Strategies for Low Energy Communities in Urban India

EVALOC International Conference on Energy and Communities, Oxford, UK

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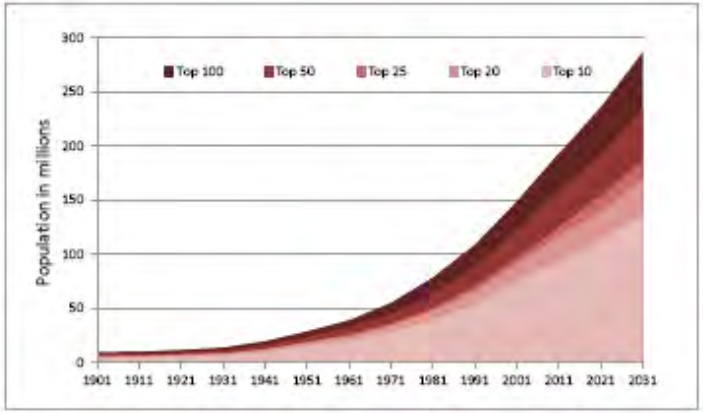
URBANIZATION TREND IN INDIA

Urban India: 2031

By 2031, it is projected that there will be 6 cities with a population greater than 10 million. A key question is how many Indians would live in how many medium and small towns - the bridge between a transforming rural and urban India?



Cities Size Class by Population
- 0 - 0.1 million
- 0.1 - 1 million
- 1 - 5 million
- 5 - 10 million
- 10 - 30 million

Source: IIHS Analysis based on Census of India. (Satellite Map, Google Inc.)

URBAN HOUSING DEMAND

Indicative size and potential of Affordable Housing in India

Tier I, II and III demand estimation (by number of households)					
Housing Category	Income Class (INR Million p.a.)	No. of Households – 2009-10 E (Million)	YoY Growth (%)	Value of House (INR Million)	Avg. Apartment Size (Sq. ft.)
Low Income	0.2 – 0.5	8.3	8.2	1 – 2	400 – 800
Mid Income	0.5 – 1.0	3.5	17.6	2 – 4	800 – 1000
Higher Mid Income	1.0 – 2.0	2.2	21.5	3.5 – 8	1000 – 1300
High Income	2.0 – 5.0	0.9	22.9	7.5 – 20	1250 – 1750
Luxury	5.0+	0.4	26.6	20+	2500+

Source: Credit Suisse, Knight Frank, KPMG Analysis

Currently 4-5 million households in the middle and low income categories require housing in urban areas. Out of these 2.1 million homes are required in seven major cities alone.

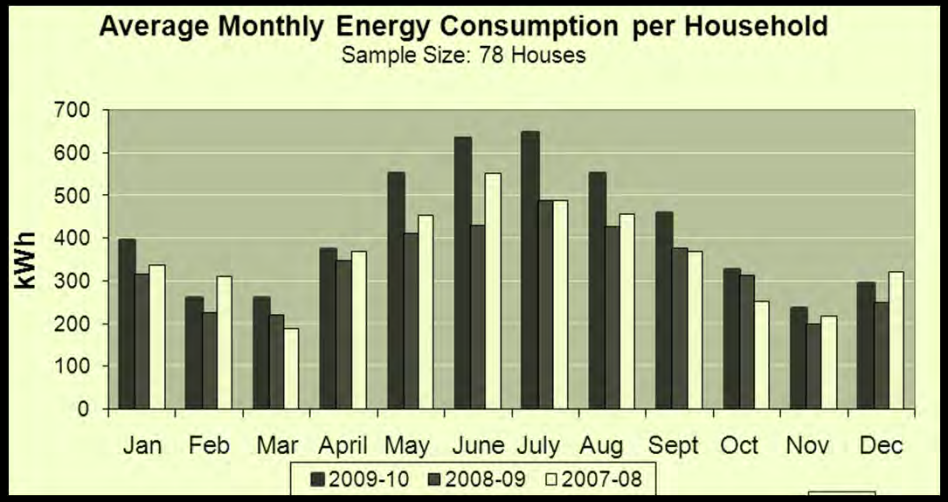


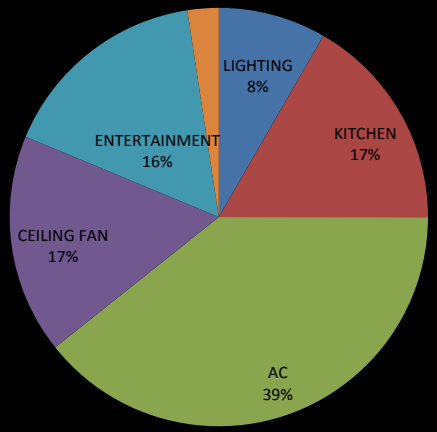

For the lower income group, moving out of slums and informal construction into formal apartment housing marks a transition into the 'middle class'.

The predominant form of urban housing will be low rise high density apartments owing to the high cost of land.

FUTURE OF THE URBAN MIDDLE CLASS

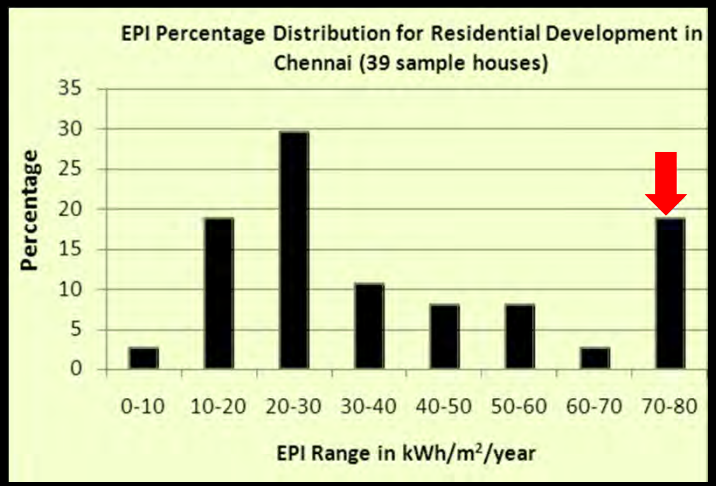
ELECTRICITY CONSUMPTION PATTERN : sample household survey

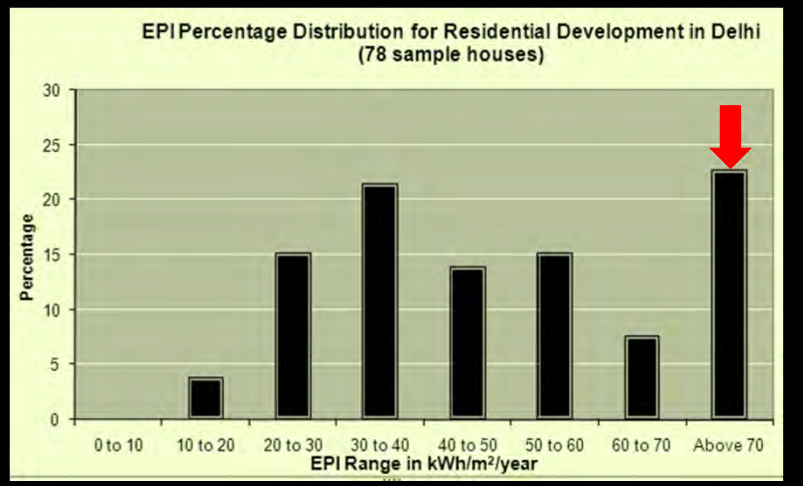




In a typical Chennai home air-conditioning and ceiling fans – electromechanical aids for comfort – consumes approximately 55 % of the energy bill .

ELECTRICITY CONSUMPTION PATTERN : sample household survey





There is an emerging trend of houses with EPI above 80 kWh/sq.m./year which are typically houses with 2 or more air conditioners and 4 or more occupants. This trend is visible in both climate types.

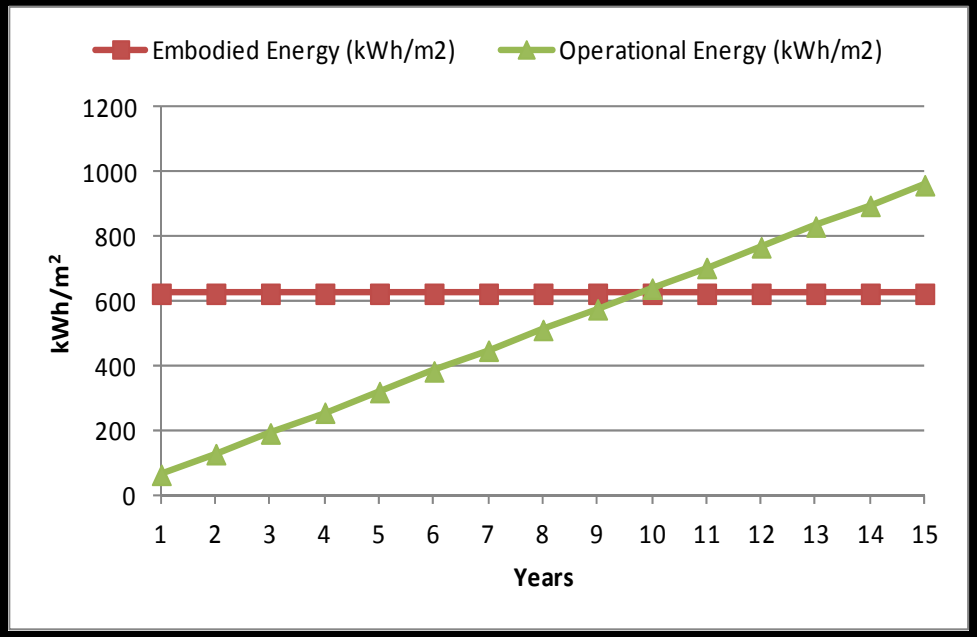
EMBODIED ENERGY IN CONSTRUCTION

	Embodied Energy		Carbon emissions	
	MJ/sqm	GJ/sqm	$KgCO_2/sm$	tCO_2/sqm
Low rise				
DDA (typical)	2028.91	2.03	229.43	0.23
IIPH	1374.43	1.37	177.43	0.18
High rise				
HEWO (typical)	2367.40	2.37	260.03	0.26
IIIT-D	2,615.4	2.6	290.6	0.29

- **For low rise buildings,** considerable reduction in embodied energy might be possible by careful designing and using materials with low embodied energy.
- **The range of CO2 emissions** shows that in a well designed low rise building emissions are **30-40% less** than an average high rise building incorporating a RCC frame structure.

Giving preference to low rise buildings (G+4) in residential development and using low embodied energy materials for external walling of a potential 20 -40 % reduction in EE/Sq. M. of residential space compared to BAU .

EMBODIED ENERGY IN CONSTRUCTION



At a conservative estimate the impact of embodied energy at the start of a residential building's life is as much as operational energy spent over 10 years .

HOUSING DELIVERY SYSTEMS

Housing Co-operatives & Institutional Rental Housing

•Institutional or participatory involvement towards environmental responsibility.

•Residents share the collective values and would consciously strive to abide by them.

•This would be irrespective of requirement of environmental law.

•This form of housing delivery may account for 10% of total housing stock.

Real Estate Market

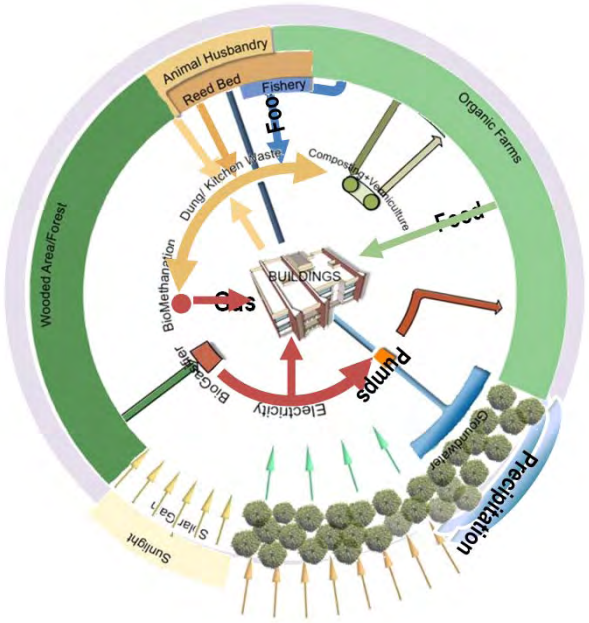
•Commitment to environmental responsibility subject to financial considerations and market preferences.

•The challenge is to socialize the future community into environmental responsibility and to leverage environmental action by design.

•Environmental responsibility will flow when environmental law is in place.

•This form of housing delivery will account for the bulk of total housing stock.

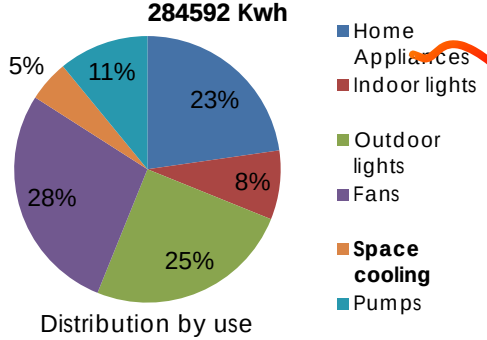
EXAMPLE: INDUSTRIAL HOUSING FOR EMPLOYEES



A comprehensive strategy is evolved – including onsite energy generation from biomass harvested from energy plantation as well as biogas from recycled organic waste.

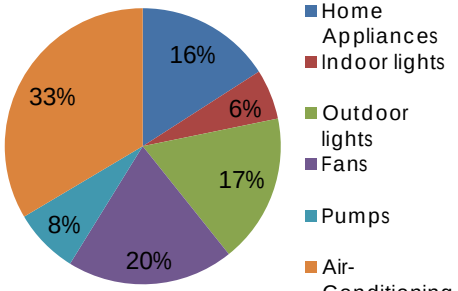
EXAMPLE: INDUSTRIAL HOUSING FOR EMPLOYEES

Estimated Annual Electricity Consumption
with Low energy space cooling
284592 Kwh

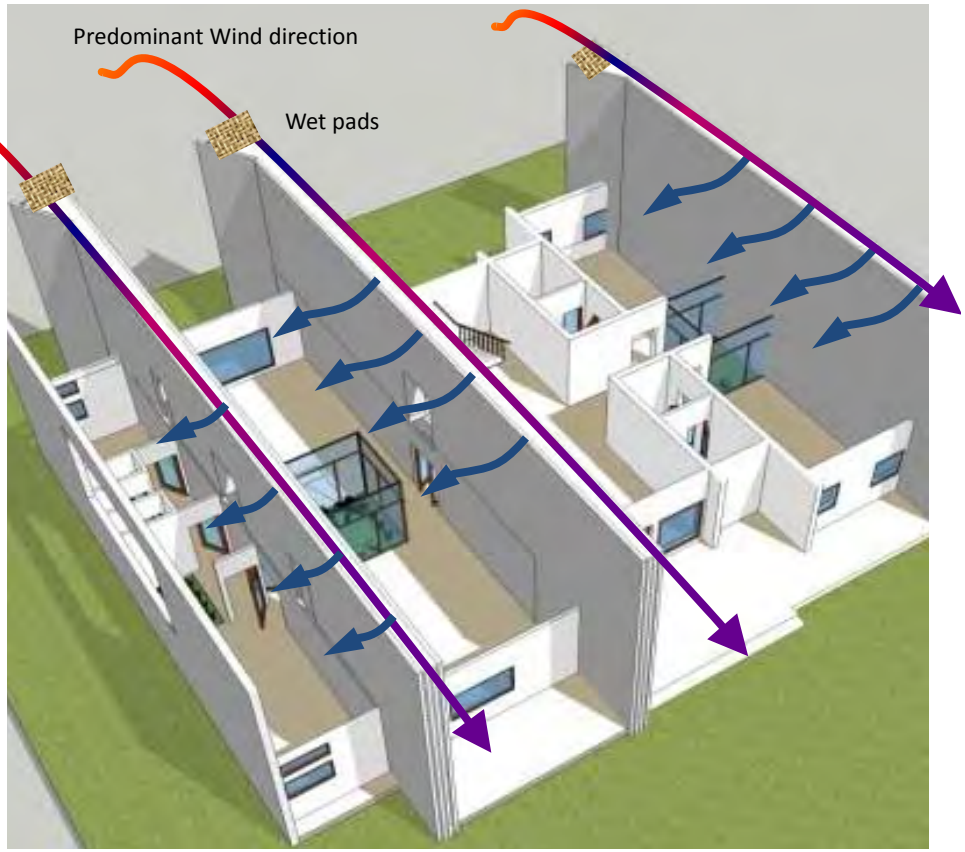


Distribution by use

Estimated Annual Electricity Consumption
with Air conditioning
406727 Kwh

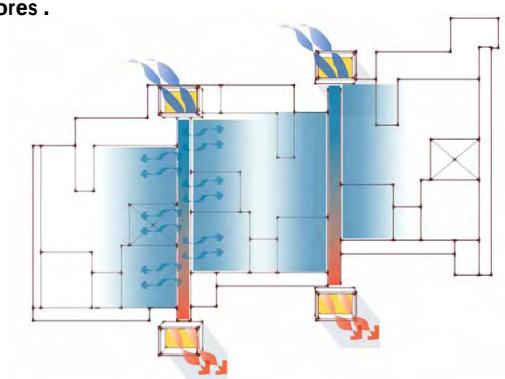


Distribution by use

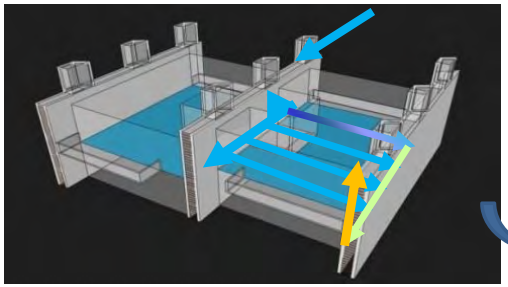


EXAMPLE: INDUSTRIAL HOUSING FOR EMPLOYEES - PROTOTYPE

1. Vertical cooling ducts formed between parallel load bearing masonry walls , which act as coolth stores .



2. Horizontal cooling ducts formed by Precast Hollow Block floor construction , which also become coolth stores .



Evaporative cooling system integrated with floor and wall structure is a shared facility between neighbors and requires a co-operative management arrangement.

Priority given to passive design for energy conservation.

On site T Beams and Hollow block production for floor constructions

EXAMPLE: DEVELOPER'S AFFORDABLE HOUSING

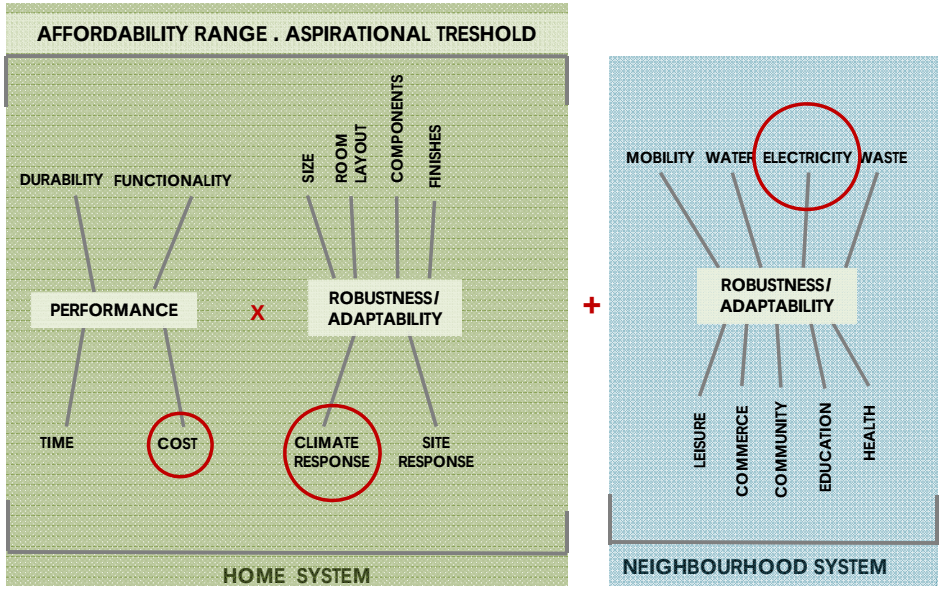
- The affordable segment dwelling units target households with earnings of Rs.10,000) to Rs.35,000 **(140-500 Euros)** per month.

- The order of criteria for choosing to buy a home is: price, followed by location, followed by size of accommodation, followed by quality of construction & finishes, followed by quality of immediate neighborhood environment.

- Essential components of a dwelling unit: Multipurpose Room/Hall, Kitchen, WC & Bath. This is extendable to one or two additional bedrooms. The hall is to be spacious, bedrooms can be tight. Kitchen to be a separate space outside the hall.

- **The new home is an aspirational life style statement of rising into the "middle class".**

EXAMPLE: DEVELOPER'S AFFORDABLE HOUSING



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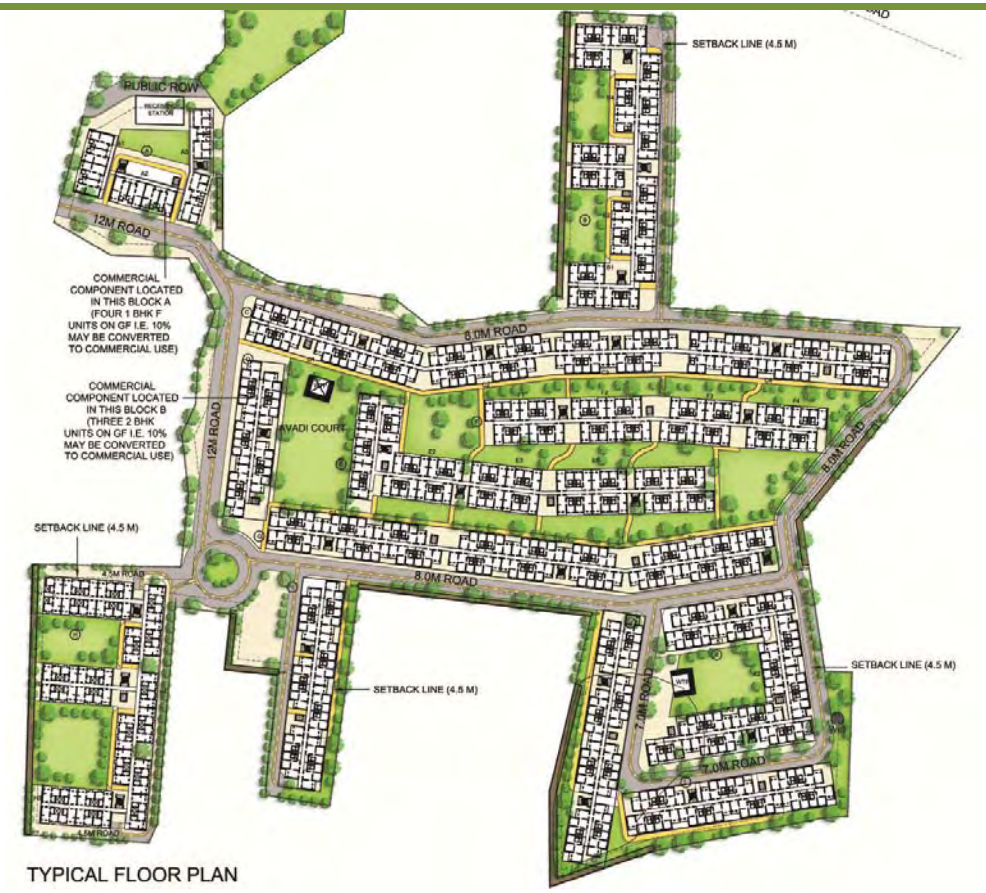
PRODUCT SUSTAINABILITY

Expenditure on building infrastructure and maintenance and electricity bills is of concern to the buyer.

- The standardized product of house types will need to be robust
- It must anticipate the lifestyle change as buyers become middle class and form a community.
- It must be adaptable to respond to different climatic locations.

EXAMPLE: DEVELOPER'S AFFORDABLE HOUSING



TYPICAL FLOOR PLAN

G.C. ACHIEVED = 17985 SQ M (33.6%)
FSI =1.31

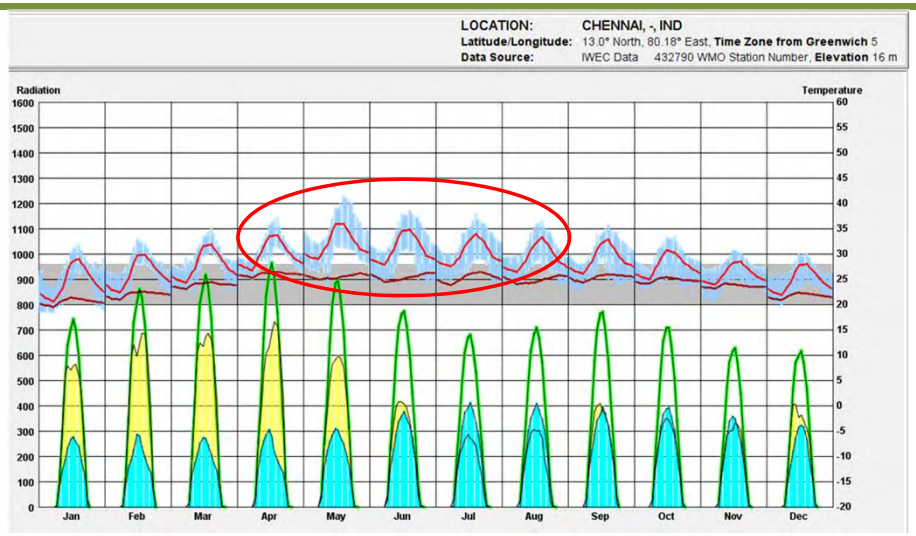
LAND UTILIZATION SATURATED

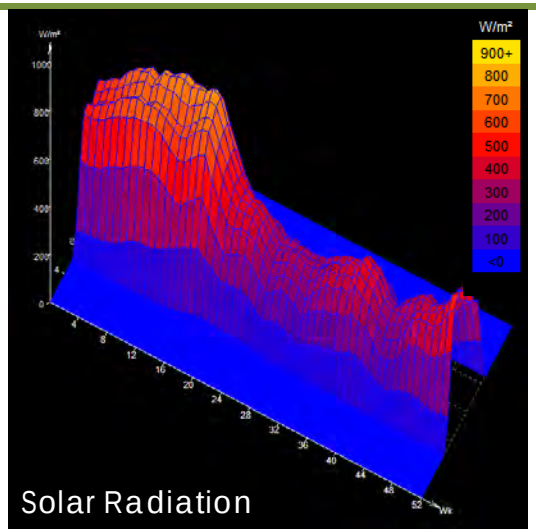
Dwelling Unit Configuration

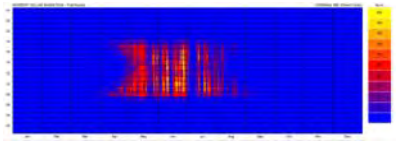
1BHK – 29 sqm	= 176
1BHK – 34 sqm	= 460
1BHK – 41 sqm	= 32
2BHK – 46 sqm	= 612
Total	= 1280 units

- 32 Local Shops
- 126 nos cars and 1280 two wheelers
- Bus Stop / taxi stand

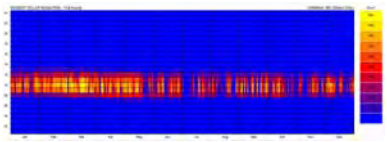
CLIMATIC CONTEXT – HOT AND HUMID



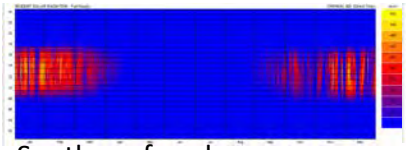




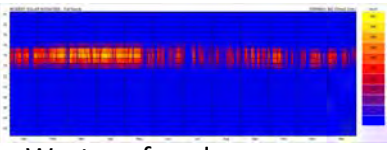
Northern facade



Eastern facade



Southern facade



Western facade

SITE LEVEL STRATEGY - ORIENTATION

SITE LEVEL STRATEGY – MICRO CLIMATE

TYPICAL FLOOR PLAN

- **Vehicular movement (hard paved) restricted to periphery**
- **Soft ground with shady trees interspersed – shaded outdoors.**
- **Breaks for breeze.**

SITE LEVEL STRATEGY – OPERATIONAL ENERGY

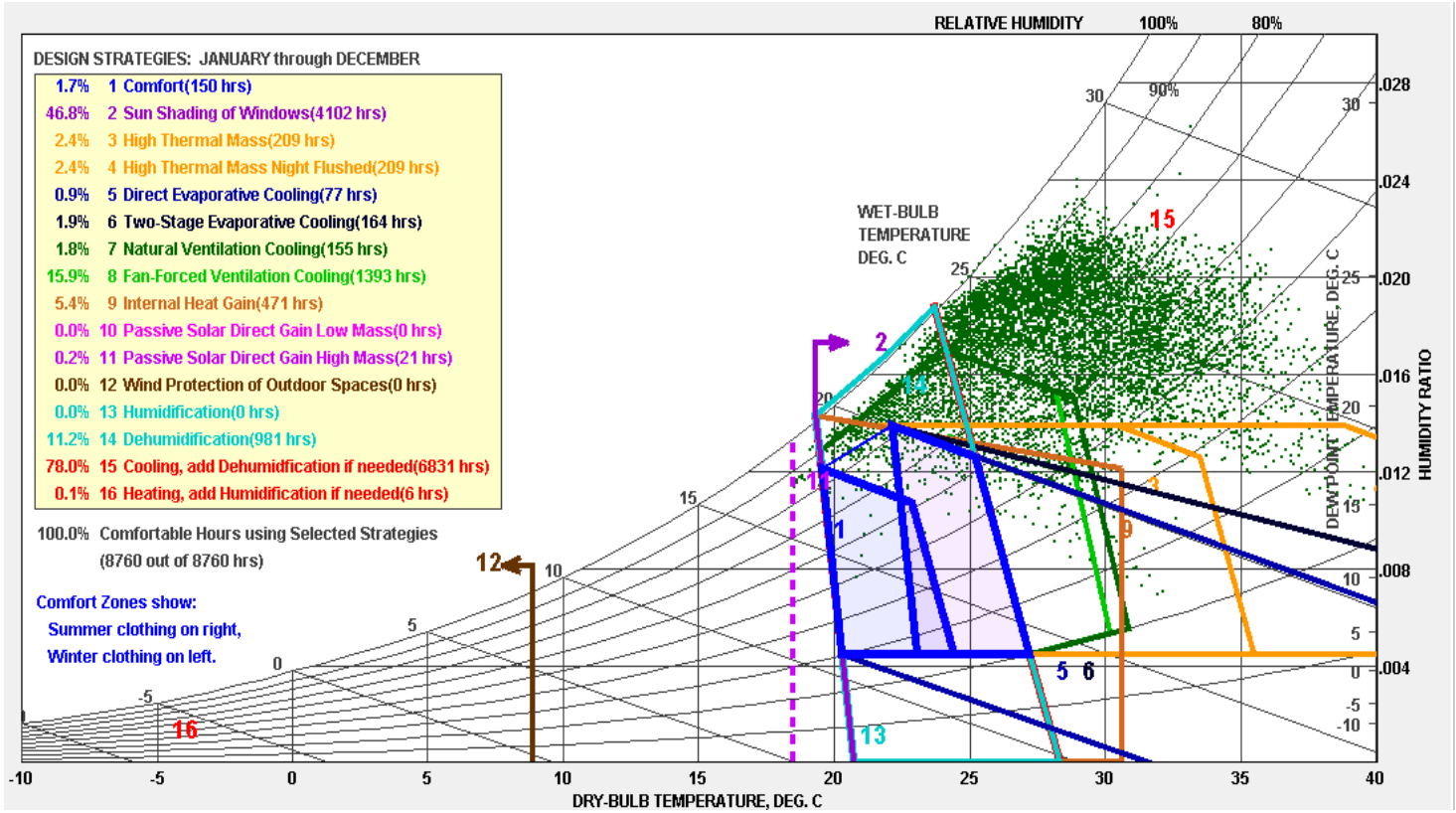
•Four storey height – minimum dependence on lifts.

•Minimum pumping energy for conveying water.

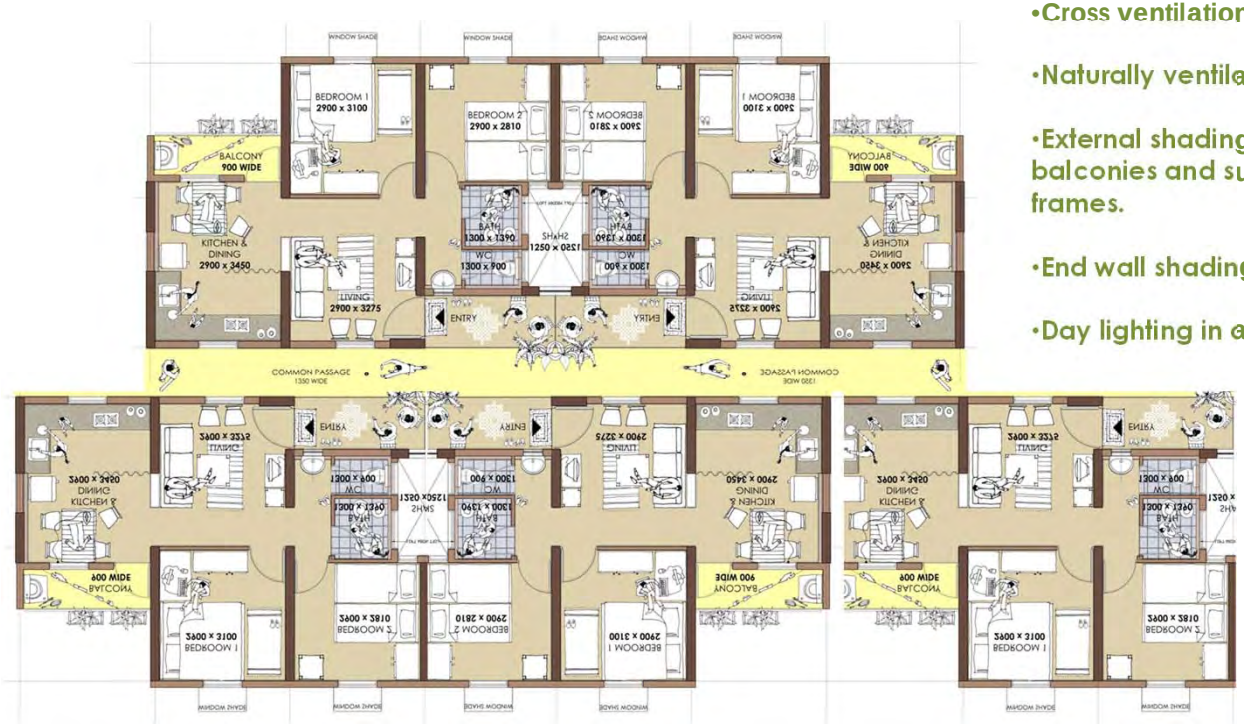
•Encouraging pedestrianisation and public transport use

•Recycling of treated waste water to reduce ground water pumping.

BUILDING LEVEL COMFORT STRATEGIES

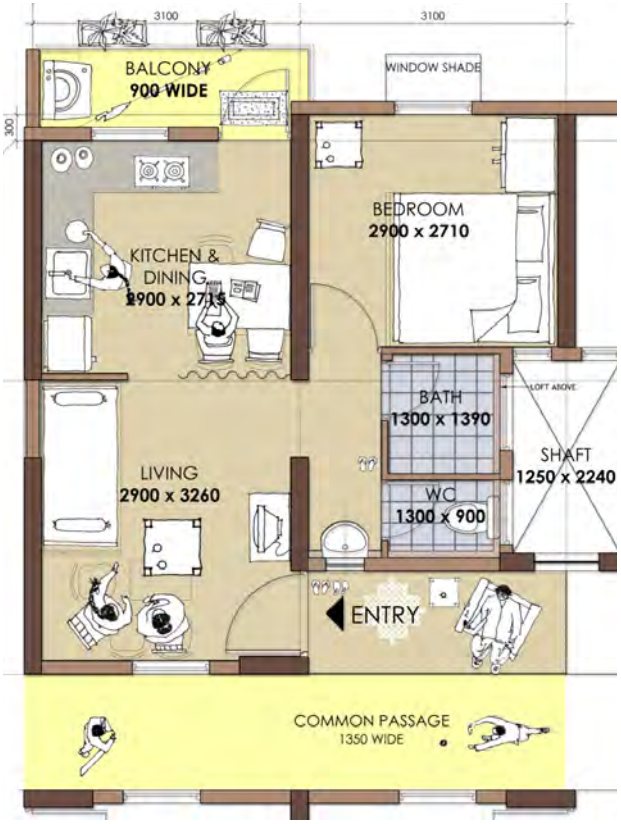


BUILDING LEVEL STRATEGY – PASSIVE DESIGN



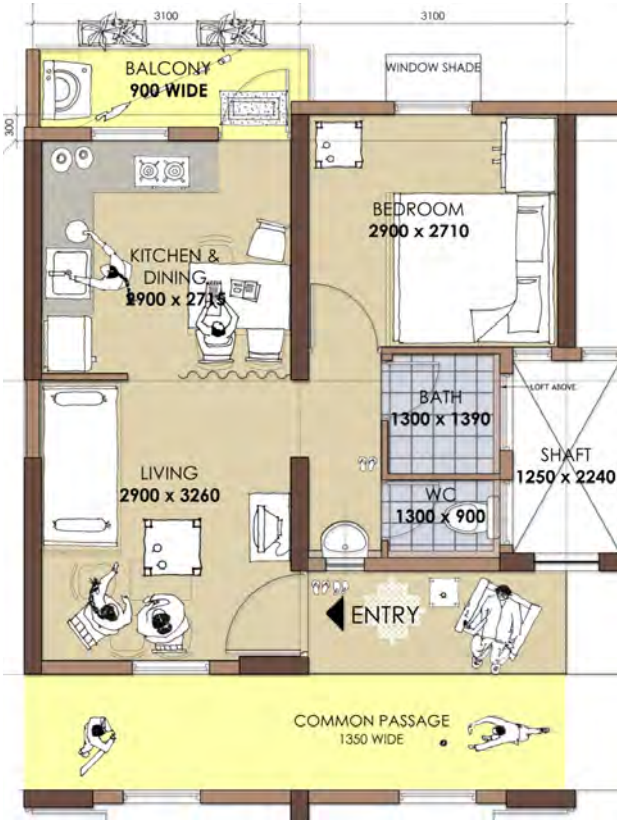
- Row housing to reduce peripheral wall exposure.
- Cross ventilation
- Naturally ventilated toilets.
- External shading system – balconies and sun shade frames.
- End wall shading
- Day lighting in all spaces

BUILDING LEVEL STRATEGY – PASSIVE DESIGN



- **Heavy thermal mass shielded from external temperatures**
- **Autoclaved Aerated Concrete blocks as an insulating envelope**
- **End concrete walls shaded by external louvers**

BUILDING LEVEL STRATEGY – PROSPECTIVE DESIGN

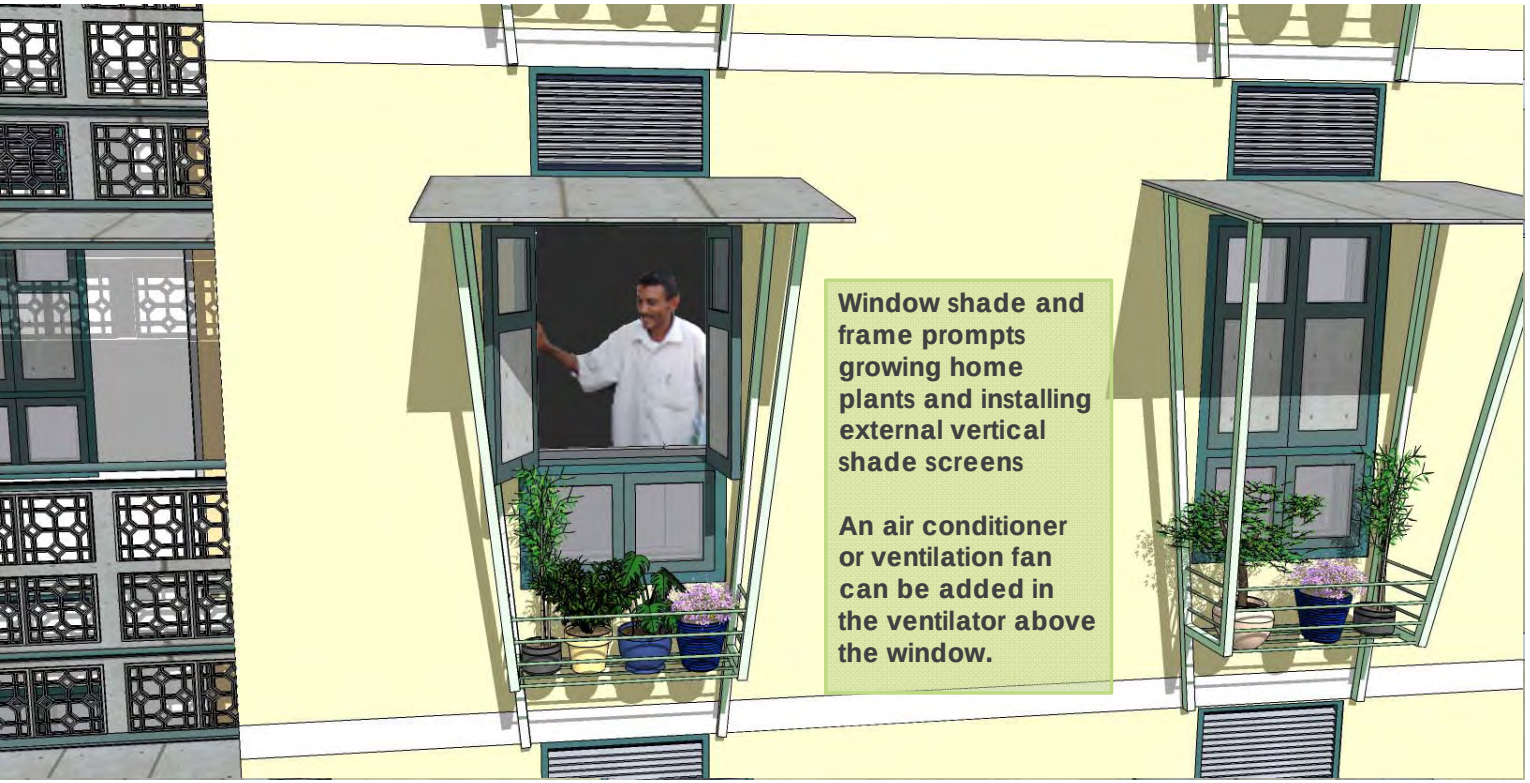


- **For homes to be affordable minimum essential provisions are provided.**
- **Improvements and additions to these provisions are to be anticipated as income and aspirations rise.**
- **Consumption is to be disciplined!**
- **Electric connection limited to 5 kW supply per home.**
- **Water supply is metered.**

Kitchen

Mechanical exhaust may be added.

BUILDING LEVEL STRATEGY – WINDOWS AND BALCONIES



BUILDING LEVEL STRATEGY – WINDOWS AND BALCONIES

BUILDING LEVEL STRATEGY – WINDOWS AND BALCONIES

Today Two years later – mechanical ventilation / air conditioning (April to August – part time)

‘WE CARE’ : ENVIRONMENTAL CONCERNS – DEVELOPER’S RESPONSIBILITY

WATER EFFICIENCY

•During Construction
Minimizing water for curing

•Post Construction

•Rain Water Harvesting
Ground water recharge

•Water Recycling
For flushing and irrigation

•Low Flow Fixtures

•Metered fresh water supply
Individual home meters

ENERGY EFFICIENCY

•Day lighting
All rooms and passages day lit

•Reducing cooling load
Natural ventilation, shading,
insulation, kitchen exhaust

•Efficient Light Fixtures

•Minimum building height
Reducing dependence on lifts, reducing pumping energy

•Low embodied energy structural system

MAINTENANCE AND REGULATION OF SERVICE INFRASTRUCTURE

•Water
Centralized pumping, storage and treatment

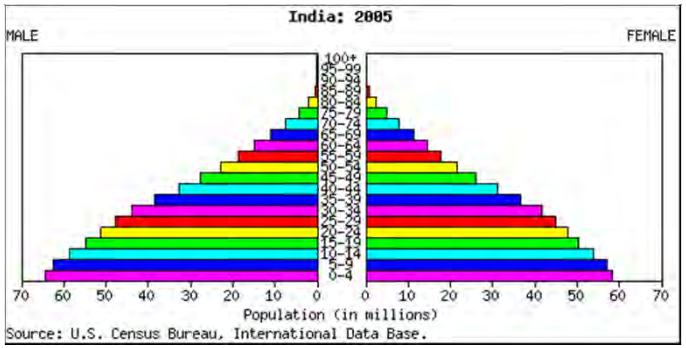
•Sewage Treatment – decentralized
Basic level treatment by ‘natural’ system,
Treatment for recycling by low energy system

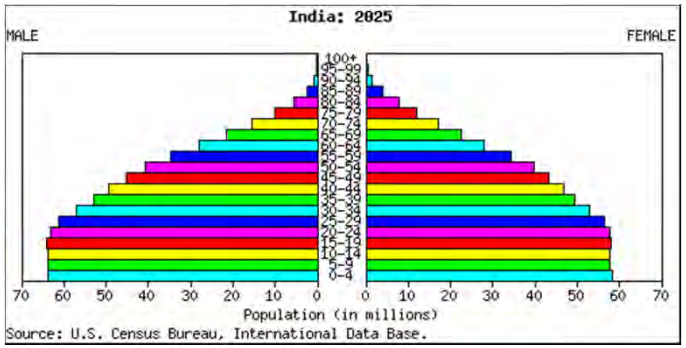
•Waste Disposal
Sorting at home,
composting, recycling

•Shared Spaces
Low maintenance landscape

•Electricity
Solar PV for pumps,
Minimum diesel gen back-up

CHANGING DEMOGRAPHY





The changing demographic profile indicates a greater attention to the needs of urban youth – adolescent, single, recent migrant, young nuclear families, with greater social and geographic mobility.

Anticipating higher levels of education with environmental awareness to create environment conscious lifestyles.

‘WE WILL’: OPPORTUNITIES OF COLLECTIVE LIVING – COMMUNITY PARTICIPATION

•RECEPTION
Resident Welcome
Orientation
Property Exchange
Bills

•HOME SUPPORT
Solar Kitchen
Laundry
Organic Food Services

•INFORMATION AND COMMUNICATION
VIRTUAL NOTICE BOARD
I. Community TV
II. Telephony
III. Internet

•TRANSPORT CONNECTIVITY
Bus Stop
Rickshaws/Taxi Bay
Rentable Bikes
Parking facility for personal vehicles

•TRADE AND EXCHANGE
Home Improvement Services
Second Hand Home Appliances
Furniture
Repairs
Grocery
Beautician
Hairdresser Etc.

‘WE WILL’: OPPORTUNITIES OF COLLECTIVE LIVING – COMMUNITY PARTICIPATION

•EDUCATION AND TRAINING

VERANDAH	VIHARA
Yoga	Tuition
Martial Arts	Craft
Dance	Music
	Theatre

•RECREATION AND CELEBRATION

Large Open Pandal for Celebration
Catering Corner
Smaller sheltered spaces for recreation

SUSTAINABLE LIFESTYLE - LEISURE, HEALTH AND PRODUCTIVITY

TRACKING PROGRESS

Research & Development Project - A special collaborative unit to be set up between:

- **Developer**
- **Bureau of Energy Efficiency, India**
- **Research Consultants, and**
- **Residents Association**

TRACKING PROGRESS

- Obtain electricity expenditure history of prospective buyers in their present accommodations.
- Obtain information on electricity consumption according to use – lighting, electrical gadgets, appliances etc.
- Map electrical consumption individually and collectively in new occupied homes.
- Develop community level exchange of information on household wise electricity consumption – creating awareness and setting bench marks for efficient use of electricity.
- Share data on electricity consumption for support infrastructure – lifts, external lighting, sewerage treatment and pumps.
- Encourage escalating tariff structure for water consumption.
- Celebrate exemplary achievements

PROPOSE ENERGY EFFICIENCY BENCHMARKS, GOALS AND MANAGEMENT SYSTEMS FOR ENVIRONMENTAL RESPONSIBILITY