Empowering Communities Through Resilient & Sustainable Design

AIA Approved Continuing Education

3 AIA/HSW Units

BUILD WITH STRENGTH

SYMPOSIUM AGENDA

7:00 - 8:00 AM - Breakfast & Registration

8:00 - 8:45 AM - Topic: Sustainability

8:45 - 9:15 AM - Topic: Insurance

9:15 - 9:45 AM - Topic: Architecture

9:45 - 10:30 AM - Topic: Inflation Reduction Act

10:30 - 10:45 AM - Networking Break

10:45 - 11:30 AM - Q&A Panel Discussion

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- **SHAWN FLAVIN, CIC & NATHAN LORTZ - CHRISTENSEN GROUP**
- **MATT GREEN - KB WALKER**
- **MIKE BERG - CLOW BERG**

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CMTA A LEGENCE Company

FOX BLOCKS TRUEGRID

NRMCA National Ready Mixed Concrete Association

Nudura Part of Tremco Construction Products Group

minnesota Concrete Council
Dedicated to Cast-in-Place Concrete

Today's Program

BUILD WITH STRENGTH
A COALITION OF THE NATIONAL READY MIXED CONCRETE ASSOCIATION

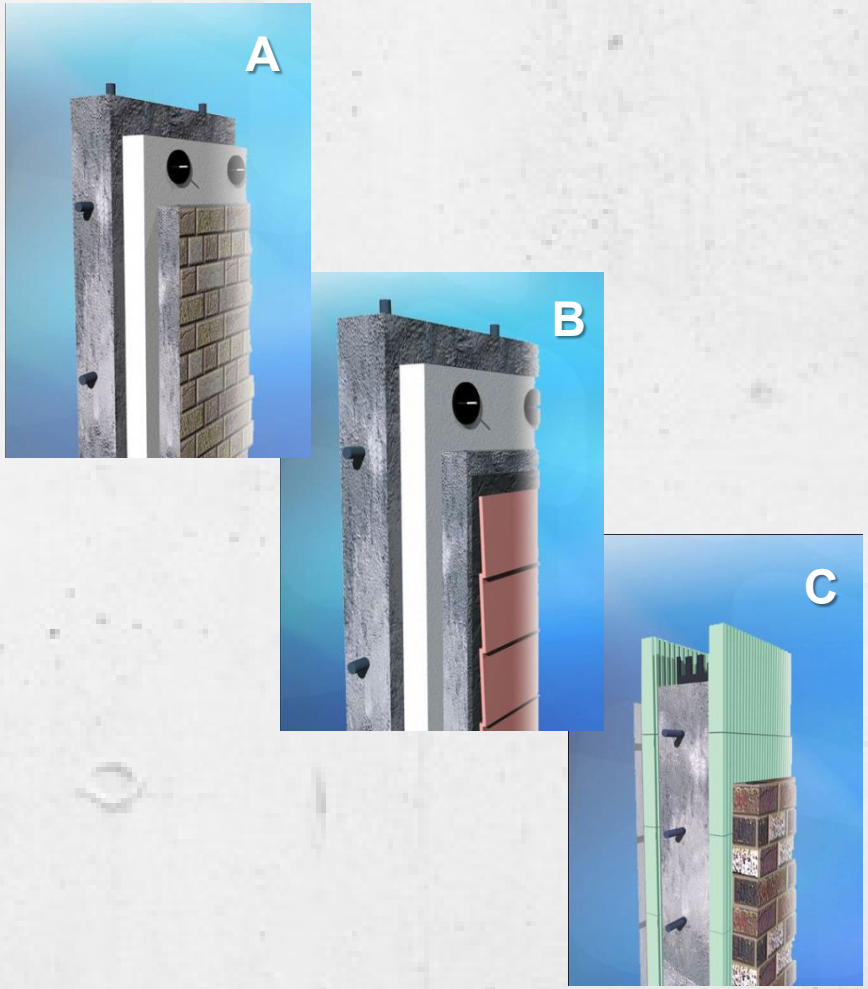
Empowering Communities Through Resilient and Sustainable Design

- Optimizing the Building Envelope to Achieve:
- Improved Energy Efficiency
- Decarbonation
- Greater Sustainability

- Exterior Walls Built with Ready Mixed Concrete
- A. Panelized/Tilt Up
- B. Conventionally Formed
- C. Insulating Concrete Forms

- Leveraging their Many Benefits

- Qualify for Various Incentives by Building Better
- Inflation Reduction Act



These are all Concrete

Multi-family




Commercial




Schools

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High-Performance Building Design

March 5, 2024

Agenda

01

Intro +
About CMTA

02

Realistic Goal
Setting

03

Collaborative
Building Design

04

High Performing
HVAC Systems

05

Integrated
Design Process

CMTA
A LEGENCE Company

01

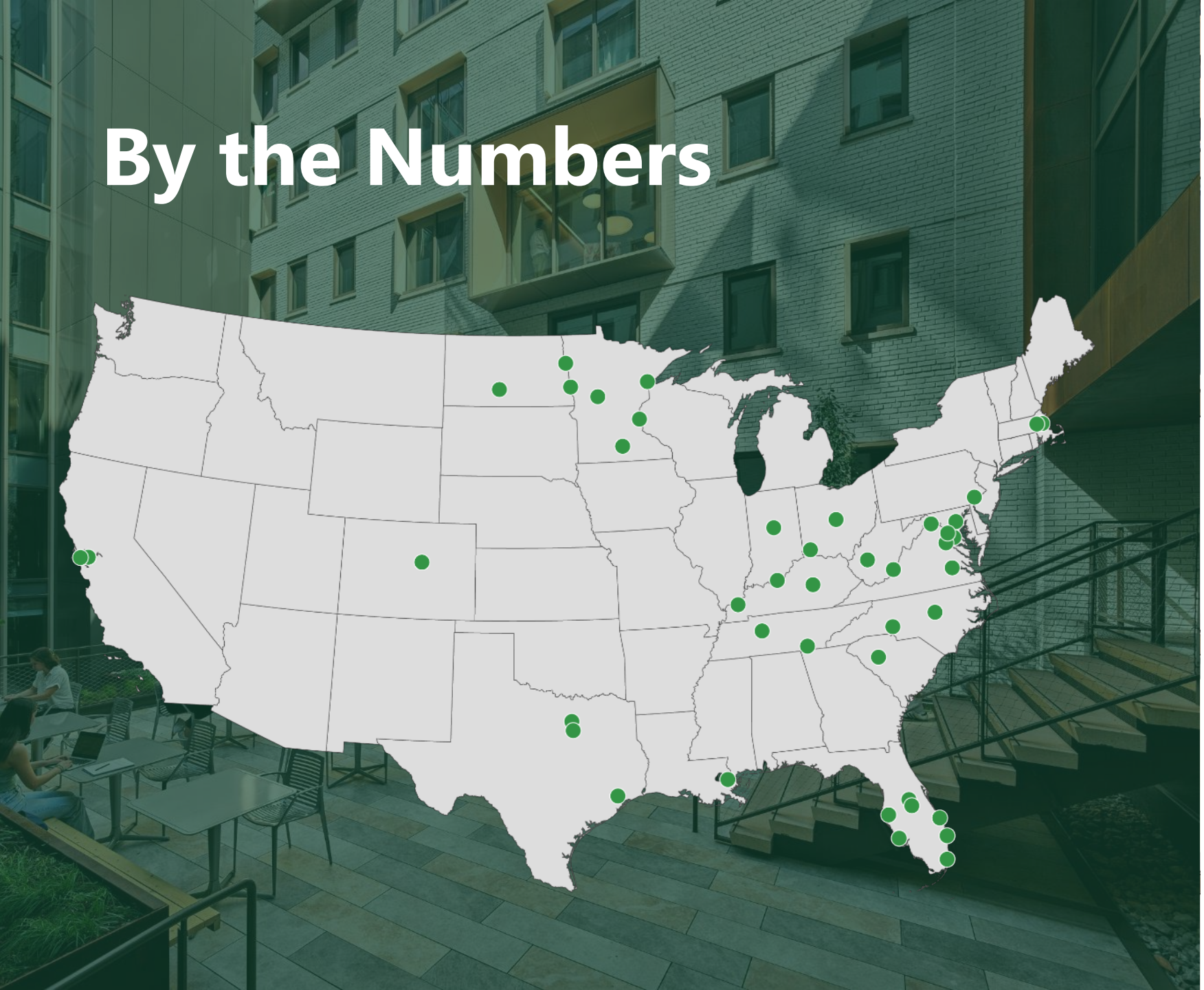
Introduction + About CMTA

Speakers

Brent Wavra, PE, LEED AP
Principal | Mechanical

Stephen Westerback
Building Science Expert

By the Numbers



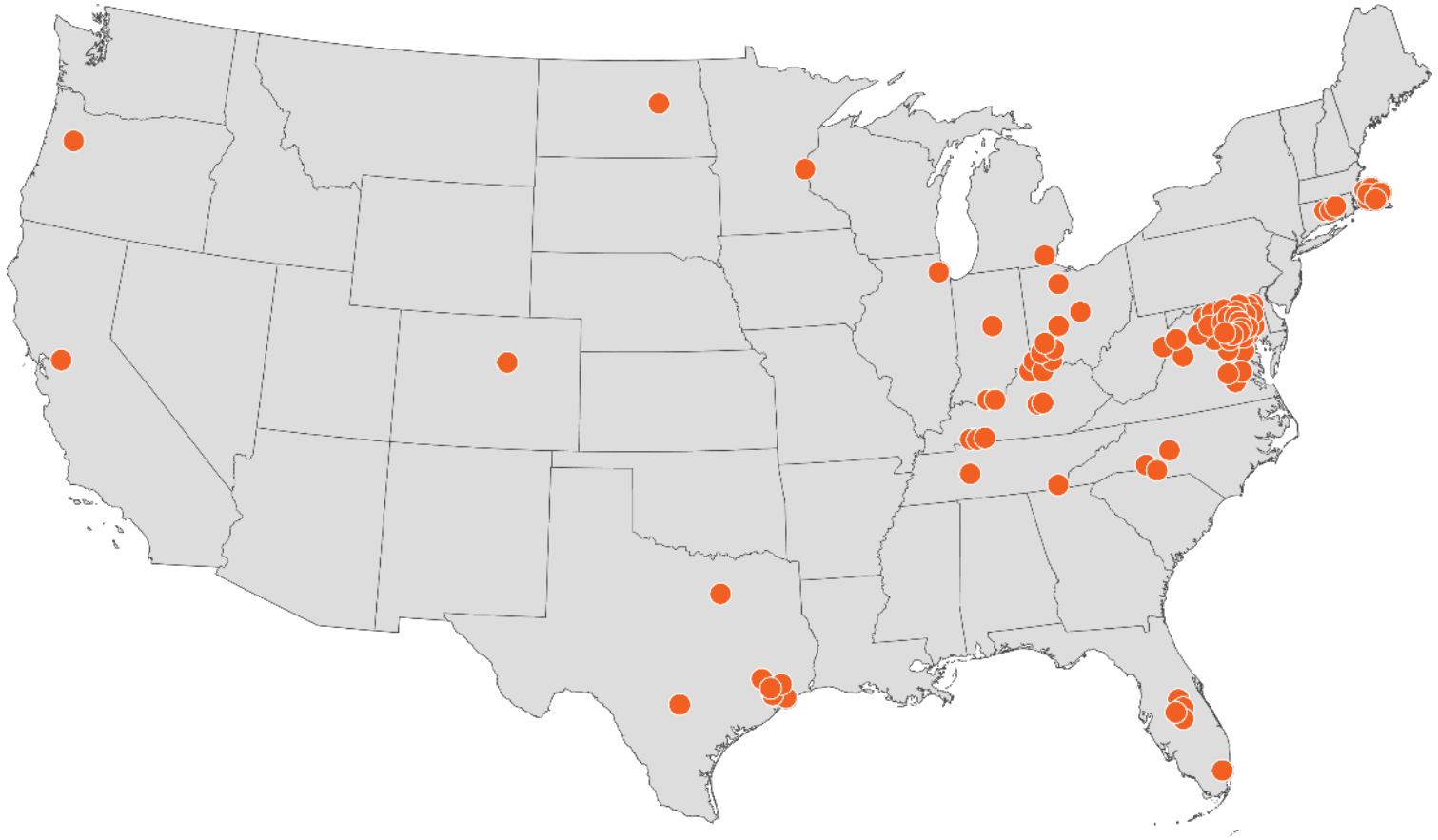
900+
Employees

44
Offices Nationwide

250
Professional Engineers

56
Years of Service

Zero Energy / Zero Carbon



9M SF

Zero Energy Certified Facilities

35M SF

Zero Energy Ready Facilities

5.5M SF

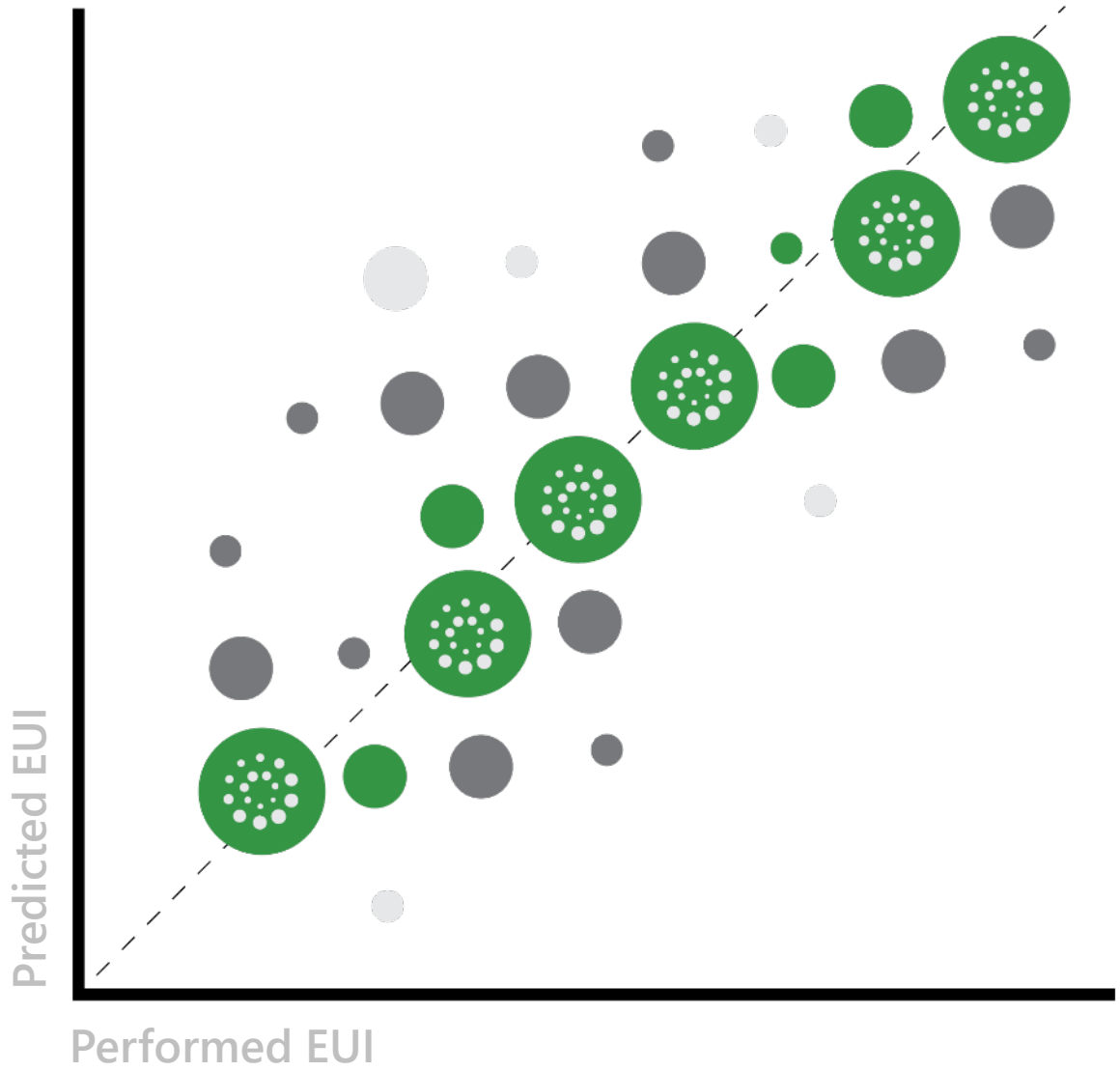
Zero Carbon Facilities

We are

Data Driven

"You cannot manage what you do not measure."

— W. Edwards Deming



AIA CES Provider Statement

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This course is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of
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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

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Course Description

High-performance design covers a wide range of design elements ranging from HVAC systems to daylighting to building orientation and beyond. In addition, what may be most effective for a K12 school might not be appropriate for a hospital. In this session, we dive deeper into varying system types across markets and how they interact with other high-performance strategies such as building envelope design. We will also share lessons learned from previous projects around goal setting and how to make the best decisions for your project.

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Learning Objectives

1. Understand the interactions between multiple high-performance strategies
2. Learn the difference between HVAC system types and their advantages/disadvantages
3. Learn how to set advantageous yet attainable sustainability goals
4. Understand how to work with the design team to make the best decisions for your project

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02

Realistic Goal Setting

Climate Action

From AIA's "Where we stand" statement

"Designing and constructing buildings that diminish greenhouse gases are architectural imperatives.

Designing and constructing buildings that support health, safety, and welfare are ethical imperatives.

In short, designing and constructing buildings that can combat the greenhouse effect will improve our chances of repairing our planet while creating a healthy, resilient, and regenerative future."

– American Institute of Architects, 2019

Photo courtesy of Iwan Baan
[Stilt houses in Ganvie, Benin]

AIA 2030

AIA 2030 Commitment

The mission of the AIA 2030 Commitment is to support the 2030 Challenge and transform the practice of architecture in a way that is holistic, firm-wide, project based, and data-driven. By prioritizing energy performance, participating firms can more easily work toward carbon neutral buildings, developments, and major renovations by 2030.

Photo courtesy of American Institute of Architects

LEED Zero

LEED Zero verifies net zero goals

LEED provides a framework for high performance buildings and spaces, and reduced greenhouse gas emissions through strategies impacting land, energy, transportation, water, waste, and materials.

Building on that work, the U.S. Green Building Council has developed LEED Zero, a complement to LEED that verifies the achievement of net zero goals and signals market leadership in the built environment.

SB 2030

B3 Sustainable Building Energy Standard

The B3 Sustainable Building 2030 Energy Standard is a progressive energy conservation program designed to significantly reduce the energy and carbon in Minnesota commercial, institutional, and industrial buildings.

Living Building Challenge

International Living Future Institute

The Living Building Challenge uses a metaphor of a flower because the ideal built environment should function as cleanly and efficiently as a flower. With the Living Building Challenge, you can create buildings that:

- Are regenerative spaces that connect occupants to light, air, nature, food, and community
- Are self-sufficient and remain within the resource limits of their site
- Produce more energy than they use and collect and treat all water on site

Photo courtesy of International Living Future Institute

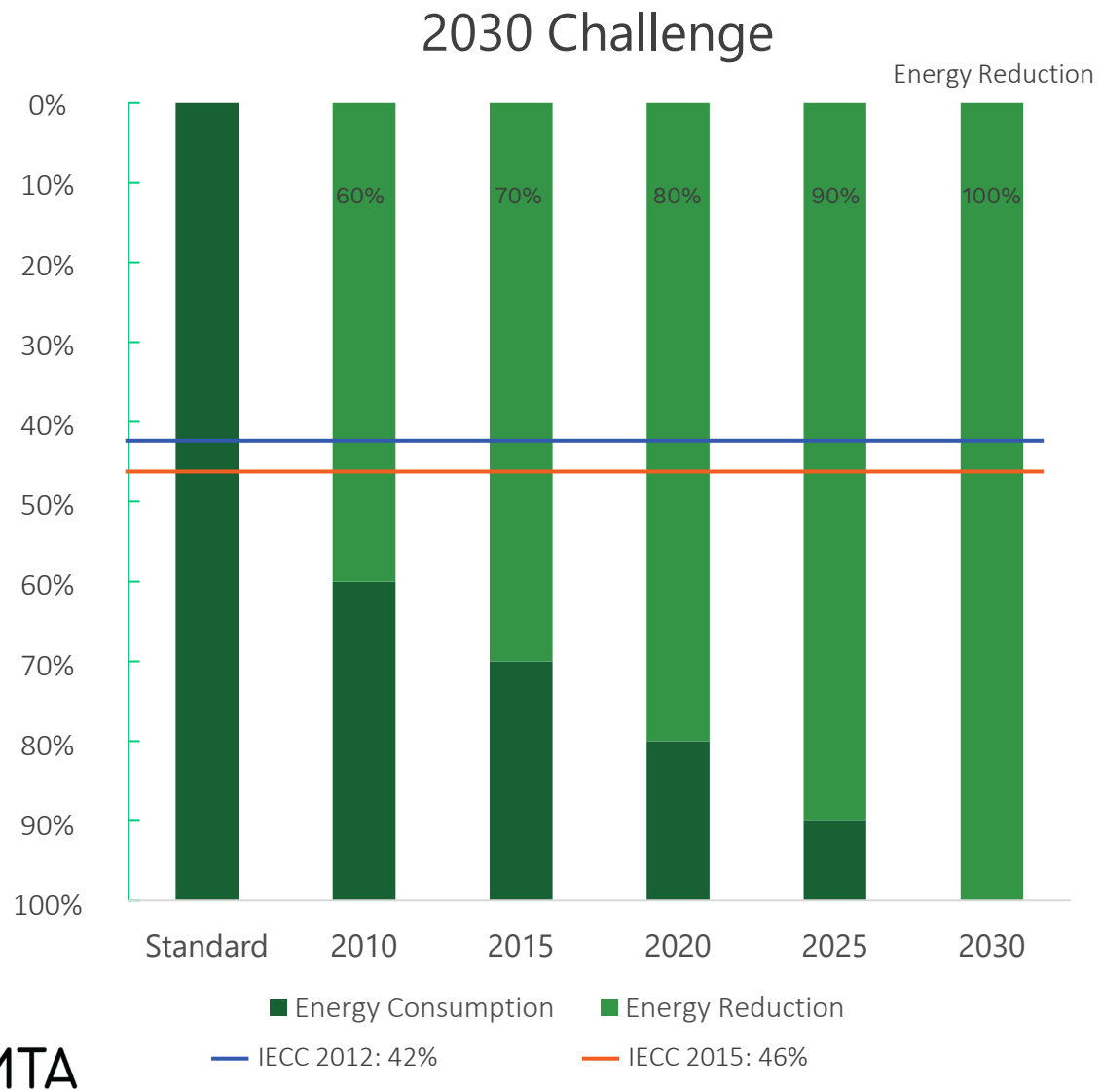
WELL Building Standards

International WELL Building Institute

The WELL Building Standard is a vehicle for buildings and organizations to deliver more thoughtful and intentional spaces that enhance human health and well-being.

WELL includes strategies that aim to advance health by setting performance standards for design interventions, operational protocols and policies and a commitment to fostering a culture of health and well-being.

Other Green Initiatives



Net Zero by 2030

2030 Energy Standard Targets

- % total site reduction from avg. existing building in 2003
- Currently 80% reduction
- 100% reduction in 2030 is net zero energy
- Can only use on-site renewable energy to offset building energy consumption (can't purchase renewable energy credits [RECs] from utility)
- Measure for 12 consecutive months over a period of 36 months

CMTA

What is EUI?

Energy Use Intensity

- Heating
- Cooling
- Lighting
- Pumps + Fans
- Plugloads
- Hot Water
- IT / AV
- Kitchen

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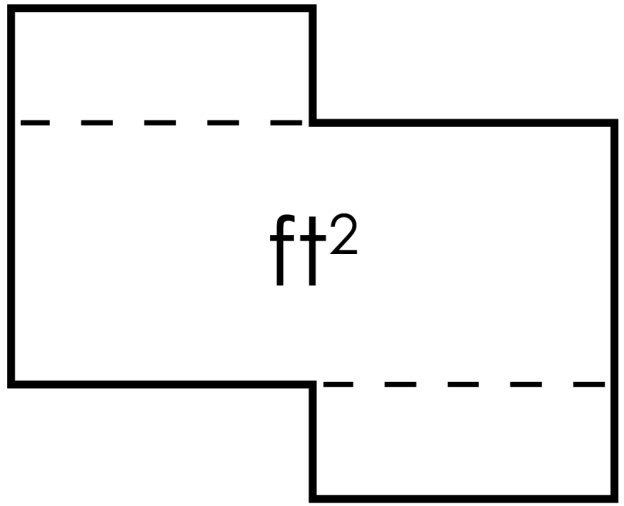

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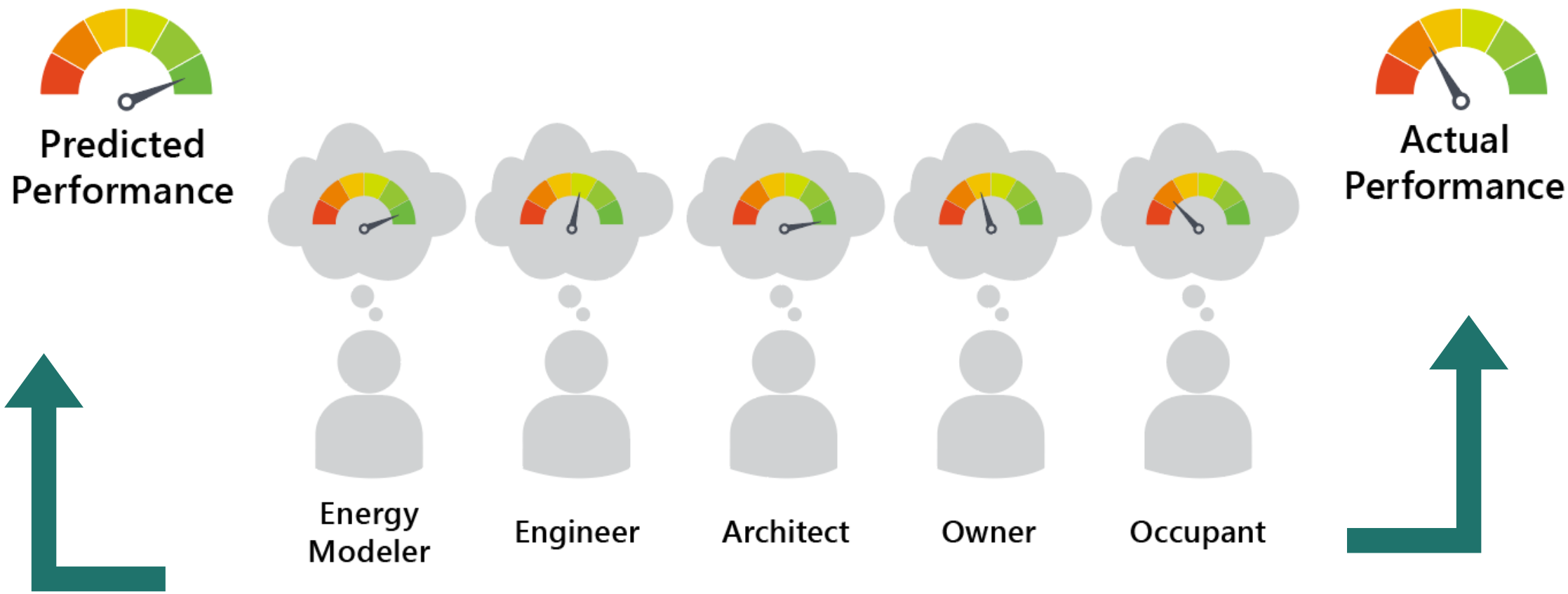
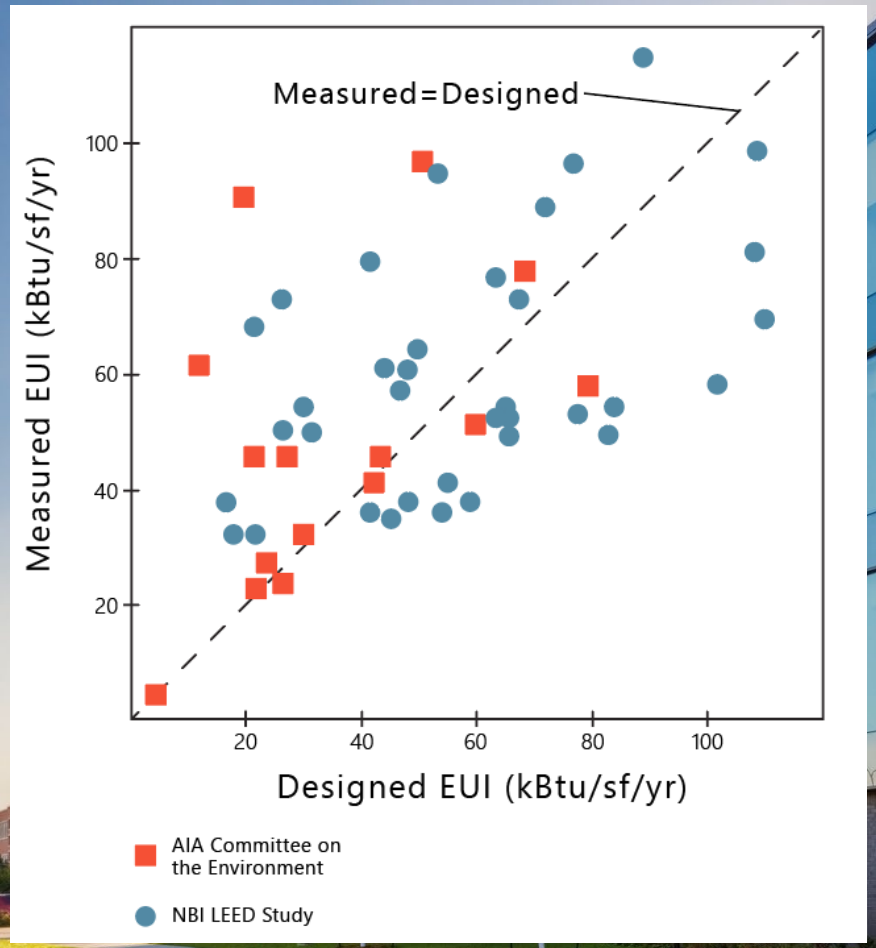
EUI
Energy Use Intensity
(kBtu/sf/yr)

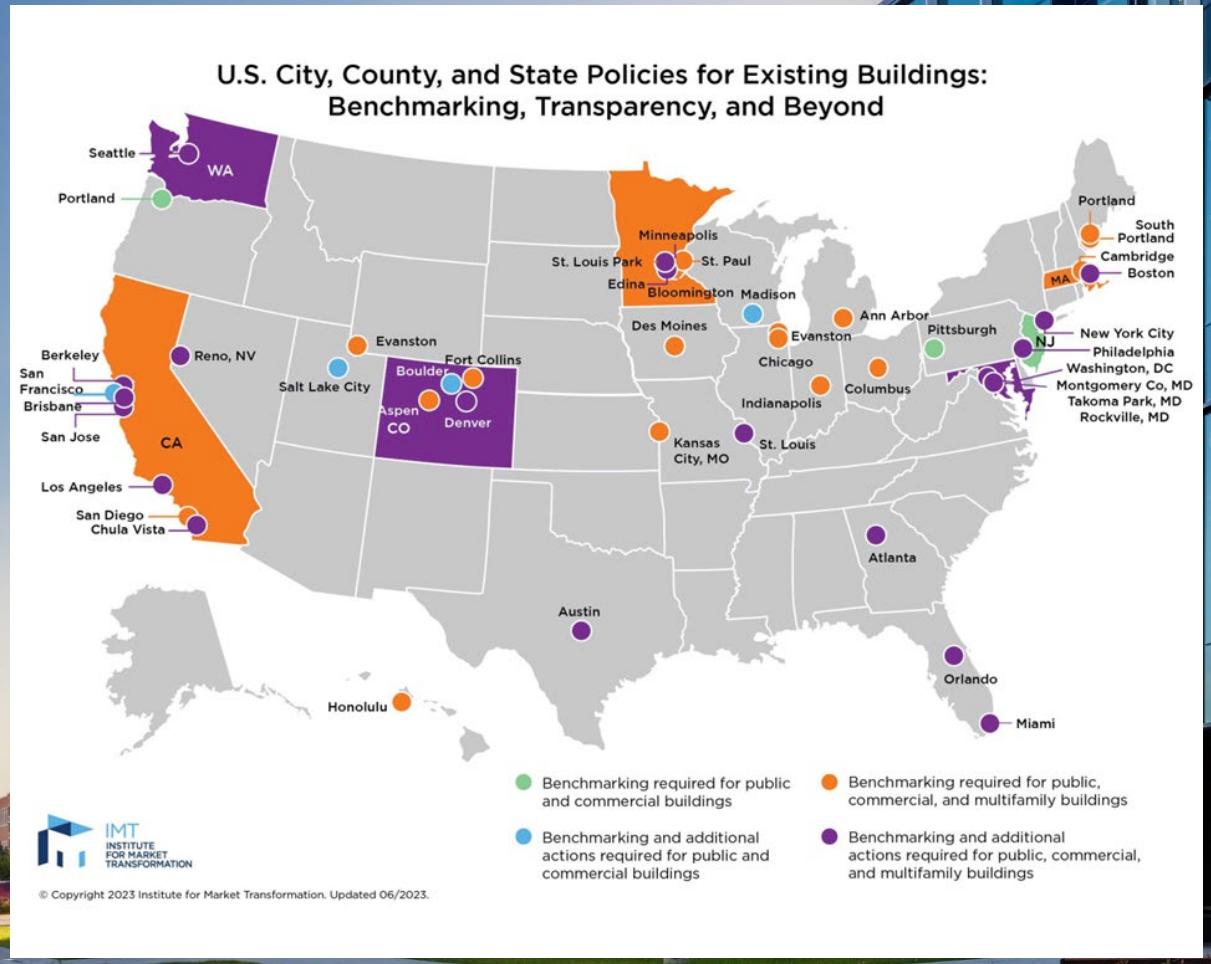
Energy per Square Foot per Year
Measured in kBtu


Predicted Performance
Actual Performance
Energy Modeler
Engineer
Architect
Owner
Occupant

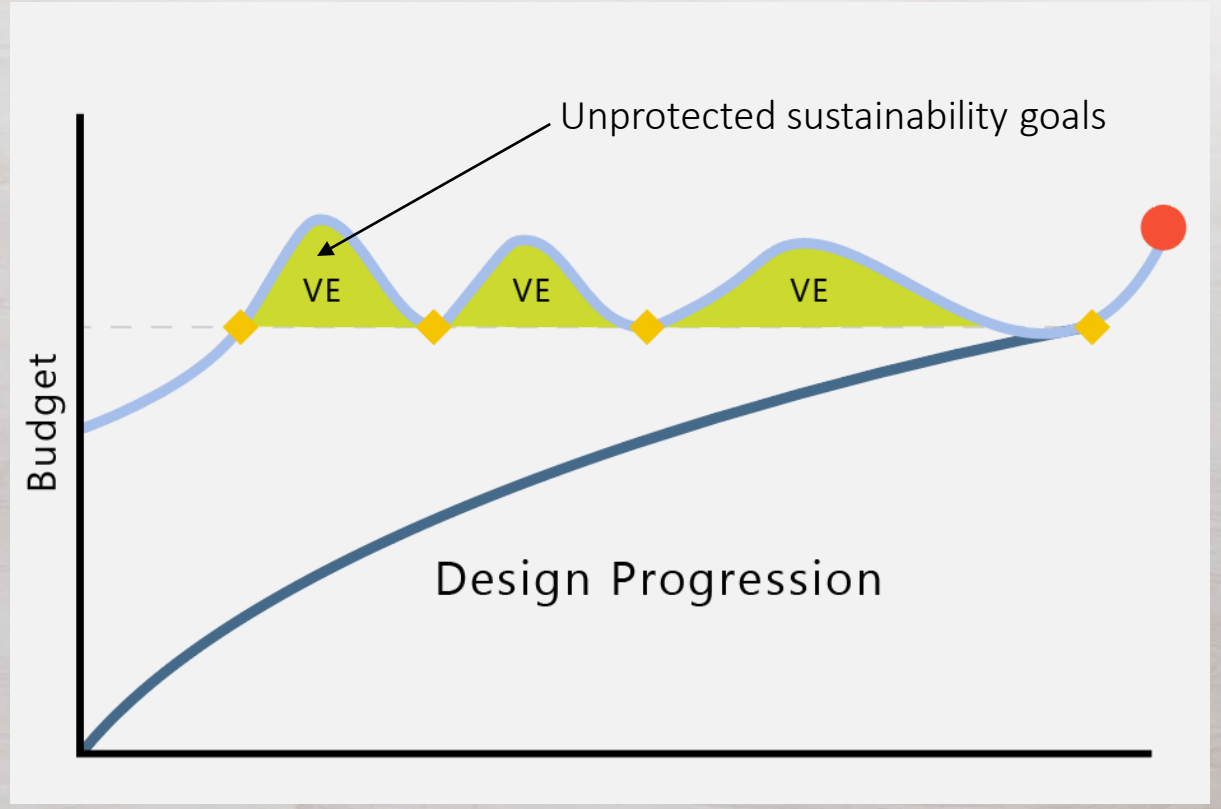
Building Performance Gap



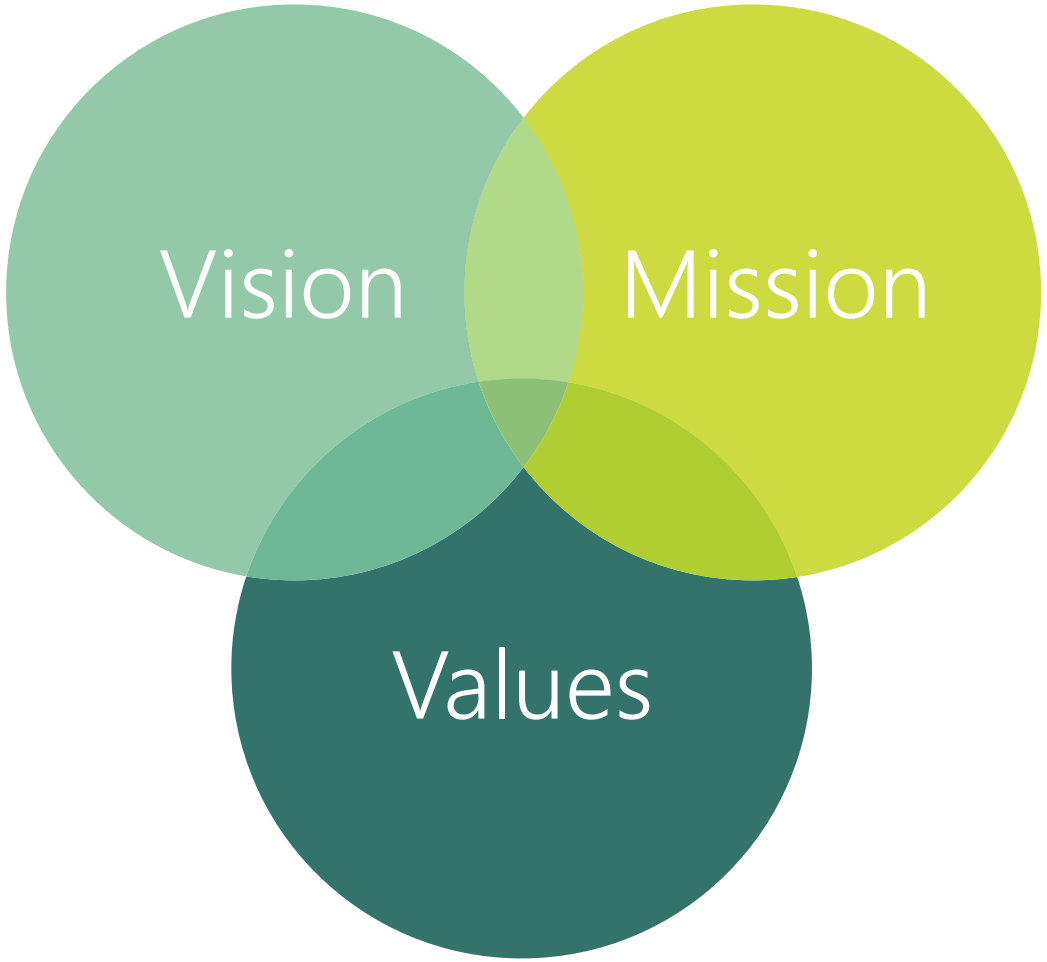
Building Performance Gap



Cost Hurdles



Connecting to the "Why High-Performance "



AIA Framework for Design Excellence

Integration

Equitable Communities

Ecosystems

Water

Economy

Energy

Well-being

Resources

Change

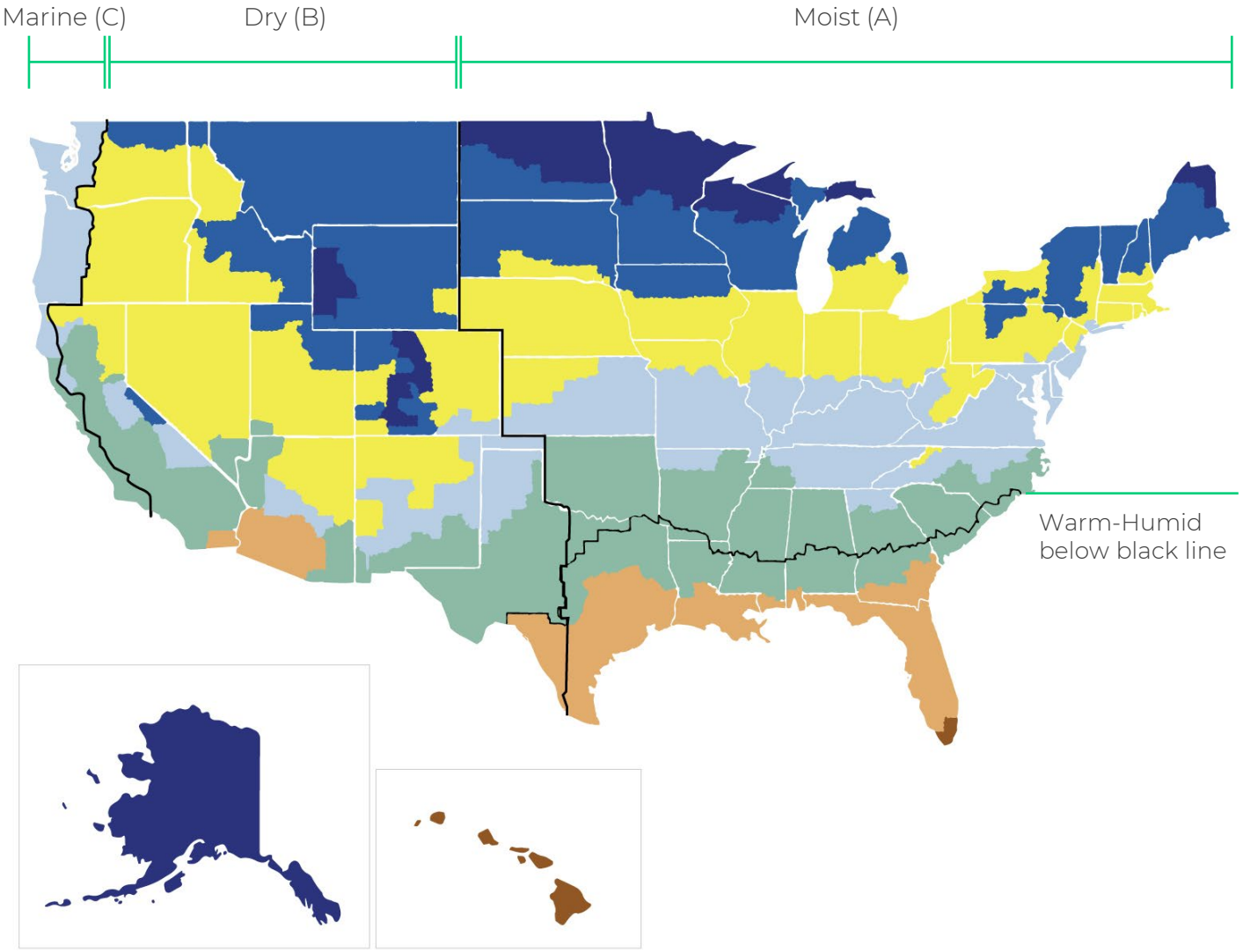
Discovery

Building Types

EUI guidelines depend on building type and climate zone

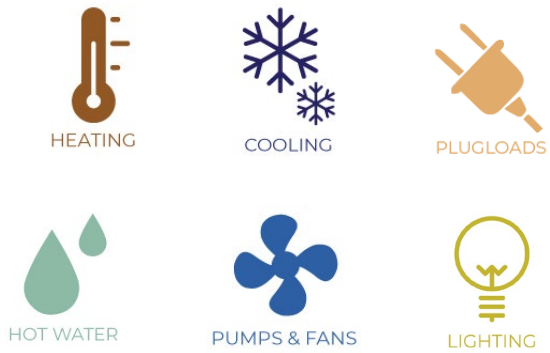
- Large office
- Medium office
- Small office
- Warehouse
- Stand-alone retail
- Strip mall
- Primary school
- Secondary school
- Supermarket
- Quick-service restaurant
- Full-service restaurant

U.S. Climate Zones



[example]

Net Zero



ANNUAL ENERGY CONSUMPTION/UTILITY BILLS

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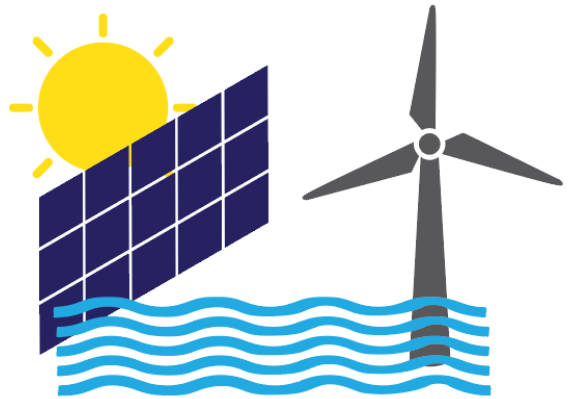
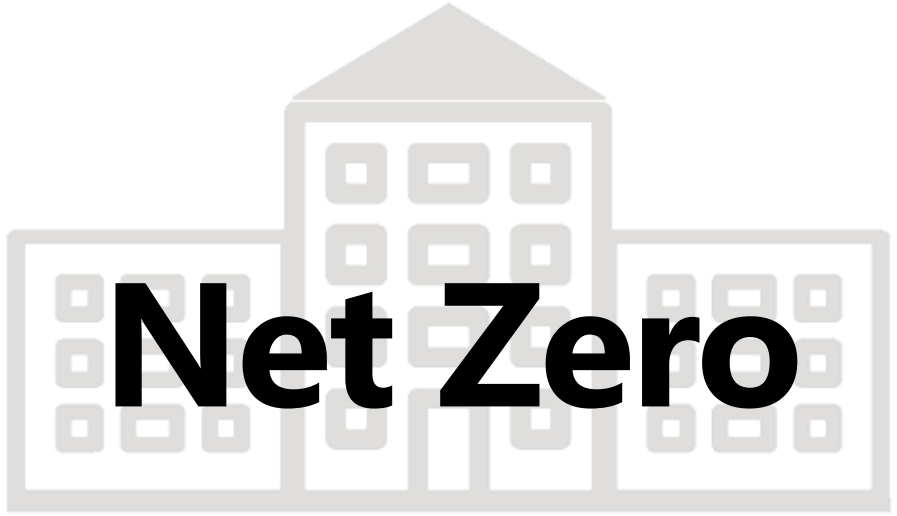


ON-SITE ENERGY PRODUCTION/REVENUE



Net Zero

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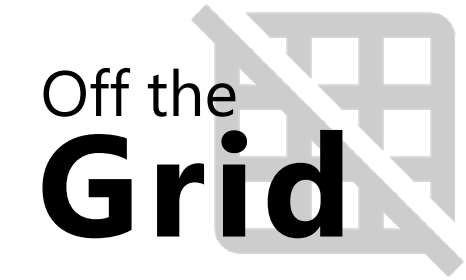
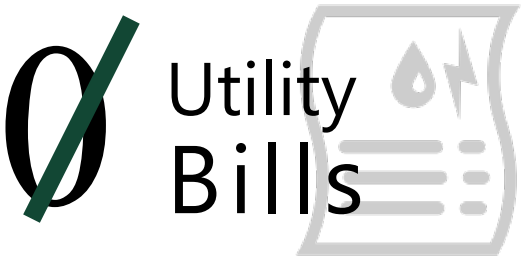


Off the
Grid



Utility
Bills

03

Collaborative Building Design

High-Performance Building Design Process

- Develop a target for onsite energy consumption
- Focus on the building envelope to reduce HVAC related energy consumption
  - Energy modeling for different envelope options
- Model systems options
  - Energy modeling for different system options
  - Building orientation and construction
- Develop onsite energy production strategy to offset the predicted onsite energy consumption

MEP Role

To reduce energy site consumption

- Design highly efficient MEP systems
  - Energy recovery
  - Controls
- Owner buy-in
- End-user training
- Building systems commissioning
  - Ongoing

To increase energy site production

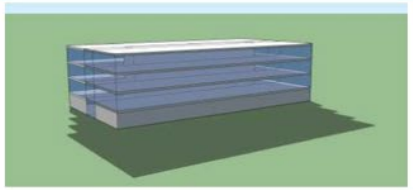
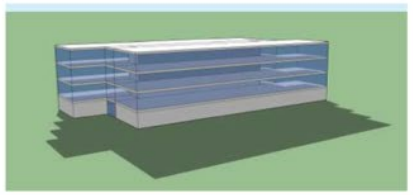
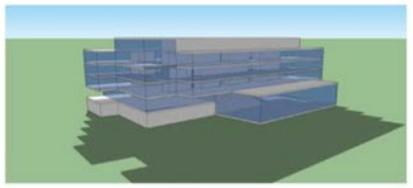
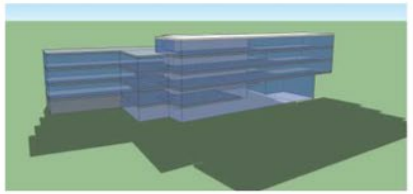
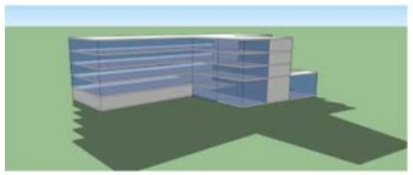
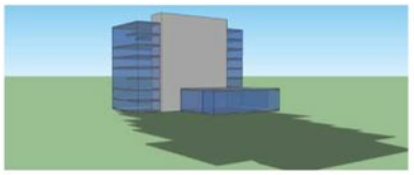
- Solar ← most common
- Wind
- Hydro
- Co-gen
- Geothermal heat pumps — Ground loop heat exchanger (GLHE) or geo-exchange

Architect Role

- It’s all about the building envelope
  - Triple-pane windows
  - R50+ roof
  - R30+ walls
  - Daylight harvesting
  - Detailing
  - Building pressure testing during construction
- Building massing and orientation

Building Massing & Orientation

- Site selection
- Building orientation

Massing Option	Diagonal		East-West		North-South	
	EUI	Peak Cooling	EUI	Peak Cooling	EUI	Peak Cooling
	45.8	431	45.8	426	46.3	443
	46.9	426	47.0	417	47.5	451
	51.8	509	52.0	497	52.1	540
	56.6	510	56.7	496	57.6	549
	59.0	540	58.9	533	59.1	568
	58.4	482	58.3	475	59.0	499

Building Envelope Overall Analysis – Northern Minnesota

OPTION	ROOF INSULATION	WALL INSULATION	FOUNDATION/ SLAB INSULATION	GLAZING	HVAC SYSTEM	LIGHTING (W/sqft)	PEAK BUILDING COOLING LOAD (Tons)	ENVELOPE COOLING LOAD (Btu/hr/sqft)	PEAK BUILDING HEATING LOAD (MBH)	ENVELOPE HEATING LOAD (Btu/hr/sqft)	ESTIMATED BUILDING EUI (kBtu/sqft/yr)	NOTES & ASSUMPTIONS
OPTION 1	R-50	R-48	R-6.5/(F-0.4)	VIG; U-Value 0.11; SHGC 0.18	Boiler (92% EFF), Air-Cooled Chiller (15.8 IPLV), DOAS, FPVAV Overhead, CO2 DCV	0.50	288	1.7	8,900	5.9	40	NO POOL; 0.05CFM/SQFT WALL AREA; **NO** PERIMITER HEAT REQ'D
OPTION 2	R-35	R-30	R-6.5/(F-0.4)	High-performance IGU; U-Value 0.28; SHGC 0.21	Boiler (92% EFF), Air-Cooled Chiller (15.8 IPLV), DOAS, FPVAV Overhead, CO2 DCV	0.50	313	2.8	9,700	8.1	43	NO POOL; 0.05CFM/SQFT WALL AREA; **NO** PERIMETER HEAT REQ'D
OPTION 3	R-35	R-19 + R-12 c.i.	R-0/(F-0.4)	U-Value 0.29; SHGC 0.45	Boiler (92% EFF), Air-Cooled Chiller (15.8 IPLV), DOAS, FPVAV Overhead, CO2 DCV	0.50	400	6.0	11,200	10.5	46	NO POOL; 0.05 CFM/SQFT WALL AREA; PERIMETER HEAT REQ'D
OPTION 4	R-35	R-13 + R-7.5 c.i	R-0/(F-0.4)	U-Value 0.29; SHGC 0.45	Boiler (80% EFF), Air-Cooled Chiller (13.7 IPLV), VAV w/ reheat	0.99	812	7.1	19,100	21.3	66	NO POOL; IECC 2018 CODE MAXIMUM (WORST-CASE) REFERENCE BUILDING; 0.40 CFM/SQFT WALL AREA

Building Envelope Overall Analysis – Northern Minnesota

OPTION	INFILTRATION RATE	PEAK BUILDING COOLING LOAD (tons)	PEAK BUILDING HEATING LOAD (MBH)	ENVELOPE HEATING LOAD (Btu/hr/sqft)	ESTIMATED BUILDING EUI (kBtu/sqft/yr)	NOTES & ASSUMPTIONS
OPTION 1	0.05 cfm/sqft wall area	533	12,700	6.9	43	**NO** PERIMITER HEAT REQ'D
OPTION 2	0.1 cfm/sqft wall area	540	13,100	8.4	44	**NO** PERIMETER HEAT REQ'D
OPTION 3	0.2 cfm/sqft wall area	560	13,800	9.5	47	**SOME** PERIMETER HEAT REQ'D
OPTION 4	0.4 cfm/sqft wall area (2018 IECC max)	553	15,200	15.3	53	PERIMETER HEAT REQ'D

Building Envelope Overall Analysis – Central Minnesota

- **High % Glazing Building (over 50%)**
- Compare different envelope upgrades to analyze impact on building
- Impact on Cooling and Heating peak loads
- System size reduction = $ reduction
- Evaluate envelope versus mechanical system upgrades

Envelope Analysis

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Energy Conservation Method *	Code Minimum **	Infiltration (0.15 cfm/sf of wall)	Infiltration (0.06 cfm/sf of wall)	Glazing / Skylights (U-0.24)	Glazing / Skylights (SHGC-0.24)	Glazing / Skylights (U-0.24, SHGC-0.24)	Glazing / Skylights (U-0.15, SHGC-0.24)	Walls (R-33) /Roof (R-40)	High Performance ***
EUI	42.8	40.6	39.9	42.0	41.9	40.9	40.0	42.6	37.9
Carbon (Metric Tons CO2e)	1,480	1,401	1,382	1,450	1,447	1,414	1,383	1,474	1,311

*Energy Conservation Method

- Refers to improved building performance implemented compared to the Code Minimum Building

**Code Minimum

- Roof: R-30
- Walls: R-13 + R-12.5 continuous insulation
- Glazing/Skylights: U-0.34 / SHGC-0.34
- Infiltration: 0.4 cfm/sf of wall

***High Performance

- Roof: R-40
- Walls: R-13 + R-20 continuous insulation
- Glazing: U-0.15 / SHGC-0.24
- Infiltration: 0.06 cfm/sf of wall

Estimated Performance Results

Building Type	EUI	EUI % Improvement	Heating % Reduction	Cooling % Reduction	Estimated # of Wells Reduced
Baseline	42.8	BASE	BASE	BASE	BASE
High Performance	37.9	11%	48%	23%	2
Recommended Pursuit	39	9%	38%	19%	2
Recommend Pursuit Description ****	• Improved glazing (U-0.24 SHGC-0.24) • Highest improved infiltration (0.06 cfm/sf of wall) • Code Minimum Insulation for walls and roof				

Four Winds CTE High School

- From our experience, Net Zero can be easier to achieve than LEED certification
- First Net Zero building in North Dakota
- First Net Zero Tribal School in the U.S.
- $317/sq. ft. total construction

How we got there…

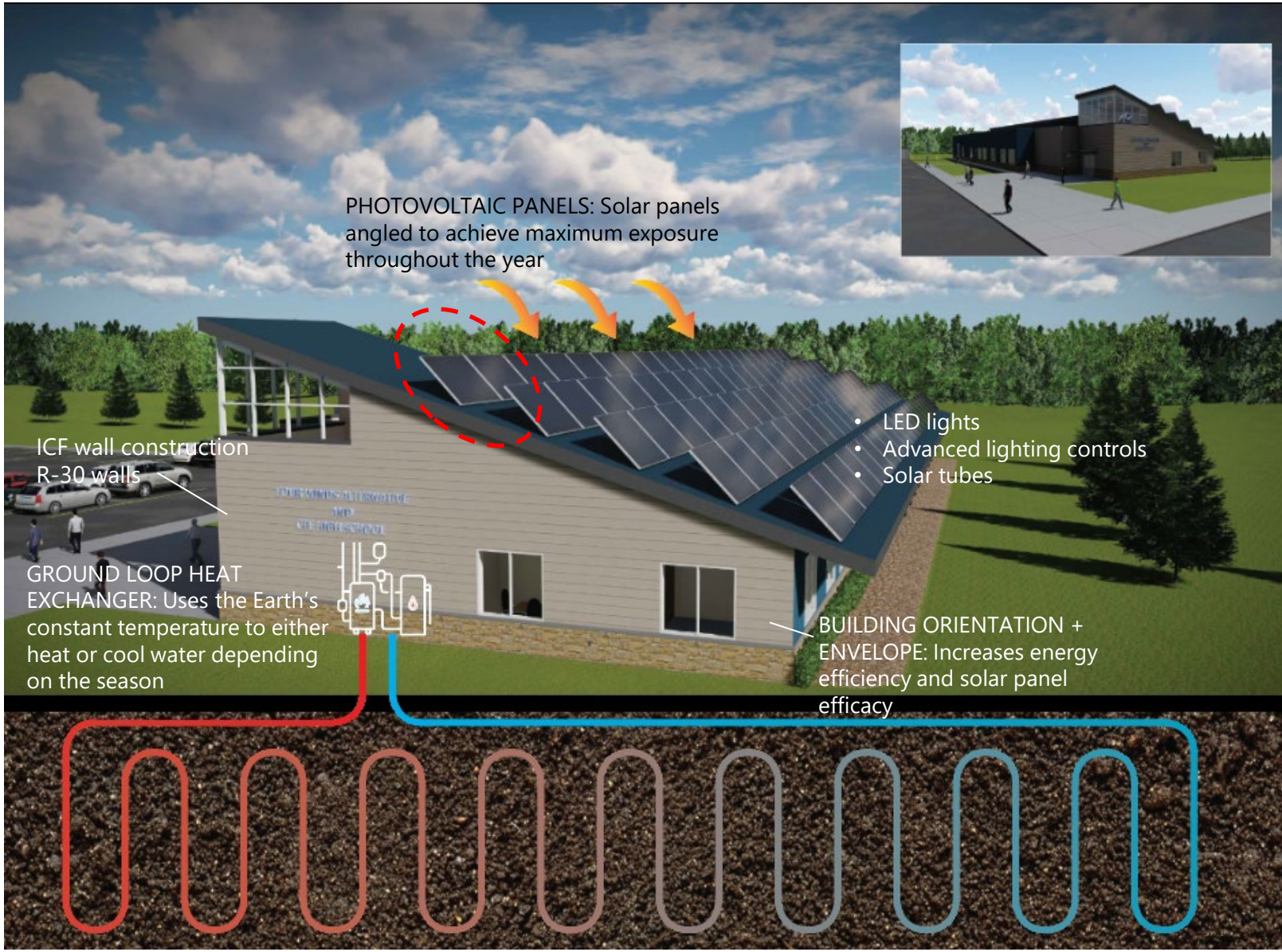
- Envelope
- MEP Systems

25 EUI

- On-site generation

30 EUI

$30 - 25 \leq +5$



Cost Shifting

Envelope vs HVAC Systems

Less Load = Less Equipment =
Less Energy = Less Onsite Renewables

- Load reduction makes high-performing systems more cost-effective.
  - 100-ton inefficient system ~ 80 Ton high performing system
  - Remove perimeter heat.
  - Less required MEP square footage
  - Less required on-site renewable square footage

04

High-Performing HVAC Systems

Traditional High-Efficiency Boiler & Chiller

HVAC System

- AHU with VAV
- RTU with VAV
- DOAS with Induction Displacement Units
- DOAS with Fan Coil
- DOAS with Fan Powered VAV

Pros

- Familiar system and controls
- More centralized system and maintenance

Cons

- Lower efficiency compared to geothermal

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Six Pipe Heat Recovery Chiller

HVAC System

- AHU with VAV
- RTU with VAV
- DOAS with Induction Displacement Units
- DOAS with Fan Coil
- DOAS with Fan Powered VAV

Pros

- Higher efficiency
- Very efficient simultaneous heating and cooling

Cons

- More complex controls

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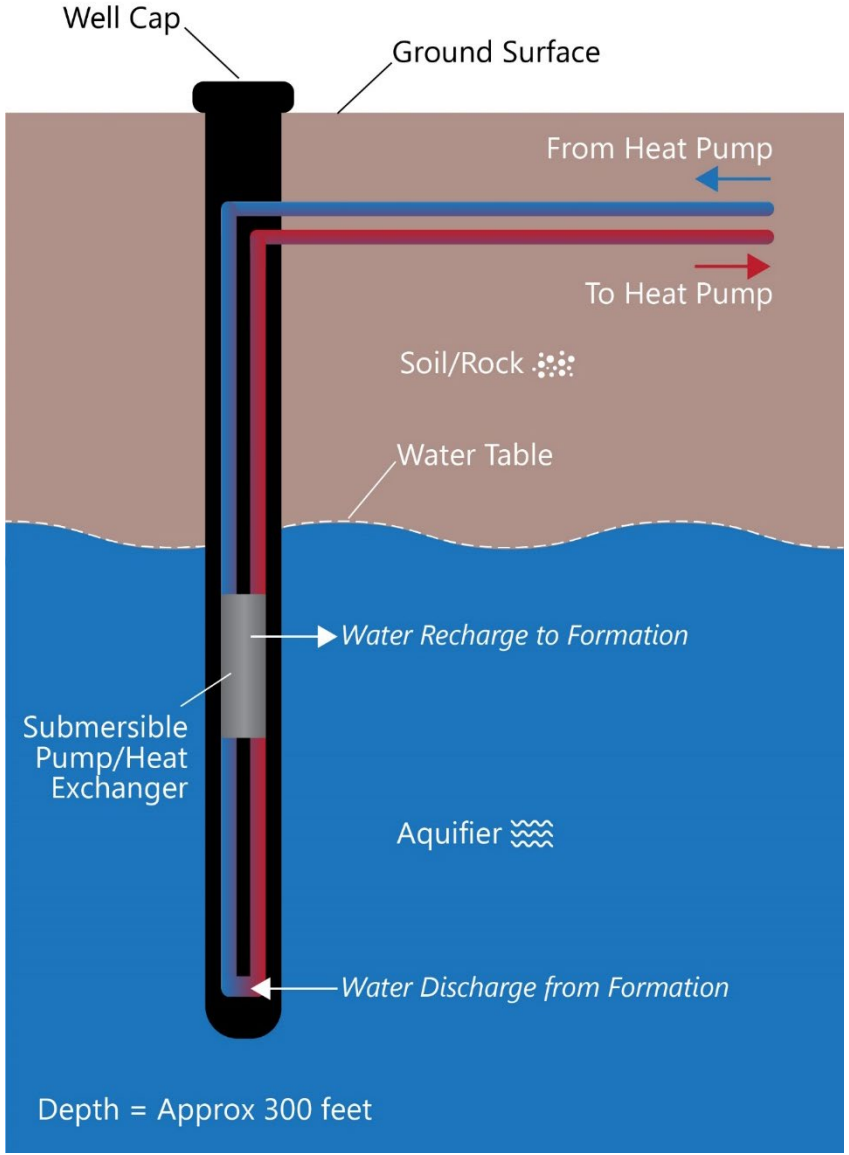
Geothermal – Wellfield Options

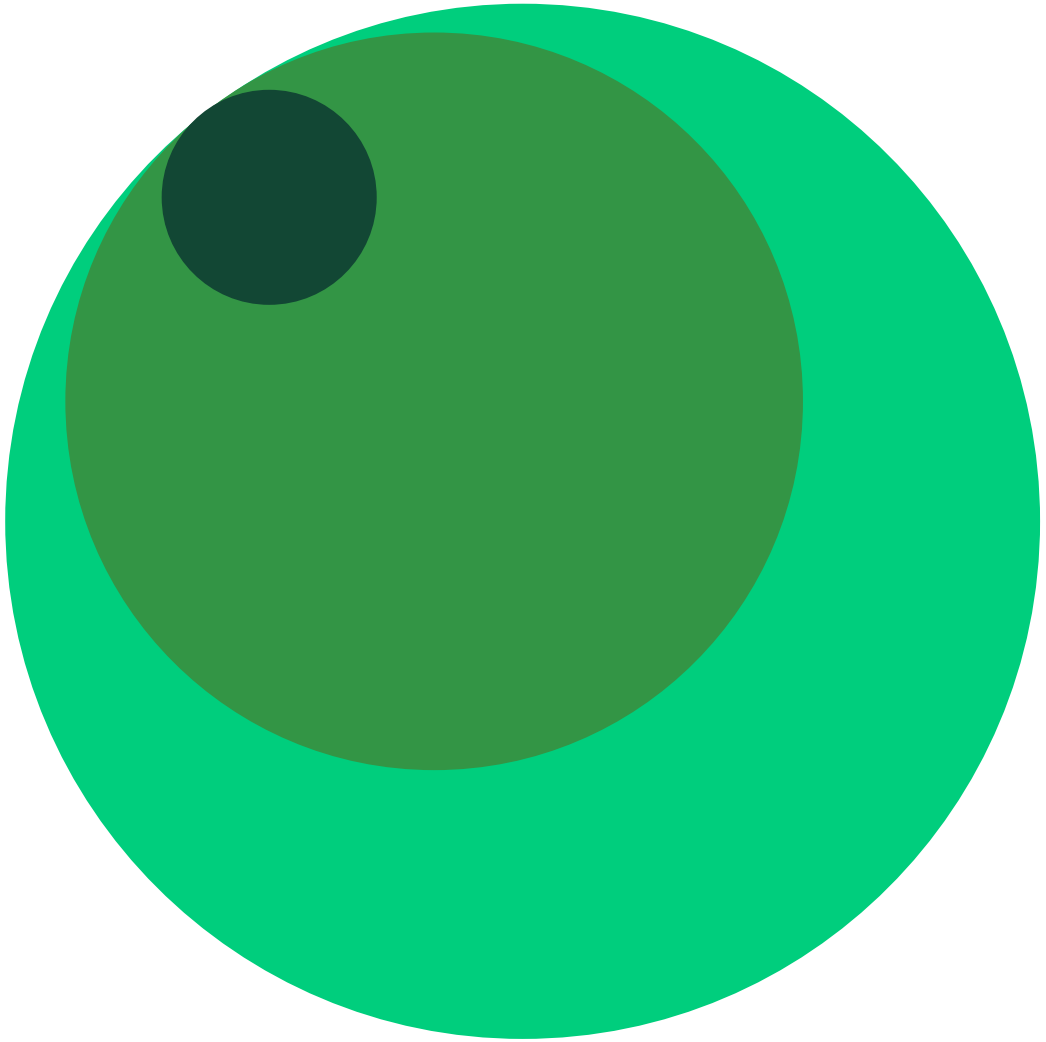
- Vertical Bore
- Horizontal Bore
- Horizontal (slinky)
- Deep well aquifer heat exchanger



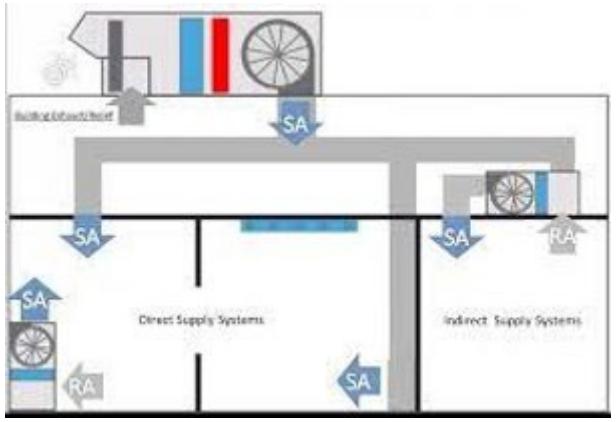
Compare Geothermal Land Use

Options Space Requirements

- 160,000 SF Office Building
  - Horizontal – 360,000 SF of wellfield
  - Vertical – 160,000 SF of wellfield
  - Deep Well Aquifer – 10,000 SF of wellfield



Geothermal – HVAC Options



Unitary Heat Pumps with DOAS

- Horizontal Heat pumps
- Vertical Heat pumps
- Heat pump DOAS with energy recovery

Pros

- Efficient
- Reduced Piping compared to four pipe
- Built in system/building redundancy

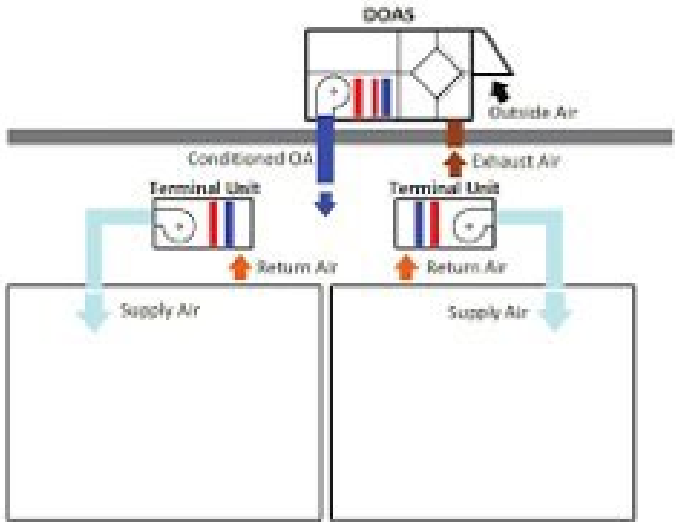
Cons

- Sound concerns
- Distributed maintenance (compressors/filters)

Geothermal – HVAC Options

Fan Coil with DOAS

- Horizontal – four pipe fan coils
- Vertical – four pipe fan coils
- Centralized heat pump/6-pipe chiller



Pros

- Centralized compressor
- Built in system/building redundancy

Cons

- Distributed maintenance (filters)
- Additional piping compared to distributed heat pump

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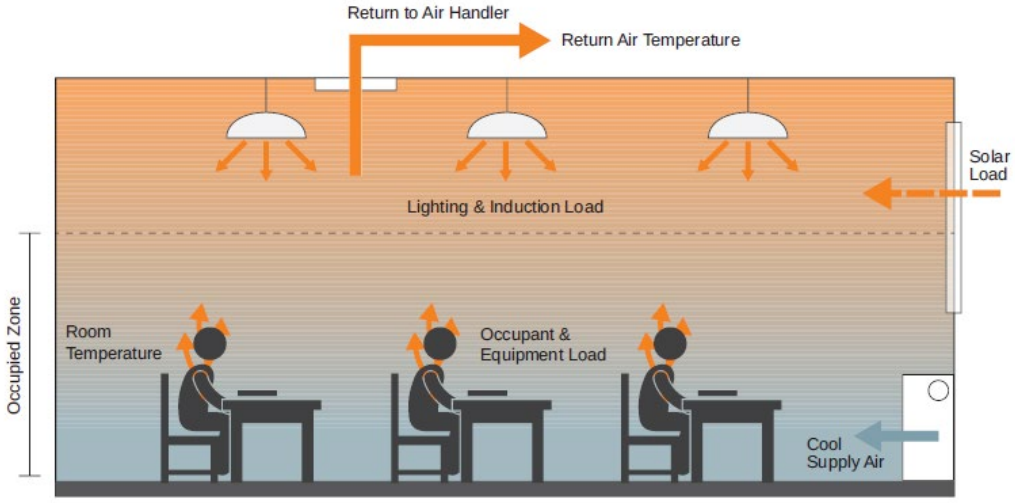
Geothermal – HVAC Options

Induction Displacement/Chilled Beam with DOAS

- Induction displacement/chilled beams
- Centralized heat pump/6-pipe chiller
  - Backup boiler



Pros

- Less filter replacement
- “Compressor-less cooling" direct sensible cooling from geo field
- Higher indoor air quality
- Less noise

Cons

- Floor space
- Latent load control

Geothermal – HVAC Options

Water to Water Heat Pump with Traditional AHU/RTU and VAV

- Central water to water heat pump/6-pipe chiller
  - Chilled water
  - Hot water
- VAV/Fan-powered VAV reheat

Pros

- Efficient compared to boiler and chiller
- Less distributed maintenance (filters/compressors/motors)

Cons

- Lower heating hot water temperatures

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Geothermal – HVAC Options

Variable Refrigerant Flow with DOAS

- Horizontal
- Cassette
- Vertical
- Wall mounted

Pros

- Very efficient
- Packaged controls
- Reduced piping
- No compressors at fan coils

Cons

- Distributed maintenance (filters)
- Increased refrigerant lines

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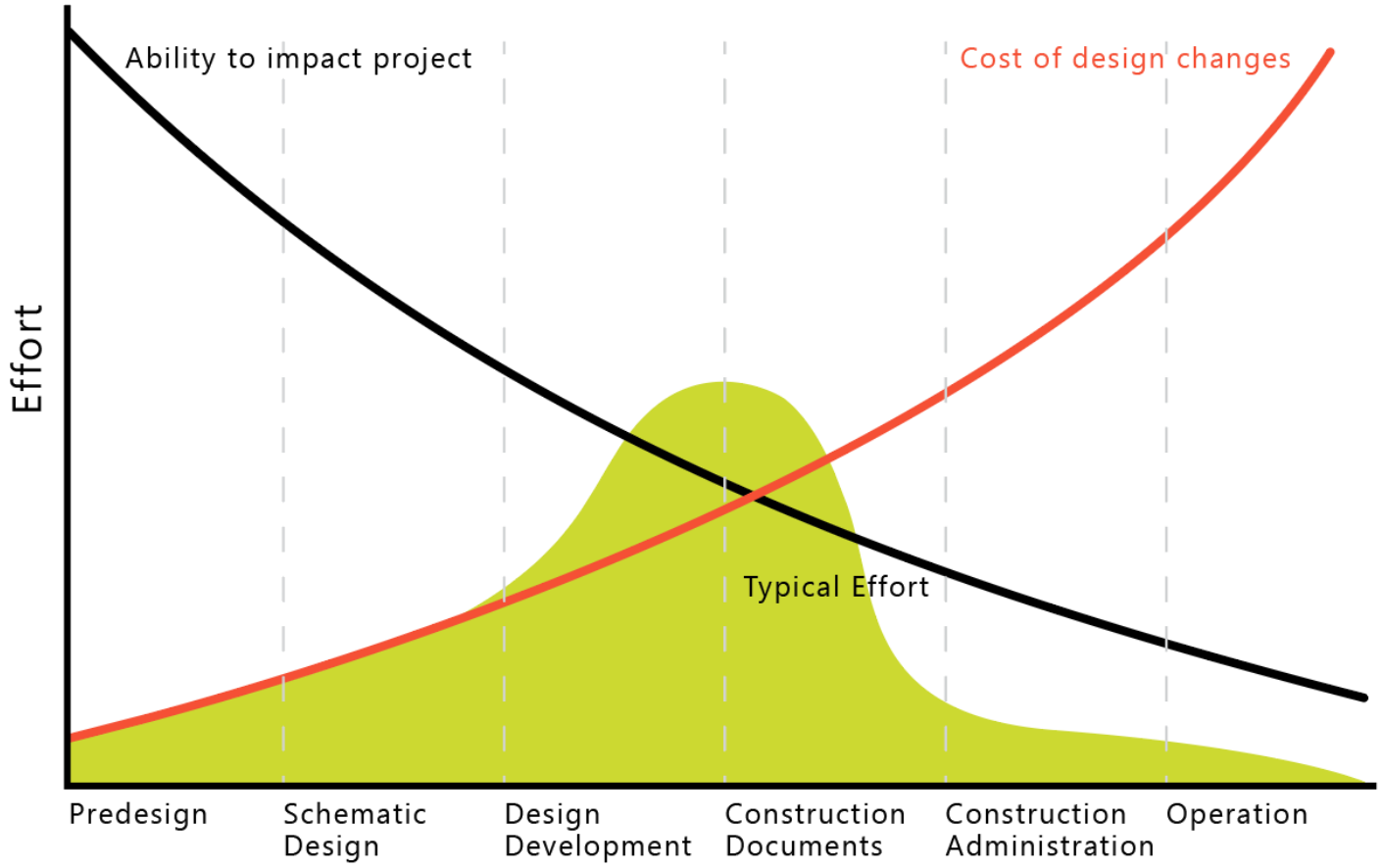
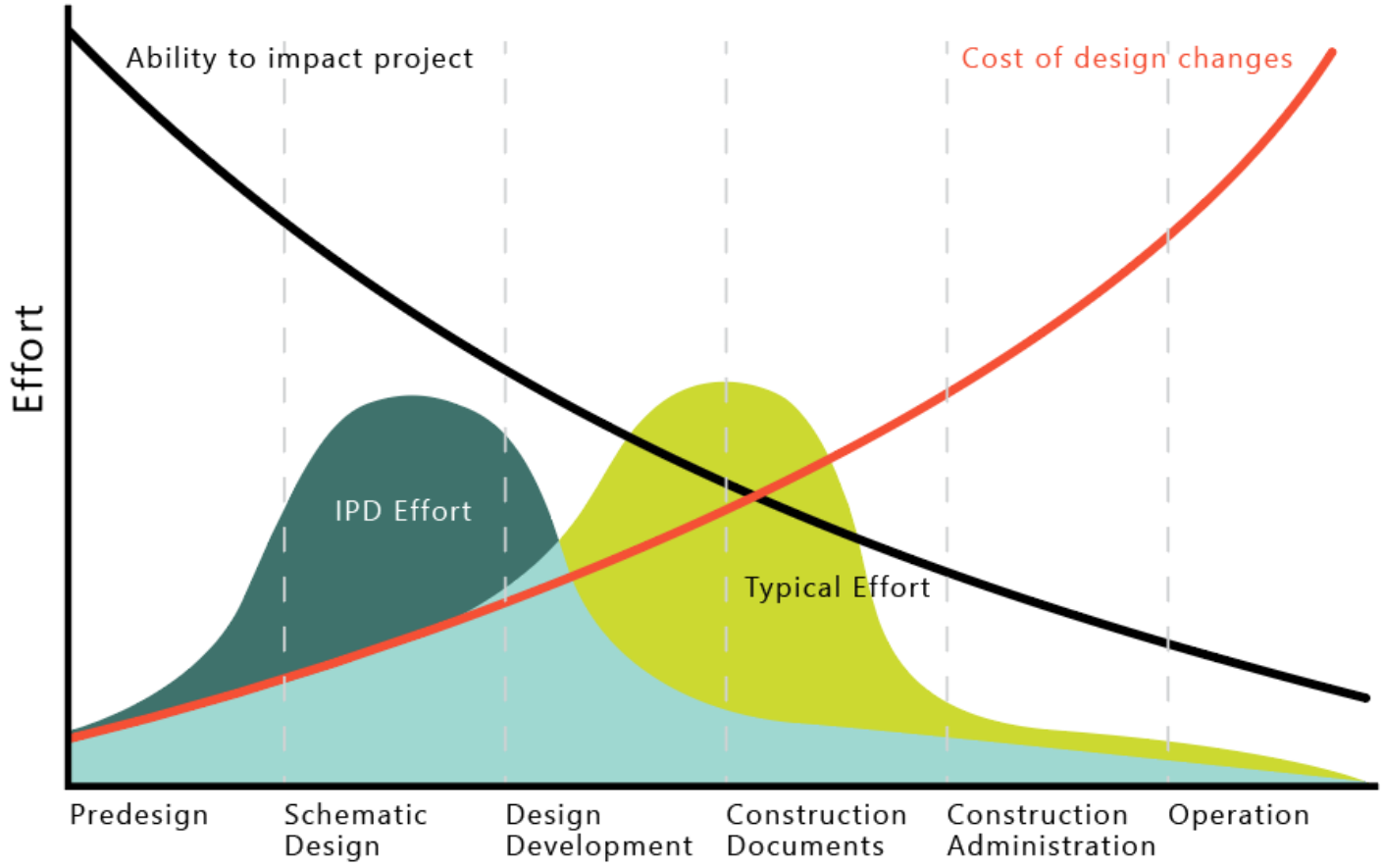
05

Integrated Design Process: Timeline Shifting

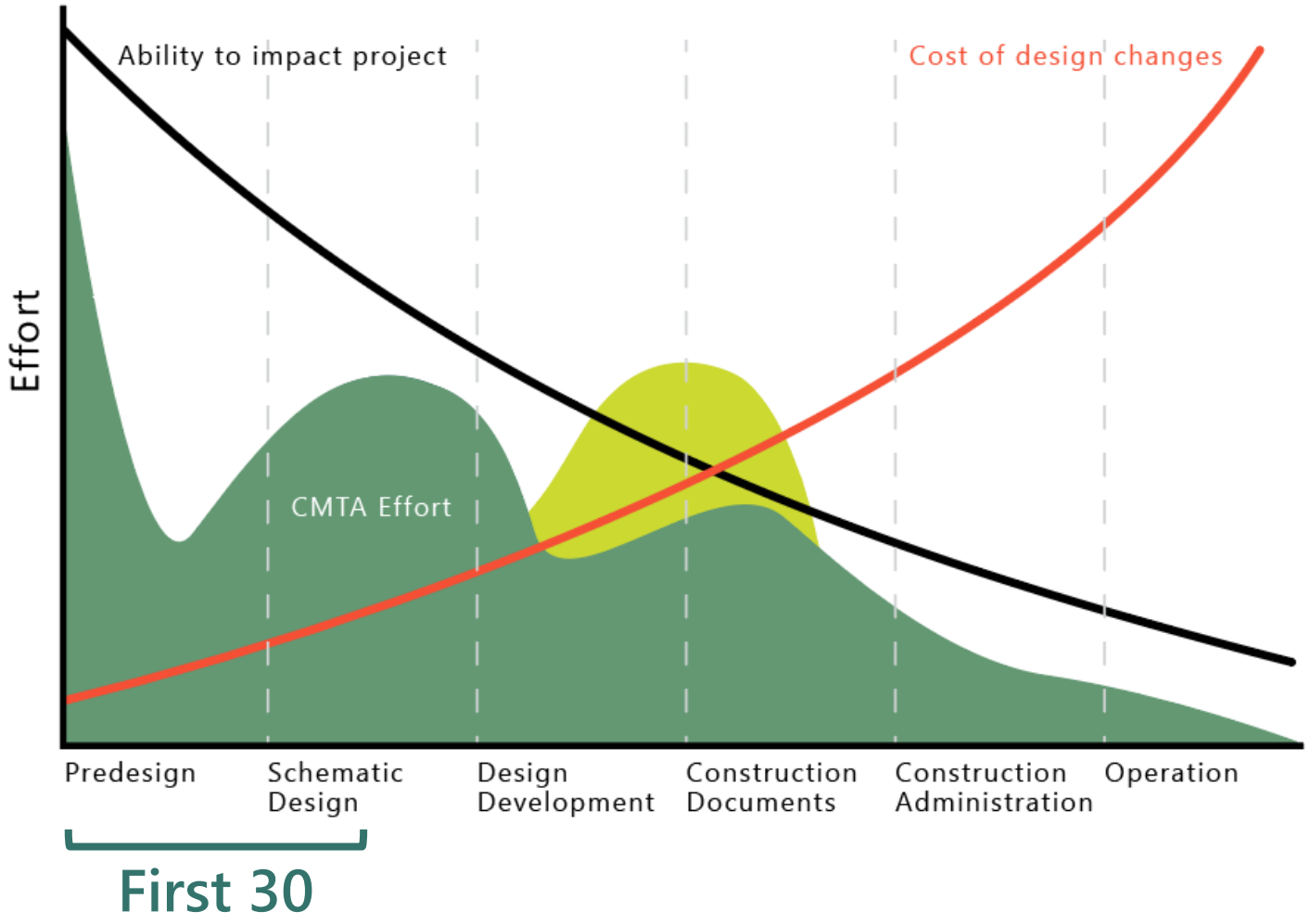
Traditional Approach + Timeline



Traditional Approach + Timeline



Vs. Proactive Approach + Timeline



Decision Making Process

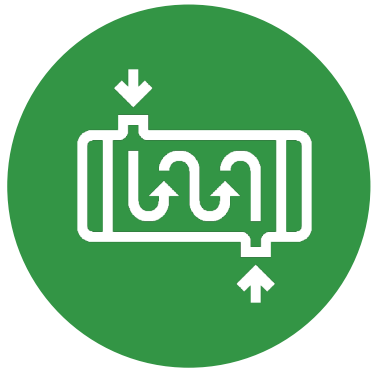
Proactive Approach

Building Orientation & Massing

Maximize daylighting and control solar heat gain

Building Envelope

Tight envelope for low infiltration, reduced heating and cooling loads



High Performance MEP Systems

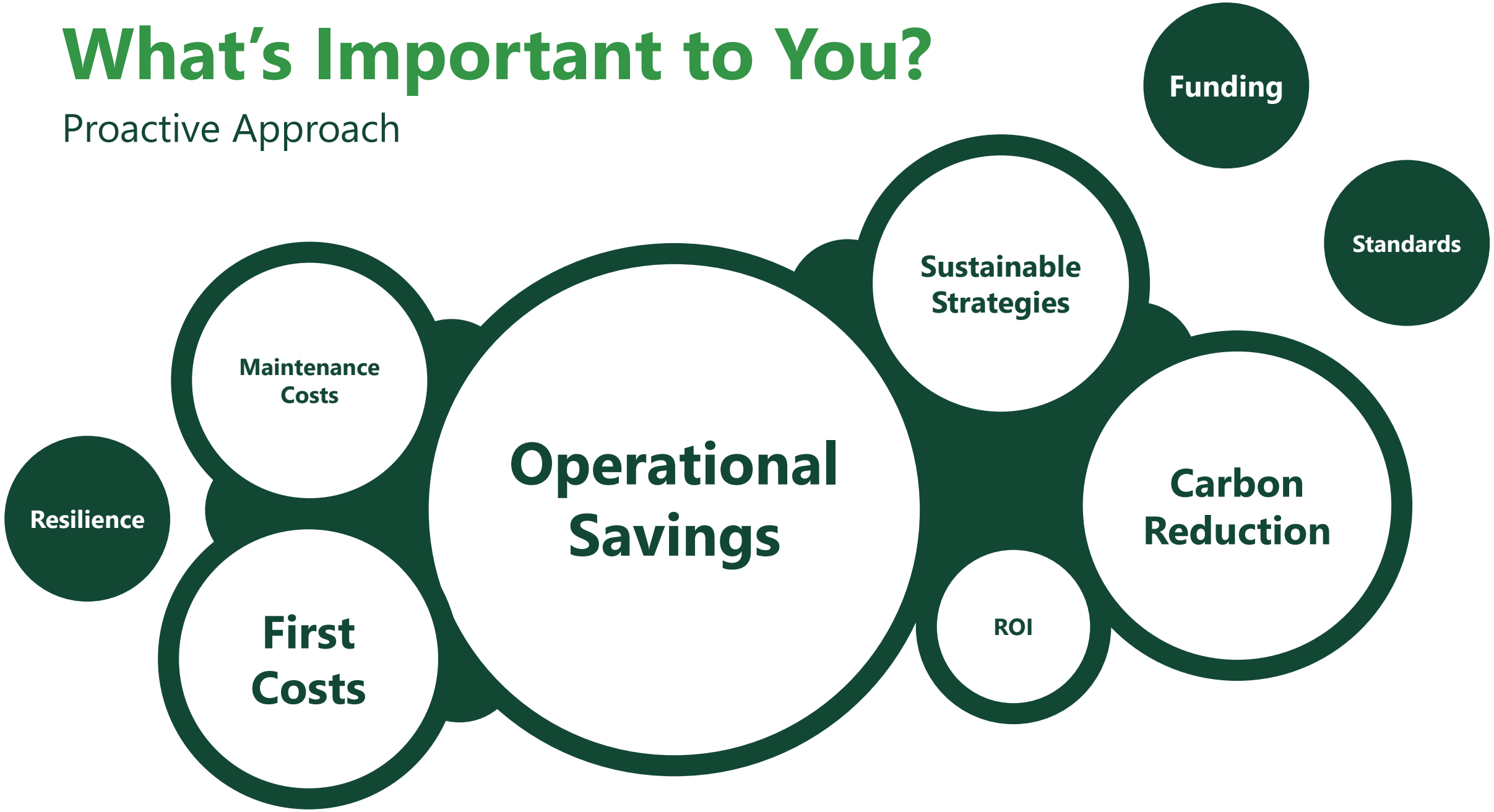
Fully electrified, heat pumps, improved IEQ

On Site Renewables

Reduce EUI first and maximize roof area

What's Important to You?

Proactive Approach



Setting Measurable Targets

Proactive Approach

Energy

- EUI
- Solar Production
- Infiltration Rate
- Thermal Bridging
- LPD/EPD

Well-being

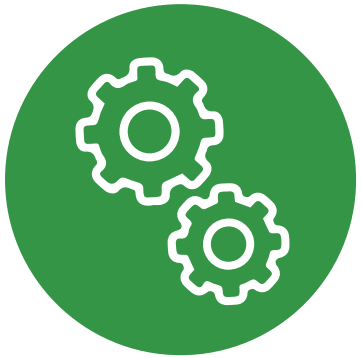
- Daylighting
- IAQ
- Thermal Comfort
- Acoustics

Economy

- Budget
- Life Cycle Costs
- Financing

Water

- WUI
- Rain-Water Capture %
- Water Quality



Resources

- Embodied Carbon Intensity
- Recycled Content
- Red List
- Waste Tracking


Let’s Connect.
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Empowering Communities Through Resilient & Sustainable Design

AIA Approved Continuing Education

3 AIA/HSW Units

BUILD WITH STRENGTH

SYMPOSIUM AGENDA

7:00 - 8:00 AM - Breakfast & Registration

8:00 - 8:45 AM - Topic: Sustainability

8:45 - 9:15 AM - Topic: Insurance

9:15 - 9:45 AM - Topic: Architecture

9:45 - 10:30 AM - Topic: Inflation Reduction Act

10:30 - 10:45 AM - Networking Break

10:45 - 11:30 AM - Q&A Panel Discussion

Optimizing the building envelope is essential to achieving energy efficiency, decarbonization, and sustainability. As is understanding available building options and financial incentives.

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- **MATT GREEN - KB WALKER**
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NRMCA National Ready Mixed Concrete Association

Nudura Part of Tremco Construction Products Group

Minnesota Concrete Council
Dedicated to Cast-in-Place Concrete

Introduction

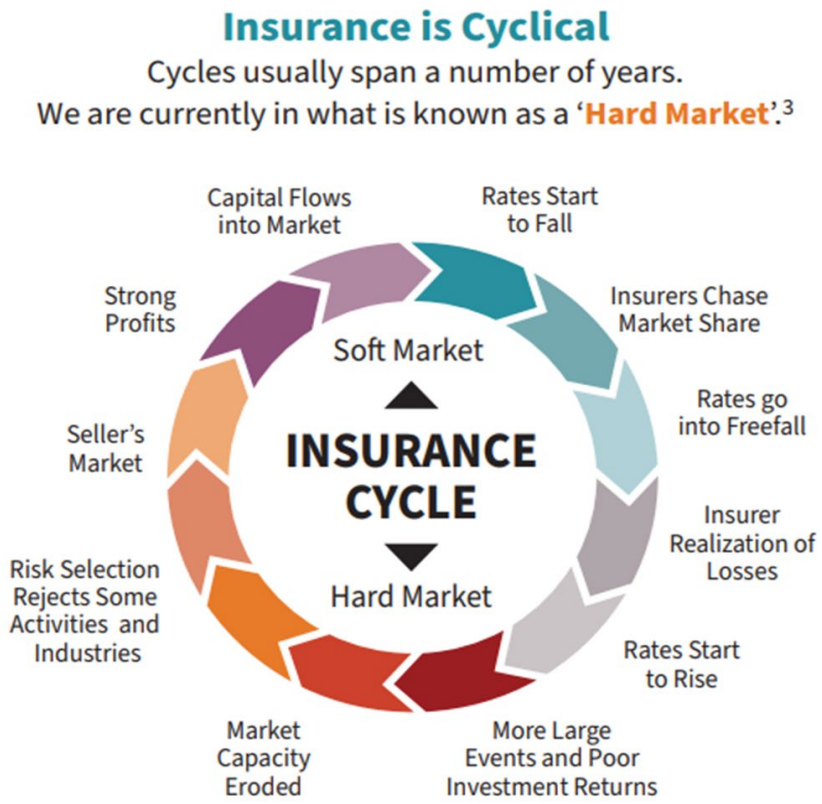
Shawn Flavin, CIC

Nathan Lortz, CIC

Insurance 101

- Insurance carriers are generally for-profit entities
- Insurance works under a shared risk platform
- Reinsurance considerations
- Historical trends

Hard Market vs. Soft Market



Current Market Conditions

- General Overview
  - Catastrophic losses
  - Inflation issues
  - Reinsurance capacity and pricing
  - Labor shortages
  - Property replacement costs
  - Underinsurance concerns
- Specific MN Examples:
  - Minnesota hailstorm 08/11/23; Total insurable losses 1.8B
  - Minnesota severe storm 07/22/22; Total insurable losses 1.4B
  - Minnesota severe storm 05/11/22; Total insurable loss 2.9B
  - Midwest hailstorm 05/09/22; Total insurable losses 2.3B
  - Midwest Derecho 12/15/21; Total insurable losses 2.0B
  - Midwest Derecho 08/10/20; Total insurable losses 13.1B
  - Total insurable losses $23,580,000,000
  - $4,035 per person in Minnesota

Underwriting Considerations

- Concrete vs. Frame
  - Combustibility
  - How does product hold up to water?
  - Mold and fungus
  - Durability to wind, hail and earthquake
  - Other considerations; Location, first response, accessibility to materials and labor

- Considerations on Frame Projects
  - Security requirements include job fencing, cameras/video monitoring, rate of rise detectors, and water flow valves
  - General Contractor must have proven experience
  - Distance between buildings and location of project are closely reviewed

Insurance Accessibility and Issuance Conditions

- Framed over 25m
- Layering carriers
- Higher deductibles and retentions
- Masonry over 25m
- Unlimited cap
- Single carrier
- Multiple carrier accessibility
- Price negotiable
- Lower deductibles and retentions

Pricing Considerations

- Builders Risk Annual Rates per $100
  - Frame: 0.40 – 0.45 up to $15,000,000 project. 0.55 – 0.70 for projects above $15,000,000
  - Masonry: 0.075 – 0.10 up to $250,000,000 project

    - EXAMPLE: 18-month $50,000,000 project cost:
      - 0.55 Annual Frame Rate: $412,500 Project Premium Cost
      - 0.10 Annual Masonry Rate: $75,000 Project Premium Cost

    - EXAMPLE: 12-month $25,000,000 project cost:
      - 0.40 Annual Frame Rate: $100,000 Project Premium Cost
      - 0.10 Annual Masonry Rate: $25,000 Project Premium Cost

- Permanent Placement

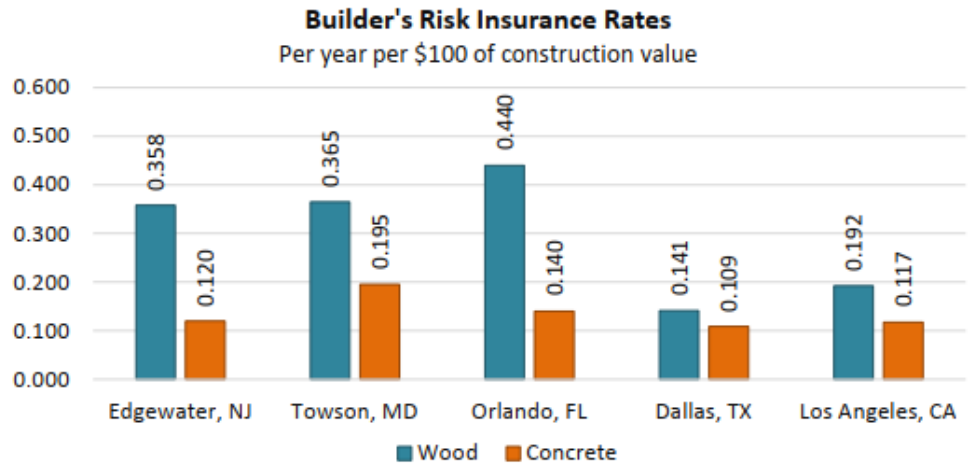


Figure 1. The average quotes for builder's risk insurance for the Reference Building in five Reference Cities in 2017 Survey

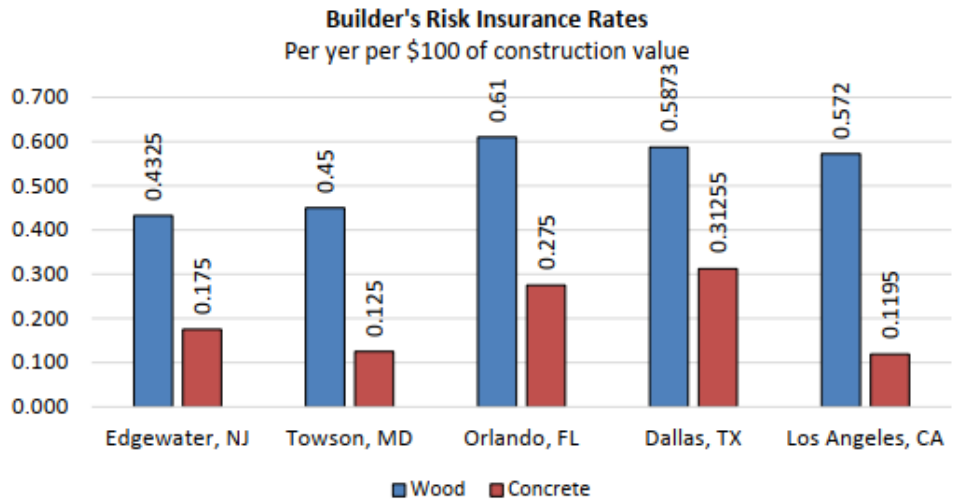


Figure 2. The average quotes for builder's risk insurance for the Reference Building in five Reference Cities in 2023 Survey

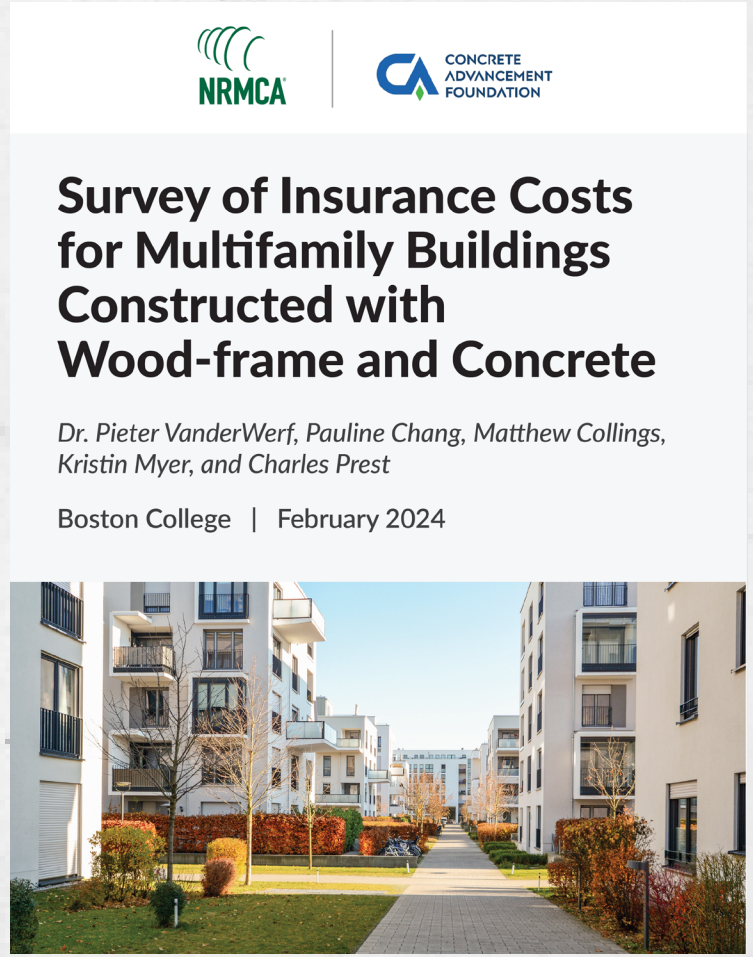
Claims Considerations

- Water
  - When water damage occurs, wood products will absorb water which can lead to wicking, warping, mold, and mildew. Masonry products can absorb water as it is easily dried and will not alter the product nor is it prone to mold or mildew. Generally speaking, water damage can lead to structural damage when using wood products opposed to metal/masonry where structural damage is highly unlikely.
- Wind
  - Although framed construction has improved over time, it is still susceptible to damage from heavy winds or tornadic activity. Masonry buildings resist the pressure and flying debris that can knock down or damage framed buildings.
- Fire
  - Framed buildings are not fire resistive and any substantial fire will damage the structure and its integrity. A masonry building could still incur a fire without jeopardizing the structures integrity.
- Hail
  - Depending on exterior finish and roof materials, framed construction can suffer substantial damage from large hail storms. A masonry building is virtually hail-resistive except to windows and any non-masonry exterior material.

NRMCA Insurance Report

BUILD WITH STRENGTH
A COALITION OF THE NATIONAL READY MIXED CONCRETE ASSOCIATION

- Update of 2017 Multifamily Study
  - 100,000 sf, 4-story, 1 and 2 BR
  - 5 locations nationwide
  - Combustible Wood Frame vs. Non-combustible Concrete
- Builders Risk
  - Comparative Savings 36% to 80% less
- Commercial Property Insurance
  - Comparative Savings 4% to 63% less



Available at NRMCA Website

https://www.nrmca.org/association-resources/codes-and-standards/

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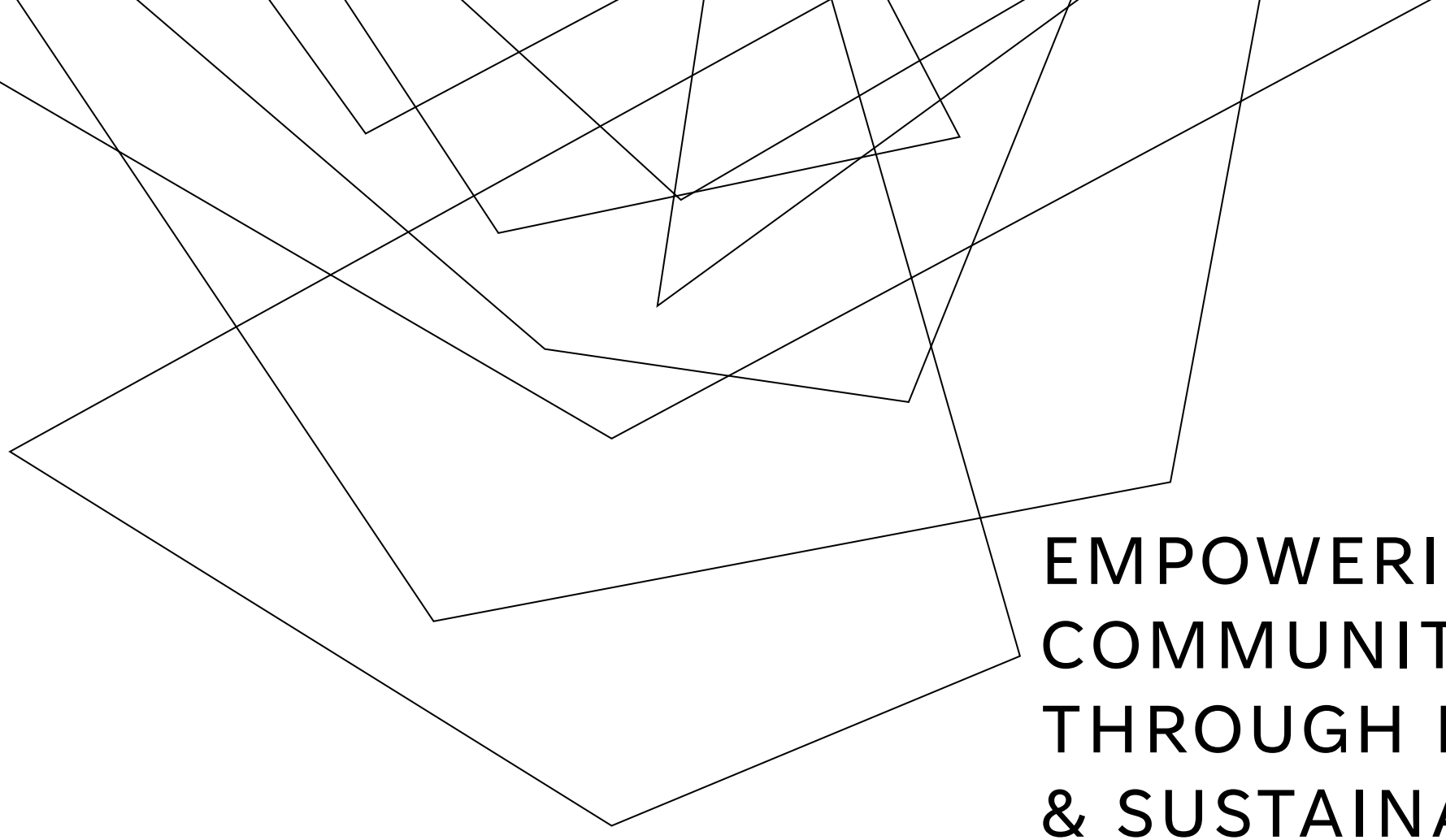
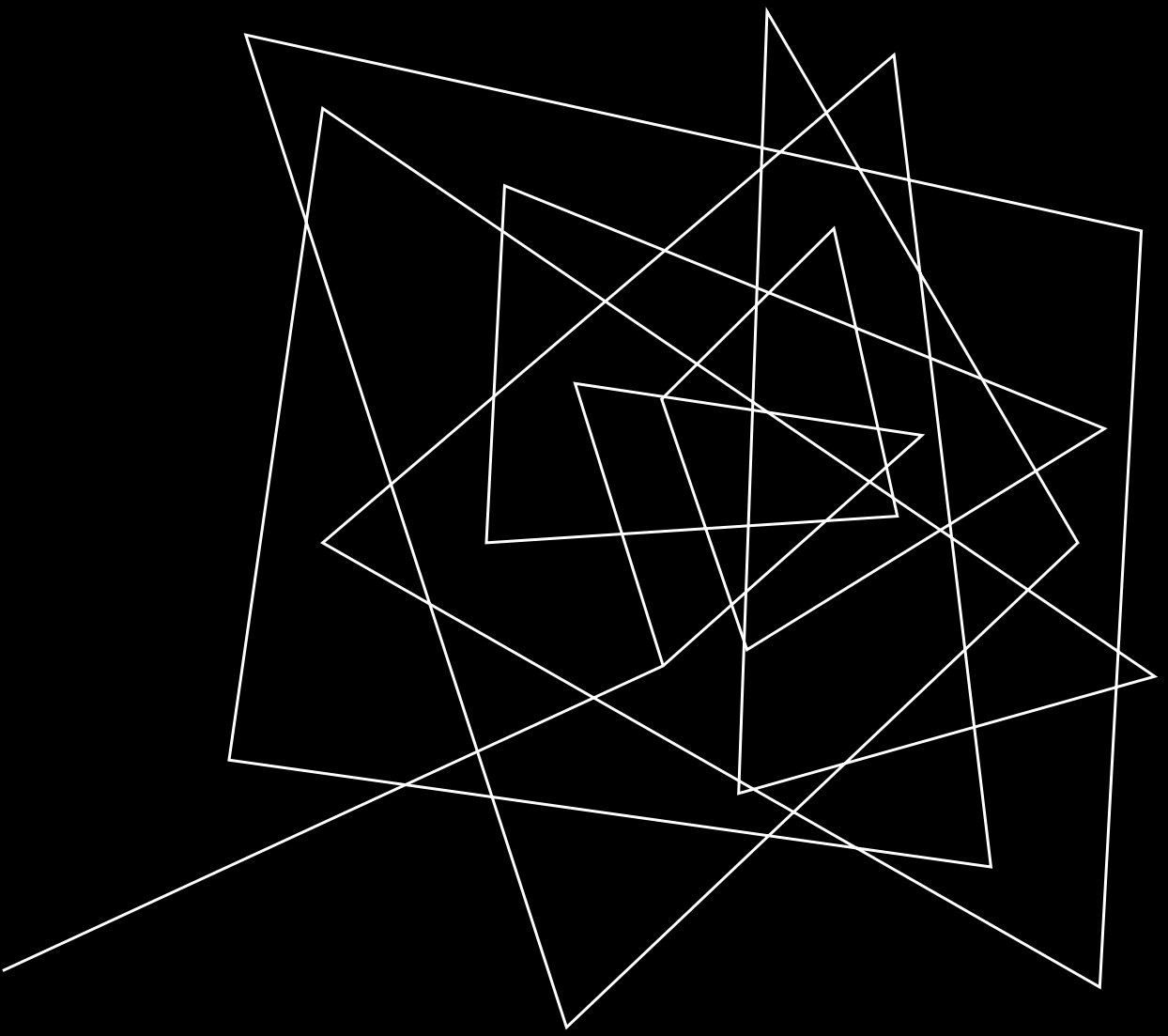


EMPOWERING COMMUNITIES THROUGH RESILIENT & SUSTAINABLE DESIGN

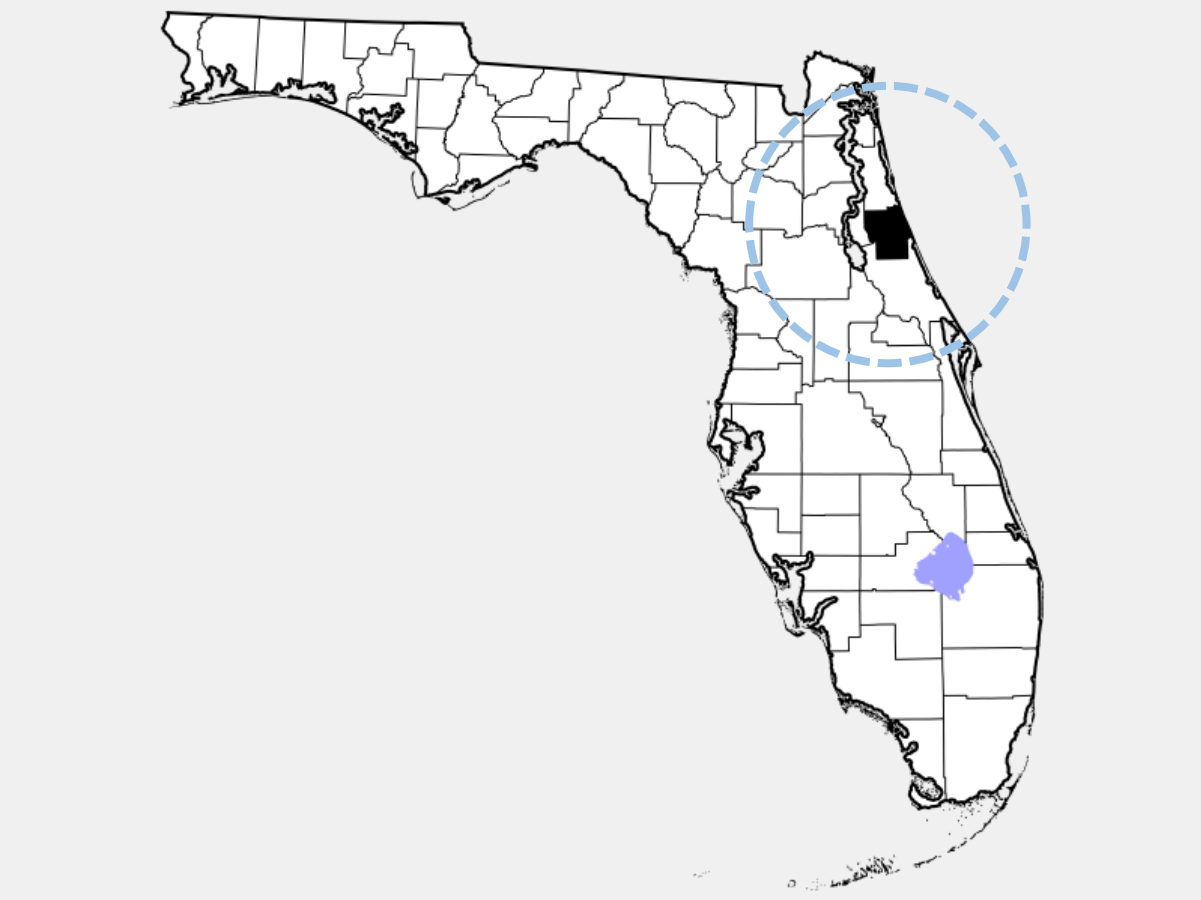
Michael Berg - Clow Berg, Inc.



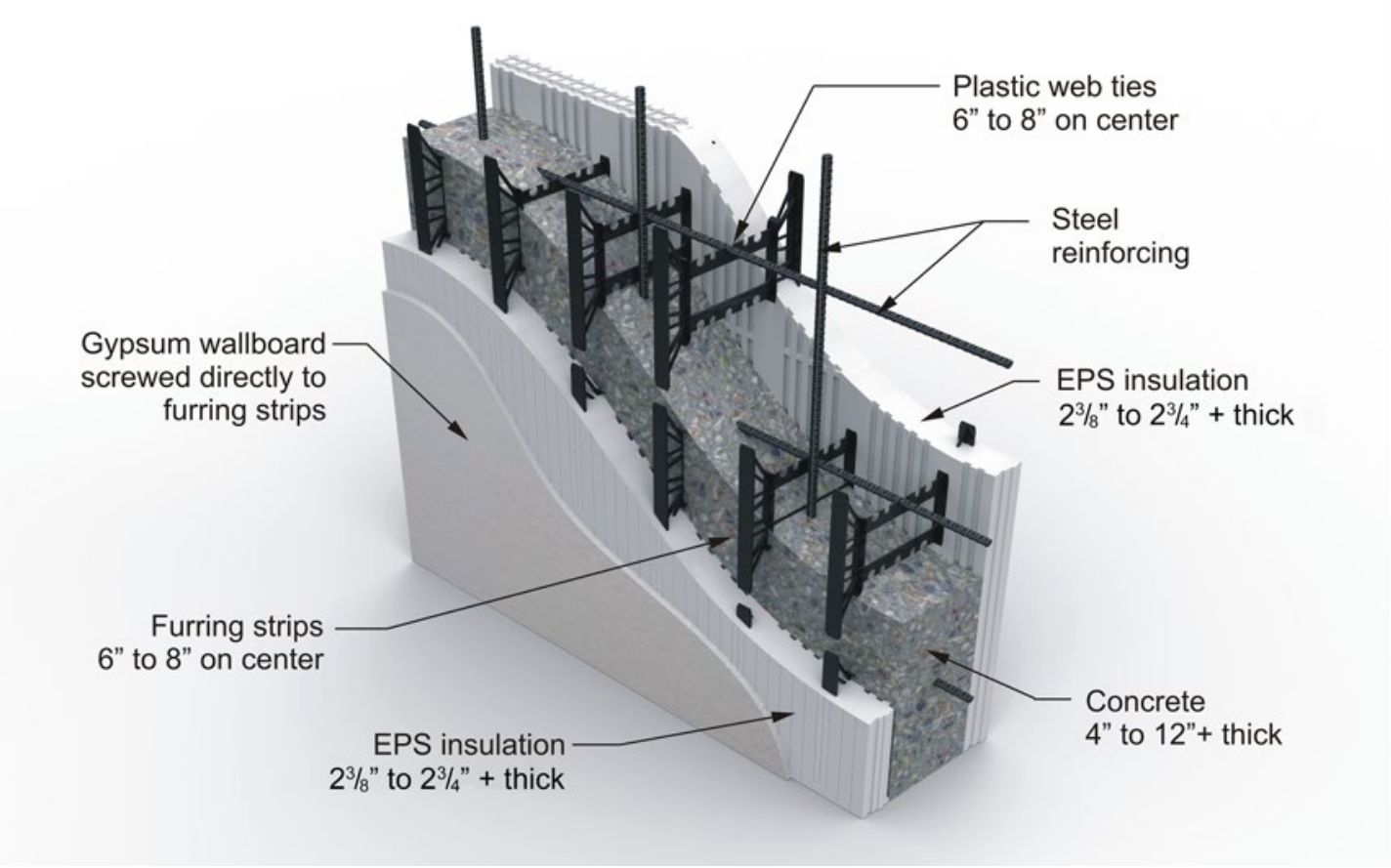
CASE STUDY 1

resiliency

“THE PROMENADE” - PALM COAST, FLORIDA



- Flagler County
- Cat 4 Hurricane Ian 2022



- Energy efficiency
- Acoustical insulation
- Reduces / eliminates mold proliferation
- Compatible with seismic or hurricane/storm standards
- 4 hr - fire protection
- Significant insurance discounts

2024 ICF Industry Comparison Chart

ICF BUILDER

Minnesota Concrete Council — Dedicated to Cast-in-Place Concrete

Manufacturer	Contact Info	Manufacturing Locations	Form Name	Form Specs: Dimensions (inches): Length	Height	Core Sizes	Sq. ft. per cu. yd. (6" core)	Wall Type (S)creen (W)affle (F)lat MPB (Modified Post & Beam)	Ties: (P)anel (B)lock (H)inge	(P)lastic (S)teel (E)PS	Spacing (inches)	Performance Data: Fire Rating (Hours)	Sound Attenuation	Sidewall Thickness
Amvic	(877) 470-9991 www.amvicsystem.com	MO, UT, AB, ON, INT'L	Amvic ICF R22	48	16	4-12	53	F	B	P	6	3+	50+	2.5
			Amvic ICF R30	48	16	6-8	53	F	B	P	8	3+	50+	3.25
BuildBlock Building Systems **	(866) 222-2575 www.buildblock.com	CA, CO, FL, ID, MA, MD, MO, NC, OH, OC, SD, TX, WI, INT'L	BuildBlock	48	16	4-8	54	F	B	P	6	3-4	54	2.5
			BuildLock	48	16	4-12+	54	F	P	P	6	3-4	54	2.5
			GlobalBlock	48	16	4-6	85	S	B	E/P	12	N/A	58	Varies
Conform Global	(800) 266-3676 www.smartblock.com	ID, UT	Smartblock SF10	40	10	6.5	55.5	S	B	E	10	2	52+	1.8
			Smartblock 12VWF	40	12	4-20+	53	F	P	P	4-6	4	56+	2.13
Fox Blocks **	(877) 369-2562 www.foxblocks.com	AK, AL, AZ, CA, CO, FL, ID, MA, MO, NE, PA, SD, TX, UT, AB, MB, NB, QC	Fox Blocks	48	16	4-12	53	F	B	P	8	4	54	2.63
			Fox Blocks Compact	48	16	4-30	53	F	P	P	8	4	54	2.63
HercuTech	(800) 289-3139 www.hercutech.com	AZ	HercuWall	48	168	3	250	MPB	B	E	8/12	2+	46+	2.5
Hobbs Building Systems	(866) 904-9255 www.hobbsverticalicf.com	AK, AR, AZ, FL, ID, MN, NC, SC, TN, TX, VA, WA, WI, QC	Contour Wall "CW"	16	Any	6	106	MPB	P	P	16		50+	Varies
			Flat Wall "FW"	8	Any	6	61	F	P	P	8	2+	50+	Varies
IntegraSpec ICF	(800) 382-9102 www.integraspec.com	AK, CA, GA, MA, QC, INT'L	IntegraSpec ICF	48	12.25	4-12+	54	F	P	P	8	3-4+	57	2.5
LiteForm Technologies	(800) 551-3313 www.liteform.com	NE, ND, SD, VA	LiteForm ICF	48	16	4-12	53	F	B,H	P	6	4	53	2.5
Logix Insulated Concrete Forms**	(888) 415-6449 www.logixicf.com	CA, KS, MN, TN, BC, AB, MB, ON	Logix Pro	48	16	4-12+	54	F	B	P	8	4+	56	2.75
			Logix Platinum	48	16	4-12+	54	F	B	P	8	4+	56	2.75
			Logix KD	48	16	4-12+	54	F	P,B	P	8	4+	56	2.75
Mikey Block Co.	(520) 623-3023 www.mikeyblock.com	AZ, NM, WI	Mikey Block	48	12	N/A	91	S	B	E	12		55	Varies
Nudura Inc.**	(866) 468-6299 www.nudura.com	AB, GA, QC	Nudura ICF Series	96	18	4-12+	54	F	H, P	P	8	4	52	2.63
			Nudura Plus Series	96	18	4-12+	54	F	H, P	P	8	4	55+	3.63-8.63
Plasti-Fab	(888) 446-5377 www.advantageicf.com	AB, ON	Advantage ICF	48	16.5	6, 8	53	F	B	P	6, 8	3-4	50+	2.63
Polycrete	(800) 570-4313 www.polycreteusa.com	VA, QB, NOR, FR	Polycrete Big Block	96	12,18, 24	5.5-24	56	F	H	S	8	4	54	2.5
			Flex 850	96	12	4-24	56	F	P	S	12	3	54	2.5
Quad-Lock Building Systems**	(888) 711-5625 www.quadlock.com	BC, GA, ON	Quad-Lock (2")	48	12	4-28+	56	F	P	P	12	4	55+	2.25
			Quad-Lock Ultra (3")	48	12	4-28+	56	F	P	P	12	4	55+	3.13
			Quad-Lock Plus (4")	48	12	4-28+	56	F	P	P	12	4	55+	4.25+
ReddiForm	(406) 587-4903 www.reddiform.com	UT, MT	ReddiForm	48	12	6,	80	S	B	E	9.5	2	53	
Reddi-Wall Inc.	(586) 752-9161 www.reddi-wall.com	MI	Reddi-Wall	60	12	6	75	S	P,B	E	10	2	55	2.1
Standard ICF Corp	(800) 424-9255 www.standardicf.net	ME, MN, OH	Standard ICF	48	16	7	56	F	B	P	12	3	50	2.5
Stronghold ICF	(877) 433-1880 www.strongholdicf.com	ID, OH, SD, AB	Stronghold ICF	48	16	4-12	53	F	P,B,H	P	8	4		2.75
Superform Products Ltd.**	(877) 627-3555 www.superformicf.ca	AB	Superform	48	12	4-8	48	F	B	P	6	3-4	55	2.75
TF Forming Systems, Inc.	(800) 360-4634 www.tfsystem.com	WI, MO, CO, GA, IA, NY	ThermoForm	8	ANY	4-24+	56	F	P	P-S	8	3-4	55+	2-6
			TransForm	16	ANY	4-24+	56	F	P	P-S	16	3-4	55+	4-6

Form Name	Building Considerations: Height Adjusters	Interlocking	Reversible	Bricklege	T-Blocks	90° Corners	45° Corner	Radius	Taper Top	End Caps	One-Sided Forming	In-Core Foam Inserts	Code Approvals: ICC-ES	CCMC	Wisconsin	Florida	Miami-Dade	City of Los Angeles	Support: CAD Details	BIM Library	Engineering Support	Training	Installation Help	Comments
Amvic ICF R22	4	Y	Y	Y	Y	Y	Y	M	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Cost effective, providing excellent performance
Amvic ICF R30	4	Y	Y	Y	M	Y	Y	M	Y				Y	Y	Y	Y	Y	Y						High performance ICF
BuildBlock	M	Y	Y	Y	M	Y	Y	Y&M	Y		Y	1-4+	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Fully reversible forms with full height furring, one-sided forms, and 4-12" + core widths available Radius forms in 2', 4', 8', 12', 16', 20' arc BuildBlock tested for hurricane performance TAS 201,202,203
BuildLock	M	Y	Y	Y	M	Y	Y	Y&M	Y		Y	1-4+	Y	Y	Y	Y	Y	Y						
GlobalBlock	M	Y	Y		M	Y	M		M	Y			Y											
Smartblock SF10		Y		Y	M	M	M	M	M	Y			Y									Y	Y	Allows interlocking different thicknesses at corners
Smartblock 12VWF		Y		Y	M	M	M	Y	M	Y			Y											
Fox Blocks	4	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	‡	Y	Y	Y	Y	Y	Y	Y	Y	Y	Extended corners, full height furring strips, reversible interlock
Fox Blocks Compact	4	Y	Y	Y	Y	Y			Y		Y	Y	Y	‡	Y	Y	Y	Y						Field assembled, forms a flat concrete wall. Integrates with the Fox Blocks series. Reveal one-sided removable. 4"-30" core available in 2" increments
HercuWall	Y	Y			Y	Y	Y	Y		Y			‡			Y	Y		Y	Y	Y	Y	Y	Delivered as pre-engineered, panelized kit
Contour Wall "CW"	N/A	N/A	N	Y	Y	Y	Y	Y	Y	M	N	N/A	‡	‡	‡	‡			Y		Y	Y	Y	Engineered by project. Panel height cut to length, knock-down system, no specialty ICF bracing needed, increased R value avail.
Flat Wall "FW"	N/A	N/A	Y	Y	Y	Y	Y	Y	Y	M	Y	N/A	‡	‡	‡	‡			Y		Y	Y	Y	
IntegraSpec ICF	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Independent panel system
LiteForm ICF	Y	T&G	N	Y	M	Y	M	M			Y	Y							Y	Y	Y	Y	Y	Continuous furring, compact corner option
Logix Pro	Y	Y		Y	Y	Y	Y	Y	Y	Y		Y	‡	‡	Y	Y	Y	Y	Y	Y	Y	Y	Y	Available in some regions with termite resistant foam
Logix Platinum	Y	Y		Y	Y	Y	Y	Y	Y	Y		Y	‡	‡	Y	Y	Y	Y						Higher insulation. Integrates with Logix Pro
Logix KD	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	‡	‡	Y	Y	Y	Y						Knockdown Line, Integrates with Logix Pro and Platinum
Mikey Block						Y	Y									Y						Y	Y	Cores are 5.5 inches 12" O.C.
Nudura ICF Series	3,12	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	‡	Y	Y	Y	Y	Y	Y	Y	Y	Y	Widest variety of block shapes, sizes and accessories
Nudura Plus Series	3,12	Y	Y	Y	M	Y	Y	M	Y	Y	Y	Y	Y	‡	Y	Y	Y	Y						Achieve higher R-Values
Advantage ICF	7.5	Y		Y	Y	Y	Y		Y		Y	Y	‡	Y					Y		Y	Y	Y	Continuous concrete bricklege
Polycrete Big Block	Y	Ship-lap		Y	M	M	M	M	Y	Y	Y	Y	Y	Y	Y				Y		Y	Y	Y	Complete factory pre-cut kits Variable height split blocks
Flex 850		T&G		Y	M	M	M	M	M	Y	Y	Y	Y	Y	Y									
Quad-Lock (2")	M	Y		Y	M	Y	Y	M	M	M		Y	Y	‡		Y	Y	Y	Y	Y	Y	Y	Y	ISO 9001 & 14001 certified Strong R-28 ICF Full height furring strips optional
Quad-Lock Ultra (3")	M	Y			M	Y	Y	M	M	M		Y	Y	‡		Y	Y							
Quad-Lock Plus (4")	M	Y		Y	M	Y	Y	M	M	M		Y	Y	‡		Y	Y	Y						
ReddiForm	M	Y	Y	M	M	Y	M	M					‡						Y		Y	Y	Y	Continuous horizontal attachment/online estimates
Reddi-Wall		Y	Y	Y	M	Y	Y	M	M	Y					Y	Y						Y	Y	
Standard ICF	M	T&G			M	Y	Y	M	M													Y	Y	Modified flatwall maximizes efficiency, insulation and durability
Stronghold ICF	4,8,12	Y	Y	Y	Y	Y	Y	M	Y	Y		Y	‡	Y	Y	Y	Y		Y		Y	Y	Y	Continuous fastening flange, webs lock together, long corner blocks
Superform	Y	Y		Y	Y	Y	Y		Y	Y			Y	‡					Y			Y	Y	Virgin polypropylene ties
ThermoForm	N/A	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	‡	P	P			Y	Y		Y	Y	Vertical panels give option of steel or plastic ties. XPS foam option.
TransForm	N/A	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	‡	P	P								

** Member of the ICF Manufacturers Association

Y=Yes N=Blank M=Made T&G= Tongue and Groove
N/A= Not Applicable P=Pending

‡ Manufacturer has alternate certification to equal national standards.

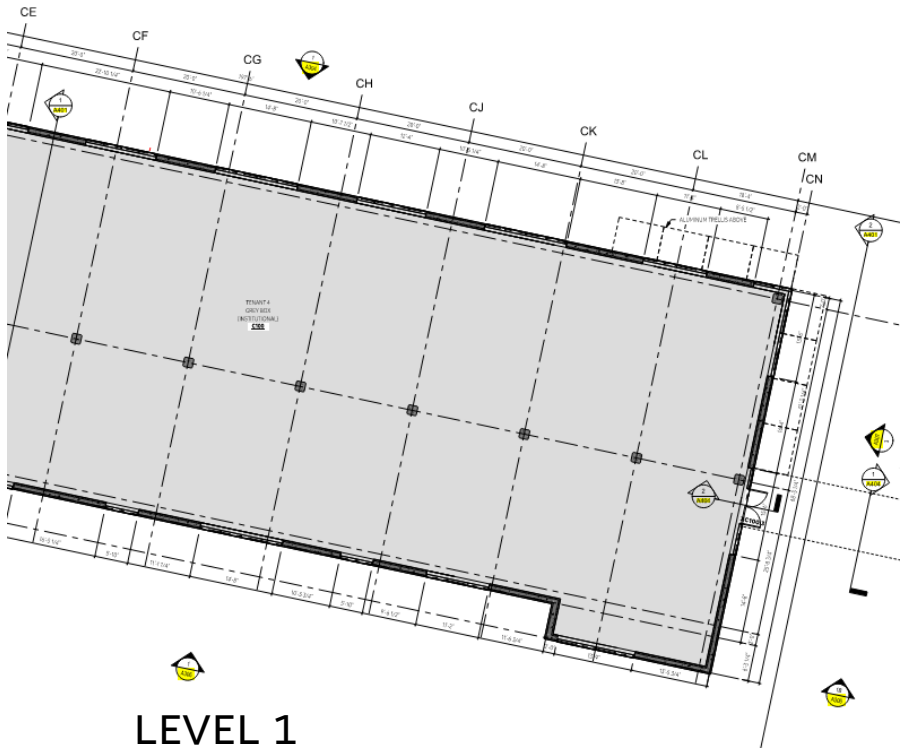
ICF Manufacturers Association Members:

- Nudura
- Fox Blocks
- BuildBlock
- Logix
- Quad-Lock
- Superform
- Amvic
- Integraspec

"THE PROMENADE" - PALM COAST, FLORIDA

- 204 Residential Units on structured levels with amenities throughout
- Podium level with large glazed openings and flexible layout for restaurant / retail / commercial tenant space opportunities
- Non-bearing ICF at unit demising walls
- Precast structured floors levels

“THE PROMENADE” - PALM COAST, FLORIDA



LEVEL 1

LEVEL 2 - 4

"THE PROMENADE" - PALM COAST, FLORIDA

Understanding System Capabilities / Parameters

- Standard details with enhancements
- Bearing wall conditions throughout vs. concrete / steel
- Working with limitations of floor systems (floor spans supporting concrete partitions)

“THE PROMENADE” – PALM COAST, FLORIDA

“THE PROMENADE” - PALM COAST, FLORIDA

ICF System + Finish Materials

- Stucco Systems
- Rain Screen Systems
- Tile Systems

Compatible Products

- (i.e. Nudura + Tremco + Dryvit)

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"THE PROMENADE" - PALM COAST, FLORIDA

Integration of Multiple Structural Systems:

- ICF Bearing Walls w/ punched openings
- ICF beams / Piers
- Cantilevered Aluminum Trellis Systems
- Precast Concrete Floors and Balconies
- Eccentric Corner Columns supporting ICF above

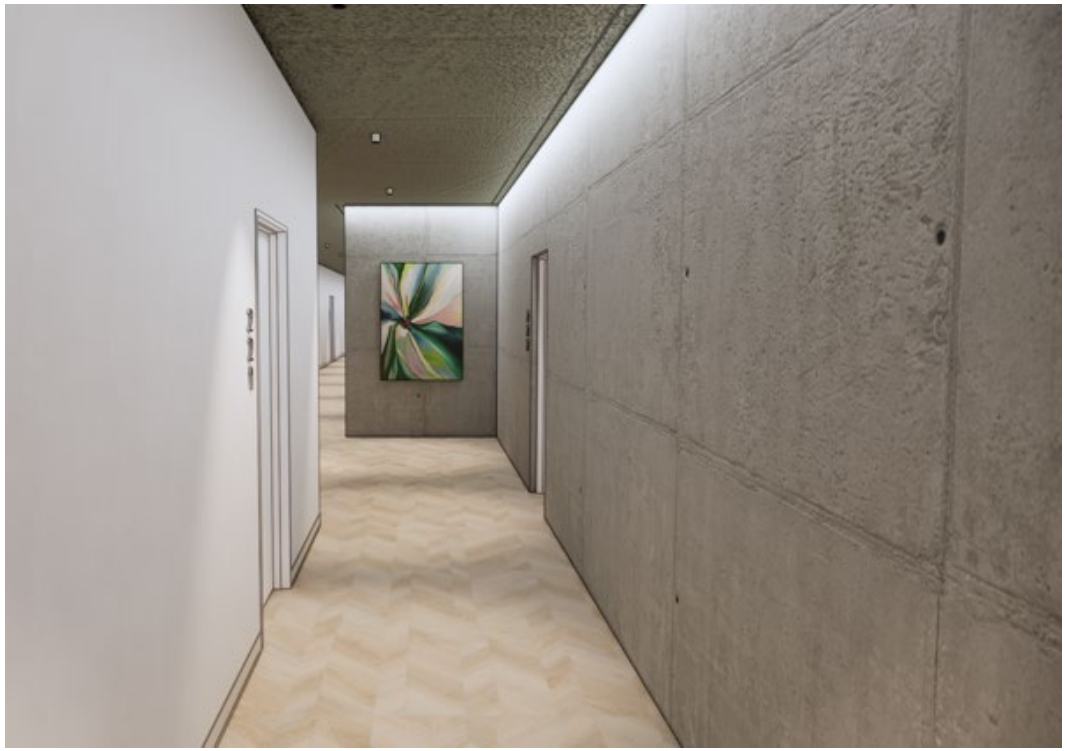
“THE PROMENADE” - PALM COAST, FLORIDA

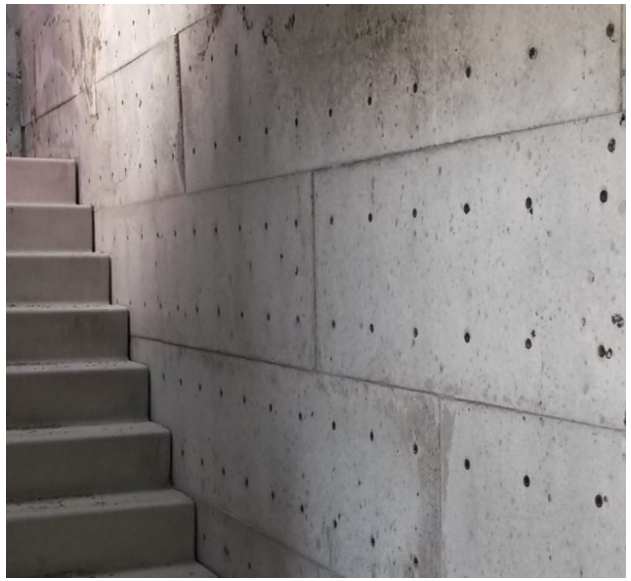
"THE PROMENADE" - PALM COAST, FLORIDA

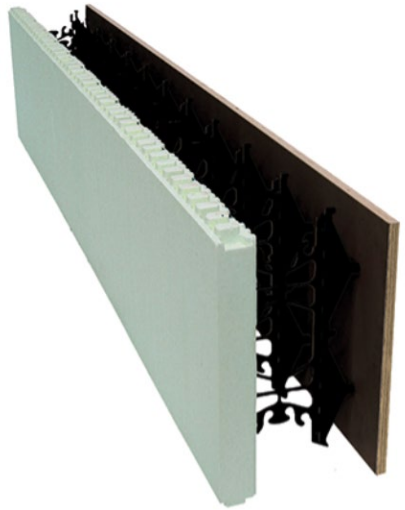
Interior Applications

- Easy Gypsum Board application
- Fire Rated Enclosures (stairs / shafts / fire walls)
- In-wall System Routing

"THE PROMENADE" - PALM COAST, FLORIDA

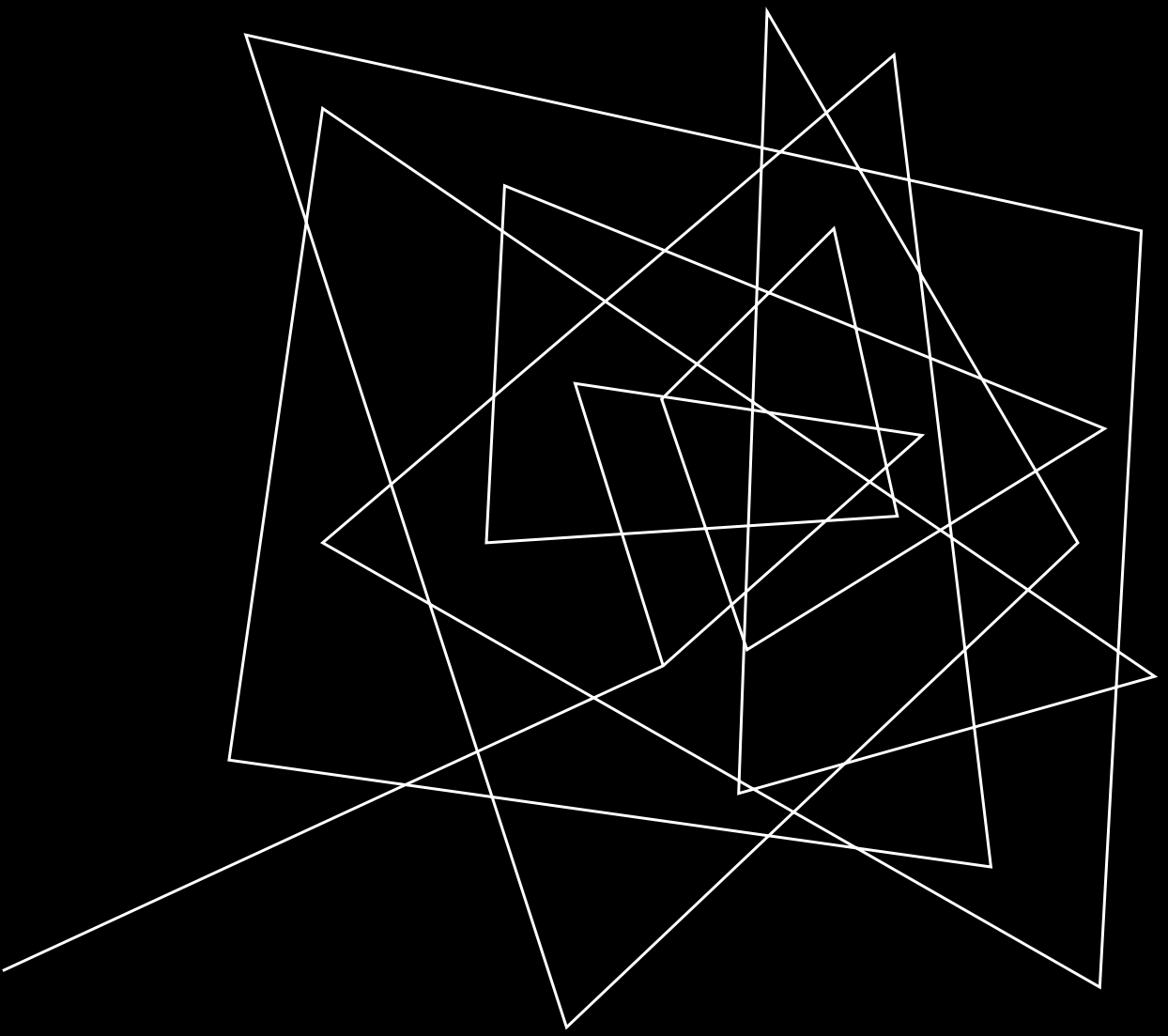






Interior Applications

- Exposed Concrete – one sided forms vs. conventional concrete forming



CASE STUDY 2

durability

SICK PARKING STRUCTURE - BLOOMINGTON, MINNESOTA

- Durability / Maintenance
- Architectural Expression
- Safety / Security
- Flexible
- Operational Cost
- Economical

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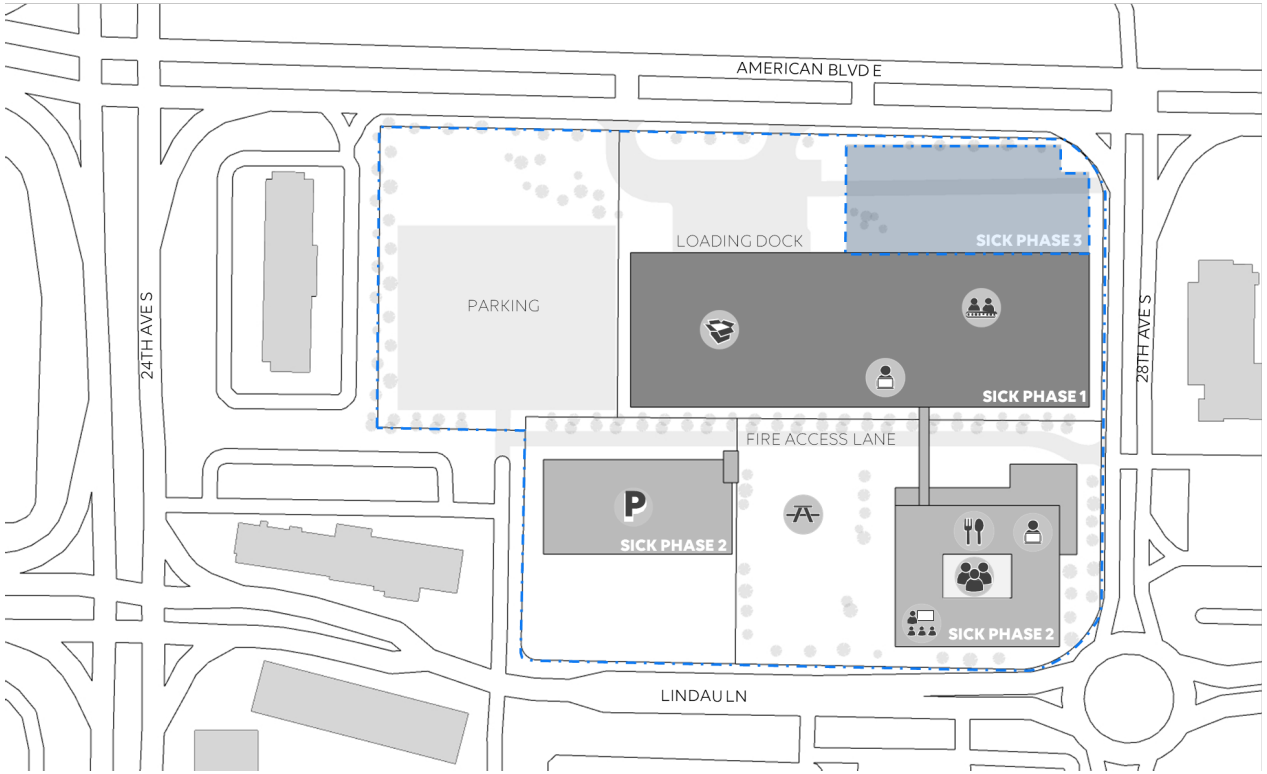
SICK PARKING STRUCTURE - BLOOMINGTON, MINNESOTA

SITE PLAN - PHASE 1, 2, & 3



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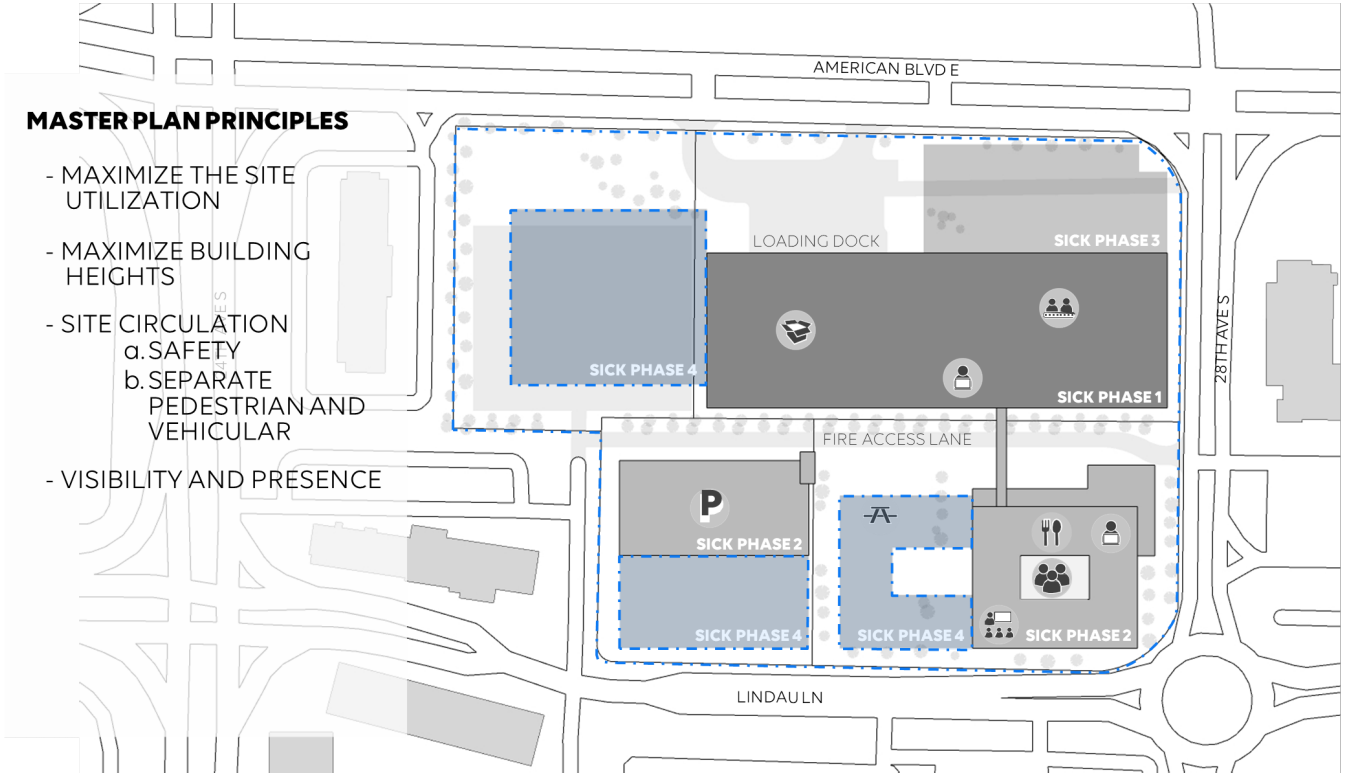
SICK PARKING STRUCTURE - BLOOMINGTON, MINNESOTA

SITE PLAN - PHASE 1, 2, 3 & 4



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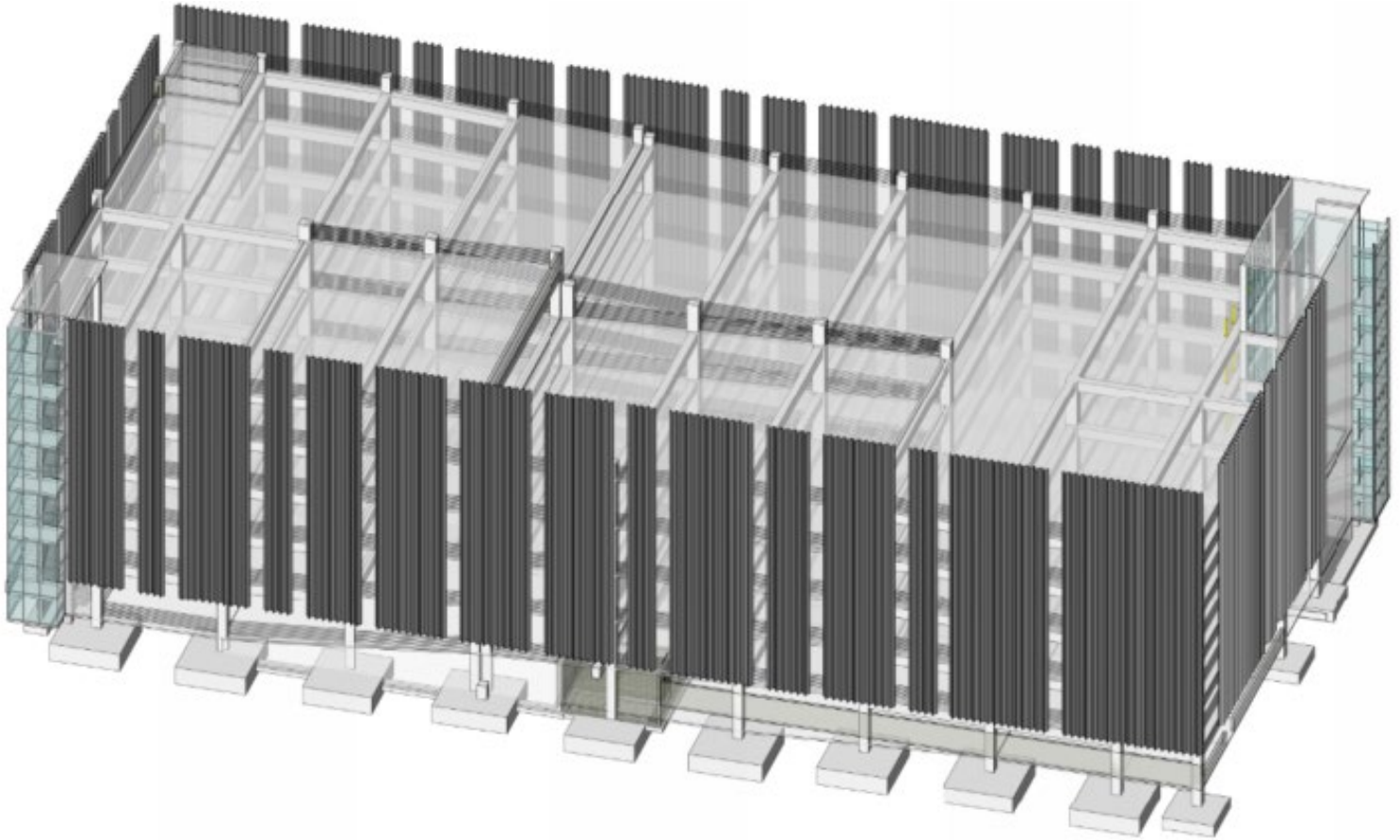
SICK PARKING STRUCTURE – BLOOMINGTON, MINNESOTA



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SICK PARKING - BLOOMINGTON, MINNESOTA

Table of Estimated Maintenance Costs for Precast Parking Deck

REGULAR MAINTENANCE COSTS						
	Cost Ea.	Quantity	Frequency (yrs)	$/yr	$/car/yr	$/sf/yr
Inspections	$ -	1.00	1.00	$ -	$ -	$ -
Cleaning	$ -	1.00	0.50	$ -	$ -	$ -
Lighting	$ -	1.00	1.00	$ -	$ -	$ -
Drainage	$ -	1.00	1.00	$ -	$ -	$ -
Painting	$ -	1.00	1.00	$ -	$ -	$ -
Elevators	$ -	1.00	0.50	$ -	$ -	$ -
Graffiti	$ -	1.00	1.00	$ -	$ -	$ -
Security	$ -	1.00	1.00	$ -	$ -	$ -
Electrical	$ -	1.00	1.00	$ -	$ -	$ -
*Minor Repairs	$ 45,000	1.00	1.00	$ 45,000	$ 80.9353	$ 0.2941
MID TERM REPLACEMENT COSTS						
	Cost Ea.	Quantity	Frequency (yrs)	$/yr	$/car/yr	$/sf/yr
*Joint Sealant	$ 9.00	34320	9.00	$ 34,320	$ 61.7266	$ 0.2243
Waterproof membrane	$ 6.50	8100	4.00	$ 13,163	$ 23.6736	$ 0.0860
Expansion Joints	$ 145.00	1125.00	6.00	$ 27,188	$ 48.8984	$ 0.1777
LONG TERM REPLACEMENT COSTS						
	Cost Ea.	Quantity	Frequency (yrs)	$/yr	$/car/yr	$/sf/yr
Drainage	$ 45,000	1.00	12.00	$ 3,750	$ 6.7446	$ 0.0245
Lighting	$ 25,000	1.00	12.00	$ 2,083	$ 3.7470	$ 0.0136
Security	$ 25,000	1.00	15.00	$ 1,667	$ 2.9976	$ 0.0109
*Structural Repairs (assumess stainless steel flange connectors)	$ 350,000	1.00	12.00	$ 29,167	$ 52.4580	$ 0.1906
Total Annual Maintenance Costs (Today's Value)				**$ 156,337**	**$ 281.18**	**$ 1.0218**
Total Cost of Maintenance assuming 3.0% inflation (at 30 years)						**$ 7,437,782**

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SICK PARKING - BLOOMINGTON, MINNESOTA

Table of Estimated Maintenance Costs for CIP Parking Deck

REGULAR MAINTENANCE COSTS						
	Cost Ea.	Quantity	Frequency (yrs)	$/yr	$/car/yr	$/sf/yr
Inspections	$ -	1.00	1.00	$ -	$ -	$ -
Cleaning	$ -	1.00	0.50	$ -	$ -	$ -
Lighting	$ -	1.00	1.00	$ -	$ -	$ -
Drainage	$ -	1.00	1.00	$ -	$ -	$ -
Painting	$ -	1.00	1.00	$ -	$ -	$ -
Elevators	$ -	1.00	0.50	$ -	$ -	$ -
Graffiti	$ -	1.00	1.00	$ -	$ -	$ -
Security	$ -	1.00	1.00	$ -	$ -	$ -
Electrical	$ -	1.00	1.00	$ -	$ -	$ -
*Minor Repairs	$ 25,000	1.00	1.00	$ 25,000	$ 44.9640	$ 0.1634
MID TERM REPLACEMENT COSTS						
	Cost Ea.	Quantity	Frequency (yrs)	$/yr	$/car/yr	$/sf/yr
*Joint Sealant	$ 12.50	2500	9.00	$ 3,472	$ 6.2450	$ 0.0227
Waterproof membrane	$ 6.50	1500	4.00	$ 2,438	$ 4.3840	$ 0.0159
Expansion Joints	$ 145.00	1125.00	6.00	$ 27,188	$ 48.8984	$ 0.1777
LONG TERM REPLACEMENT COSTS						
	Cost Ea.	Quantity	Frequency (yrs)	$/yr	$/car/yr	$/sf/yr
Drainage	$ -	1.00	25.00	$ -	$ -	$ -
Lighting	$ -	1.00	25.00	$ -	$ -	$ -
Security	$ -	1.00	25.00	$ -	$ -	$ -
*Structural Repairs	$ 250,000	1.00	15.00	$ 16,667	$ 29.9760	$ 0.1089

Total Annual Maintenance Costs (Today's Value)	**$ 74,764**	**$ 134.47**	**$ 0.4887**
Total Cost of Maintenance assuming 3.0% inflation (at 30 years)			**$ 3,556,923**

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SICK PARKING STRUCTURE - BLOOMINGTON, MINNESOTA

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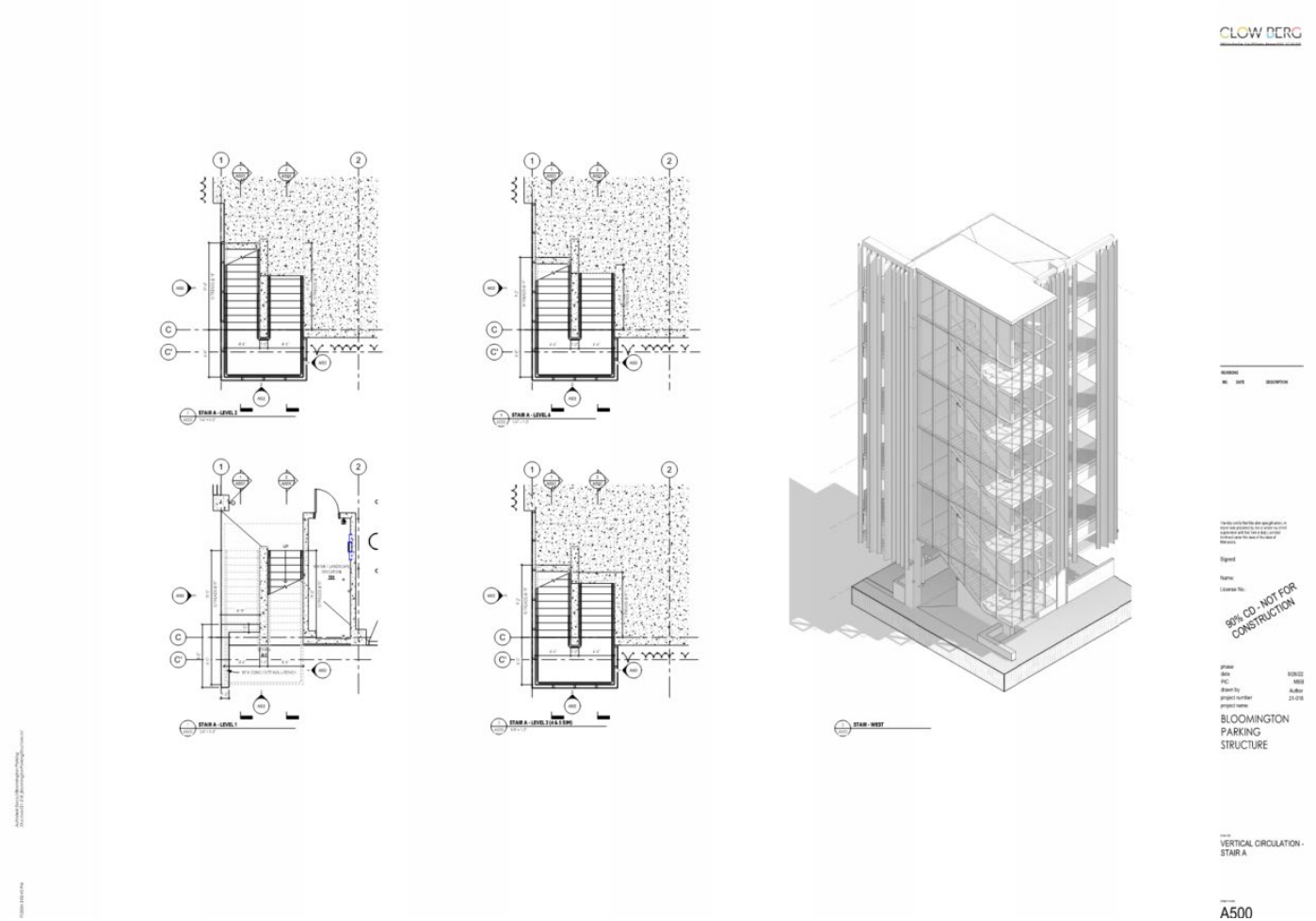

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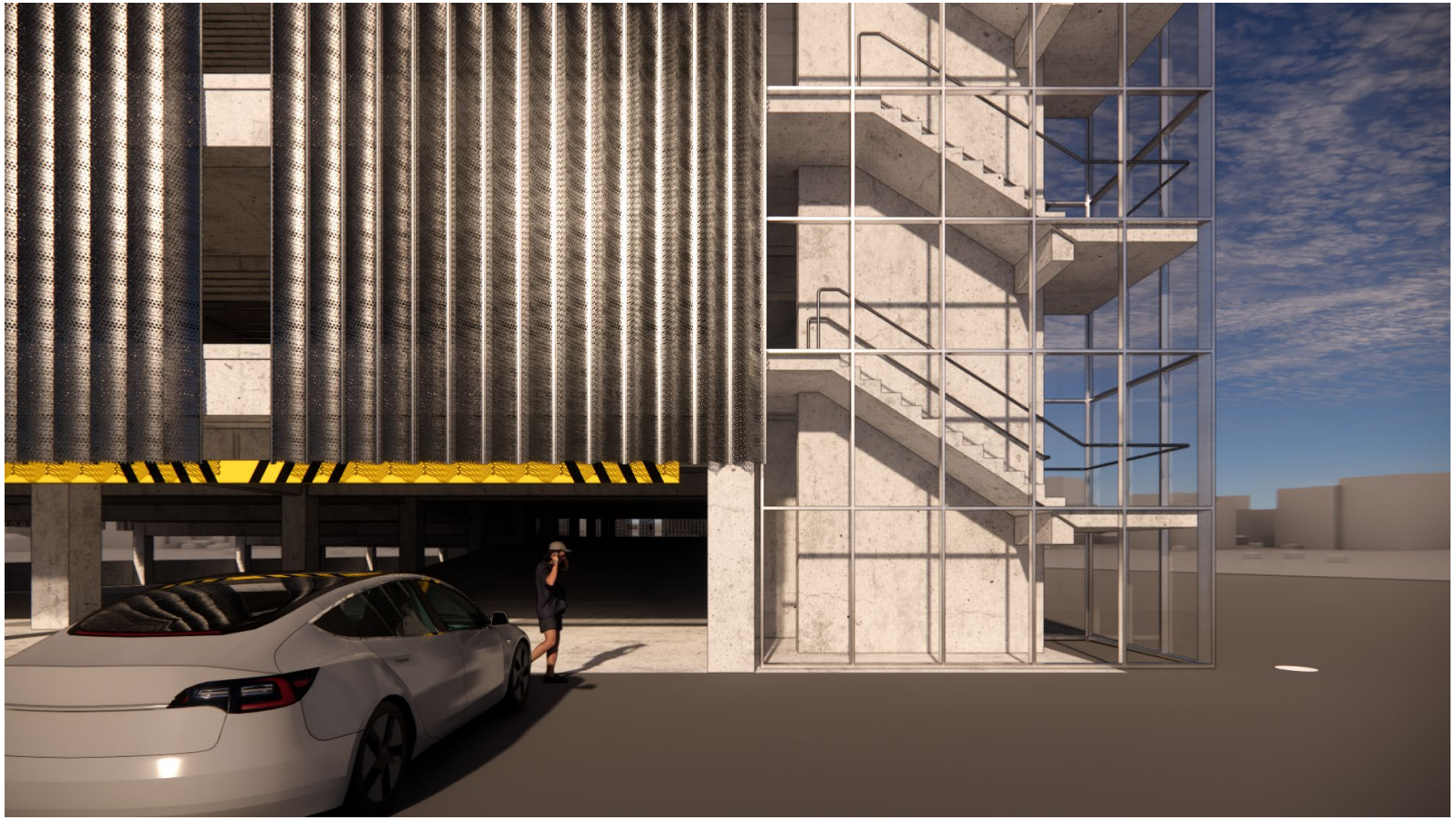
SICK PARKING STRUCTURE - BLOOMINGTON, MINNESOTA



- Architectural Expression
- Design Flexibility

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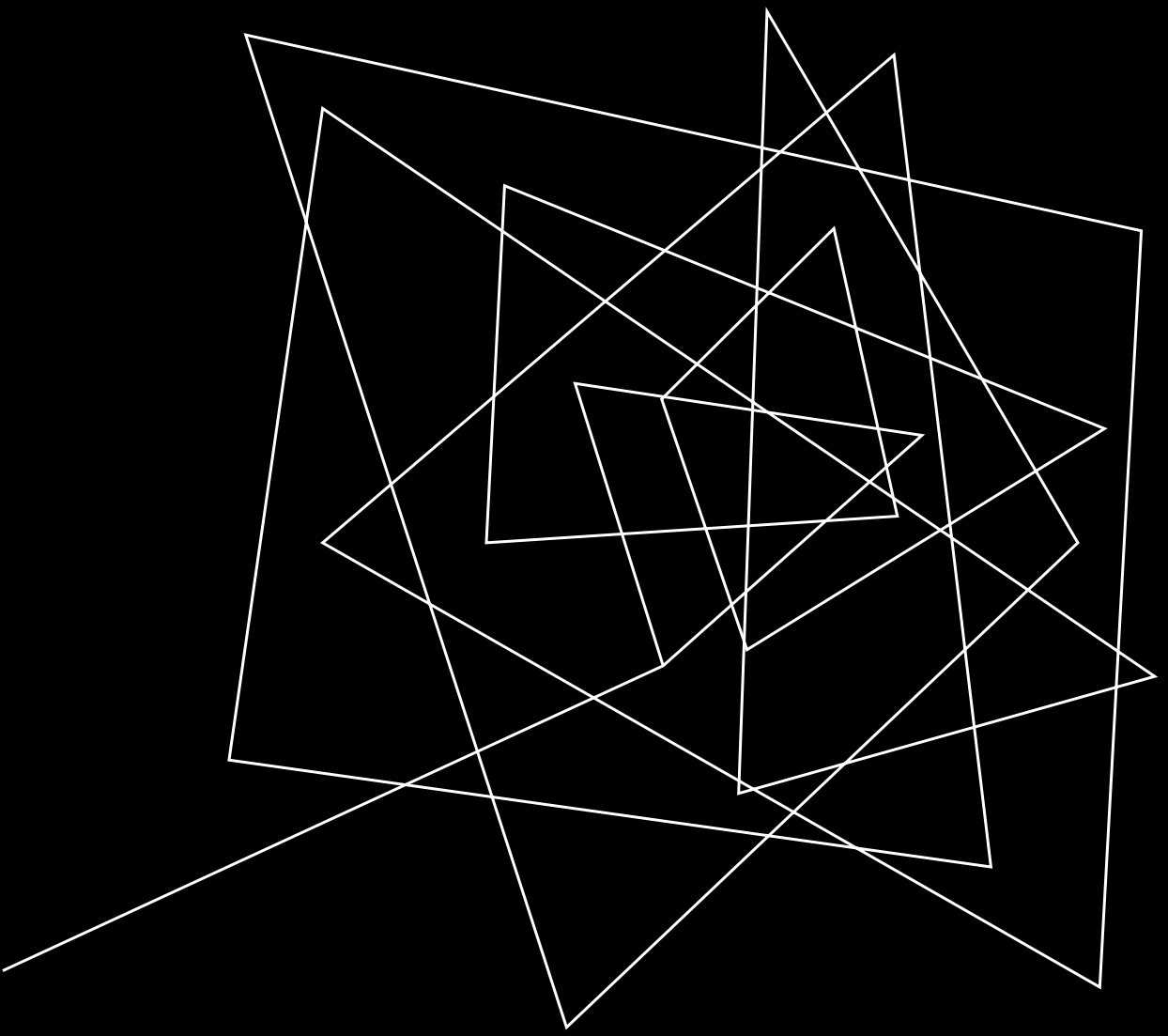
SICK PARKING STRUCTURE - BLOOMINGTON, MINNESOTA

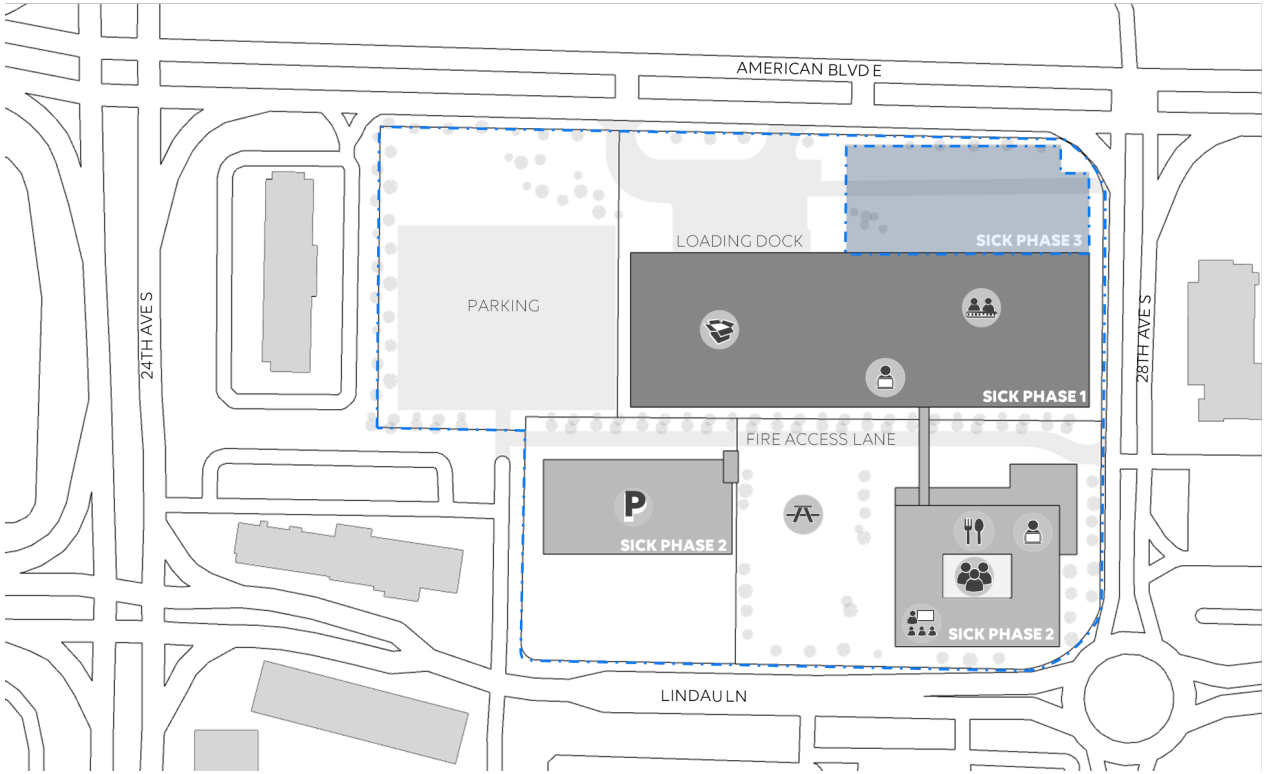


CASE STUDY 3

sustainability

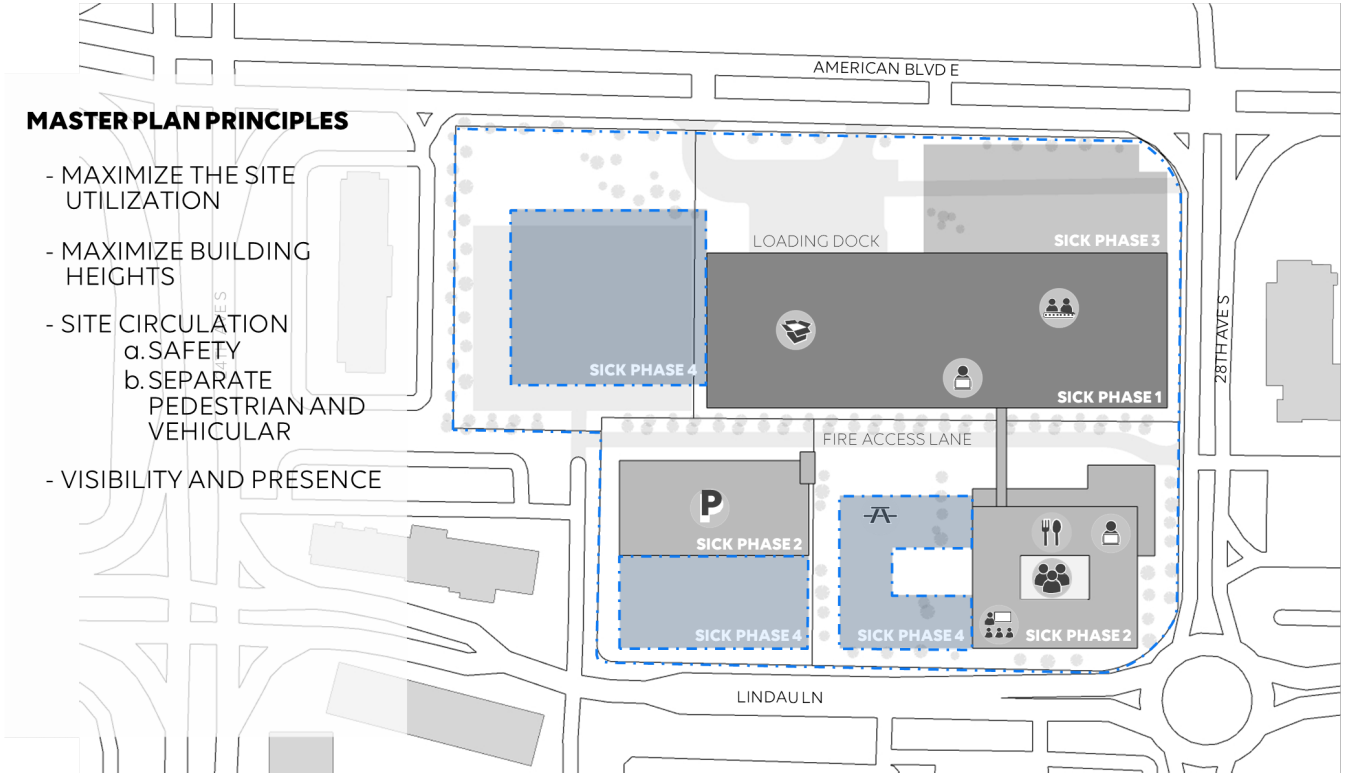
SICK OFFICE / RESOURCE CENTER - BLOOMINGTON, MINNESOTA

SITE PLAN - PHASE 1, 2, & 3



SICK OFFICE / RESOURCE CENTER - BLOOMINGTON, MINNESOTA

SITE PLAN - PHASE 1, 2, 3 & 4



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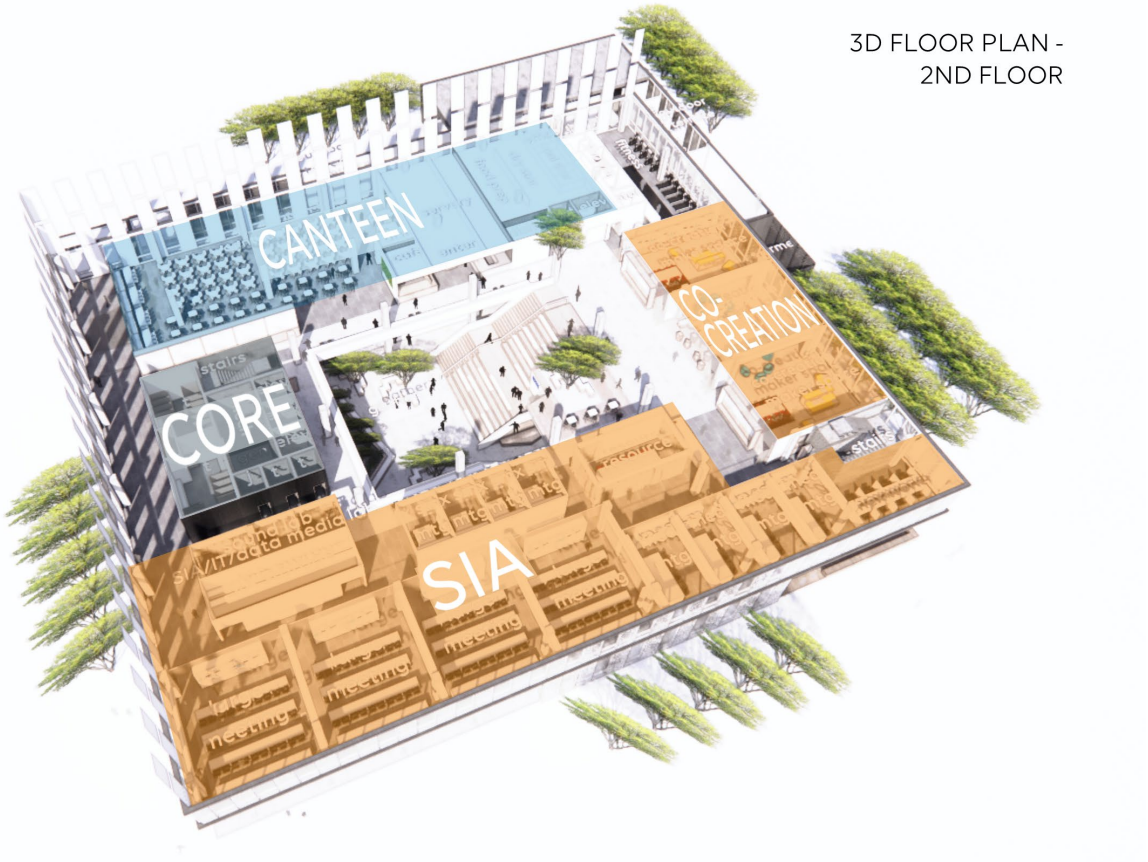
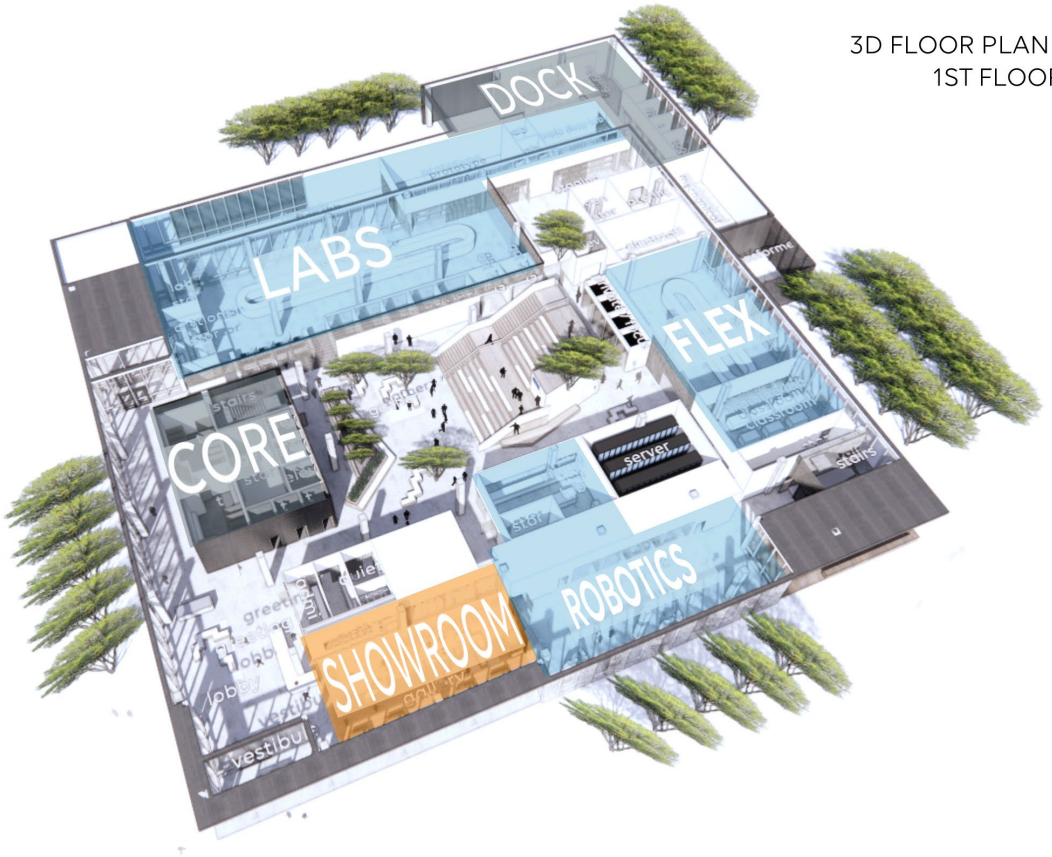


3D FLOOR PLAN -
2ND FLOOR

- Low Carbon Concrete

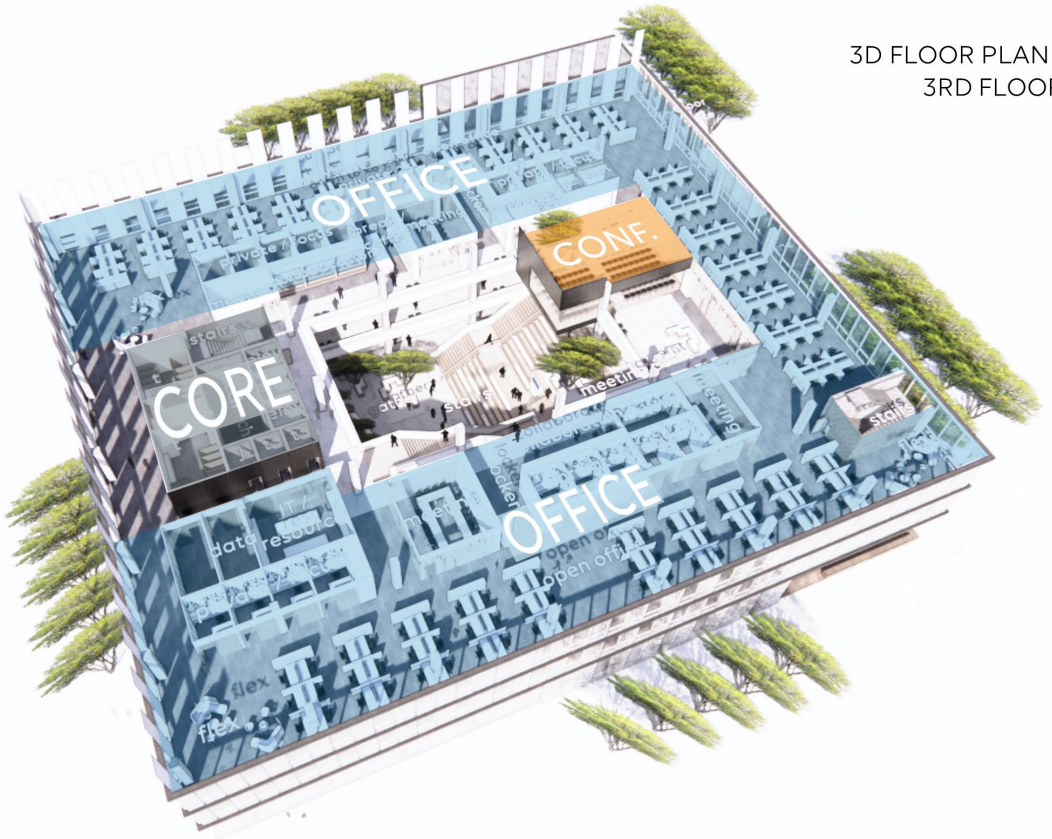
SICK OFFICE / RESOURCE CENTER - BLOOMINGTON, MINNESOTA



3D FLOOR PLAN -
1ST FLOOR

- Low Carbon Concrete
- Net Zero Path
- Geothermal

SICK OFFICE / RESOURCE CENTER - BLOOMINGTON, MINNESOTA



3D FLOOR PLAN -
3RD FLOOR

- Low Carbon Concrete
- Net Zero Path
- Geothermal
- Flexible
- Economical

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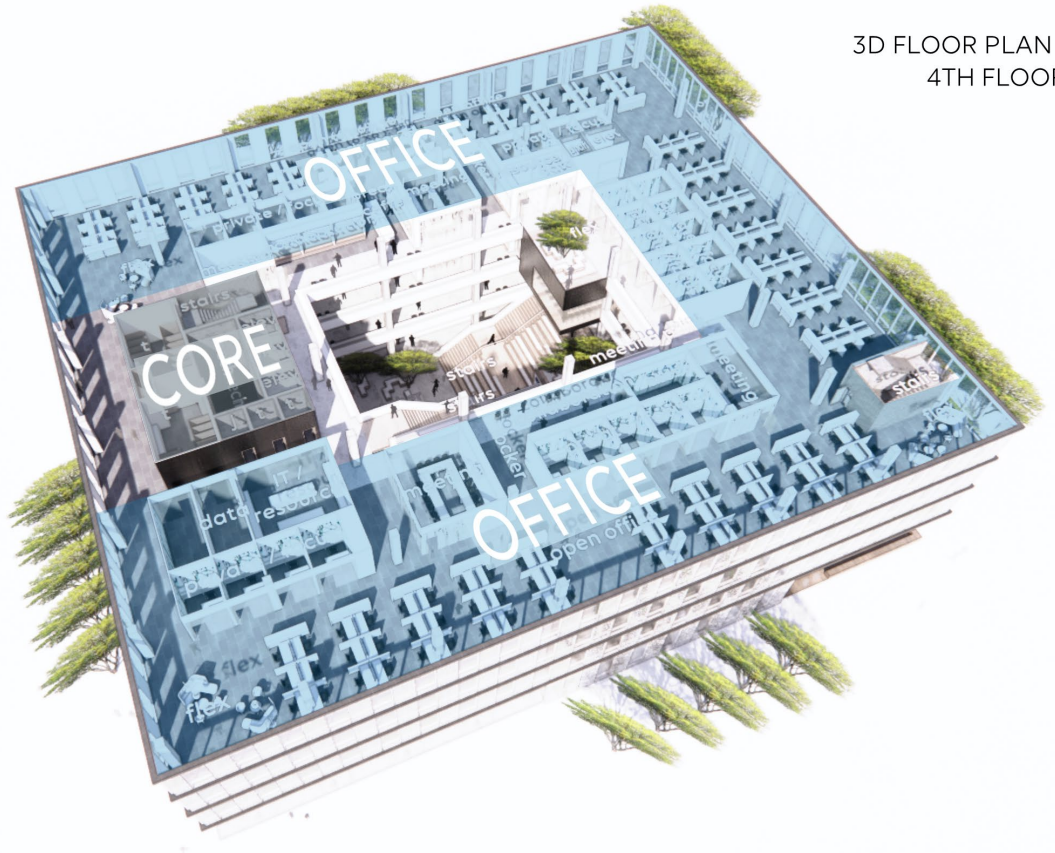

3D FLOOR PLAN -
4TH FLOOR

- Low Carbon Concrete
- Net Zero
- Geothermal
- Flexible
- Economical
- Acoustic
- Aesthetics

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Owner looking for Leadership and Guidance on their Sustainability journey

- No Specific Programs or Targets
- Expressed an interest in Geothermal and Carbon Reduction
- Examine Options, Develop Value Analysis
- Step One: Work with great design partners!

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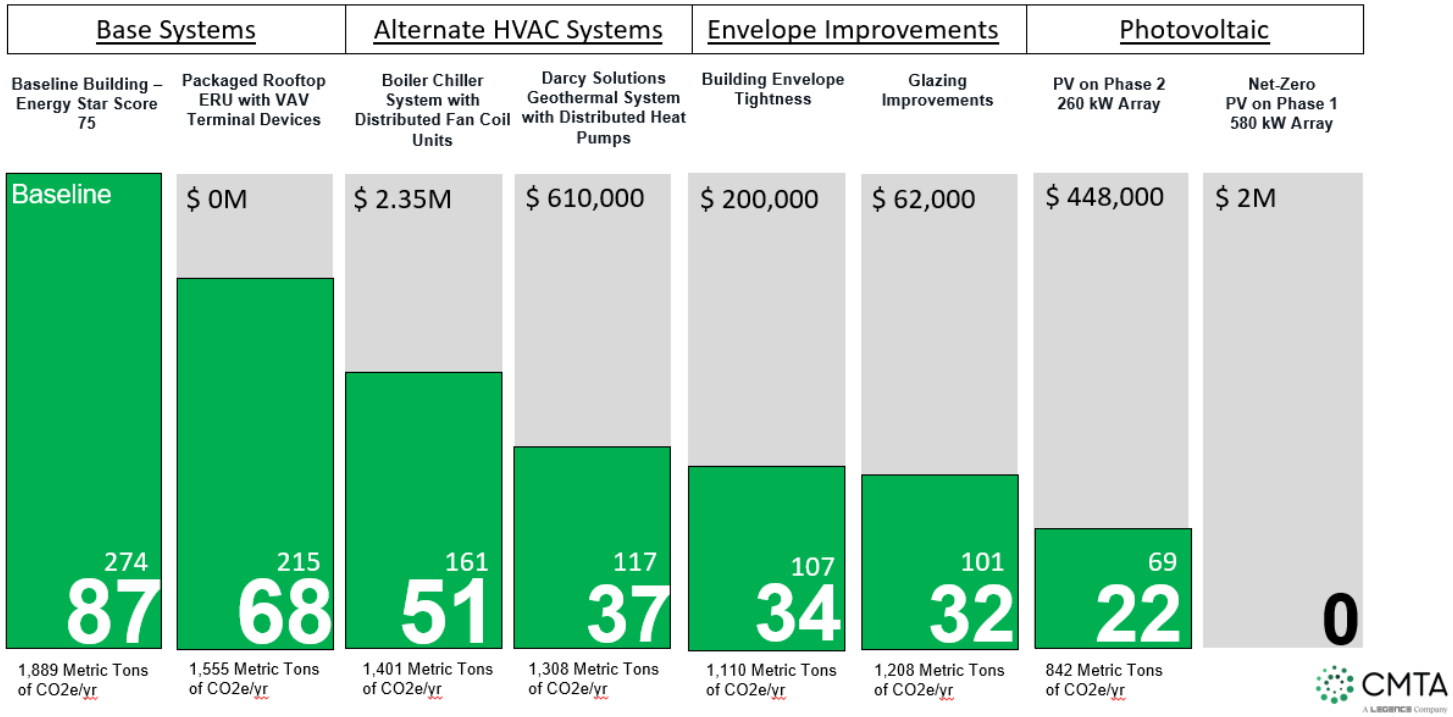
EUI & Carbon Reduction Roadmap



- Owner looking for Guidance on a Path to Net Zero
- No Specific Programs or Targets
- Expressed an interest in Net Zero, Geothermal and Carbon Reduction

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Concrete Mix Design Collaboration

- Owner looking for Guidance in Carbon Reduction
- No Specific Programs or Targets
- Budget Conscious

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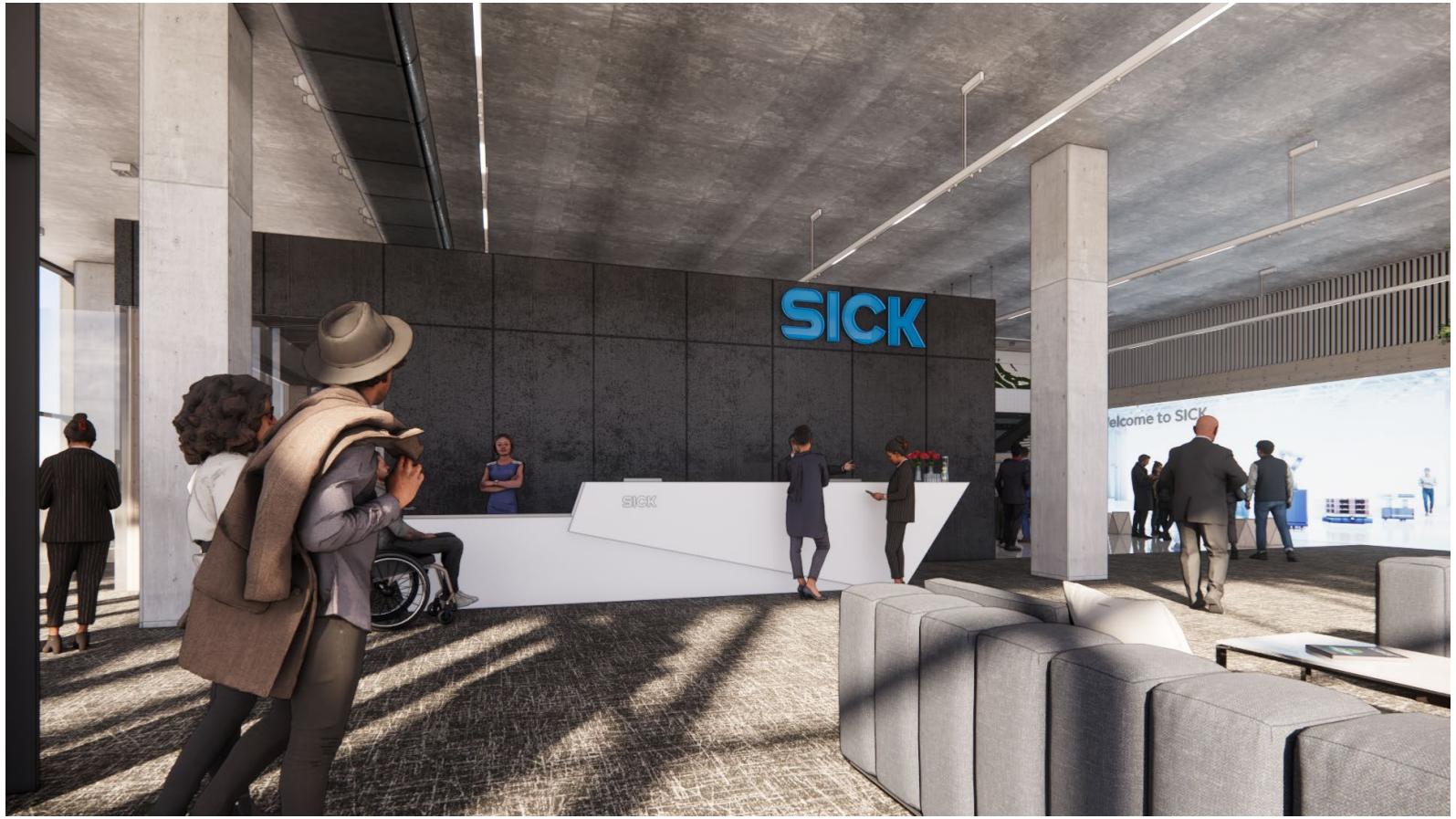

Low Carbon Concrete Mix Design Collaboration Goals:

- Workability
- Cost
- Construction Scheduling
- Strength
- System Requirements (PT vs. SOG)
- Finish Quality
- Market Partners

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Low-Carbon Concrete Symposium Collaborators:

- General Contractor (Ancoats)
- Concrete Contractor (Northland)
- Concrete Ready-Mix Supplier (AVR)
- Structural Engineers (Thornton-Tomasetti / MBJ)
- Civil Engineer (Kimley Horn)
- Architect (Clow Berg)

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Parking Garage

	Yards	GSA Mix Limits	NRMCA Average EPD	Conventional Mix	CO_2 Eq.	LCC Mix	CO_2 Eq.	Best No Cost Option	CO_2 Eq.
4000 psi GRADE BEAM AND FOOTING	98	266	251	R2001	179	R5446	105	R5446	105
4000 psi PADS	813	266	251	R2001	179	R5446	105	R5446	105
4000 psi SOG	509	266	251	R2028	257	R2203	173	R2028	257
6000 psi COLUMNS	430	420	293	R4066	253	R2215	169	R4066	253
6000 psi WALLS	663	420	293	R4066	253	R2215	169	R4066	253
6000 psi CONCRETE BEAMS	1441	420	293	R4066	253	R2218	172	R4066	253
6000 psi P.T. OR STRUCTURAL SLABS	3666	420	293	R4066	253	R2218	172	R4066	253
TOPPING	0			R5215	264	R5215	202		
4500 psi EXTERIOR CONCRETE	3	296	279	R2028	257	R2018	178	R2018	178
	7,622	2,982,608	2,173,857		1,863,253.00		1,247,367.00		1,795,602.00
SAVINGS VS. GSA			808,751		1,119,355		1,735,241		1,187,006
% REDUCTION VS. GSA			27.1		37.5		93.1		39.8
SAVINGS VS. NRMCA					310604		926,490		378,255
% REDUCTION VS. NRMCA					14.3		42.6		17.4
SAVINGS VS. CONVENTIONAL							615,886		67,651
% REDUCTION VS. CONVENTIONAL							33.1		3.6

SICK OFFICE / RESOURCE CENTER - BLOOMINGTON,

Office Building

	Yards	GSA Mix Limits	NRMCA Average EPD	Conventional Mix	CO_2 Eq.	LCC Mix	CO_2 Eq.	Best No Cost Option	CO_2 Eq.
5000 psi GRADE BEAM AND FOOTING	124	296	279	R2001	179	R5446	105	R5446	105
5000 psi PADS	604	296	279	R2001	179	R5446	105	R5446	105
5000 psi SOG	1139	296	279	R3039	280	R2203	173	R4057	249
6000 psi COLUMNS	542	420	293	R4065	252	R2215	169	R4065	252
6000 psi WALLS	619	420	293	R4065	252	R2215	169	R4065	252
6000 psi CONCRETE BEAMS	128	420	293	R4065	252	R2218	172	R4065	252
6000 psi P.T. OR STRUCTURAL SLABS	4117	420	293	R4065	252	R2218	172	R4065	252
4000 psi TOPPING	27	266	251	R5202	264	R5215	202	R5202	264
4500 psi EXTERIOR CONCRETE	6	296	279	R2028	257	R2018	178	R2018	178
TOTALS	7307	2,832,110	2,113,302		1,820,214.00		1,206,358.00		1,730,559.00
SAVINGS VS. GSA			718,808		1,011,896		1,625,752		1,101,551
% REDUCTION VS. GSA			25.4		35.7		89.3		38.9
SAVINGS VS. NRMCA					293088		906,944		382,743
% REDUCTION VS. NRMCA					13.9		42.9		18.1
SAVINGS VS. CONVENTIONAL							613,856		89,655
% REDUCTION VS. CONVENTIONAL							33.7		4.9

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THANK YOU

Michael Berg

mberg@clowberg.com

www.clowberg.com

Empowering Communities Through Resilient & Sustainable Design

AIA Approved Continuing Education

3 AIA/HSW Units

BUILD WITH STRENGTH

SYMPOSIUM AGENDA

7:00 - 8:00 AM - Breakfast & Registration

8:00 - 8:45 AM - Topic: Sustainability

8:45 - 9:15 AM - Topic: Insurance

9:15 - 9:45 AM - Topic: Architecture

9:45 - 10:30 AM - Topic: Inflation Reduction Act

10:30 - 10:45 AM - Networking Break

10:45 - 11:30 AM - Q&A Panel Discussion

Optimizing the building envelope is essential to achieving energy efficiency, decarbonization, and sustainability. As is understanding available building options and financial incentives.

PRESENTERS:

- **BRENT WAVRA & STEPHEN WESTERBACK- CMTA**
- **SHAWN FLAVIN, CIC & NATHAN LORTZ - CHRISTENSEN GROUP**
- **MATT GREEN - KB WALKER**
- **MIKE BERG - CLOW BERG**

SPONSORS

Christensen Group Insurance

CMTA A LEGENCE Company

FOX BLOCKS TRUEGRID

NRMCA National Ready Mixed Concrete Association

Nudura Part of Tremco Construction Products Group

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Inflation Reduction Act

It’s Impact on Projects

Agenda

01

Intro +
About CMTA

02

Inflation
Reduction Act

03

Geothermal
Investment Tax Credit

- Previous Policy
- New Policy
- Impact – For-profit/Non-profit

04

Solar Investment
Tax Credit

- Previous Policy
- New Policy
- Impact – For-profit/Non-profit

CMTA
A LEGENCE Company

01

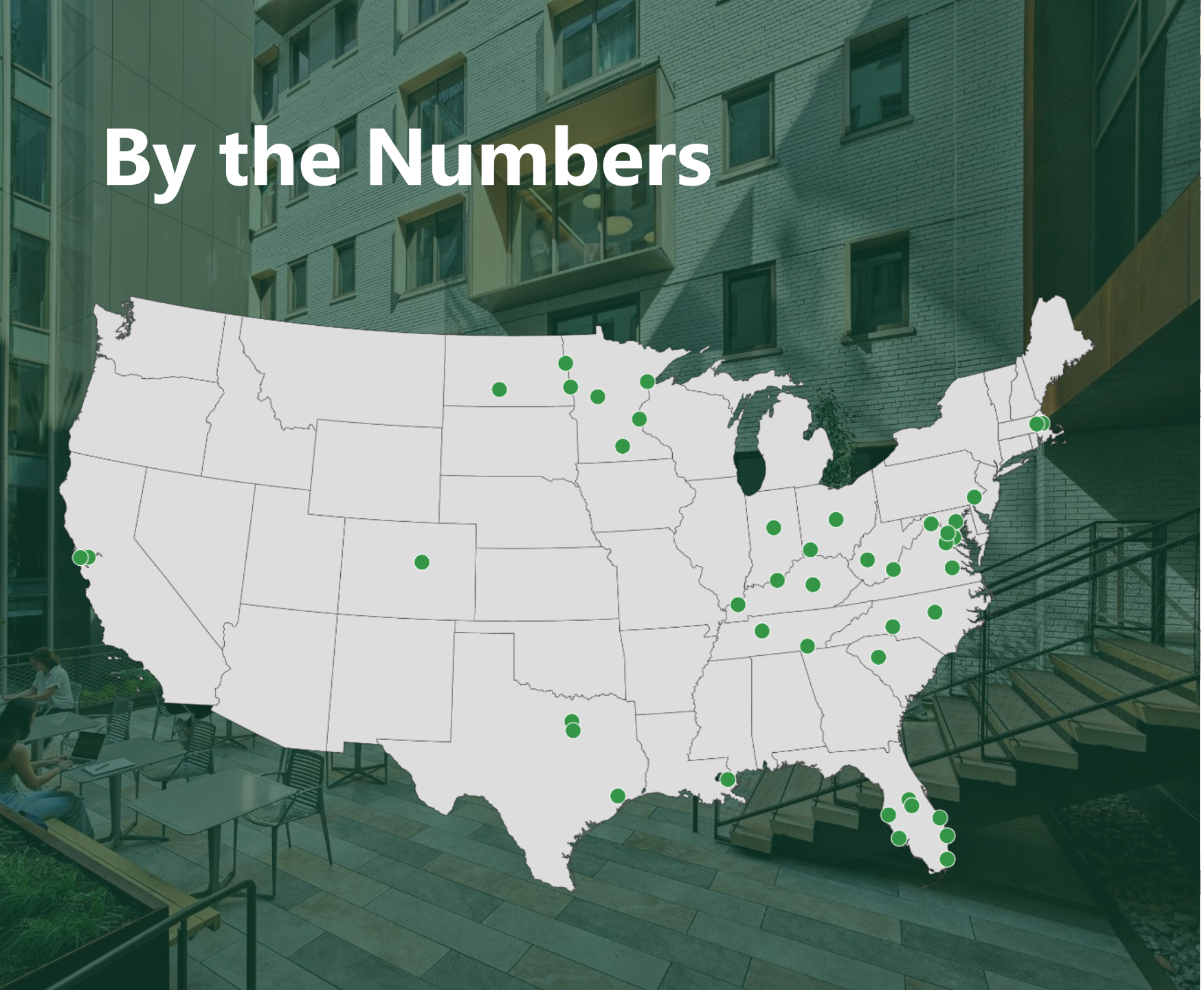
Introduction + About CMTA

Speakers

Brent Wavra, PE, LEED AP
Principal | Mechanical

Stephen Westerback
Building Science Expert

By the Numbers



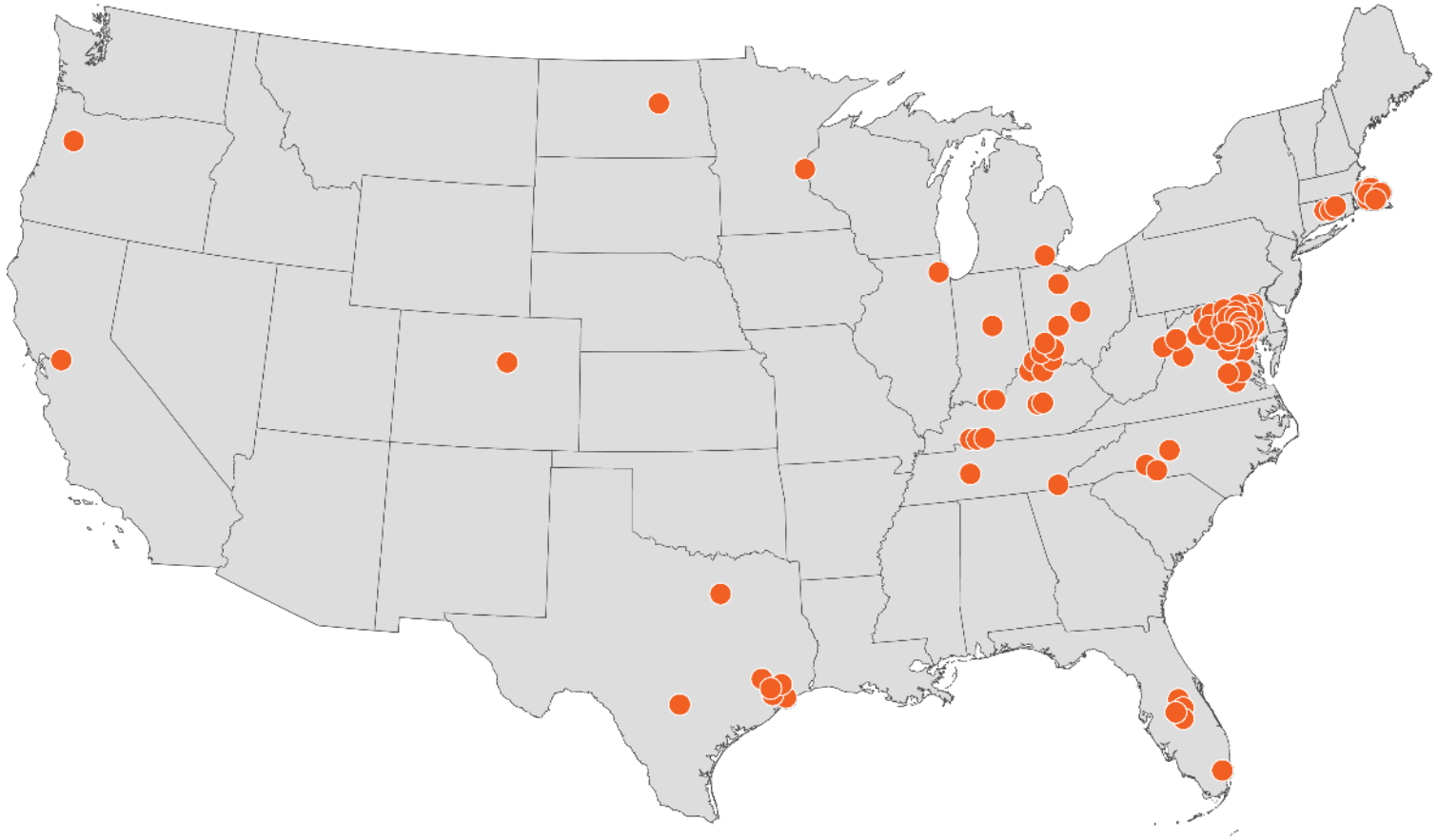
900+
Employees

44
Offices Nationwide

250
Professional Engineers

56
Years of Service

Zero Energy / Zero Carbon



9M SF

Zero Energy Certified Facilities

35M SF

Zero Energy Ready Facilities

5.5M SF

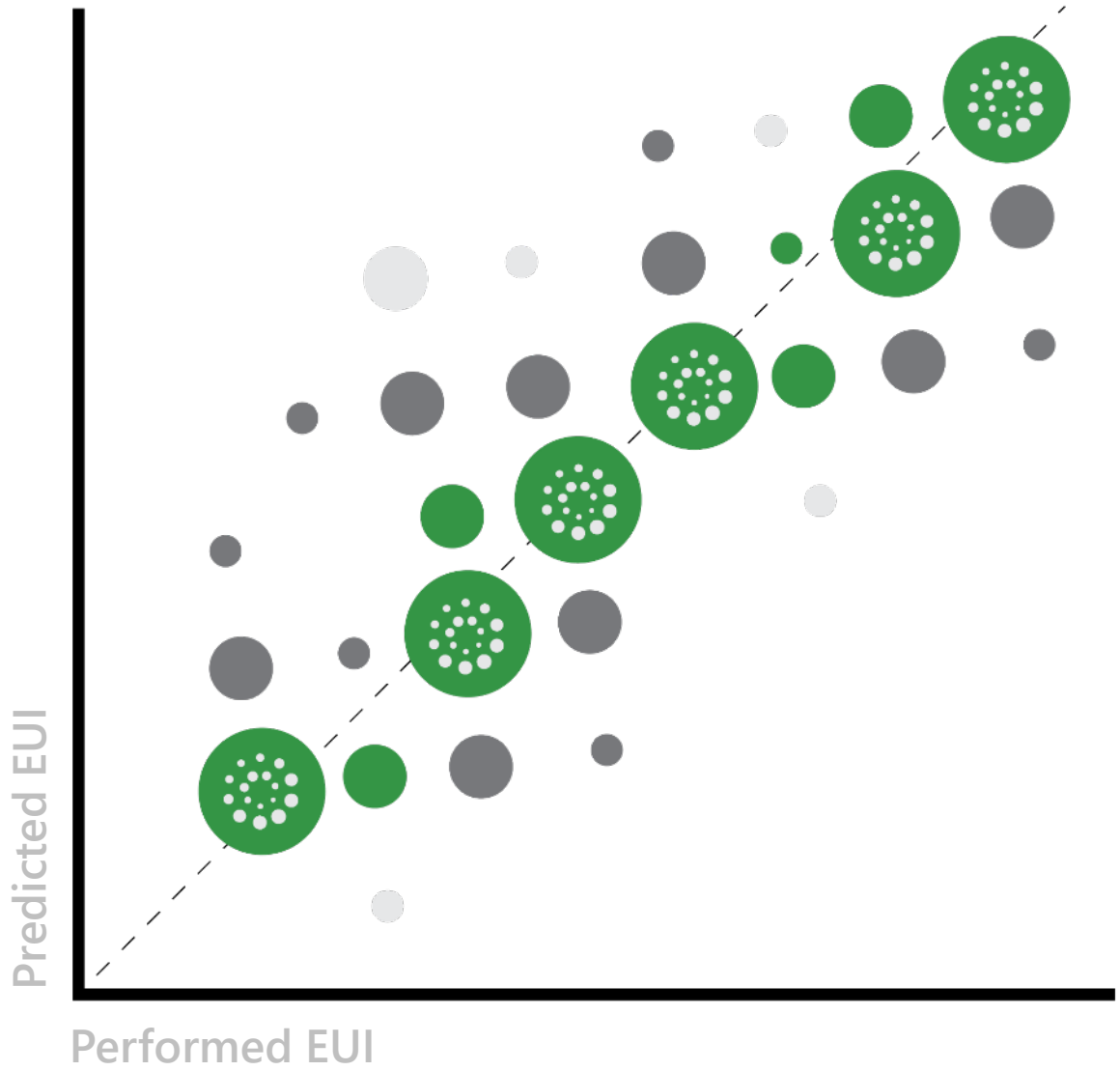
Zero Carbon Facilities

We are

Data Driven

"You cannot manage what you do not measure."

— W. Edwards Deming



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Course Description

The Inflation Reduction Act (IRA) is arguably the most important piece of environmental legislation to pass in this lifetime. It offers over $350+ billion in federal incentives for clean and renewable energy investments, decarbonization, sustainability investments, energy efficiency, and infrastructure upgrades, but the question remains for many owners, *'how does this affect my facility?'*

Many facility owners have been slow to adopt green energy solutions due to cost and energy demand, but the IRA helps to break down these barriers to entry. In this session, we'll break down the IRA so it's easier to digest and apply to many types of projects. We will also discuss how this legislation has been applied to real-life projects.

Learning Objectives

1. Explain new legislation and changes to existing legislation that have occurred in federal energy efficiency programs in the past two years.

2. Demonstrate how these new programs can be leveraged to enhance the life cycle cost analysis of high performance and energy efficient buildings.

3. Identify mechanical and electrical strategies that can be applied to high performance building design that would qualify for these federal programs.

4. Illustrate the benefits to building owners including first cost savings, utility savings, maintenance savings and carbon reduction.

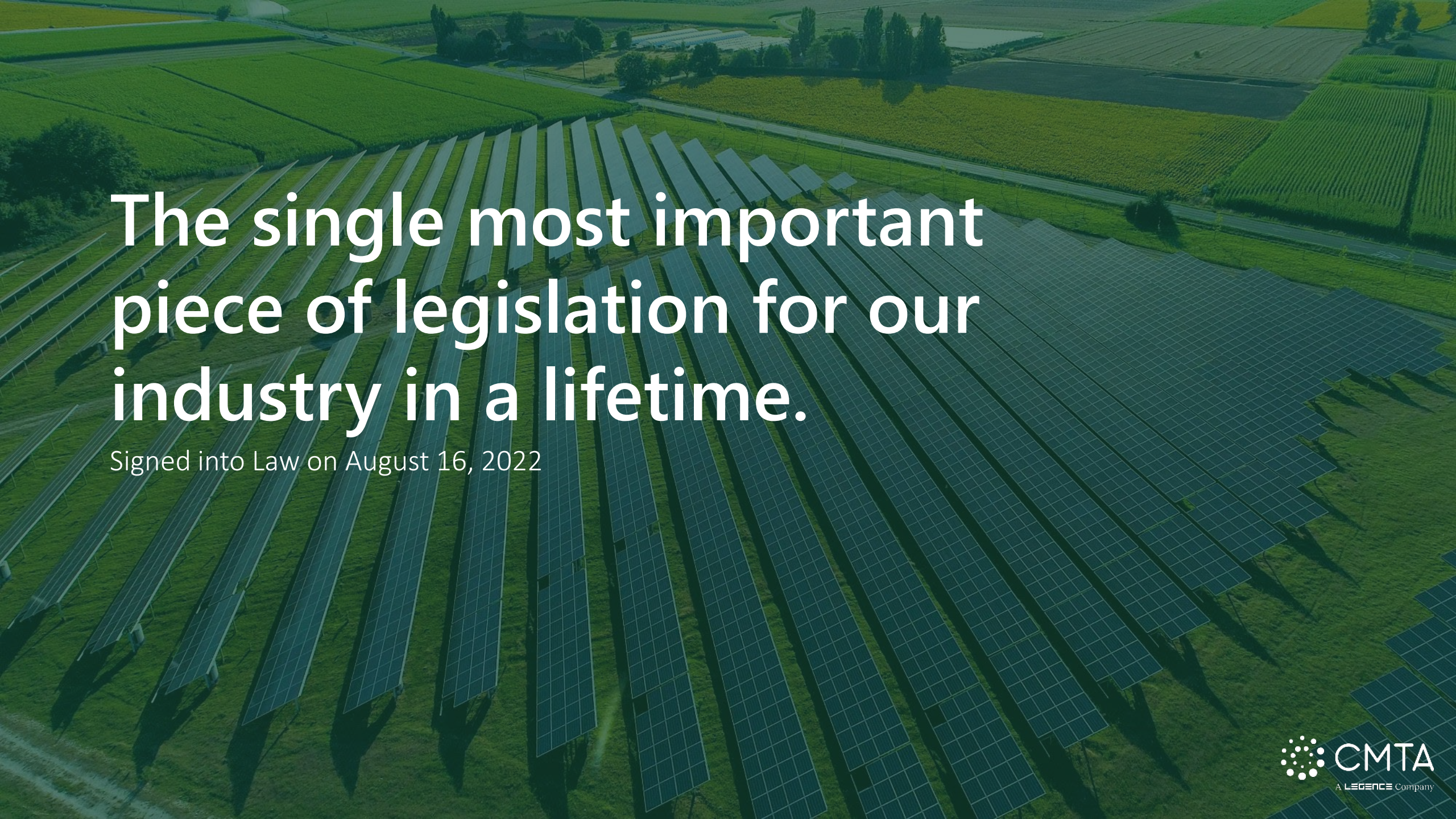
02

Inflation Reduction Act

Disclaimer

We at CMTA are not CPAs. We've done our research, but there are some things to be careful of:

- We are not tax advisors. This Act influences the finances of building designs. Therefore, we are providing a technical summary of the impacts that we see on the technical design of buildings.
- Tax law is constantly changing.
- Within Inflation Reduction Act, further clarifications are expected to be released in the coming months by the Department of Treasury.


The single most important piece of legislation for our industry in a lifetime.
Signed into Law on August 16, 2022
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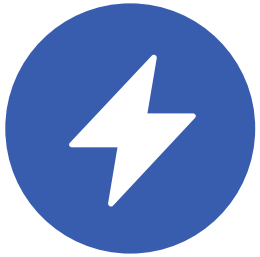
Inflation Reduction Act

ITC Increases
Green systems / technologies

30% Base Tax Credit
Installed efficiency / generation

Direct-Payment to Not-for-Profit Owners



Energy Community
Bonus 10% incentive

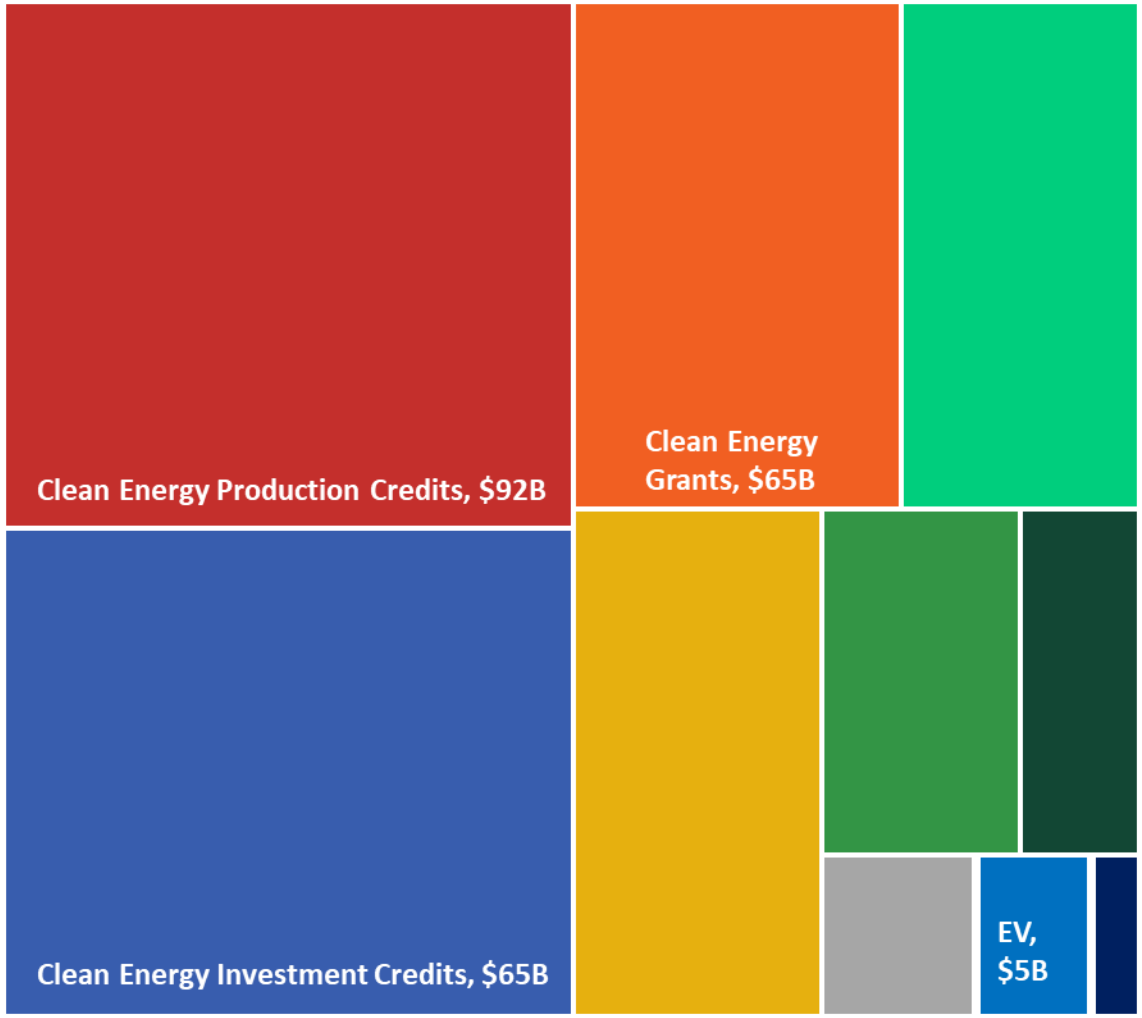
179d Increases
Up to $5/SF

Domestic Manufacturing
Bonus 10% incentive

IRA – Financial Bridge

IRA Categories

- Clean energy production
- Clean energy investment
- Advanced manufacturing
- Non-commercial
- Carbon capture use and sequestration (CCUS) and hydrogen
- Clean/renewable fuel
- Fleet/EV
- Energy-efficient buildings
- Clean energy grants
- Clean or low-emission vehicle/fuel grants

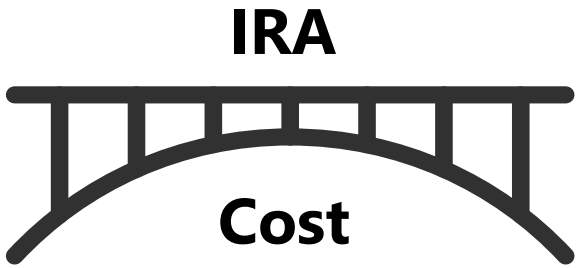


IRA – Financial Bridge

Action

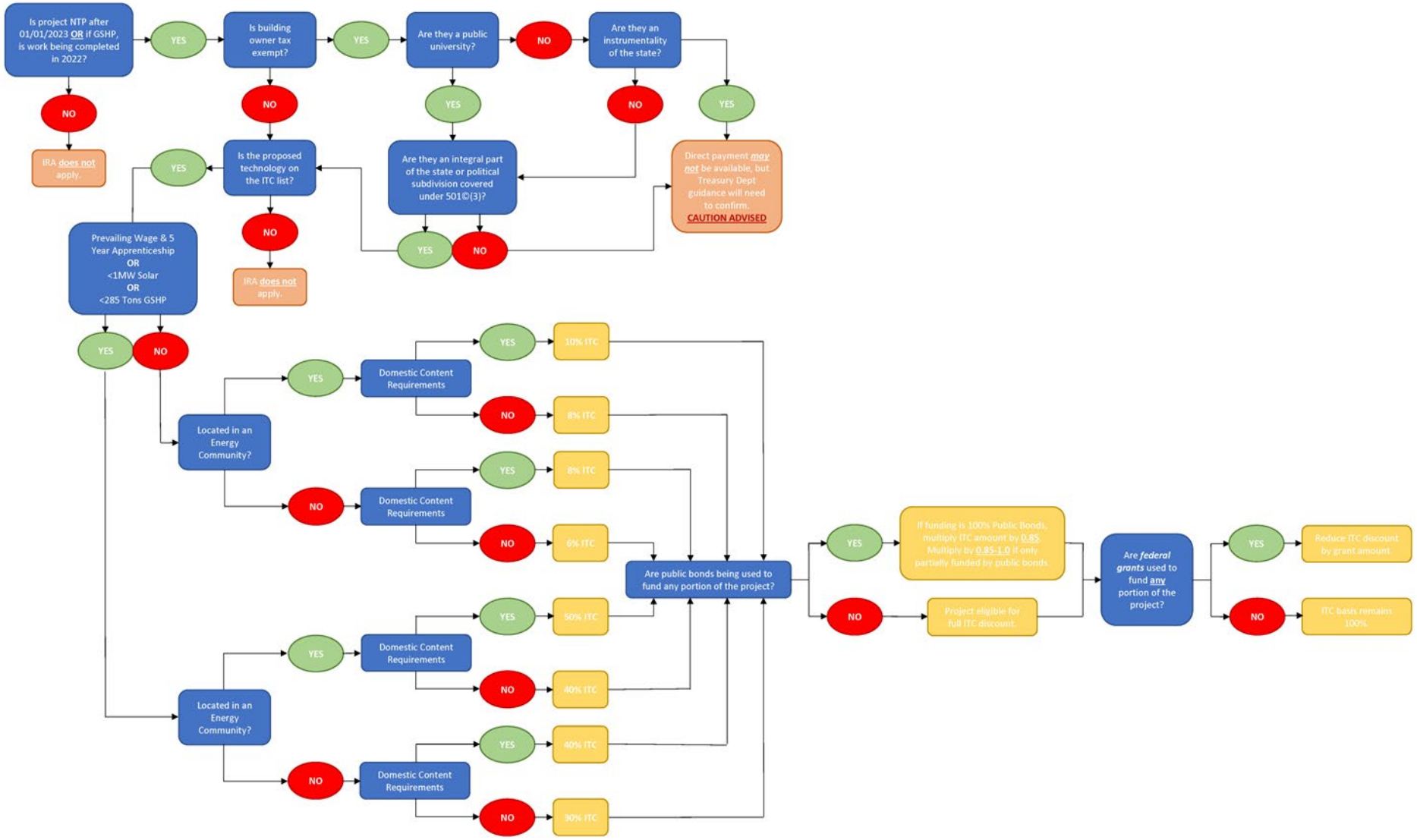
Cost

IRA – Financial Bridge



Action

IRA Flowchart



Best Value Solutions

First Costs

- Minimize upfront costs while achieving the highest value
  - Plan for the future
  - Right-size equipment
  - Invest wholistically in the building

Maintenance / Operations

- Provide simple, easy-to-maintain systems

Health & Well-being

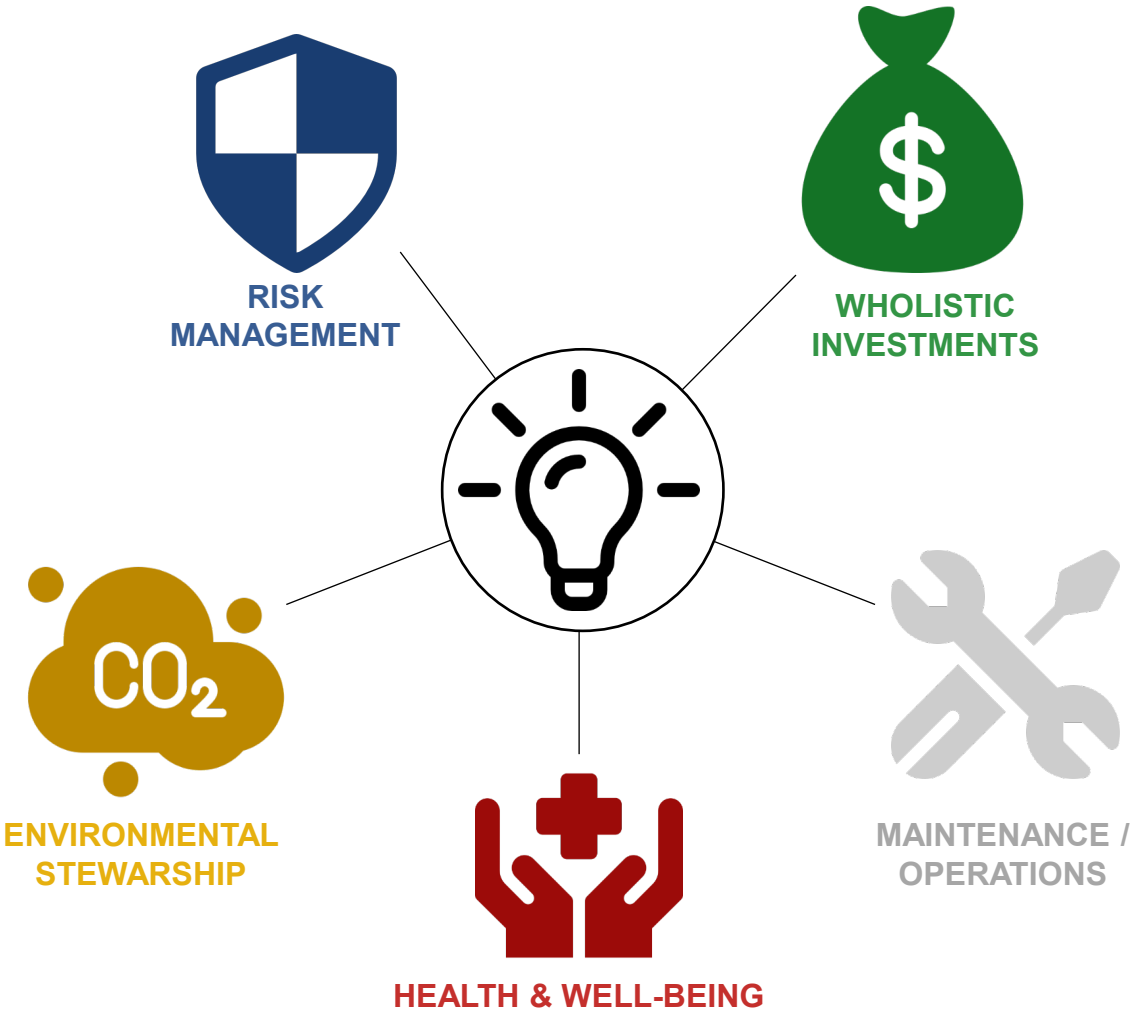
- Improve occupant satisfaction
- Make a positive impact on occupant wellbeing

Environmental Stewardship

- Achieve significant reductions in energy costs
- Reduce carbon emissions and air pollutants

Risk Management

- Minimize unplanned system downtime
- Increase redundancy and improved control
- Reduced susceptibility to regulatory issues



Inflation Reduction Act Technologies

- **Solar Energy**
- Wind Energy
- Geothermal Energy
- **Ground Source Heat Pumps**
- Fuel Cells
- Microturbines
- **Combined Heat and Power**
- **Energy Storage**
- Biogas
- **Waste to Energy**
- Dynamic Glass
- Microgrid Technology
- Electric Vehicles
- **Electric Vehicle Charging Infrastructure**
- Carbon Sequestration
- Advanced Manufacturing
- Clean Hydrogen
- Zero Emission Nuclear
- Sustainable Aviation Fuel
- Biodiesel Renewable Fuel
- Energy Efficiency
- Energy Efficient Homes
- ***Air Source Heat Pumps – not included!***

03

IRA Impact – Geothermal

IRA Impact – Geothermal

Previous Policy

10% Investment Tax Credit (ITC)

- Geo Field, WSHPs, Pumps, Piping, Ductwork, Soft Costs?

Tax-Exempt Entities *Did Not Qualify*

Tax Credits *Non-Transferable*

No Special Requirements

IRA Impact – Geothermal

New Policy

Increases to 30% Investment Tax Credit (ITC)
- Geo Field, WSHPs, Pumps, Piping, Ductwork, Soft Costs?

Tax-Exempt Entities **Direct Pay Option**
Use () amount **if** funded with tax-exempt debt
(i.e., tax-exempt bonds)

Taxpaying Entity **Sale of Credits**

Prevailing Wage & 15% Apprenticeship Requirements
Reduces to 6% ITC if not met

IRA Impact – Geothermal

Contingencies / Requirements

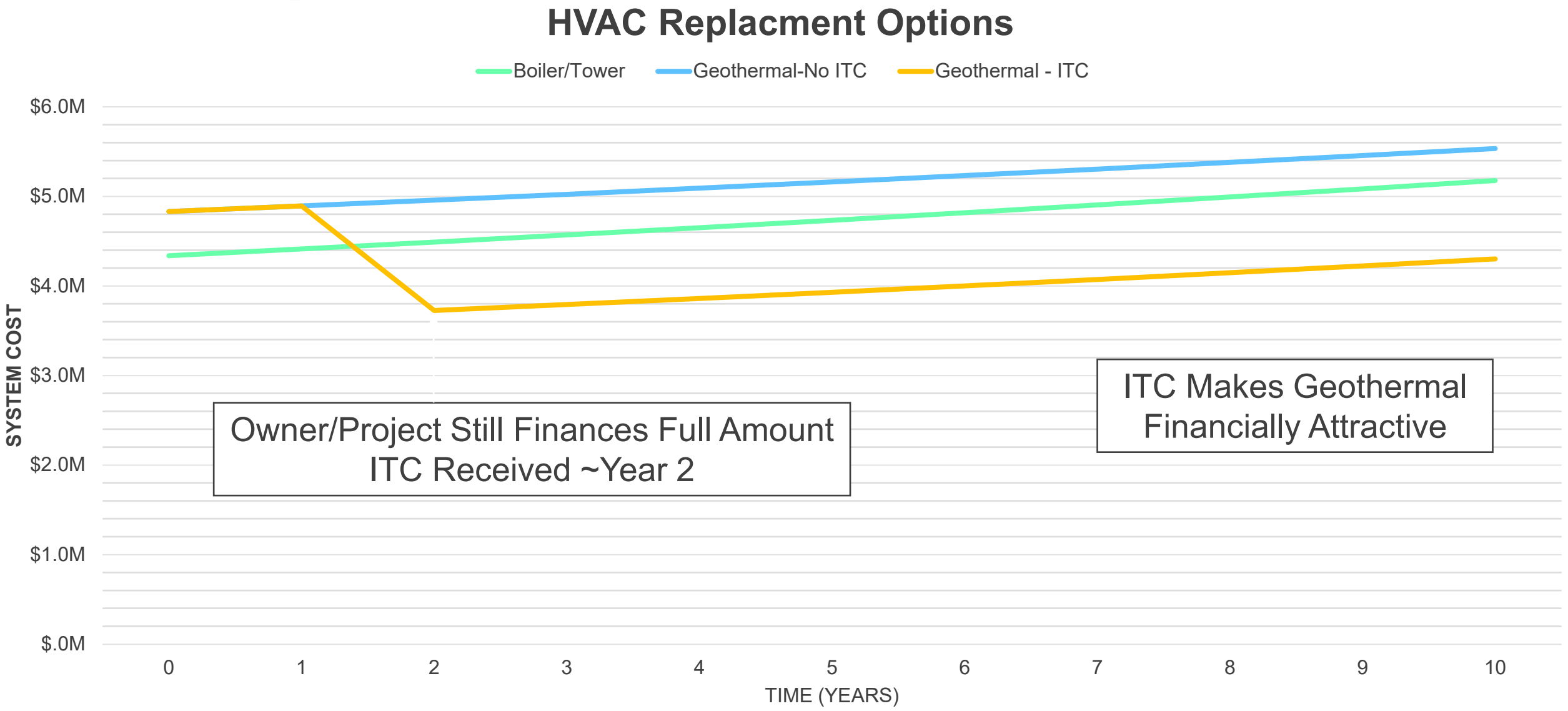
1. Must Meet Prevailing Wage / Apprenticeship Requirements:
   - Pay All Contractors Prevailing Wage (Including Repairs up to 5 Years After Project)
   - 15% of Work Completed by Certified Apprentices

   Unless:

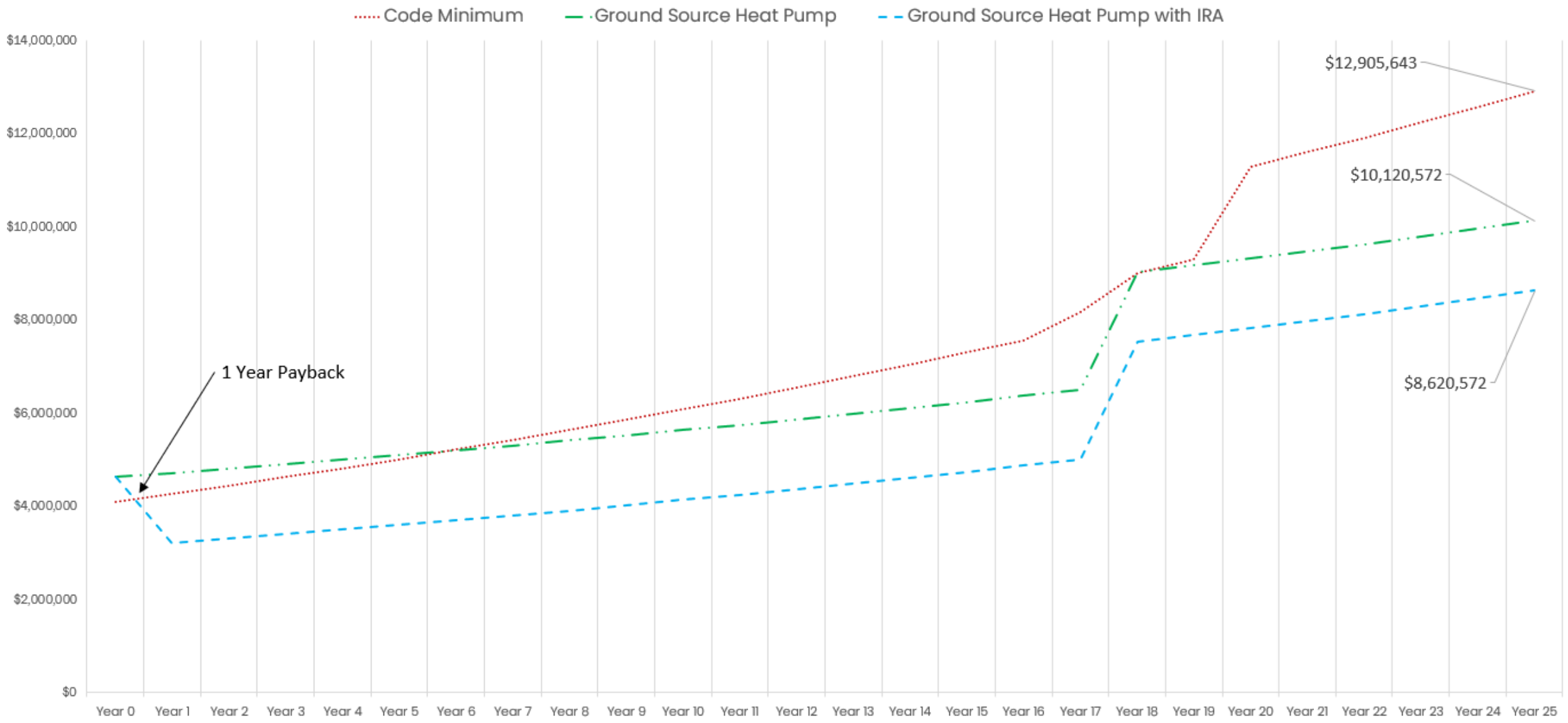
   - Less than 1MW of thermal output (~284 tons; 114,000 Sq. Ft.)
   - Construction begins before 60 days after IRS guidance
   - 75% of heating/cooling BTUs must come from Geothermal

2. After 2026, Domestic Content Credit Adder Required for Direct Pay

IRA Impact


HVAC Replacment Options
Boiler/Tower
Geothermal-No ITC
Geothermal - ITC
$6.0M
$5.0M
$4.0M
$3.0M
$2.0M
$1.0M
$.0M
SYSTEM COST
0
1
2
3
4
5
6
7
8
9
10
TIME (YEARS)
Owner/Project Still Finances Full Amount
ITC Received ~Year 2
ITC Makes Geothermal
Financially Attractive

Midwest Project – Full Geo LCCA (w/ IRA)



03

IRA Impact – Solar

IRA Impact – Solar

Previous Policy | For-Profit

26% Investment Tax Credit (ITC)

No Production Tax Credit (PTC)

1 Year Credit Carryback

IRA Impact – Solar

New Policy | For-Profit/Not-for-Profit & State Entities

- 26% Investment Tax Credit (ITC)
- 30% Investment Tax Credit*
    - Up to 70% with Credit Adders
- Direct Pay Option

- No Production Tax Credit (PTC)
- $0.026/kWh Production Tax Credit*

- 1 Year Credit Carryback
- 3 Year Credit Carryback
- Credits Can Be Transferred to Another Entity

Investment Tax Credit – Credit Adders

Domestic Content: +10%

- 100% of steel and iron must be US manufactured
- Goods must be 40% US manufactured through 2024, 55% by 2027

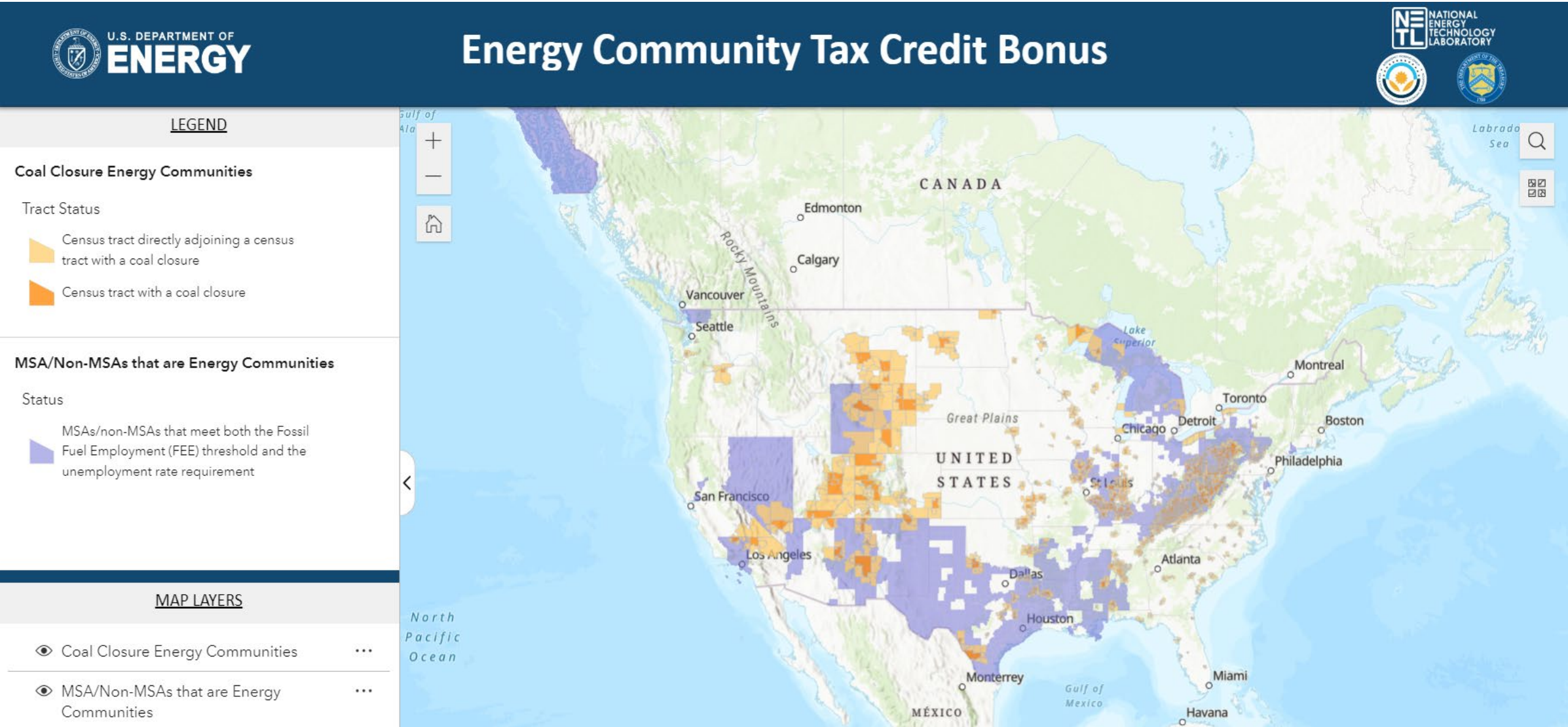
Existing Energy Communities: +10%

- Projects located in areas with significant extraction jobs in coal, oil, or natural gas
- Projects in Brownfield sites

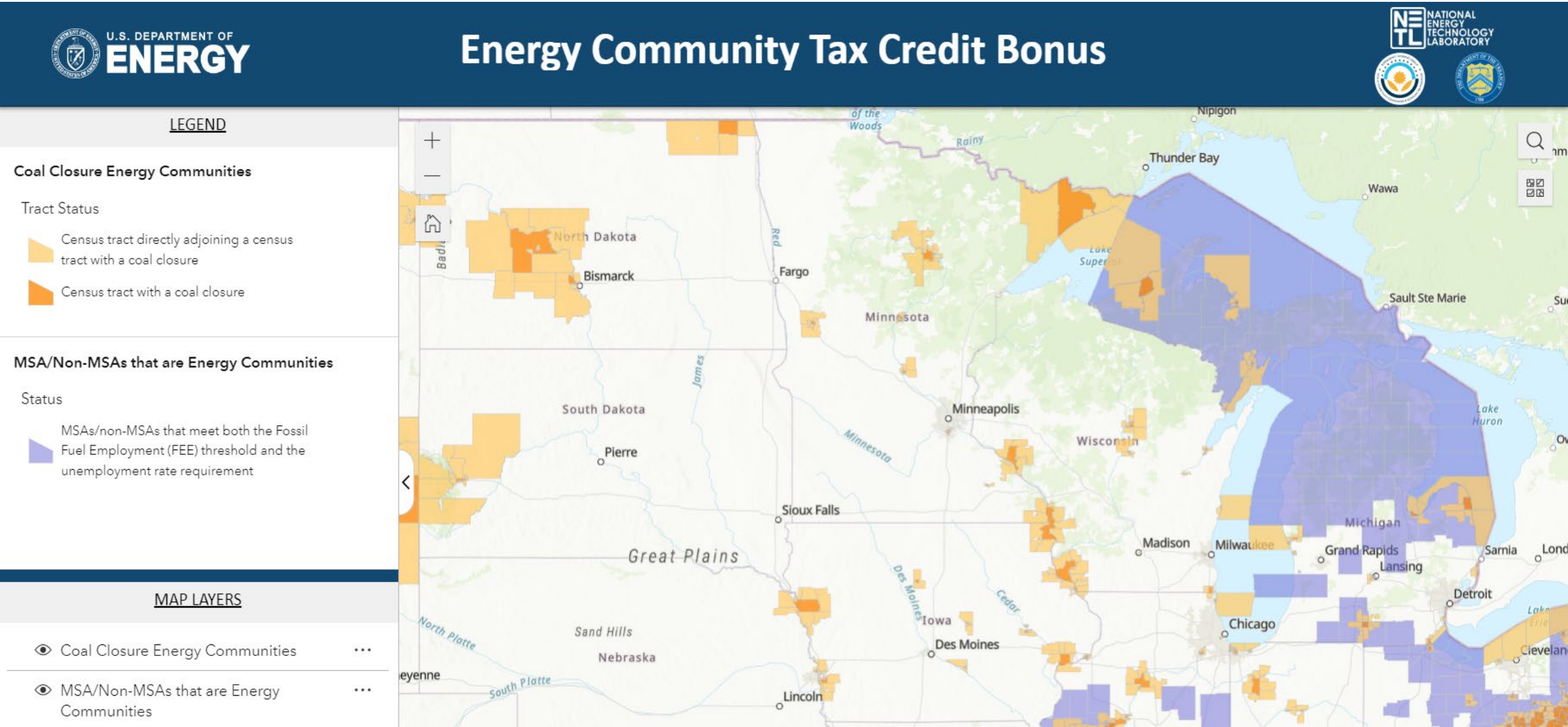
Recent Guidance from Treasury

- Energy Communities Map Updated
- Tax Exempt Eligibility Clarifications
- Federal Funding Clarifications
- Elective Payment Election (aka Direct Pay) Filing Clarifications

Energy Communities



Upper MW Energy Communities



Applicable Entities

Tax Exempt Eligibility

- 501(a), 501(C) and 501(d): “public charities, private foundations, social welfare organizations, labor organizations, business leagues and others. It also includes religious or apostolic organizations”

State, Local & Political Subdivisions

- “States, political subdivisions and their agencies and instrumentalities are all eligible for elective pay. This includes the District of Columbia. It also includes cities, counties and other political subdivisions. Water districts, school districts, economic development agencies and public universities and hospitals that are agencies and instrumentalities of states or political subdivisions are also included.”

Elective Pay Election Filing

Pre-filing Required

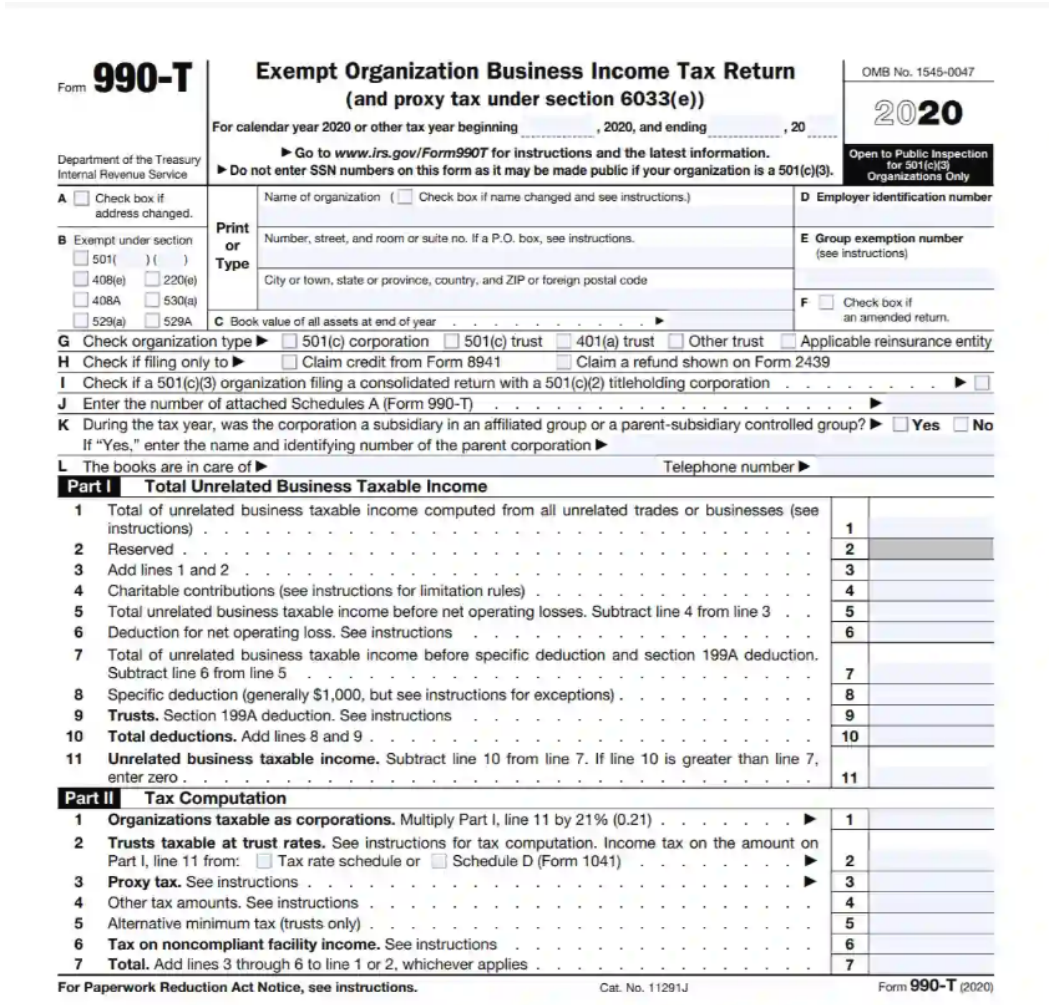
- “A pre-filing registration is a required electronic process for all entities that intend to make elective payment election.”
- “More information about the pre-filing process will be available when the process is released in late 2023.”

Forms Needed

- 990-T & Form 3800

Timing

- “Elective pay is only available after an applicable credit is earned and able to be claimed on the relevant annual tax return.”
- “In general, payments occur after the tax return is processed…”



Form **990-T** — **Exempt Organization Business Income Tax Return (and proxy tax under section 6033(e))** — OMB No. 1545-0047 — **2020**

Department of the Treasury, Internal Revenue Service

For calendar year 2020 or other tax year beginning , 2020, and ending , 20

▶ Go to *www.irs.gov/Form990T* for instructions and the latest information.

▶ Do not enter SSN numbers on this form as it may be made public if your organization is a 501(c)(3).

Open to Public Inspection for 501(c)(3) Organizations Only

A ☐ Check box if address changed.

B Exempt under section ☐ 501( )( ) ☐ 408(e) ☐ 220(e) ☐ 408A ☐ 530(a) ☐ 529(a) ☐ 529A

Print or Type

Name of organization (☐ Check box if name changed and see instructions.)

Number, street, and room or suite no. If a P.O. box, see instructions.

City or town, state or province, country, and ZIP or foreign postal code

C Book value of all assets at end of year ▶

D Employer identification number

E Group exemption number (see instructions)

F ☐ Check box if an amended return.

G Check organization type ▶ ☐ 501(c) corporation ☐ 501(c) trust ☐ 401(a) trust ☐ Other trust ☐ Applicable reinsurance entity

H Check if filing only to ▶ ☐ Claim credit from Form 8941 ☐ Claim a refund shown on Form 2439

I Check if a 501(c)(3) organization filing a consolidated return with a 501(c)(2) titleholding corporation ▶ ☐

J Enter the number of attached Schedules A (Form 990-T) ▶

K During the tax year, was the corporation a subsidiary in an affiliated group or a parent-subsidiary controlled group? ▶ ☐ Yes ☐ No

If “Yes,” enter the name and identifying number of the parent corporation ▶

L The books are in care of ▶ Telephone number ▶

Part I Total Unrelated Business Taxable Income

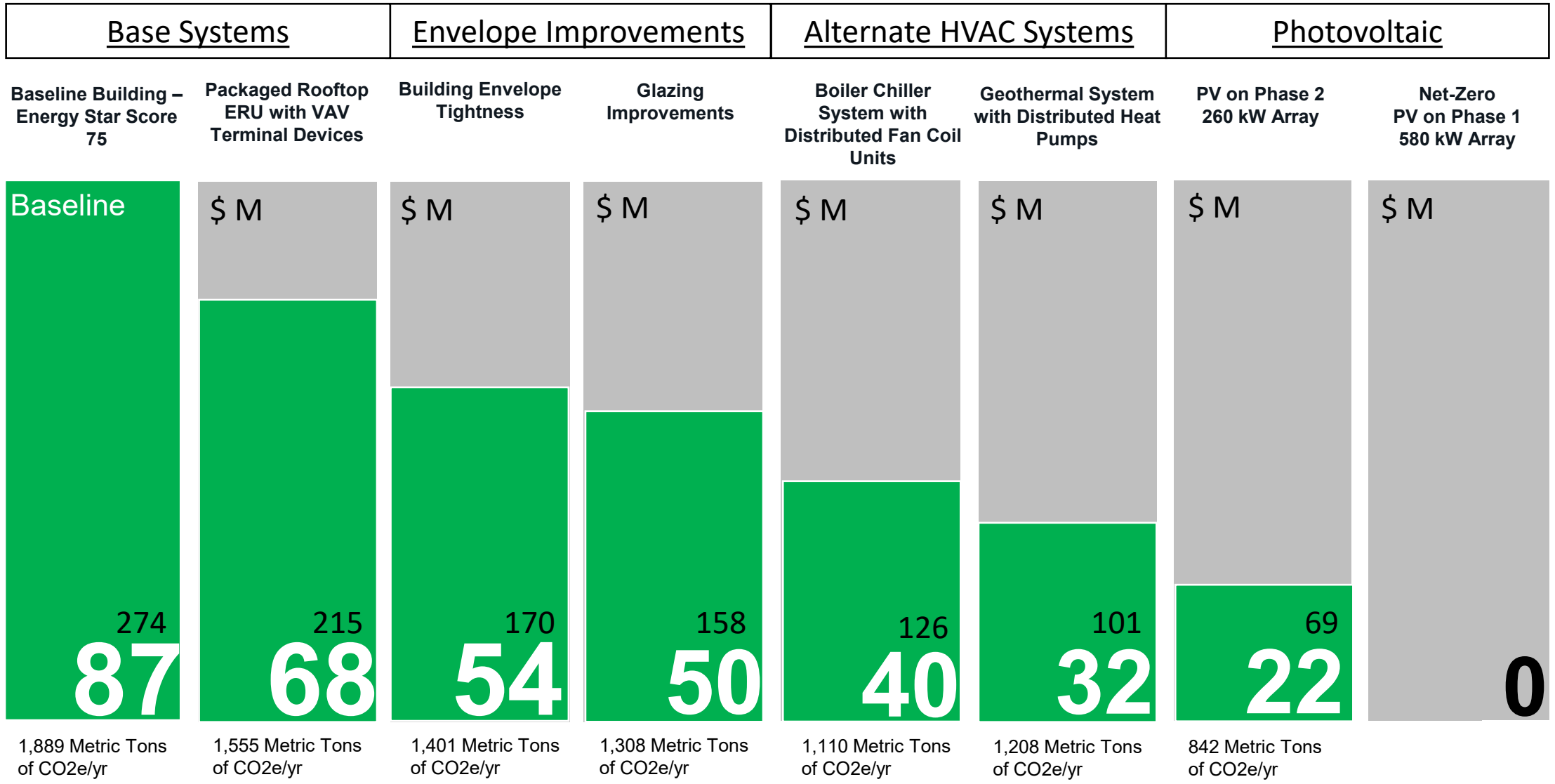
1	Total of unrelated business taxable income computed from all unrelated trades or businesses (see instructions)	1	
2	Reserved	2	
3	Add lines 1 and 2	3	
4	Charitable contributions (see instructions for limitation rules)	4	
5	Total unrelated business taxable income before net operating losses. Subtract line 4 from line 3	5	
6	Deduction for net operating loss. See instructions	6	
7	Total of unrelated business taxable income before specific deduction and section 199A deduction. Subtract line 6 from line 5	7	
8	Specific deduction (generally $1,000, but see instructions for exceptions)	8	
9	**Trusts.** Section 199A deduction. See instructions	9	
10	**Total deductions.** Add lines 8 and 9	10	
11	**Unrelated business taxable income.** Subtract line 10 from line 7. If line 10 is greater than line 7, enter zero	11	

Part II Tax Computation

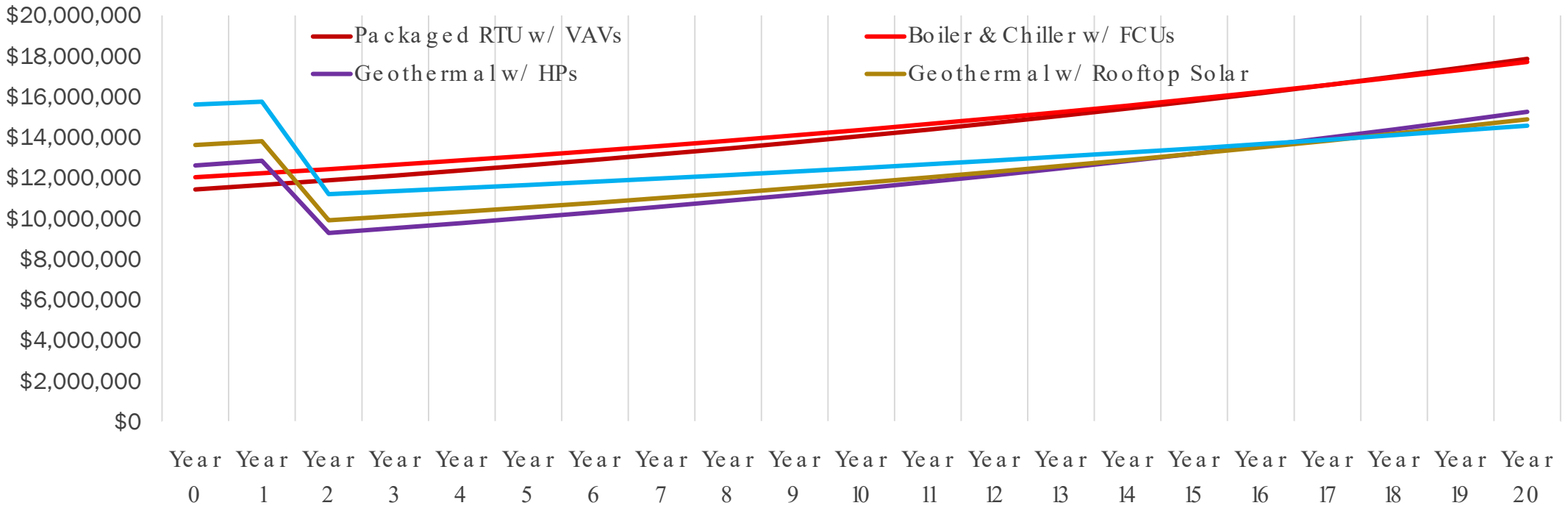
1	**Organizations taxable as corporations.** Multiply Part I, line 11 by 21% (0.21) ▶	1	
2	**Trusts taxable at trust rates.** See instructions for tax computation. Income tax on the amount on Part I, line 11 from: ☐ Tax rate schedule or ☐ Schedule D (Form 1041) ▶	2	
3	**Proxy tax.** See instructions ▶	3	
4	Other tax amounts. See instructions	4	
5	Alternative minimum tax (trusts only)	5	
6	**Tax on noncompliant facility income.** See instructions	6	
7	**Total.** Add lines 3 through 6 to line 1 or 2, whichever applies	7	

For Paperwork Reduction Act Notice, see instructions. Cat. No. 11291J Form **990-T** (2020)

EUI + Carbon Reduction Roadmap: Fortune 200 (with Lab) Company Case



Life Cycle Costs Analysis
Fortune 200 (with Lab) Company Case Study



- Packaged RTU w/ VAVs = $11,435,000
- Boiler & Chiller w/ FCUs = $12,036,000
- Geothermal w/ HPs = $12,622,000
- Geothermal Rooftop Solar = $13,622,000
- Net-Zero = $15,622,000

→ Includes energy and maintenance costs with 4% annual inflation

→ Includes rebates from the IRA (Inflation Reduction Act), requires Davis-Bacon prevailing wages to qualify, IRA tax credit is received after building is occupied

Resources

- IRA Text: Text - H.R.5376 - 117th Congress (2021-2022): Inflation Reduction Act of 2022 | Congress.gov | Library of Congress
- Solar Impact Overview: Inflation Reduction Act - Printer Friendly | SEIA
- IRA Impact on Local Governments: Inflation Reduction Act: Clean Energy Project Eligibility for Local Governments - National League of Cities (nlc.org)
- Cornell Law Interpretation of Direct Payment Code: 26 U.S. Code § 6417 - Elective payment of applicable credits | U.S. Code | US Law | LII / Legal Information Institute (cornell.edu)
- Defining an “Energy Community”: What is an “Energy Community”? (resources.org)


Let’s Connect.
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Empowering Communities Through Resilient & Sustainable Design

AIA Approved Continuing Education

3 AIA/HSW Units

BUILD WITH STRENGTH

SYMPOSIUM AGENDA

7:00 - 8:00 AM - Breakfast & Registration

8:00 - 8:45 AM - Topic: Sustainability

8:45 - 9:15 AM - Topic: Insurance

9:15 - 9:45 AM - Topic: Architecture

9:45 - 10:30 AM - Topic: Inflation Reduction Act

10:30 - 10:45 AM - Networking Break

10:45 - 11:30 AM - Q&A Panel Discussion

Optimizing the building envelope is essential to achieving energy efficiency, decarbonization, and sustainability. As is understanding available building options and financial incentives.

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- **BRENT WAVRA & STEPHEN WESTERBACK- CMTA**
- **SHAWN FLAVIN, CIC & NATHAN LORTZ - CHRISTENSEN GROUP**
- **MATT GREEN - KB WALKER**
- **MIKE BERG - CLOW BERG**

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