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ENERGY MODELING SPECIALIST
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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

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MODULE L3

Building Energy Modeling Checklists

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

Building Energy Modeling input checklists are invaluable tools that facilitate the systematic collection and organization of essential data needed for accurate energy simulations. By ensuring that all relevant parameters are addressed, modelers can enhance the reliability of their analyses and contribute to more energy-efficient building designs.

Learning Objectives

- Introduction and Course Outline
- Building Energy Modeling Checklists
- AutoCAD to BEM Software Importation
- ASHRAE Standards and Guidelines
- BEM software inputs for the project section, facade, systems, and zones
- 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

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INTRODUCTION

- BEM is a crucial process for evaluating and optimizing building energy performance.
- It allows architects, engineers, and energy consultants to make informed decisions about design, equipment selection, and operational strategies.
- Input checklists in BEM guide the modeler in collecting and verifying necessary data before simulation.
- Key components include building geometry and orientation, thermal envelope, internal loads, HVAC systems, renewable energy systems, and operational characteristics.
- To maximize effectiveness, practitioners should adopt a collaborative approach, review checklist items against design documents, and use built-in templates in BEM software packages.
- Referring to past projects and empirical data can provide a benchmark for expected performance and validate inputs against real-world scenarios.

BUILDING ENERGY MODELING INPUT CHECKLISTS

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- BEM is a crucial process for evaluating and optimizing building energy performance.
- It allows architects, engineers, and energy consultants to make informed decisions about design, equipment selection, and operational strategies.
- The accuracy and reliability of simulation outcomes depend on the quality of the input data.

IMPORTANCE OF INPUT CHECKLISTS

- Input checklists guide the modeler in collecting and verifying necessary data before simulation.
- They help minimize errors and omissions that could compromise the results of the energy analysis.

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COMPONENTS OF BEM INPUT CHECKLISTS

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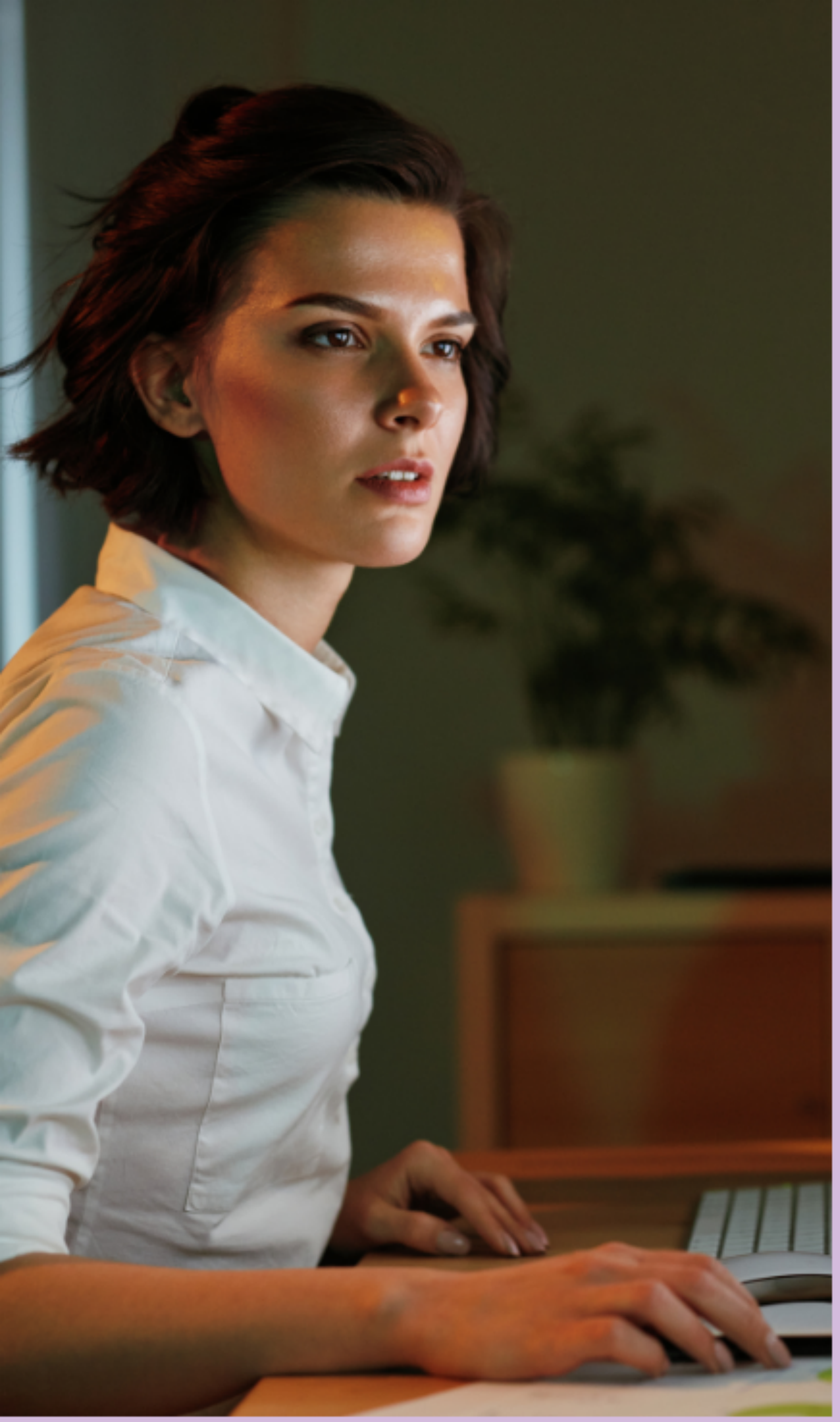
- Building Geometry and Orientation: Checklist Items include overall dimensions, floor area, volume, number of floors and stories, orientation relative to cardinal directions, and window-to-wall ratio.
- Thermal Envelope: Checklist Items include wall construction materials, insulation values, roof and floor assembly details, window specifications, and air leakage rates.
- Internal Loads: Checklist Items include occupancy schedules, plug loads, lighting power density, and control strategies.
- HVAC Systems: Checklist Items include type of heating, ventilation, and air conditioning systems, efficiency ratings, and control strategies.
- Renewable Energy Systems: Checklist Items include types of renewable systems, system capacities, orientations, and performance metrics.
- Operational Characteristics: Checklist Items include building usage patterns, maintenance schedules, utility rates, and demand charges.

IMPLEMENTING INPUT CHECKLISTS



- Regular reviews of checklist items against design documents and specifications can identify discrepancies early in the modeling process.
- Software utilization: BEM software packages often include built-in templates for input checklists.
- Case Studies and Historical Data: Referring to past projects and empirical data can provide a benchmark for expected performance and validate inputs against real-world scenarios.

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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		*Conversion from SI to IP*
Material 2:	Btu/sq ft F			*(W/sqm K) / 5.678 = Btu/sqf*
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		COP = EER/3.413	
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			

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SPACE DEFINITION

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

Floor	Given Name	Conditioned ?	LPD	EPD	Occupancy	Daylight Sensors	Occupancy Sensors	Supply Air	Outside Air
(GF, 1st, 2nd, etc)		(C- conditioned)	(Light Power Density)	(Equipment Power Density)	(Sqft / person)	(Yes or No)	(Yes or No)	(cfm/sq ft)	(cfm/person)
		(Un - Unconditioned)	(W/sqft)	(W/sqft)					
GF	Management Office	C	1.1	1	275	Yes	Yes	1.1	15
GF	Parking	Un	0.7	0	150	No	No	0.8	20

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

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Construction Material Specifications.

Construction Type**	Name of material	U-value (Btu/hr-ft2-F)	R-Value (hr-ft2-F/Btu)	Thickness(inch)	Conductivity (Btu/hr-ft-F)	Density(lb/ft3)	Specific heat (Btu/lb-F)
Wall							
Floor							
Roof							
Partitions							
Internal Floor							

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.

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INPUT / OUTPUT CHECKLIST

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INPUT						
PROJECT INFORMATION						
Data Points	**Source**		**PLOT NO S.31121**			
Project Name	Client		**AT JAFZ**			
Address	Client		PLOT NO S.31121			
Site Azimuth	Client		Abu Dhabi			
Climate Zone	Preparer					
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	Client					
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 summery 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					

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SPACE DEFINITION

Floor	Cond.	Given Name	VDOE Name	Space Type	LPD	EPD	Occupancy	Daylight Sensors	Occupancy Sensors
Ground Floor	C	MESSHALL	0MESSHALL	Restroom	0.9	0	250		
Ground Floor	C	OFFICE	0OFFICE	Corridor	0.5	1	250		
Ground Floor	C	Pantry	0Pantry	Active Storage	0.8	1	250		
Ground Floor	C	Prayer Room	0PRAYER HALL	Fellowship Hall	0.9	1	250		
Ground Floor	U	WAREHOUSE	U0WARE HOUSE	Inactive Storage	0.3	1.5	15000		

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ERROR LOGS

Error

All zones served by this system should have throttling range not less than 4°F, otherwise the system operation may not be stable.

Solution

If this type of error occurs, go to zones and change your throttling range 3°F to 4°F

One more thing selects all Zones which having an errors and then insert 4°F. You can use ctrl or shift key to select all the zones.

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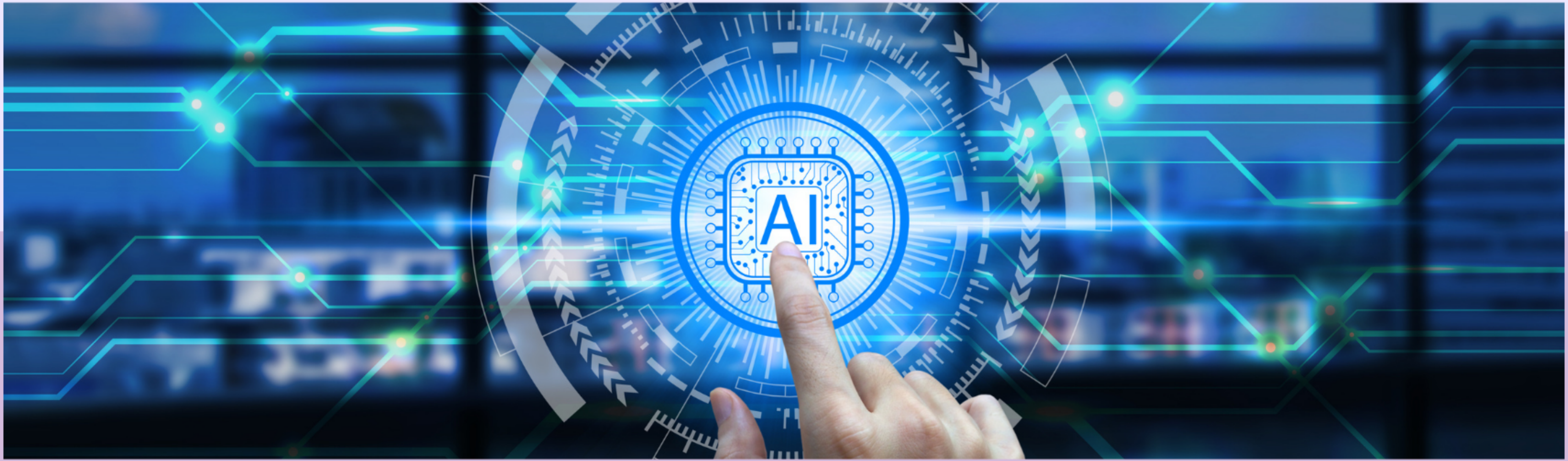
THANK YOU

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