



TOBIN CENTER FOR THE PERFORMING ARTS

Laura Ashley A. Alferes
Lighting | Electrical
Faculty Advisor | Dr. Kevin Houser
04.14.2014



Tobin Center for the Performing Arts

Project Background + Design Development

Main Lobby

Circulation Space

Event Plaza

Outdoor Space

Electrical Depth

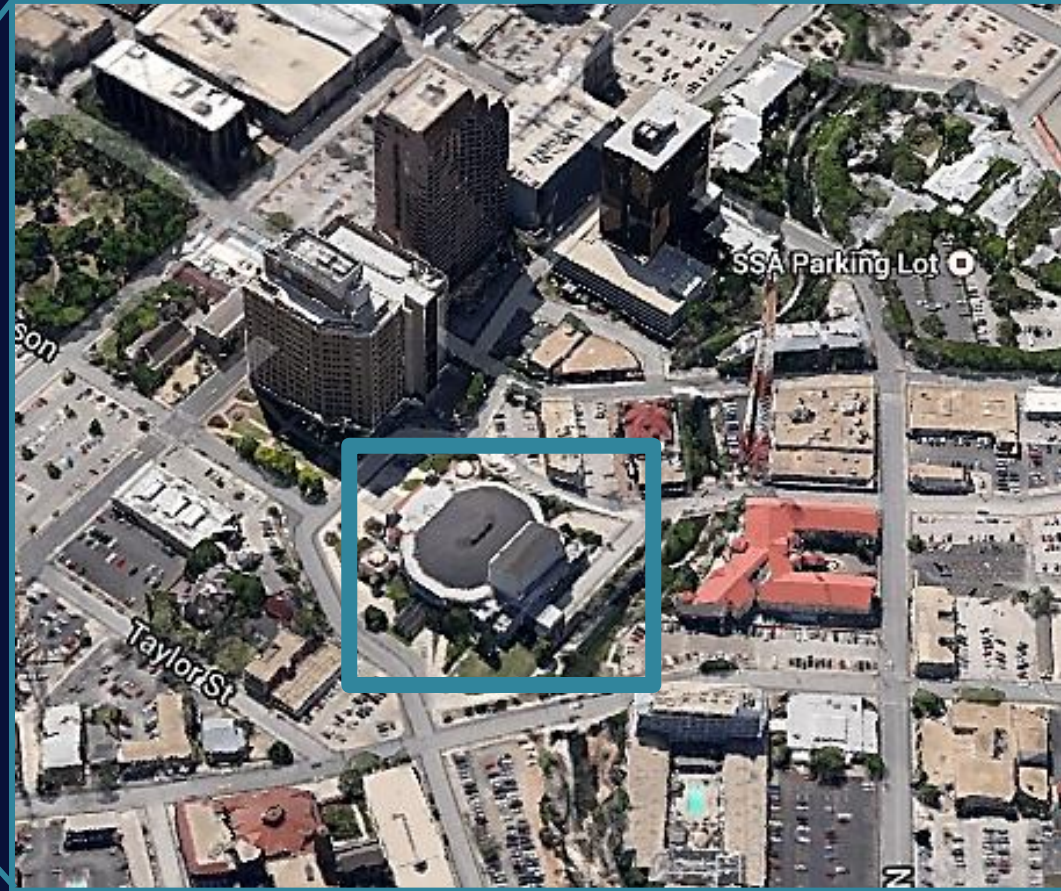
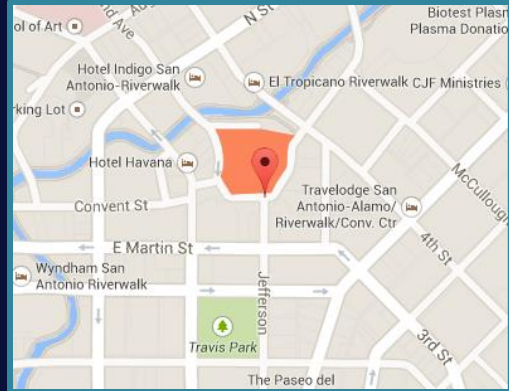
BIPV+ CM Breadth

Mechanical Breadth

Biogas Energy

Acknowledgments

Summary + Questions



Tobin Center Aerial View [Photo Credit: Google Maps]

Statistics

Name: Tobin Center for the Performing Arts

Location: San Antonio, TX

Size: 172,970 sf

Levels: 6+1 basemnt

Project Team

Architect of Record: LMN Architects

Construction Manager: Linbeck

MEP: Timmons Designer Engineers, TTG Goetting

Lighting Designer: Horton Lees Brogden, Inc.

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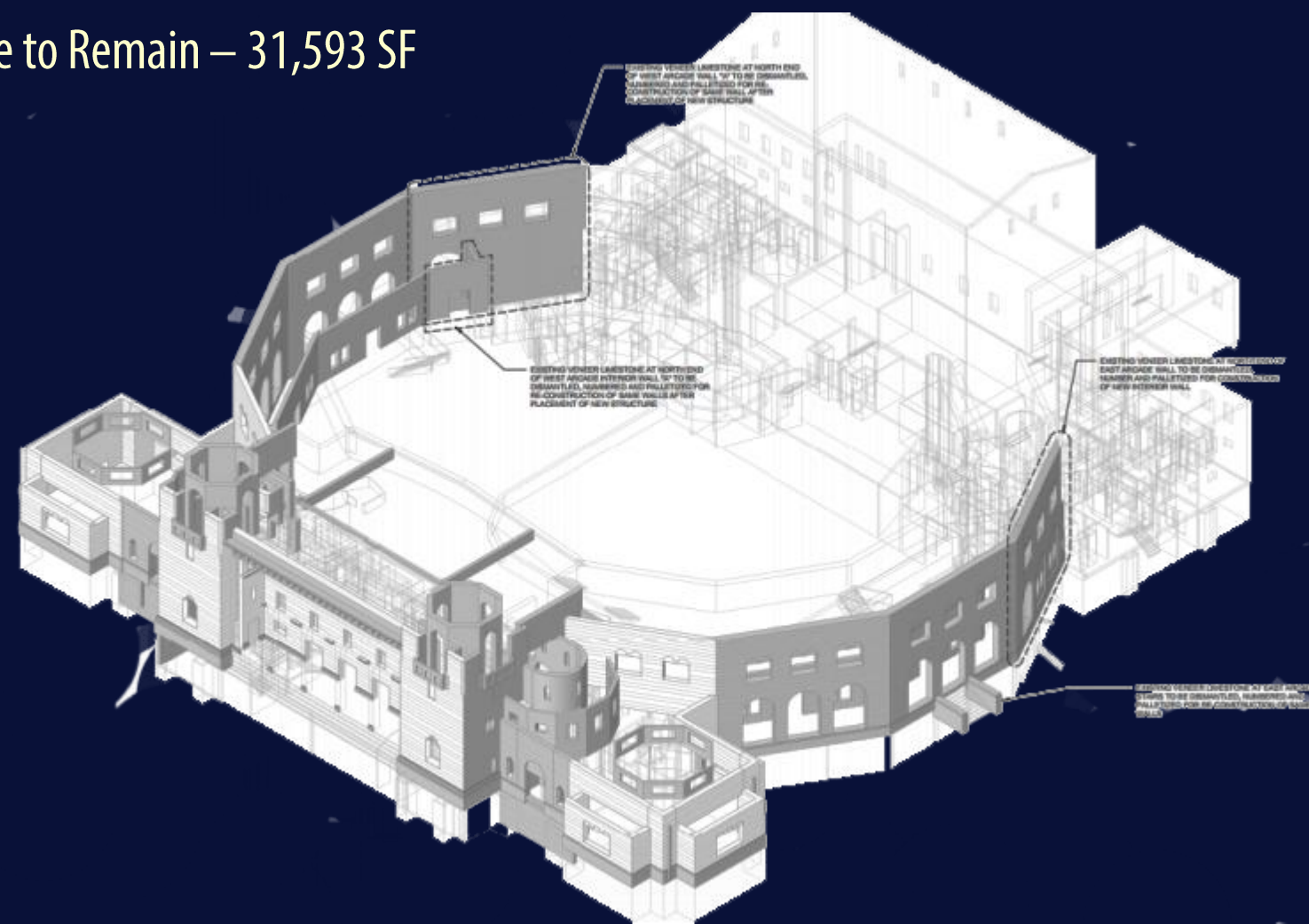
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[Courtesy of LMN Architects]

Estimated Stone to Remain – 31,593 SF



[Courtesy of LMN Architects]

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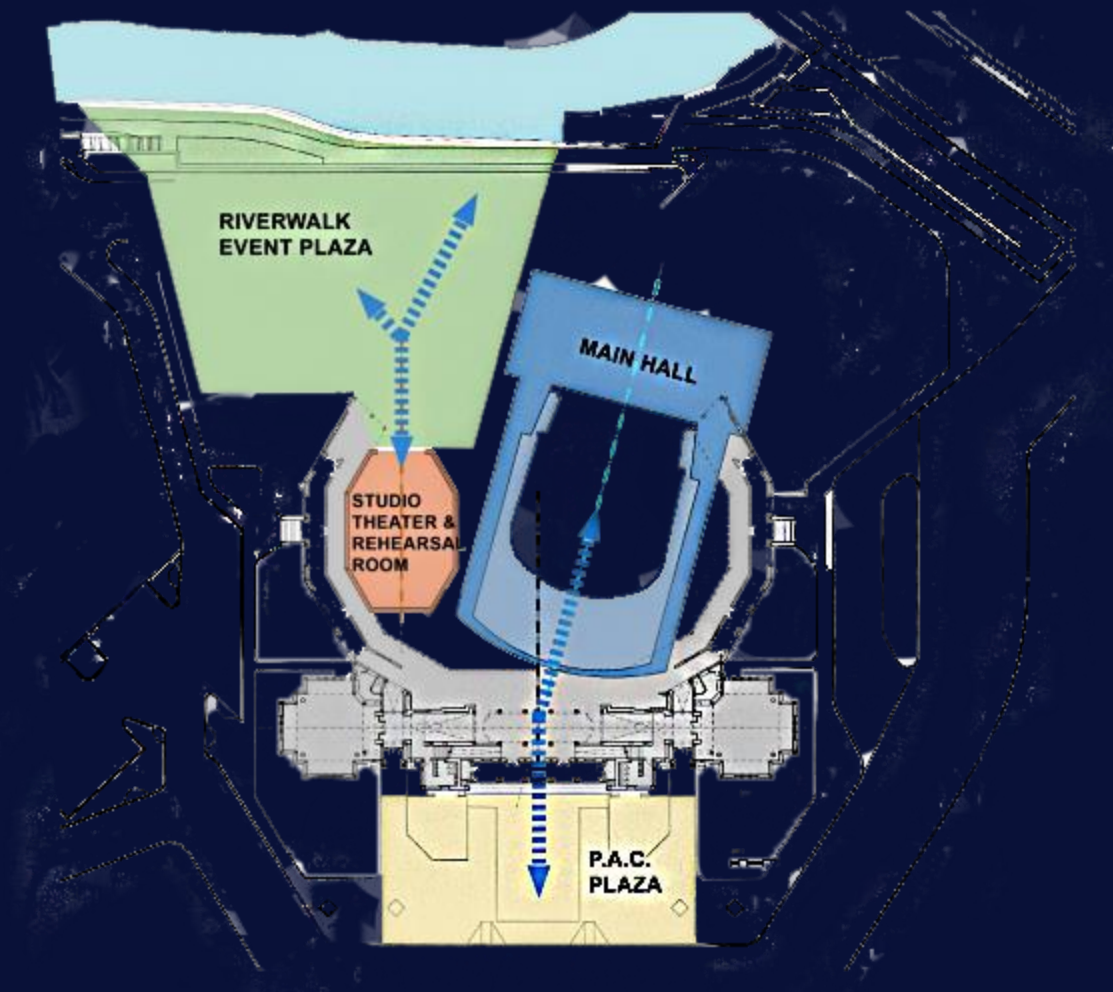
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[Courtesy of LMN Architects]

create a **dynamic** interplay of **form, geometry**
and **material** between historic element and the new addition

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[Photo Credit: Google Images, Performing Arts]

EMBRACE THE ARTS

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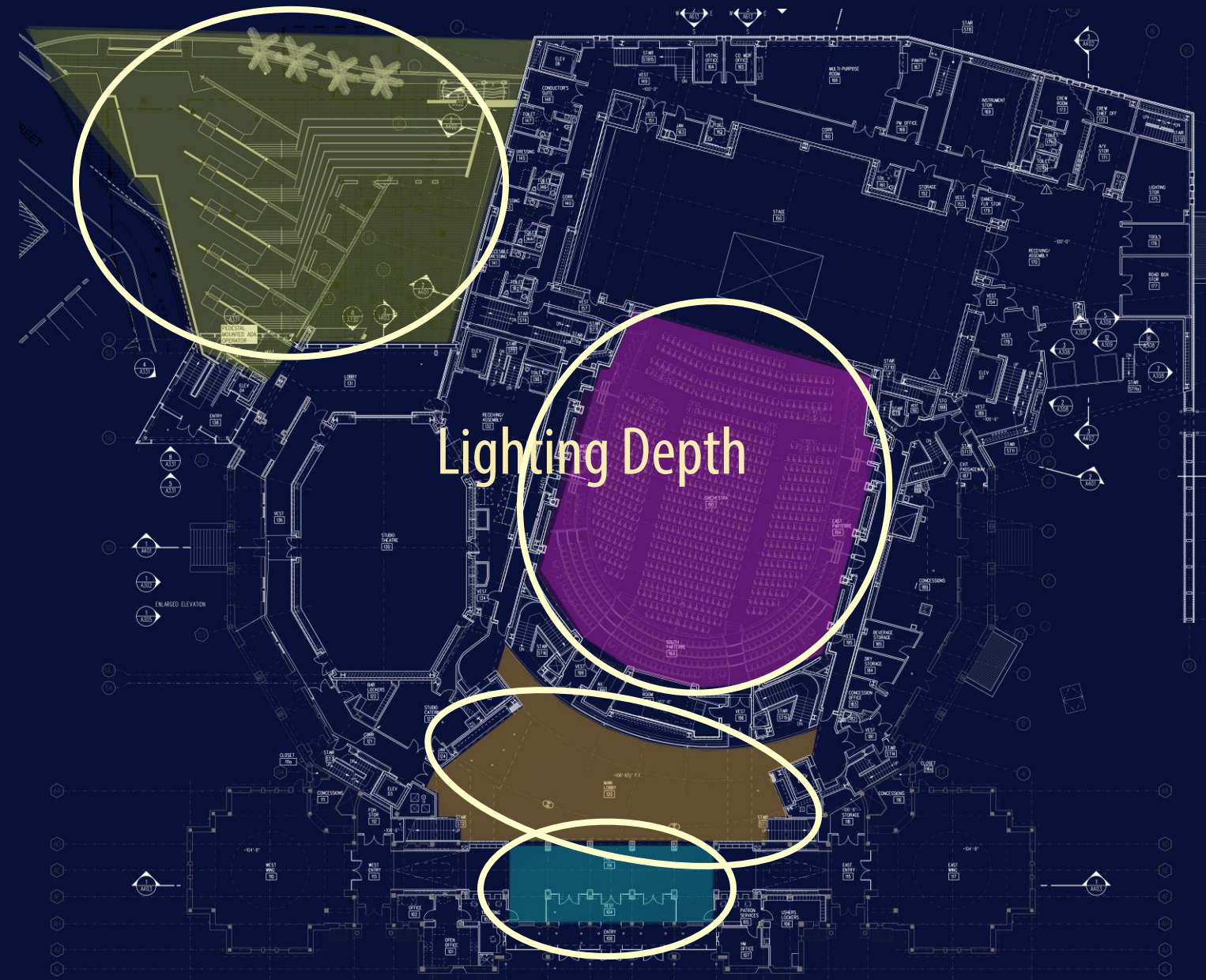
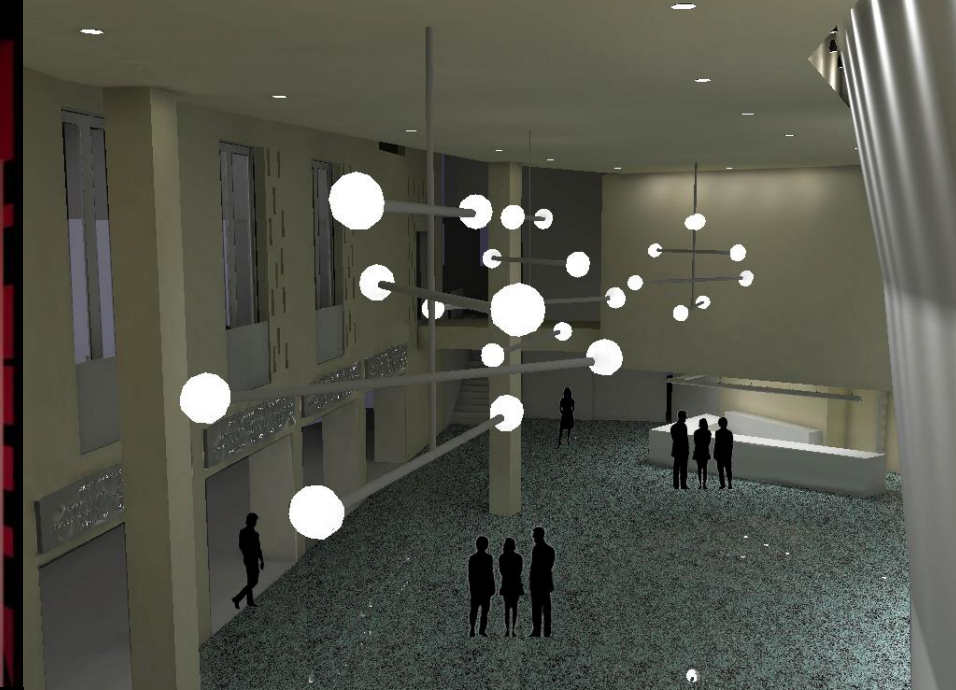
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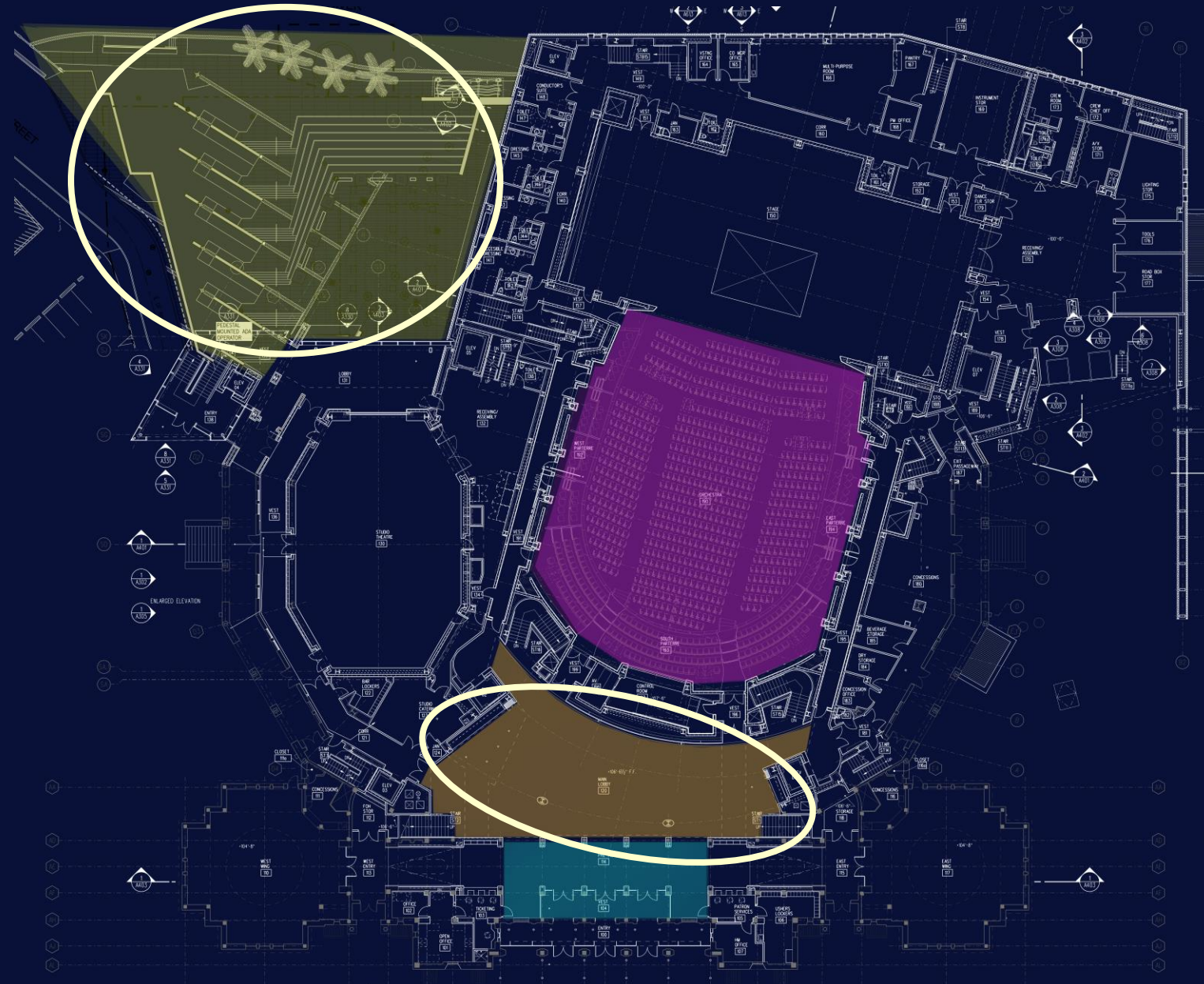
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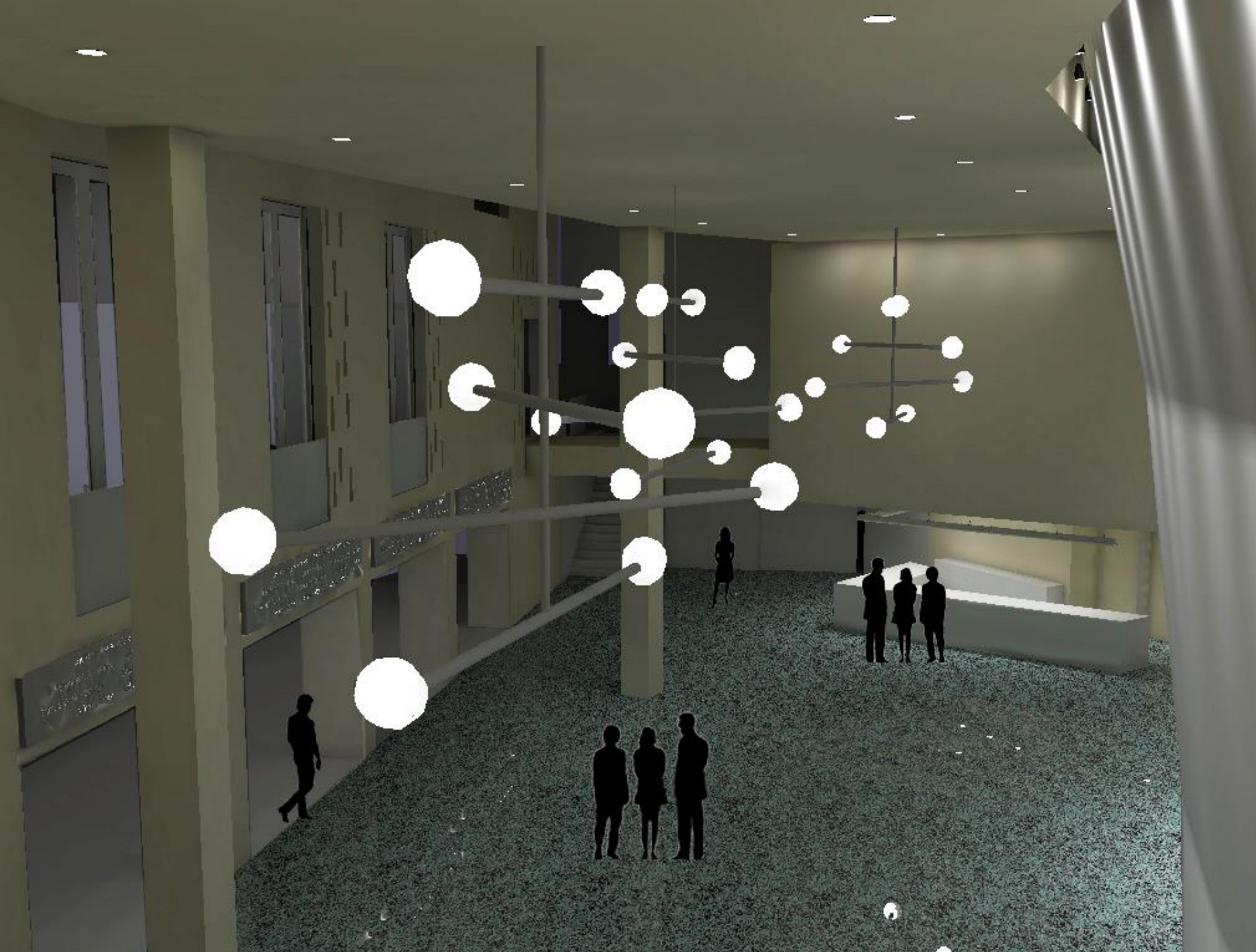
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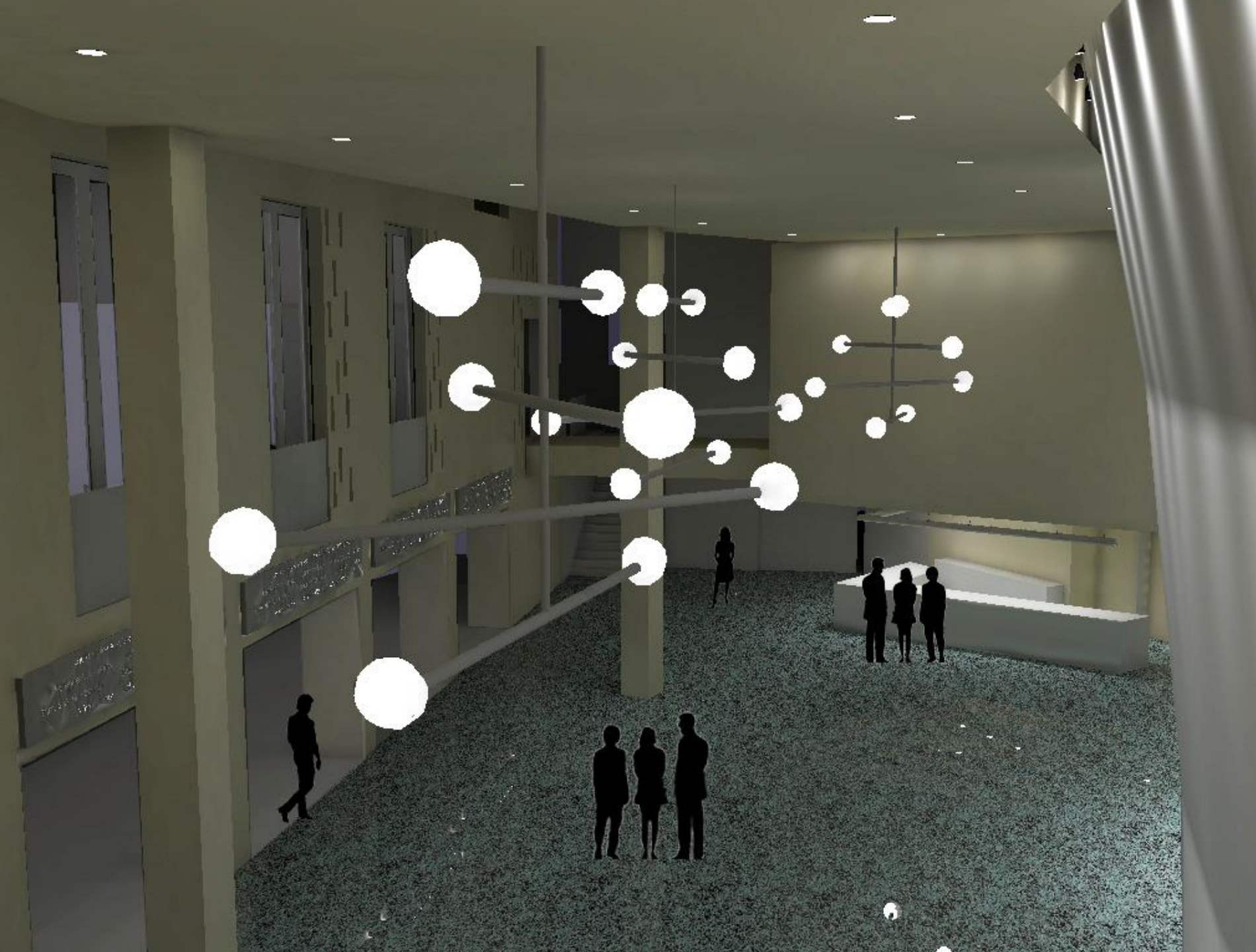
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Design Criteria



Circulation + Socializing
Engaging + Inviting
Musical Composition + Note

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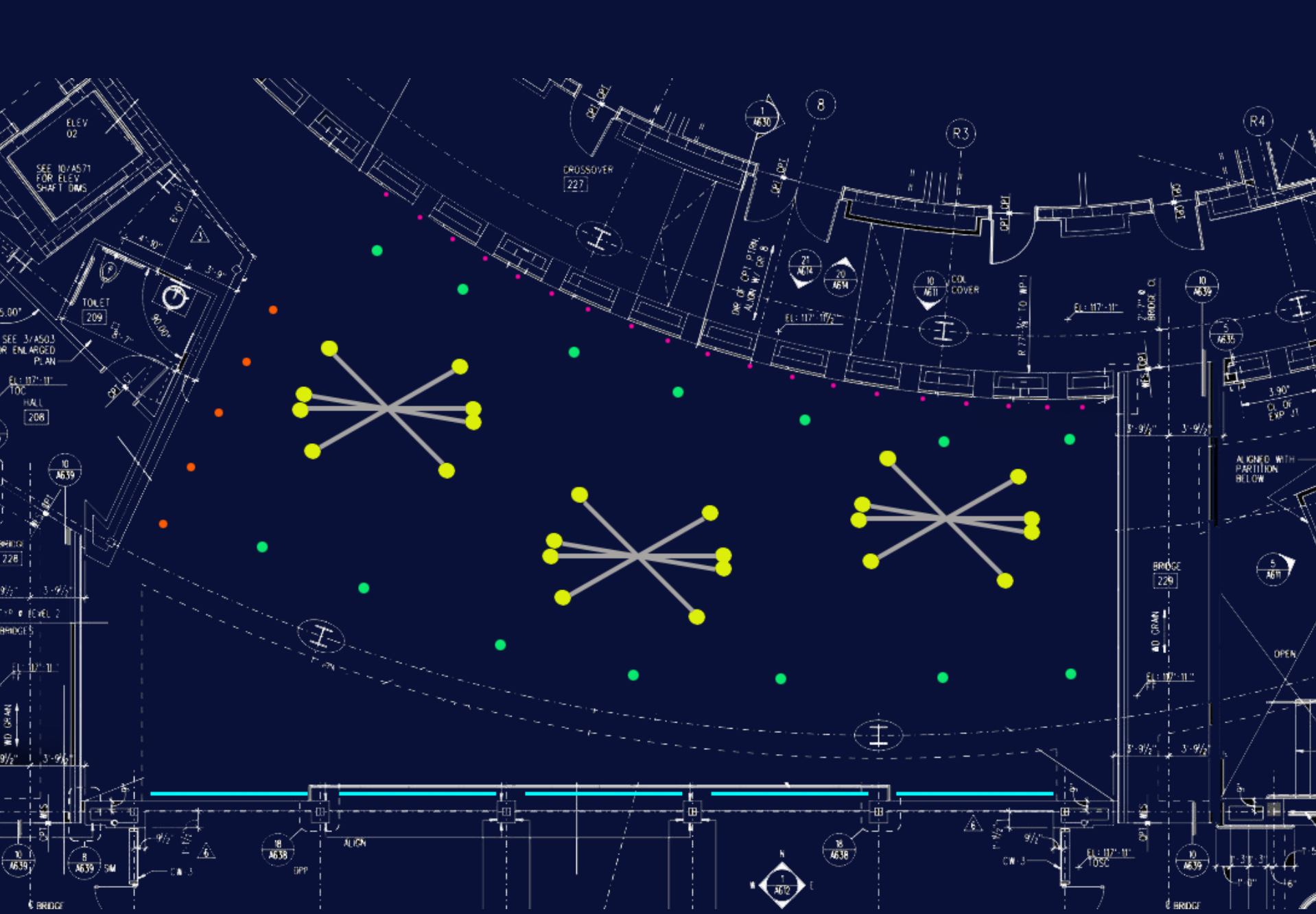
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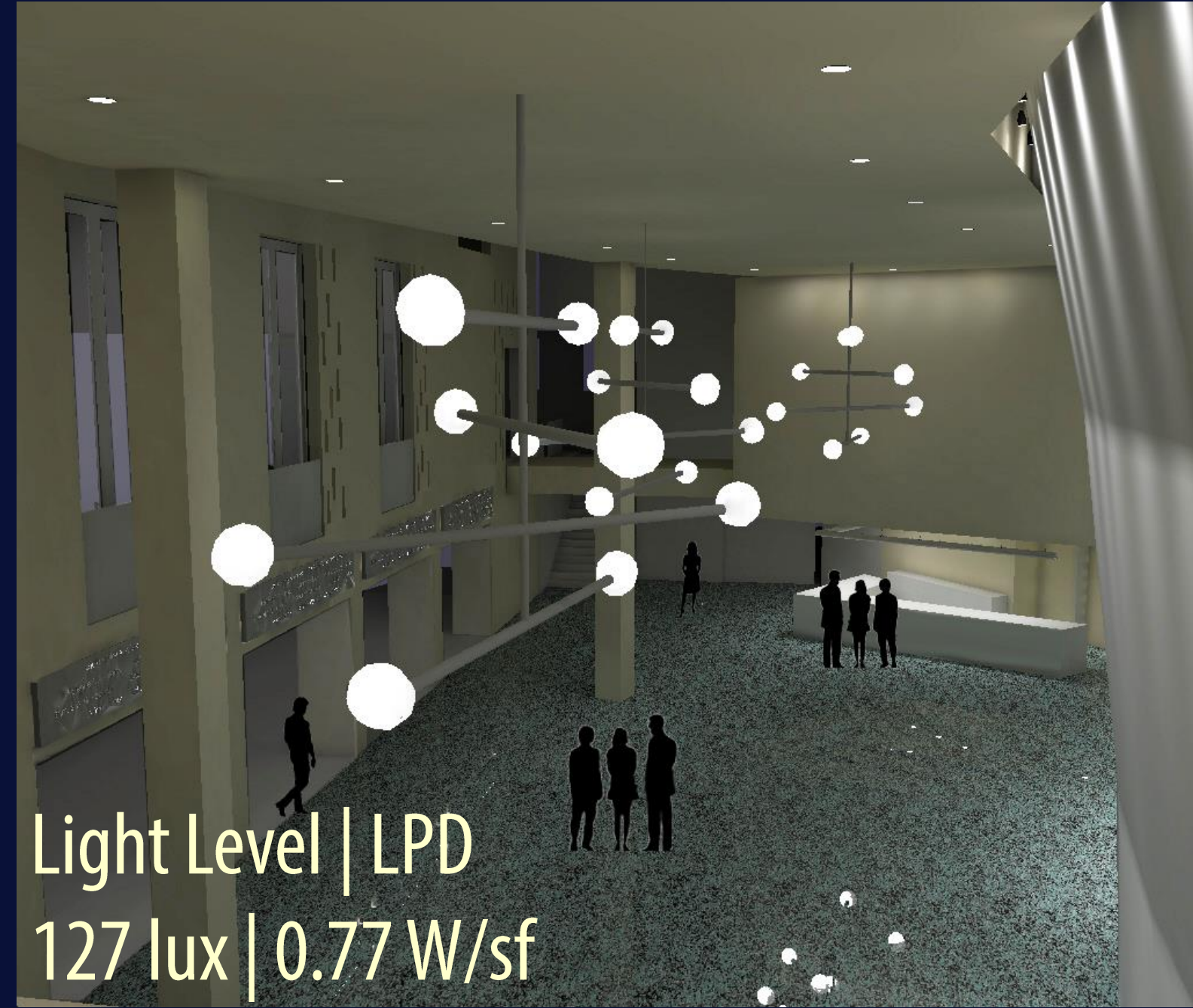
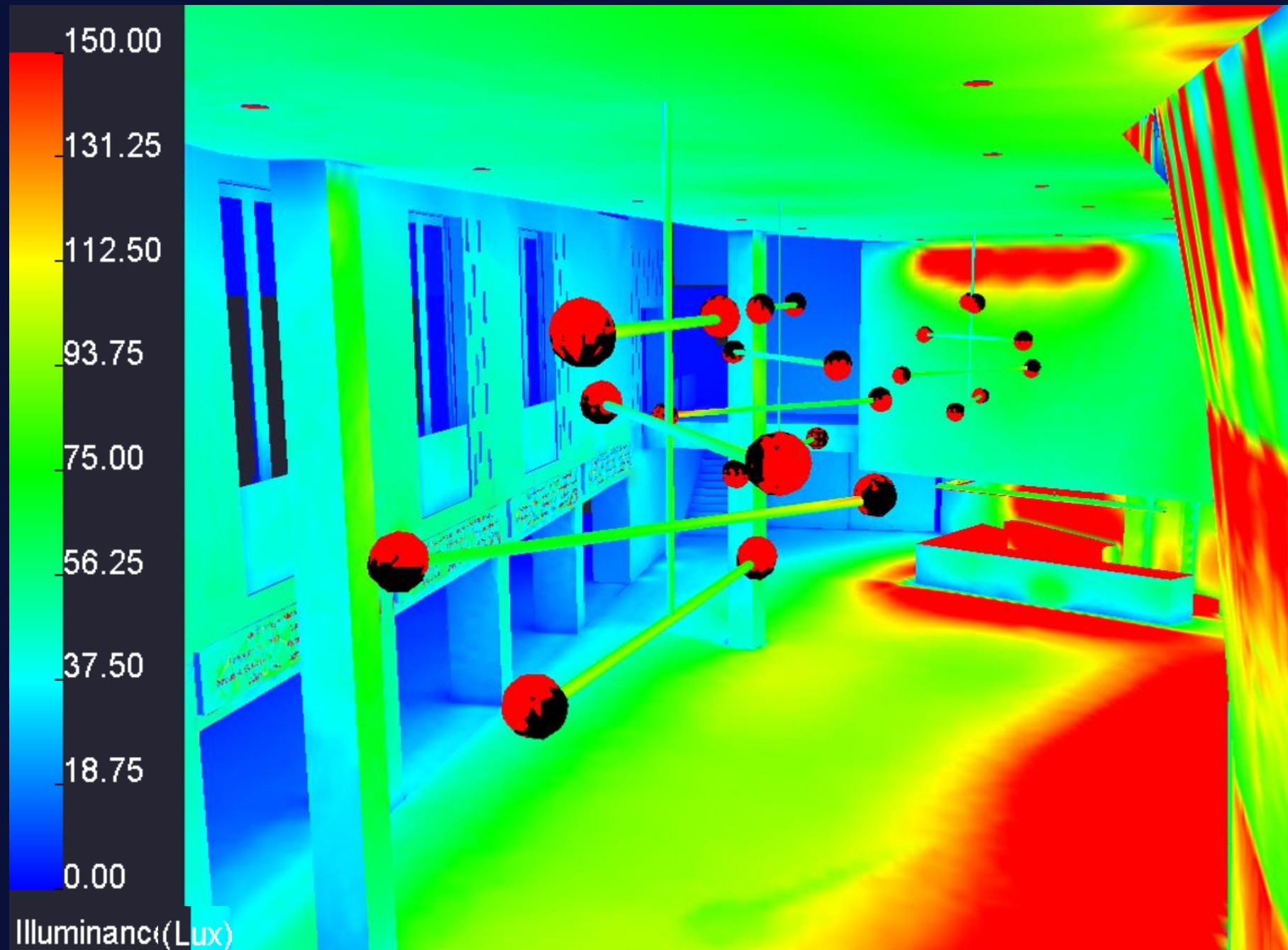
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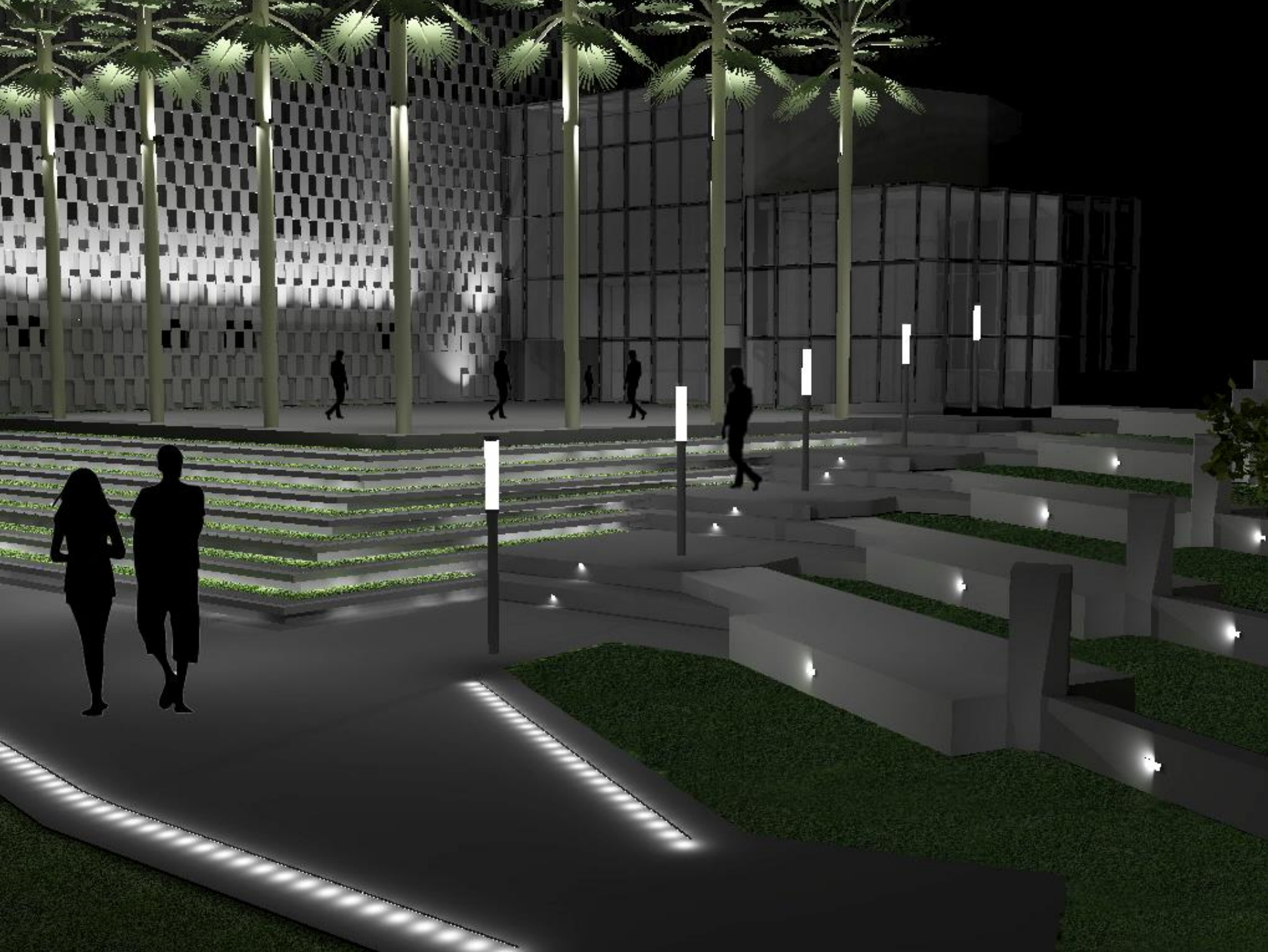
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Event Plaza

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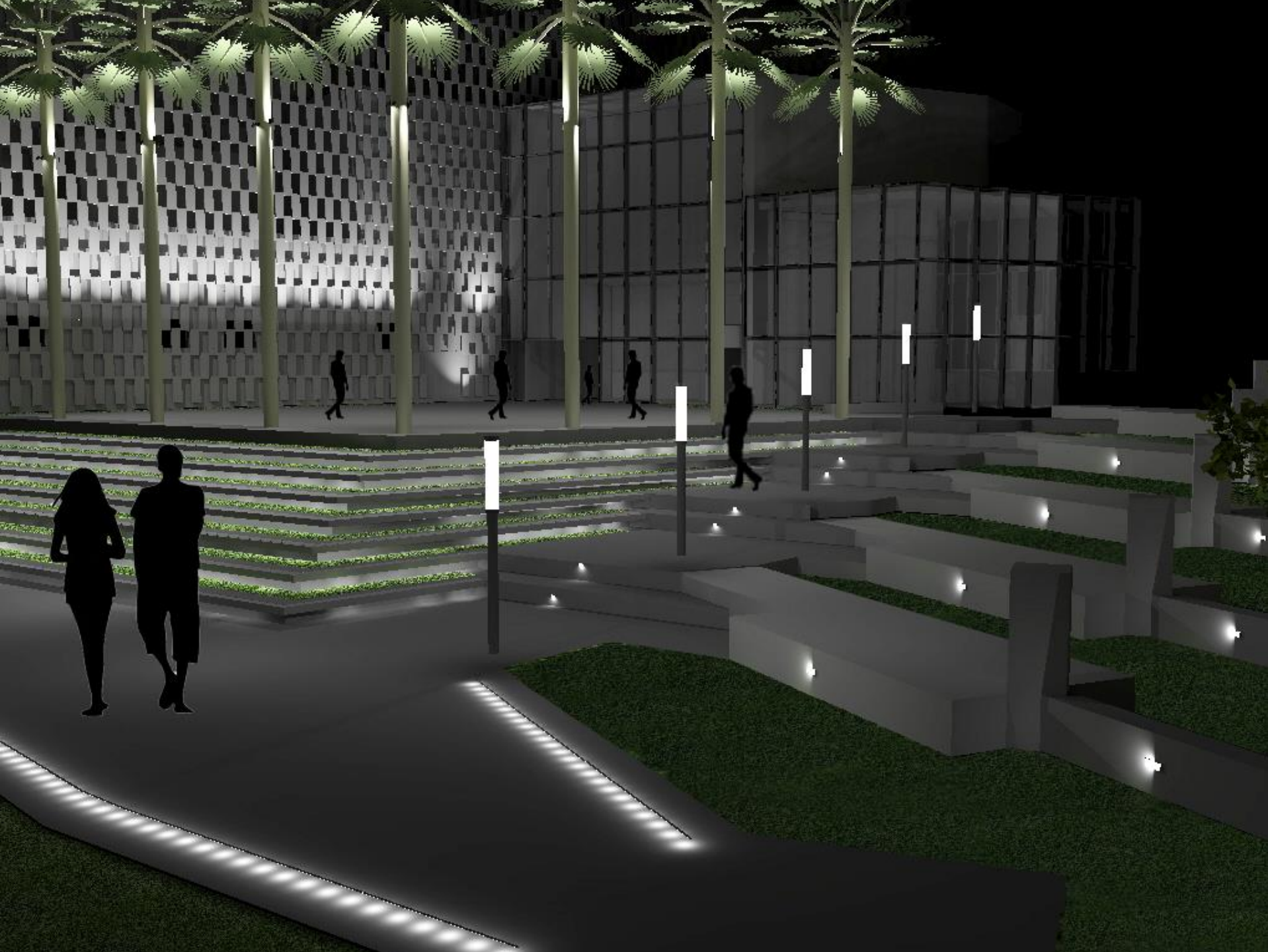
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Design Criteria



Eventful + Exciting
Safety
LZ3
Performing Arts Genres

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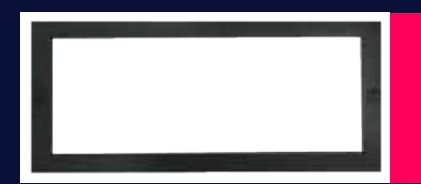
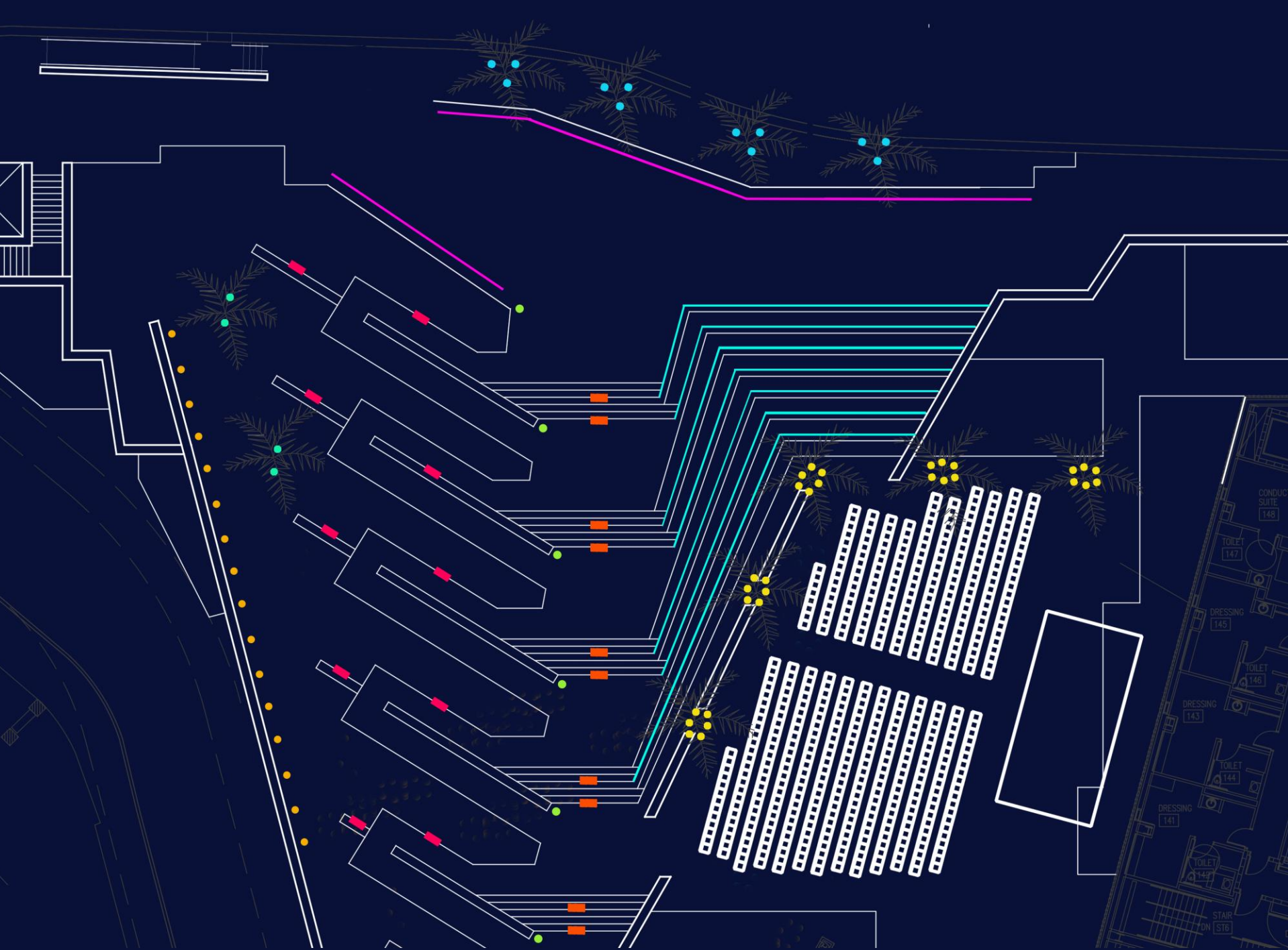
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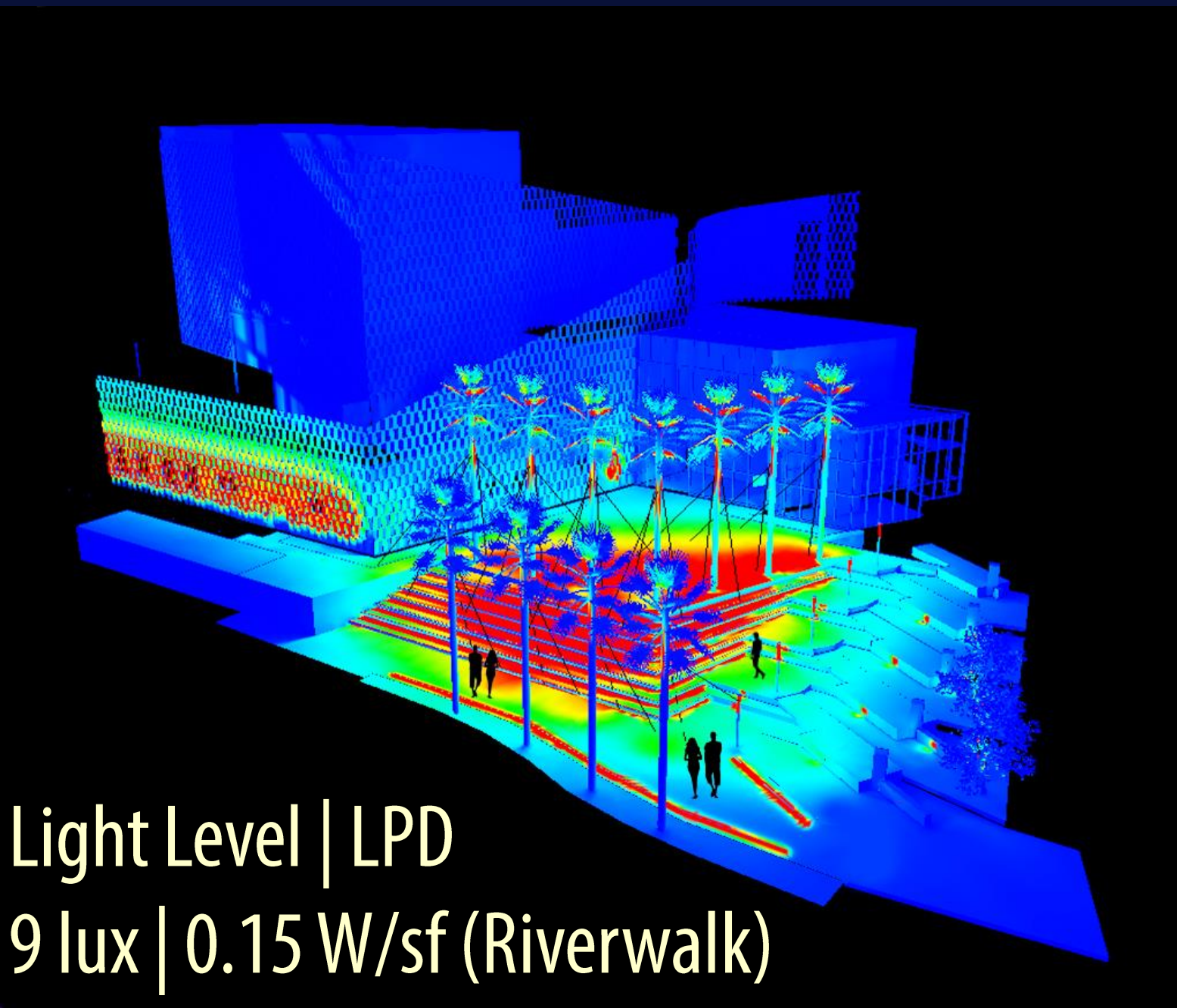
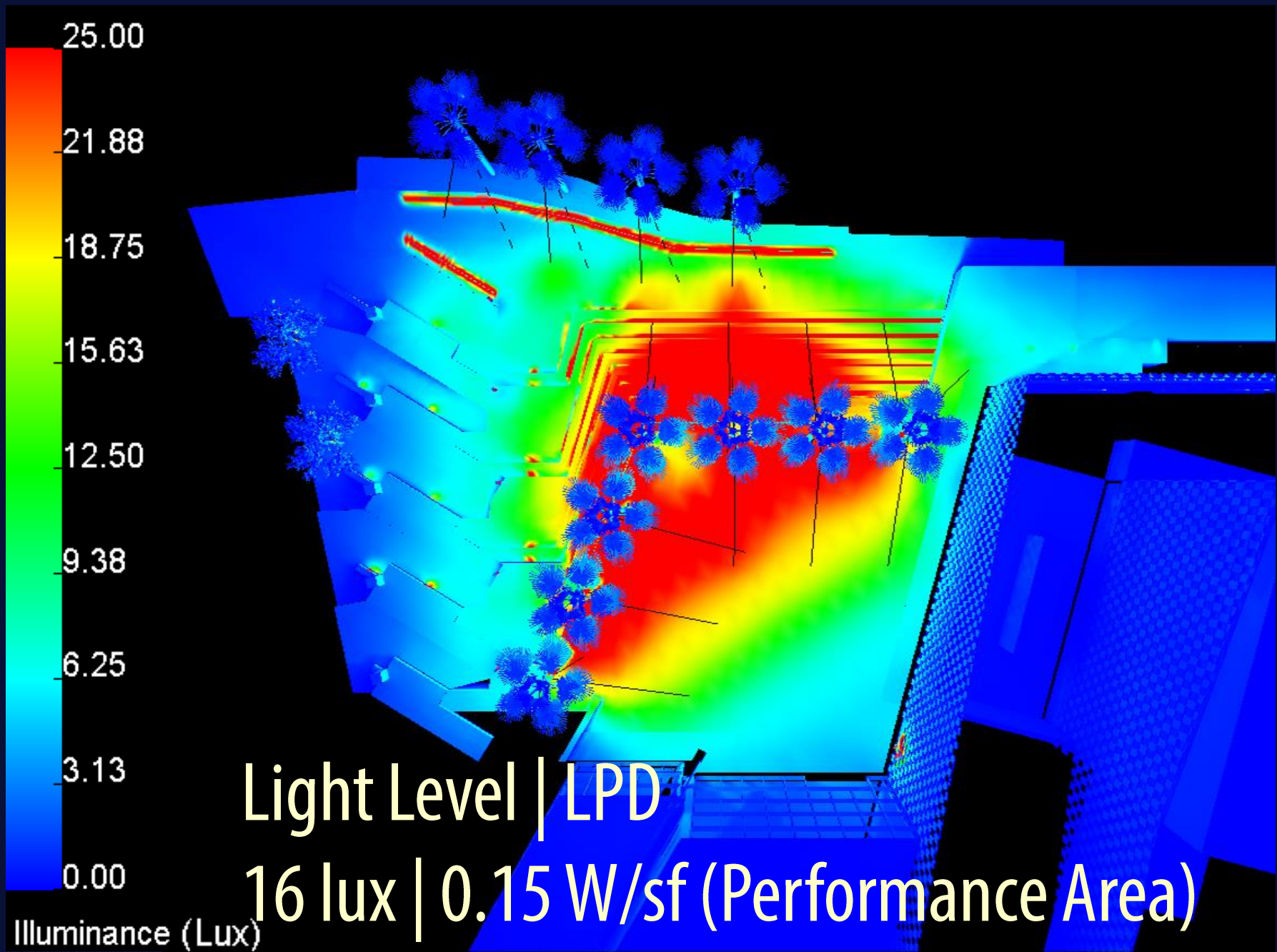
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Goal:

Maximize solar utility. **Electrical Depth** BIPV

Client:

Tobin Center

Given locale:

San Antonio

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**SYSTEM
ADVISOR
MODEL**

NREL NATIONAL RENEWABLE ENERGY LABORATORY

UNIVERSITY OF COLORADO

Sandia National Laboratories

Version 2012.5.11: Loading libraries...

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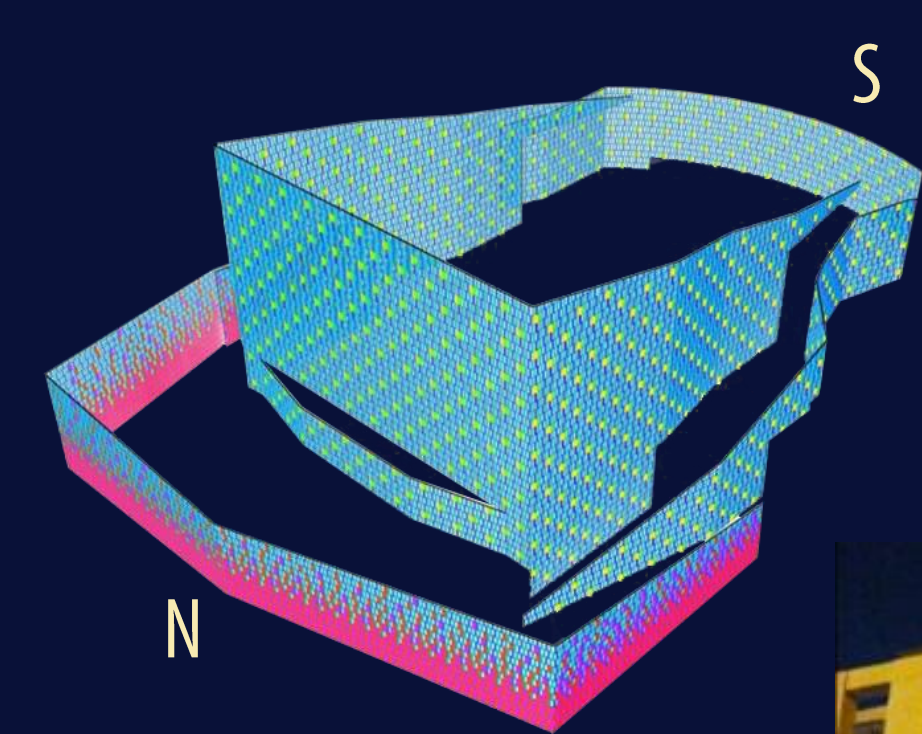
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CPS Energy Approved

Module	Output(Wdc)	Efficiency (%)	Material
BIPV054-T86	54	13.84	Multi-crystalline Silicon

Inverter	Max DC Power (Wdc)	Efficiency (%)	Power Consumption During Operation (Wdc)
ST42	44012.6	95.97	287.42

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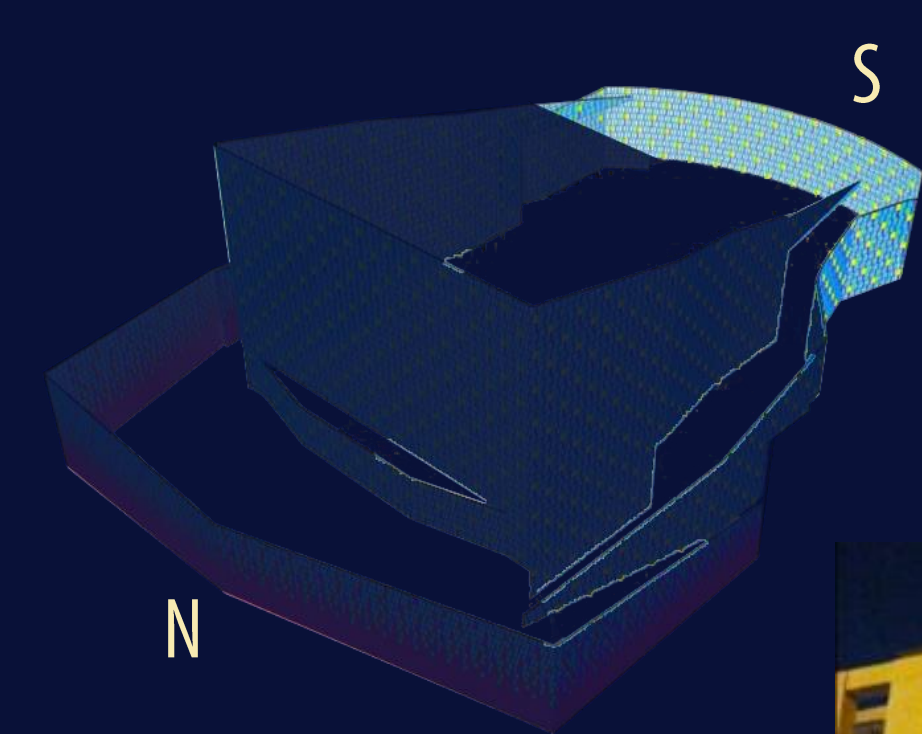
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Proposed System Size

Modules per String	Strings in Parallel	No. of Inverters
45	130	8

No. of Modules	Module Capacity	Inverter Capacity	DC to AC Ratio
5850	315.76 kWdc	352.1 kWdc	0.94

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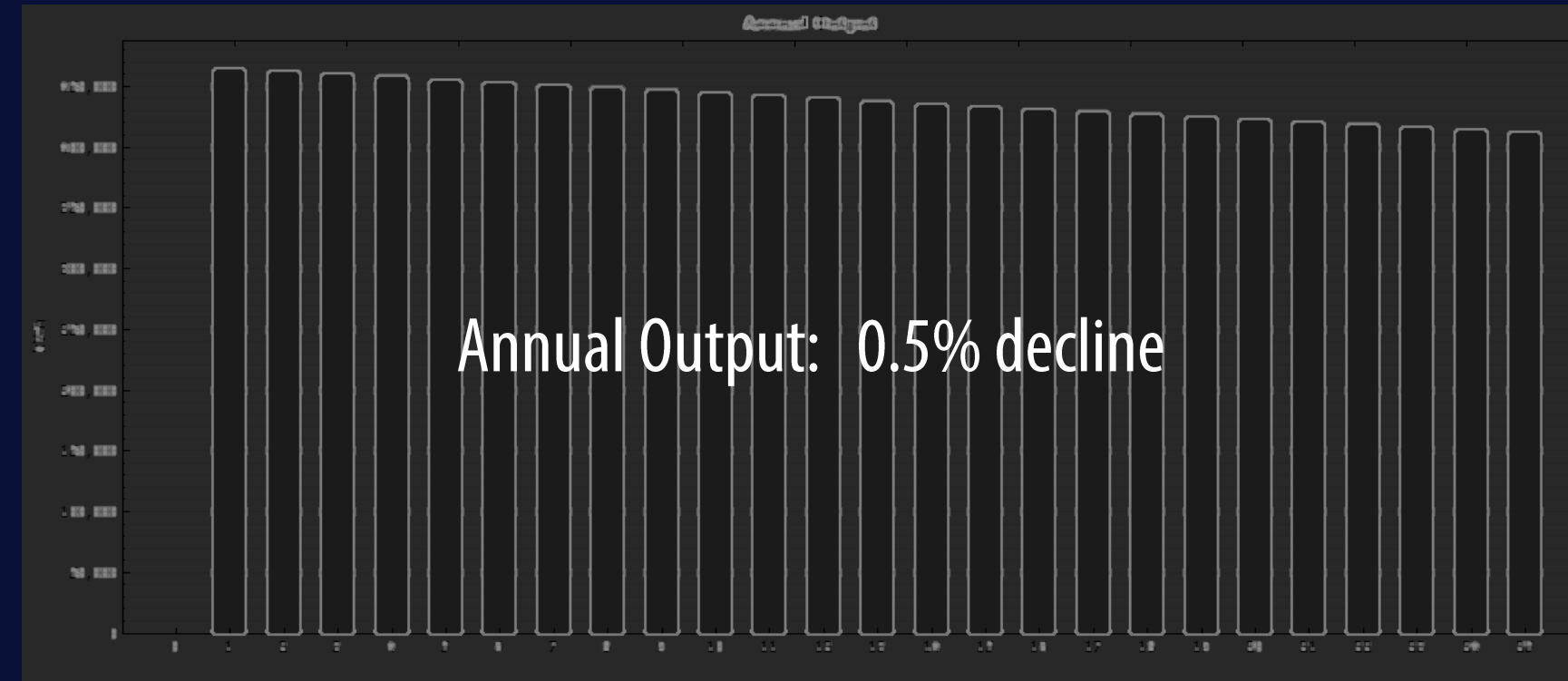
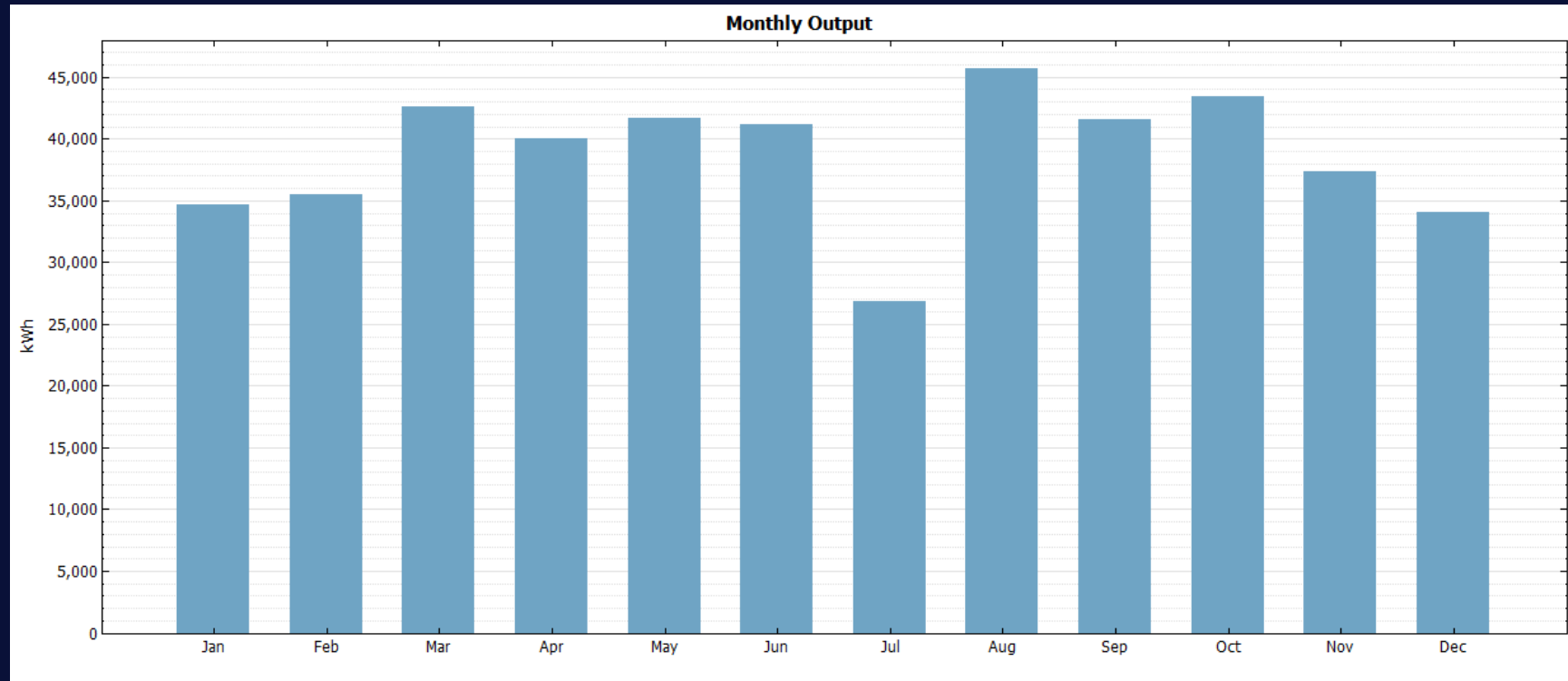
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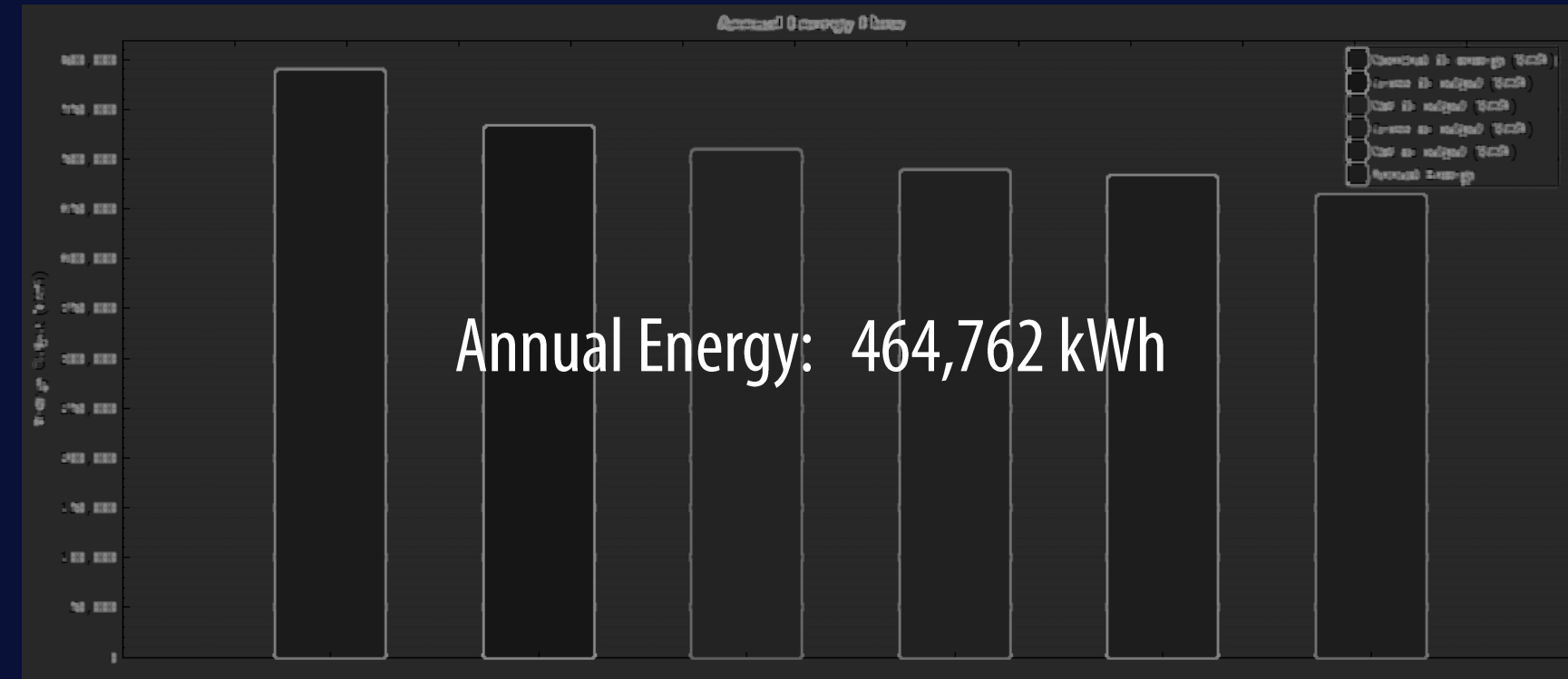
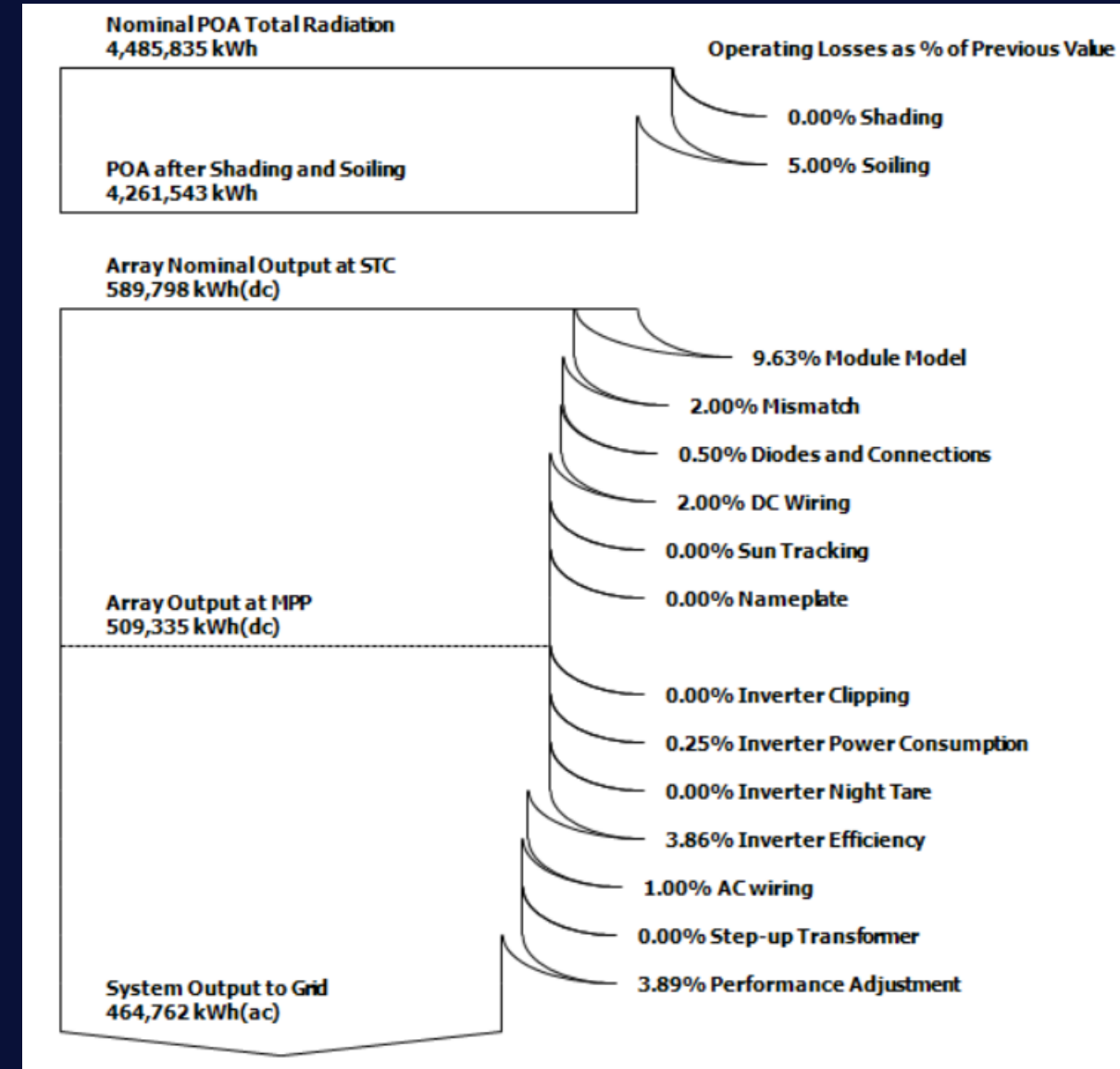
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Loss Diagram



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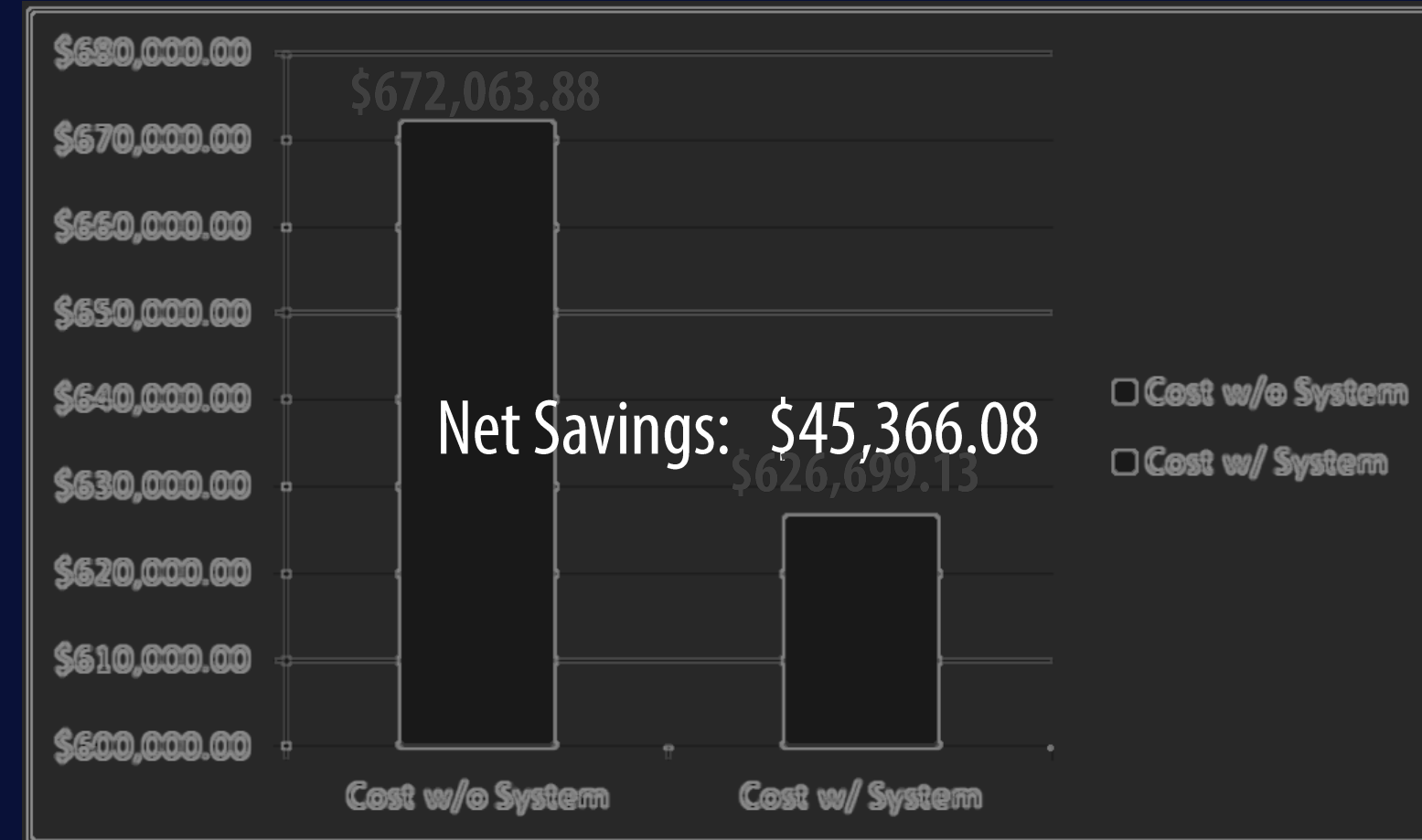
BIPV System Cost: \$789,782.84

Per Capacity: \$2.50 per Watt

Electricity Cost w/o System: \$672,063.88

Electricity Cost w/ System: \$626,699.13

Payback Period: 14.43 years



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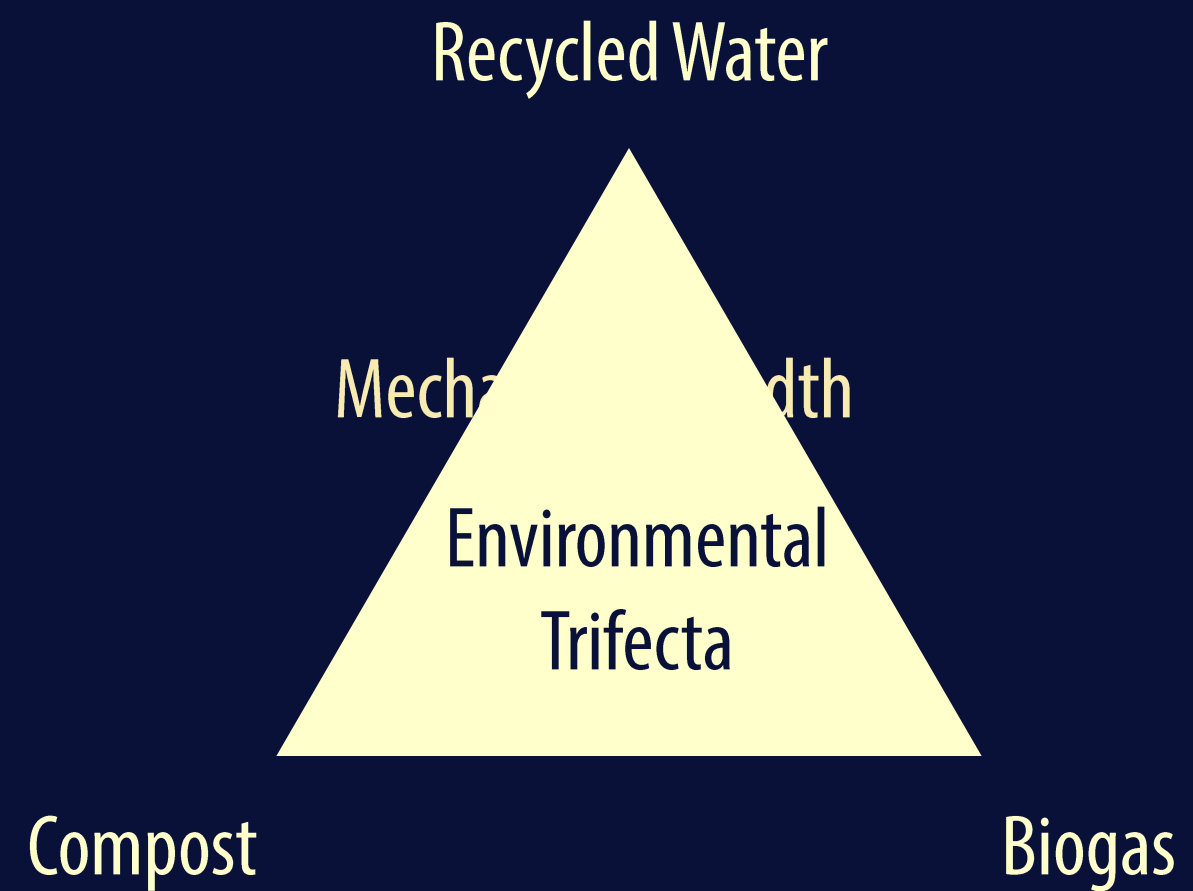
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[Photo Credit: San Antonio Water System]



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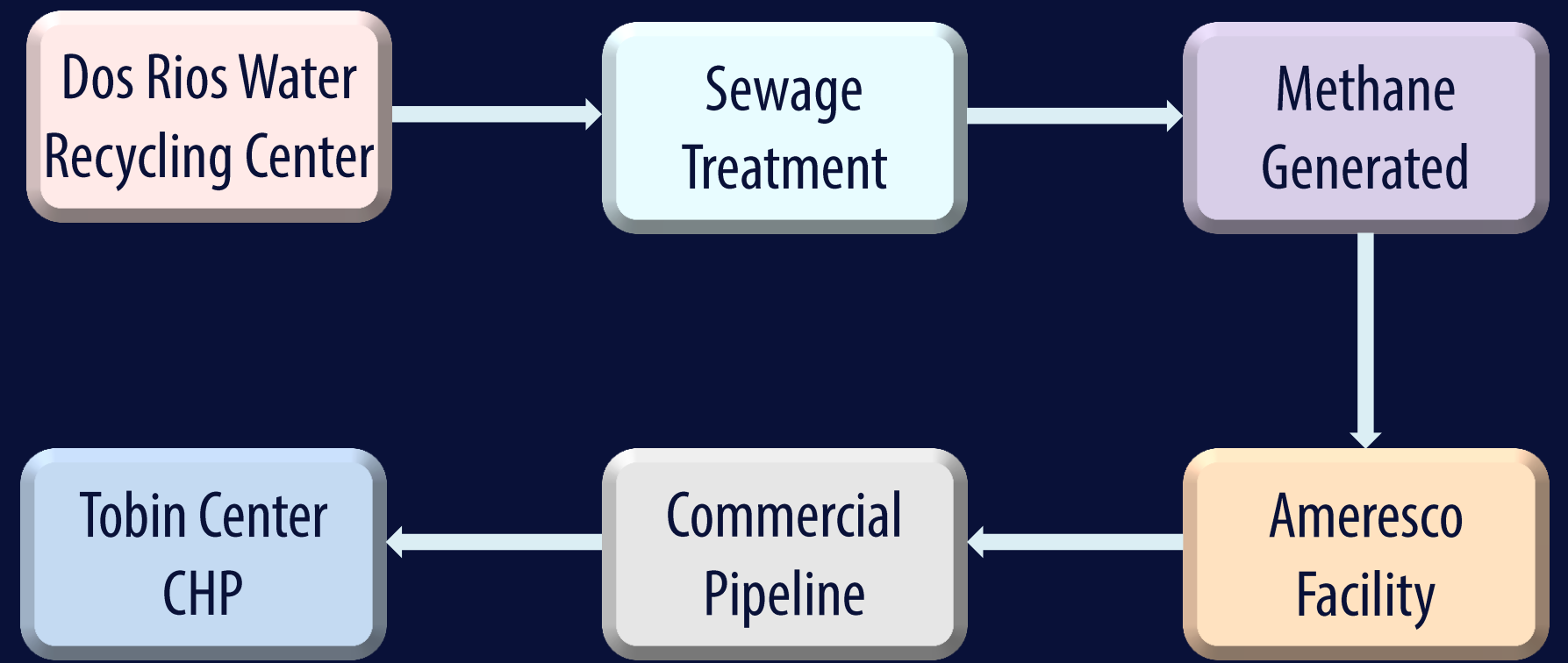
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[Photo Credit: San Antonio Water System]

Biogas Energy



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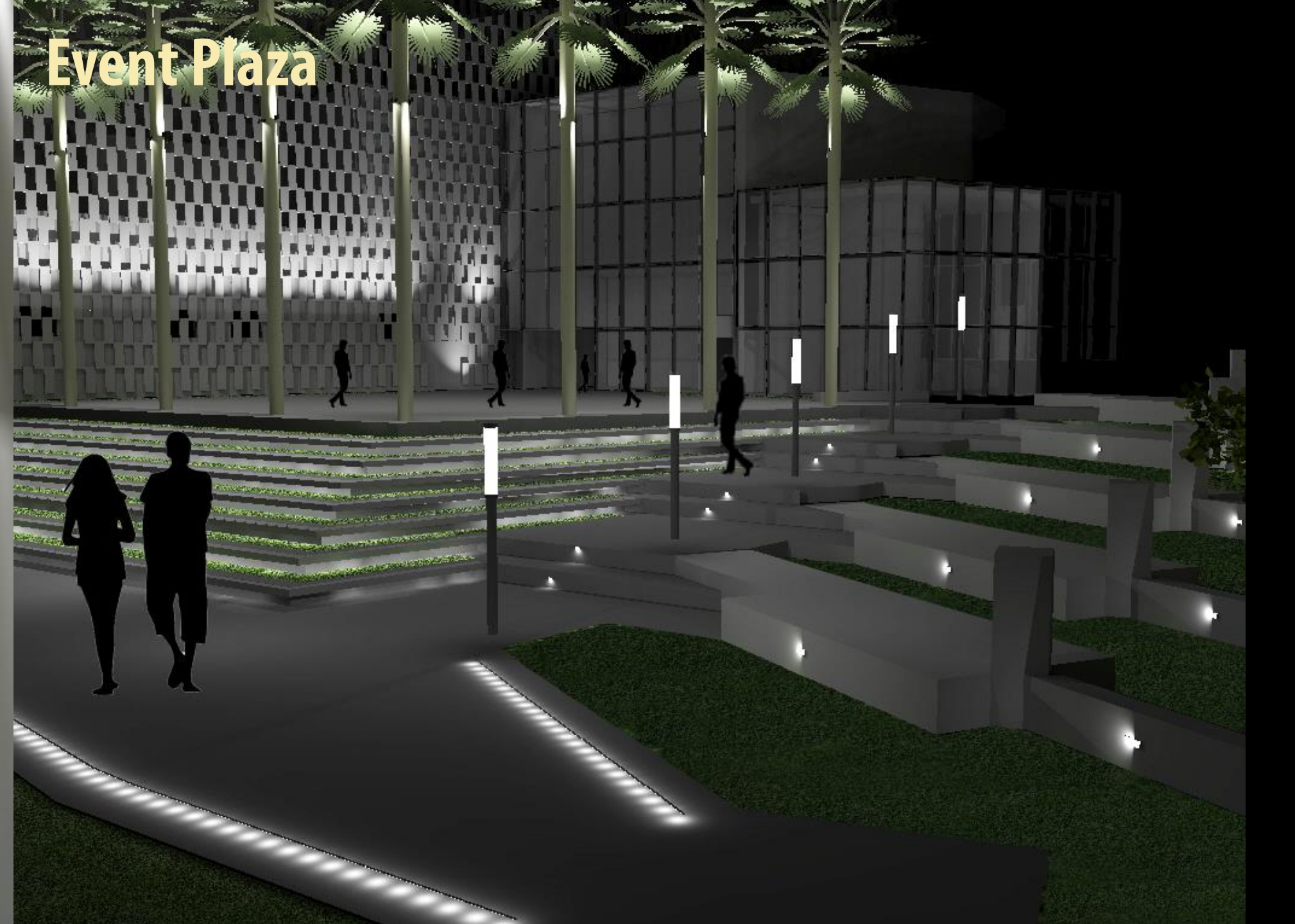
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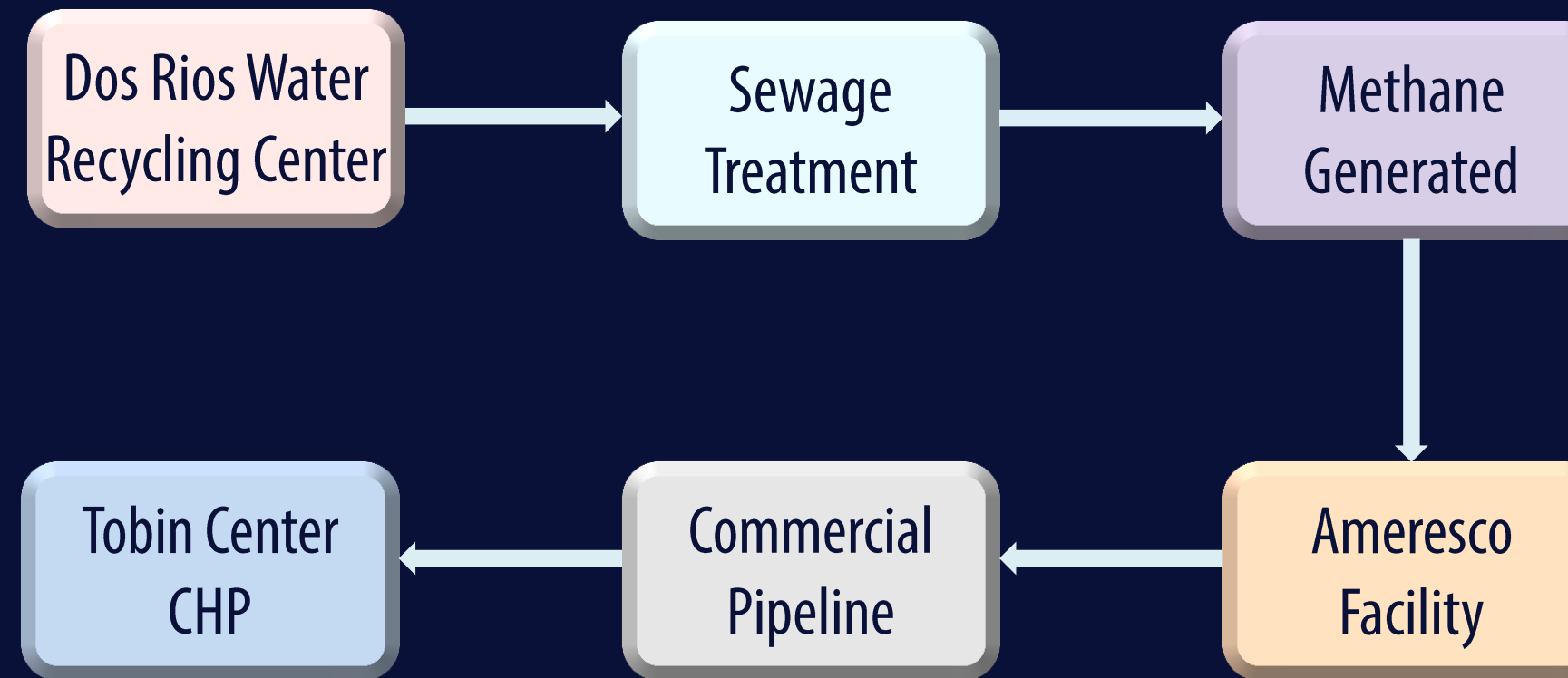
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Elec. Depth + CM Breadth



Mechanical Breadth



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Special Thanks to:

- Dr. Kevin Houser
- Dr. Richard Mistrick
- Leslie Beahm
- LMN Architects +
HLB Lighting, Inc.
- Matt Snellgrove, The
Projects Group
- Prof. Kevin Parfitt
- Prof. Jeffrey Brownson
- Family + Friends
- Audience Members

Questions?

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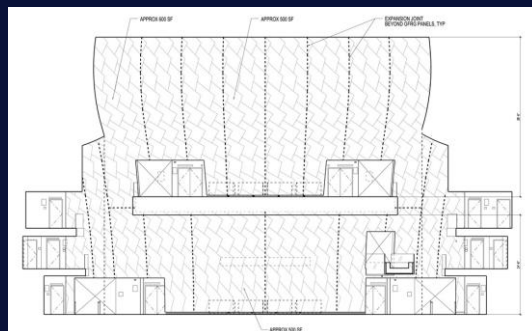
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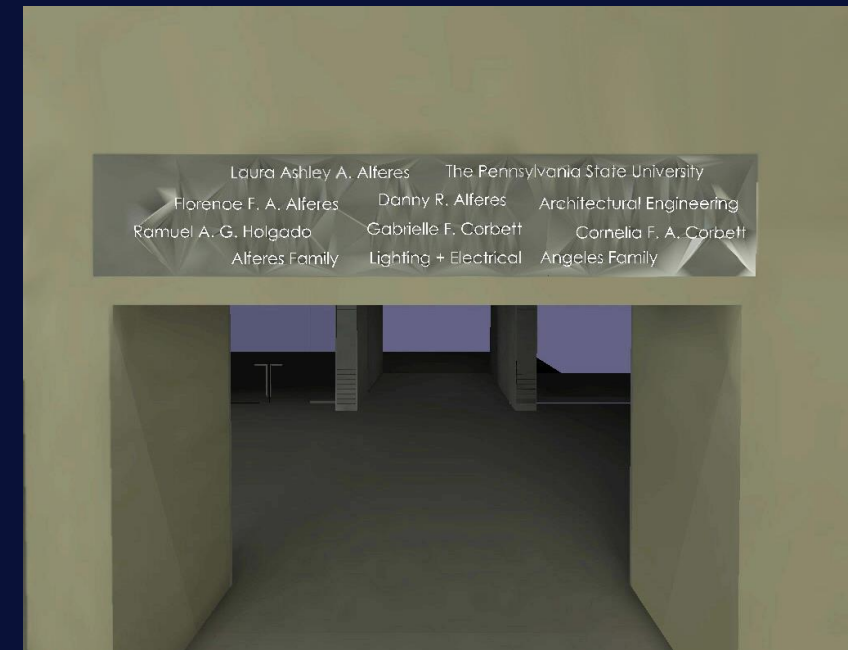
Main Lobby



Glass Fiber Reinforced Gypsum



French Cleat System



5/8" THICK PAINTED ALUMINUM PANELS WITH WATERSET TYPOGRAPHY. PANEL SIZE IS APPROX. 77" x 62". DONOR NAMES ARE BACKED WITH 1/16" THICK POLISHED METAL PANELS IN TWO FINISHES:

TIER 1 AND 2 DONORS
1) BRUSHED BRASS

TIER 3 AND 4 DONORS
2) BRUSHED STAINLESS STEEL

PANELS ARE SECURED TO WALL WITH FRENCH CLEAT SYSTEM AND ARE REMOVABLE FOR FUTURE UPDATE. DONOR NAME LETTERFORM CENTERS (TOP, PR, ETC.) ARE SECURED TO METALLIC BACKER PANELS WITH ADHESIVE AS REQD.

PAINT REQUIRES ADDITION OF FLATTENING AGENT TO ADJUST PAINT SHEEN. PANEL FINISH, COLOR AND SHEEN LEVEL IS TO MATCH FINISH OF ADJACENT WALL SURFACES. SAMPLES REQD.

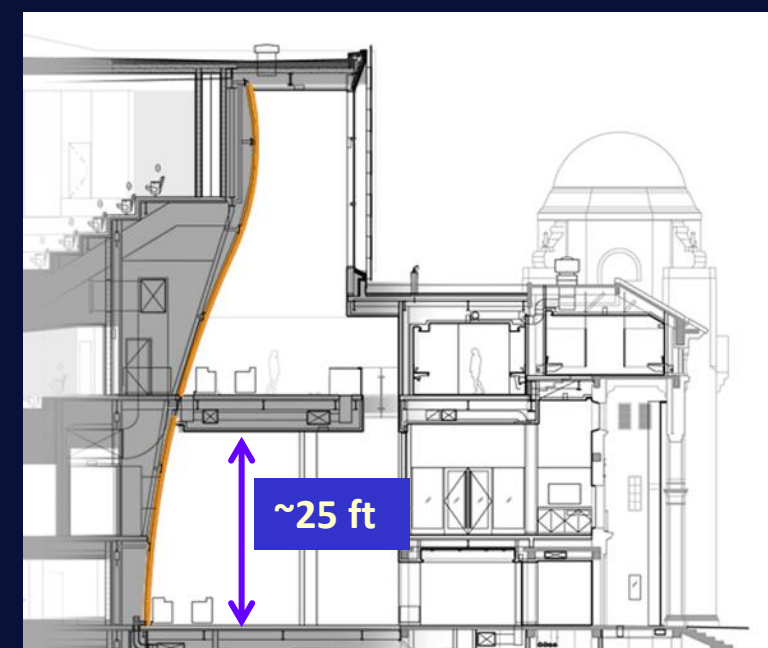
1/4" MAXIMUM SPACE BETWEEN PANELS. SPACES ARE TO BE EQUAL ALONG LENGTH OF WALL.

DERICK R. WAINGROW
AVA & CHARLE
ELLEN &
A KRAUSE & WILLIAM
S
JONI & MILES BENI
ALL
EDYTHE L. BROAD F
ONYMOUS
RONALD J. ARN

Main Lobby

Type	Quantity	Length of Fixture	Quantity of ballasts/ft	Input Watts	Amps/ballast	Amps/Fixture type	VA/Fixture	Total VA per fixture type	Total VA/Room	Total KVA/Room	Demand Factor	Demand Load
E	24	1	1	12.50	0.13	-	15.60	374.40	2521.53	2.52	1.25	3.15
F1	14	1	1	32.51	-	0.27	32.51	455.13				
G	22	1	1	36.00	-	0.30	36.00	792.00				
H	5	1	1	200.00	-	1.00	120.00	600.00				
J	5	1	1	60.00	-	0.50	60.00	300.00				
K	6	1	1	34.00	-	0.28	34.00	204.00				
L	4	1	1	50.00	-	0.42	50.00	200.00				
M	3	1	1	8.70	-	0.07	15.03	45.08				

Table 220.12 General Lighting Loads by Occupancy	
Assembly halls and auditoriums	1 VA/sf



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Event Plaza

<u>PA</u> Illum. level – target provided	10:1 lux 15.67 lux
<u>PA</u> Power Density – target provided	0.16 W/ft ² 0.15 W/ft ²
<u>RW</u> Illum. level – target provided	6 lux 8.90 lux
<u>RW</u> Power Density – target provided	0.16 W/ft ² 0.158 W/ft ²

<u>Planter</u> Illum. level – target provided	6 lux 16.77 lux
<u>Planter</u> Power Density – target provided	1.0 W/ft ² 0.78 W/ft ²
<u>Step & Landing</u> Illum. level – target provided	6 lux 8.84 lux
<u>Step & Landing</u> Power Density – target provided	1.0 W/ft ² 0.16 W/ft ²

Event Plaza

Quantity of ballasts/ft	Input Watts	Amps/b allast	Amps/ Fixture type	VA/ Fixture	Total VA per fixture type	Total VA/Room	Total KVA/Room	Demand Factor	Demand Load
1	28.7		0.24	28.70	1033.2	28559.46	28.56	1.25	35.70
1	6		0.05	6.00	72.00				
	100		0.83	100.00	26500				
	15.36		0.13	15.36	629.76				
1	64.9		0.54	64.90	324.5				
1	2.7		0.02	2.70	16.2				
1	2.85		0.02	5.18	41.45				
1	3.6		0.03	3.60	14.4				
1	1.77		0.01	1.77	21.24				

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Electrical Depth – COMCheck



Section 1: Project Information

Project Type: **New Construction**

Project Title : Tobin Center for the Performing Arts

Construction Site: _____ Owner/Agent: _____ Designer/Contractor: _____

Section 2: Interior Lighting and Power Calculation

A Area Category	B Floor Area (ft ²)	C Allowed Watts / ft ²	D Allowed Watts (B x C)
Patron's Lounge (Common Space Types:Lounge/Recreation)	1558	0.73	1137
Main Lobby (Performing Arts Theater:Lobby)	3626	2	7252
Main Auditorium (Performing Arts Theater:Audience/Seating Area)	11648	2.43	28305
Total Allowed Watts =			36694

Section 3: Interior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Patron's Lounge (Common Space Types: Lounge/Recreation, 1558 sq.ft.)				
LED: A: Other:	1	11	8.2	90.2
LED: B: Other:	1	20	4	80
LED: C1 & C2: Other:	1	91	1.5	136.5
LED: D: Other:	1	4	12.5	50
Main Lobby (Performing Arts Theater: Lobby, 3626 sq.ft.)				
Compact Fluorescent: E: Other: Electronic:	1	24	12.5	300
LED: F1: Other:	1	14	32.5	455
LED: G: Other:	1	22	33.1	728.2
LED: H: Other:	1	30	4.7	141
Halogen: J: Other:	1	5	60	300
LED: K: LED Linear Lamp 33W:	1	6	34	204
Incandescent: L: Incandescent 50W:	1	4	50	200
LED: M: Other:	1	3	8.7	26.1
Main Auditorium (Performing Arts Theater: Audience/Seating Area, 11648 sq.ft.)				
HID: N: Metal Halide: Standard:	1	121	128	15488
LED: P: Other:	1	20	101.4	2028
LED: Q: Other:	1	11	50.7	557.7
LED: U: Other:	1	402	5.4	2170.8
			Total Proposed Watts =	22956

Interior Lighting PASSES: Design 37% better than code.

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Section 1: Project Information

Project Type: **New Construction**
 Project Title : Tobin Center for the Performing Arts
 Exterior Lighting Zone: **4 (High activity metropolitan commercial district)**
 Construction Site: _____ Owner/Agent: _____ Designer/Contractor: _____

Section 3: Exterior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Performance Area (Plaza area, 5173 ft2): Tradable Wattage				
LED: X1: Other:	1	36	28.7	1033.2
Riverwalk (Walkway >= 10 feet wide, 3365 ft2): Tradable Wattage				
LED: X2: LED MR 6W:	1	12	6	72
LED: X4: LED Linear Lamp 10W:	1	41	10	410
Planters (Stairway, 2640 ft2): Tradable Wattage				
LED: X3: Other:	2	265	9.1	2411.5
Steps & Landings (Walkway >= 10 feet wide, 1271 ft2): Tradable Wattage				
LED: X5: Other:	1	5	64.9	324.5
LED: X6: Other:	1	6	2.7	16.2
LED: X7: Other:	1	8	2.9	23.2
Total Tradable Proposed Watts =				4291

Section 2: Exterior Lighting Area/Surface Power Calculation

A Exterior Area/Surface	B Quantity	C Allowed Watts / Unit	D Tradable Wattage	E Allowed Watts (B x C)	F Proposed Watts
Performance Area (Plaza area)	5173 ft2	0.2	Yes	1035	1033
Riverwalk (Walkway >= 10 feet wide)	3365 ft2	0.2	Yes	673	482
Planters (Stairway)	2640 ft2	1	Yes	2640	2411
Steps & Landings (Walkway >= 10 feet wide)	1271 ft2	0.2	Yes	254	363
Total Tradable Watts* =				4602	4291
Total Allowed Watts =				4602	
Total Allowed Supplemental Watts** =				1300	

* Wattage tradeoffs are only allowed between tradable areas/surfaces.
 ** A supplemental allowance equal to 5% of total allowed wattage may be applied toward compliance of both non-tradable and tradable areas/surfaces.

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Main Lobby

Circulation Space

Event Plaza

Outdoor Space

Electrical Depth

BIPV+ CM Breadth

Mechanical Breadth

Biogas Energy

Acknowledgments

Summary + Questions

Electrical Depth – Branch Ckts.

PANEL 'LP-2B'														
PROJECT: TOBIN CENTR PA			MAIN CIRCUIT BREAKER:			ENCLOSURE: NEMA 1			0 RECPT			5 HEAT		
PROJECT #: 840390			MAIN LUGS ONLY: 225A			MOUNTING: SURFACE			1 LTG			6 A/C		
LOCATION:			BUSSING: 225A			CB TYPE: BOLT-ON			2 EQUIP			7 KITCH		
NOTES:			VOLTAGE: 208/120V, 3PH, 4W			PROVIDE: NEUTRAL BUS			3 MTR			8 ELEVE		
SCHEDULE DATE: #####			INTERRUPTING: 10 KAIC RMS SYM			GROUND BUS			4 COMP			9 125%		
ELECTRICAL #153														
CCT	AMP	P	CIRCUIT DESCRIPTION	LOAD	TYPE	PH	TYPE	LOAD	LOAD DESCRIPTION	AMP	P	CCT		
1	20	1	RECEPTACLES - VEST 215	900	0	A	2	1500	HAND DRYER - WOMEN 211	20	1	2		
3	20	1	RECEPTACLES - FURN STORAGE 214	540	0	B	2	1500	HAND DRYER - WOMEN 209	20	1	4		
5	20	1	VIDEO DISPLAY - VEST 213	500	2	C	2	1500	HAND DRYER - WOMEN 208	20	1	6		
7	20	1	RECEPTACLES - VEST 215	900	0	A	2	500	VIDEO DISPLAY - PATRONS LOUNGE 204	20	1	8		
9	20	1	RECEPTACLES - WOMEN 208	540	0	B	0	360	RECEPTACLES - PATRONS LOUNGE 204	20	1	10		
11	20	1	RECEPTACLES - PATRONS LOUNGE 204	540	0	C	0	720	RECEPTACLES - LEVEL 02 VESTIBLES	20	1	12		
13	20	1	REFRIGERATED CAB. - PATRON LOUNGE 204	780	7	A	7	360	BACK BAR- CONCESSION LVL 2	20	1	14		
15	20	1	CART FRONT - CONCESSION LVL 2	360	7	B	1	80	SIGNAGE - PATRON LOUNGE 204	20	1	16		
17	20	1	SIGNAGE - CROSSOVER 227	200	1	C	2	500	AUTOMATIC WINDOW SHADE SYSTEM	20	1	18		
19	20	1	SIGNAGE - VEST 215	240	1	A	0	540	RECEPTACLES - LEVEL 06 WP GFCS	20	1	20		
21	20	1	SPARE			B			SPARE	20	1	22		
23	20	1	SPARE			C			SPARE	20	1	24		
25	60	3	TO PANEL LP-2BB	1039	1	A			SPARE	20	1	26		
27			*	1039	1	B			SPARE	20	1	28		
29			*	1039	1	C			SPARE	20	1	30		
31	60	3	TO PANEL LP-2BB	1209	1	A			SPARE	20	1	32		
33			*	1209	1	B			SPARE	20	1	34		
35			*	1209	1	C			SPARE	20	1	36		
37	20	1	SPARE			A			SPARE	20	1	38		
39	20	1	SPARE			B			SPARE	20	1	40		
41	20	1	SPARE			C		360	VAV 2-1, 2-2 & CAV 2-1	20	1	42		
			PANEL VA	SUB FEED	FEED THRU	TOTAL CONN	TOTAL DEMAND		NOTES:					
			VA			VA	AMPS							
PHASE A			7968	0	0	7968	8500	72						
PHASE B			5628	0	0	5628	6210	52						
PHASE C			6568	0	0	6568	7180	60						
TOTAL			20163	0	0	20163	21980	61						

LP-2BB

Serves: Patron's Lounge & Main Lobby

Minimum Required Branch Circuits: 5 ckts

OCPD: 20A

Feeders: 1#4, 1#3 Gnd. in ¾" Conduit

LP-2BB is served by LP-2B. Based on redesign, the new circuit breaker size is 200A and the feeder size is 1-#3/0, 1-#6 Gnd. in 1-1/2" Conduit

PANEL 'LP-2BB'														
PROJECT: TOBIN CENTR PA			MAIN CIRCUIT BREAKER:			ENCLOSURE: NEMA 1			0 RECPT			5 HEAT		
PROJECT #: 840390			MAIN LUGS ONLY: 225A			MOUNTING: SURFACE			1 LTG			6 A/C		
LOCATION:			BUSSING: 225A			CB TYPE: BOLT-ON			2 EQUIP			7 KITCH		
NOTES:			VOLTAGE: 208/120V, 3PH, 4W			PROVIDE: NEUTRAL BUS			3 MTR			8 ELEVE		
SCHEDULE DATE: #####			INTERRUPTING: 10 KAIC RMS SYM			GROUND BUS			4 COMP			9 125%		
CCT	AMP	P	CIRCUIT DESCRIPTION	LOAD	TYPE	PH	TYPE	LOAD	LOAD DESCRIPTION	AMP	P	CCT		
1	20	1	PATRON'S LOUNGE LTG TYPE C1&C2	240	1	A	1	1374	LOBBY LTG TYPE E&H	20	1	2		
3	20	1	PATRON'S LOUNGE LTG TYPE A&D	140	1	B	1	455	LOBBY LTG TYPE F1	20	1	4		
5	20	1	PATRON'S LOUNGE LTG TYPE B	80	1	C	1	792	LOBBY LTG TYPE G	20	1	6		
7	20	1	SPARE			A	1	300	LOBBY LTG TYPE J	20	1	8		
9	20	1	SPARE			B	1	449	LOBBY LTG TYPE K,L,M	20	1	10		
11	20	1	SPARE			C			SPARE	20	1	12		
13	20	1	SPARE			A			SPARE	20	1	14		
15	20	1	SPARE			B			SPARE	20	1	16		
17	20	1	SPARE			C			SPARE	20	1	18		
19	20	1	SPARE			A			SPARE	20	1	20		
21	20	1	SPARE			B			SPARE	20	1	22		
23	20	1	SPARE			C			SPARE	20	1	24		
25	20	1	SPARE			A			SPARE	20	1	26		
27	20	1	SPARE			B			SPARE	20	1	28		
29	20	1	SPARE			C			SPARE	20	1	30		
31	20	1	SPARE			A			SPARE	20	1	32		
33	20	1	SPARE			B			SPARE	20	1	34		
35	20	1	SPARE			C			SPARE	20	1	36		
37	20	1	SPARE			A			SPARE	20	1	38		
39	20	1	SPARE			B			SPARE	20	1	40		
41	20	1	SPARE			C			SPARE	20	1	42		
			PANEL VA	SUB FEED	FEED THRU	TOTAL CONN	TOTAL DEMAND		NOTES:					
			VA			VA	AMPS							
PHASE A			1914	0	0	1914	2393	20						
PHASE B			1044	0	0	1044	1306	11						
PHASE C			881	0	0	881	1101	9						
TOTAL			3840	0	0	3840	4800	13						

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Acknowledgments
Summary + Questions

Electrical Depth – Branch Ckts.

PANEL 'LP-4A'												
PROJECT: TOBIN CENTR PA PROJECT #: 840398 LOCATION: NOTES: SCHEDULE DATE: #####			MAIN CIRCUIT BREAKER: MAIN LUGS ONLY: 225A BUSSING: 225A VOLTAGE: 208/120V, 3PH, 4W INTERRUPTING: 10 KAIC RMS SYM			ENCLOSURE: NEMA 1 MOUNTING: SURFACE CB TYPE: BOLT-ON PROVIDE: NEUTRAL BUS GROUND BUS			0 RECPT 1 LTG 2 EQUIP 3 MTR 4 COMP		5 HEAT 6 A/C 7 KITCH 8 ELEVE 9 125%	
CCT	AMP	P	CIRCUIT DESCRIPTION	LOAD	TYPE	PH	TYPE	LOAD	CIRCUIT DESCRIPTION	AMP	P	CCT
1	20	1	SIGNAGE-VEST 401	40	1	A	0	360	RECEPTACLE - SE EXTERIOR WALL	20	1	2
3	20	1	SIGNAGE-VEST 407	40	1	B	2	500	ELEVATOR #3 ROOF VENT	20	1	4
5	20	1	RECEPTACLE - SW EXTRIOR WALL	540	0	C	2	500	ELEVATOR #5 ROOF VENT	20	1	6
7	20	1	SPARE			A			SPARE	20	1	8
9			TO PANEL 'LP-4AA'	1503	1	B	1	1503	TO PANEL 'LP-4AA'			10
11	60	3	*	1503	1	C	1	1503	*	60	3	12
13			*	1503	1	A	1	1503	*			14
15			TO PANEL 'LP-4AA'	1503	1	B	1	1503	TO PANEL 'LP-4AA'			16
17	60	3	*	1503	1	C	1	1503	*	60	3	18
19			*	1503	1	A	1	1503	*			20
21			TO PANEL 'LP-4AA'	1503	1	B	1	1503	TO PANEL 'LP-4AA'			22
23	60	3	*	1503	1	C	1	1503	*	60	3	24
25			*	1503	1	A	1	1503	*			26
27	20	1	SPARE			B	1	1503	TO PANEL 'LP-4AA'	20	1	28
29	20	1	SPARE			C			SPARE	20	1	30
31	20	1	SPARE			A			SPARE	20	1	32
33	20	1	RECEPTACLE - STAIR ST29, 26	1080	0	B			SPARE	20	1	34
35	20	1	RECEPTACLE - STAIR ST25, 30	1080	0	C			SPARE	20	1	36
37	20	1	RECEPTACLE - S ROOF TOP	180	0	A	0	360	RECEPTACLE - NW ROOF TOP	20	1	38
39	20	1	SPARE			B	0	600	RECEPTACLE - VEST 402	20	1	40
41	20	1	SPARE			C	0	900	RECEPTACLE - VEST 406	20	1	42
			PANEL VA	SUB FEED	FEED THRU	TOTAL CONN	TOTAL DEMAND		NOTES:			
PHASE A			9958	0	0	9958	13348	111				
PHASE B			13041	0	0	13041	15681	131				
PHASE C			12038	0	0	12038	14293	119				
TOTAL			35037	0	0	35037	43321	120	GOETTING & ASSOCIATES R1.0			

LP-4AA

Serves: Event Plaza

Minimum Required Branch Circuits: 19 ckts

OCPD: 20A

Feeders: 2#1/0, 1#4 Gnd. in 1-1/4" Conduit

LP-4AA is served by LP-4A. Based on redesign, the new circuit breaker size is 400A and the feeder size is 4-#3/0, 1-#3 Gnd. in 1-1/4" Conduit

PANEL 'LP-4AA'												
PROJECT: TOBIN CENTR PA PROJECT #: 840398 LOCATION: NOTES: SCHEDULE DATE: #####			MAIN CIRCUIT BREAKER: MAIN LUGS ONLY: 225A BUSSING: 225A VOLTAGE: 208/120V, 3PH, 4W INTERRUPTING: 10 KAIC RMS SYM			ENCLOSURE: NEMA 1 MOUNTING: SURFACE CB TYPE: BOLT-ON PROVIDE: NEUTRAL BUS GROUND BUS			0 RECPT 1 LTG 2 EQUIP 3 MTR 4 COMP		5 HEAT 6 A/C 7 KITCH 8 ELEVE 9 125%	
CCT	AMP	P	CIRCUIT DESCRIPTION	LOAD	TYPE	PH	TYPE	LOAD	CIRCUIT DESCRIPTION	AMP	P	CCT
1	20	1	EVENT PLAZA LTG TYPE X1	1033	1	A	1	382	EVENT PLAZA LTG TYPE X5, X6, X7	20	1	2
3	20	1	EVENT PLAZA LTG TYPE X2 & X4	702	1	B	1		SPARE	20	1	4
5	20	1	EVENT PLAZA LTG TYPE X3	8833	1	C	1		SPARE	20	1	6
7	20	1	*	8833	1	A	1		SPARE	20	1	8
9	20	1	*	8833	1	B	1		SPARE	20	1	10
11	20	1	SPARE			C			SPARE	20	1	12
13	20	1	SPARE			A			SPARE	20	1	14
15	20	1	SPARE			B			SPARE	20	1	16
17	20	1	SPARE			C			SPARE	20	1	18
19	20	1	SPARE			A			SPARE	20	1	20
21	60	1	SPARE			B			SPARE	60	1	22
23	20	1	SPARE			C			SPARE	20	1	24
25	20	1	SPARE			A			SPARE	20	1	26
27	20	1	SPARE			B			SPARE	20	1	28
29	20	1	SPARE			C			SPARE	20	1	30
31	20	1	SPARE			A			SPARE	20	1	32
33	20	1	SPARE			B			SPARE	20	1	34
35	20	1	SPARE			C			SPARE	20	1	36
37	20	1	SPARE			A			SPARE	20	1	38
39	20	1	SPARE			B			SPARE	20	1	40
41	20	1	SPARE			C			SPARE	20	1	42
			PANEL VA	SUB FEED	FEED THRU	TOTAL CONN	TOTAL DEMAND		NOTES:			
PHASE A			10249	0	0	10249	12811	107				
PHASE B			9535	0	0	9535	11919	99				
PHASE C			8833	0	0	8833	11042	92				
TOTAL			28617	0	0	28617	35771	99	GOETTING & ASSOCIATES R1.0			

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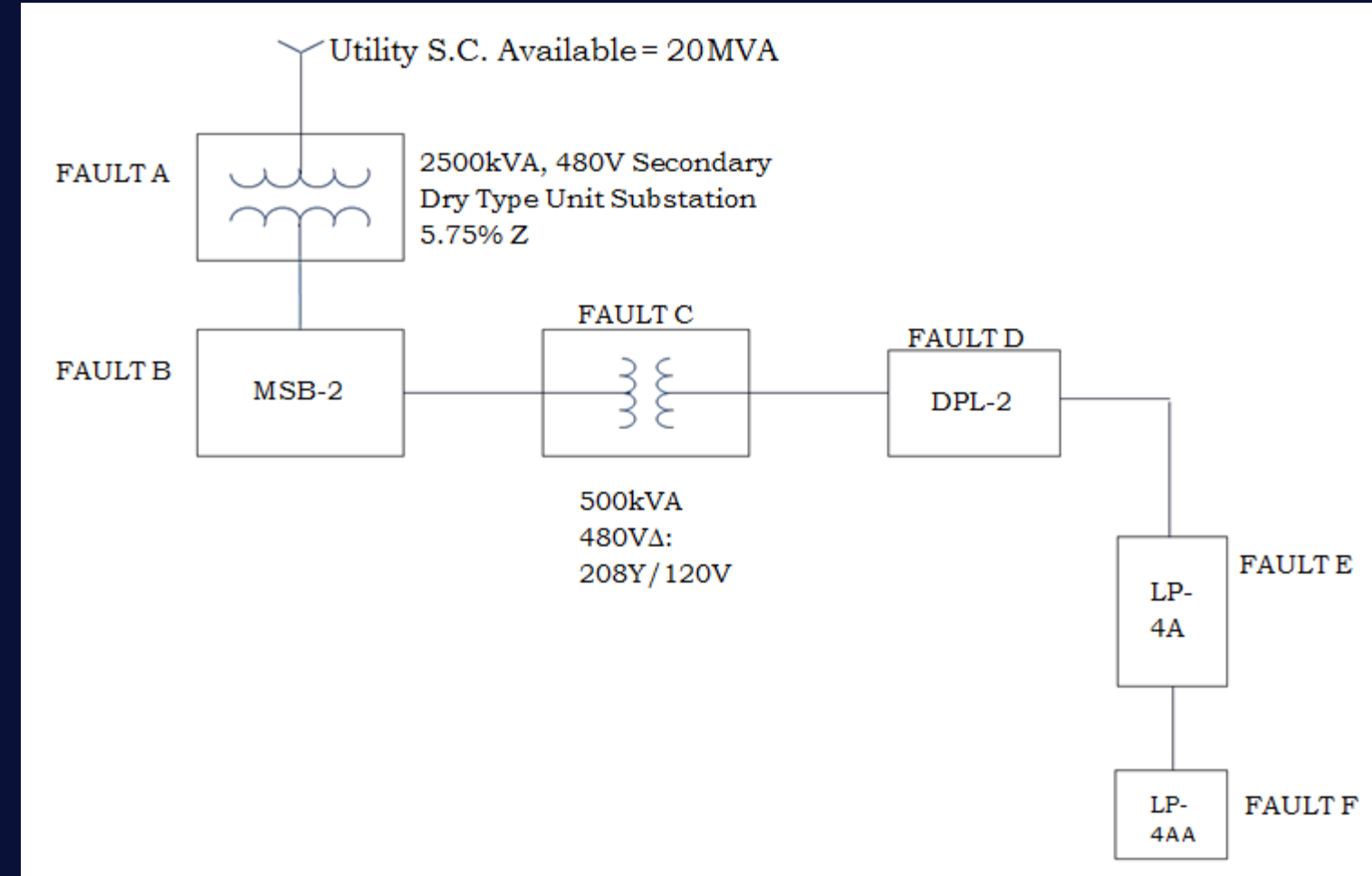
Electrical Depth
BIPV+ CM Breadth

Mechanical Breadth
Biogas Energy

Acknowledgments
Summary + Questions

Electrical Depth – Short Circuit Analysis

Fault	Equipment	Current
Fault A	2500kVA Transformer	16,508.24A
Fault B	MSB-2	15,952A
Fault C	500kVA Transformer	13,898.3A
Fault D	DPL-2	13,574.7A
Fault E	LP-4A	12,255.8A
Fault F	LP-4AA	10,925.3A



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