

BEYOND
SMART CITIES



BUILDING ENERGY MODELING STEP-BY-STEP PROCEDURES FOR LEED CERTIFICATION

ONLINE PROFESSIONAL COURSES LED BY
THE WORLD'S TOP SPECIALISTS

ONLINE TRAINING BY KRISHNAJI PAWAR

LEED AP(BD+C), GSAS CGP, GCP, ISO 14001

LEARN.BEYONDSMARTCITIES.IN

BEYOND
SMART CITIES

MODULE
L21

Review BEM Software Output Reports

KRISHNAJI PAWAR - CEO & FOUNDER

LEED AP(BD+C),GSAS CGP,GCP,ISO 14001

WWW.BEYONDSMARTCITIES.IN





BUILDING ENERGY MODELING : STEP-BY-STEP PROCEDURES FOR LEED CERTIFICATION

BEM output reports typically consist of summary data, detailed energy use breakdown, thermal comfort analysis, renewable energy contributions, and graphic representations. Stakeholders must verify that the input data accurately represents the building's characteristics, analyze the detailed energy use breakdown, evaluate design alternatives, and ensure compliance with local energy codes and sustainability certifications.

Learning Objectives

- Introduction and Course Outline
- Building Energy Modeling Checklists
- Scaling an imported drawing from AutoCAD
- ASHRAE Standards and Guidelines
- Zones Input Details in BEM Tools
- Setup and Running the Building Energy Modeling Simulation
- Review BEM Software Output Reports.
- Sample Energy Modeling Report
- Summary and Resources
- BEMP Practice Test V.4.1



INTRODUCTION

- BEM software simulates energy consumption, aiding in informed decisions for design improvements and energy efficiency strategies.
- Systematic review of BEM output reports is crucial for understanding a building's energy performance.
- Output reports include summary data, detailed energy use breakdown, thermal comfort analysis, renewable energy contributions, and graphic representations.
- Stakeholders verify input data accuracy, analyze detailed energy use breakdown, evaluate design alternatives, and ensure compliance with local energy codes and sustainability certifications.
- This process enhances building efficiency and contributes to sustainability goals.
- Effective interpretation and utilization of BEM output reports remain crucial for professionals in architecture, engineering, and energy management.

IMPORTANCE OF REVIEWING BEM OUTPUT REPORTS

- Output reports from BEM simulations evaluate energy consumption patterns, identify inefficiencies, and propose enhancements.
- Reviewing these reports is akin to a financial audit, ensuring the building's energy performance aligns with design goals and regulatory standards.



OBJECTIVES OF REVIEWING OUTPUT REPORTS

- Verification of Input Data: Ensure that the assumptions and parameters entered into the model accurately represent the building's characteristics.
- Identification of Energy Consumption Patterns: Analyze energy use profiles to determine peak consumption periods and identify potential areas for improvement.
- Evaluation of Design Alternatives: Compare the energy performance of different design options to support decision-making.
- Compliance Assessment: Verify adherence to local codes, standards, and sustainability certifications such as LEED or BREEAM.



STRUCTURE OF BEM OUTPUT REPORTS

- Summary Data: High-level statistics on total energy consumption, peak load, and energy costs.
- Detailed Energy Use Breakdown: A disaggregated view of energy consumption by end-use categories.
- Thermal Comfort Analysis: Data on indoor environmental conditions.
- Renewable Energy Contributions: Information on energy generation from on-site renewable sources, if applicable.
- Graphical Representations: Visual aids that illustrate energy trends and comparisons.



Project Information

Name: Walls & Floors
 Address: Plot No. S20905
 Description:
 Analysis done by: Sheila @ Pacific Control Systems
 Gross Area: 46,462 ft²
 Conditioned Area: 12,077 ft²
 Project File: c:\users\krish\desktop\case study _1\visual doe model\walls and flors_case study _1.gph
 Case Name: Base Case
 Case Description: Base Case
 Number of Blocks: 5

Block 1, Level 1: GF WAREHOUSE

Block Information		Ceiling and Plenum Heights	
Shape	CUSTOMBLK	Floor to Floor Height	13.12332 ft
Zoning	Custom	Plenum Height	4 ft
Number of Zones	2	Number of Floors	1
Number of Facades	10		

Block Dimensions

Coordinates (ft)	Point	X (ft)	Y (ft)
X	Pt. 1	80.8	-79.1
Y	Pt. 2	17.7	-79.1
Z	Pt. 3	17.7	0.0
	Pt. 4	0.0	0.0
	Pt. 5	0.0	19.4
	Pt. 6	-52.1	19.4
	Pt. 7	-52.1	216.2
	Pt. 8	69.6	216.2
	Pt. 9	80.8	216.2
	Pt. 10	80.8	205.1

Block Constructions

Construction	Description	U-Factor (Btu/h-ft ² -°F)	HC (Btu/ft ² -°F)
Roof	ASH ROOF	0.063	0.9
Ceiling	Gyp. bd. ceiling	0.745	0.5
Floor	ASH FLOORS	0.350	9.3
Int. Floor	R-0 Mass	0.182	9.3
Interior Wall	Partition	0.387	1.0

Facade Dimensions

Name	Bay Width (ft)	Window Height (ft)	Window Width (ft)
SE-0WHSE	Custom	n.a.	n.a.
SE-0WHSE	Custom	n.a.	n.a.
SW-0WHSE2	Custom	n.a.	n.a.
SW-0WHSE2	Custom	n.a.	n.a.
SW-0WHSE2	Custom	n.a.	n.a.
SW-0WHSE2	Custom	n.a.	n.a.
SW-0WHSE2	Custom	n.a.	n.a.
NW-0WHSE	Custom	n.a.	n.a.
NW-0WHSE	Custom	n.a.	n.a.
NE-0WHSE	Custom	n.a.	n.a.
NE-0WHSE	Custom	n.a.	n.a.
NE-0WHSE	Custom	n.a.	n.a.
NE-0WHSE	Custom	n.a.	n.a.
NW-0WHSE-TELRM	Custom	n.a.	n.a.

Facade Shading

Name	Window Recess (ft)	Interior Shading	Exterior Shading	Overhang Distance (ft)	Overhang Projection (ft)	Side Fin Distance (ft)	Side Fin Projection (ft)
SE-0WHSE	0	No	No	n.a.	n.a.	n.a.	n.a.
SE-0WHSE	0	No	No	n.a.	n.a.	n.a.	n.a.
SW-0WHSE2	0	No	No	n.a.	n.a.	n.a.	n.a.
SW-0WHSE2	0	No	No	n.a.	n.a.	n.a.	n.a.
SW-0WHSE2	0	No	No	n.a.	n.a.	n.a.	n.a.

SW-0WHSE2	0	No	No	n.a.	n.a.	n.a.	n.a.
SW-0WHSE2	0	No	No	n.a.	n.a.	n.a.	n.a.
NW-0WHSE	0	No	No	n.a.	n.a.	n.a.	n.a.
NW-0WHSE	0	No	No	n.a.	n.a.	n.a.	n.a.
NE-0WHSE	0	No	No	n.a.	n.a.	n.a.	n.a.
NE-0WHSE	0	No	No	n.a.	n.a.	n.a.	n.a.
NE-0WHSE	0	No	No	n.a.	n.a.	n.a.	n.a.
NE-0WHSE	0	No	No	n.a.	n.a.	n.a.	n.a.
NW-0WHSE-TELRM	0	No	No	n.a.	n.a.	n.a.	n.a.

Facade Constructions

Name	Window Construction	U-Factor (Btu/h-ft ² -°F)	SC	VLT	Wall Construction	U-Factor (Btu/h-ft ² -°F)	HC (Btu/ft ² -°F)
SE-0WHSE	customized	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SE-0WHSE	customized	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SW-0WHSE	n.a.	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SE-0WHSE1	n.a.	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SW-0WHSE1	n.a.	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SE-0WHSE2	n.a.	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SW-0WHSE2	customized	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SW-0WHSE2	customized	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SW-0WHSE2	customized	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SW-0WHSE2	customized	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SW-0WHSE2	customized	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
NW-0WHSE	customized	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
NW-0WHSE	customized	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
NE-0WHSE	customized	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
NE-0WHSE	customized	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
NE-0WHSE	customized	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
NW-0WHSE-TELRM	customized	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
NE-0WHSE-TELRM	n.a.	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3

VisualDOE 4.1 - Architectural Details

February 22, 2025

Block 2, Level 2: MZ WAREHOUSE

Block Information		Ceiling and Plenum Heights	
Shape	CUSTOMBLK	Floor to Floor Height	25.912 ft
Zoning	Custom	Plenum Height	4 ft
Number of Zones	1	Number of Floors	1
Number of Facades	8		

Block Dimensions			
Coordinates (ft)	Point	X (ft)	Y (ft)
X	Pt. 1	80.8	-79.1
Y	Pt. 2	17.7	-79.1
Z	Pt. 3	17.7	0.0
	Pt. 4	0.0	0.0
	Pt. 5	0.0	19.4
	Pt. 6	-52.1	19.4
	Pt. 7	-52.1	216.2
	Pt. 8	80.8	216.2

Block Constructions			
Construction	Description	U-Factor (Btu/h-ft ² -°F)	HC (Btu/ft ² -°F)
Roof	ASH ROOF	0.063	0.9
Ceiling	Gyp. bd. ceiling	0.745	0.5
Floor	ASH FLOORS	0.350	9.3
Int. Floor	R-0 Mass	0.182	9.3
Interior Wall	Partition	0.387	1.0

Facade Dimensions			
Name	Bay Width (ft)	Window Height (ft)	Window Width (ft)

Facade Shading							
Name	Window Recess (ft)	Interior Shading	Exterior Shading	Overhang Distance (ft)	Overhang Projection (ft)	Side Fin Distance (ft)	Side Fin Projection (ft)

Facade Constructions							
Name	Window Construction	U-Factor (Btu/h-ft ² -°F)	SC	VLT	Wall Construction	U-Factor (Btu/h-ft ² -°F)	HC (Btu/ft ² -°F)
SE-1WHSE	n.a.	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SW-1WHSE	n.a.	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SE-1WHSE1	n.a.	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SW-1WHSE1	n.a.	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SE-1WHSE2	n.a.	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
SW-1WHSE2	n.a.	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
NW-1WHSE	n.a.	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3
NE-1WHSE	n.a.	n.a.	n.a.	n.a.	ASH WALL	0.124	5.3

Skylight Information						
Name	Depths (ft)	Height (ft)	Window Construction	U-Factor (Btu/h-ft ² -°F)	SC	VLT
Surface_12324	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12325	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12326	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12327	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12328	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12329	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12330	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12331	9.84	3.28	SKYLIGHT	1.98	0.22	0.70

VisualDOE 4.1 - Architectural Details

February 22, 2025

Surface_12332	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12333	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12334	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12335	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12336	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12337	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12338	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12339	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12340	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12341	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12342	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12343	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12344	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12345	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12346	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12347	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12348	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12349	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12350	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12351	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12352	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12353	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12354	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12355	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12356	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12357	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12358	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12359	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12360	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12361	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12362	9.84	3.28	ASH GL	1.98	0.22	0.70
Surface_12363	9.84	3.28	SKYLIGHT	1.98	0.22	0.70
Surface_12364	9.84	3.28	ASH GL	1.98	0.22	0.70

VisualDOE 4.1 - Systems Summary

February 22, 2025

Project Information

Name: Walls & Floors
 Address: Plot No. S20905
 Description:
 Analysis done by: Sheila @ Pacific Control Systems
 Project File: c:\users\krish\desktop\case study _1\visual doe model\walls and flors_case study _1.gph
 Case Name: Design Case All
 Case Description: Copy based on Copy based on Base Case
 Number of Systems: 23

Systems Summary

Name	Type	Conditioned Area (ft²)	Supply Air (CFM)	Min. OA Ratio	Cooling Cap (kBtu/h)	Heating Cap (kBtu/h)	Cooling Peak (kBtu/h)	Heating Peak (kBtu/h)	Cooling Energy (MBtu)	Heating Energy (MBtu)
SER2	PTAC	221	1106	0.011	0	0	10.9	3.4	23.2	0.3
SER3	PTAC	186	282	0.036	0	0	6.4	3	13.2	0.3
SER4	PTAC	244	351	0.038	0	0	7.5	3.7	14.7	0.3
SER5A	PTAC	179	259	0.038	0	0	5.6	3	11.1	0.2
SER5B	PTAC	181	275	0.036	0	0	5.8	3.1	11.5	0.3
SER6	PTAC	186	248	0.041	0	0	5.4	2.4	10.7	0.2
GAC1	PSZ	466	1177	0.059	44.6	33.5	23.8	5.2	46.9	0.1
GAC2	PSZ	948	981	0.053	37.2	27.9	22	3.4	50.2	0.1
GAC3	PSZ	1091	1118	0.053	42.4	31.8	25.2	3.4	56.6	0.1
GAC4	PSZ	1089	1227	0.048	46.1	34.6	29.4	5.3	58.8	0
GAC5	PSZ	618	1492	0.023	52.6	39.4	31.8	3.1	50	0
GAC6	PSZ	896	1162	0.042	43	32.2	25.5	3.4	59.1	0.1
GAC7	PSZ	338	843	0.022	29.6	22.2	14.9	2.8	33.4	0.1
GSP2	PSZ	60	84	0.039	3.1	2.3	2.3	0.7	4.9	0
MAC1	PSZ	418	1765	0.013	60.6	45.5	18.9	0.5	40.8	0
MAC2	PSZ	342	1638	0.011	56	42	17.6	0	35	0
MAC3	PSZ	924	913	0.055	34.8	26.1	22.6	3.2	44.8	0
MAC4	PSZ	661	825	0.044	30.6	23	19.2	3.6	35.2	0
MAC5	PSZ	809	1693	0.026	60.2	45.1	29.3	4.2	51.4	0
MAC6	PSZ	507	530	0.052	20.1	15	13.7	2.6	24.8	0
MAC7	PSZ	477	1958	0.026	70	52.4	43.8	14.5	72.4	0.3
MAC8	PSZ	531	685	0.042	25.4	19	16	2.2	33.9	0
MAC9	PSZ	703	3143	0.012	108.2	81.1	38.7	2.1	68.8	0

Systems Summary per Conditioned Area

Name	Type	Conditioned Area (ft²)	Supply Air (CFM/ft²)	Min. OA Ratio	Cooling Cap (Btu/h/ft²)	Heating Cap (Btu/h/ft²)	Cooling Peak (Btu/h/ft²)	Heating Peak (Btu/h/ft²)	Cooling Energy (kBtu/ft²)	Heating Energy (kBtu/ft²)
SER2	PTAC	221	4.999	0.011	0	0	49	15	104.8	1.2
SER3	PTAC	186	1.517	0.036	0	0	34	16	71.1	1.4
SER4	PTAC	244	1.437	0.038	0	0	31	15	60.3	1.4
SER5A	PTAC	179	1.449	0.038	0	0	31	17	61.9	1.4
SER5B	PTAC	181	1.523	0.036	0	0	32	17	63.6	1.5
SER6	PTAC	186	1.334	0.041	0	0	29	13	57.5	1.1
GAC1	PSZ	466	2.525	0.059	96	72	51	11	100.6	0.2
GAC2	PSZ	948	1.035	0.053	39	29	23	4	53	0.1
GAC3	PSZ	1091	1.025	0.053	39	29	23	3	51.9	0.1
GAC4	PSZ	1089	1.126	0.048	42	32	27	5	53.9	0
GAC5	PSZ	618	2.414	0.023	85	64	51	5	80.9	0
GAC6	PSZ	896	1.297	0.042	48	36	28	4	66	0.1
GAC7	PSZ	338	2.495	0.022	88	66	44	8	99	0.3
GSP2	PSZ	60	1.405	0.039	52	39	39	12	82.2	0.3
MAC1	PSZ	418	4.219	0.013	145	109	45	1	97.4	0
MAC2	PSZ	342	4.786	0.011	164	123	51	0	102.2	0
MAC3	PSZ	924	0.988	0.055	38	28	24	3	48.5	0
MAC4	PSZ	661	1.247	0.044	46	35	29	5	53.3	0
MAC5	PSZ	809	2.093	0.026	74	56	36	5	63.6	0
MAC6	PSZ	507	1.044	0.052	40	30	27	5	48.9	0
MAC7	PSZ	477	4.109	0.026	147	110	92	30	151.9	0.7
MAC8	PSZ	531	1.289	0.042	48	36	30	4	63.8	0

VisualDOE 4.1 - Zones Summary

February 22, 2025

Project Information

Name: Walls & Floors
 Address: Plot No. S20905
 Description:
 Analysis done by: Sheila @ Pacific Control Systems
 Project File: c:\users\krish\desktop\case study _1\visual doe model\walls and flors_case study _1.gph
 Case Name: Design Case All
 Case Description: Copy based on Copy based on Base Case
 Number of Blocks: 5

Zone Loads

Name	Area (ft²)	LPD (W/ft²)	EPD (W/ft²)	Occupancy	Occupant Density (ft²/person)	Daylight Control	Illuminance (fc)	Control Fraction	Infiltration (ach)	SS-G Max Cl/Ht (kBtu/h)
U0-WHSE	32589	.67	.75	Office	15000.0	None	n.a.	n.a.	0.5	n.a.
U0WHSE-TELRM	124	.27	.75	Warehouse	15000.0	None	n.a.	n.a.	0.5	n.a.
U1WHSE	32713	.67	.10	Warehouse	15000.0	None	n.a.	n.a.	0.5	n.a.
U0WA-TOILET	204	.81	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a.
OWA-LOCKR	221	.54	.75	Office	275.0	None	n.a.	n.a.	0.5	10.91/3.37
U0OFC-ENTRY	184	1.17	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a.
U0-VSTRWC	44	.81	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a.
U0OFC-STRS1	145	.54	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a.
U0-OFC-FWC	180	.81	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a.
U0OFC-STRS2	99	.54	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a.
U0OFC-MWC	245	.81	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a.
U1OFC-CEOWC	65	.81	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a.
U1OFC-PNTRY	48	.72	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a.
U1OFC-FLSTRGERM	27	.27	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a.
U1OFC-MWC	245	.81	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a.
U1OFC-STRS	186	.54	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a.
OWA-PRYRRM	186	.81	.75	Office	275.0	None	n.a.	n.a.	0.5	6.4/3.02
OWA-M-HALL	244	.81	.75	Office	275.0	None	n.a.	n.a.	0.5	7.54/3.73
OWA-SMPLRMA	179	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	5.56/2.98
OWA-SMPLRMB	181	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	5.84/3.08
OWA-WINCHRG	186	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	5.39/2.38
O0FC-EXMNGR	94	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-DRYPNTRY	28	.72	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-SALESMNGR	90	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-EMTEAM	254	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-OPNOFC1	948	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-OPNOFC2	1091	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-OPNOFC3	843	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-STRERM	66	.27	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-CSMNGR	90	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-GPCSD	91	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-LOBBY	409	1.17	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-PNTRY	47	.72	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-HLWAY	123	.45	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-STRGE	40	.27	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-CMTNGRM12	763	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-SMPLRM	133	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-MTNGRM2	156	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-MTNGRM1	182	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
O0FC-HLWAY1	60	.45	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
IOFC-DNING	327	1.89	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
IOFC-STRERM	91	.27	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
IOFC-OPNOFC1	236	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
IOFC-ITDEPT	73	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
IOFC-SRVRRM	32	1.80	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
IOFC-OPNOFC2	672	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
IOFC-ACNTS	253	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.
IOFC-OPNOFC3	349	.99	.75	Office	275.0	None	n.a.	n.a.	0.5	n.a./n.a.

VisualDOE 4.1 - Results

February 22, 2025

Project Information

Name: Walls & Floors

Address: Plot No. S20905

Description:

Analysis done by: Sheila @ Pacific Control Systems

Weather File: ARE_Abu[1].Dhabi_IWEC

Project File: c:\users\krish\desktop\case study _1\visual doe model\walls and flors_case study _1.gph

Calculation Engine: DOE-2.1E-119

Electrical Use Summary

Alternative	Lights	Equipmen t	Heating	Cooling	Fans	Ext. Lights	Ext. Equip.	Total
Electrical End-use Totals (kWh)								
Base Case	196,318	107,641	1,730	100,108	44,696	44,597	8,821	503,911

VisualDOE 4.1 - Results

February 22, 2025

Project Information

Name: Walls & Floors

Address: Plot No. S20905

Description:

Analysis done by: Sheila @ Pacific Control Systems

Weather File: ARE_Abu[1].Dhabi_IWEC

Project File: c:\users\krish\desktop\case study _1\visual doe model\walls and flors_case study _1.gph

Calculation Engine: DOE-2.1E-119

Electrical Use Summary

Alternative	Lights	Equipmen t	Heating	Cooling	Fans	Ext. Lights	Ext. Equip.	Total
Electrical End-use Totals (kWh)								
Design Case All	152,473	107,641	602	73,540	38,596	30,507	8,821	412,180

UNDERSTANDING THE VISUAL DOE OR BEM TOOLS INPUT/OUTPUT CHECKLIST

- BEM is a critical tool in designing and analyzing energy performance in buildings.
- BEM software simulates energy consumption, allowing architects, engineers, and energy analysts to make informed decisions.
- Visual DOE is a graphical approach to designing and analyzing experiments, visualizing the relationships between input variables and output variables.
- BEM is a framework aimed at improving organizational performance, encompassing principles like leadership, strategy, customer focus, measurement, analysis, knowledge management, and workforce management.



OBJECTIVES OF REVIEWING OUTPUT REPORTS



- **Verification of Input Data:** Ensure that the assumptions and parameters entered into the model accurately represent the building's characteristics.
- **Identification of Energy Consumption Patterns:** Analyze energy use profiles to determine peak consumption periods and identify potential areas for improvement.
- **Evaluation of Design Alternatives:** Compare the energy performance of different design options to support decision-making.
- **Compliance Assessment:** Verify adherence to local codes, standards, and sustainability certifications such as LEED or BREEAM.

THE INPUT/OUTPUT CHECKLIST

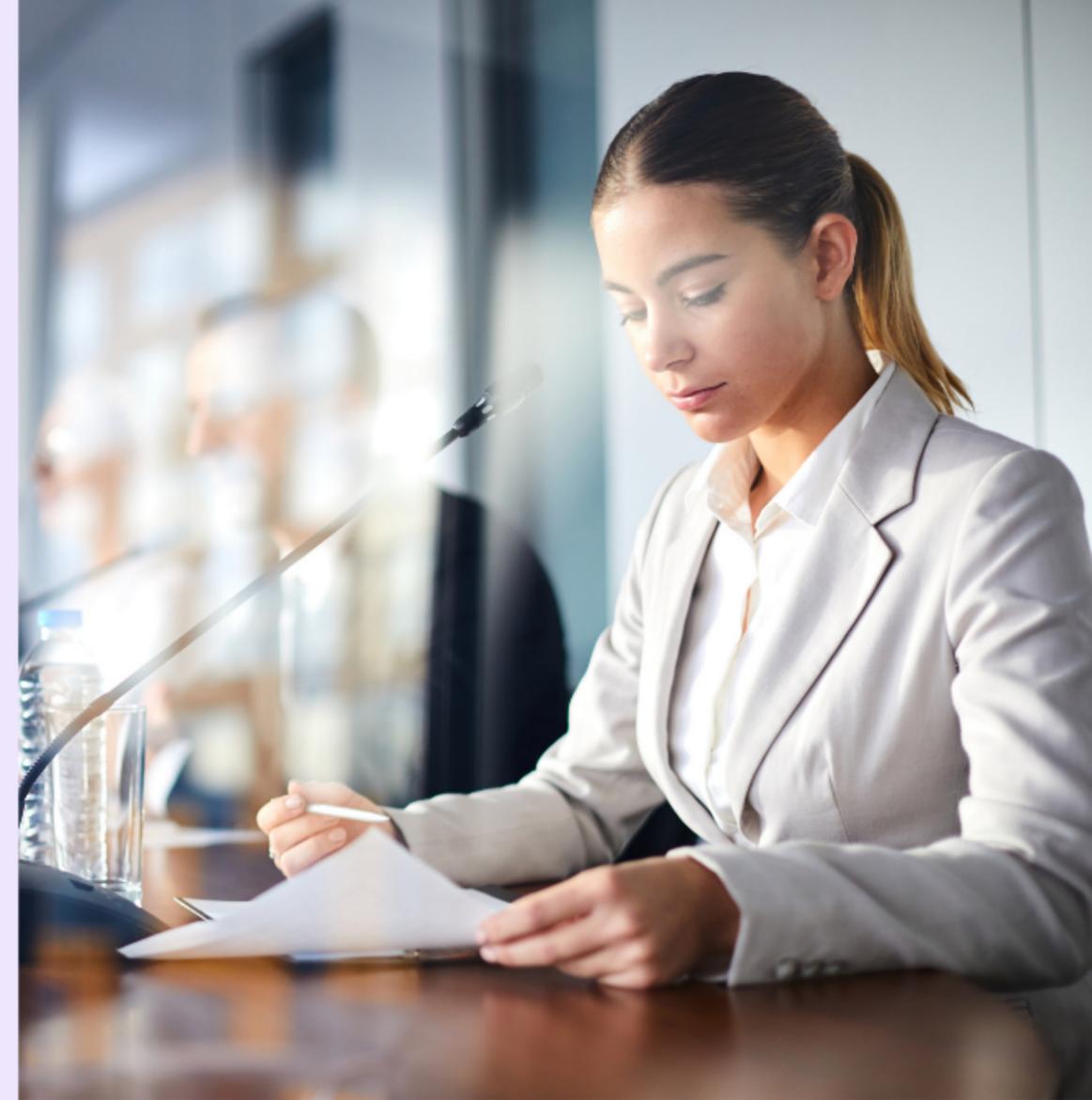
The checklist serves as a systematic guide for practitioners using Visual DOE and BEM tools. It includes:

- Input Variables (Factors): Conditions to be manipulated during the experiment.
- Output Variables (Responses): Metrics to assess the effect of the input variables.
- Experimental Conditions: Details regarding the environment and setup of the experiment.
- Data Collection Methods: Techniques for gathering data during the experiment.
- Analysis Techniques: Statistical methods used to analyze the collected data.
- Expected Outcomes: Predicted results based on the initial hypothesis.



FILLING OUT THE CHECKLIST

- Identifying Input Variables: List all potential factors that could influence the response variable.
- Defining Output Variables: Clearly specify the response variables that will be assessed.
- Specifying Experimental Conditions: Document the environment in which the experiment will be conducted.
- Choosing Data Collection Methods: Determine how data will be collected during the experiment.
- Selecting Analysis Techniques: Identify the statistical methods that will be used to analyze the data.
- Stating Expected Outcomes: Articulate the anticipated results based on prior knowledge or theoretical predictions.



INPUT CHECKLIST: PROPOSED CONDITION (ARCHITECT / MEP SPECIFICATIONS)

PROJECT & ENVELOPE INFORMATION

(Please complete only fields shown as boxes; attach supporting documents, specification cutsheets)

PROJECT INFORMATION

Data Points

Project Name		
Address		
Site Elevation	ft	
North Azimuth		
Major Activity of the building		
Working days per week (if any)		
Timing/schedule of a working day (if any)		
Specific number of holidays other than weekends (if any)		

BUILDING ENVELOPE

Gross Floor Area	sq.ft	
Conditioned floor Area	sq.ft	
Number of floors		
Window Wall Ratio		

BUILDING MATERIAL SPECIFICATION	Units	ASHRAE 90.1	Proposed
---------------------------------	-------	-------------	----------

Roof Material				
	Material 1: Btu/sq ft F	U-0.063 ASH RF ID		<i>Conversion from SI to IP (W/sqm K) / 5.678 = Btu/sqft</i>
	Material 2: Btu/sq ft F			
Ceiling Material	Btu/sq ft F			
Floor	Btu/sq ft F	U-0.350 ASH FL SJ		
	Material 1: Btu/sq ft F			
Internal Floor	Btu/sq ft F			
Partitions	Btu/sq ft F			
Wall Construction	Btu/sq ft F	U-0.124 ASH WA SF		
Glazing Material				
	General Glazing (U value,SHGC, Tvis) Btu/sq ft F	U Fixed -1.22 SHGC all -0.25		
	North Glazing (U value,SHGC, Tvis) Btu/sq ft F	U Fixed -1.22 SHGC all -0.61		
Skylight (U value) (if any)	Btu/sq ft F			
Below Grade wall (C value_U effective) (if any)	Btu/sq ft F			
Infiltration	ACH	0.5		

OTHERS

Exterior shading devices		
Interior shading devices		
Process loads		
Fuel type		
Loads	Btu/hr	
Schedule		
Exterior lighting		
Lighting power	kW	
Schedule		
Miscellaneous Energy Use		
Type		
Power	kW	
Schedule		

BEYOND SMART CITIES - Energy Modeling Requirements

If you have multiple HVAC systems serving different floors, please provide details separately



HVAC SPECIFICATION	Data Points	
System Type		As VAV, PTAC
Economizer		Temperature Limits - Upper & lower
Heat Recovery		Sensible Heat Exchange
Heating Type		
Heating Unit Type/Efficiency		
Heating Supply Temperature		
Cooling Unit Type/ Efficiency		
Cooling unit EER		
Cooling Supply Temperature (Only PTAC & PSZ)		
Fan Type/efficiency		
Supply Fan Control		
Supply Fan Efficiency (Only For VAV)		
Spaces served by system type		
Chiller specification		
No of Chillers		Nos
Type of Chiller		Centrifugal / Screw
COP of Chiller		<i>COP = EER/3.413</i>
Size of Each Chiller		tons
Secondary pump (Chilled water circulating pump)	(if applicable)	
Type		Fixed / Variable-speed control
pump head		ft
motor eff		
impeller eff		
Evaporator pump details		
Flow		gpm/ton
primary loop pressure drop		ft
impeller eff		
motor eff		
Condenser pump details		
Flow		gpm/ton
CW loop Pressure drop		ft
Impeller efficiency		
motor eff		
Cooling Tower		
Capacity Control type		IF Variable Speed Fan() Min fan speed ratio
Design Wet Bulb Temp.		F
Approach Temperature		F
Design range		F
Fan bhp/ton		
Motor eff		

BEYOND SMART CITIES - Energy Modeling Requirments

Please provide the following details for the Refrigerant



Refrigerant Details

Type of System

As VAV, PTAC, Split etc.

No. of Units

Capacity of each unit

Tons

Refrigerant

Refrigerant charge

lb/ton



REVIEW OF THE MODEL

The effectiveness of the checklist lies in its systematic approach, which ensures comprehensive consideration of all relevant factors.



Potential Corrections and Enhancements:

- Flexibility of Input Variables: Encourage practitioners to modify input variables based on preliminary results.
- Integration of Real-time Data: Enhance the responsiveness of the experimental design.
- Collaboration and Peer Review: Encourage collaboration among team members.
- Comprehensive Documentation: Facilitate better understanding and replication of the experiment in future studies.

BEYOND SMART CITIES

Building Energy & Sustainability Division



INPUT / OUTPUT CHECKLIST

INPUT

PROJECT INFORMATION

Data Points	Source	Units	ASHRAE 90.1	As-Is	Proposed
Project Name	Client		PLOT NO S.31121		
Address	Client		AT JAFZ		
Site Azimuth	Client		PLOT NO S.31121		
Climate Zone	Preparer		Abu Dabhi		
Site Elevation	Preparer	ft			
Discount	Preparer	%			
Project Life Cycle cost	Preparer				
Holiday Set	Preparer				
Electricity	Preparer				
Fuel	Preparer				

PROJECT DOCUMENTATION

Data Points	Source	Units	ASHRAE 90.1	As-Is	Proposed
Drawing List	Client		yes		
Site Plan			yes		
All Floor Plans(Including Basements,Car Parking and Roof Plans)			yes		
All Sections			yes		
All Elevations			yes		
Mechanical, Electrical,Lighting and Plumbing Drawings			NO		

VENTILATION YES

HVAC Calculations Client

BUILDING MATERIAL SPECIFICATION

Data Points	Source	Units	ASHRAE 90.1	As-Is	Proposed
Drawings					
Roof Material	Specs				
Material 1:	Specs	Btu/sq ft F	U-0.063		
Material 2:	Specs	Btu/sq ft F			
Ceiling Material	Specs	Btu/sq ft F			
Floor	Specs	Btu/sq ft F	U-0.350		
Material 1:	Specs	Btu/sq ft F			
Internal Floor	Specs	Btu/sq ft F			
Partitions	Specs	Btu/sq ft F			
Kind of Opening	Drawings				
Wall Construction	Specs	Btu/sq ft F	U-0.124		
Glazing Material	Specs				
General Glazing (U value,SHGC)		Btu/sq ft F	U Fixed -1.22 SHGC all -0.19		
General Glazing (U value,SHGC)		Btu/sq ft F			
Window Size	Drawings				
Overall Percentage		Percentage	More than 40%		
Window Size		Feet	Varies		
Window Sill	Drawings	Feet	Varies		
Lighting Power Density	Client	Watt per Sq ft	Varies		Use Table 9.6.1
Light to Space					
Equipment Power Density	Client	Watt per Sq ft	Varies		Use image (mail)
Occupancy Density	Client	Sq ft per Person	275		Table G-D in Case study
Zone type(Conditioned/Unconditioned)					
Infiltration	Client	ACH	0.5		

System Type PACKAGEDGED SINGLE ZONE Use table G3.1.1A in Appendix G

Oversizing Ratio for Cooling 1.15

Oversizing Ratio For Heating 1.25

EER=3.413/COP for IP Units
 For PTAC System COP is given in 6.8.1D
 For VAVS don't take any value,run the simulation and from system summary take the total value of Cooling Peak in **Watt** (X 1000) and then check in the table 6.8.1D, take COP and calculate EER from Formula.

OUTPUT

Condition Area	2739	Sq.ft
Cooling Capacity	148.5	KBtu/h
Area/ Ton	222	
Unmet Hrs	129	
Attach Plant Summery if VAVS/Chiller system is used	NO	
Attach System Summery if PTAC/PSZ system is used	yes	

B E Y O N D
S M A R T C I T I E S

CONTACT US



+91 6363032722



info@beyondsmartcities.in



learn.beyondsmartcities.in



#55,HMR Layout ,Bengaluru ,India



THANK YOU

