strategies towards zero energy architecture

AZRIL AMIR JAAFAR
The climatic challenges in Malaysia are caused by:

- High temperatures
- High humidity
- Excessive Radiation
- Glare
- Large overhang for sun shading
- Wind flow for ventilation
- Low thermal capacity material to promote air flow thru the wall
- shaded transition corridor
- air-well for ventilation and lighting
- heavy thermal capacity material to prevent heat penetration
### Sustainable Design Strategy

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Context</td>
<td>+ ACMV Strategy</td>
<td>+ Solar PV</td>
<td>+ BMS</td>
</tr>
<tr>
<td>+ Building usage + typology</td>
<td>+ Artificial lighting</td>
<td>+ Solar heat collector - AC - Hot water</td>
<td>+ Dali system etc</td>
</tr>
<tr>
<td>+ Building Orientation</td>
<td>+ Small power / plug load</td>
<td>+ Wind</td>
<td>+ Sensors</td>
</tr>
<tr>
<td>+ Space Planning</td>
<td></td>
<td>+ Water</td>
<td>+ Intelligent features</td>
</tr>
<tr>
<td>+ Building Envelope</td>
<td></td>
<td>+ Etc</td>
<td></td>
</tr>
<tr>
<td>+ Natural Light Strategy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ Efficient Use of resources - water - Material selection (embodied energy)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ Other contextual elements</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Office
- Government office
- High rise
- Cluster of buildings
- Putrajaya
  > urban setting
sustainable design strategy

240 kWh/m²/yr

100%

20%

20%

60%

137 kWh/m²/yr

Code-complying Buildings

Passive Design

Efficient M&E system

Renewable Energy

Enhanced Energy Management

4G3
shading of 4 blocks
south view
orientation | Planning strategy + minimising AC areas + Promote air flow in between buildings
Indoor street atrium concourse
west building facade
@ verandah / serambi
typical floor plan
Podium 1
Solar gains: 11th, 12th, 14th & 15th Floor

Solar gains: 10th, 13th, 16th & 17th Floor

date: Wed 21 Jun
sky garden
@ the tower
cut-away perspective of façade @ podium 2 & 3

Multi-functional light shelf:
- sunshade
- reflects daylight into office

office space
Office
- Private HQ
- Low rise
- Single Building
- Shah Alam
  > urban setting
to create an iconic and **progressive** architecture which reflects the aspiration and dynamism of *PKNS*

to harmoniously integrate a **global** outlook with a **Selangor** cultural identity

to integrate and enhance the **site context** and **surroundings** for the benefit of the **General Public**

**to achieve an environmentally responsive**, **energy efficient and sustainable building which complements its natural settings**

to introduce a **permeable and transparent** building which incorporates business and leisure into one location

to provide a place for **conference and celebrations** – for **PKNS and their customers** to enjoy
connect the city

Office program built around the public spaces
connecting with nature
sustainable design strategy

240 kWh/m²/yr

- Code-complying Buildings: 100%
- Passive Design: 30%
- Efficient M&E system: 25%
- Renewable Energy: 10%
- Enhanced Energy Management: 5%
- PKNS HQ: 30%

72 kWh/m²/yr
passive strategy - orientation
passive strategy - planning
services vs usable spaces
passive strategy - **planning**

+ space planning
+ AC vs Non AC spaces
passive strategy - planning
+ vertical arrangement
+ roof buffer
promote air flow that cool the plaza and the surrounding spaces.
promote air flow
promote **air flow** below roof
reduce heat island effect
Grass as insulation
High performance building envelope

- Less glazing on the eastern and western walls to reduce exposure to solar radiation
- Walls and windows (U-Values:
  - 0.50 W/m²K for walls,
  - 0.25 W/m²K green roof and
  - 1.2 W/m²K for the low-e double glazing).
Partial facade views of office blocks and floating meeting rooms with DGU curtain walls and Islamic motive sunscreen.

Close-up facade views of office blocks with DGU curtain walls and Islamic motive sunscreen.
Western facade

Shaded by large Overhang
Buffered by Outer screen and vertical planting
maximise daylighting

- Sloped ceiling
- Lighting Zones
- Glare Control
- Open Plan
naturally ventilated corridors & staircase
Solar thermal collectors power the AC systems, using thermal energy from the sun to drive an absorption chiller.
Overall water consumption is reduced by over 60%

- Water efficient fittings
- A Greywater Harvesting System
  - harvest water from ACMV condensate
  - used water from the basin taps, surau ablution
- Rainwater harvesting system

Rainwater harvested from roof
Rainwater stored in tank

Use in toilet
• Self closing tap
• Water efficiency fitting

Use for landscaping irrigation

Store for landscaping irrigation

• Dual flush
Material procurement that focuses on **regional, recycled** and **low VOC** non-toxic building materials.
PKNS HQ offset over 5,000 tones of CO2 emissions per year reducing energy usage by 70% compared to typical Malaysian office buildings.
sustainable transportation

downsizing carpark
giving parking priority to Green vehicles and carpools.

Provision of electric vehicle chargers for 5% of the car park lots.
connecting with nature
connecting with nature
City sustainable icon
Office
- Commercial Office
- High rise
- Office tower
- Johor Bahru
  > urban setting
> Basic SQUARE

> Interlocking SQUARE with Sky Garden on both side

> PARABOLIC CURVE with Sky Garden on both side
sustainable design strategy

- Code-complying Buildings: 100%
- Passive Design: 22%
- Efficient M&E system: 37%
- Renewable Energy: 3%
- Enhanced Energy Management: 38%
- The Project: 38%
Daylight Harvesting System
- Good for Health (improve circadian system), better sleep at night, improve productivity.
- Reduce energy consumption by 30% for tenants. (50% of lights will be switch off most of the time)

Very Good Indoor Air Quality
- Low VOC material. (High VOC will cause cancer)
- Lots of fresh air provided at low energy cost (from heat recovery system)
- UV Light in AHU to kill bacteria/viruses. Less sick leaves because air treated with UV light even someone is sick in office.
**Vertical Fin**
Extruded Alumn. Section in PVDF Finish with 1.5mm thk. Hairline Stainless Steel.

**DGU Glass**
Extruded Alumn. Section in PVDF Finish
6mm thk Clear HS + 1.52mm thk Clear PVB + 6mm thk Stoppray Green HS Soft-Coated
LOW-E + 12AS + 6mm thk Clear HS (HS : Heat Strengthened)

**Spanrel Glass**
6mm thk Dark Green HS + 1.52mm thk Clear PVB + 6mm thk Clear HS (with alumun. Backpan)
Airport Terminal
- Large Structure
- Sepang
Naturally ventilated and lit airport
Jeddah Haj Terminal
Large Centralized Concession hub in airport (relief from long walking distance)

Reduce walking distance by creating nodes.
Reduce AC area
- Non AC in circulation area

A/C area : 30%

Immigration : 4,700.59 sq.m
Concession : 34,744.96 sq.m
Holding Lounge : 29,727.47 sq.m
Efficient process - thru Automation