building green

Design Processes

by

Deependra Prashad (DPAP)
Practicing Architect & Sustainable Design Consultant

ArchitecturalDesignEcologicPlanning

Indira Paryavaran Bhawan

Design Brief for Indira Paryavaran Bhawan

Ministry of Environment and Forests (MoEF), an emerging ministry with a vital role for the future

A visitor, A citizen, An NGO, a professional, all would perceive the ministry's building as an embodiment of MoEF's vision and its role as an umbrella of the environmental preservation movement

Executing the Design Brief

Bringing different ministry segments together is itself a green imperitive

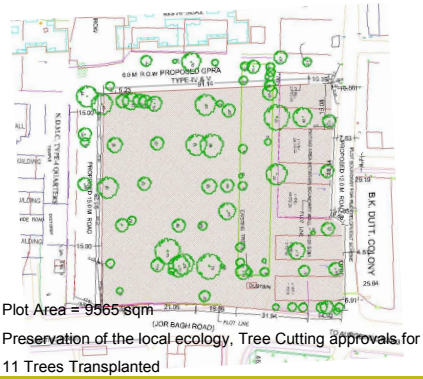
Executing the Design Brief

e+

The building is being designed as the first "Energy-Positive" - Urban - govt. - building

Architectural Concept

Developing the Plan



- Plot Area = 9565 sqm
- Preservation of the local ecology, Tree Cutting approvals for 46, but only 19 cut
- 11 Trees Transplanted
- Excavated Soil reutilized at other construction sites and the Zoo

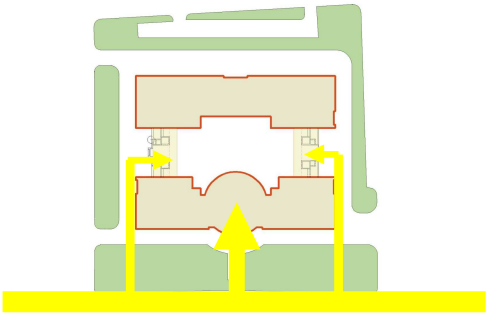
Developing the Plan

Wider Front Setback (22m) to protect front tree line

Preserve the integrity of the green street

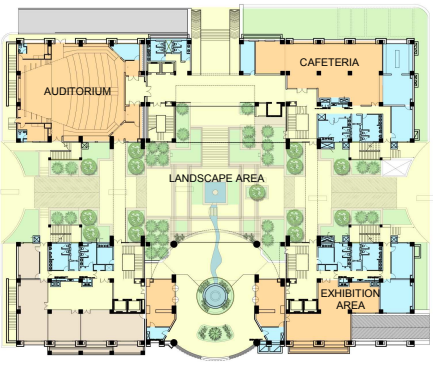
Emphasis on the North & South, Bringing the Greens in

Priority for the Pedestrian



Plan developed for direct pedestrian axis to East, North and West Entrance without crisscrossing vehicles

Developing the Plan – Ground Floor



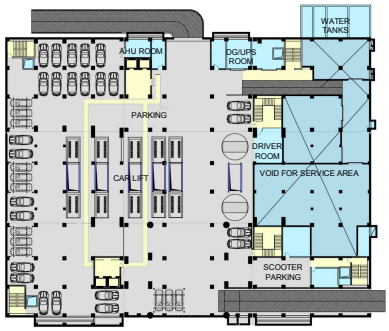
OFFICE
RECREATION
CIRCULATION
SERVICES

Ground Floor populated by Common and Public facilities

N

The Courtyard also helps in air movement besides being a shaded interaction space

Developing the Plan – Upper Basement



OFFICE
RECREATION
CIRCULATION
SERVICES

- Zero tolerance to surface parking

N

- First Basement Parking with Automated parking Below. Helps reduce volume of parking / excavation / embodied energy of structure

Developing the Plan – Lower Basement

OFFICE
RECREATION
CIRCULATION
SERVICES

N

- Automated Parking with 19sqm/car instead of 35sqm/car in manual parking

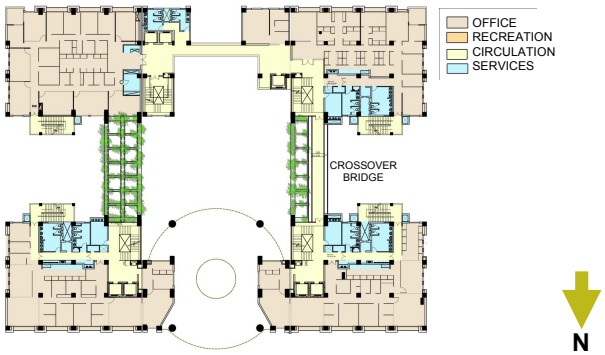
Developing the Plan – First Floor

OFFICE
RECREATION
CIRCULATION
SERVICES

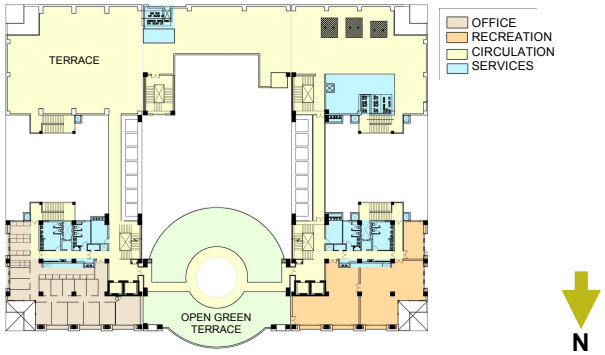
N

Keeping Service Areas, Staircases on low light areas. Efficient Usage of the perimeter to maximize daylit areas and views for the users

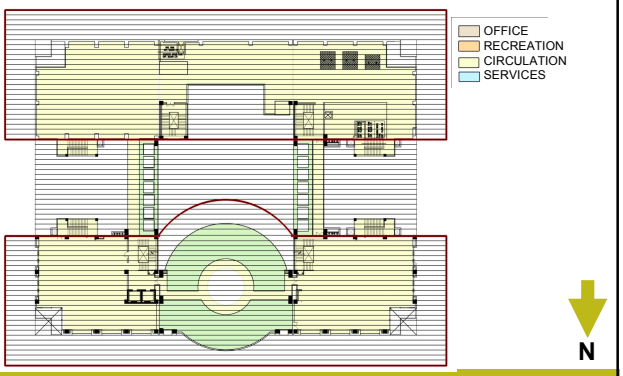
Developing the Plan – Third Floor



Developing the Plan – Seventh Floor

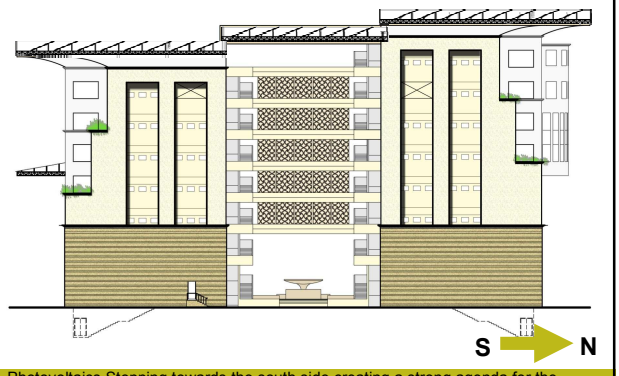


Toward an Energy Positive Approach



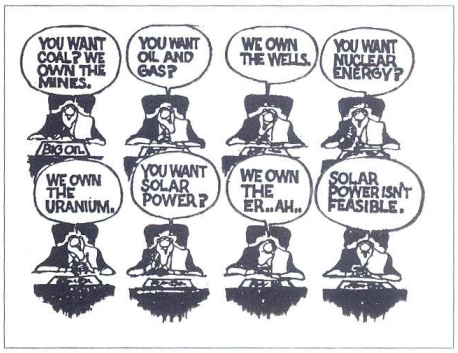
Provision of Solar Photovoltaics for Net Zero requirement also Shades the Roof

Towards an Energy Positive Approach



Photovoltaics Stepping towards the south side creating a strong agenda for the future for urban buildings on limited site areas

Toward an Energy Positive Approach



Powerful interests have held back the age of solar energy.

This is an initiative to mainstream Solar energy in urban areas as against coal and other non-renewables

Indira Paryavaran Bhawan

Elevations - North

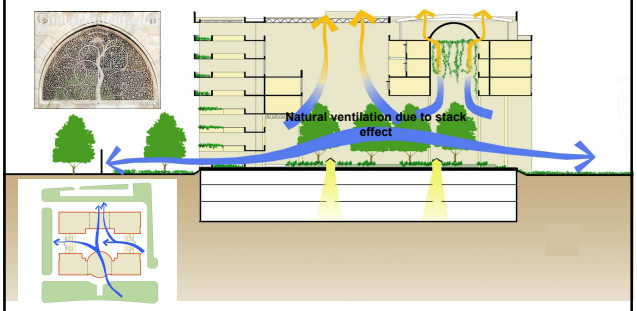
Superstructure = 19,088 sqm

Basement Area = 11,826 sqm

Total Area = 30,914 sqm

Environmental Response

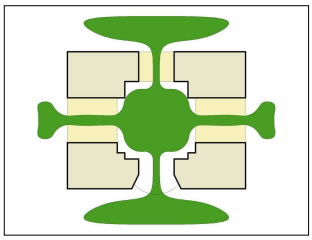
Utilizing lessons from nature & traditional buildings



- Maximum Ground Coverage Used (30%) to keep building height comparable to the surroundings

-Respecting the Eco-logic of the site. Building Punctures & jalis to Aid Cross Ventilation

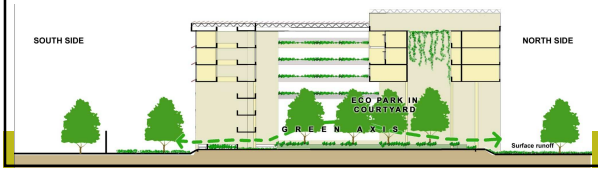
Showcasing Biodiversity



- Regenerative Architecture keeping the existing balance of nature to connect outdoor greens and the courtyard greens

- Showcase green bio diversity from Bio-climatic regions of Hot Dry, Composite, Warm Humid, Temperate, Cold Dry & Cold Cloudy

- Developing Winter Southside sunspaces for office workers + Deciduous trees



Showcasing Bio Diversity

Grassland Communities, Conservatory of Fruit yielding species, medicinal herbs, Native Flora

Demarcated Areas representing various forest ecosystems. For e

Subtropical mixed evergreen forest ecosystem

Top canopy - *Toona ciliata, Dalbergia latifolia, Mitragyna parvifolia, Syzygium cumini*

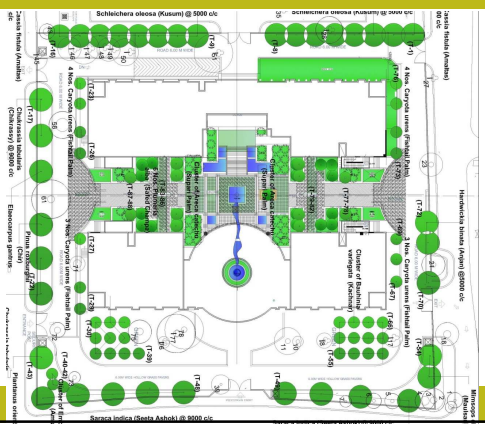
Middle storey - *Trewia nudiflora, Artocarpus lakoocha, Cinnamomum camphora,*

Shrub layer- *Dillenia indica, Coffea benghalensis, Murraya paniculata, Bauhinia malabarica,*

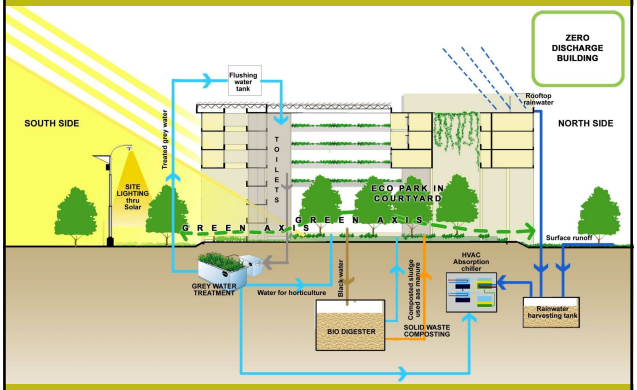
Herbs and Grasses- *Barleria cristata, Flemingia bracteata, Desmodium triflorum*

Climbers- *Vigna capensis, Combretum decandrum, Vitis paniculatum*

Showcasing Bio Diversity

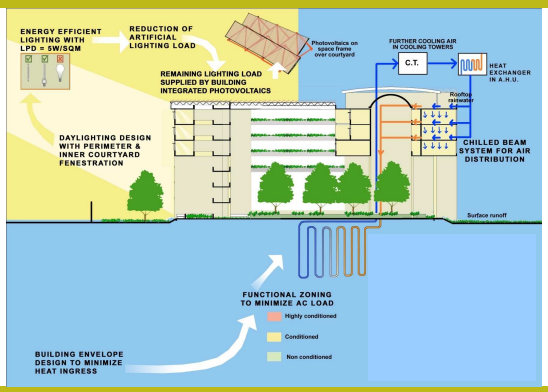


Site and Water Mgmt Strategies



Appropriate Shading from Summer Sun, while allowing in winter sun

Energy Conservation Measures

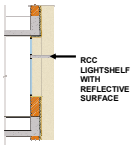


Usage of Materials with Low Embodied energy

Cool Roofs with high SRI tiles- high strength, hard wearing

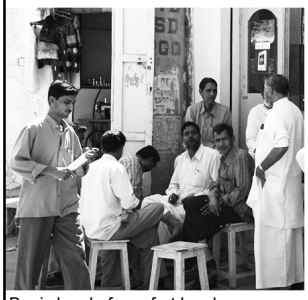
Terrazzo Flooring

- AAC Blocks with flyash for recycling and insulation
- Flyash based Plaster & Mortar
- Stone and Ferrocement Jalis
- Local Stone Flooring
- Bamboo Jute Composite Doors and frames & flooring
- High Efficiency Glass, high VLT, low SHGC & Low U-value, Optimized by shading
- Light Shelves for bringing in diffused sunlight



Zero Energy

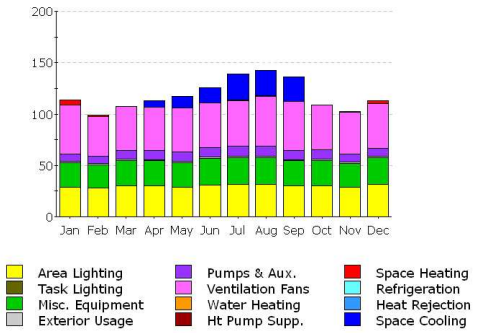
Changing Expectations in Thermal Comfort



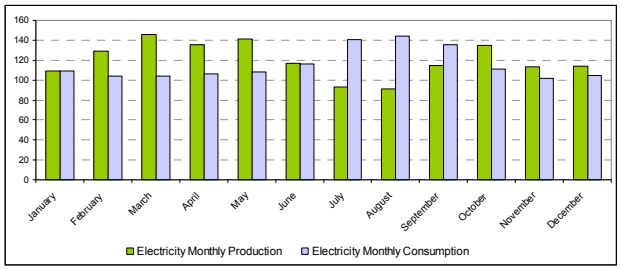
Basic level of comfort levels many of us are used to in climate appropriate clothing ⟷ Highly controlled temperatures which can reduce to the extremely cold. Clothing - Heavy Business wear

Executive Decision for the Setpoint temperature for summers set to 26 degC & Winters at 19 degC

Energy Consumption on Site



Annual Energy Production & Consumption (MWh)



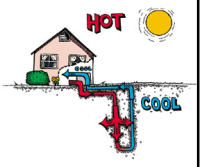
Energy Positive Building

- Extra Efficient (imported) Solar photo voltaic (SPV) Proposed (Terrace & Projections) : 800 kW
- Energy produced by above SPV Panels per year : 14,91,000 kWh
- Energy consumption for bldg / year : 14,21,000 kWh

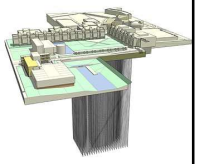
Performance Parameters

S.No	Description	Conventional	IPB
1	Air-conditioning Load	150 Sqft/TR	450 Sqft/TR
2	Lighting Power Density	1.1 W/Sqft (ECBC)	0.5 W/Sqft
3	Electrical Load	10 W/sqft	4.3 W/sqft

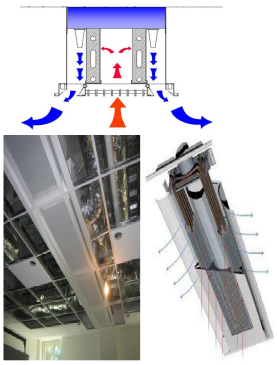
Geothermal Cooling



- Condenser water heat shall be rejected to earth by boring at suitable depth & sending hot water at 100°F (37.8° C) & back at 90^0 F (32.2° C).
- Enormous water saving since no make up water is required.
- Make up water pumping & treatment cost get eliminated.
- Saves cooling tower fan energy.



Active Chilled Beams



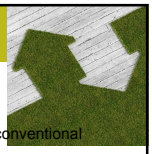
Working Principle

Supply air flows through nozzles in small air jets which induce room air to flow around the coil & air gets cooled.

Design / Constructional / operational advantages

- Reduces power consumption
- Easy Installation
- No noise as no moving parts
- Easy Air balancing activity
- No filters maintenance
- Save architectural space height

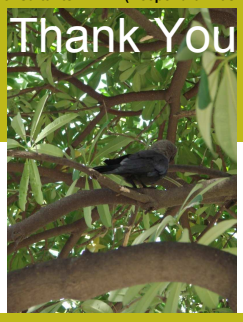
Net Zero Design



IPB reduces energy requirement by 70% overall vis-à-vis conventional

- N-S Orientation – Limiting WWR – Insulation on wall & roof– Extensive Greenery to reduce heat load
- Maximizing Day lighting to reduce lighting loads
- Extremely Low Lighting Power Density – 5w/sqm
- Planning to Minimize AC loads (Keeping open atrium for cross ventilation, Non conditioned lobbies)
- Efficient HVAC with Screw Chillers, VFD's, Chilled Beams
- Ground based heat exchange for Condenser Water
- Remote Computing - thin client servers
- Energy efficient appliances (5 star BEE)
- …. SPV's for the remaining load

Project Leader (CPWD- ADG Mr. P.K.Gupta)
Architectural Design: CPWD (Mr. R.K.Koshal)
Landscape Design: CPWD (Mr. Sodhi)
MEP Design: Spectral (Dr. P.C.Jain & Mr.S.Modi)
Commissioning: SGS
Interior Design: Kothari Associates
Green Building Consultants: DPAP (Deependra Prashad, Neeraj Kapoor)



Thank You

Projected Cost

	Rs. In Crores
• A A & E S	128.63
– Civil Incl WS SI	67.96
– Electrical	22.08
– Solar	8.50
– Furniture	8.35
– Mechanised Parking	14.00
– Local Bodies Charges	1.15
– Consultancy Services	0.70
– Misc incl Contigencies & labour Cess	5.89

Unit cost Rs 41,610 / sqm. Rs 34,380/sqm. excluding parking & furniture.