



**Pandit Deendayal Upadhyay
Government Medical College,
Rajkot, Gujarat**

ENERGY SIMULATION REPORT

Client:

Pt.DDUMC, Rajkot

Project Manager:

HLL Lifecare Ltd.

Architect:

HLL Lifecare Ltd.

GRIHA Consultant:

Date: 11.06.2020

Benefits of performing energy modeling on building

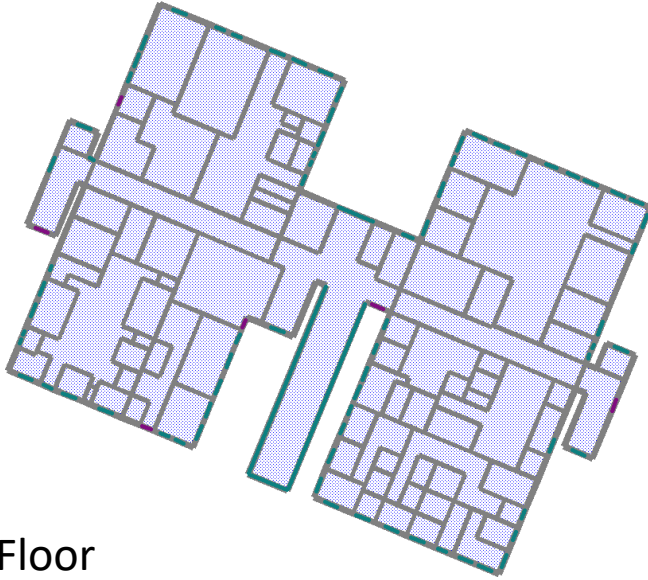
- Independent evaluation of the energy efficiency of the proposed new design.
- The overall Annual Energy consumption of the building can be estimated before the design is complete.
- Provide with the most cost effective design to meet environmental goals
- Quantifies the operational savings over the life of the building.
- The design can be done right the first time instead of paying more to correct it later.

Zoning Patterns

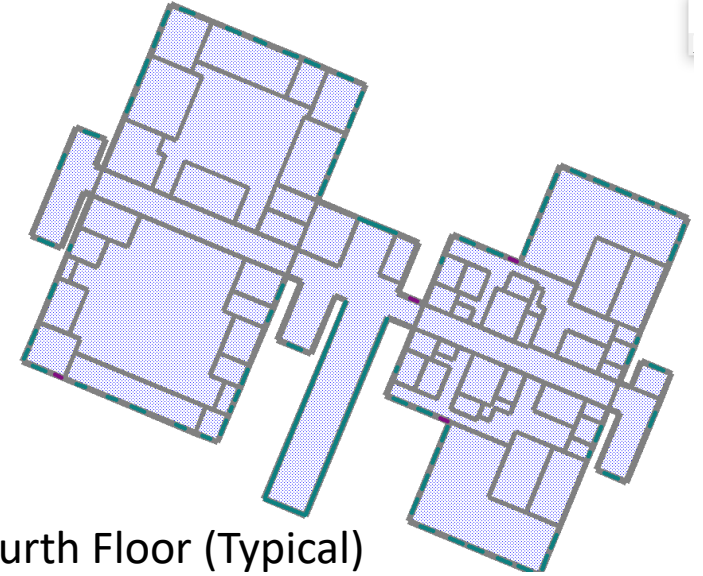
A Zoning plan is developed for each floor and entered into the simulation model. Each zone is assigned a set of properties Including:

- lighting power density,
- equipment power density,
- occupant density,
- infiltration rate,
- outside air requirement, and
- occupancy schedule.
- Each zone is also assigned physical properties of:
 - floor-to-floor height,
 - material density and conductivity, and
 - fenestration area.

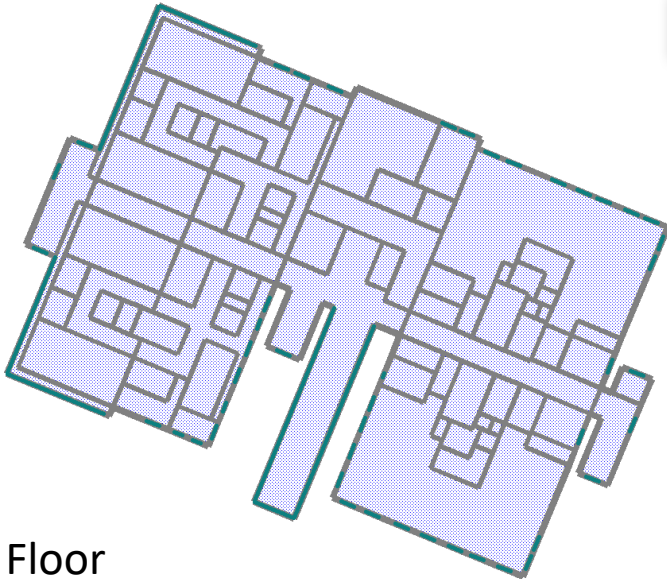
Floor Plans



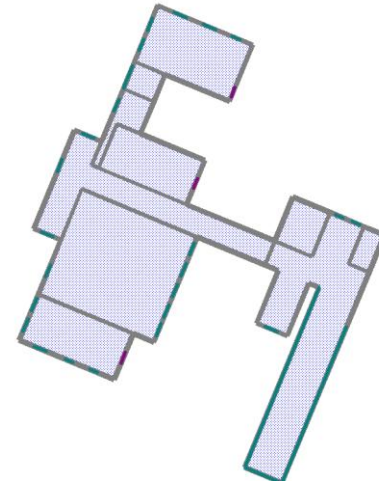
Ground Floor



First Floor to Fourth Floor (Typical)



Fifth Floor



Sixth Floor

Building Parameters (Base case vs. Proposed case) – BUILDING ENVELOPE

Sl. No.	Parameters	Proposed Case
1	Above Grade Wall construction	cement plaster 15mm +100 mm thick AAC block + 500 mm thick air cavity + 200 mm thick AAC block +15mm thick cement plater U factor: 0.0435 m².C/W
2	Below Grade Wall Construction	Not Applicable
3	Roof Construction	RCC slab with under deck insulation of 50mm PUF U Factor: 0.676 m².C/W and roof heat reflective paint
4	Exterior Floor Construction	Not Applicable
5	Slab-on-Grade Construction	Un insulated
6	Fenestration Type	Single glazed unit U-Value: 5.394 m ² .C/W SHGC: 0.82 For North Side U-Value: 1.05 m ² .C/W SHGC: 0.43
7	Fixed Shading Devices	Horizontal – 600mm, Vertical – 700mm
8	Automated Movable shading Devices	None

RCC Roof + PUF			
Material Description	Thickness (mm)	Conductivity (w/m.c)	Resistance (m².C/W)
Outside Surface Resist.			0.059
150 mm RCC [https://www.engineeringtoolbox.com/thermal-conductivity-d_429.html]	150	1.279	0.117
40 mm PUF Insulation	40	0.035	1.143
25 mm Plaster	20	0.5	0.040
Inside Surface Resist.			0.121
R-Value			1.479
U-Value			0.676
U-Value (Btu/hr.ft².°F)			0.119

Autoclaved Aerated Concrete Blocks (AAC)			
Material Description	Thickness (mm)	Conductivity (w/m.c)	Resistance (m².C/W)
Outside Surface Resist.			0.0586
External Plaster (Cement plaster, sand aggregate) [http://www.engineering.com/Library/ArticlesPage/tabid/85/ArticleID/152/Thermal-Conductivity.aspx]	15	0.720	0.0208
ACC Block	100	0.170	0.5882
Air gap [http://www.engineeringtoolbox.com/thermal-conductivity-d_429.html]	500	0.024	20.8333
ACC Block	200	0.150	1.3333
Internal Plaster (Gypsum plaster, sand aggregate)	15	0.720	0.0208
Inside Surface Resist.			0.1206
R-Value			22.9758
U-Value			0.0435
U-Value (Btu/hr.ft².°F)			0.0077

SPECIFICATION SHEET

Product Dimension

Product	Length	Height	Thickness
AAC Block	600 MM	200 MM	100 mm,200mm

Properties of AAC Block :

Properties	Values
Density (oven Dey)	551-650 Kg/Cum
Compressive Strength	Minimum 30 Kg/cm ²
Thermal Conductivity(K Value)	0.17 W/mK(on Average)
Resistant to Fire	2-6 hrs Depending Upon Thickness
Drying Shrinkage	0.1%
Design Gross Density	850 Kg/Cum.(Appx.)

Specification Of AAC Block Work :

Providing and laying of Autoclaved Aerated Concrete (AAC) Block Masonry Using Blocks Having Dimensions Of 600 mm x 200 mm . Thickness Ranging From 100mm to 200mm Conforming to I.S:2185(Part-III) The Jointing cement Sand Mortar in The Composition of 1:4(cement:sand) Shall be used with suitable Plasticizer(optional). Sand Having Modulus of Fineness 1:1 Shall Be used. Horizontal and Vertical Joint Thickness Shall be Approximately 10 mm . In case of

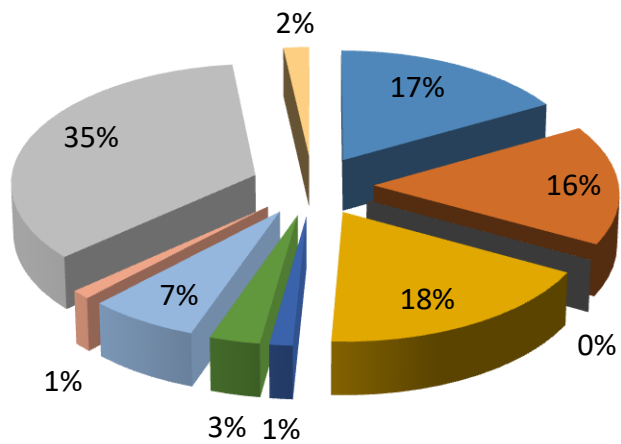
Building Parameters (Base case vs. Proposed case) – ELECTRICAL SYSTEMS & PROCESS LOADS

Sl. No.	Parameters	Proposed Case
9	LPD (for Indoor spaces)	Please Ref. the LPD Sheet & Electrical Drawing
10	Average Exterior LPD -	0.019 W/ft ²
11	Average EPD	1.24 W/ft ²
12	Process lighting	None
13	Lighting control	None
14	Day lighting Controls	None

Building Parameters (Base case vs. Proposed case) – MECHANICAL SYSTEMS

Sl. No.	Parameters	Proposed Case
14	HVAC System Types	Air cooled system with AHUs & FCUs –
15	Cooling Design temperature	21 deg. C for OT & 24 deg. C for Other Areas
16	Economizer	None
17	Demand Control Ventilation	None
18	Heat Recovery Wheels	Only for Major OTs with 100% Fresh Air
19	Unitary Equipment Cooling efficiency	1.2 kW/ton
20	Chiller Type	Air cooled screw chiller
21	No of Chillers	3 (2W+1S)
22	Capacity	180 TR
23	COP at ARI Condition	3.061
24	Cooling Tower	Not applicable
25	Domestic Hot Water system	Not applicable
26	Evaporative Cooling	Not applicable

ANALYSIS RESULTS



- Lighting Conditioned
- Lighting Unconditioned
- Space Heating
- Space Cooling
- Pumps
- Heat Rejection
- Fan conditioned
- Fan Unconditioned
- Receptacles Conditioned
- Receptacles Unconditioned

		kW/sqm/yr
Lighting Conditioned	433.9	433,900.00
Lighting Unconditioned	420.8	420,800.00
Space Heating	0.1	100.00
Space Cooling	460.7	460,700.00
Pumps	37	37,000.00
Heat Rejection	81	81,000.00
Fan conditioned	175.8	175,800.00
Fan Unconditioned	30.90	30,901.48
Receptacles Conditioned	901.9	901,900.00
Receptacles Unconditioned	47	47,000.00
Base Utilities		
Total Consumption	2589.10	2,589,101.48

Total Area (sqm) 11800

Achieved EPI 219

Benchmark EPI 450

Reduction (%) 51%

Note: The percentage displayed for the "Proposed/ Base %" column of the base case is actually the percentage of the total energy consumption.

* Denotes the base alternative for the ECB study.

		* Alt-1 PROPOSED SUPER SPE		
		Energy 10 ³ kWh/yr	Proposed / Base %	Peak kW
Lighting - Conditioned	Electricity	433.9	17.0	50
Lighting - Unconditioned	Electricity	420.8	16.5	48
Space Heating	Electricity	0.1	0.0	100
Space Cooling	Electricity	460.7	18.0	372
Pumps	Electricity	37.0	1.4	31
Heat Rejection	Electricity	81.0	3.2	42
Fans - Conditioned	Electricity	175.8	6.9	20
Receptacles - Conditioned	Electricity	901.9	35.3	103
Receptacles - Unconditioned	Electricity	47.0	1.8	5
Total Building Consumption		2,558.1		
		* Alt-1 PROPOSED SUPER SPE		
Total	Number of hours heating load not met	0		
	Number of hours cooling load not met	632		

ANALYSIS RESULTS

Static

			[mm]	[inch]		
101 Parking	42500	cfm	30	1.18	14.73	Kw
008 Waiting Area	5400	cfm	30	1.18	1.87	Kw
061 Corridore	5400	cfm	30	1.18	1.87	Kw
112 Corridore	5400	cfm	30	1.18	1.87	Kw
123 Corridore	5401	cfm	30	1.18	1.87	Kw
520 Cath Wash	200	cfm	25	0.98	0.06	Kw
064 Kitchen Areas	25450	cfm	65	2.56	19.11	Kw
					41.38	Kw

		kW/sqm/yr
Fan Unconditioned	30.90	30,901.48

$$41.38 \text{ kW} + 0.24 \text{ kW} = 41.63 \text{ kW}$$

$$41.63 \text{ kW} \times 8760 \text{ hrs} = 364637.4 \text{ kW}$$

$$364637.4 \text{ kW} / 11800 \text{ sqm.} = 30.9 \text{ kW/sqm/yr}$$

Static

			area	height	vol		[mm]	[inch]			
050 Toilet	10	ach	23	4.2	96.6	16.1	cfm	30	1.18	0.01	Kw
074 Toilet	10	ach	104	4.2	436.8	72.8	cfm	30	1.18	0.03	Kw
102 Toilet	10	ach	110	4.2	462	308	cfm	30	1.18	0.11	Kw
125 Toilet	10	ach	92	4.2	386.4	257.6	cfm	30	1.18	0.09	Kw
514 Toilet	10	ach	61	4.2	256.2	42.7	cfm	25	0.98	0.01	Kw
528 Toilet	10	ach	16	4.2	67.2	11.2	cfm	25	0.98	0.00	Kw
										0.24	Kw

Conclusion – ENERGY PERFORMANCE INDEX

- As per the GRIHA rating the Energy performance index standards for the 24 hours and seven days operating non residential building in hot and dry climate is **450kwh/sqmt/annum**
- The Benchmark EPI = **450 kWh/m²/annum (as per GRIHA Criteria 14)**
- Achieved EPI = **219 kWh/m²/annum**
- The PDDUMC building is applicable for total **14 points** under optimize energy performance **Criteria 14.**

ANNUAL ENERGY PERFORMANCE	
Benchmark EPI	450 kWh/m ² /annum
Annual energy consumption	2589101 kWh
Build up Area	11800 sqft
Achieved EPI	219 kWh/m ² /annum
Percentage reduction	51.24 %

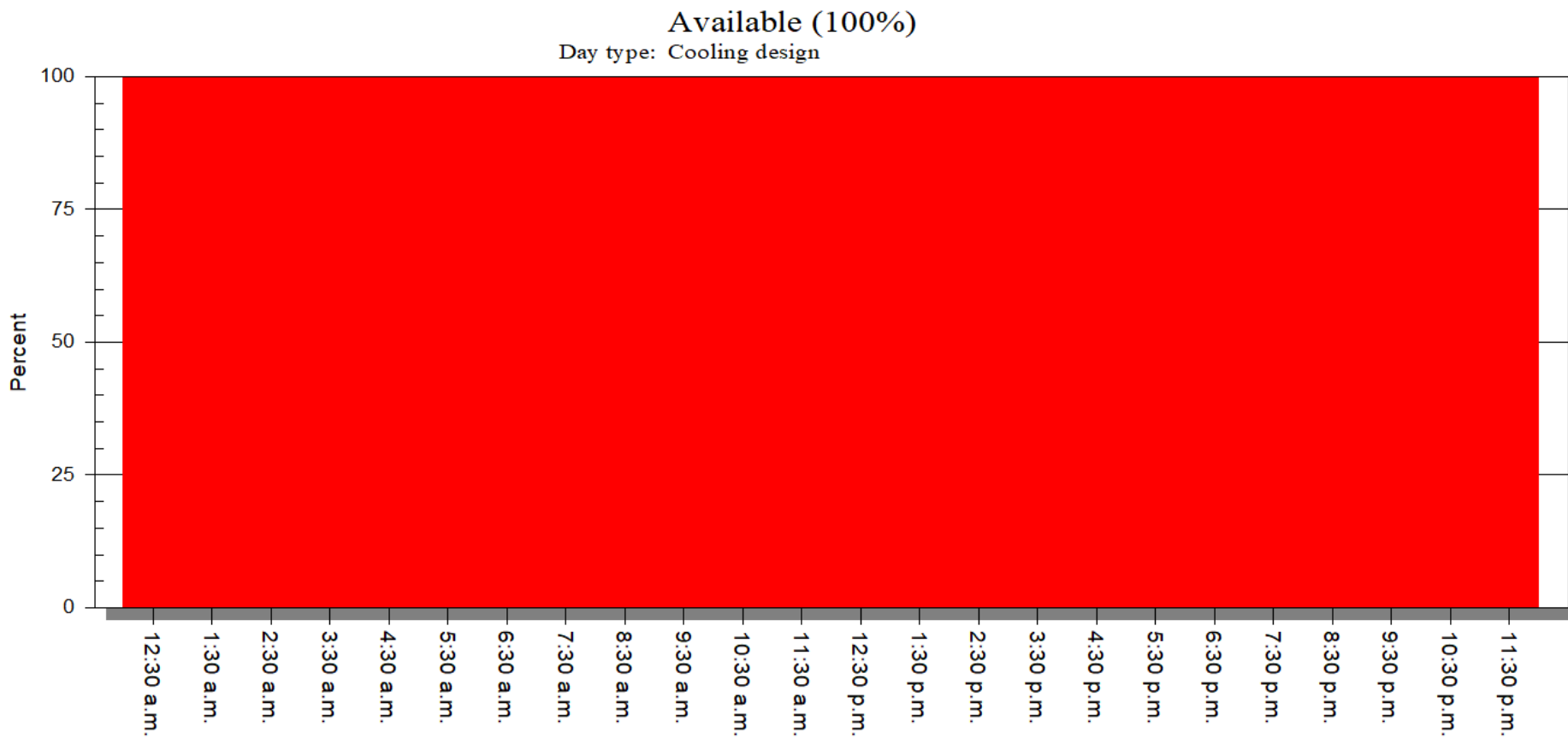
APPENDIX – II. SYSTEM MET AND UNMET HOURS

TOTAL COOLING UNMET HOURS	= 632
TOTAL HEATINGUNMET HOURS	= 0
TOTAL UNMET HOURS	= 632
PERCENTAGE OF UNMET HOURS	= 7.21%

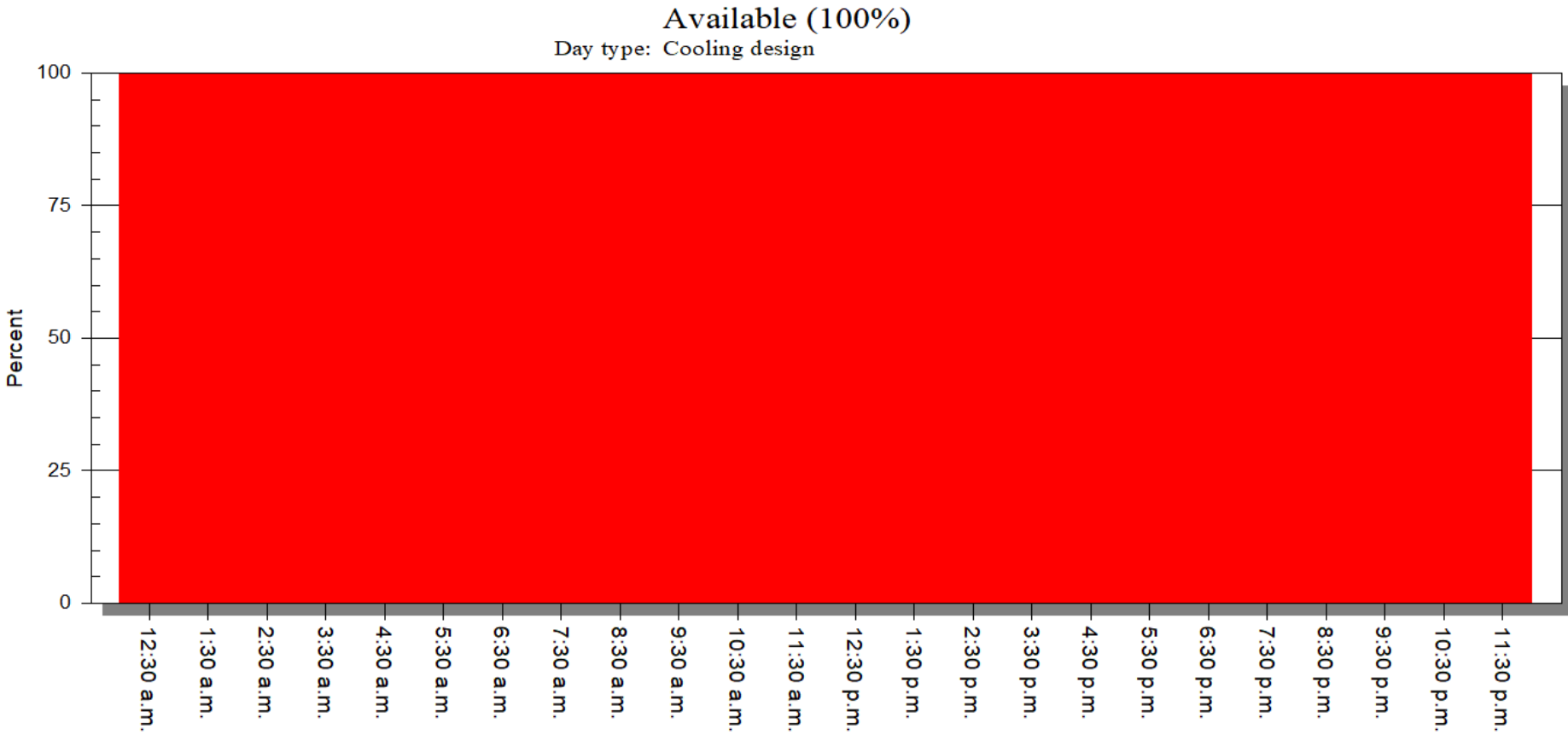
BEPU REPORT

- **For conditioned spaces No of unmet hours = 0**
- **For unconditioned habitable space peak number of unmet hours = 632**
- **Percentage of time the comfort not met for unconditioned space = unmet hours/total occupied hours = (632/8760) = 7.21%**
- **Hence the thermal comfort criteria for building are MET under criteria 14.**

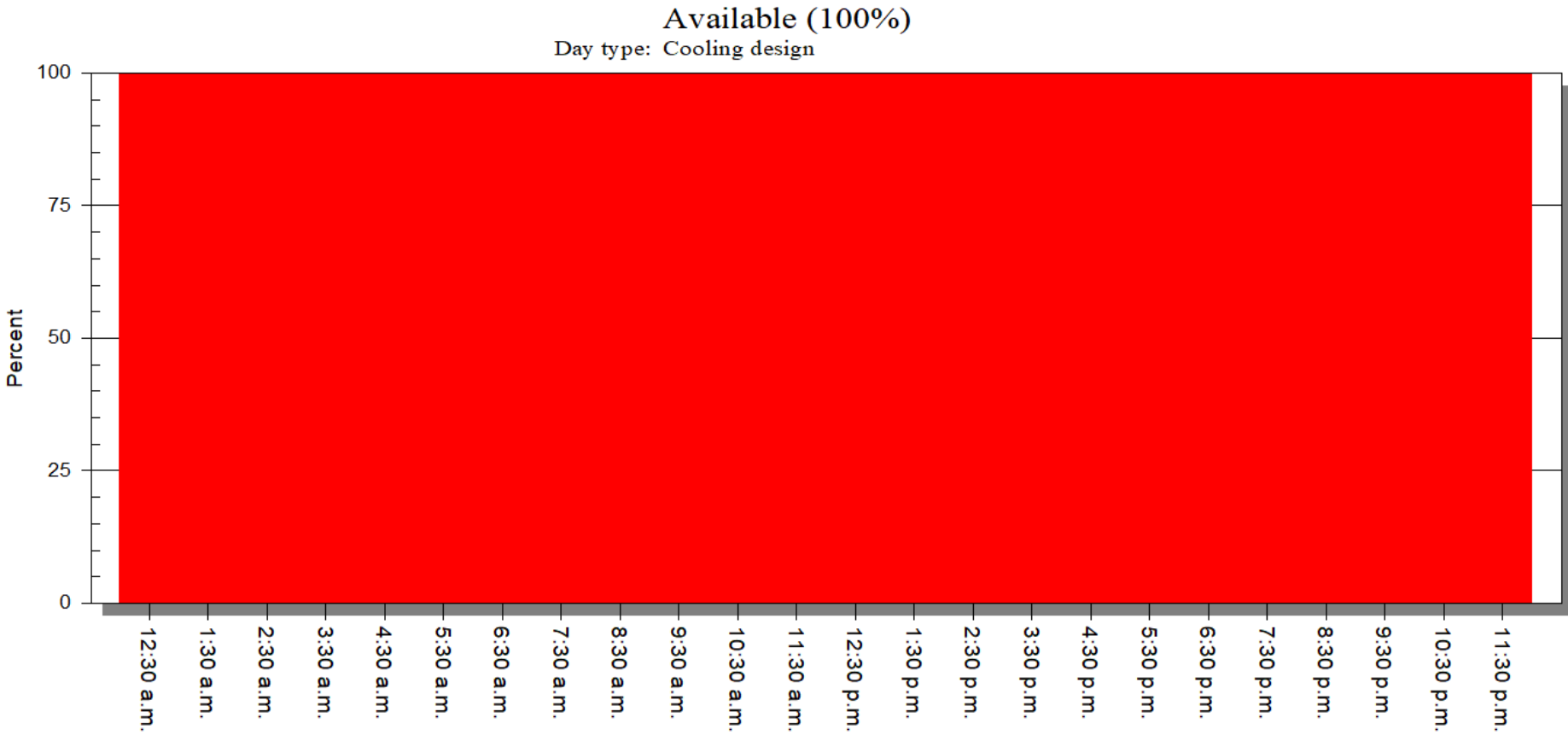
APPENDIX – III. SCHEDULES USED FOR HOSPITAL - OCCUPANCY



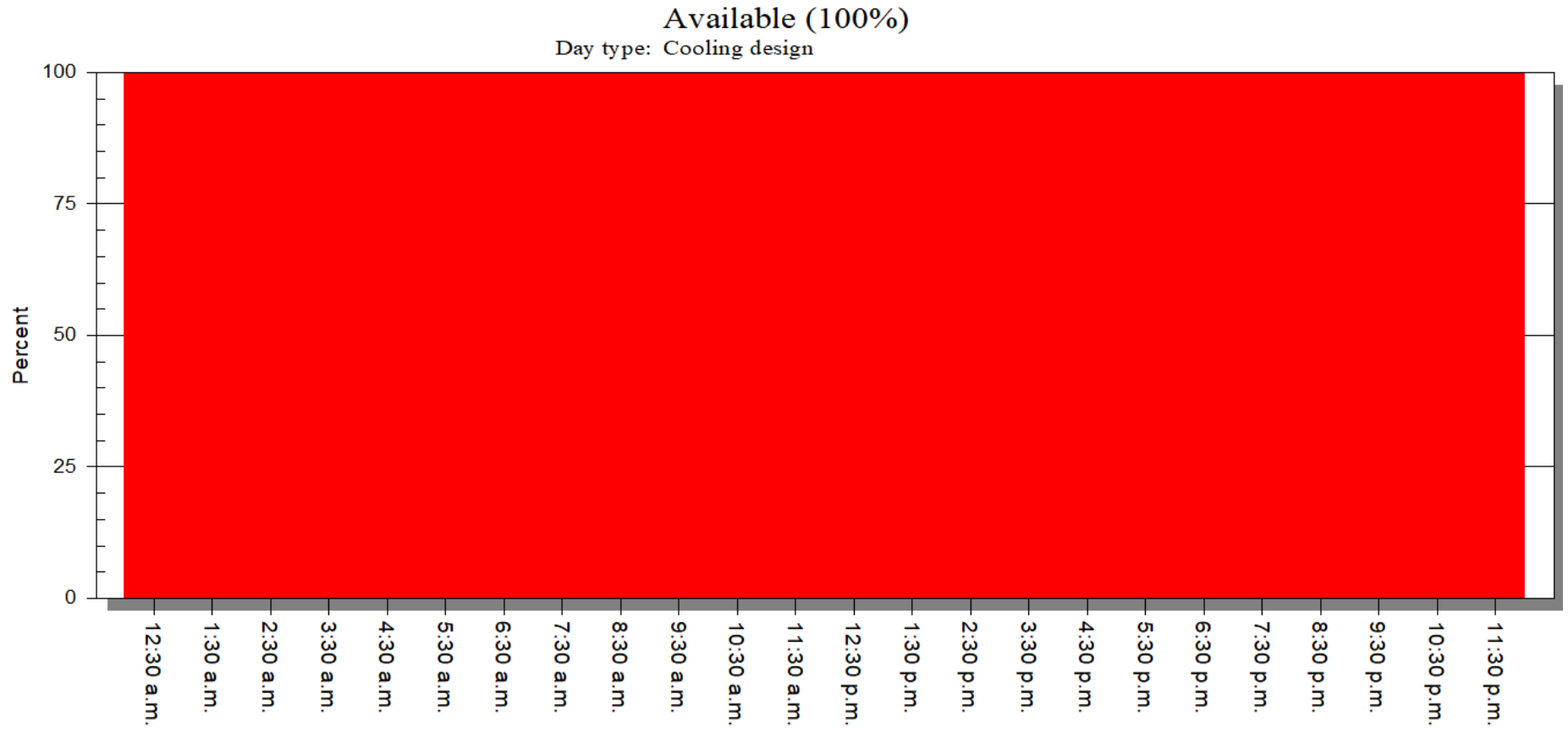
APPENDIX – III. SCHEDULES USED FOR HOSPITAL – Lighting



APPENDIX – III. SCHEDULES USED FOR HOSPITAL – Misc. Equipment



APPENDIX – III. SCHEDULES USED FOR HOSPITAL – Cooling Design Temperature



APPENDIX – IV. Weather Data

LOCATION: Rajkot, Gujarat
 CLIMATE: Composite
 Latitude (N): 21.834310
 Longitude (E): 70.827050

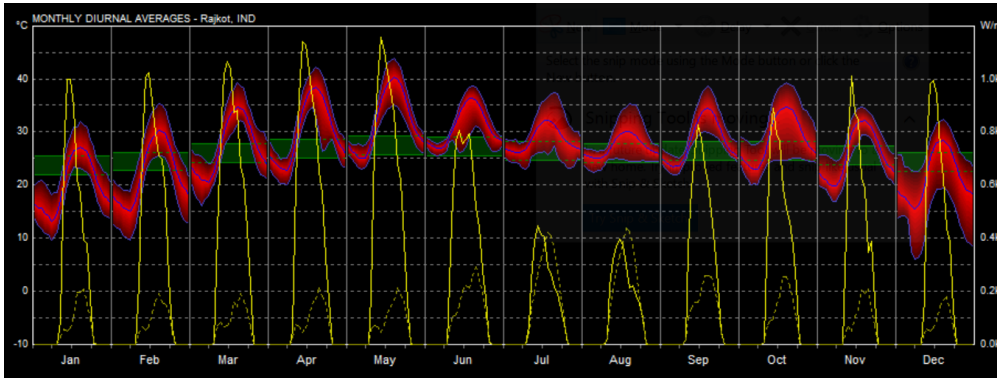


CHART 1: MONTHLY DIURNAL AVERAGE TEMPERATURE

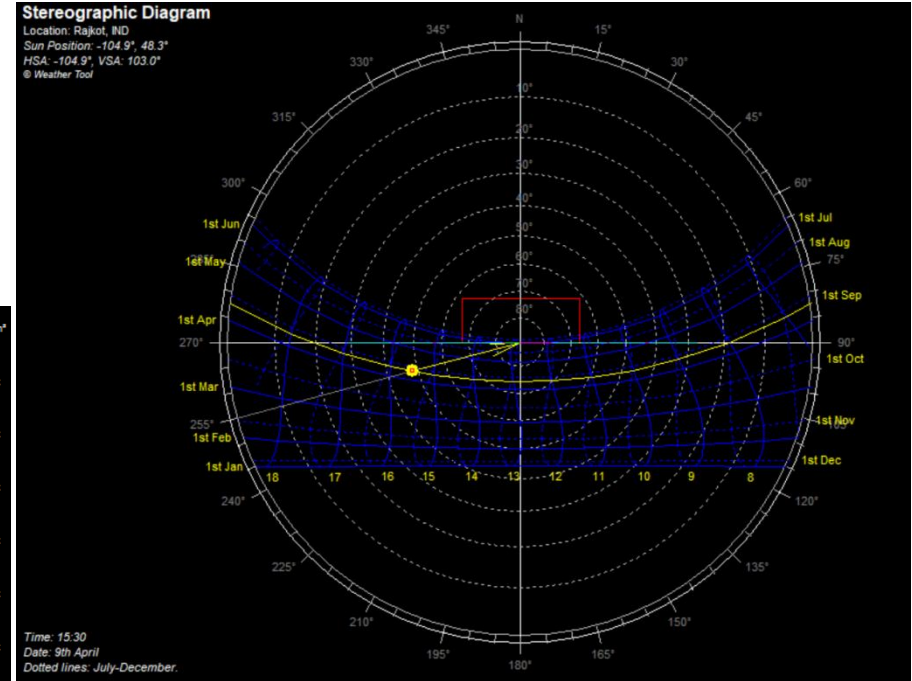


CHART 2: SUN PATH DIAGRAM FOR RAJKOT

Basis of Design

Indoor Design Condition	
Relative Humidity	Temperature
Not exceeding 60% at full load condition	24°C ± 2°C 21°C ± 1°C (OT)

Outside Condition	
Summer	40.6°C DB/23.3°C WB/24 % RH
Monsoon	33.9°C DB/28.3°C WB/68 % RH
Winter	12.2°C DB/7.7°C WB/55 % RH
Inside condition	
Room temperature	23±1°C
Operation Theater	20±2°C
Relative humidity	55± 5%