الجامعة المصرية اليابانية للعلوم والتكنولوجيا

エジプト日本科学技術大学

EGYPT-JAPAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

The sustainability of EJUST Campus

HATEM MAHMOUD

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The sustainability of EJUST Campus

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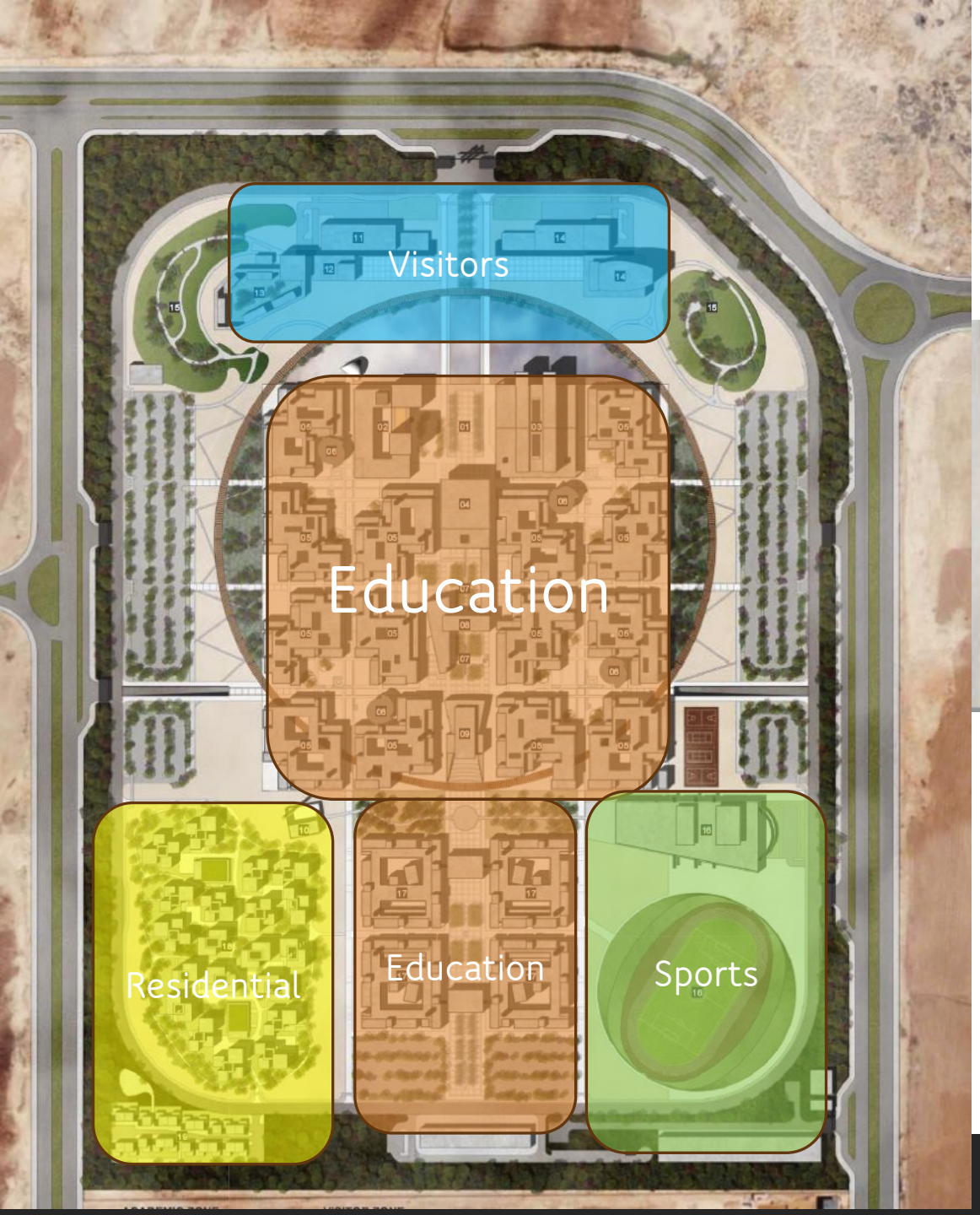
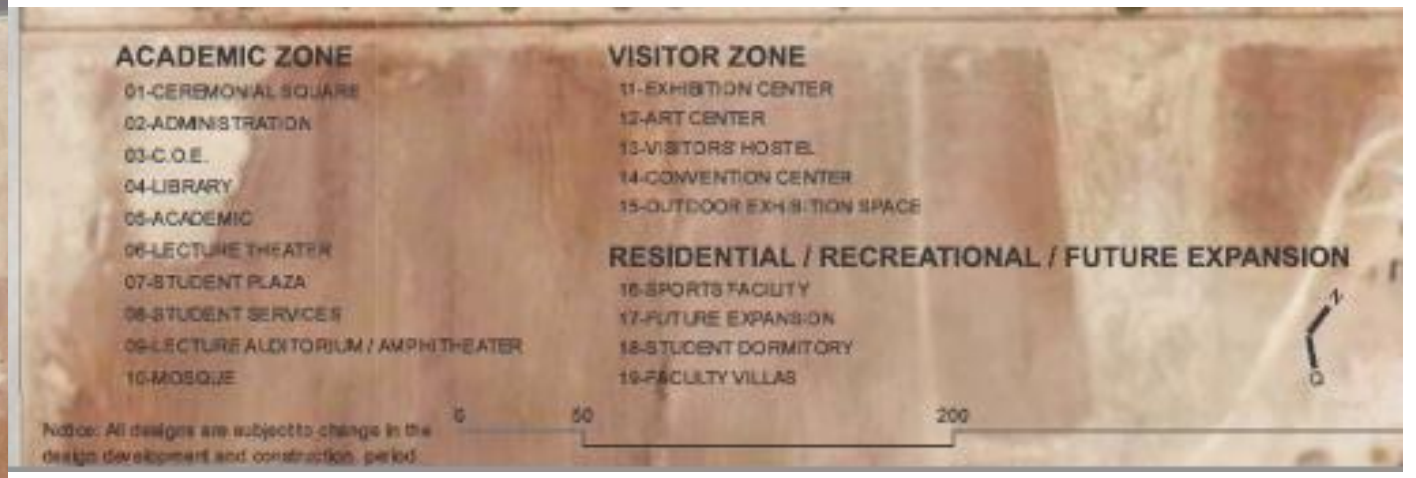
Arata is a Japanese architect, urban designer, and theorist from Ōita. He was awarded the RIBA Gold Medal in 1986 and the Pritzker Architecture Prize in 2019


Visitors
Education
Residential
Education
Sports


ACADEMIC ZONE
01-CEREMONIAL SQUARE
02-ADMINISTRATION
03-C.O.E.
04-LIBRARY
05-ACADEMIC
06-LECTURE THEATER
07-STUDENT PLAZA
08-STUDENT SERVICES
09-LECTURE AUDITORIUM / AMPHITHEATER
10-MOSQUE
VISITOR ZONE
11-EXHIBITION CENTER
12-ART CENTER
13-VISITORS' HOSTEL
14-CONVENTION CENTER
15-OUTDOOR EXHIBITION SPACE
RESIDENTIAL / RECREATIONAL / FUTURE EXPANSION
16-SPORTS FACILITY
17-FUTURE EXPANSION
18-STUDENT DORMITORY
19-FACULTY VILLAS
0
50
200
Notice: All designs are subject to change in the design development and construction period

Bird Eye View

Bird Eye View

Bird Eye View

Space Program

- B17- Faculty Of Engineering E
- B18- Faculty Of Engineering F
- B19- Faculty Of Engineering G
- B20- Faculty Of Engineering H
- B21- Faculty Of Engineering I
- B22- Faculty Of Engineering J
- B23- Faculty Of Engineering K
- B24- Faculty Of Engineering L
- B25- Faculty Of Engineering M
- B26- Faculty Of Engineering N
- B27- Business & Humanity A
- B28- Business & Humanity B
- B29- Business & Humanity C
- B30- Business & Humanity D

Sustainable Design in EJUST

The study sets up the targets to achieve and demonstrate the sustainability vision:

The study sets up the targets to achieve and demonstrate the sustainability vision:

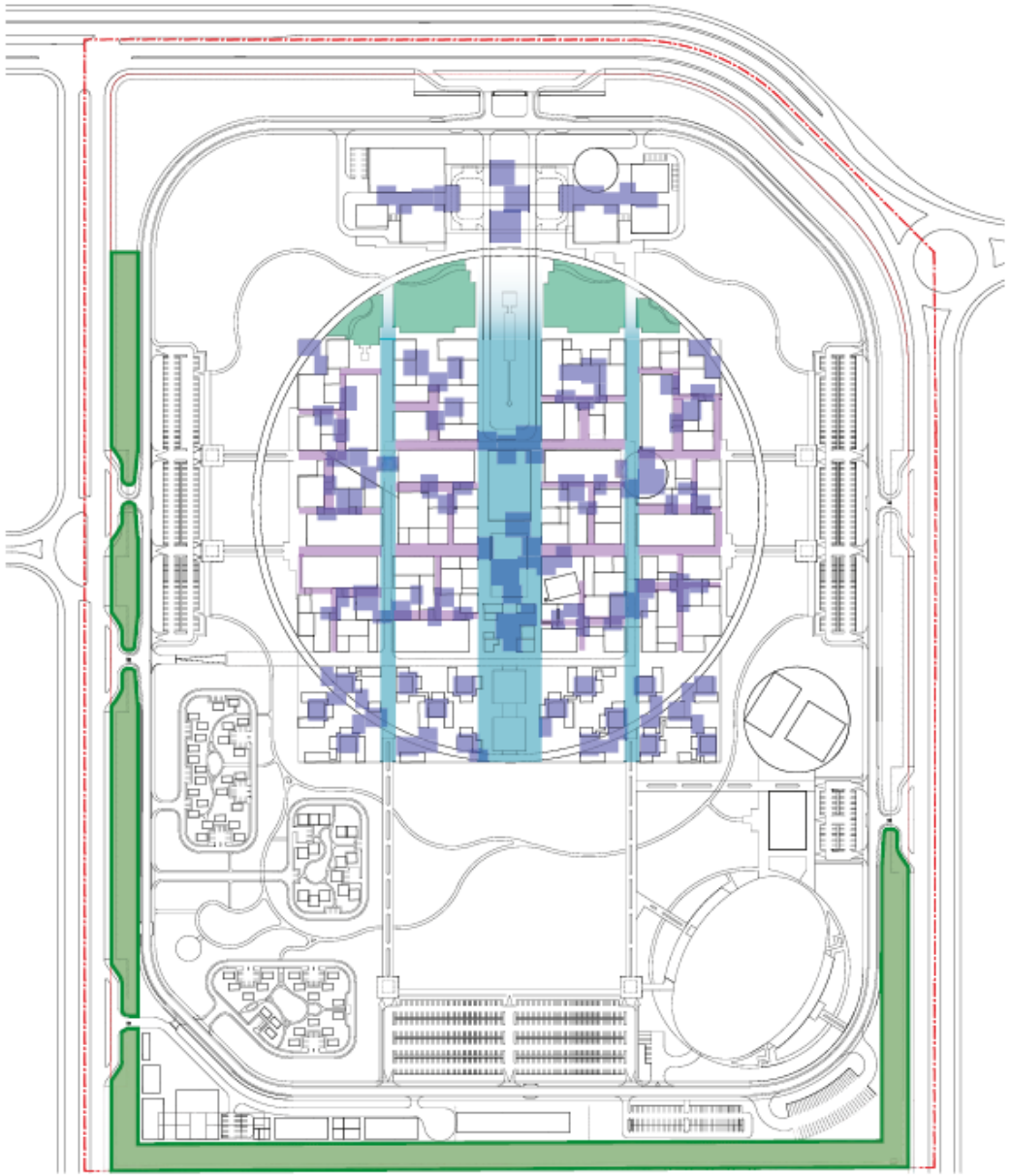
• **Energy & carbon** – **40% energy use reduction** against business as usual in Alexandria, through better space planning, building passive and active design;

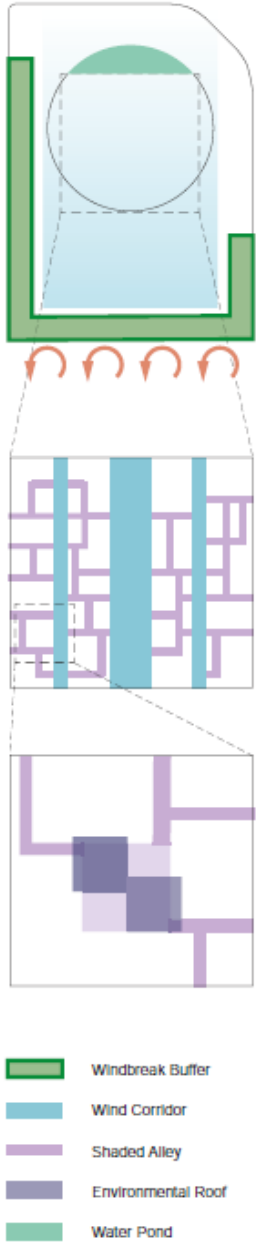
• **Water**– **50% water use reduction** against business as usual, through wastewater recycle and natural water treatment means;

• **Outdoor space & community** – improves open space comfort level throughout the year (over 80% of a year) through spatial arrangement and sustainable master planning, to improve space quality and encourage community activities;

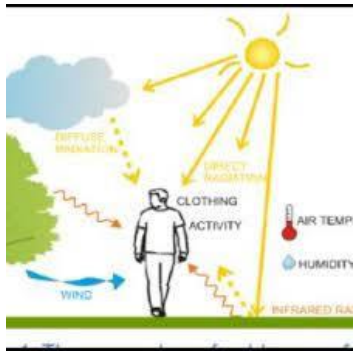
• **Cultural architecture & natural ventilation** – integration of traditional solar chimney in the modern campus buildings to **reduce air-conditioning energy by 20%**; and

• **Sustainability features** – showcase of large-scale sustainability features to educate campus users and visitors, including solar chimney, air tunnel, wetland, high efficiency wind turbine, etc.





Main Idea



The main ideas addressed in this master plan are:

- The environmental roof.

- The solar chimneys.

- The shaded alleys and

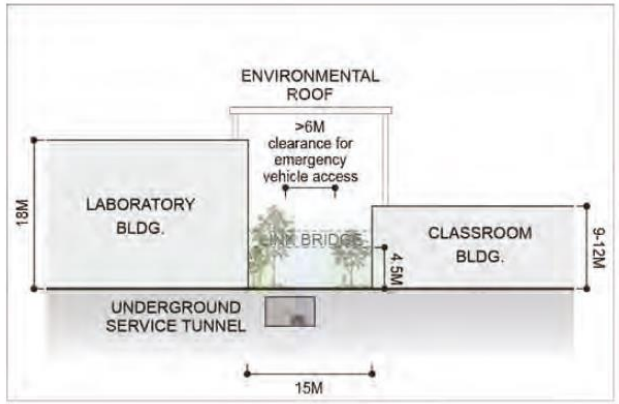
- The wind tunnels.

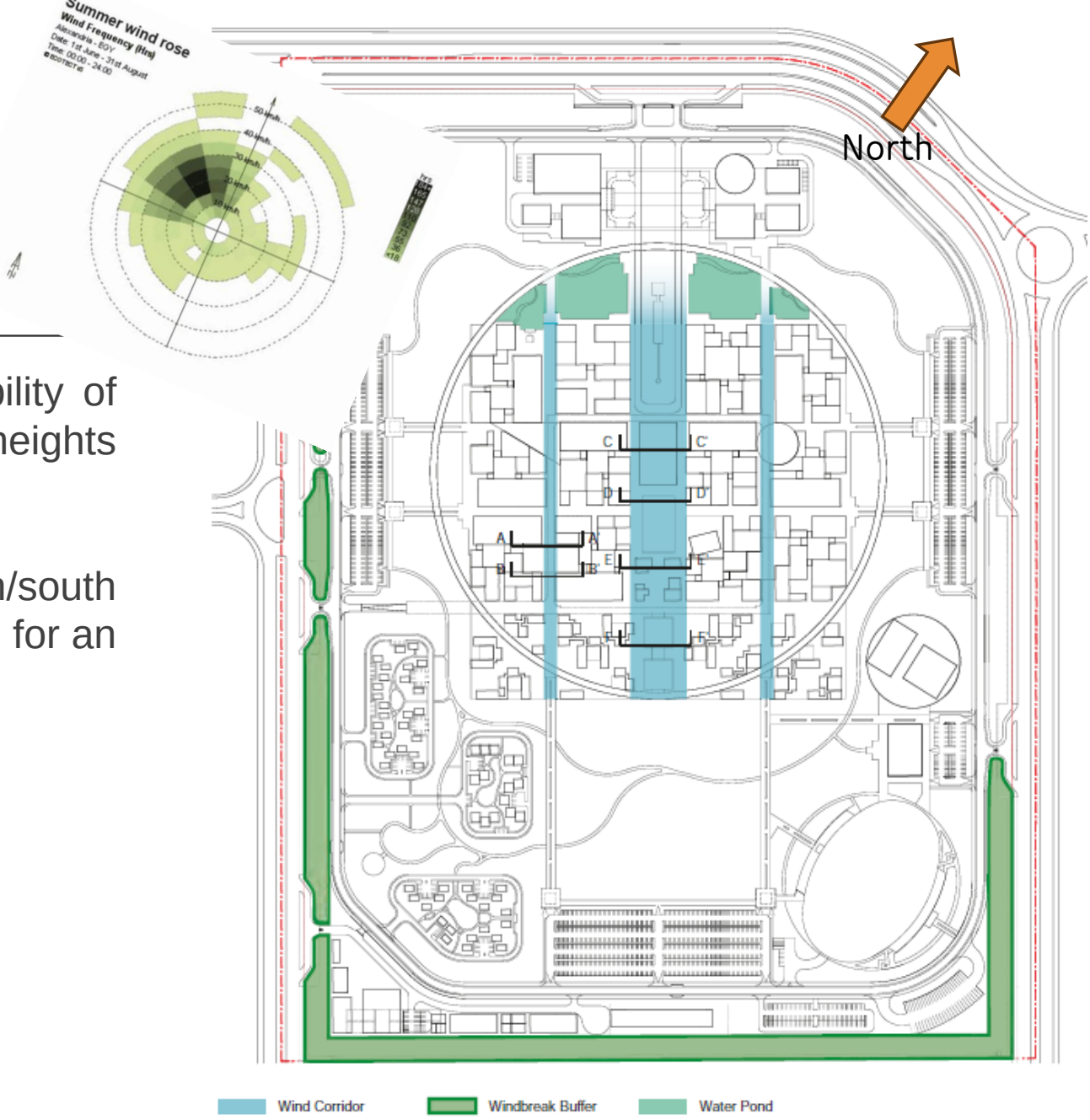
All these components work hand in hand to achieve a holistic sustainable strategy making use of the north western wind infi ltrating through the site, and regulating the environmental conditions to suit the people on the campus by introducing shading elements.

Environmental Concept

The outdoor air in Alexandria provides the possibility of cooling buildings by natural means. The buildings' heights are generally low
allowing for adequate natural ventilation.
In addition, the main roads running along the north/south axis of the campus allow for wind corridors and thus for an air flow coming
from the North-Western side.

TOTAL WINDCORRIDOR AREA----------
28,000sqm





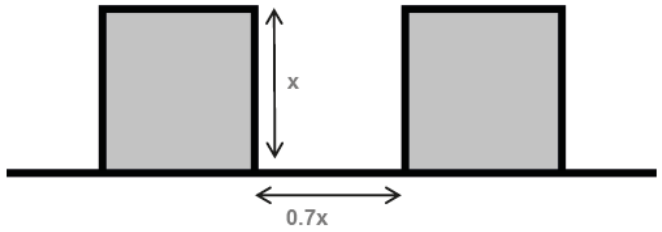


Figure 3.5 Proximities between buildings should be approximately 0.7 to 1 time of adjacent building height

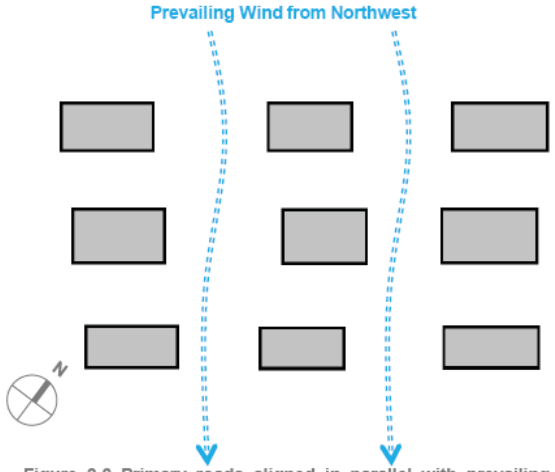


Figure 3.6 Primary roads aligned in parallel with prevailing wind direction to create wind corridors

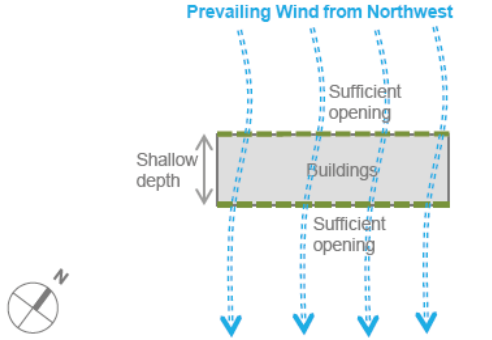


Figure 3.7 NW facing facades utilising prevailing wind

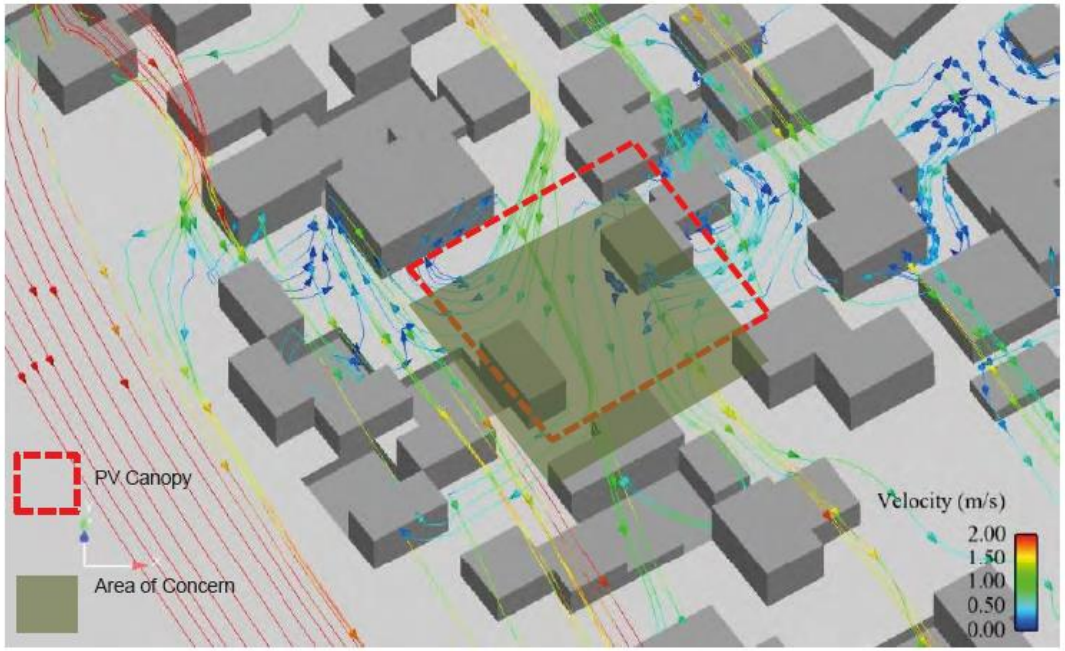


Figure 5.7 Wind Environment in Outdoor Space 1

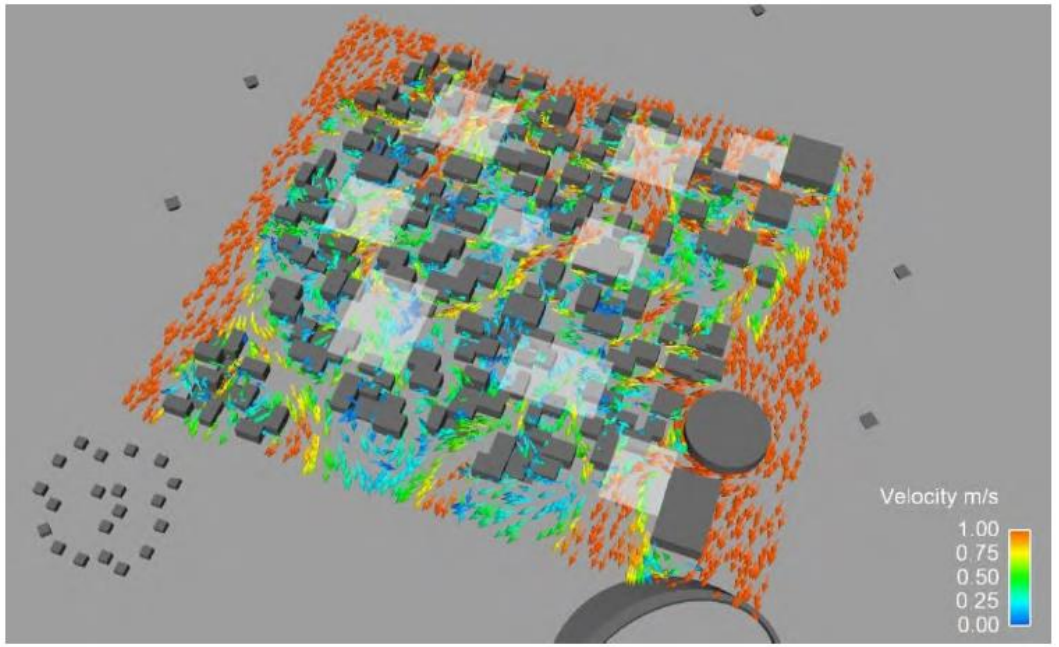


Figure 5.6 Vector Plot of E-JUST under Annual/ Summer Prevailing Wind Direction

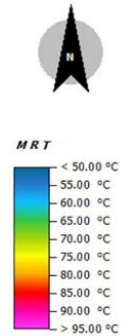
CFD simulation

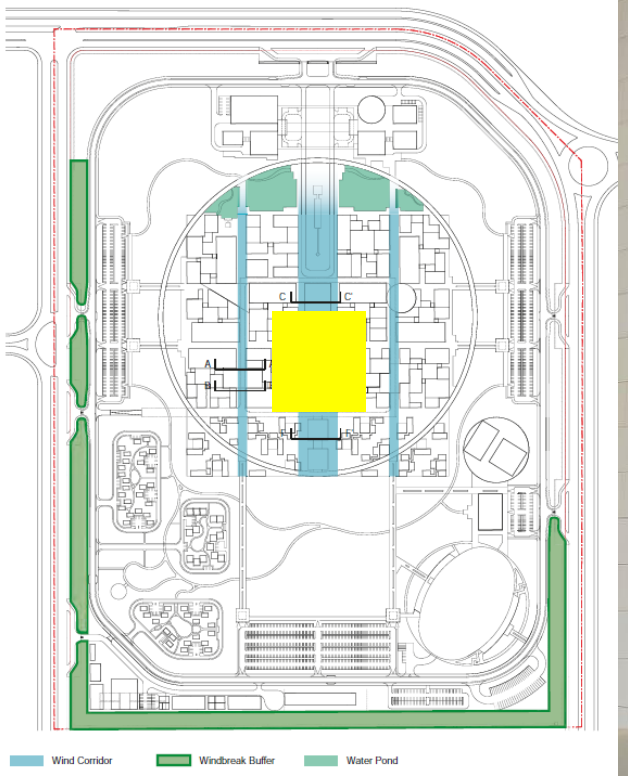
Table 5.3 Monthly usability (total numbers of hours) of Outdoor Space 1 in term of Thermal Sensation during opening hours of E-JUST

Month	Number of opening hours of E-JUST that Outdoor Space 1 can be considered as comfortable	
Jan	278	
Feb	204	
Mar	N/A	Dust Storm Period
Apr	N/A	
May	N/A	
Jun	303	
Jul	341	
Aug	329	
Sep	316	
Oct	339	
Nov	300	
Dec	260	
Usability % in non-dust storm period of a year	**89%**	

Thermal comfort simulation

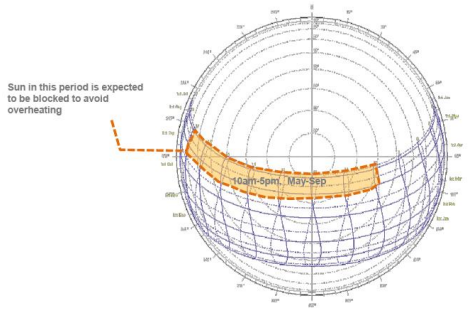
Code	10:00 am			12:00 pm			14:00 pm			16:00 pm			18:00 pm			Key
	Min	Max	Aver	Min	Max	Aver	Min	Max	Aver	Min	Max	Aver	Min	Max	Aver	
BC	56.5	77.6	76.7	66.6	70.7	70.0	62.6	84.0	83.1	55.6	83.4	81.0	37.0	49.7	45.4	
SB	54.1	75.3	71.4	64.9	68.7	66.6	60.6	82.1	78.3	54.3	82.1	70.1	37.2	49.2	40.1	
AC	51.4	74.6	66.1	61.7	67.4	65.3	57.8	81.1	70.2	53.6	81.3	55.2	38.1	48.5	38.7	
PC	49.1	73.5	63.0	59.3	66.6	63.5	54.5	79.8	68.3	50.0	79.5	58.7	36.3	47.0	37.3	
H	48.8	73.5	63.3	59.1	66.5	63.3	54.2	79.7	68.9	49.7	79.5	58.9	36.2	46.9	37.2	

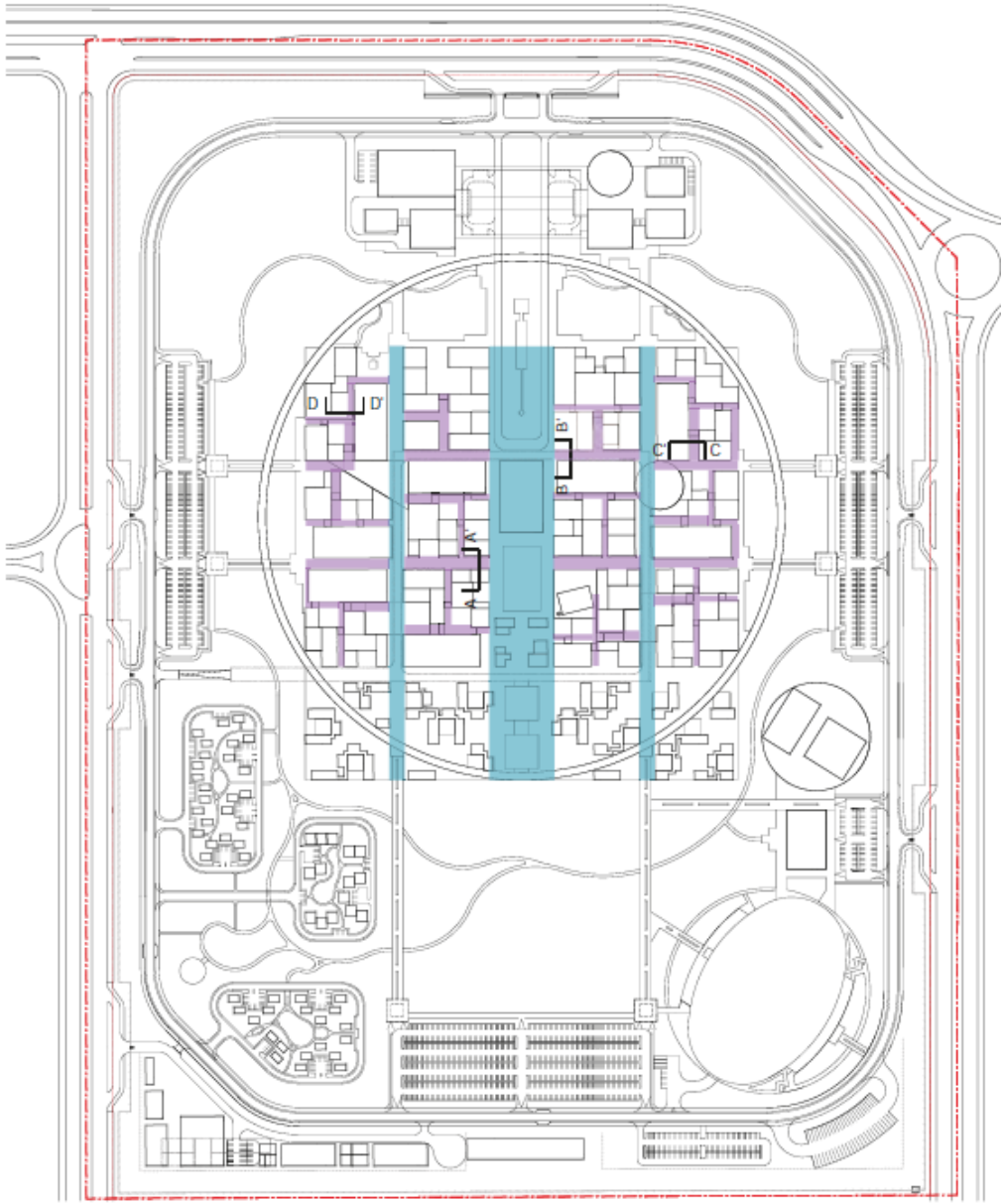




Main wind corridor

Environmental Concept



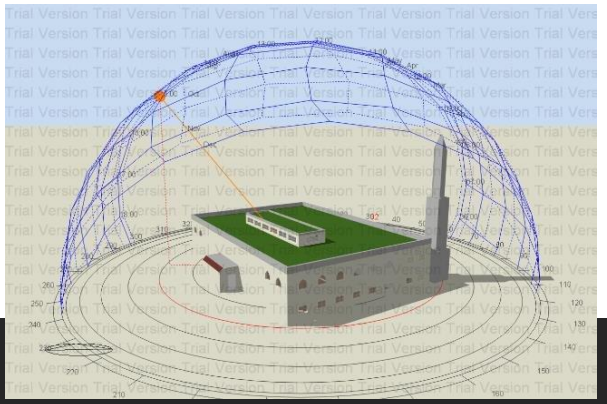


SHADED ALLEY SPATIAL TYPOLOGIES

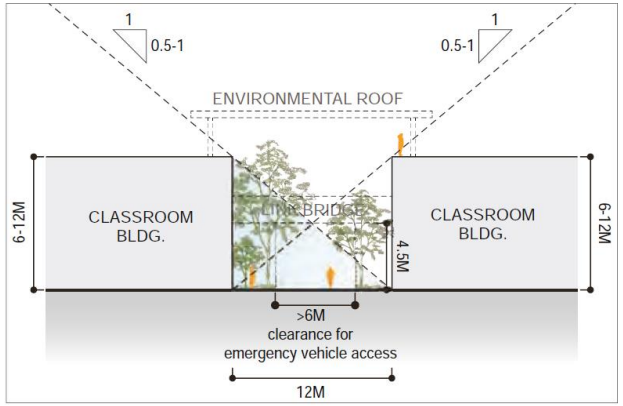
The buildings on the campus are positioned close to each other to b able to create alleys of different width between them.

These alleys provide shadow and facilitate the air movement within campus to cool the outdoor spaces and buildings

TOTAL SHADED ALLEY AREA----------
7,400sqm



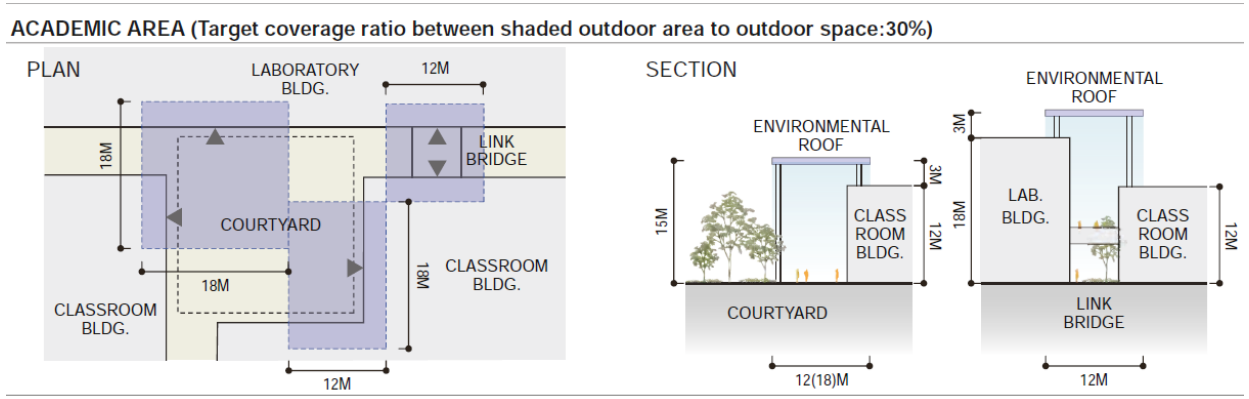
SECTION A-A' W=12M



Environmental Concept

ENVIRONMENTAL ROOF SPATIAL TYPOLOGIES

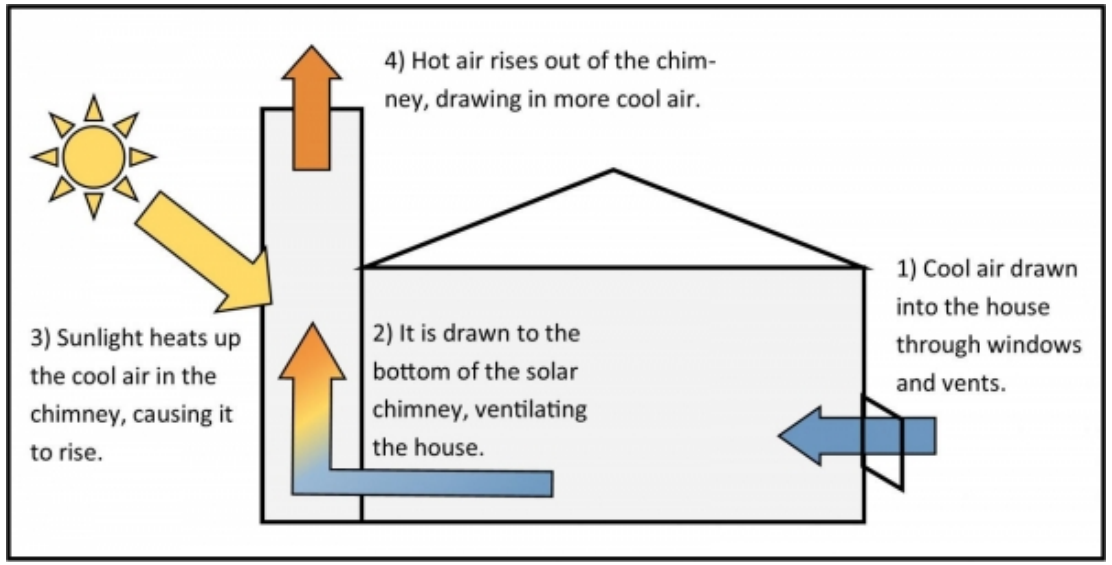
The environmental roofs serve as the main factor in reducing the undesired heat island effect.
The environmental roof is used to shelter alleys at seleted locations to create a pleasant climate and spaces for the users outside the buildings.
These spaces are characterized by their semi-outdoor quality, with natural ventilation and shade.

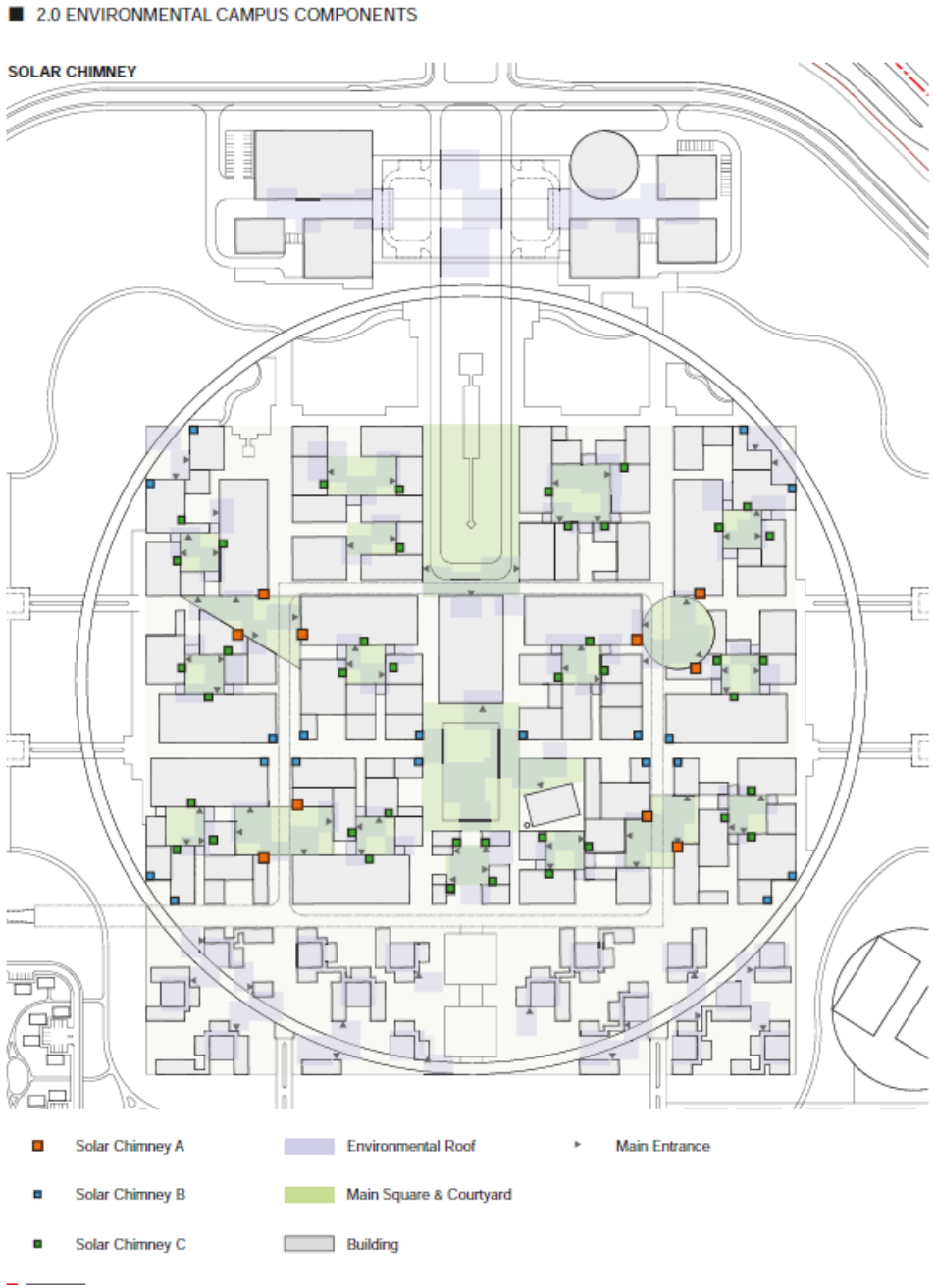


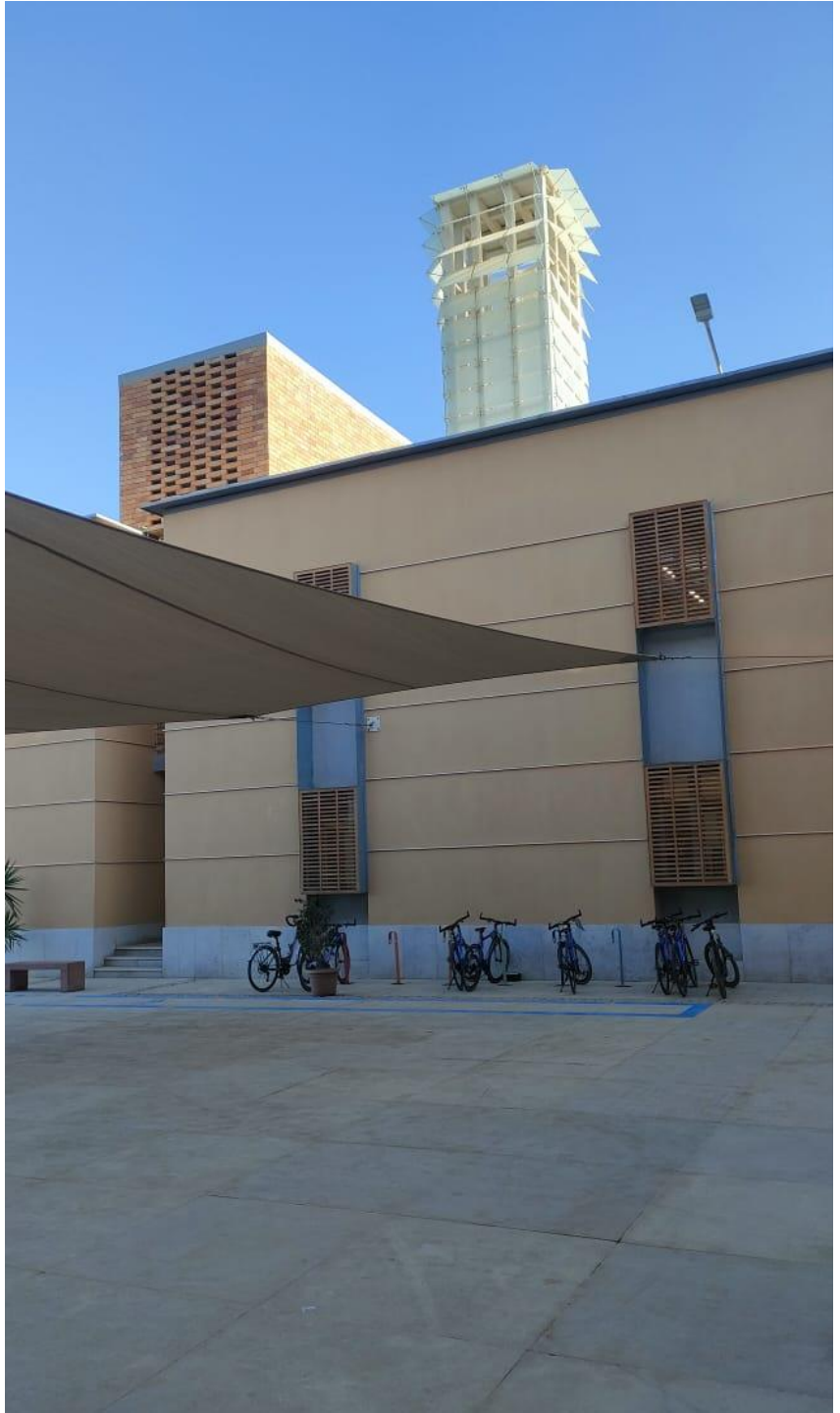
Shaded areas

Environmental Concept

- A solar chimney is **a type of passive solar heating and cooling system** that can be used to regulate the temperature of a building as well as providing ventilation. -- solar chimneys are a way to achieve energy efficient building design.







Solar chimneys in Building 8

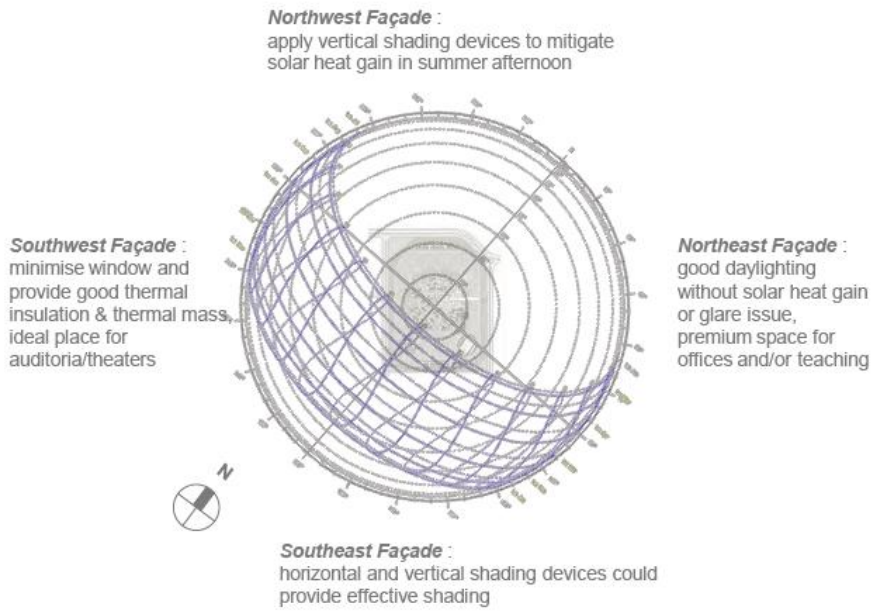
(EJUST Campus)

Climatic modifiers

Facade Solar Control

Alexandria has long annual sunshine hours (3,594 hours) and strong solar heat radiation – over 1,700 kWh/m2/yr (Hong Kong – about 1,300 kWh/m2/yr). Solar control in summer months is important to avoid overheating in interior spaces. Solar heat gain can lead to 10% (offices) to

50% (residential) of cooling load in buildings in E-JUST. Hence, good solar control facade can effectively reduce the cooling energy.




E-JUST

Environmental Concept

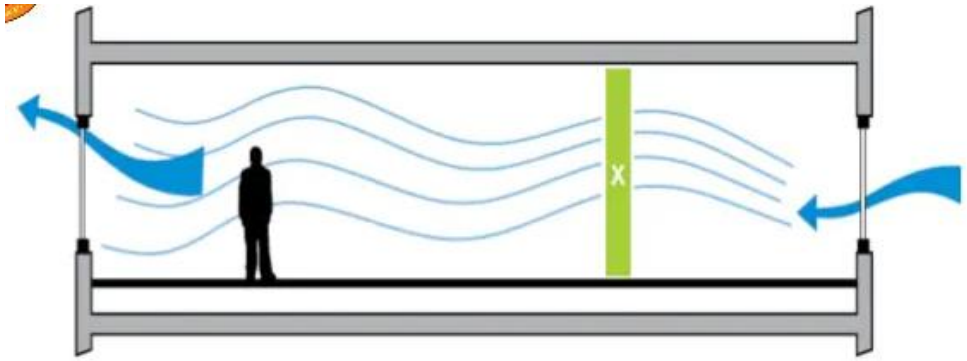
- Wetland System: The water feature at the north of main campus is considered a semi-wetland system that self sustains water quality.

- The development provides extensive greenery and water features to avoid heat island effect, with coverage of 450,000 m2 and 33,000 m^2 respectively. Nevertheless, water use for irrigation and water feature will be a challenge to the sustainability design. Wetland is mentioned in the current scheme to treat wastewater to a better quality for discharge and on-site recycling.

Natural Ventilation

Most of the passive & active design strategies recommended by Arup is either already implemented or possible to implement in the future design phases, maintaining the **presumed 26% energy reduction**.

Excluding the viability of natural ventilation during dust storm period, the natural ventilation can be utilized in 25% of non-dust storm period in a year and up to 18% of energy can be saved in compared to full air-conditioning scenario.
In addition to adopting natural ventilation, the traditional design – air tunnel can offer alternative source of fresh air during dust storm days. Since the air tunnel is below ground and being naturally ventilation at nights, the air tunnel can pre-cool the fresh air throughout a year. The free pre-cooling would save up to 46% of fresh air load with respect
to the full-air- conditioning scenario that the air-conditioning system deals with smaller temperature change.



Energy & Carbon Strategy

The E-JUST development features a holistic energy plan with understanding of individual energy use characteristics, climatic responsive architecture, natural resources, site context and site specific needs.

The hierarchy diagram on the right shows the framework for E-JUST, starting from good industry practices and low-cost passive design to reduce resource demands. With the reduced demands, efficient active systems are strategically selected to further reduce energy use. Finally, certain amount of renewable technologies are applied on site to offset carbon emissions.

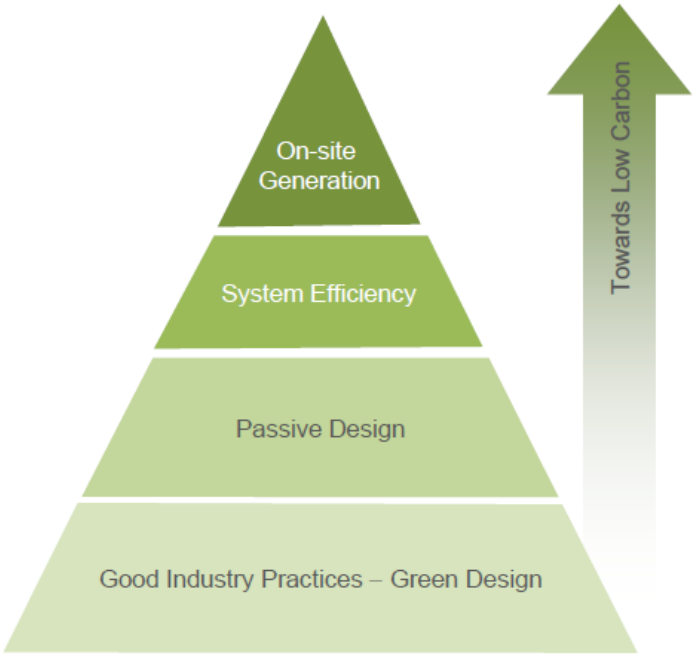


Figure 3.1 Hierarchy Diagram for E-JUST

Reducing Energy Demand

As shown in the diagrams and Table 3.1, labs, residential spaces and auditoria/lecture theaters occupy the largest area and demand significant energy. Therefore, these spaces are the key areas for energy demand reduction.

- With design and active systems, the Energy used of labs can be reduced by 95kWh/m2/year while still meeting strict indoor environment requirement. The Energy Use Intensity EUI of residential quarters is halved while improving occupant comfort through the means of passive and active designs.

- **The total energy demand and carbon emissions can be reduced by approximately 26%.**

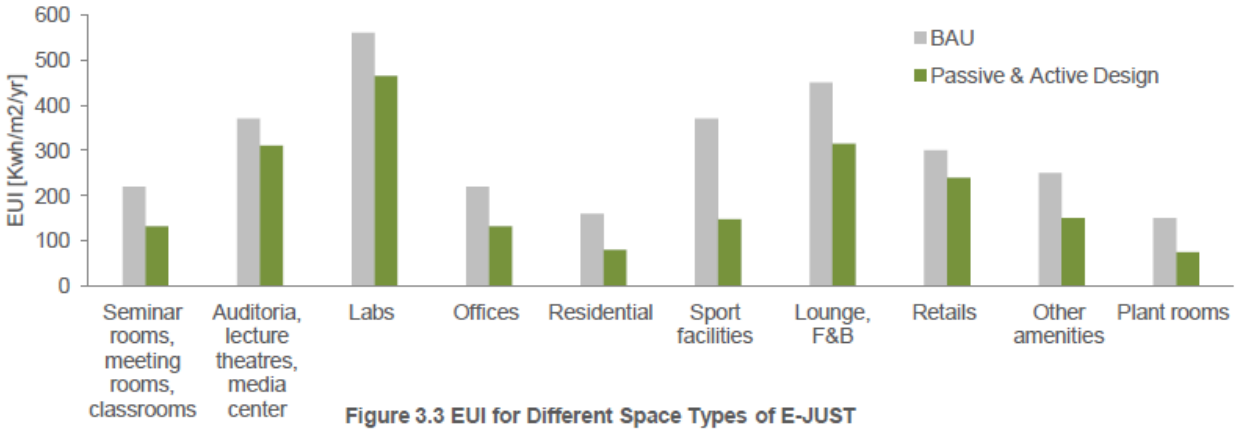
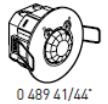
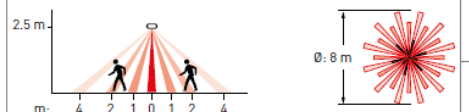
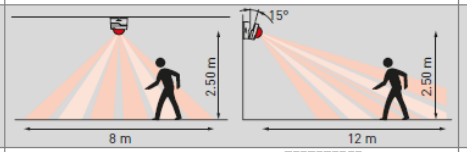
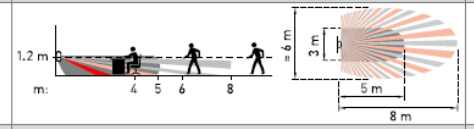
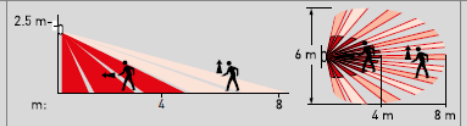
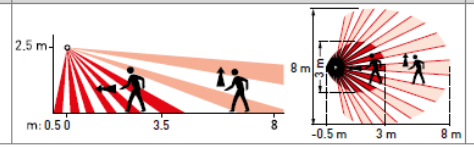


Figure 3.3 EUI for Different Space Types of E-JUST

SAVINGS
60%
according to EN 15193

Cat.Nos	Installation type technology	Range	Detection area	Degree protection	Examples of application
 0 489 41/44*		8 m		IP 41	Corridor, stairways, restrooms, underground car park, etc.
 0 489 48**/49**				IP 20	
 0 697 40/80		8 m		IP 55	Utility room, car park, cellar, outdoor etc.
 0 784 50		8 m		IP 40	Corridor, stairways, restrooms etc.
 0 489 42/45*		8 m		IP 42	Corridor, stairways, restrooms, utility room
 0 489 43/46*		8 m		IP 55	Utility room, car park, cellar, outdoor

* blister version - ** surface ceiling mounting version

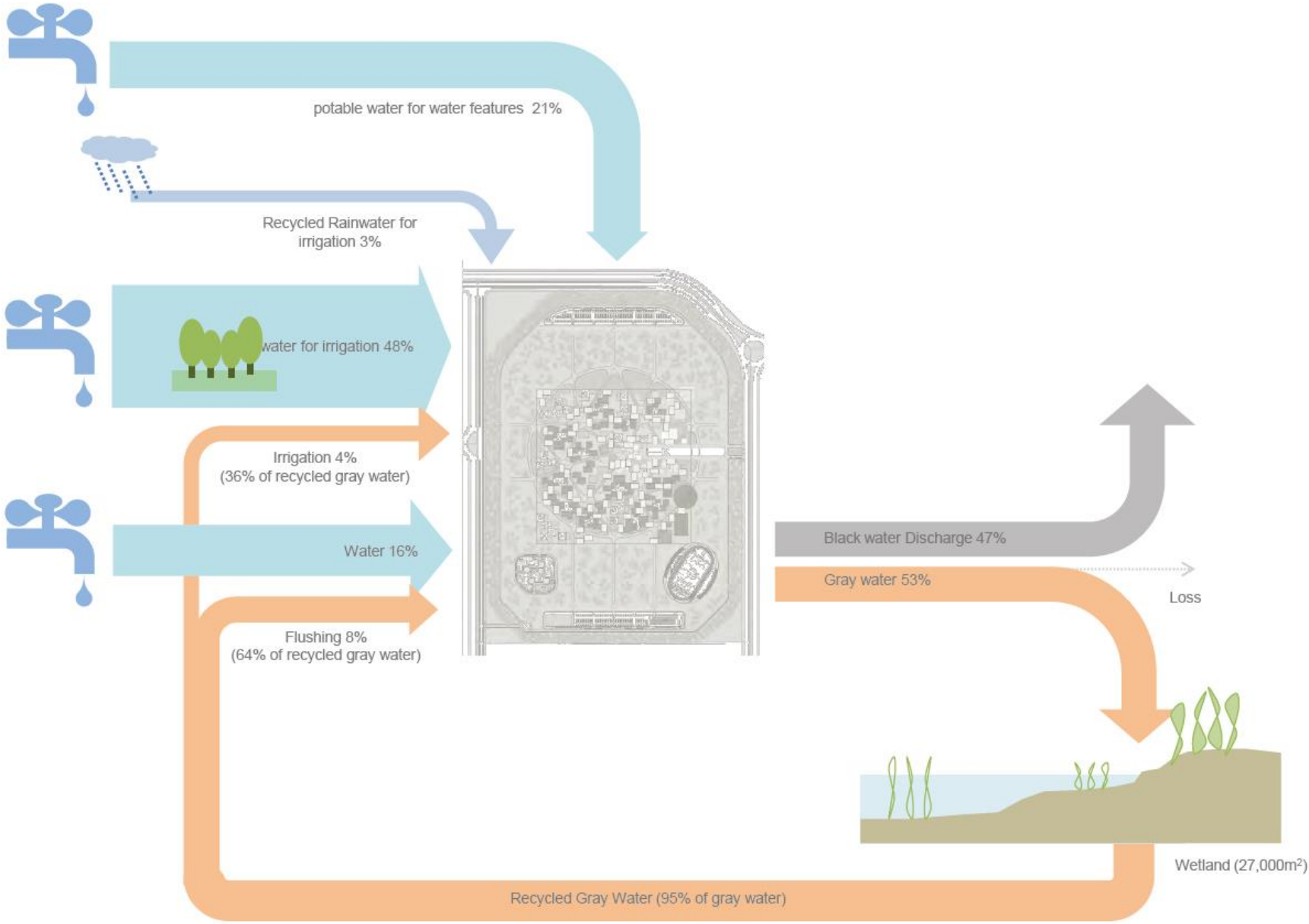
PUTTING A STOP TO ENERGY WASTE

MOTION AND LIGHTING MANAGEMENT SENSORS

DESIGN AND APPLICATION GUIDE

Low Energy Air Conditioning

Water Management Strategy



Flexible installations

Transportation

Eco-friendly transportation

Concept of complete street

Connecting campuses with bike lanes

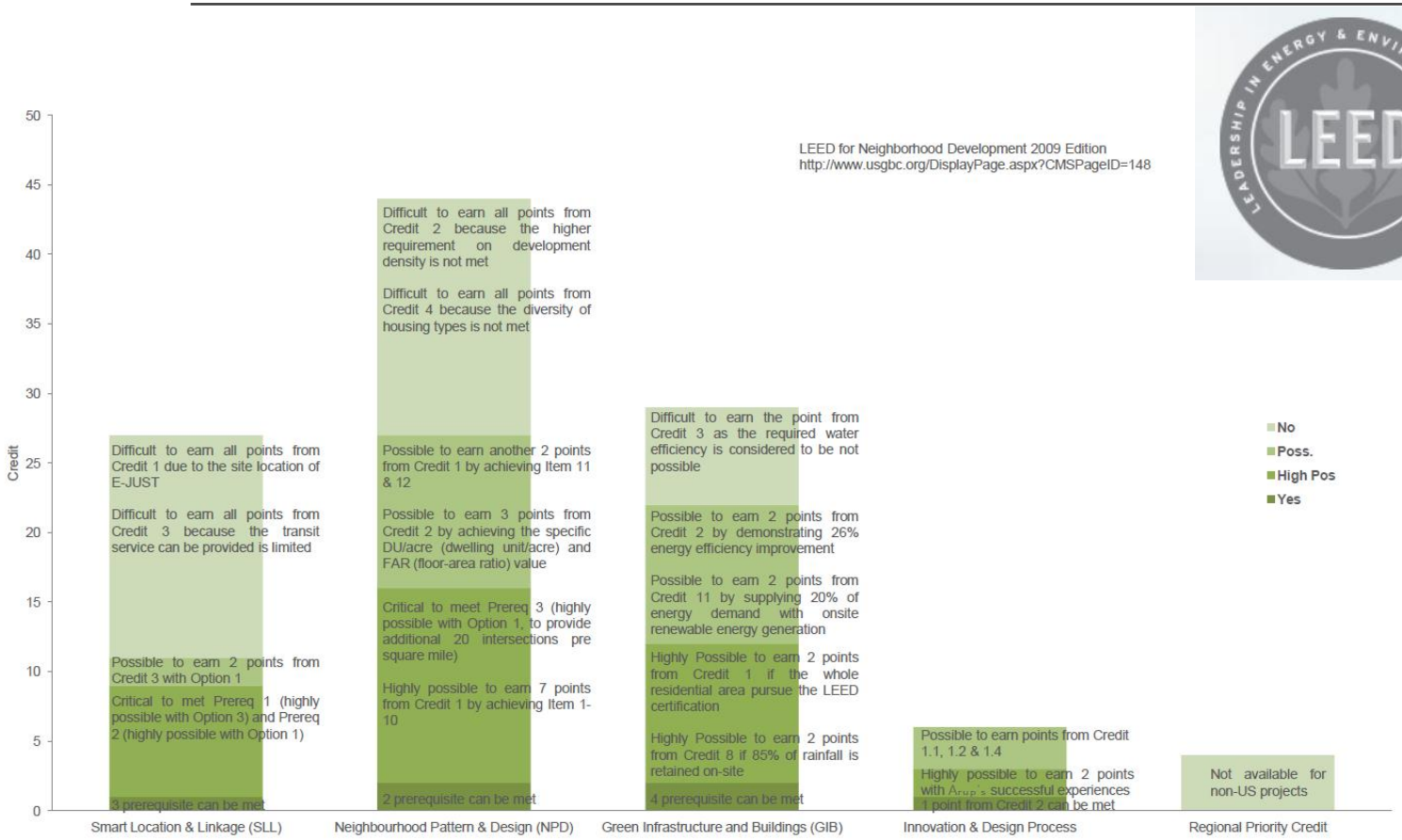
Pedestrian Priority and Bike lane

Pedestrian Priority and Bike lane

Electric cars

Waste Management

Masterplan Scale Pre-Assessment
LEED (Leadership in Energy and Environmental Design)



LEED ND

It is believed that E-Just can perform fairly well in all aspects except „Smart Location & Linkage" and „Regional Priority", achieving 66 credits and securing „gold" rating, assuming all prerequisites are met.

- Smart Location & Linkage;
- Neighbourhood Pattern & Design;
- Green Infrastructure and Buildings;
- Innovation and Design Process; and
- Regional Priority Credit

Egypt Japan University of Science & Technology
Alexandria, Egypt

ARUP

LEED - Neighborhood Development
Pre-assessment Scoring on Interim Masterplan

7/6/2013

		Credit					Intent & Requirements	Responsible Party	Assessment & Opportunity
		Available	Yes	High Poss	Poss.	No			
Credit Summary									
(1)	Smart Location & Linkage (SLL)	27	1	8	2	16			
(2)	Neighbourhood Pattern & Design (NPD)	44	2	14	11	17			
(3)	Green Infrastructure and Buildings (GIB)	29	2	10	10	7			
(4)	Innovation & Design Process	6	1	2	3	0	By achieving "Yes", "High Possible", & "Possible" points, E-JUST shall be possible to secure 60 credit points for GOLD rating, given all pre-requiresites are secured.		
(5)	Regional Priority Credit	4	0	0	0	4			
	Total	110	6	34	26	44			
Certified 40-49 points Silver 50-59 points Gold 60-79 points Platinum 80+ points									
Smart Location & Linkage (SLL)		27	1	8	2	16			
Prereq 1	Smart Location	Required		Y			Locate the project within planned water and wastewater service area, and provide new water and wastewater infrastruction for the project PLUS 1 of the requirement options	Client / Planner	Option 3 has the highest possibility. Project shall provide adequate transit modes connecting to other city districts, with daily trips no less than 60 & 40 rides on weekdays and weekend. Stops of transit services shall be located within 1/4 miles walking distance from all dwelling premises entrances.
Prereq 2	Imperilled Species and Ecological Communities	Required		Y			To conserve imperiled species & ecological communities. Project shall engage consultation and necessary biological surveys.	Client / Planner	Approach by Option1, conduct necessary EIA or similar consultation or biological survey, in order to certify there is no affected species or ecological community.
Prereq 3	Wetland and Water Body Conservation	Required	Y				No wetland, water bodies land within 50 Feet.	Client / Planner	There is no water bodies and wetlands.
Prereq 4	Agricultural Land Conservation	Required	Y				No sites without affect soils.	Client / Planner	There is no sites with affected soils.
Prereq 5	Floodplain Avoidance	Required	Y				Sites without floodplains, as defined by Local agency.	Client / Planner	No floodplains on site.
Credit 1	Preferred Locations	10		3		7	To encourage development close to existing municipal zones and infrastructure.	Client / Planner	Option 3 has the highest possibility. Earn at least 2 points under NPD C4. See NPD C4 for details.
Credit 2	Brownfield Redevelopment	2				2	Encourage reuse of contaminated land		Not Attempted
Credit 3	Locations with Reduced Automobile Dependence	7			2	5	Encourage development with less dependance on automobile. 1/4 mile distance to bus station.	Client / Planner	Further to SLL P1, Campus has to provide bus transportation with possible schedule, as weekdays 76 trips and weekend 50 trips
Credit 4	Bicycle Network and Storage	1				1	Promote bicycle use. There is an existing bicycle network with 1/4 mile and the project shall provide bicycle storage.	Client / Planner / Architect	NO bicycle network outside campus. Bicycle storage is also needed to facilitate the award of credit NPD-C5 and NPD-C7
Credit 5	Housing and Jobs Proximity	3		3			Encourage balanced community with diversity. Project with residential component at least 30%. Coverage of the ½ mile walking distance for Job Locations and walk routes from project center.	Client / Planner	Option 1. Have to provision 30% building for dormitory and stuff quarters.
Credit 6	Steep Slope Protection	1				1	Minimize erosion to protect habitat		No slope on site
Credit 7	Site Design for Habitat or Wetland and Water Body Conservation	1	1				To conserve native plants, wildlife habitat, wetlands & water bodies.	Client / Planner	Option 1. Further to SLL prerequisite 3, there is no wetland or water bodies within 100 feet.
Credit 8	Restoration of Habitat or Wetlands and Water Bodies	1		1			Use native plants to restore at least 10% of development footprint.	Client / Planner	From the provided masterplan, the landscape coverage is presumed to be more than 10%.
Credit 9	Long-Term Conservation Management of Habitat or Wetlands and Water Bodies	1		1			Create and commit to implementing a long-term (at least 10 year) management plan for new or existing on-site native habitats, water bodies and wetlands.	Client	Facility management to create corresponding documents.

Egypt Japan University of Science & Technology
Alexandria, Egypt

LEED - Neighborhood Development
Pre-assessment Scoring on Interim Masterplan

ARUP

7/6/2013

		Credit					Intent & Requirements	Responsible Party	Assessment & Opportunity
		Available	Yes	High Yes	Poss.	No			
Neighbourhood Pattern & Design (NPD)		44	2	14	11	17			
Prereq 1	Walkable Streets	Required	Y				To promote transportation efficiency, reduce vehicle dependence, encourage comfortable street environment. Requirements are: (a) 90% of new Building Frontage, principal functional entry have to face a public space (e.g. street, square,park ,BUT NOT a parking lot) and connected to sidewalk or equivalent provisions for walking. The square, park or plaza must be at least 50 feet wide at a point perpendicular to each entry. (b) At least 15% new streets frontage have building-height-to-street-width ration of 1:3. (c) Continuous sidewalks, 8 feet wide on retail, mixed use and 4 feet wide on others) (d) No more than 20% of the street frontages within the project are faced directly by garage and service bay opening	Client / Planner / Architect	Make sure the campus in the site fulfil these 4 conditions. (a) & (d) are considered fulfilled. (b) & (c) shall be implemented.
Prereq 2	Compact Development	Required	Y				To conserve land, promote livability, walkability. Residential component of the project at a density of 7 dwelling unites per acre. Non-residential components at a density of 0.50 FAR (floor-area-ratio) or greater.	Client / Planner / Architect	Approach the pre-requisite by Option 2. - with dormitory, dwelling unit ratio is considered fulfilled in campus - with most of buildings are 3 storeys in average, FAR is considered fulfilled. The exact area in acre available for residential uses and non-residential uses has to be clarified.
Prereq 3	Connected and Open Community	Required		Y			To promote high level of internal connectivity Project with internal streets ; at least 140 intersections per square mile. AND, at least on through street intersecting at the project boundary at least every 800 feet.	Client / Planner	As option 1 stated, the site is with internal streets, however, the density of intersection within the site may not reach the required 140 per square mile.
Credit 1	Walkable Streets	12		7	2	3	Further to NPD P1, more detail & quantifiable requirements: 1.) At least 80% of the total linear feet of street-facing building facade in the project is no more than 25 feet from the property line. 2.) At least 50% of the total linear feet of street-facing building facade in the project is no more than 18 feet from the property line. 3.) At least 50% of the total linear feet of mixed use and non-residential street facing building facades in the project is within 1 foot of a sidewalk or equivalent provision for walking. 4.) Functional entries to the building occur at an average of 75 feet or less along non-residential or mixed-use building or block. 5.) Continuous sidewalks are available along both sides of all streets within the project. A least 5 feet wide on non-retail or mixed-use blocks. 6.) At least 50% of the residential unit mush have an elevated finished floor no less than 24 inches above the sidewalk grade. 7.) At least 40% of all street frontage within the project has a minimum building-height-to-street-width ratio 1:3	Client / Planner / Architect	Item 1-10 are highly possible to be achieved. High Possibility for 7 Points. Item 11 & 12 need further verification & implementation. Securing these gives extra 1 possible point to each. Remaining 3 nos. of requirements are considered not feasible.

Annual Report

The campus was developed to be a real teaching and training for the sustainability

https://ejust.edu.eg/sustainability

Sustainability is part of everything **we** do

Bio-receptive Concrete

Image shows moss in its natural habitat (Site.2 (Glasshouse, growing on quay wall) before collecting on the left, and on the right, a close-up view (own image)

Climate Change Adaptation and Nature Conservation

أكاديمية البحث العلمي والتكنولوجيا
ACADEMY OF SCIENTIFIC RESEARCH AND TECHNOLOGY

وزارة التعليم العالي والبحث العلمي
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

Thematic area of the research project:

Green innovation to mitigate the impact of climate change

Bio-receptive Concrete Panels as an Innovative Approach for Buildings' Climate Change Mitigation and Adaptation

(Energy Efficient and Sustainable Buildings)


Thank You!