PROJECT DAKSH
Indian Institute of Technology, Bombay
National Institute of Design, Ahmedabad
E VOLUTION O F A R T I S T V I L L A G E, B E L A P U R

Past 1978

Present 2020

Future
RESIDENT’S PAIN POINTS

- No vehicle access in case of emergencies
- Flooding and waterlogging during monsoon
- Lack of dedicated parking spaces
- Reduced natural lighting and ventilation
CONCEPTUAL STRATEGY

- Community living
- Compact and functional
- Scalable design
- Customisable design
- Future provisions
- Resource sharing
AFFORDABLE SOLUTION

Construction Cost Comparison

Housing Price as a Multiple of Monthly Income

Competitive and affordable pricing
QUICKER CONSTRUCTION

Cycle Time (Weeks)
A Single Bedroom House

Cycle Time in weeks

0 4 8 12 16 20
Minimally Code Compliant House of a Similar Design Proposed Design

- Plywood Panel
- Ply Frame
- uPVC Sliding window with Saint Gobain’s Double Glazed Nano Silver Chroma Glass
- Veneer Flooring
- GFRG Wall finished with paint
- 35mm Fiber Glass Door
- Greenlam Laminates
- Zero VOC wallpapers
- Indian Handloom textiles
- Aquawood waterproof flooring
- Steel Framed Staircase
- Bamboo/Brick/Concrete Jail (DIY)
- Gypsum False Ceiling with Moisture Resistant Board
- Radiant Panel

Team Shunya
Building a sustainable future
More latitude for companies to adjust operating margins
DESIGN BENEFITS

- Ventilation
- Parking Space
- Road connectivity
- Climate Responsive Design
- Raised Plinth
0.063 Btu/hr/sqft/°F  
Roof Assembly u-value

0.043 Btu/hr/sqft/°F  
Floor Assembly u-value

0.161 Btu/hr/sqft/°F  
Wall Assembly u-value

• **Climate Zone:** Warm and Humid (3A)
• **Maximum Temperature:** 38 °C
• **Minimum Temperature:** 16 °C

**Highlights:**
- Centralised HVAC
- Thermal Energy Storage
- Radiant Cooling and Dehumidification Panels (RC&DP)

**Temperature Profile for Project Site**
Non-coincident load of 99 kW for radiant panel sizing

Coincident load of 65 kW for centralized HVAC design

Thermal Storage System:
- Hot Water: 60 °C
- Chilled Water: 15 °C
Developed at the Heat Pump Laboratory of IIT Bombay

Specially designed for warm & humid climate (Mumbai)

Radiant panel can take sensible and latent load

Daily cooling load profile for a year for the project
● **Saved CO$_2$ Emissions:** 1210.4 tCO$_2$/yr

● **Cost of Energy:** 0.076$/kWh
  
  (44.5% decrease)

● **Excess Energy:** 2.3 MWh/yr

● **EUI:** 25.5 kBtu/sqft.yr
Cluster Specifications: 50 kWp of PV, 100 kWh of Battery, 50 kVA of Inverter
Efficient Homes is an in-house automation system designed with a user-friendly app.

- Sensor Node
- Actuation Unit
- Home Security Unit
- Smart Meter
- Surveillance Camera
CONTROL STRATEGIES

➔ Scheduling Appliances
➔ Occupant Comfort
➔ Smart Lighting system

Efficient Homes is an in-house automation system designed with a user-friendly app.
# HERS INDEXES

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**Reasons:**

➔ Heating is not required for the location

➔ Variation in HVAC Load

➔ Nearest Climatic Conditions (i.e. Charleston)
LOWER LIFE CYCLE COST

LIFE CYCLE COST COMPARISON ($)
1 BHK House, Horizon: 50 years

- Total Life cycle cost: $38,109 vs. $64,128
- Maintenance costs: $196 vs. $196
- Water costs: $7271 vs. 6806
- Energy costs: $22374

40.5% savings in Life Cycle Cost
Maximum Lateral Drift - 0.38m
INTERIOR VIEWS
CONCLUSION

✓ Passive techniques
✓ Affordability
✓ Resilience
✓ Thermal Comfort
✓ Net Positive Cluster
✓ Future ready
THANK YOU