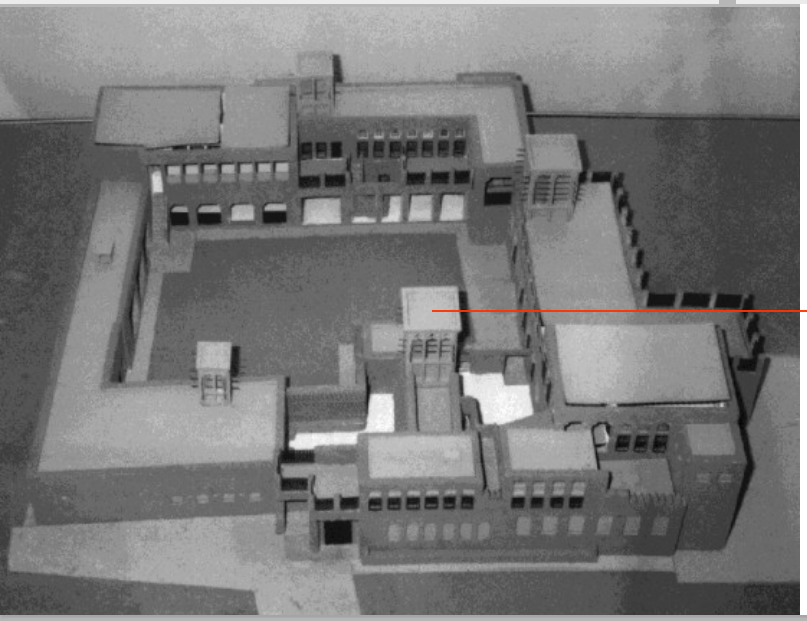


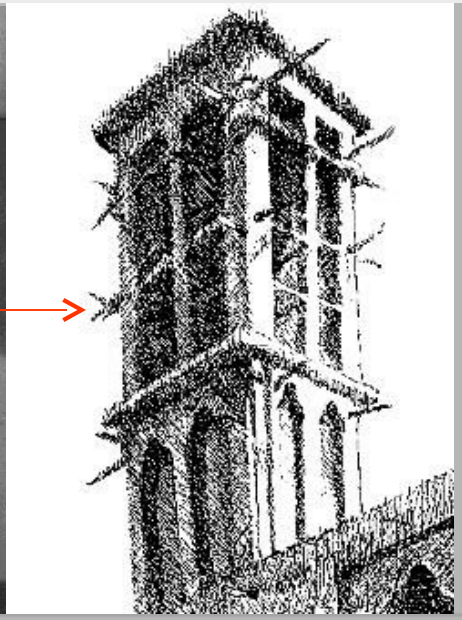
DUBAI: PAST & PRESENT







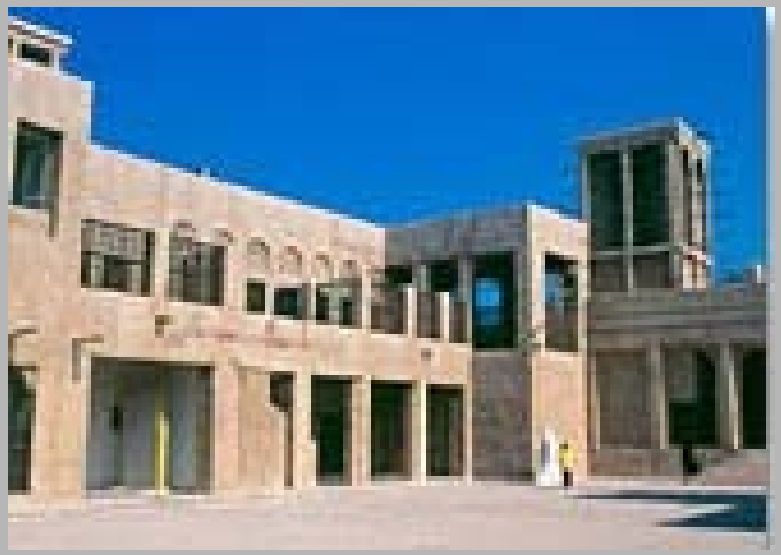




LEARNINGS FROM TRADITIONAL ARCHITECTURE

Massing for mutual shading
Blank walls facing West
Smaller opening on W & S side
Solids & Voids

Staggered mass facing courtyard
Covered circulation areas
Solids & Voids



LEARNINGS FROM TRADITIONAL ARCHITECTURE

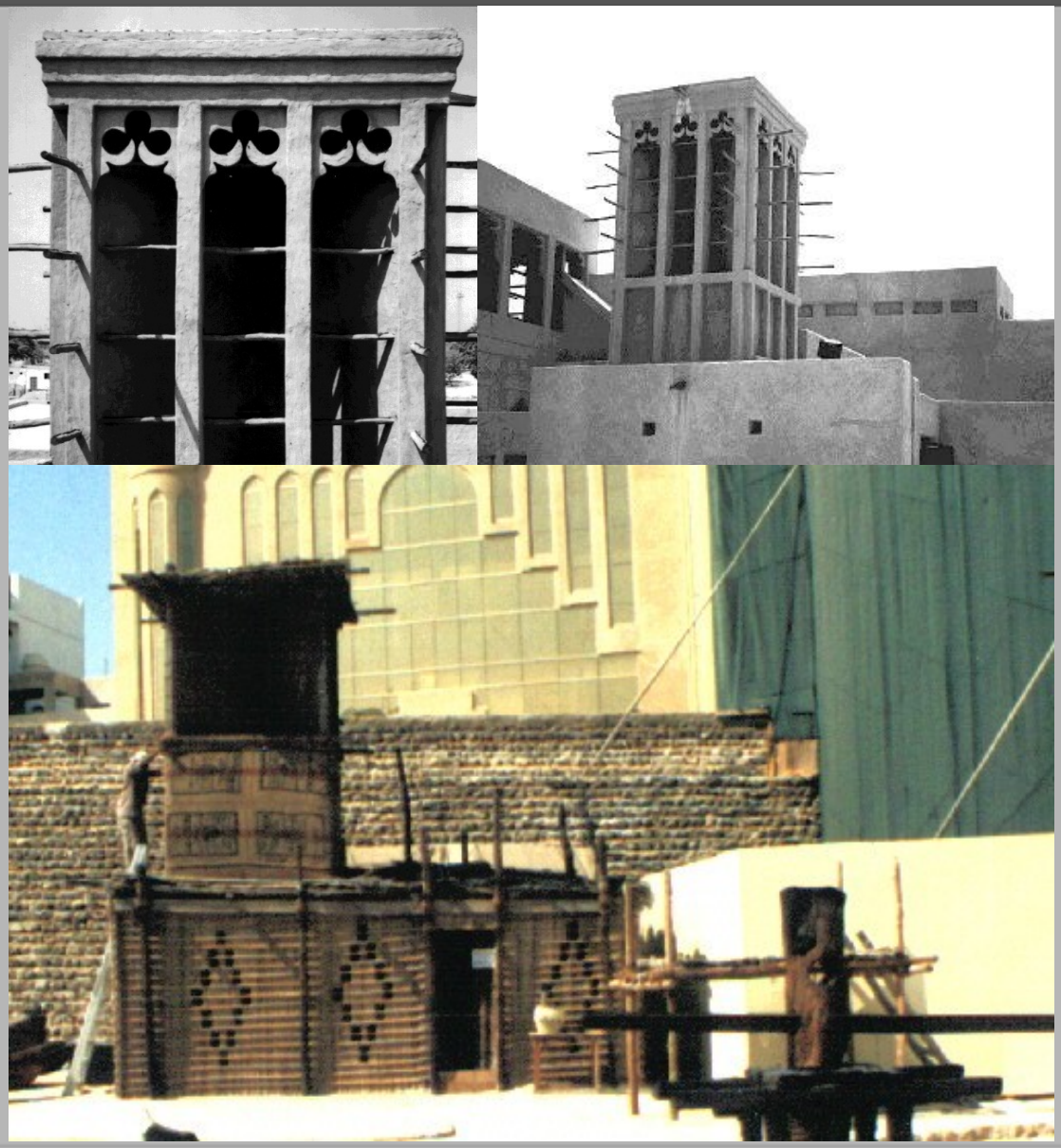
The traditional vernacular style of architecture in Dubai is the result of a mixture of three dominant factors:

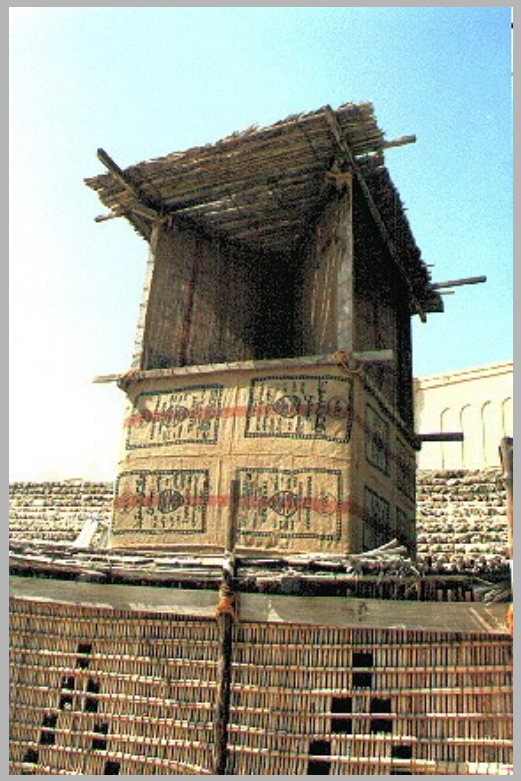
the climate (hot and humid),

the religion and customs of its people, and

the locally available building materials.

To reduce the heat as much as possible, houses were constructed close to each other, with narrow alleys (*sikka*s) running in between from North to South, ending at the creek. For most of the day, these alleys were shaded by the high walls of the houses and allowed the fresh North wind to circulate freely.





LEARNINGS FROM TRADITIONAL ARCHITECTURE

Narrow Shaded Streets opening into courtyard

Tall Structures abutting street

Proportions of openings: Solids & Voids

Projected balconies at upper level reducing gap for direct sunlight

(carved in stone or wood)

Vegetation

Introvert Design

Segregation of spaces

Use of Wind Towers

Thermal buffer : walls, courts, patios

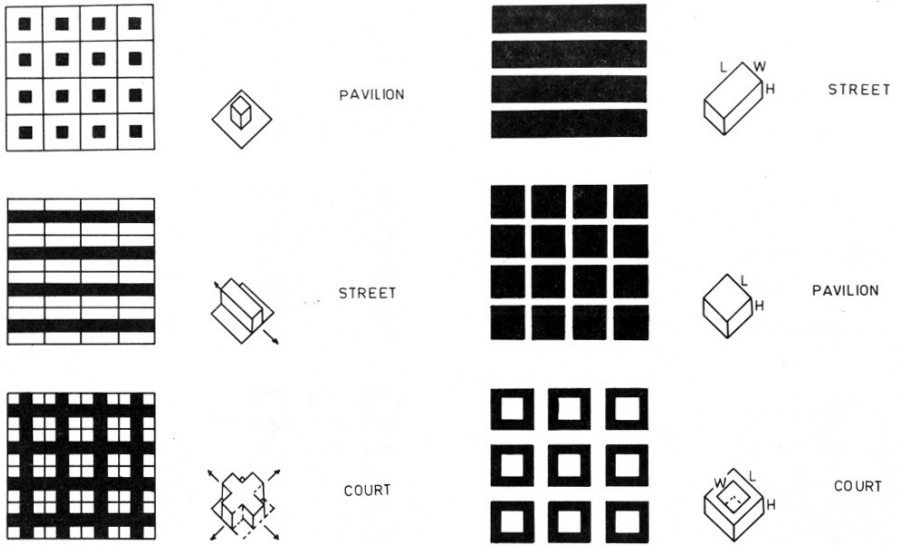


Fig. 3.1 Three different dispositions of built forms

Fig. 3.2. Modified Court, Pavilion and Street forms

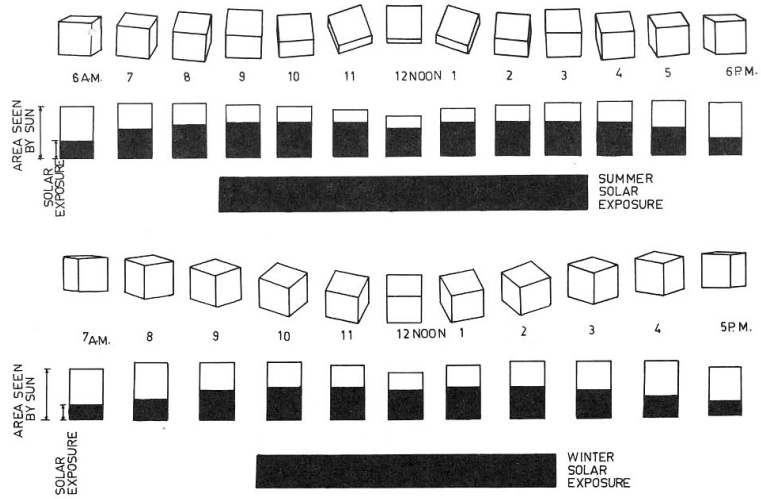


Fig. 3.17. Hourly solar views, projected area and solar exposure and total daily solar exposure for a cube for summer and winter (for 29°N latitude.)

Building Clusters and Solar Exposures

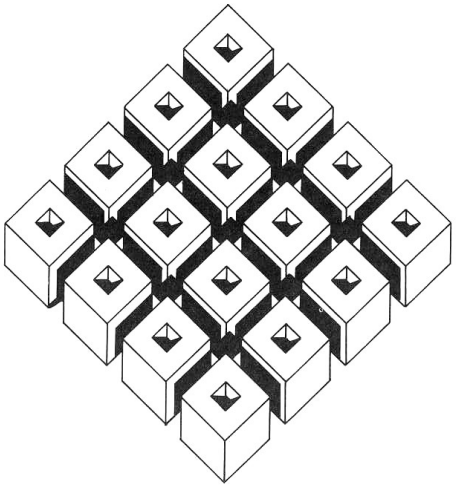
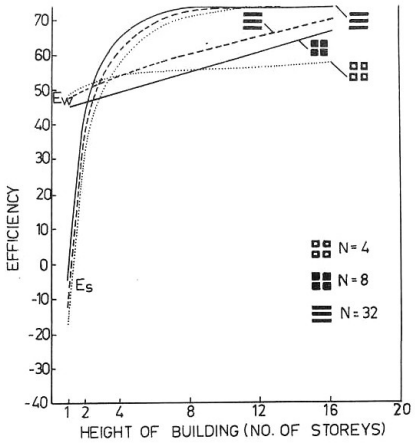


Fig. 3.6. Shade and light pattern of a cluster of Courts

Building Clusters and Solar Exposures



3.20. Solar efficiency of building clusters with respect t building height

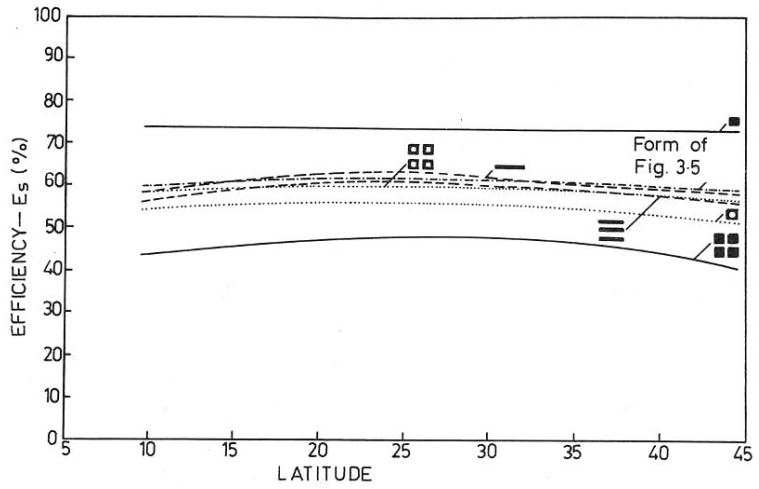
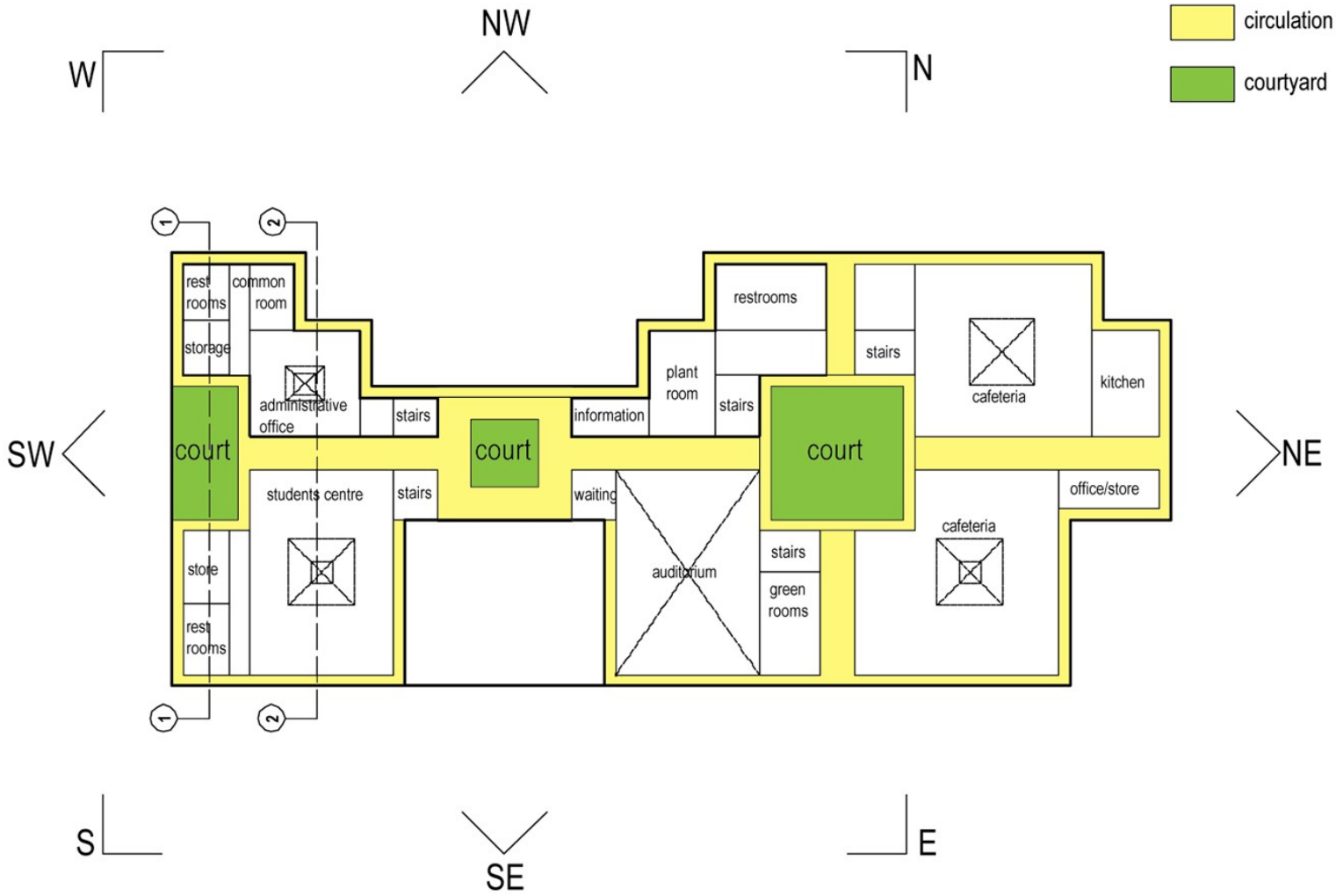
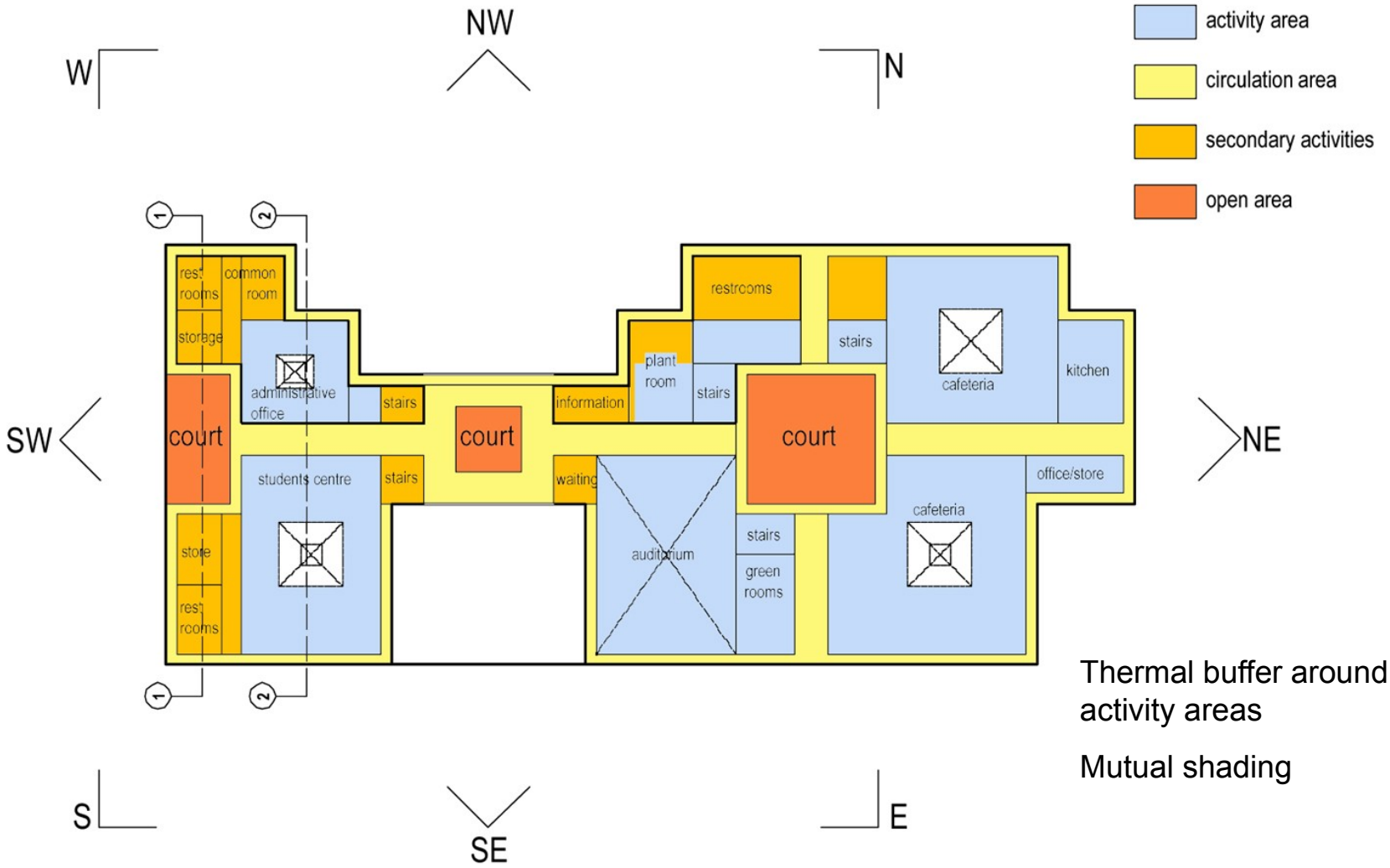


Fig. 3.26. Solar efficiency E_s of building forms at different latitudes



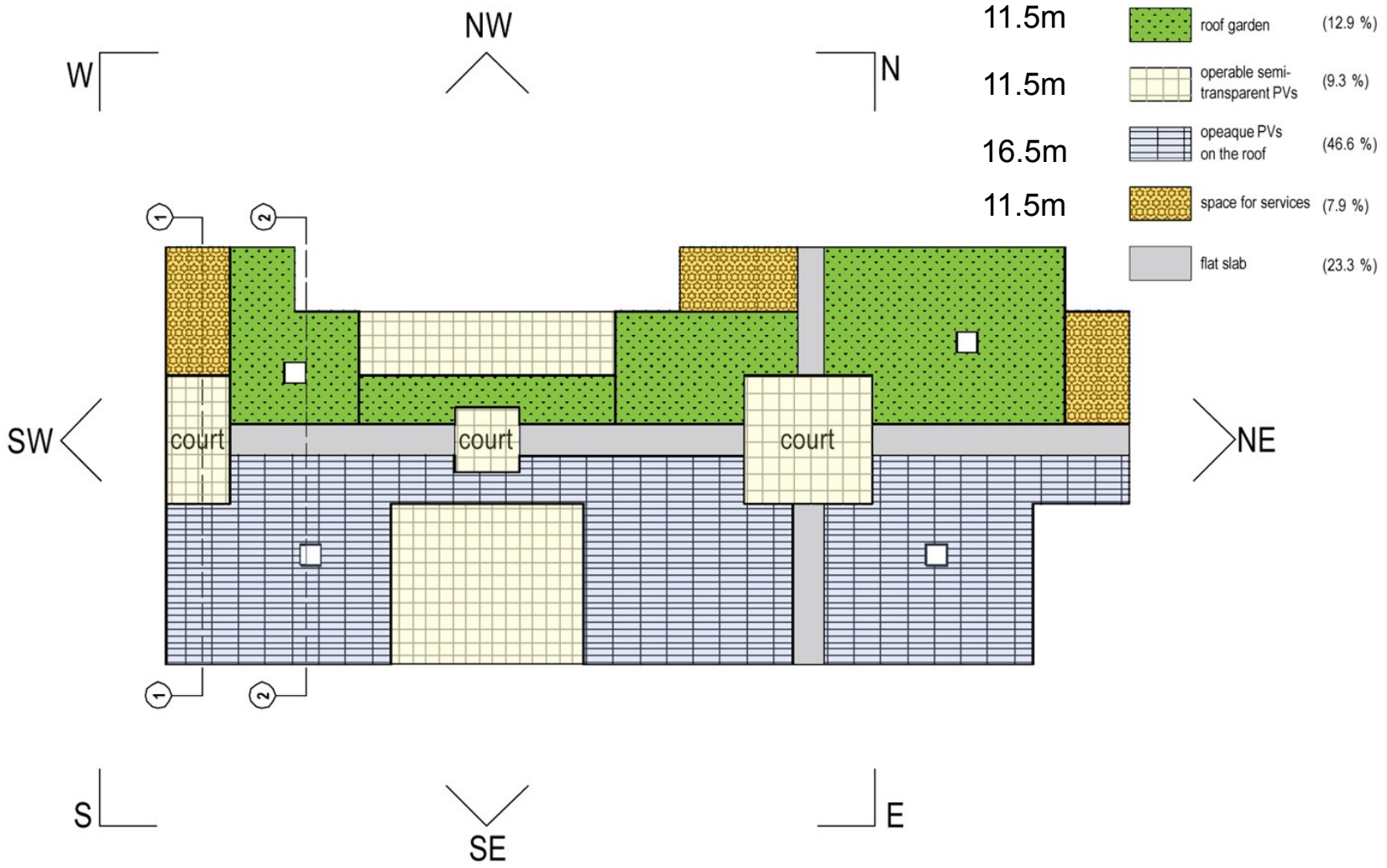
Design development : Plan



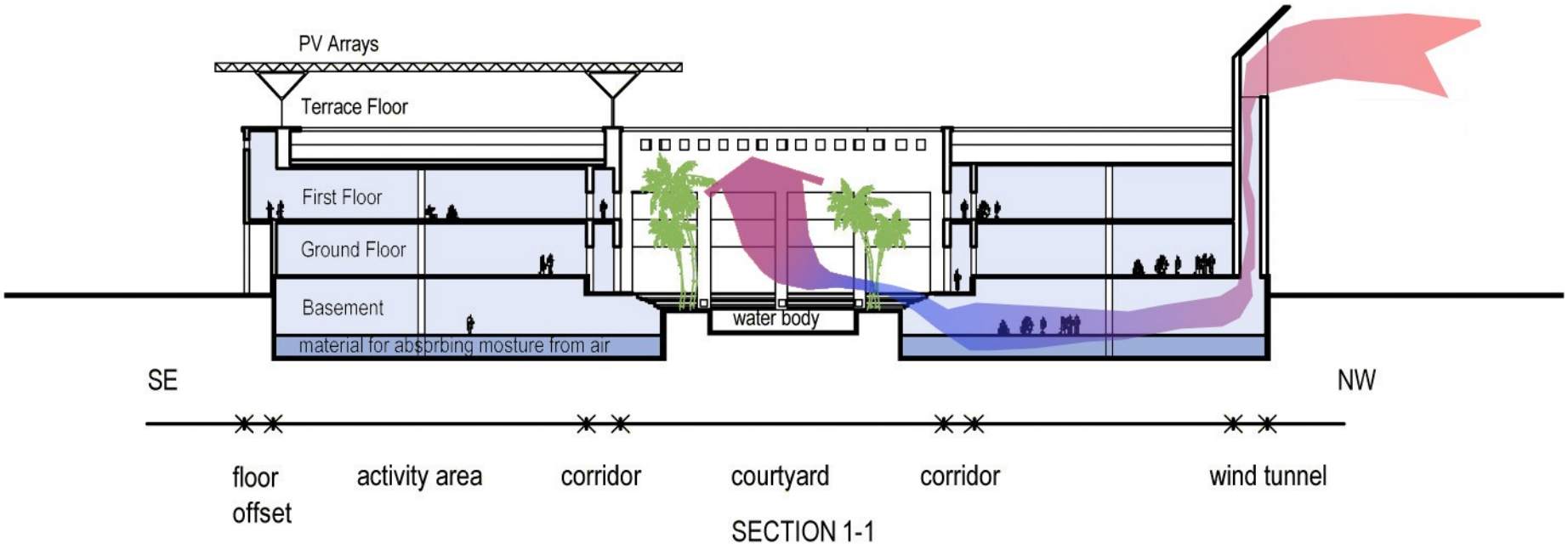
Thermal buffer around activity areas

Mutual shading

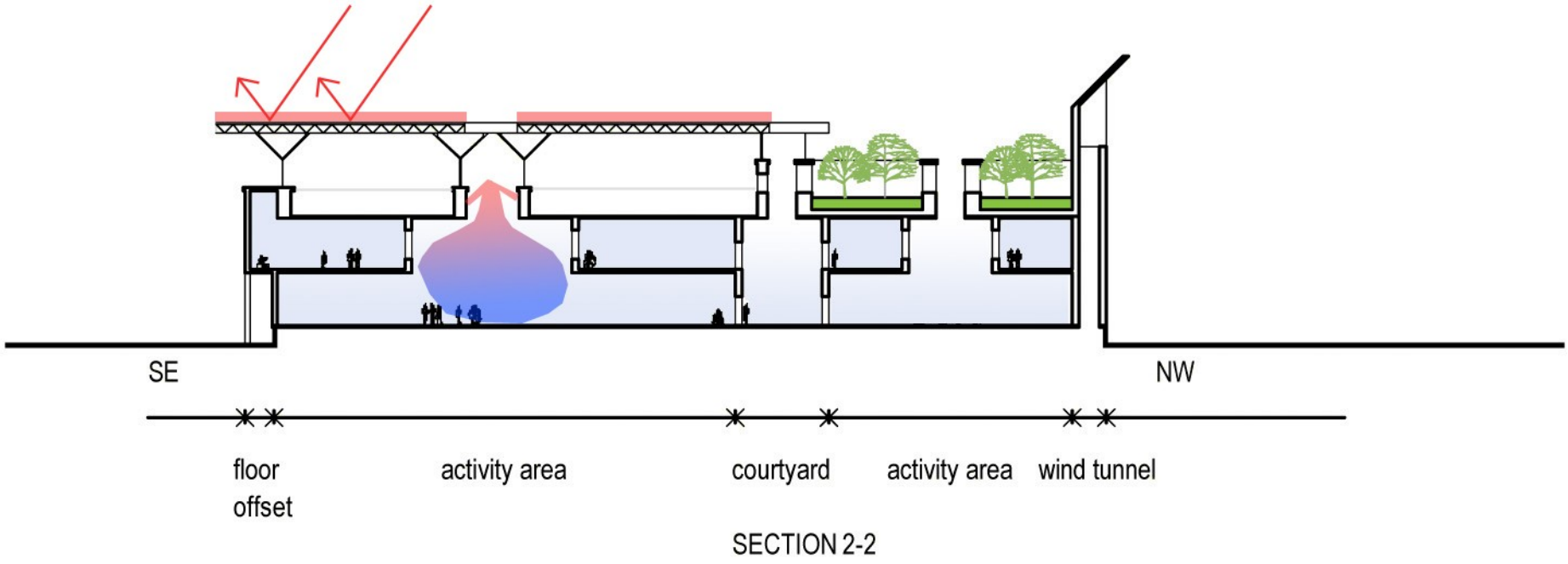
Design development: Thermal Zones



Design development: Roof Plan



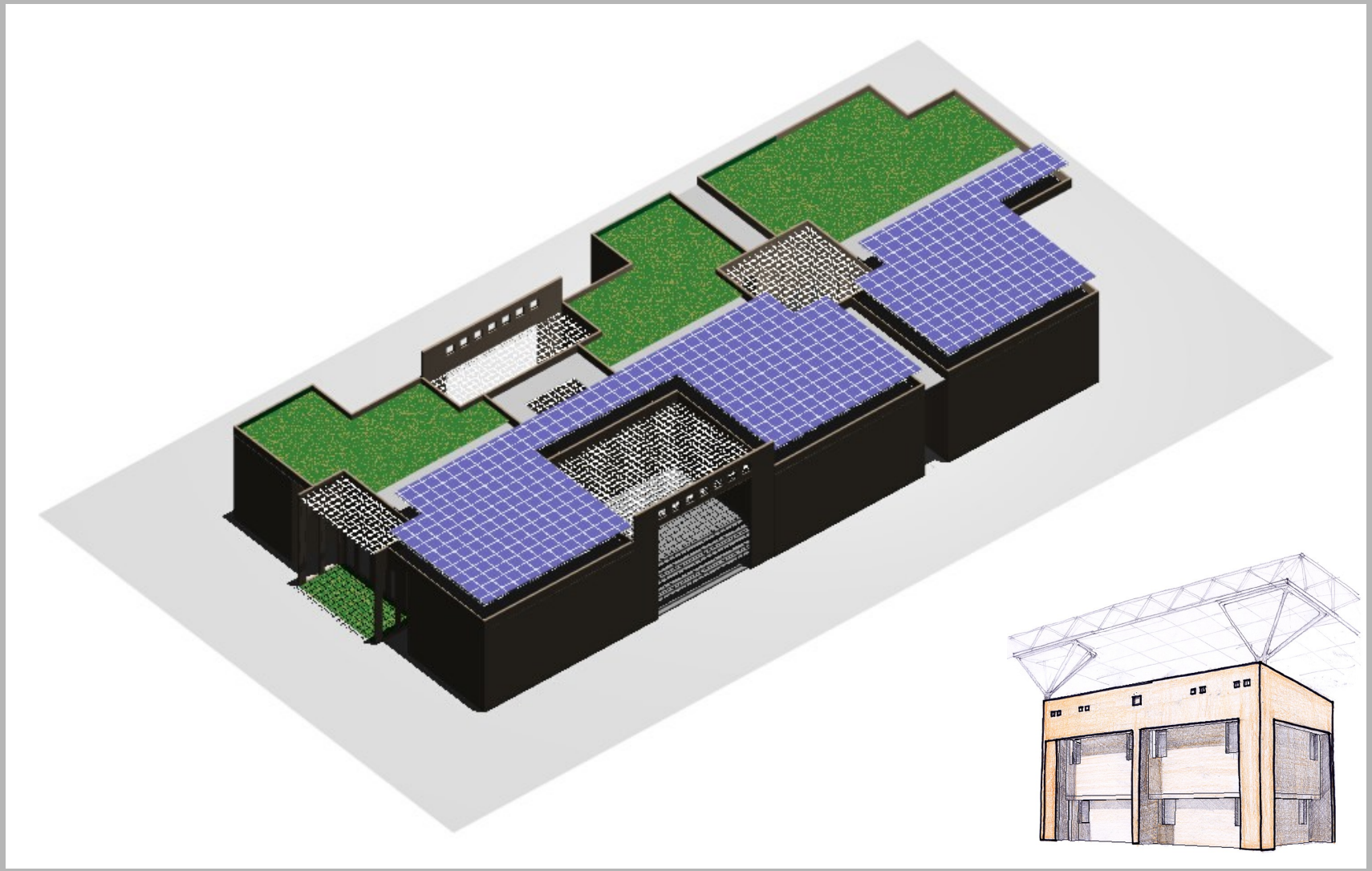
Design development: Section 1



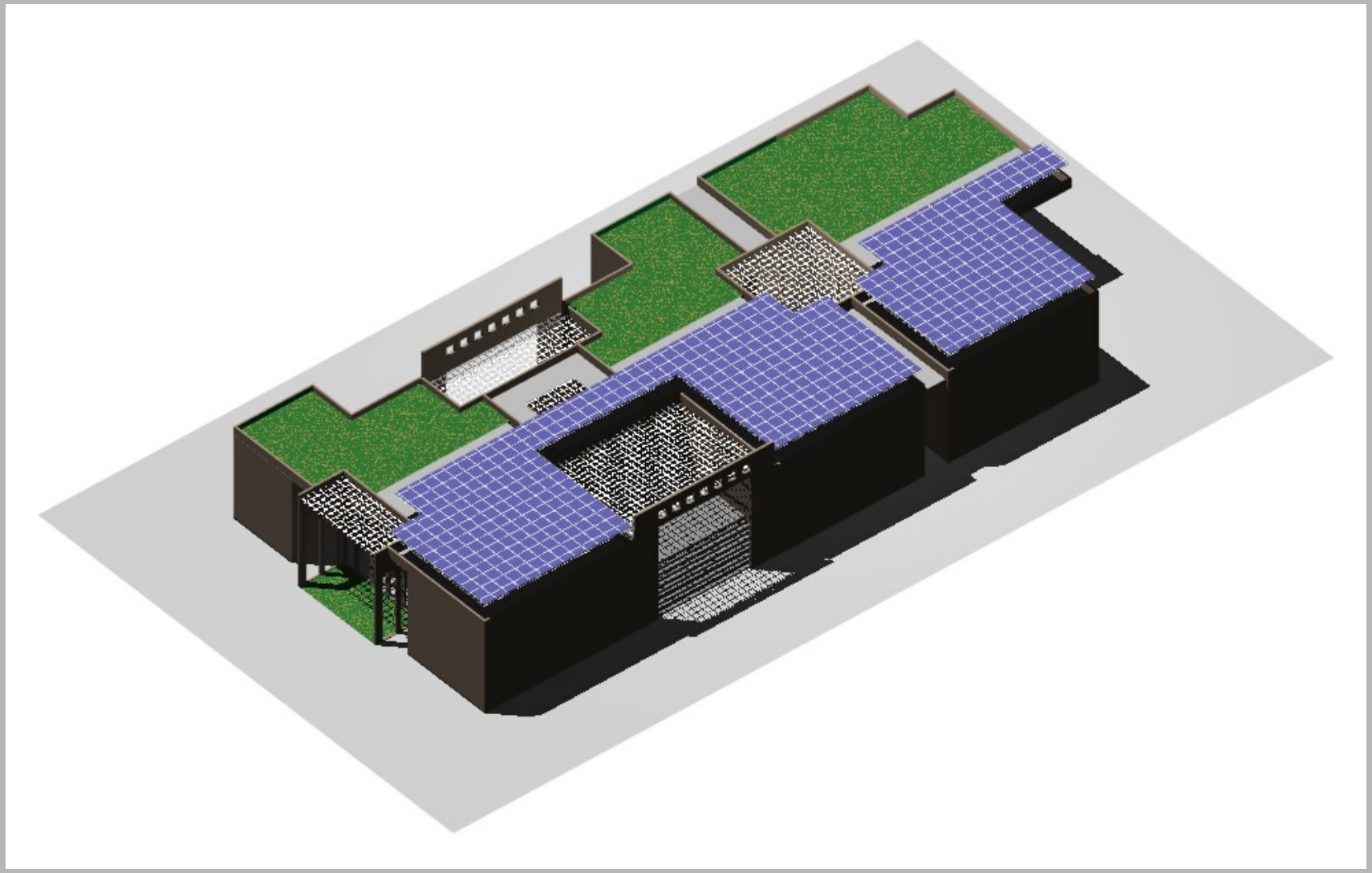
SECTION 2-2

Design development: Section 2

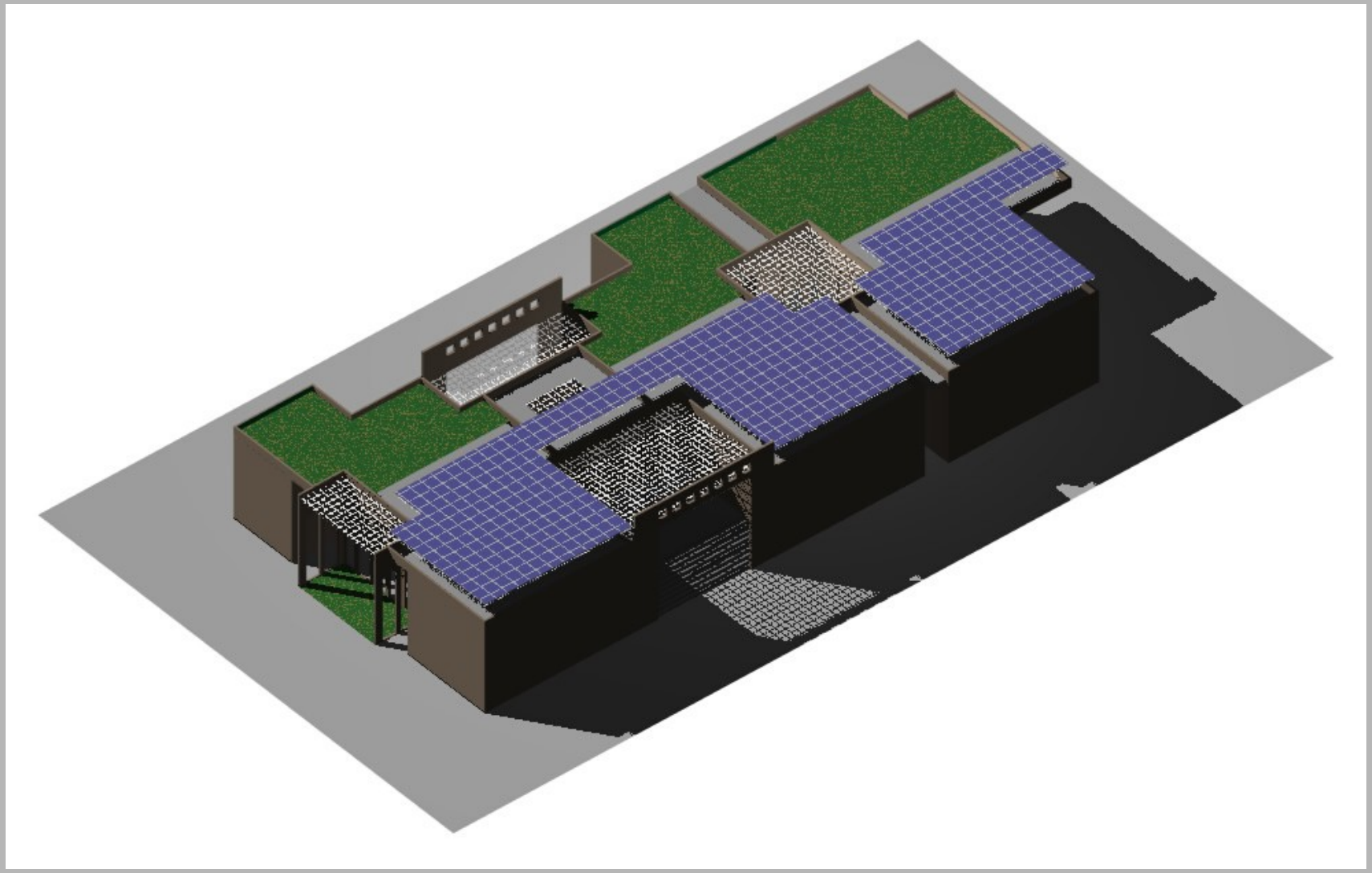
Built-form:Study of Shades & Shadows
(Summer Solstice 10:00am)



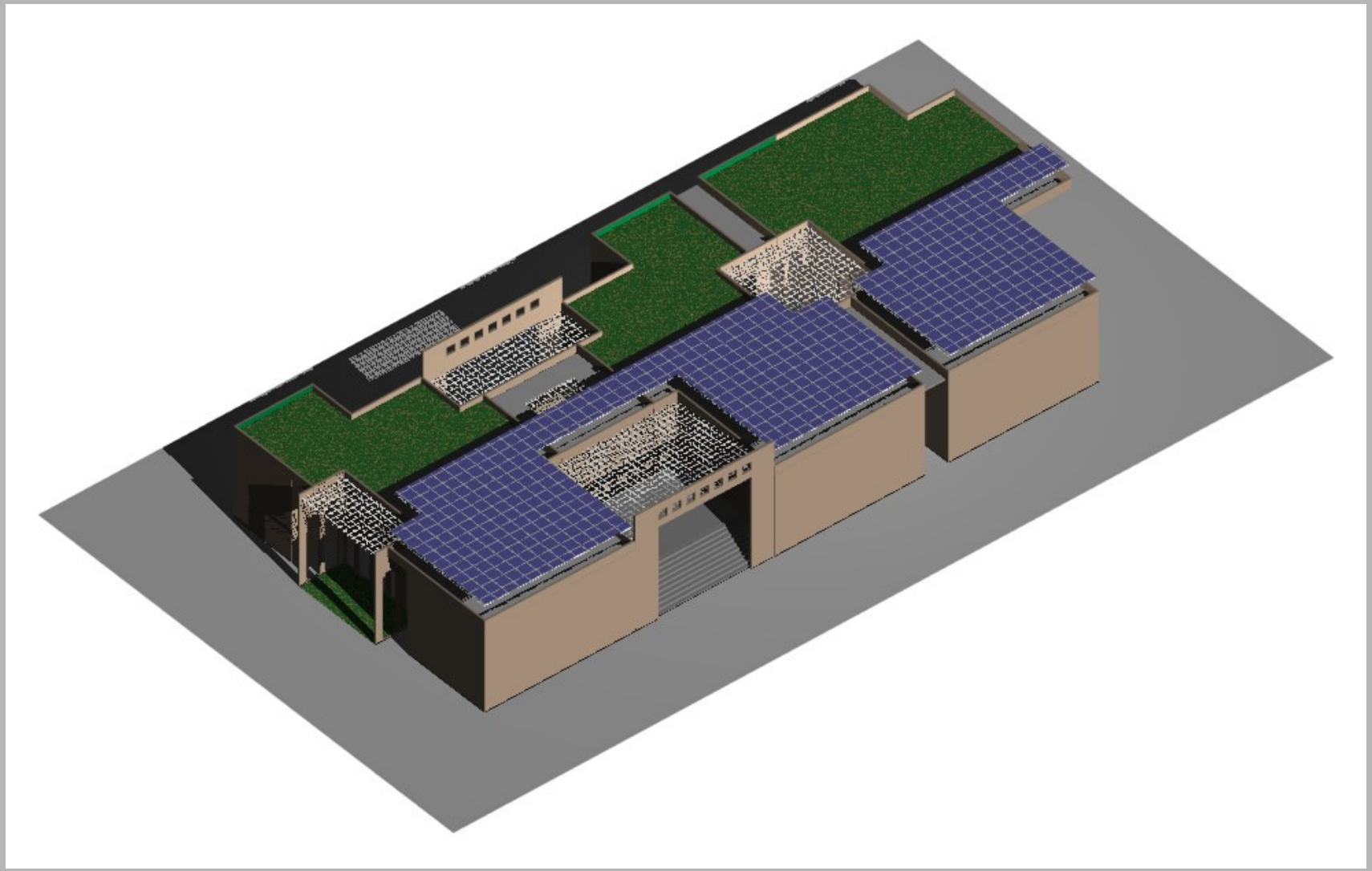
Built-form:Study of Shades & Shadows
(Summer Solstice 12:00pm)



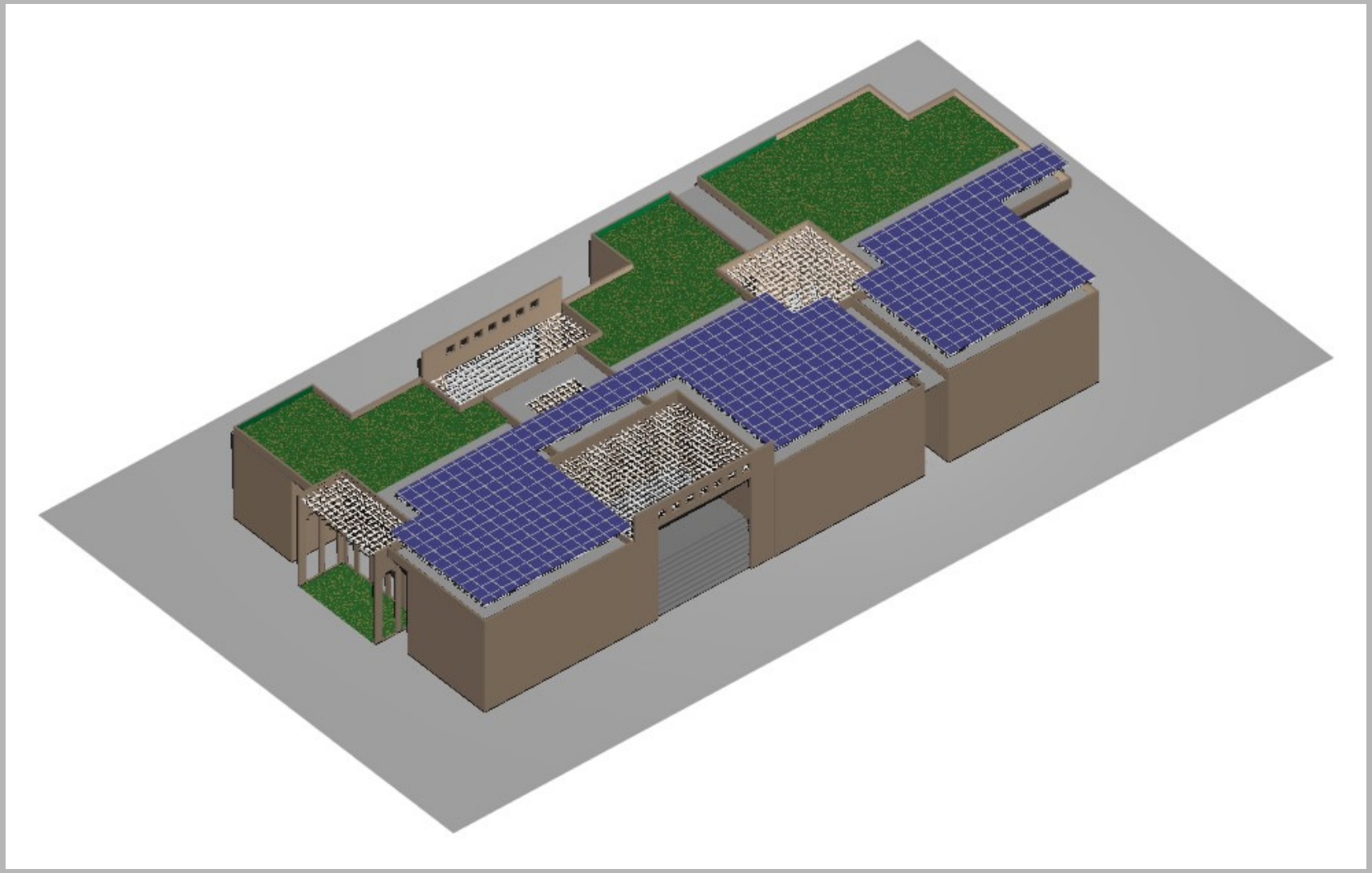
Built-form:Study of Shades & Shadows
(Summer Solstice 2:00pm)



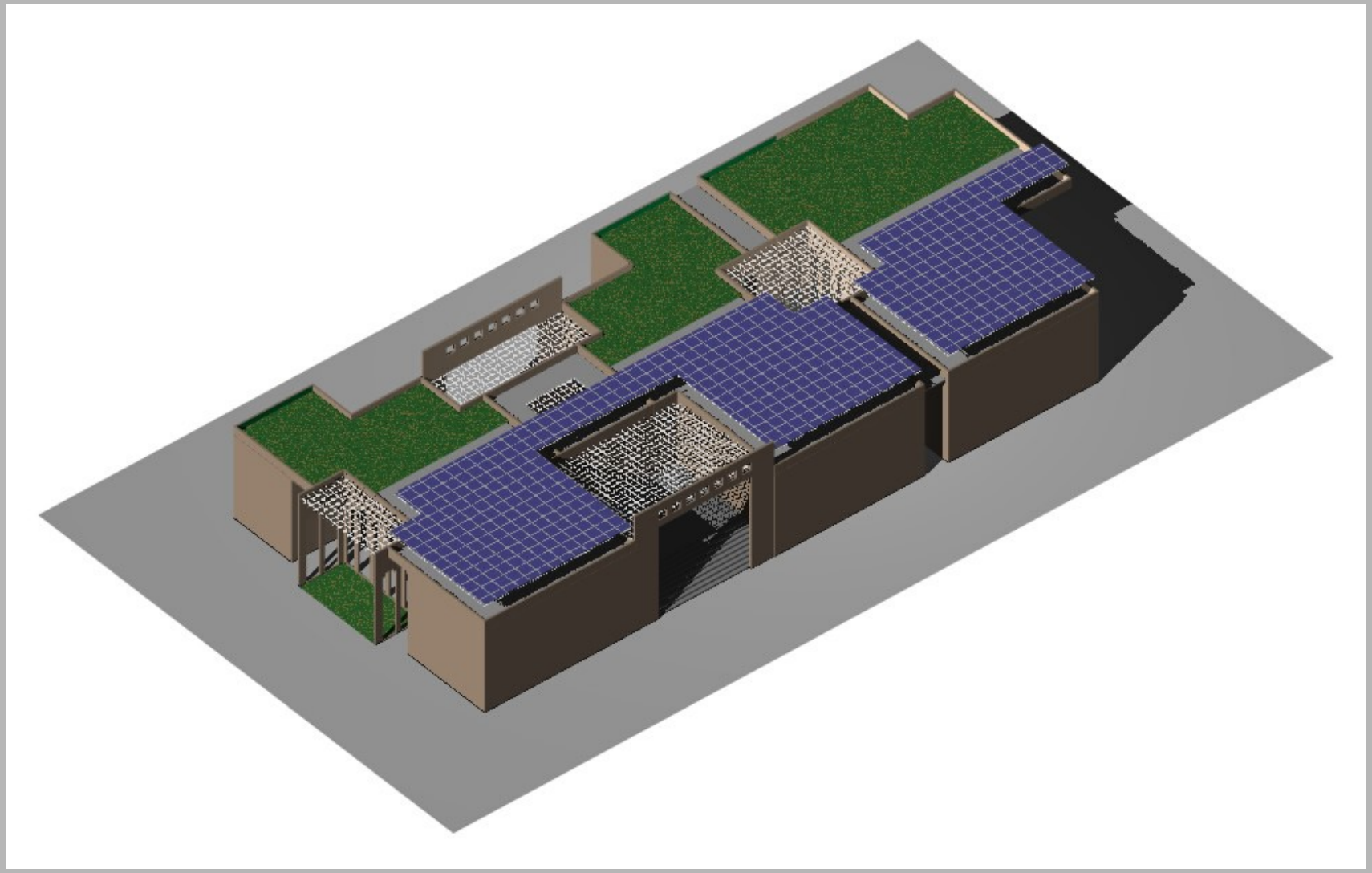
Built-form:Study of Shades & Shadows
(Summer Solstice 4:00pm)



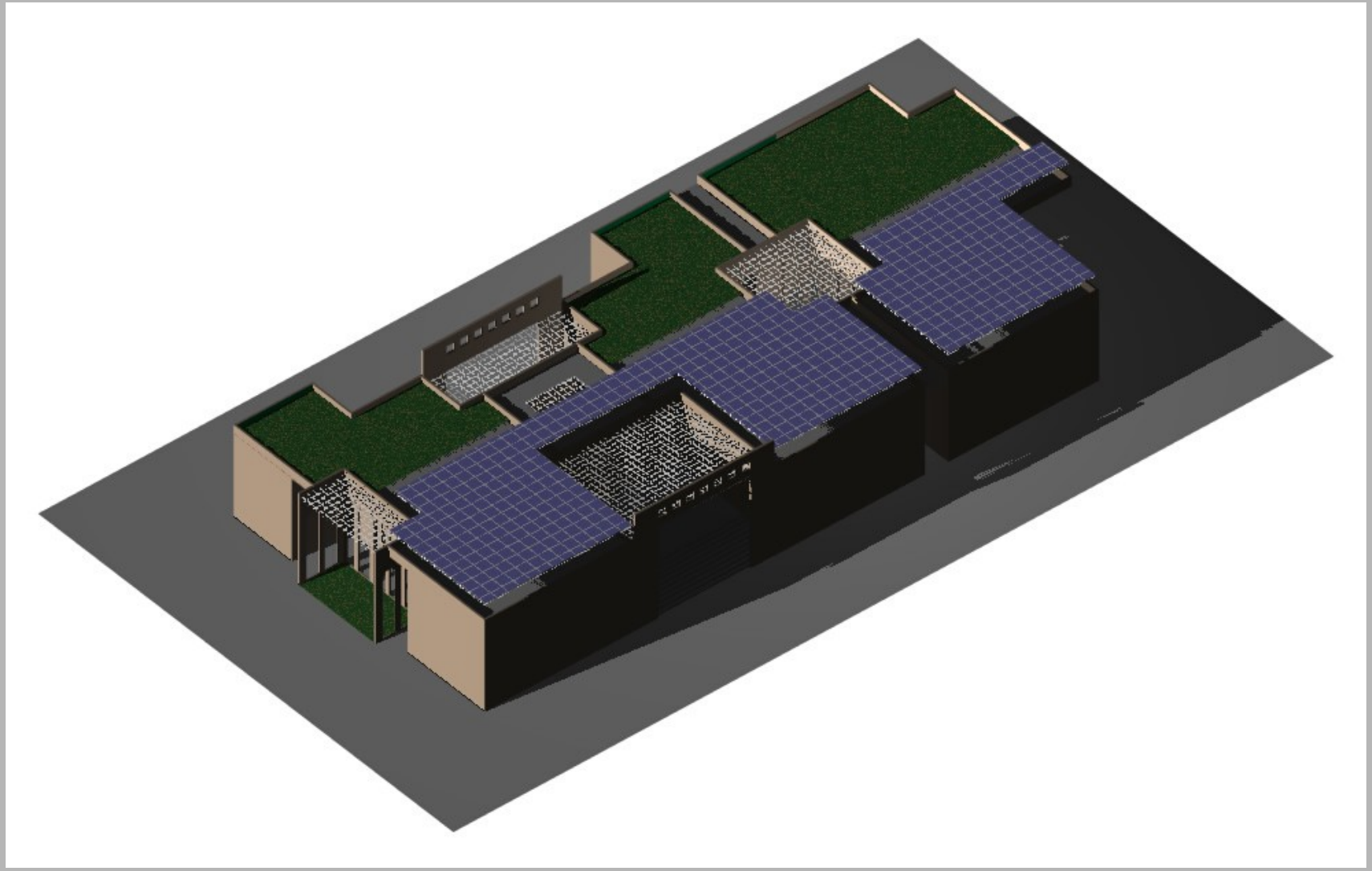
Built-form:Study of Shades & Shadows
(Winter Solstice 10:00am)



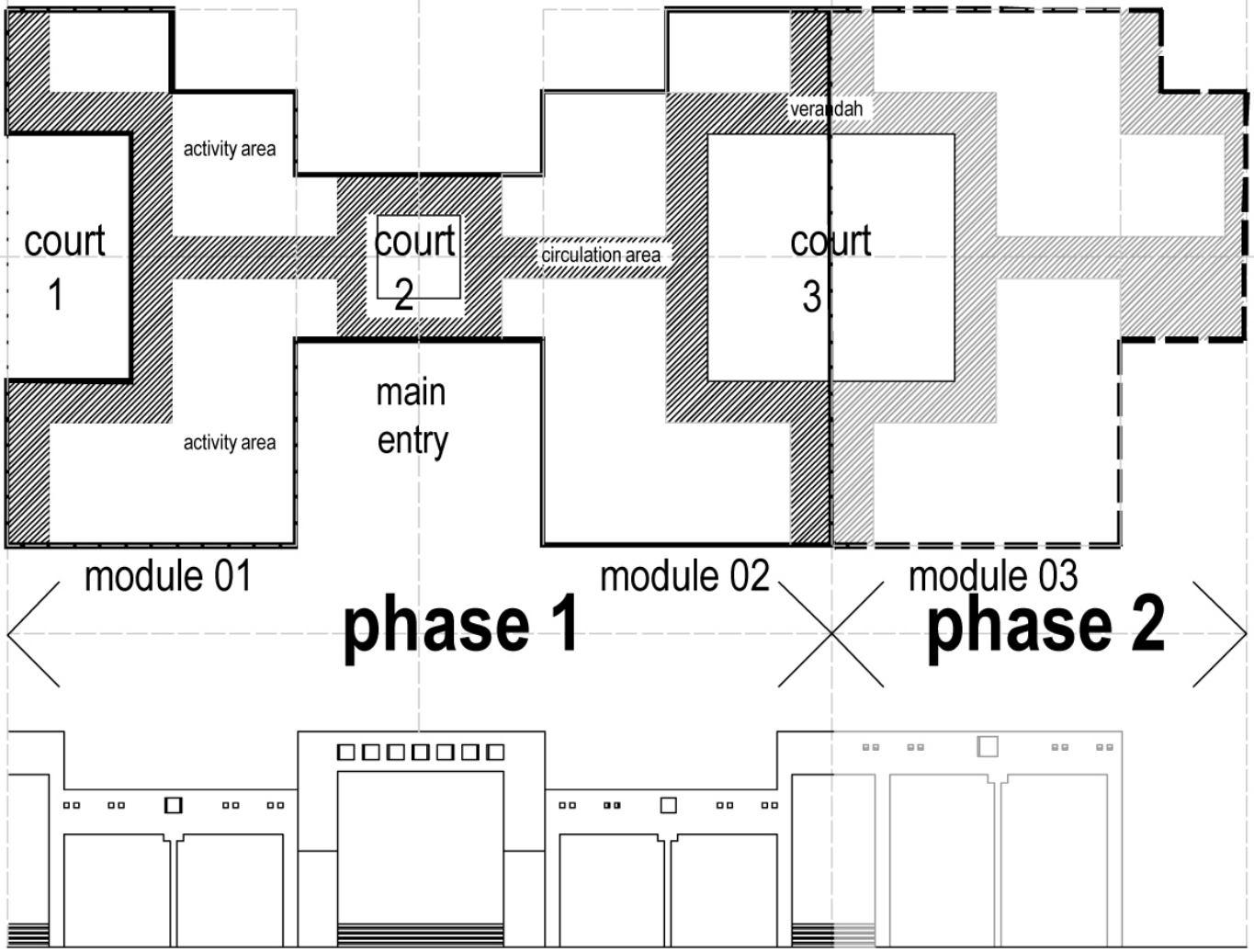
Built-form:Study of Shades & Shadows
(Winter Solstice 12:00pm)



Built-form:Study of Shades & Shadows
(Winter Solstice 2:00pm)



Built-form:Study of Shades & Shadows
(Winter Solstice 4:00pm)

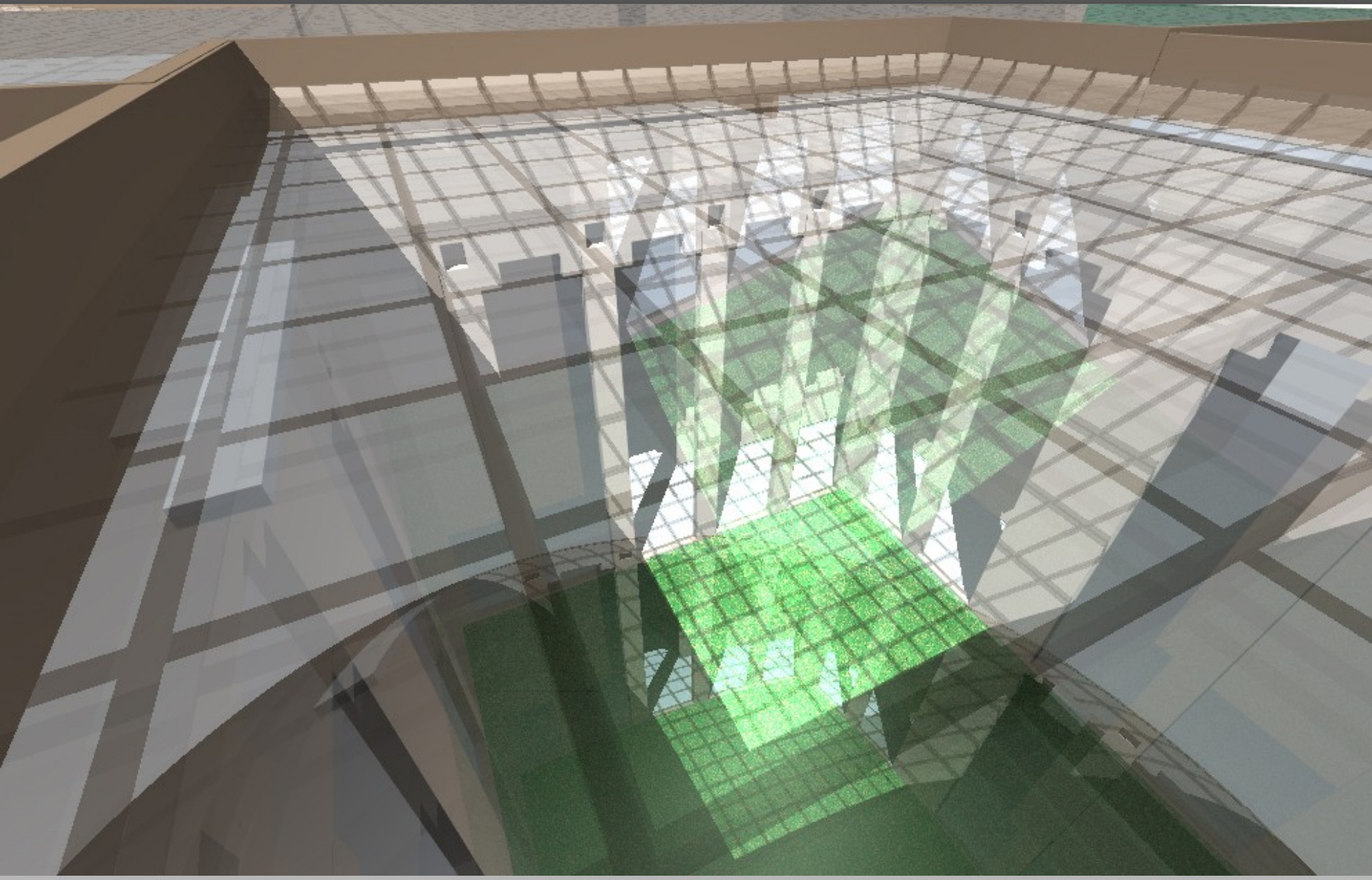


schematic elevation

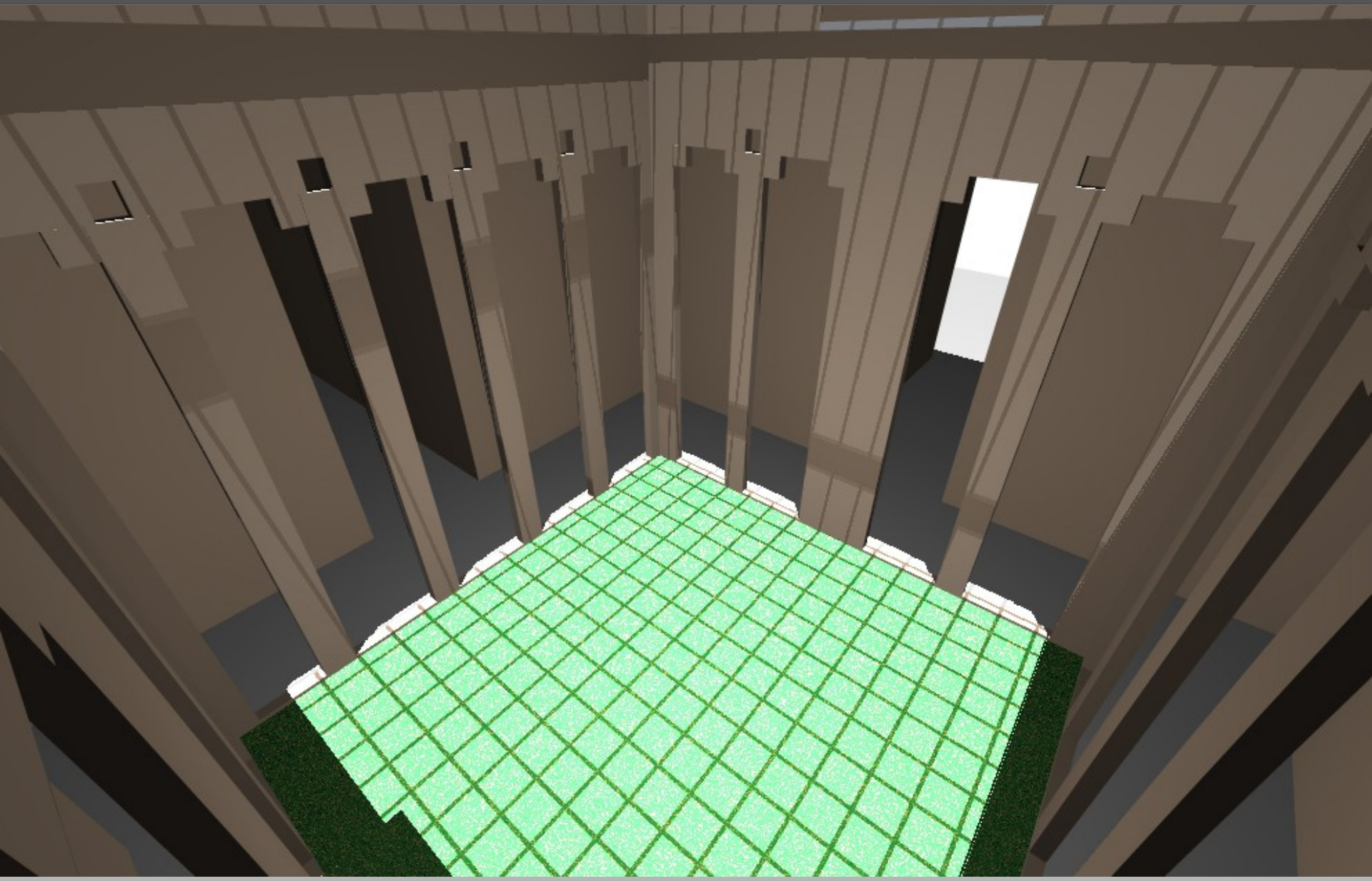
PowerGuard Specifications

Attributes	Values (USA)	Values (Metric)
Tile Weight	5 - 7 lb/ft²	24.4-34.2 kg/m²
Tile Dimensions	Range: 22" x 27" - 50" x 65"	Range: 0.56m x 0.69m - 1.27m x 1.65m
R-Value	R-10 or greater	0.029 watt/m° K
Roof Penetrations	None, except high-wind areas	None, except high-wind areas
System Monitoring	Data Acquisition System (DAS)	Data Acquisition System (DAS)
Typical Output	1-1.25kWp/100 sq ft	1.07-1.23kWp/10m²

Built-form: Aerial View



Built-form: Top of Courtyard



Built-form: View to Courtyard

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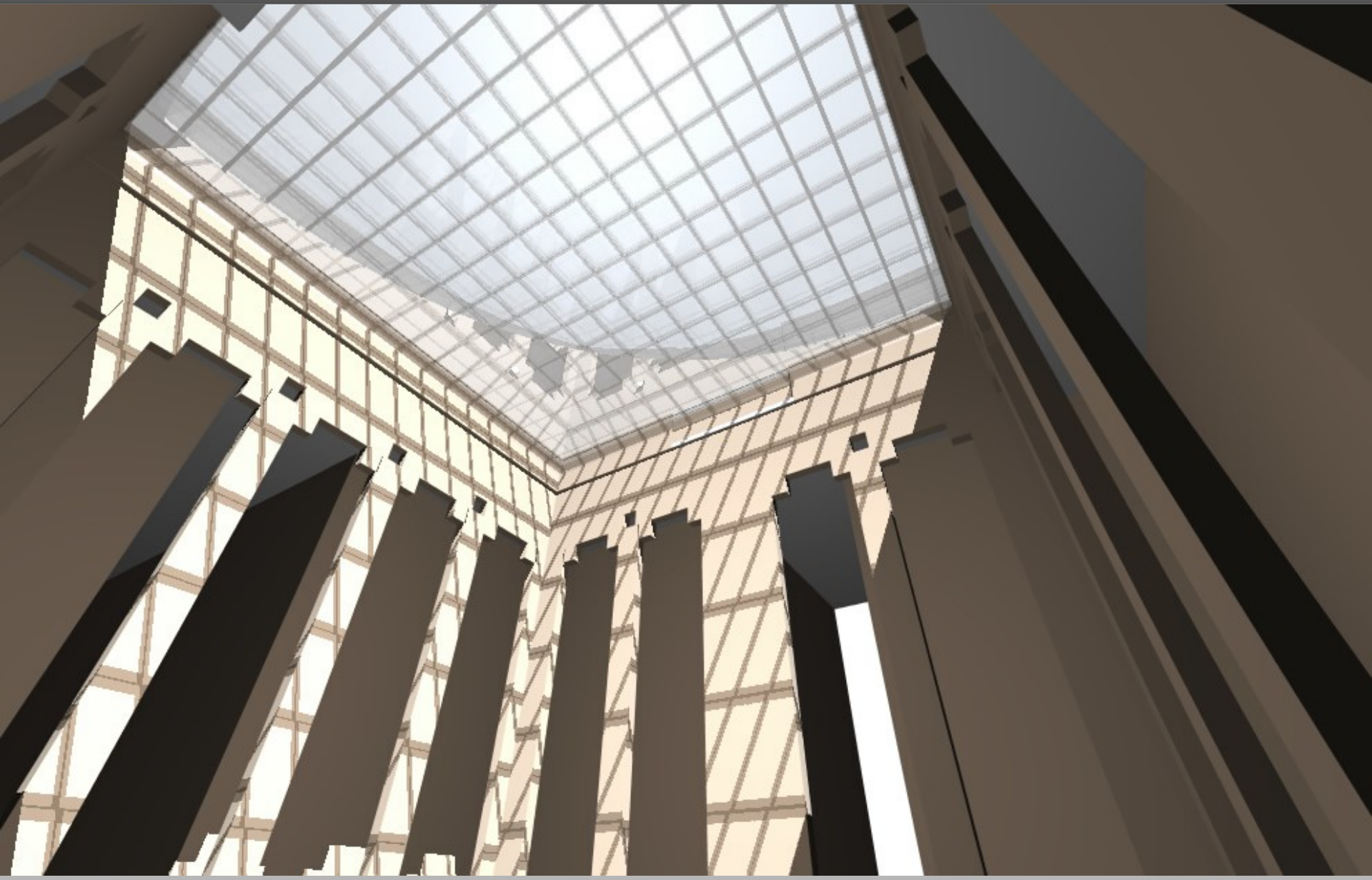
BHIWAPURKAR + HUANG
+ KASTILAHN + COLLIER



Built-form: View from Courtyard

- Building Floor Area = 34,000 sq.m.
- Annual Electric Demand = 34,000sqm x 2.5kw/= 85,000 kw
- PV Array Area = 7,734 sq.m.
- Type of PV panel used: Mono-crystalline PV panels
- Annual energy generation

= 7,734sqm x 0.146kwh/sqm/h/y = 1,129.2 kwh/y

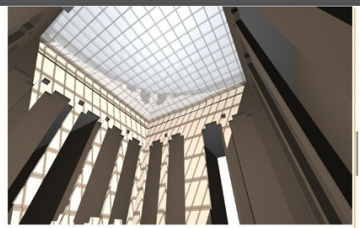
- % of energy generated by PV panels = 7.5%

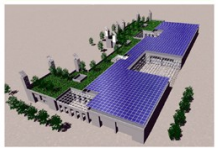
AGU

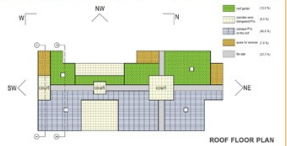
Student Center

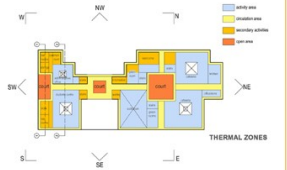
Al-Ghurair University, Dubai, UAE

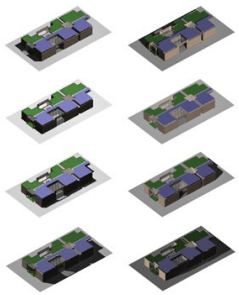
For many of us, the stereotyped images of photovoltaic systems are shiny panels mounted awkwardly and conspicuously on the roofs of remote buildings. Energy-saving, environmentally correct, but not architecturally elegant. However, the picture is now changing. The industry has evolved dramatically over the past decade. Photovoltaic panels which convert sunlight to electricity without consuming fuel or creating pollution, are no longer tacked-on appendages begging to be concealed.

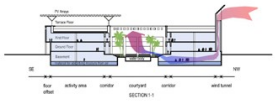


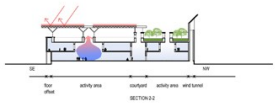


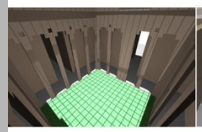


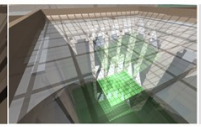












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