D4-71. Pathways to SB 2030: Three Minnesota Case Studies

AIA Minnesota

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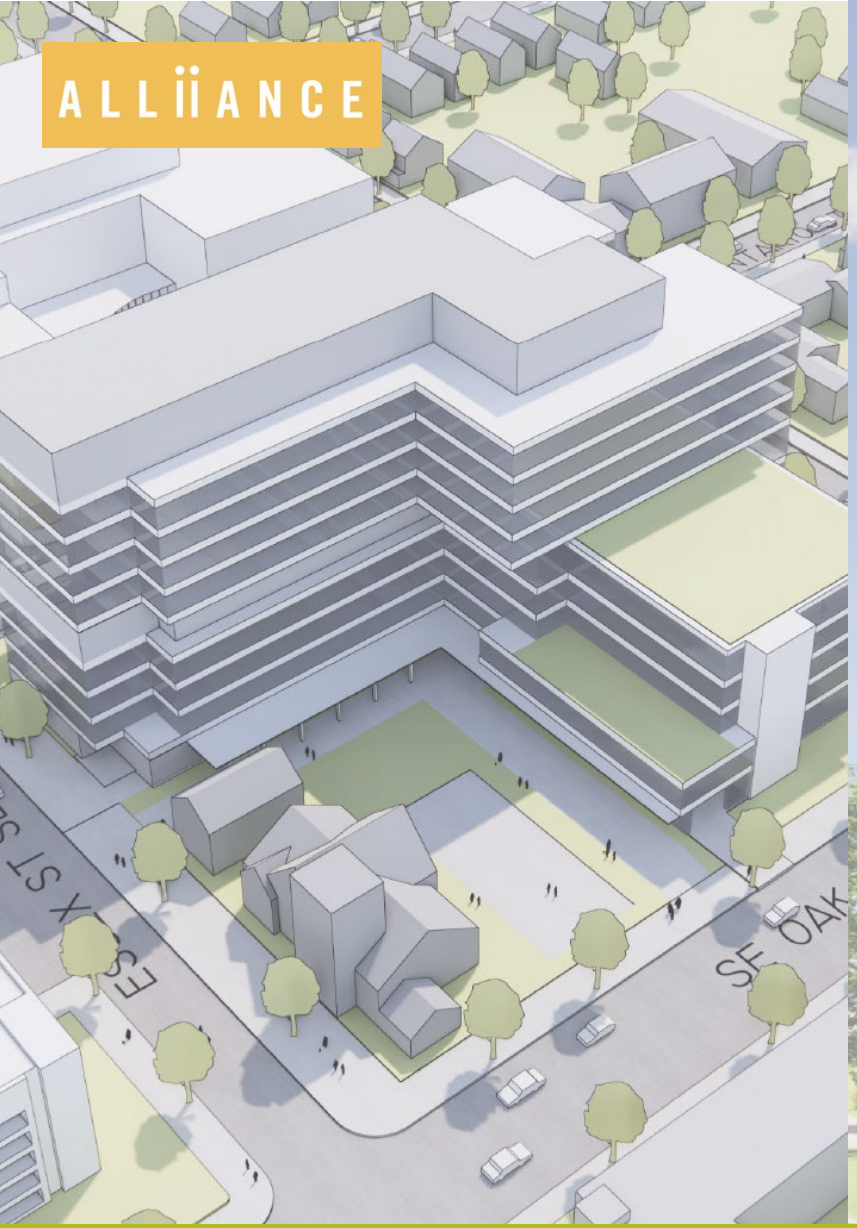
Thursday, November 11, 2021

12:30 – 1:30 pm



LHB
PERFORMANCE DRIVEN DESIGN.

Pathways to SB 2030: 3 MN Case Studies

November 11, 2021

Learning Objectives

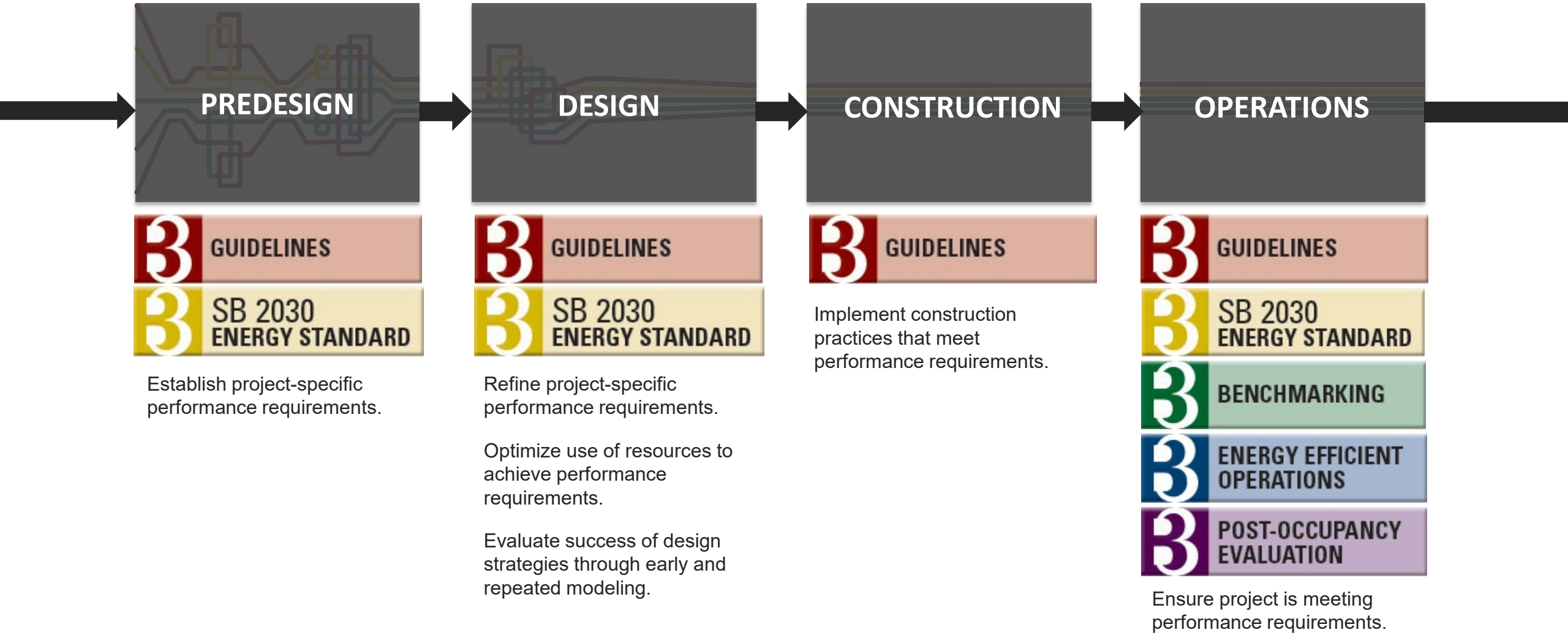
1) Understand the **SB 2030 Energy Standard program objectives** and **compliance pathways**.

2) Compare and contrast **renewable energy strategies** from the hierarchy of options in SB 2030 that can be incorporated into project planning, design, and development.

3) Provide guidance for project design teams to evaluate **energy efficient envelope** options during project planning and design.

4) Incorporate **decarbonization strategies** into project planning, design, and development to ensure energy and carbon reductions in building operations.

B3/SB 2030 Programs and Tools



Establish project-specific performance requirements.

Refine project-specific performance requirements.

Optimize use of resources to achieve performance requirements.

Evaluate success of design strategies through early and repeated modeling.

Implement construction practices that meet performance requirements.

Ensure project is meeting performance requirements.

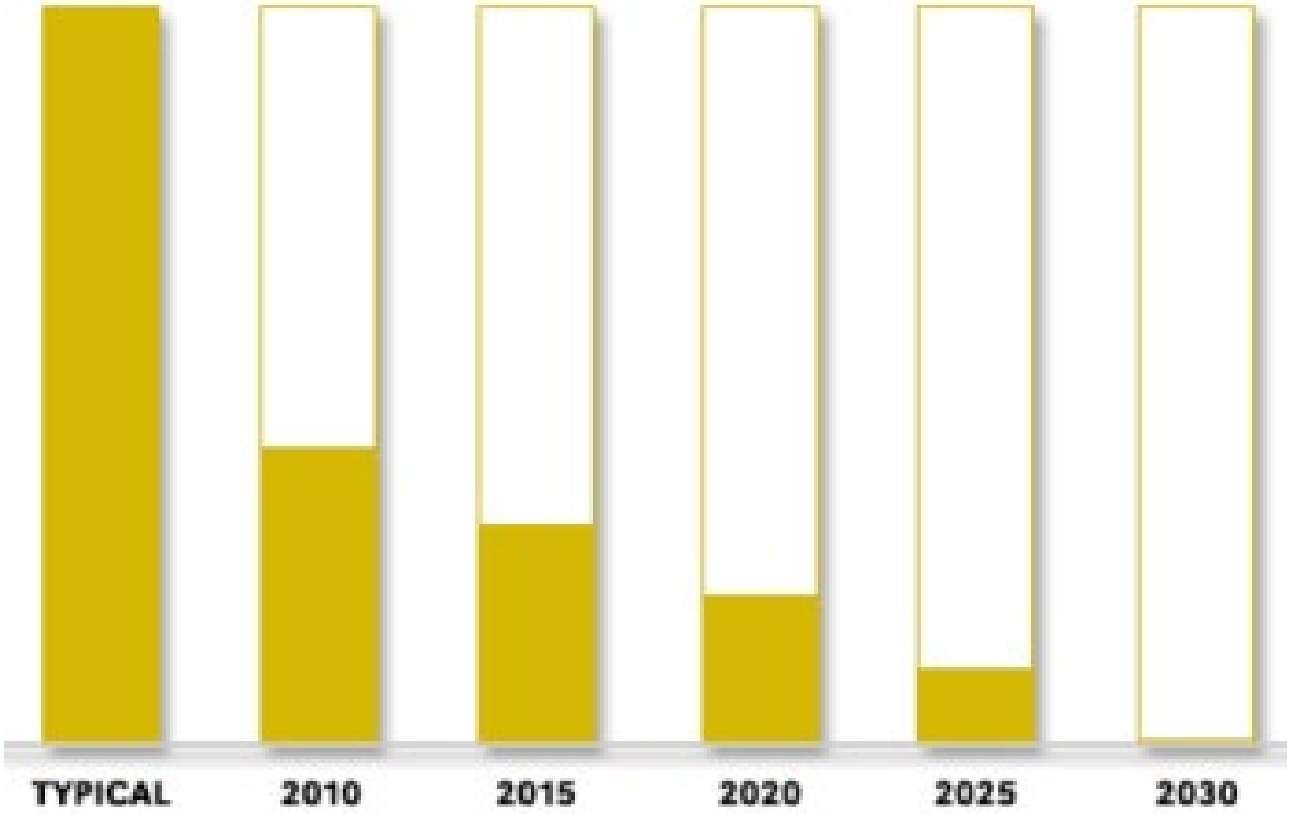
SB 2030

Meet energy performance targets (Energy Standards) that reduce the use of carbon producing fuel for building operations* by:

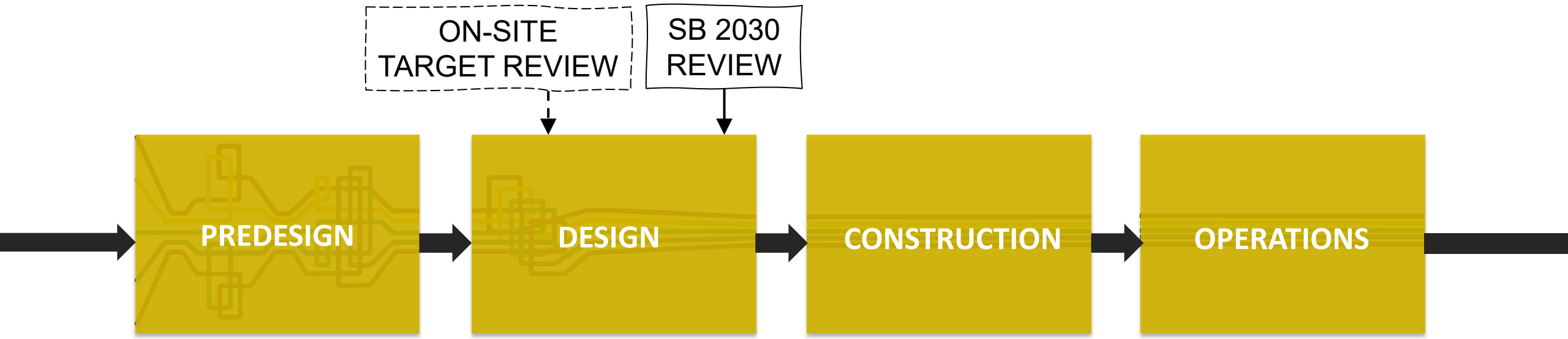
- 60% (for buildings designed) in 2010
- 70% in 2015
- 80% in 2020
- 90% in 2025
- 100% in 2030

*from a baseline of representative buildings in existence in 2003

Reduction targets are now the same for new construction and renovations



SB 2030 Process



Calculate the SB 2030 Standard.

Establish appropriate project budget.

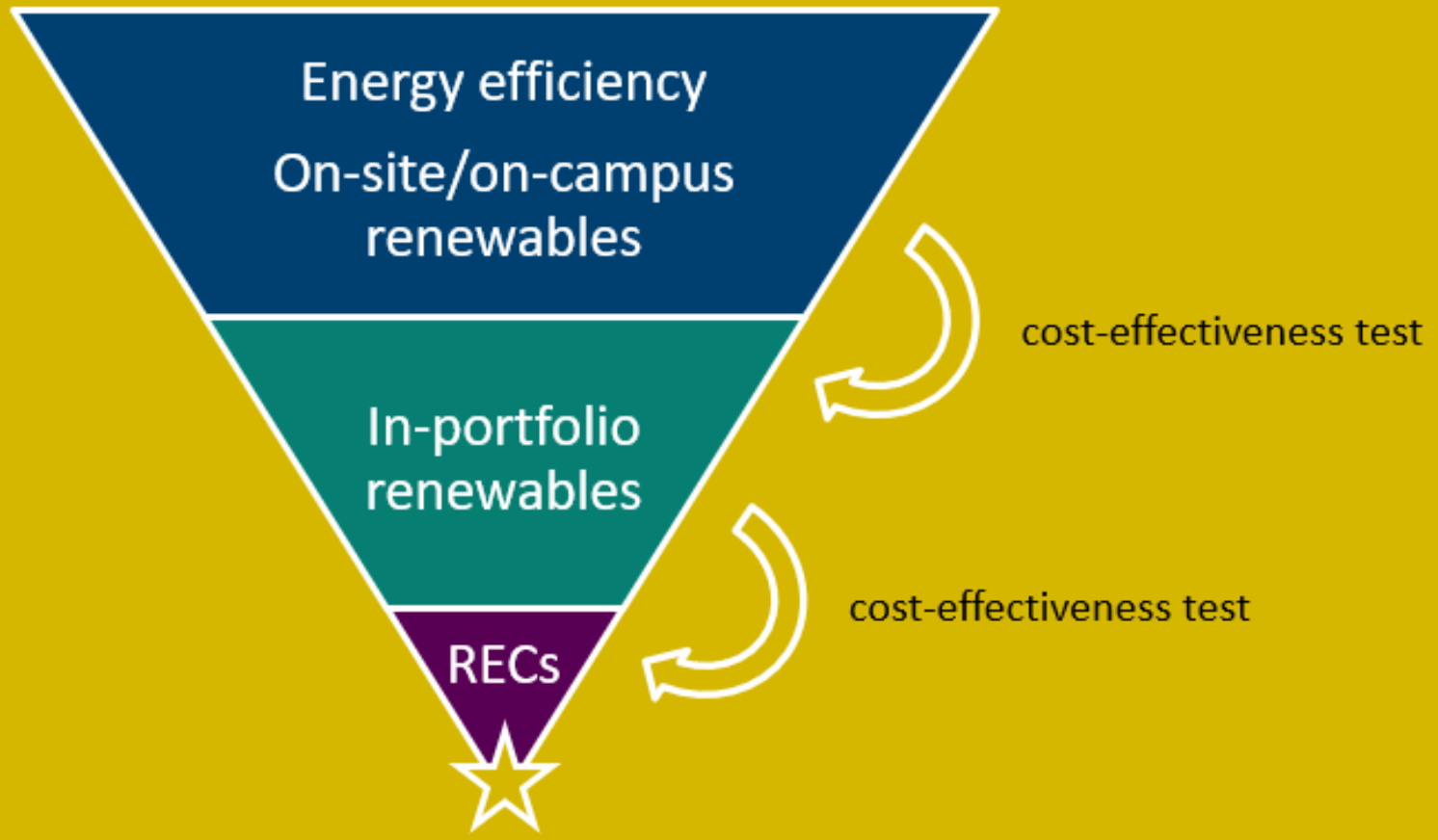
Conduct energy modeling to ensure project meets the Standard.

Determine on-site target based on cost-effectiveness of energy efficiency and on-site renewables. Evaluate off-site renewable options as necessary.

Implement construction practices that meet performance requirements.

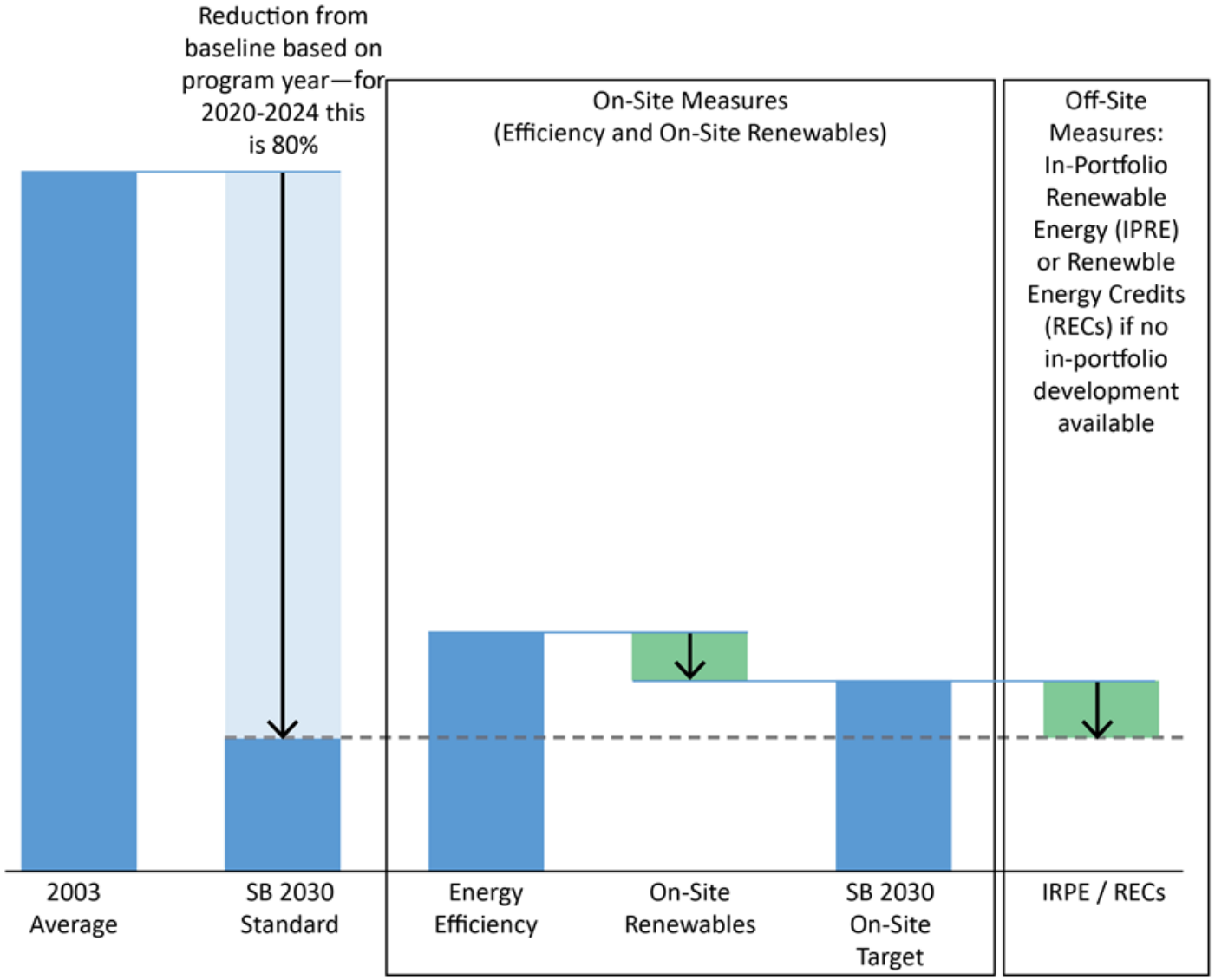
Track and report annual energy use through B3 Benchmarking

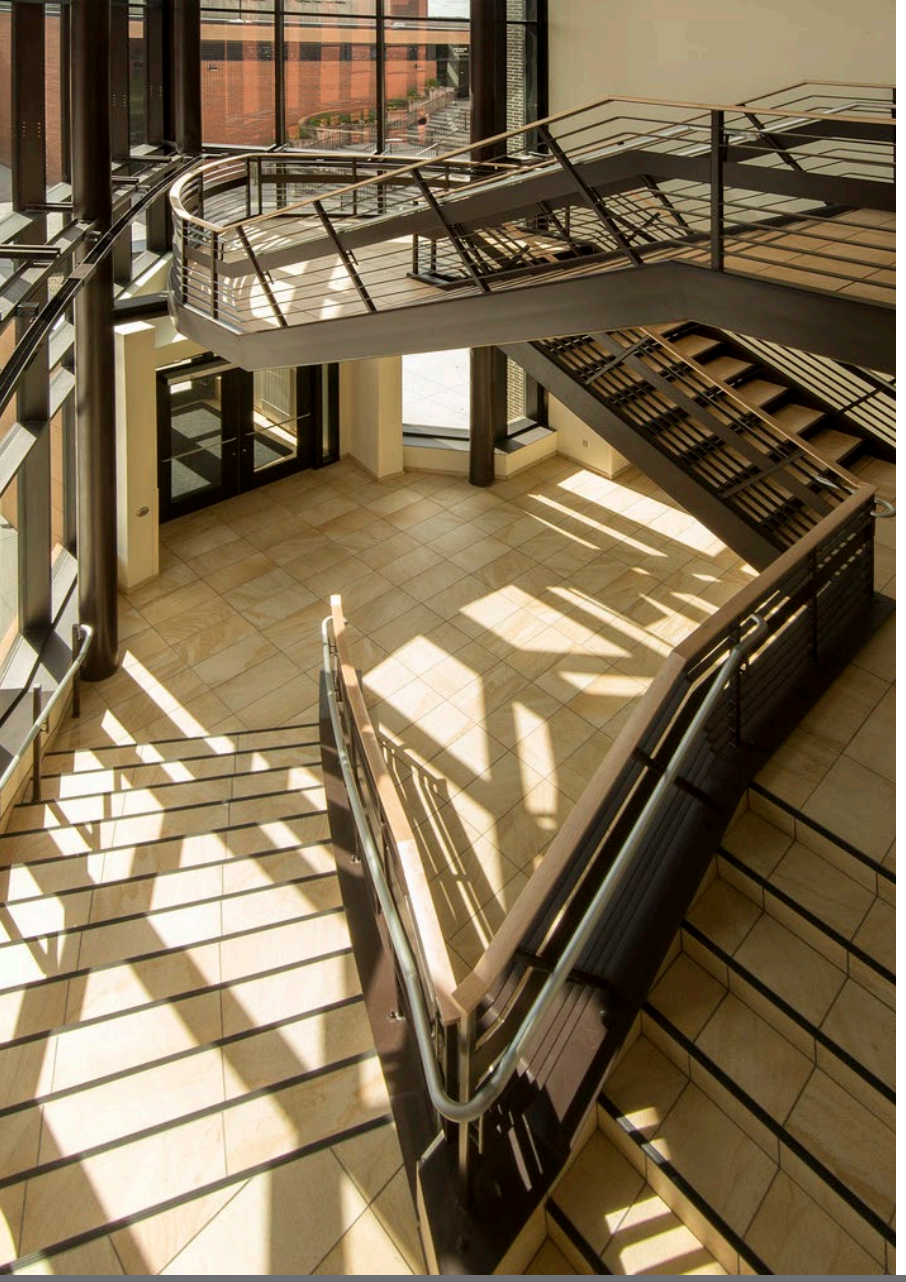
Energy Hierarchy



Example

- Maximize use of energy efficiency and on-site renewables
- Off-site renewables can be used to get the rest of the way to the SB 2030 Standard



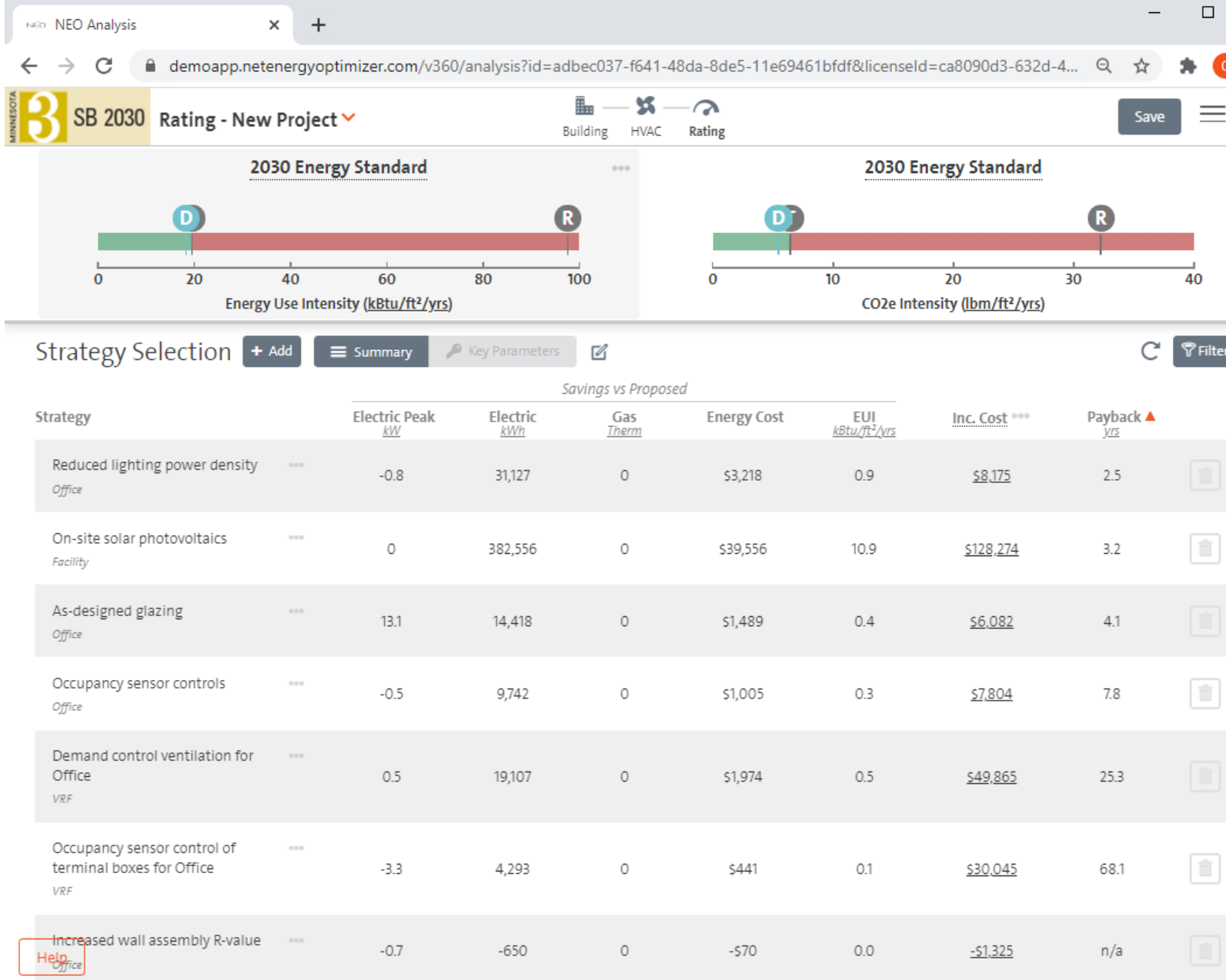


Alternative Compliance Paths

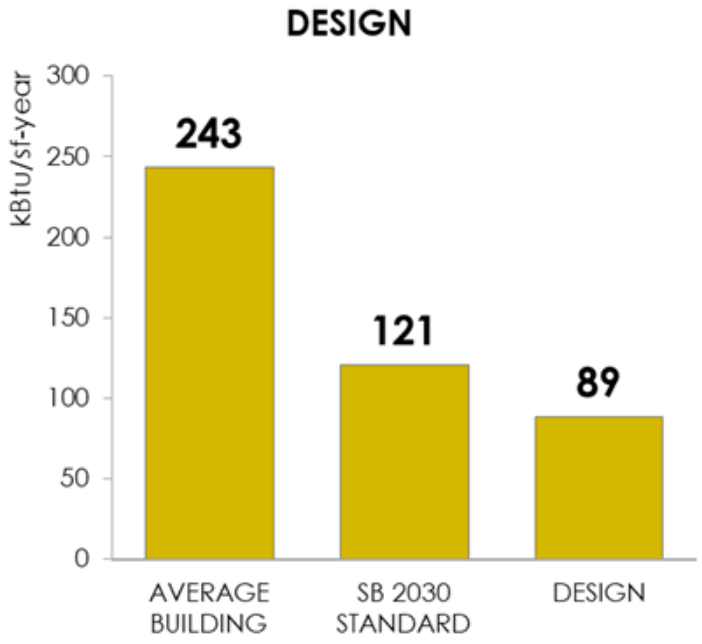
- **Small Buildings Method**: a prescriptive approach available for projects under 20,000sf
- **Partial Mechanical Upgrades**: an alternative approach for renovations that are not replacing the full mechanical systems
- **Wastewater Treatment Facilities**: a process that includes benchmarking existing facility, documenting potential energy conservation measures, and providing anticipated performance metrics

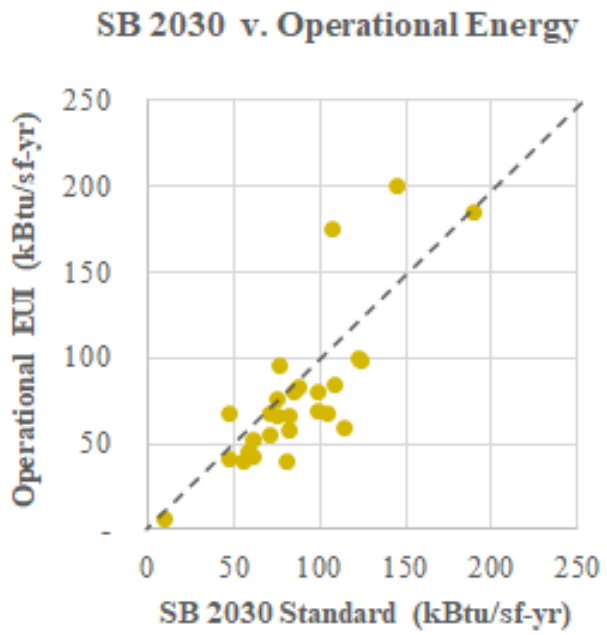
Energy Standard Tool

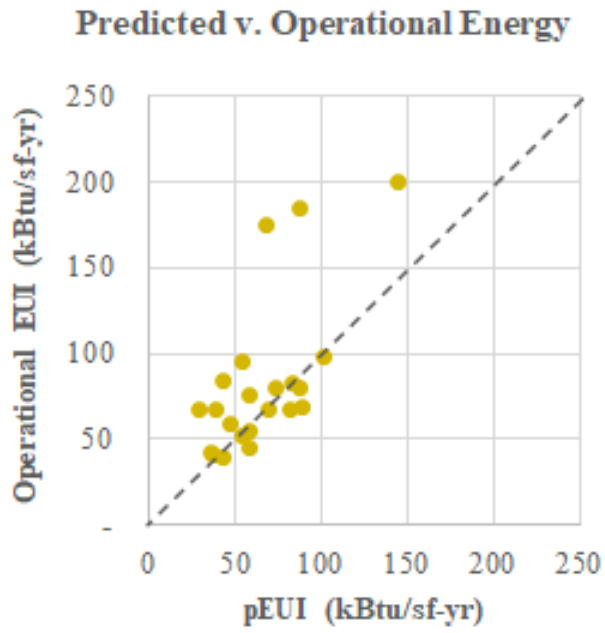
- Calculates SB 2030 Standard using basic project information
- Can produce a design model for SB 2030 compliance
- Incorporates renewable energy generation
- Includes cost-effectiveness test



SB 2030 Analysis







B3 Case Studies Database

Name	Organization	City	Building Type(s)	Construction Type	Building Area (sf)	Occupancy Date	Design Energy – SB 2030 Standard (kBtu/sf-yr)	Design Energy – Design (kBtu/sf-yr)	Design Energy – Ratio (Design/Standard)	Design Energy – Graphic (Design/Standard)
 **Apple Valley Bus Layover Facility**	Minnesota Valley Transit Authority	Apple Valley	Transit Facility	New Construction	509	1/15/2015	204	62	0.30	
 **Hennepin County Library - Brooklyn Park**	Voluntary	Brooklyn Park	Library	New Construction	39,385	8/30/2016	70	29	0.41	
 **Bemidji Regional Public Television Station**	Minnesota Department of Employment and Economic Development	Bemidji	Television Station, Office	New Construction	16,789	3/3/2015	116	49	0.42	
 **The Hormel Institute Medical Research Center**	Minnesota Department of Employment and Economic Development	Austin	Laboratory	New Construction	63,700	6/1/2016	300	132	0.44	
 **UMTC Mechanical Engineering Infrastructure**	University of Minnesota	Minneapolis	Laboratory, Office, Classroom	Renovation	144,000	9/1/2019	305	136	0.45	
 **Wells Street Houses**	City of Saint Paul	Saint Paul	Housing	New Construction	17,241	1/6/2015	70	31	0.45	

casestudies.b3mn.org

ALLiiANCE

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Image: Tardis by Babbel1996

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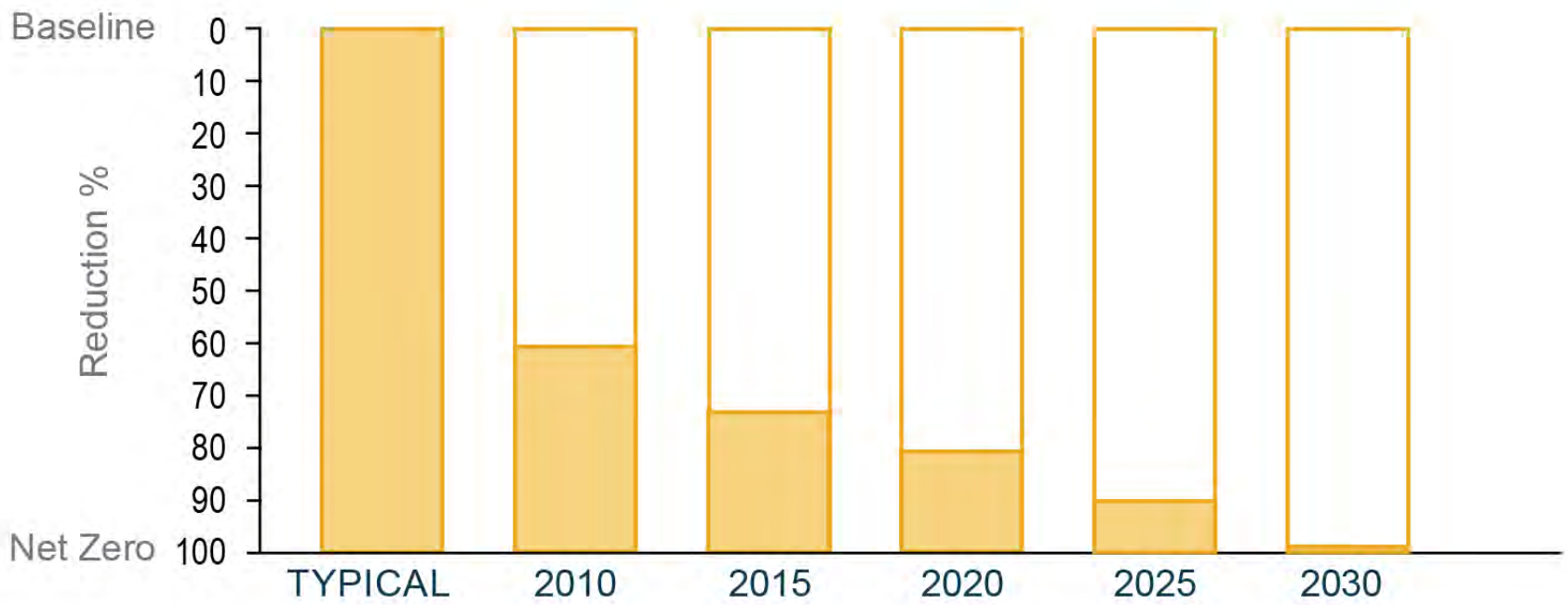
SB 2030 Energy Standard



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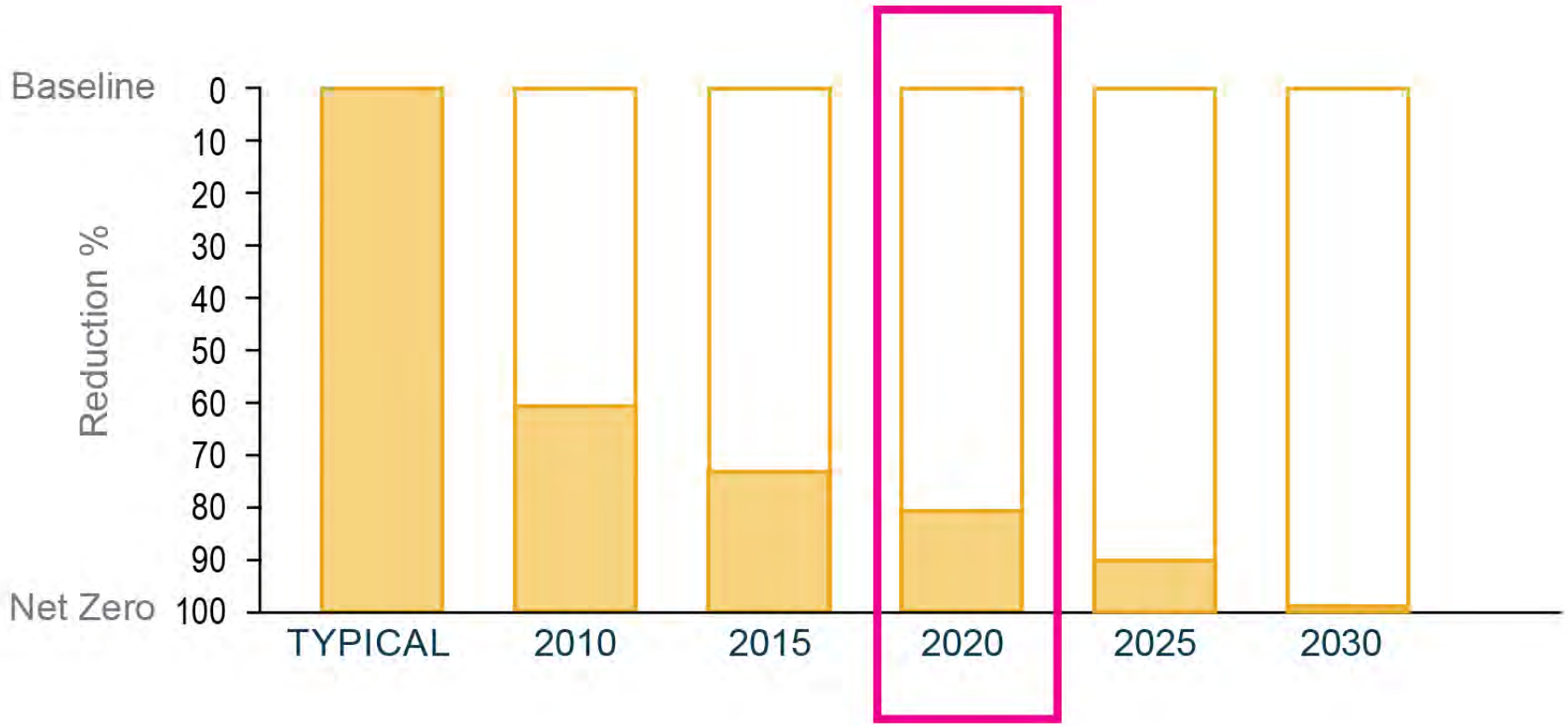
SB 2030 Energy Standard



80%

Program Summary

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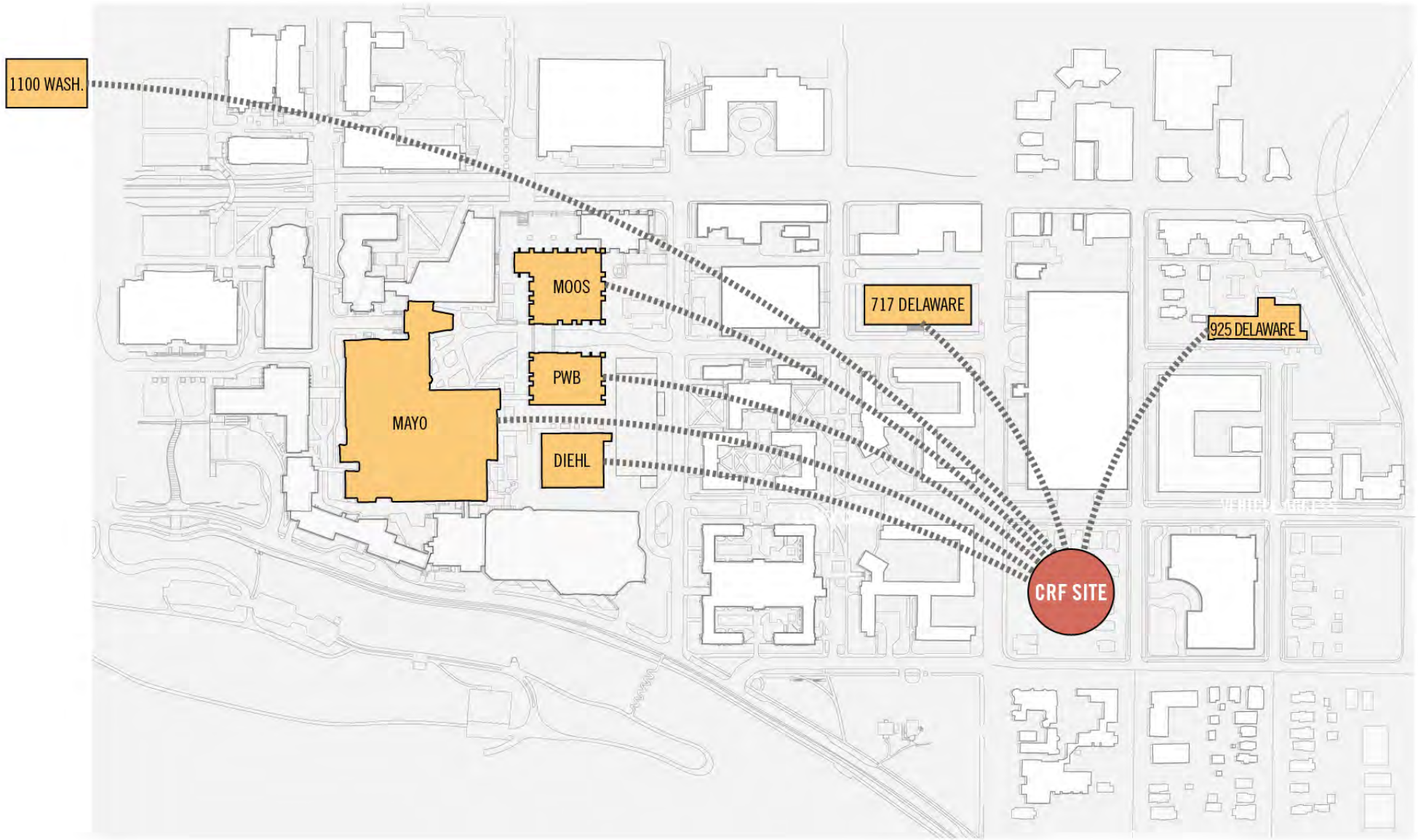
Program Elements



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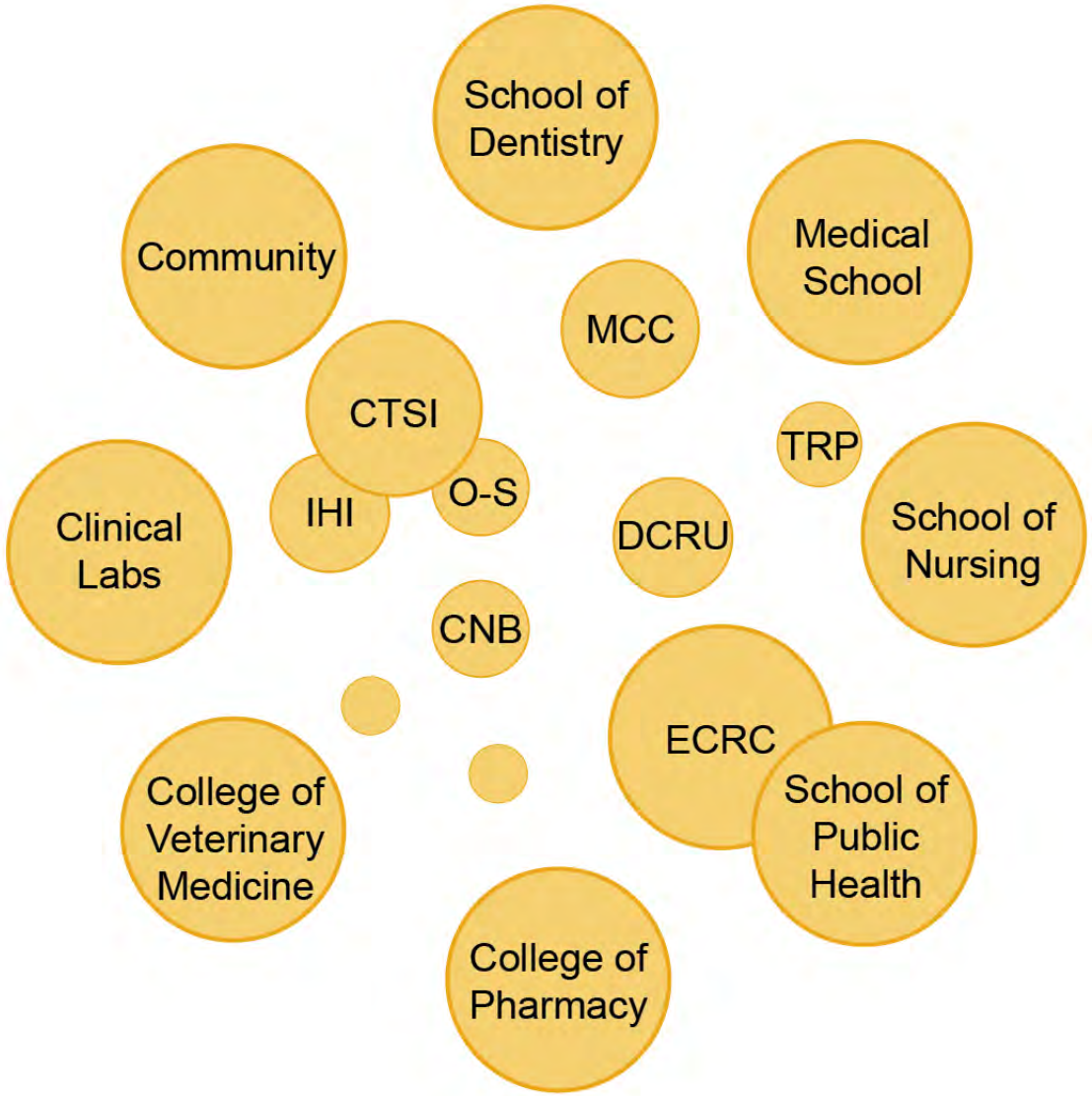
Program Elements



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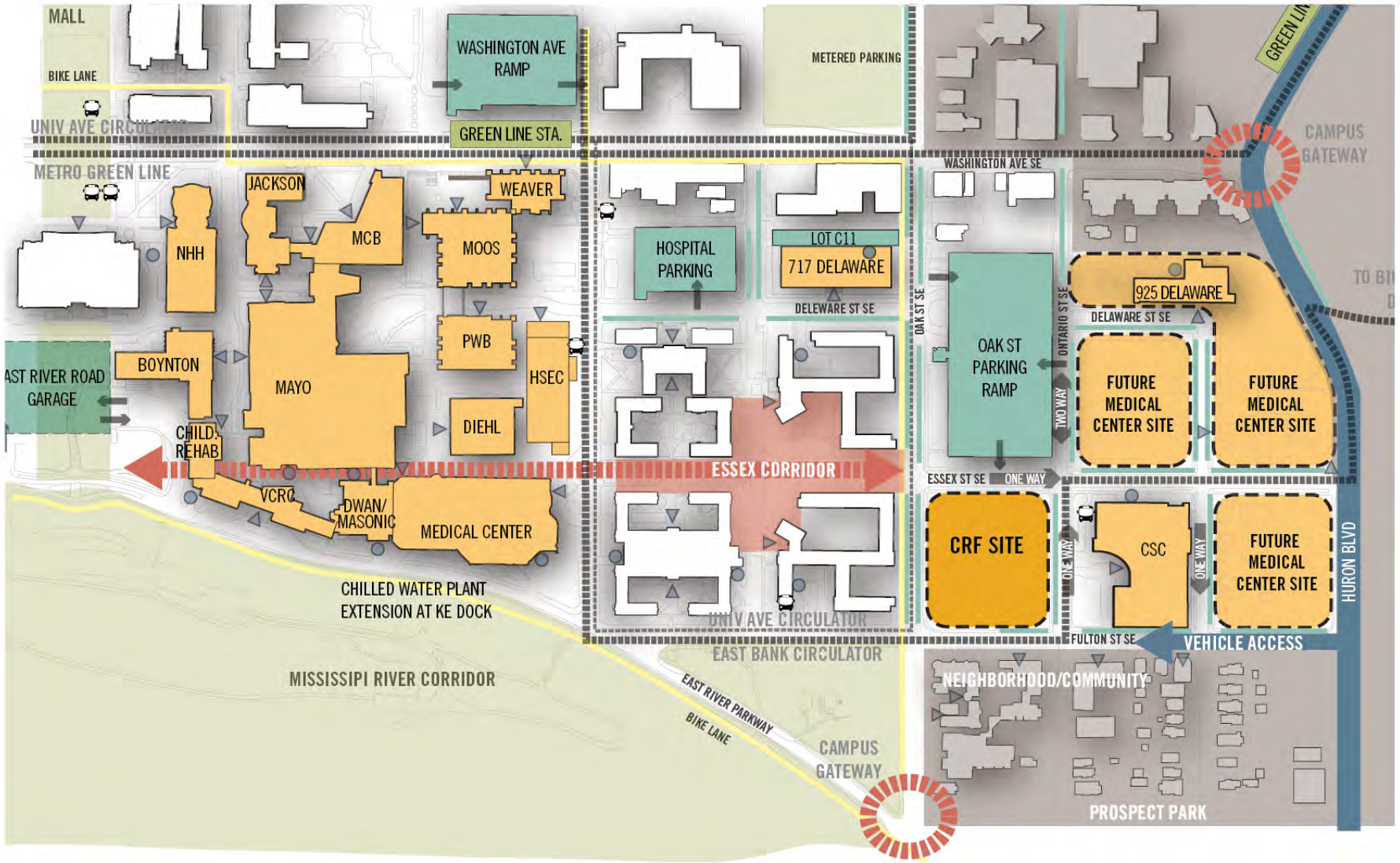
Existing Site Campus Diagram



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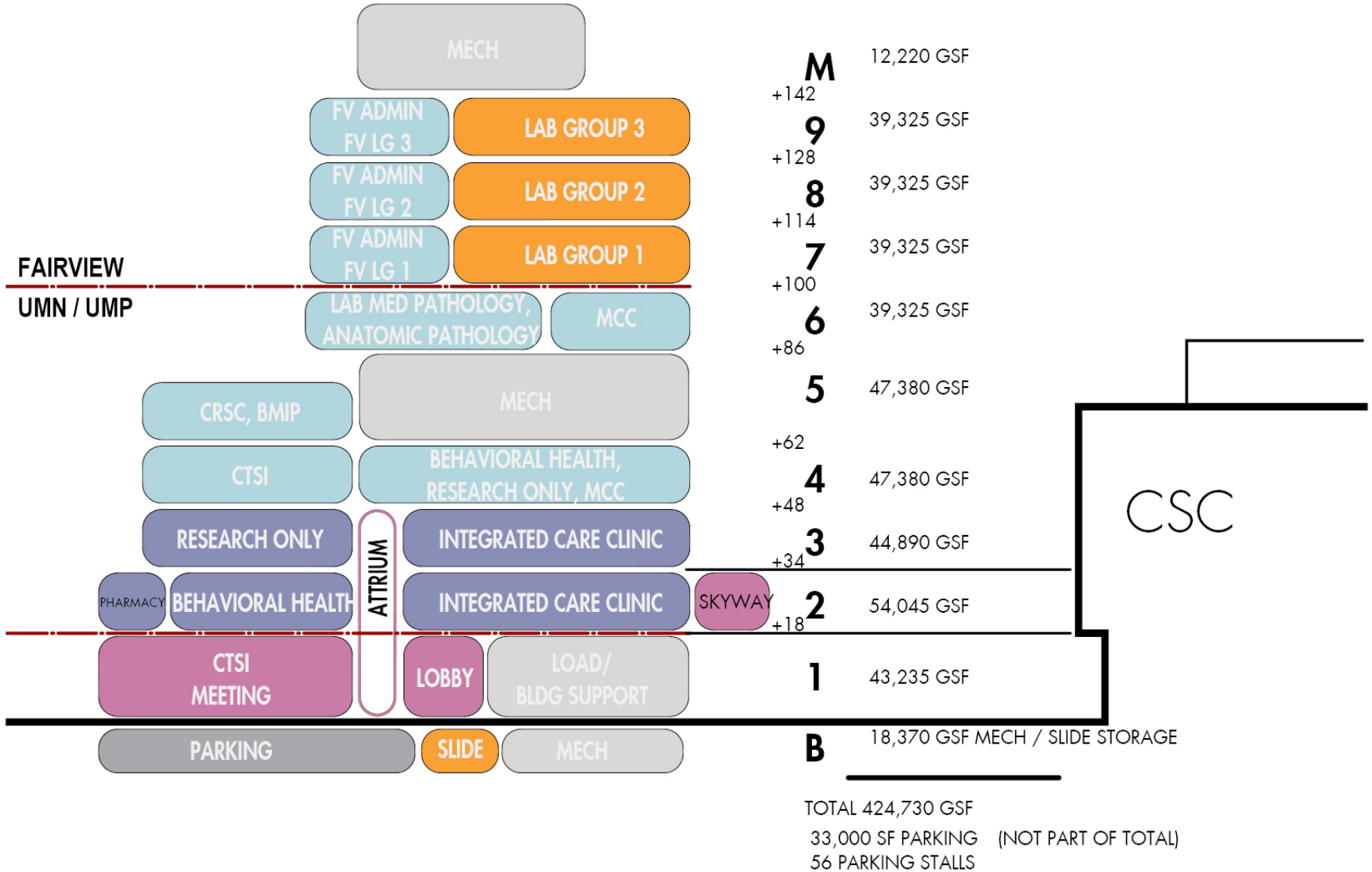
Building Section and Program Stack



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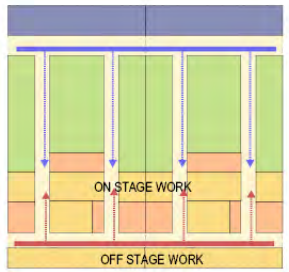
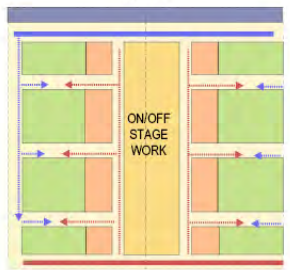
Organizing Principles: Modules

Clinical Modules



10 EXAM
1 PROCURE
+SUPPORT



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1 PROCURE
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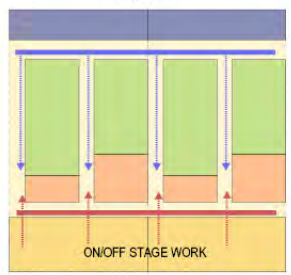
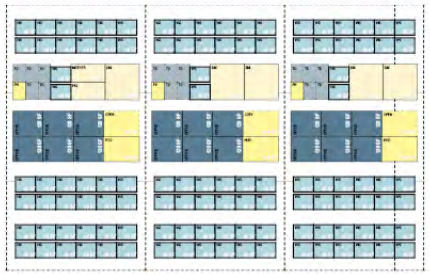
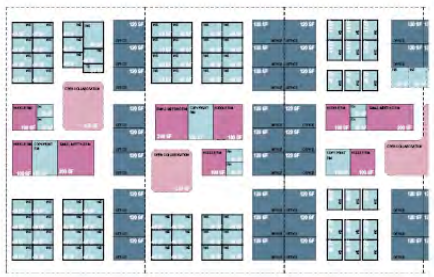
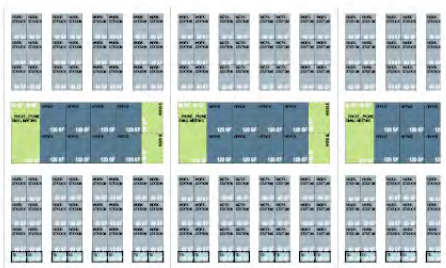


10 EXAM
1 PROCURE
+SUPPORT

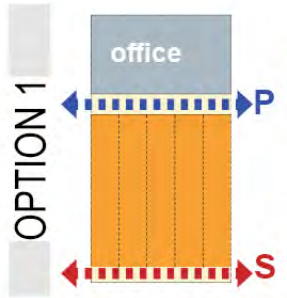
Office Modules

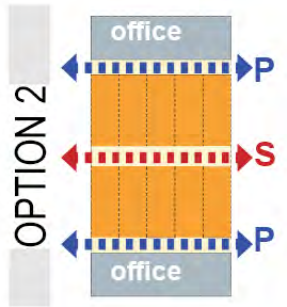


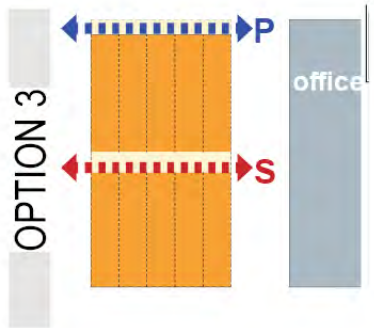




Lab Modules







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Site Access for Vehicles and Pedestrians (View from Southeast)

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Site Access for Vehicles and Pedestrians (View from Northwest)

Images: Ray Wenderlich, Fred Seibert

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Team Effort for High Performance

Energy and Atmosphere

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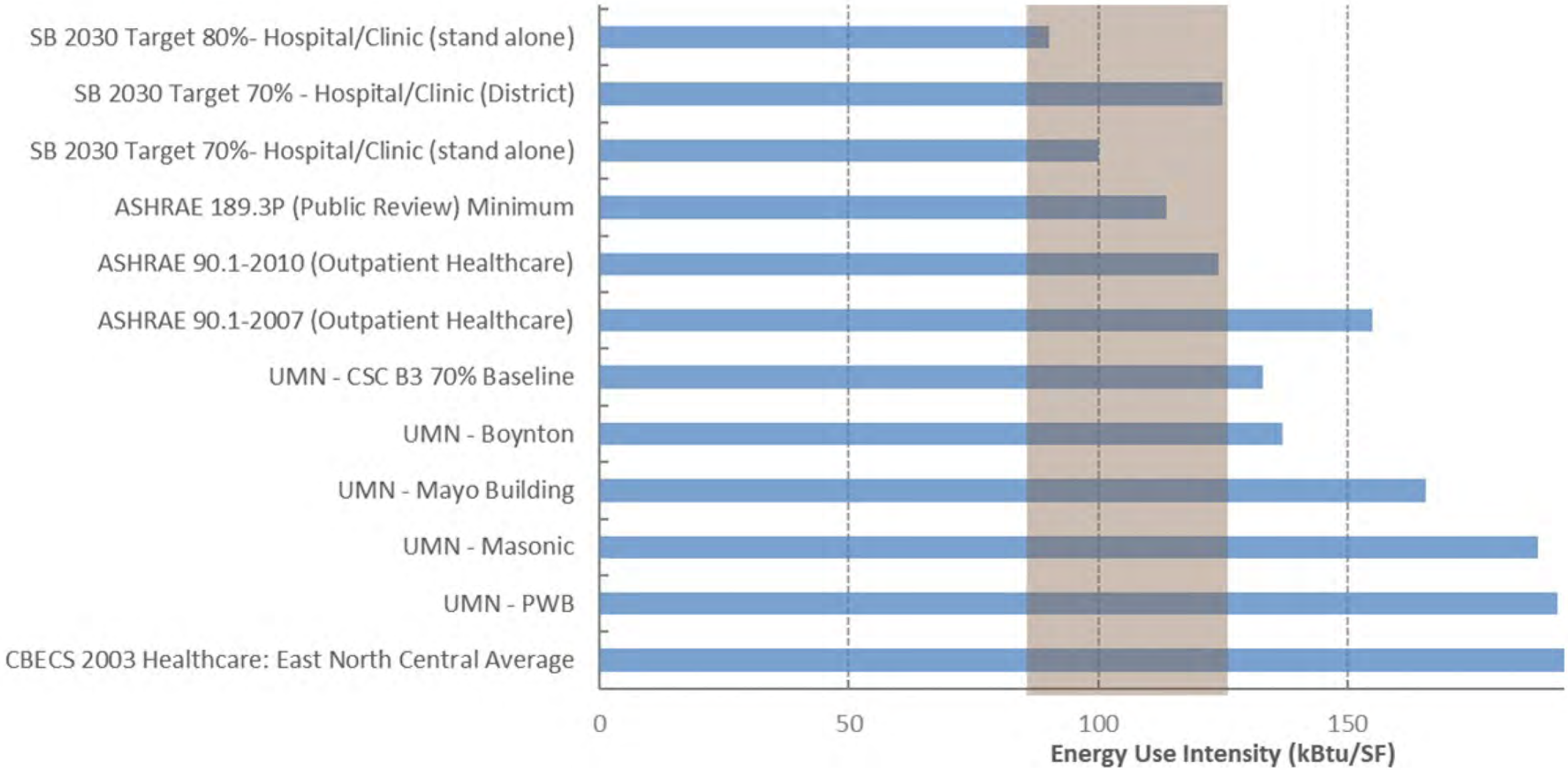
Energy Use Intensity



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SB 2030 Energy Standard

Predesign
Energy Leader

PD | D | FD | CO

E.1 Energy Use

E1A. Meet SB 2030 Energy Standards

REQUIRED

Read The Guideline

Fields in yellow are editable. Fields in blue are calculated. Fields in gray are not applicable or disabled at this phase.

If you are requesting to use the Small Buildings Method or other alternative path please contact guidelines@b3mn.org as soon as possible to begin the review process to verify specific path requirements and in order to enable the alternate path tracking tool entries. Data collected as part of the B3 and SB 2030 programs will be publicly accessible, including on the B3 Case Studies Database.

E1A2A. Click here to download the MN SB 2030 Compliance and Reporting Instructions

E1A3B. **Which method are you using to calculate your Energy Standard?** Energy Standard Tool

Launch the SB 2030 Standards Tool

E1A5K. **SB2030 Energy Standard**	73	kBtu/s.f./yr.

Note: Design Energy and Design Carbon Emissions values are referenced from consumption information collected in E.1D. Please provide consumption data before attempting compliance with E.1C in the Design and Final Design submissions.

E1A6. **Design Energy Use per Square Foot**	0	kBtu/s.f./yr.
E1A7. **Design Total Energy Use**	0	kBtu/yr.
E1A8E. **SB2030 Energy Standard Carbon Footprint**	17	lb.CO2e/s.f./yr
E1A8M. **Design Carbon Emissions per Square Foot**	0	lb.CO2e/s.f./yr

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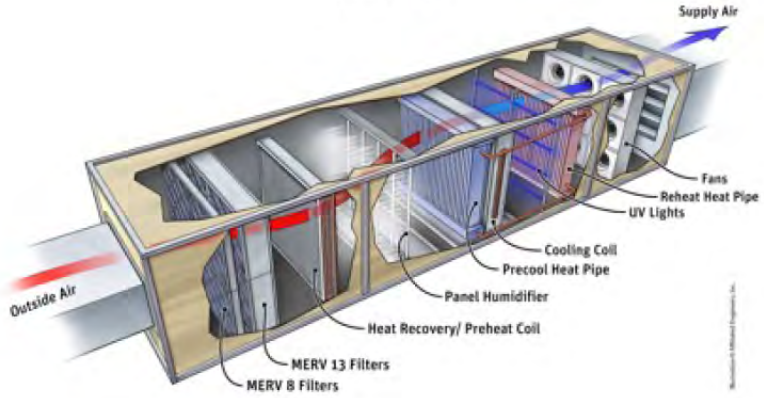
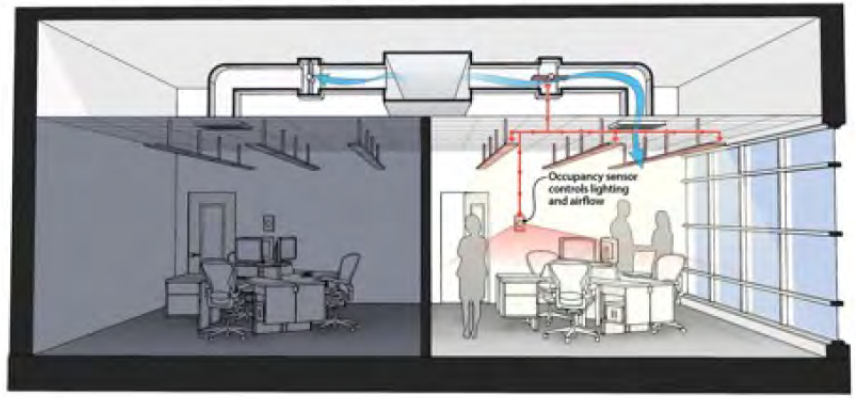
Energy Conservation Measures: HVAC Strategies

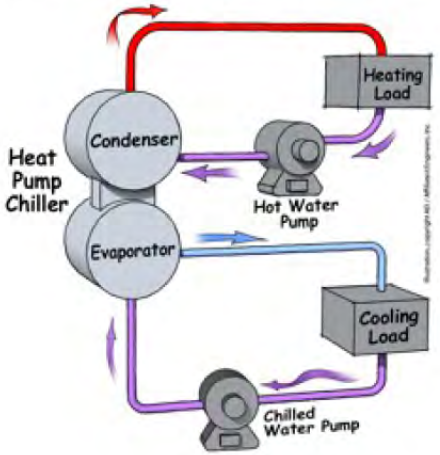
DOAS



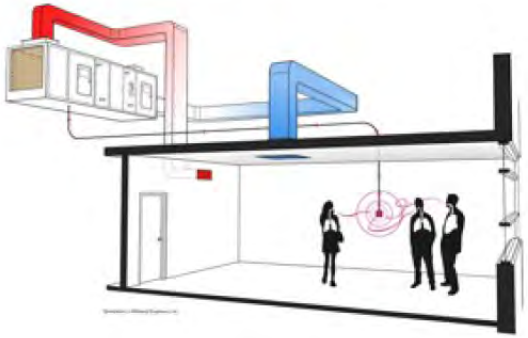
Enhanced zoning, control for occupancy



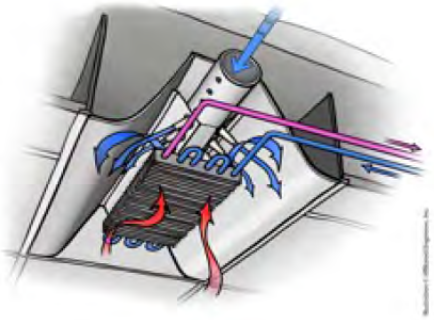
Heat Recovery Chiller



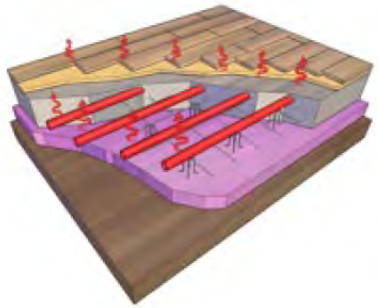
CO_2 control



Active chilled beam



Radiant slab



Chilled/heated panels or sails

Displacement Ventilation

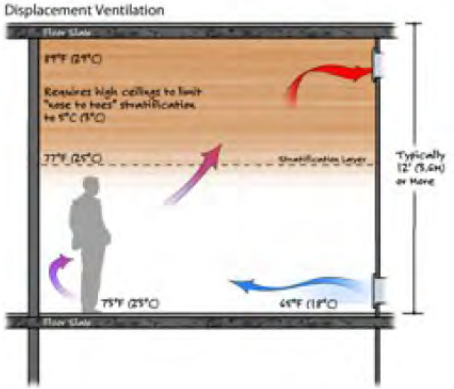


Image: Affiliated Engineers, Inc.

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Energy Conservation Measures: Energy Recovery

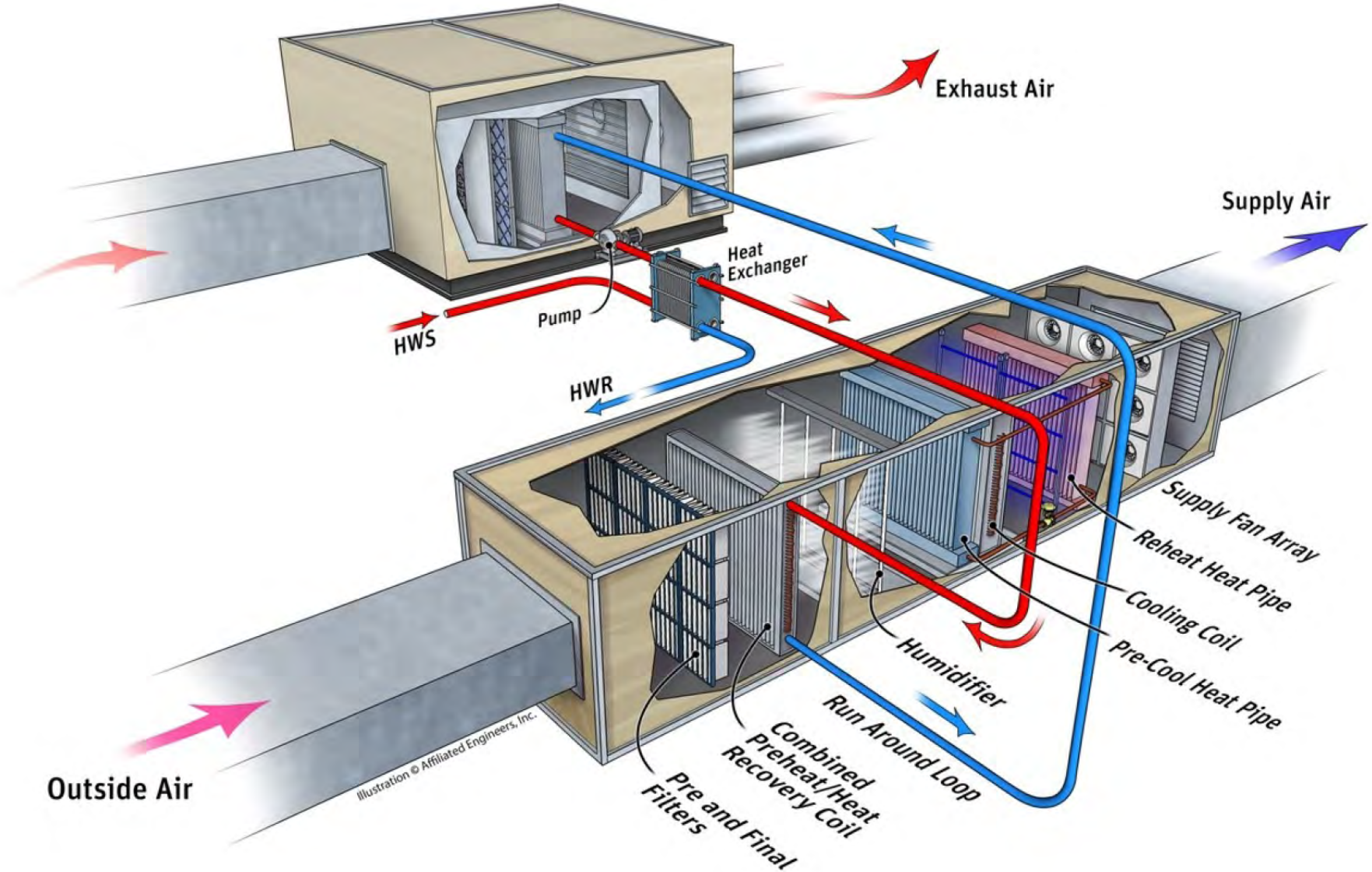

Image: Affiliated Engineers, Inc.

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Energy Conservation Measures: Run Around Loop

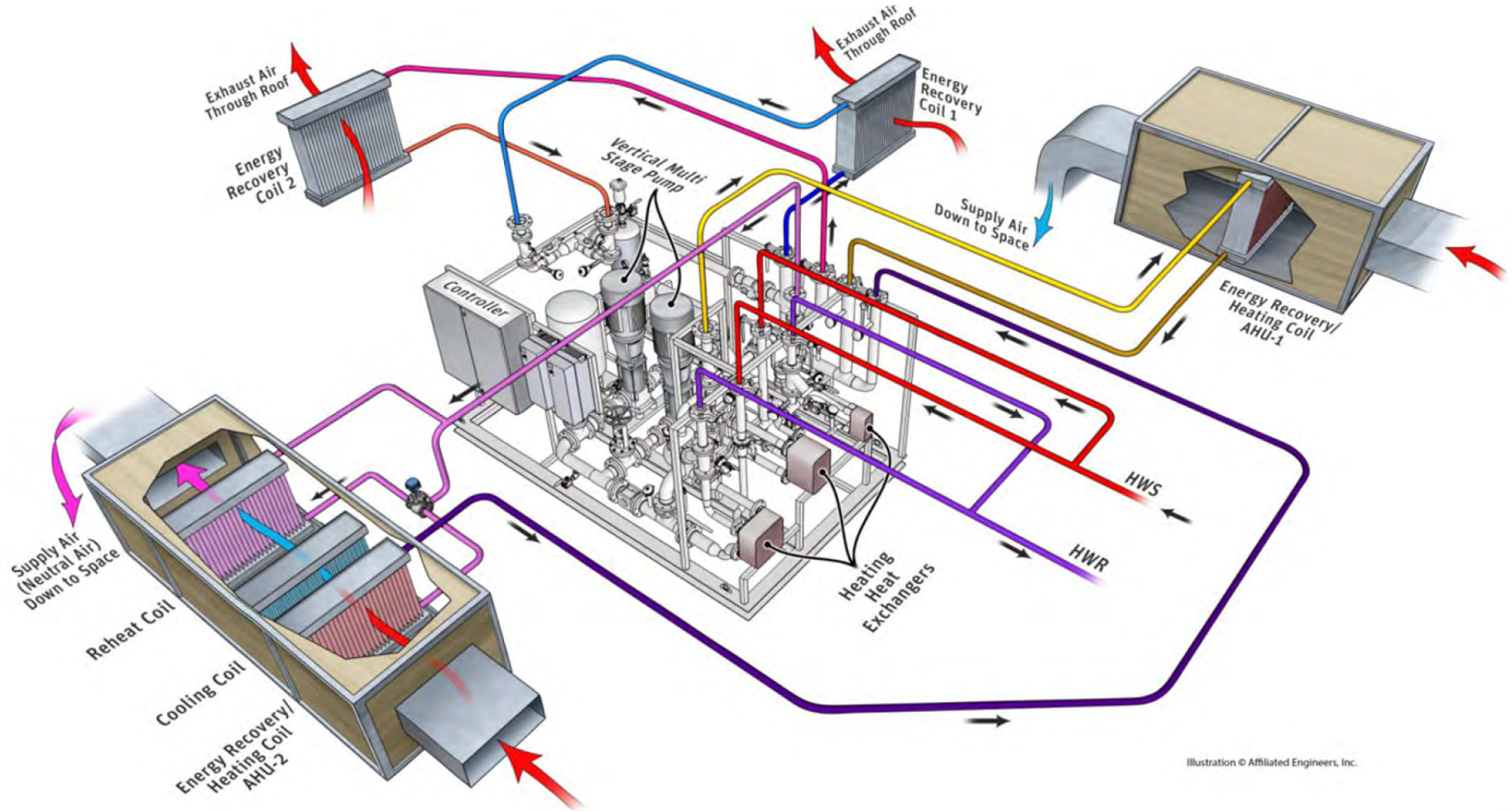

Image: Affiliated Engineers, Inc.

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Renewable Energy: UMN Solar

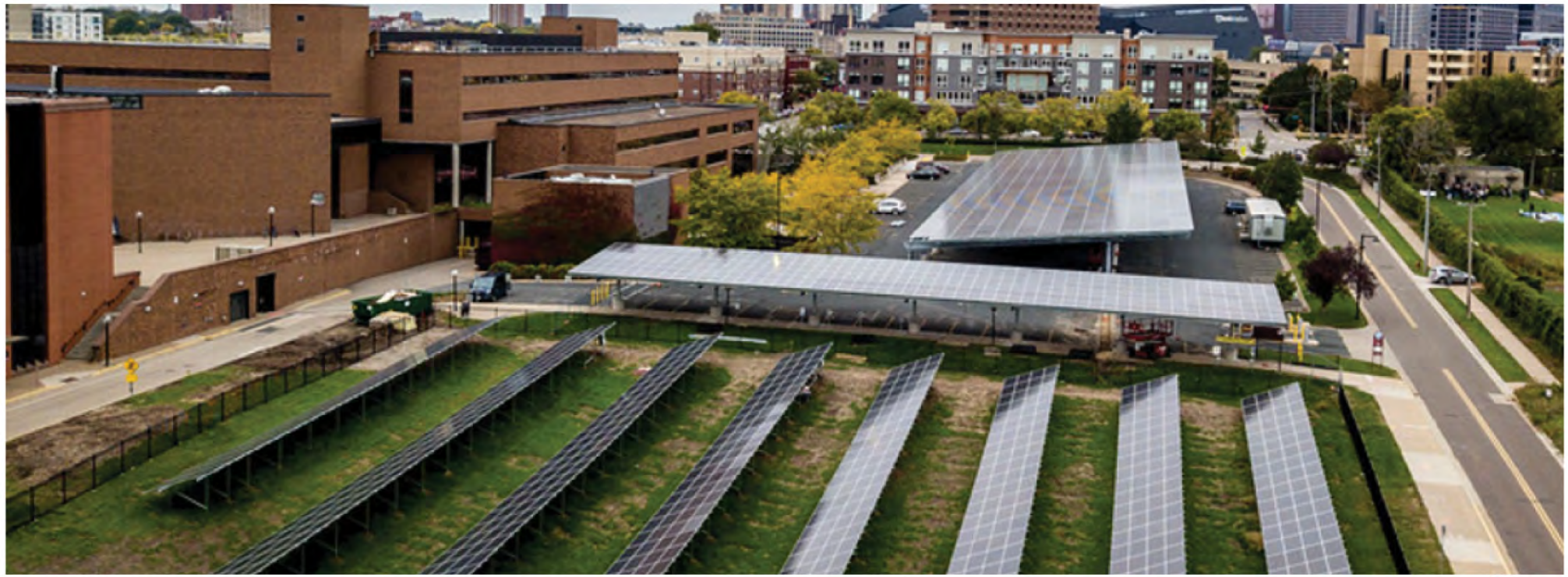

Image: Frank Jossi

Indoor Environmental Quality

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Daylighting

Image: Cancer Cardio Research Building, photo by Paul Crosby

Site and Water

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Future Land Use: 30 Year Horizon

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Stormwater Management

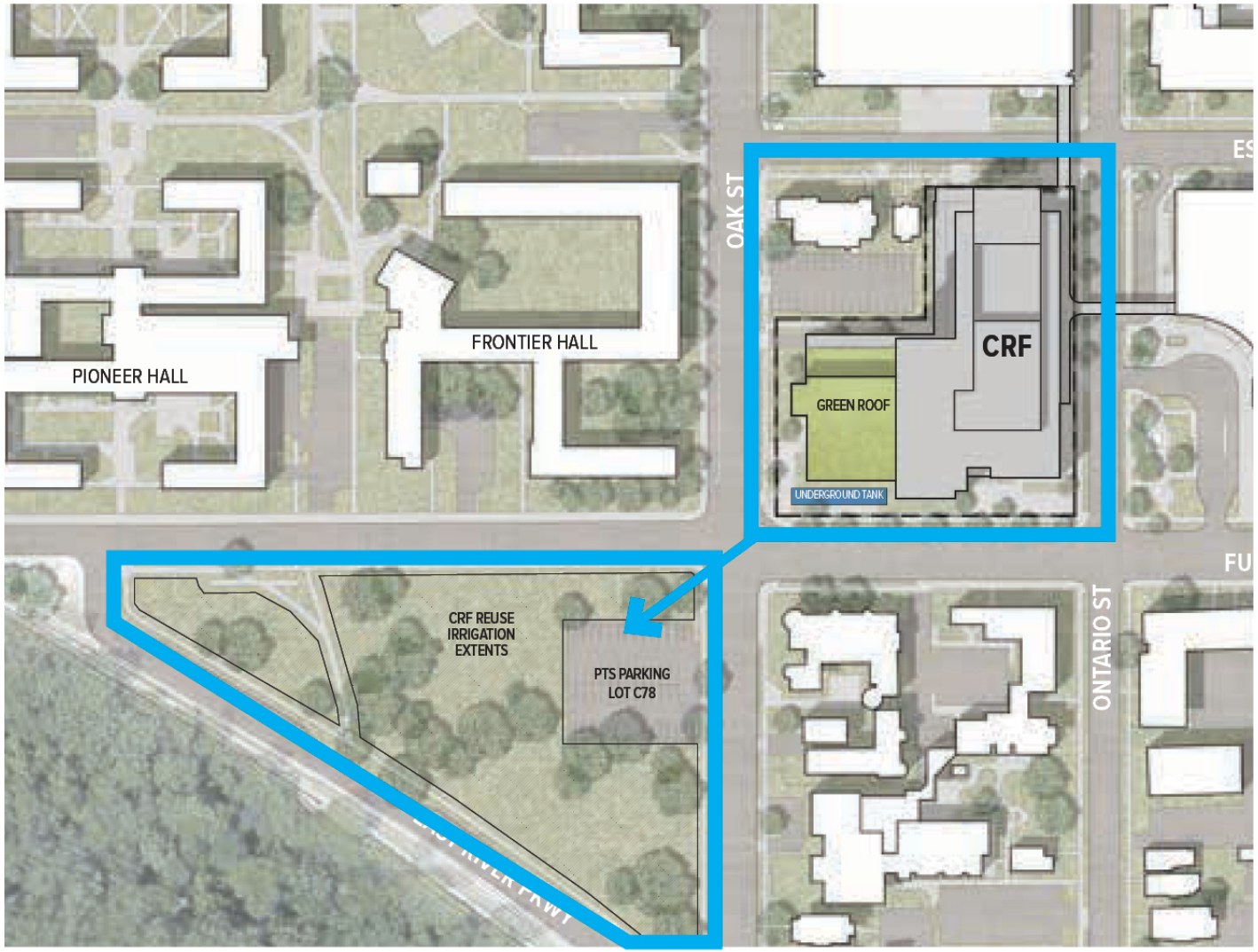

Image: Minneapolis Central Library, photo by Kestral Design Group

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Mississippi Flyway

Rufa Red Knot

Mississippi Flyway

Piping Plover

Images: Perky Pet, USFWS

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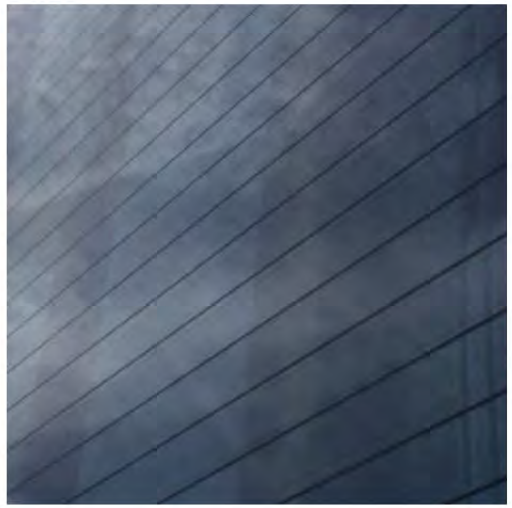
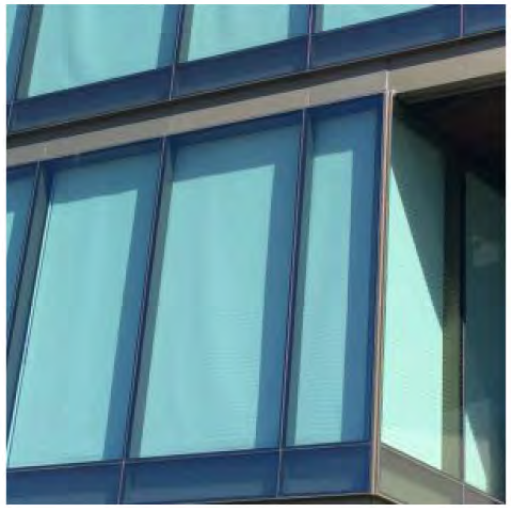
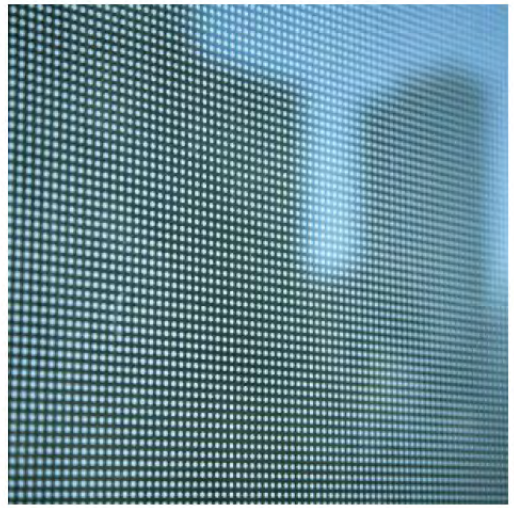
Bird Safe Glazing


Images: Viracon

What's Next

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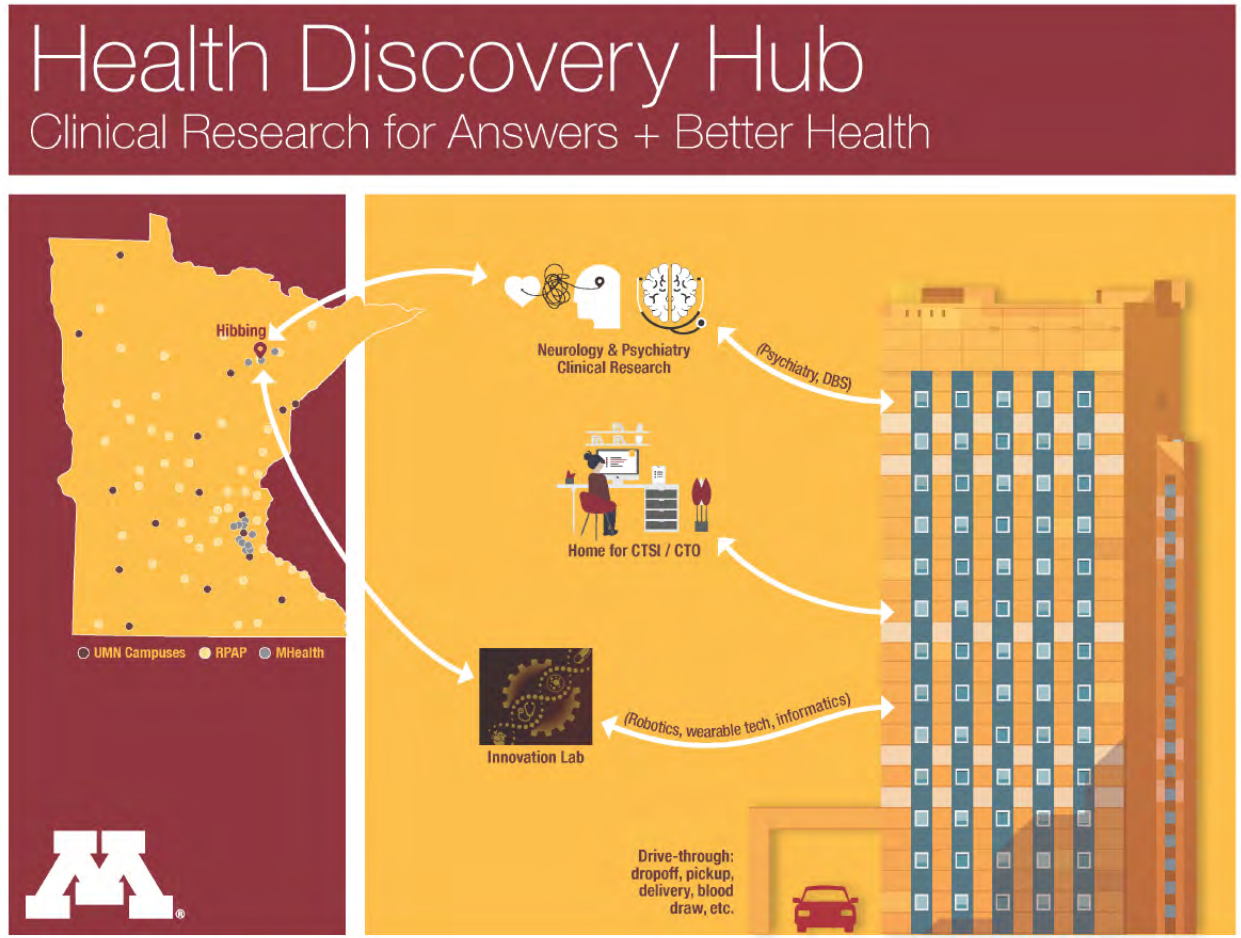
Existing Site Campus Diagram



Thank you to the University of Minnesota
Thank you to our partner ZGF and the entire team:

AEI
EVS
Damon Faber
MBJ
Walker Consultants
4RM+ULA
Kvernstoen, Rönnholm & Assoc.
Lerch Bates
Rippe Associates

LHB
PERFORMANCE DRIVEN DESIGN.

CommonBond Highland Bridge

Matthew Finn, AIA

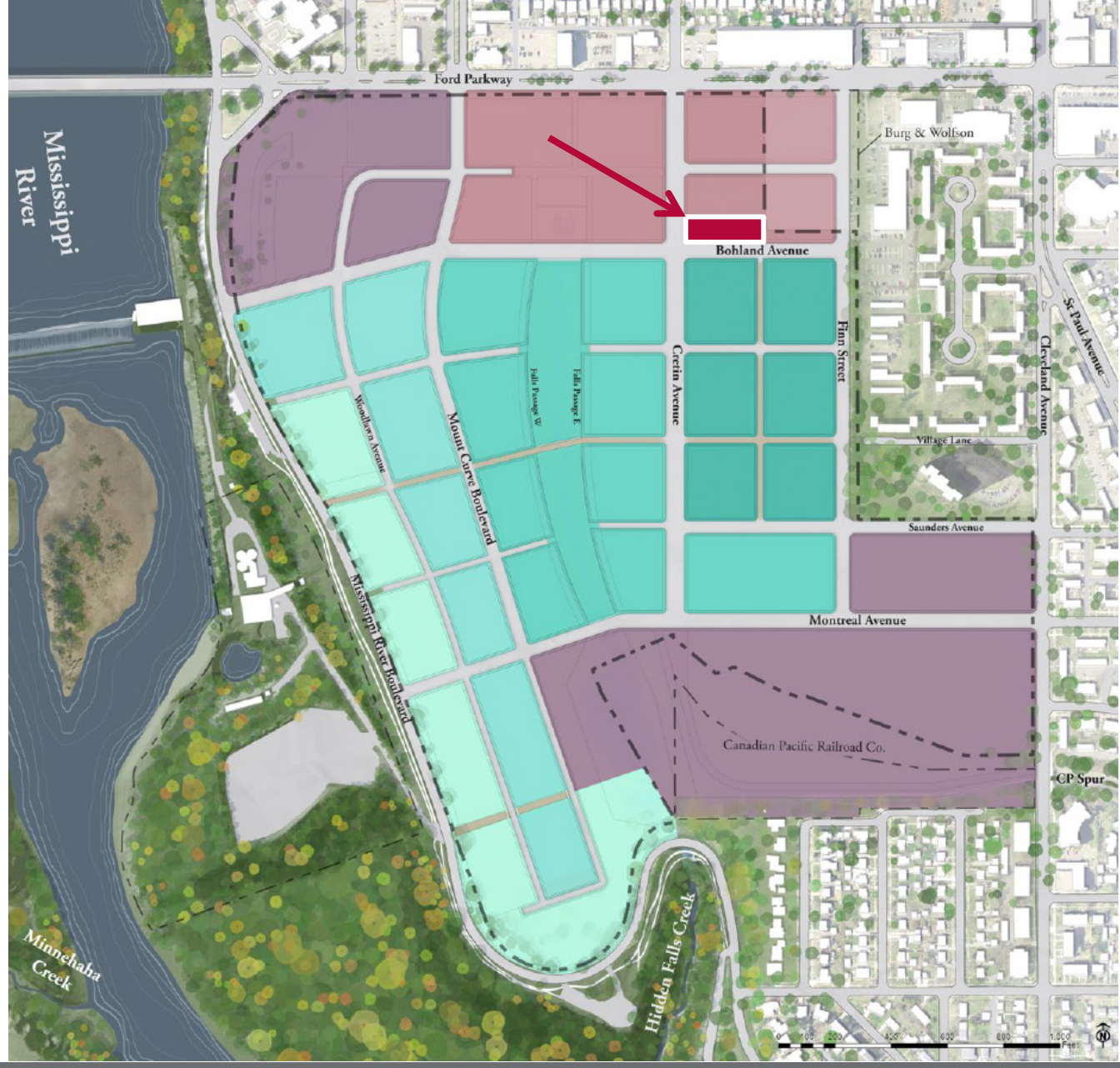
Highland Bridge Plan

Walkable neighborhood

Commercial corridor

River access

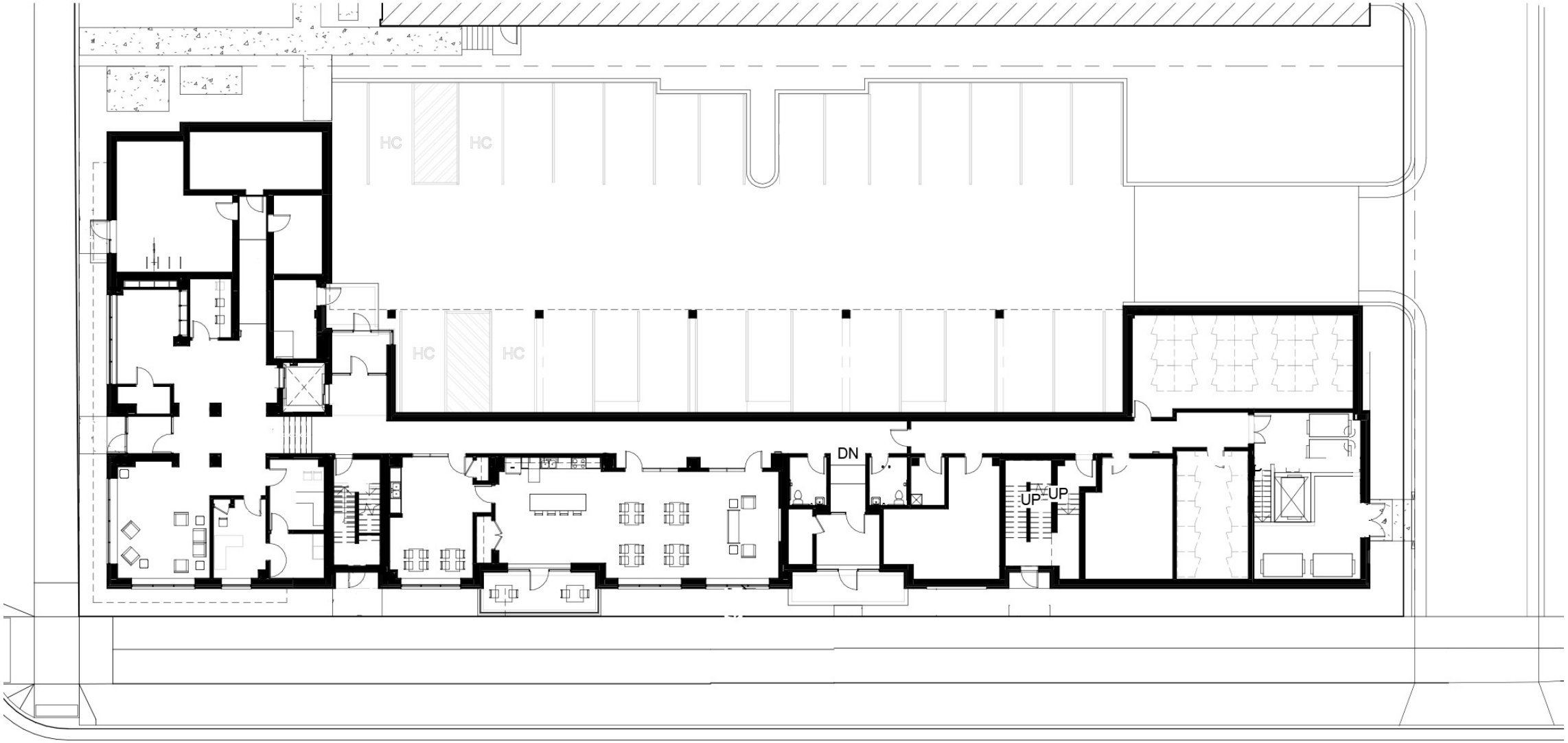
New public park



PROJECT TEAM

Owner:	CommonBond
Architect:	LHB
MEP engineer:	Cain Thomas
Energy model:	Cain Thomas
General Contractor:	Ryan Companies
EDA program:	Willdan
SB 2030 support:	CSBR, w/ CEE

Rendering by Ryan Companies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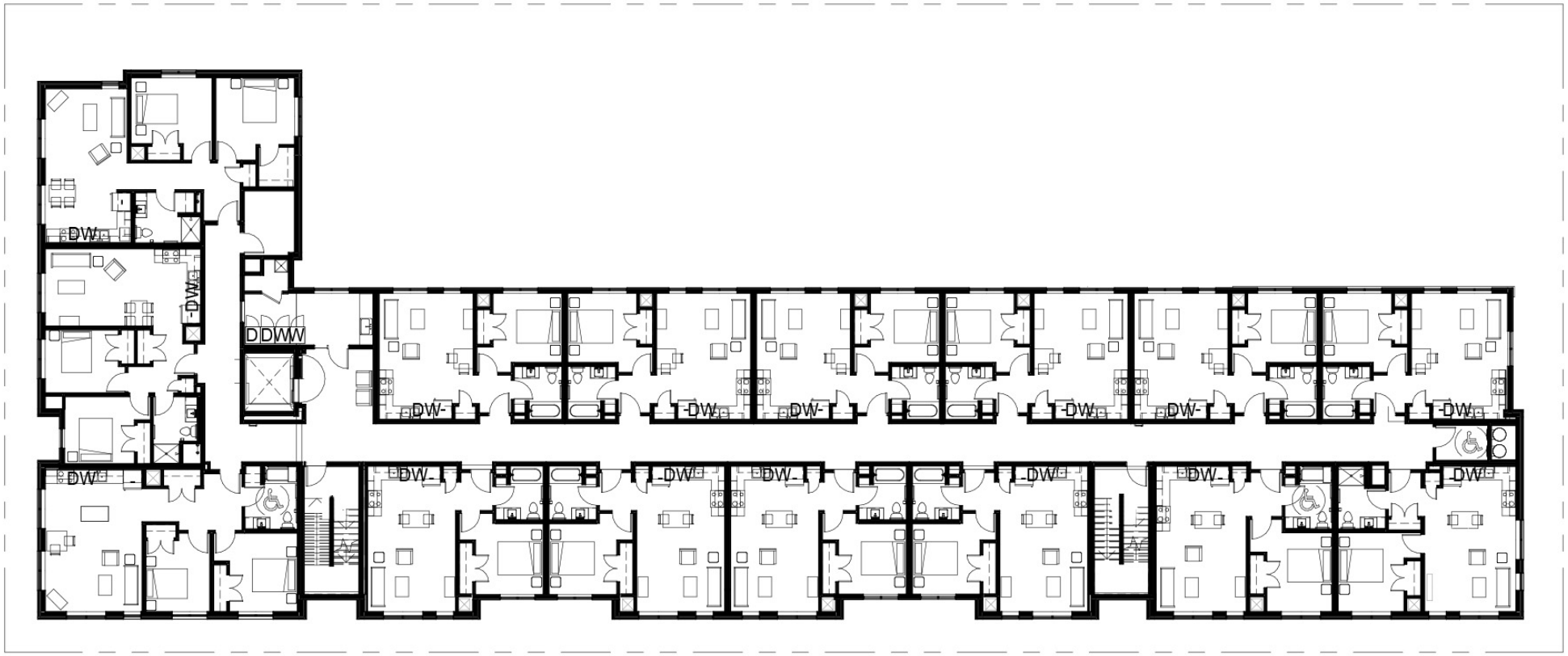
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APPROACH

Strategies identified for analysis:

Continuous insulation

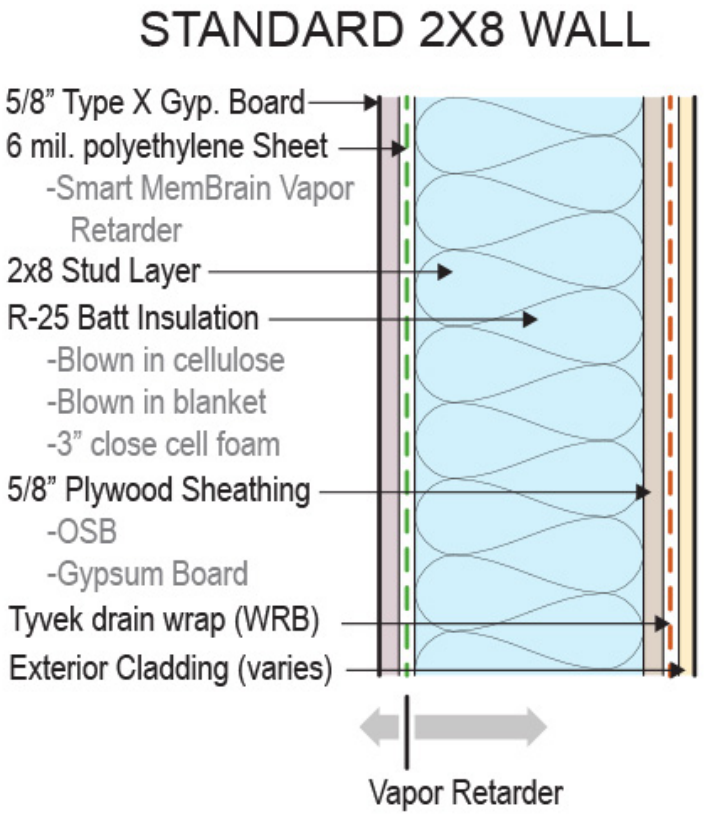
Increased roof insulation

Window U-factor

Enhanced efficiency HVAC

Photo voltaic array

VERIFICATION



Continuous insulation

Baseline: 2x8 w/ batts

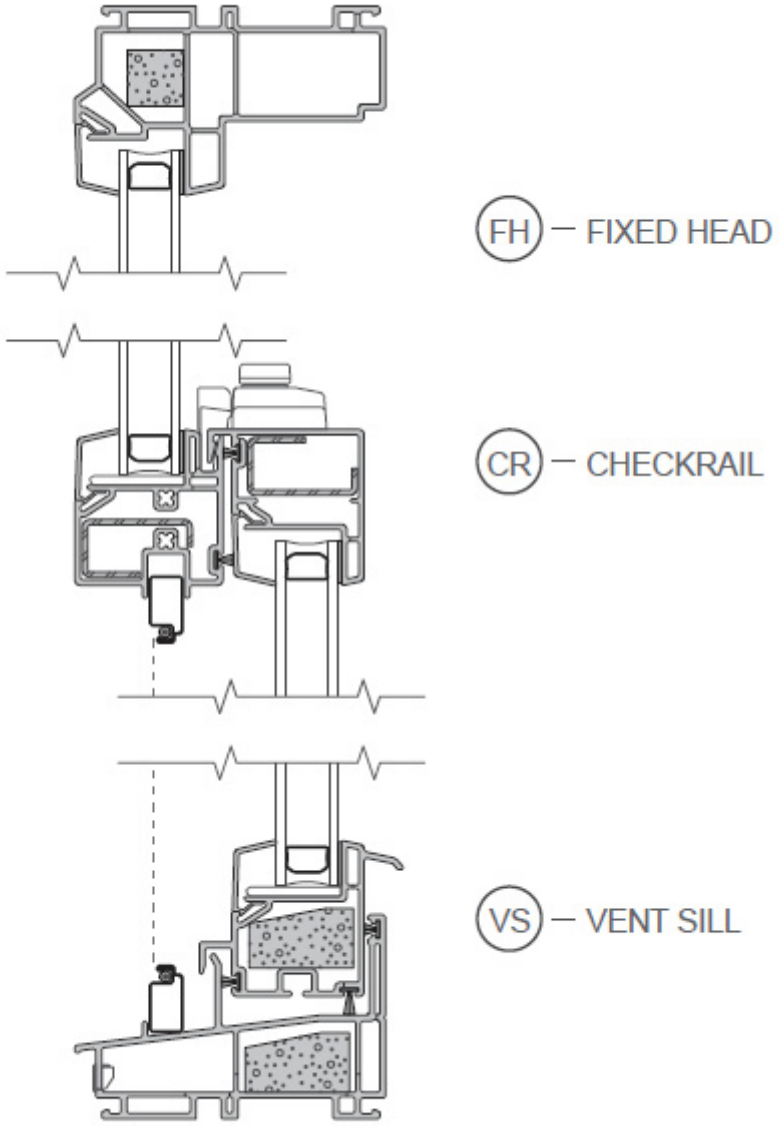
Enhanced: 3" mineral wool over 2x8 w/ batts

Roof insulation

Baseline: R-40

Enhanced: R-50

VERIFICATION



Window performance

Triple pane

U	0.22
SHGC	0.44

Double pane

U	0.27
SHGC	0.28

VERIFICATION

Enhanced efficiency HVAC in dwelling units

VRF, DOAS with full energy recovery

Magic pak

Air-source heat-pump with backup electric radiant

2-pipe fan coil fed by boiler and split dx cooling

VERIFICATION

Photovoltaic array on roof

40kw

Matched common area loading

Payback:

11 years with tax incentive

16 years without tax incentive

Envelope strategies

Windows:

Energy star for northern climates

U = 0.27, SHGC = 0.28

Walls

U = 0.051, code compliant 2x8 w/ batts in cavity

Roof

R-50 average, all above vapor barrier

Glass Thickness	Type of Glazing	NFRC Certified Product #	Glass (mm) Ext.	Glass (mm) Int.	Gap Fill	Performance Values[1] U-Factor	SHGC	VLT	CR	Shaded Areas Meet ENERGY STAR® Performance Criteria in Zones Shown U.S. Zone N	NC	SC	S	Canada[2] ER	Canada[2] Zone CA
Vent															
11/16"	Clear IG	PEL-N-102-00822-00001	2.5	2.5	Air	0.48	0.59	0.62	43						
	with grilles-between-the-glass	PEL-N-102-00822-00002				0.48	0.53	0.55	43						
11/16"	Clear IG	PEL-N-102-00822-00003	3	3	Air	0.48	0.59	0.62	43						
	with grilles-between-the-glass	PEL-N-102-00822-00004				0.48	0.53	0.55	43						
11/16"	Advanced Low-E IG	PEL-N-102-00853-00001	2.5	2.5	Argon	0.31	0.28	0.53	57						
	with grilles-between-the-glass	PEL-N-102-00853-00002				0.31	0.26	0.47	57						
11/16"	Advanced Low-E IG	PEL-N-102-00853-00003	3	3	Argon	0.31	0.28	0.53	57						
	with grilles-between-the-glass	PEL-N-102-00853-00004				0.31	0.26	0.47	57						
11/16"	SunDefense™ IG	PEL-N-102-00867-00001	2.5	2.5	Argon	0.30	0.21	0.49	57		NC	SC	S		
	with grilles-between-the-glass	PEL-N-102-00867-00002				0.30	0.19	0.43	57		NC	SC	S		
11/16"	SunDefense™ IG	PEL-N-102-00867-00003	3	3	Argon	0.30	0.21	0.49	57		NC	SC	S		
	with grilles-between-the-glass	PEL-N-102-00867-00004				0.30	0.19	0.43	57		NC	SC	S		
11/16"	AdvancedComfort Low-E IG	PEL-N-102-00879-00001	2.5	2.5	Argon	0.27	0.28	0.52	46	N	NC				
	with grilles-between-the-glass	PEL-N-102-00879-00002				0.27	0.25	0.46	46	N	NC	SC	S		
11/16"	AdvancedComfort Low-E IG	PEL-N-102-00879-00003	3	3	Argon	0.27	0.28	0.52	46	N	NC				
	with grilles-between-the-glass	PEL-N-102-00879-00004				0.27	0.25	0.46	46	N	NC	SC	S		
11/16"	NaturalSun Low-E IG	PEL-N-102-00841-00001	2.5	2.5	Argon	0.32	0.52	0.60	57						
	with grilles-between-the-glass	PEL-N-102-00841-00002				0.32	0.47	0.53	57						
11/16"	NaturalSun Low-E IG	PEL-N-102-00841-00003	3	3	Argon	0.32	0.52	0.60	57						
	with grilles-between-the-glass	PEL-N-102-00841-00004				0.32	0.47	0.53	57						
Vent – with Foam Insulation															
11/16"	Advanced Low-E IG	PEL-N-102-00927-00001	2.5	2.5	Argon	0.28	0.28	0.53	58		NC				
	with grilles-between-the-glass	PEL-N-102-00927-00002				0.28	0.26	0.47	58		NC				
11/16"	Advanced Low-E IG	PEL-N-102-00927-00003	3	3	Argon	0.28	0.28	0.53	58		NC				
	with grilles-between-the-glass	PEL-N-102-00927-00004				0.28	0.26	0.47	58		NC				
11/16"	SunDefense IG	PEL-N-102-00941-00001	2.5	2.5	Argon	0.28	0.21	0.49	58		NC	SC	S		
	with grilles-between-the-glass	PEL-N-102-00941-00002				0.28	0.19	0.43	58		NC	SC	S		
11/16"	SunDefense IG	PEL-N-102-00941-00003	3	3	Argon	0.28	0.21	0.49	58		NC	SC	S		
	with grilles-between-the-glass	PEL-N-102-00941-00004				0.28	0.19	0.43	58		NC	SC	S		
11/16"	AdvancedComfort Low-E IG	PEL-N-102-00953-00001	2.5	2.5	Argon	0.24	0.28	0.52	46	N	NC				
	with grilles-between-the-glass	PEL-N-102-00953-00002				0.24	0.25	0.46	46	N	NC	SC	S		
11/16"	AdvancedComfort Low-E IG	PEL-N-102-00953-00003	3	3	Argon	0.24	0.28	0.52	46	N	NC				
	with grilles-between-the-glass	PEL-N-102-00953-00004				0.24	0.25	0.46	46	N	NC	SC	S		
11/16"	NaturalSun Low-E IG	PEL-N-102-00915-00001	2.5	2.5	Argon	0.29	0.52	0.60	57	N					
	with grilles-between-the-glass	PEL-N-102-00915-00002				0.29	0.47	0.53	57	N					
11/16"	NaturalSun Low-E IG	PEL-N-102-00915-00003	3	3	Argon	0.29	0.52	0.60	57	N					
	with grilles-between-the-glass	PEL-N-102-00915-00004				0.29	0.47	0.53	57	N					

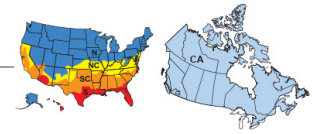
R-Value = 1/U-Factor
SHGC = Solar Heat Gain Coefficient
VLT % = Visible Light Transmission
CR = Condensation Resistance
ER = Canadian Energy Rating

(1) Glazing performance values are calculated based on NFRC 100, NFRC 200 and NFRC 500. ENERGY STAR® values are updated to 2016 (Version 6) criteria.

(2) The values shown are based on Canada's updated ENERGY STAR® 2020 initiative.

For center-glass values, see the Product Performance section.

See the Product Performance section for more detailed information or visit www.energystar.gov for Energy Star guidelines.



Mechanical strategies

All-electric dwelling unit HVAC

Terminal equipment: Fan coil

Heating: Air-source heat-pump, electric radiant

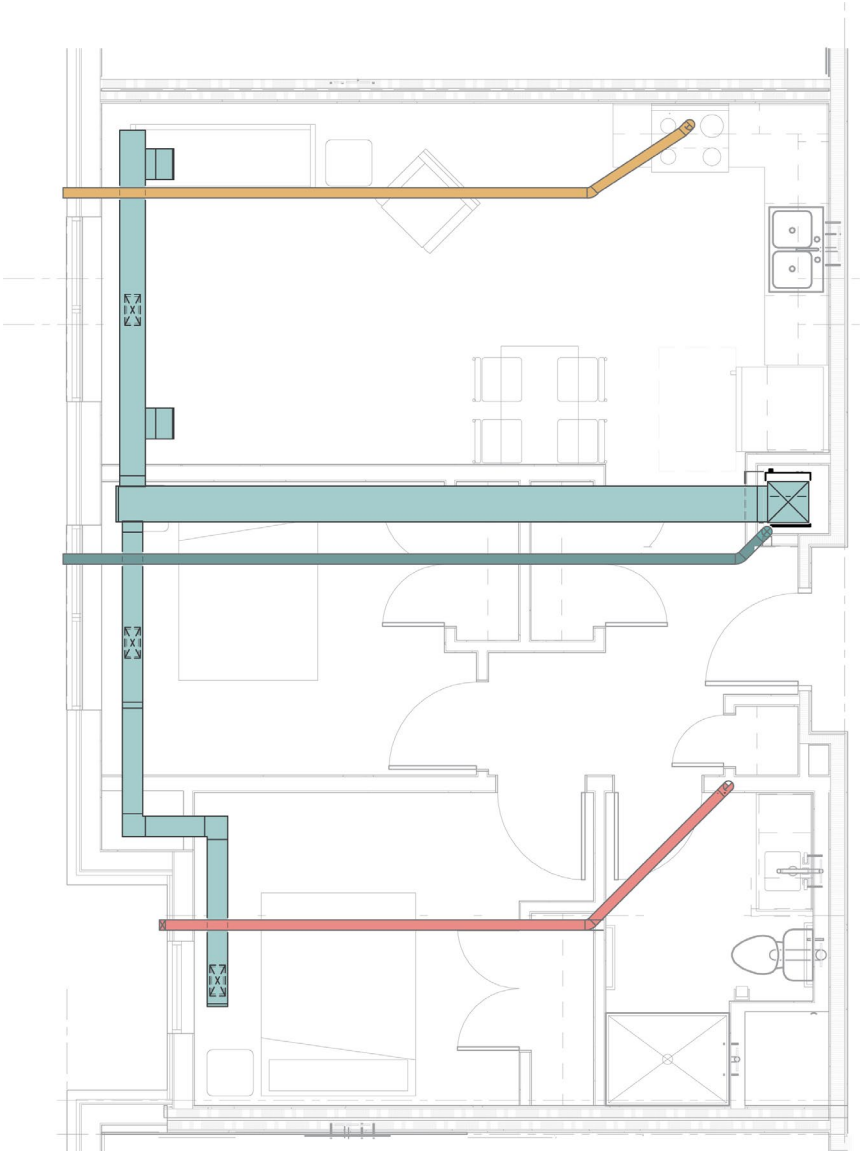
Cooling: Air-source heat-pump

Fresh air: Duct from exterior into return air

Exhaust: Ducted range hood & bath exhaust

Common area HVAC:

High efficiency gas furnaces, High-SEER dx cooling, Electric unit heaters



Electrical & Plumbing strategies

Hot water:

95 eff. Gas-fired domestic water heaters, very low flow fixtures throughout

Lighting:

All LED fixtures

Occupancy sensors

Appliances:

Energy star appliances

Balance: efficiency, renewables, REC's

12-year payback

Fan-coil, standard wall, double-pane window

On-site renewables

Very close, 15 years without tax incentives, 10 years with.

PV ready, with an alternate written into documents

Renewable energy credits

Estimated at roughly $20,000

20 kbtu/sf/year delta (42 proposed, 22 target)

Past projects | Looking forward

HVAC:

Still see plenty of HE magic paks, the system here shows a lot of promise.

Envelope:

Typical 4-story projects with Minnesota Housing funding will be required to use continuous insulation in 2022.

Renewables:

We were seeing some PV; commodities market is chewing up contingency funding.

Dorothy Day Place:

Very different, larger, large open spaces, mixed program, district energy, full ERV, chilled beams, all continuous insulation.

Stryker Apartments:

Very similar, 3 fan coils / condenser, owner-paid electric utility, commercial elec rate

Simpson:

Similar size, very different program, mixed program, pursuing funding for geothermal with every finger and toe crossed

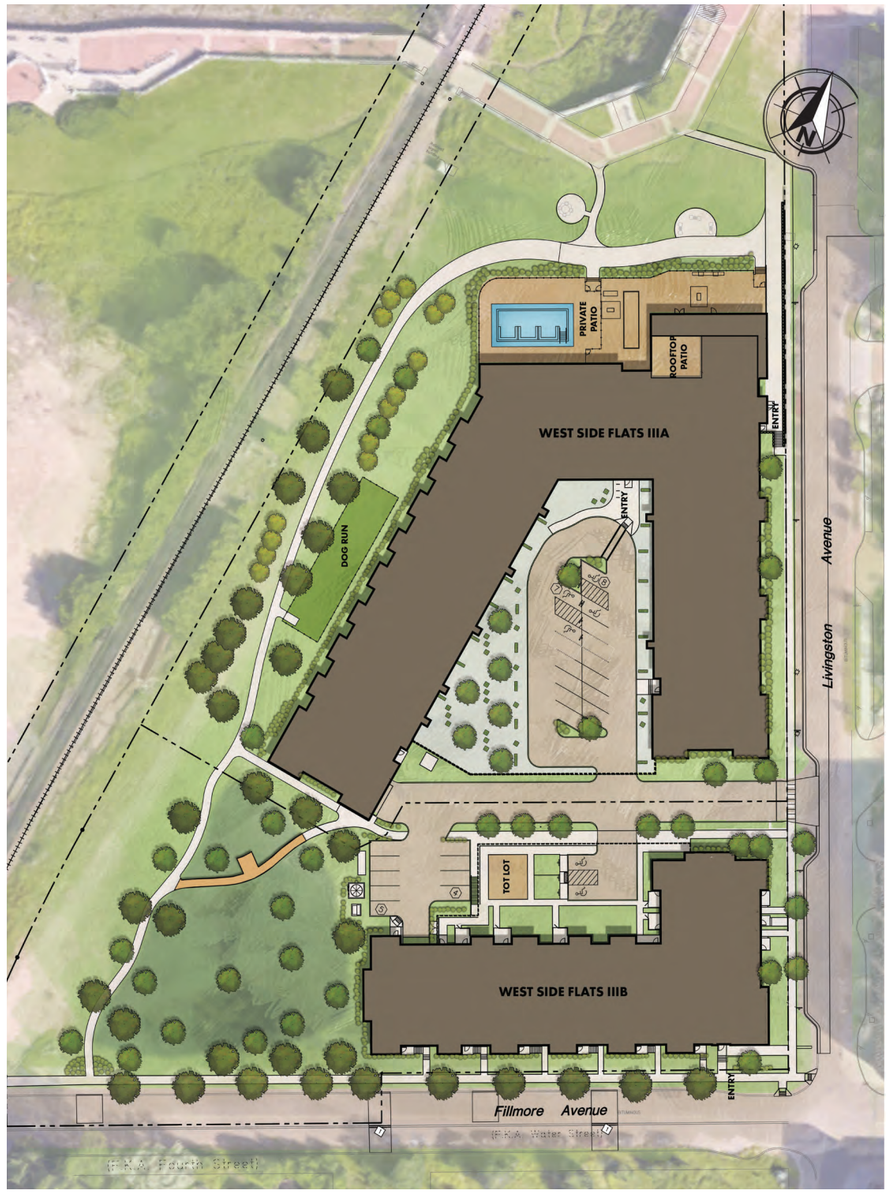
precipitate
ARCHITECTURE | PLANNING RESEARCH

Pathways to SB2030

lessons from west side flats, st. paul, minnesota

A'21MN Conference
November 11, 2021

site plan




1-866-GET-Duke
TRANS CUBE
1202
FRANA

passive house methodology (phius)

PASSIVE STRATEGIES
REDUCE ENERGY DEMAND

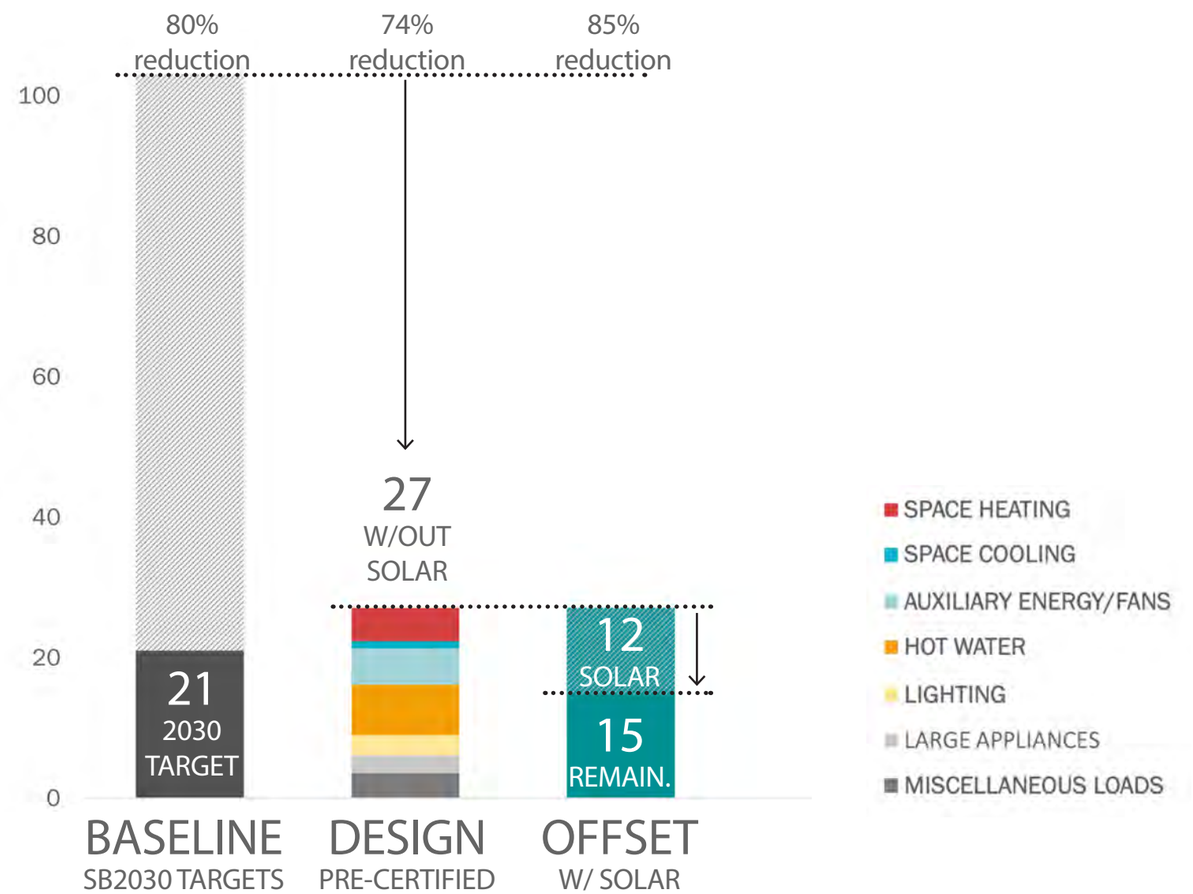
Airtight Envelope
Super Insulated / Thermal Bridge Free
High Performance Windows & Doors

Energy Recovery
Efficient Systems

ACTIVE STRATEGIES
MEET ENERGY DEMAND

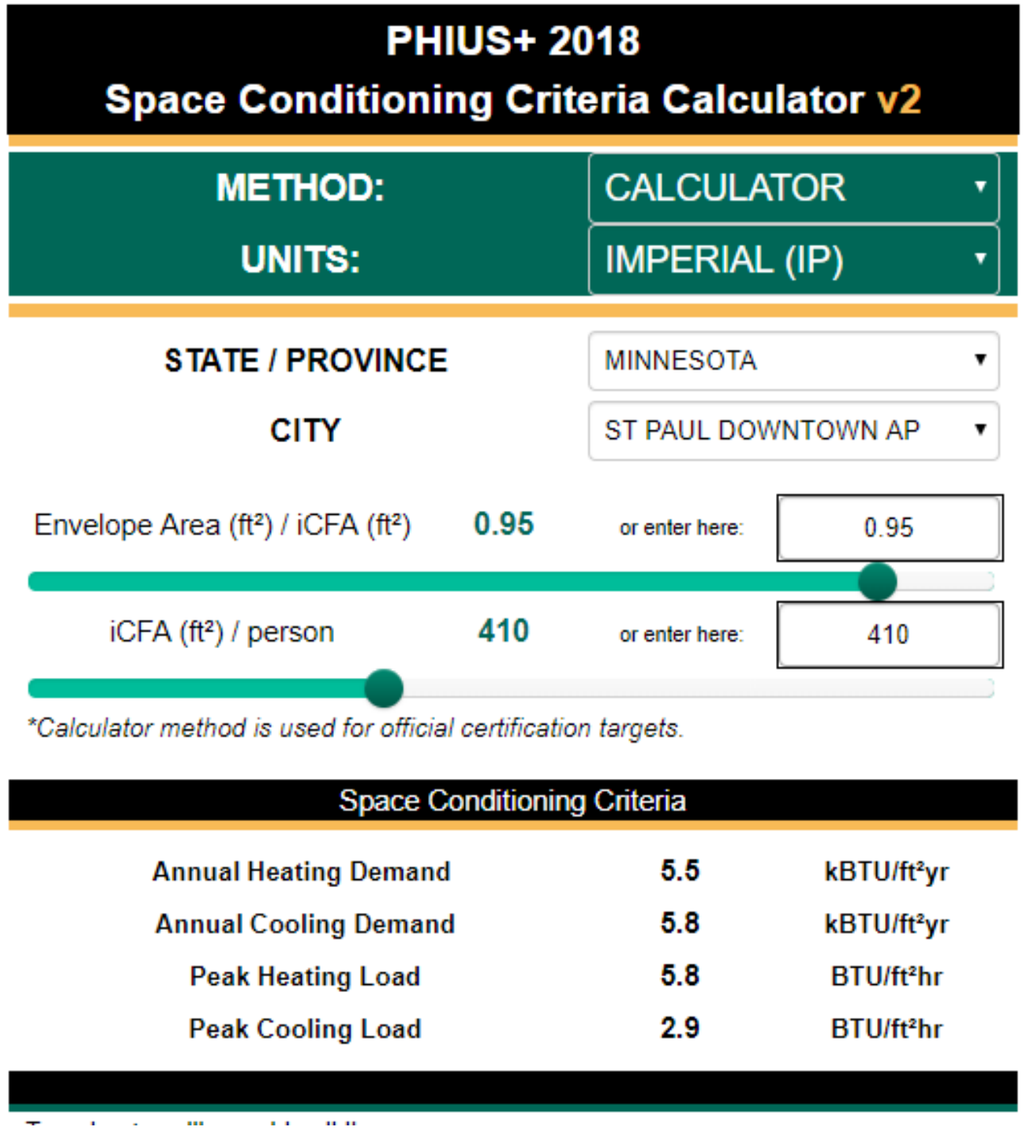
meeting the targets: annual energy use

site | kBtu/GSF/year



project metrics

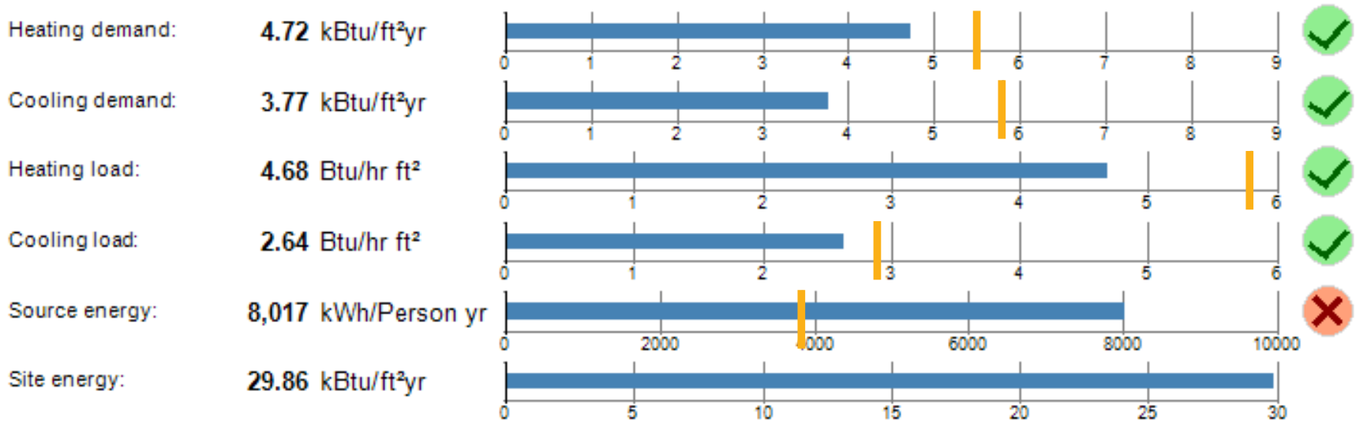
Occupants	227
GSF	97,519
iCFA	93,010
Envelope Area	88,068
Envelope Area / iCFA	0.95
iCFA / person	410



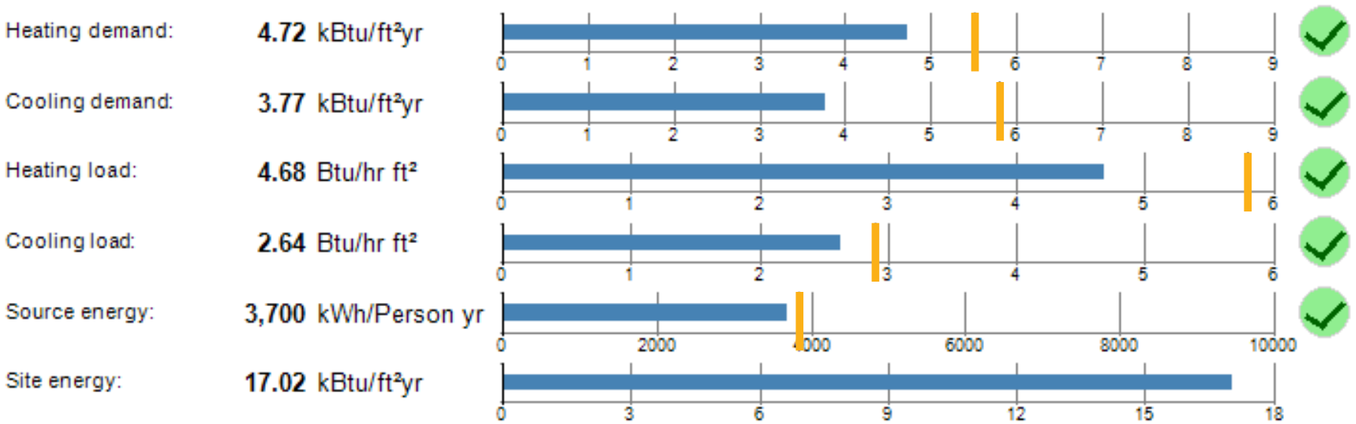
screenshot from PHIUS Space Conditioning Criteria Calculator v2

energy targets

WITHOUT SOLAR



WITH SOLAR



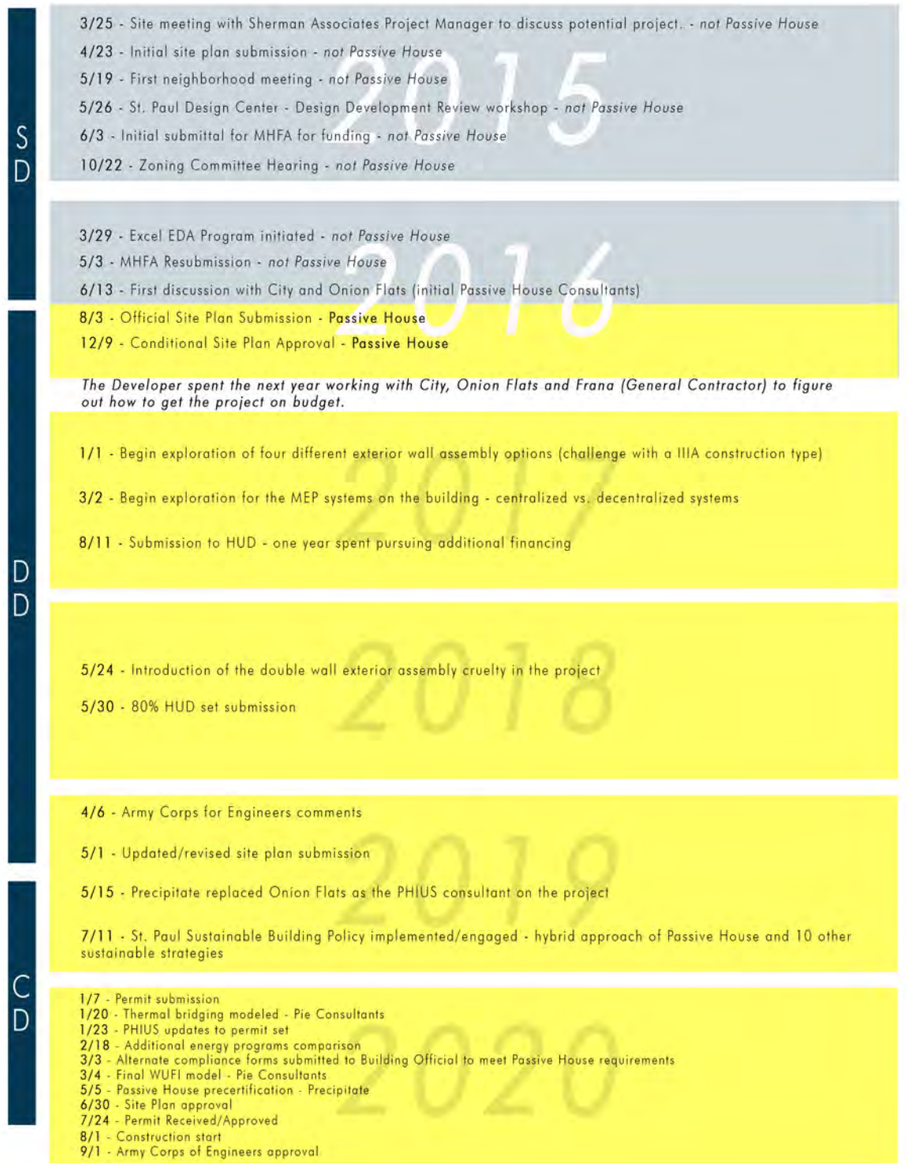
screenshots from WUFI Passive

project challenges

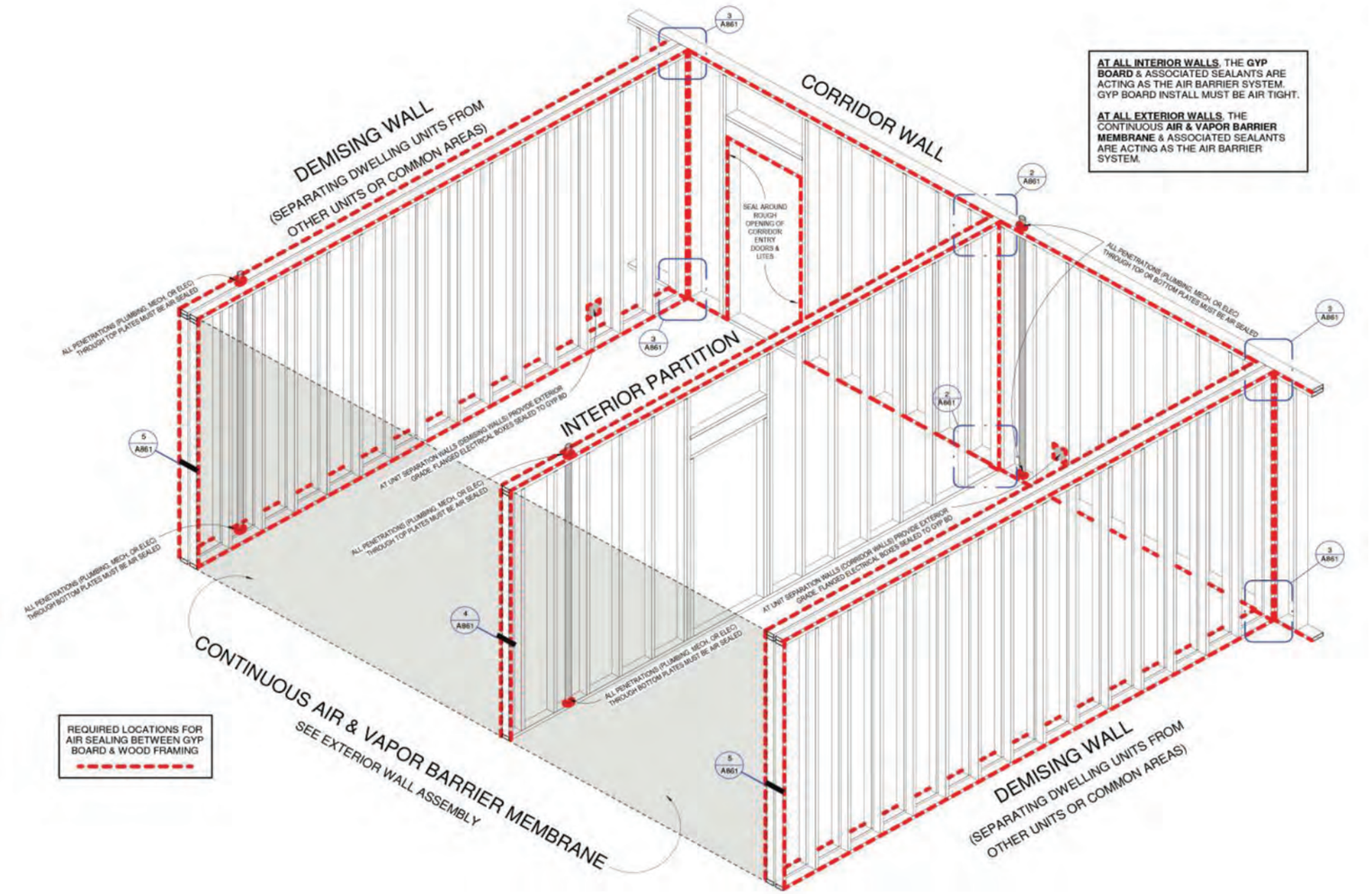
- Timeline
- Passive House comes late to the table
- Starts and Stops (financing)
- Type IIIB Construction above a Podium

  Fire treated lumber

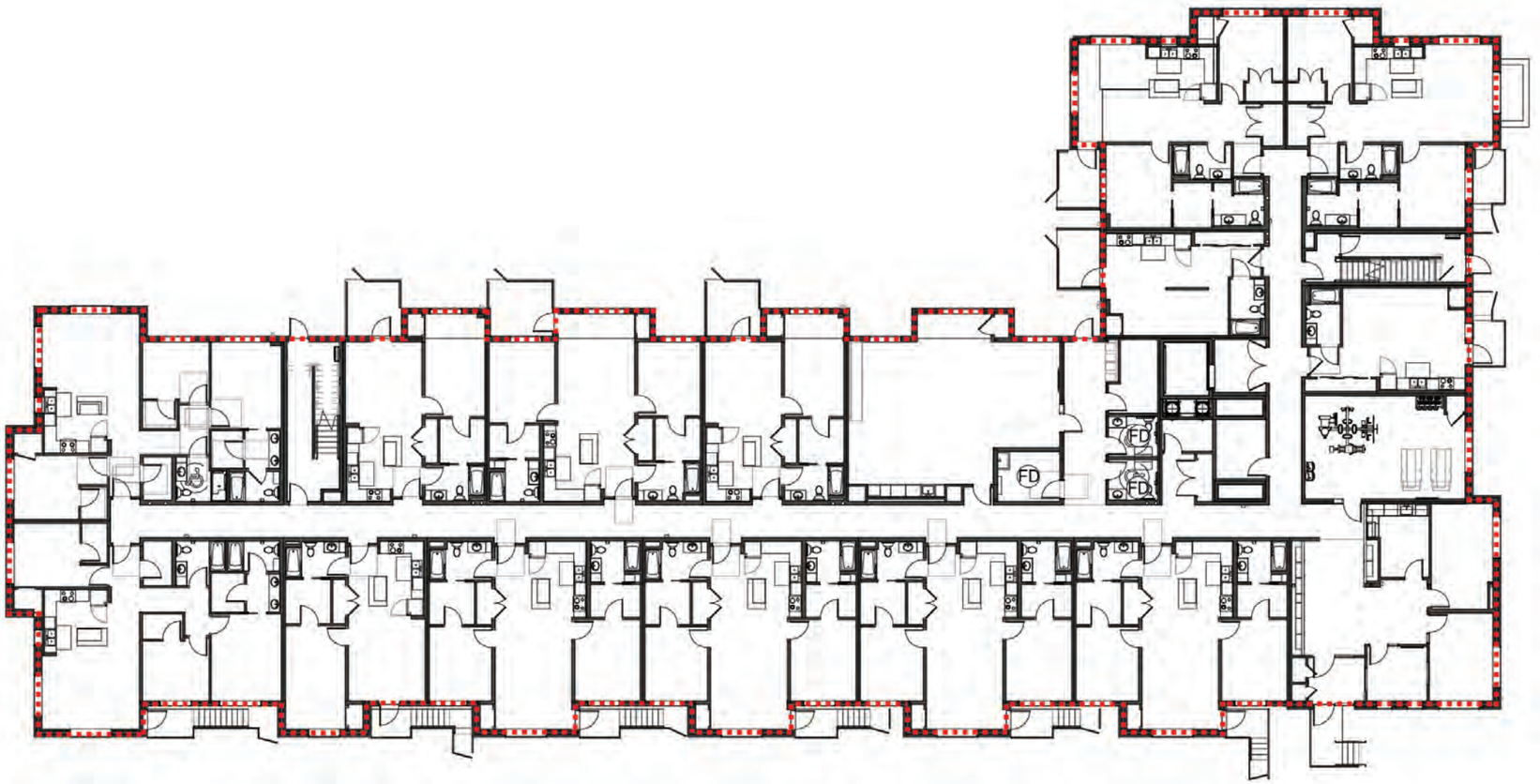
  5 stories, so NFPA 285 testing required
- This was the first Passive House project for the Architect, Engineer, and Contractor



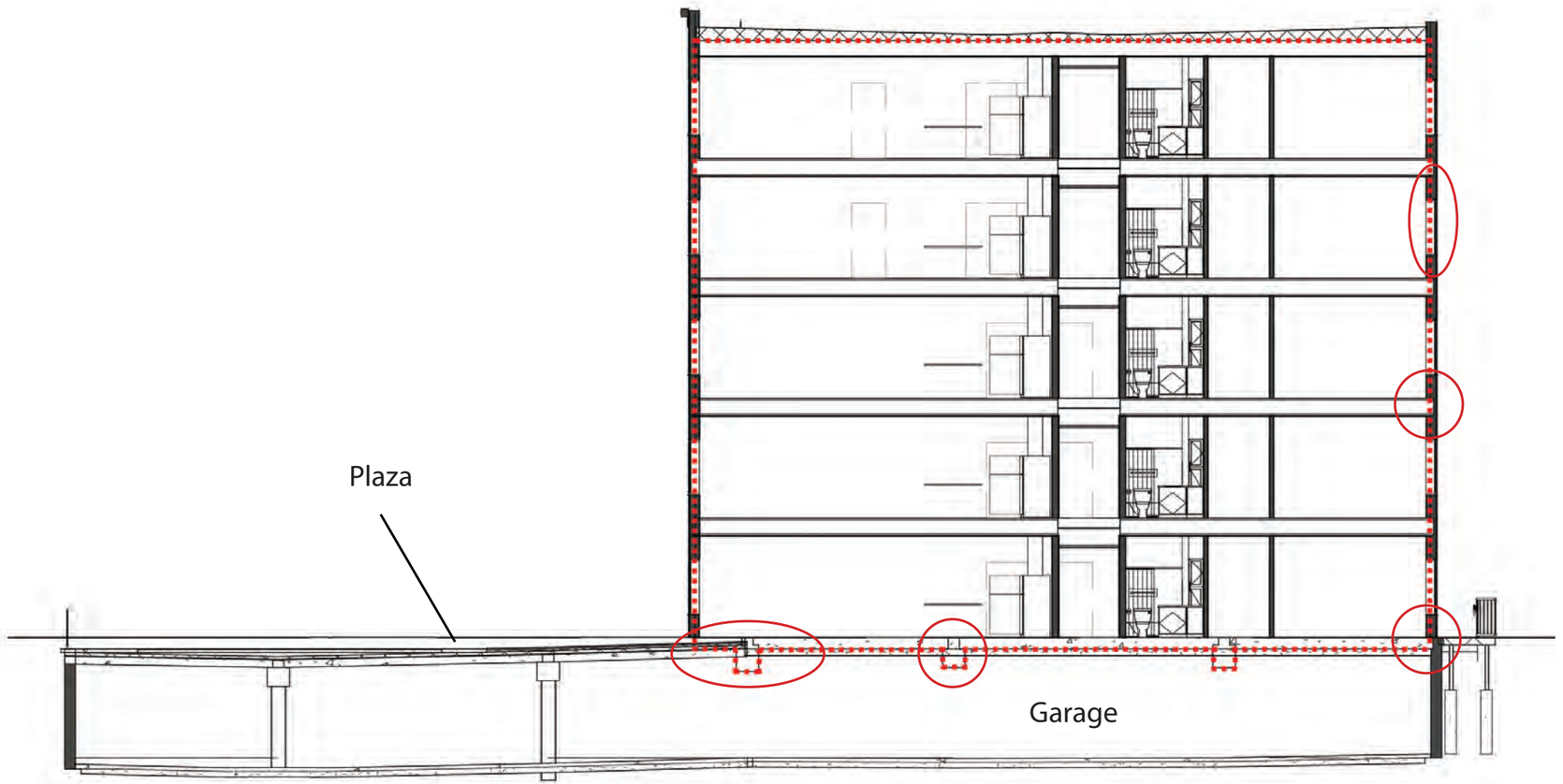
collaborative design workshops



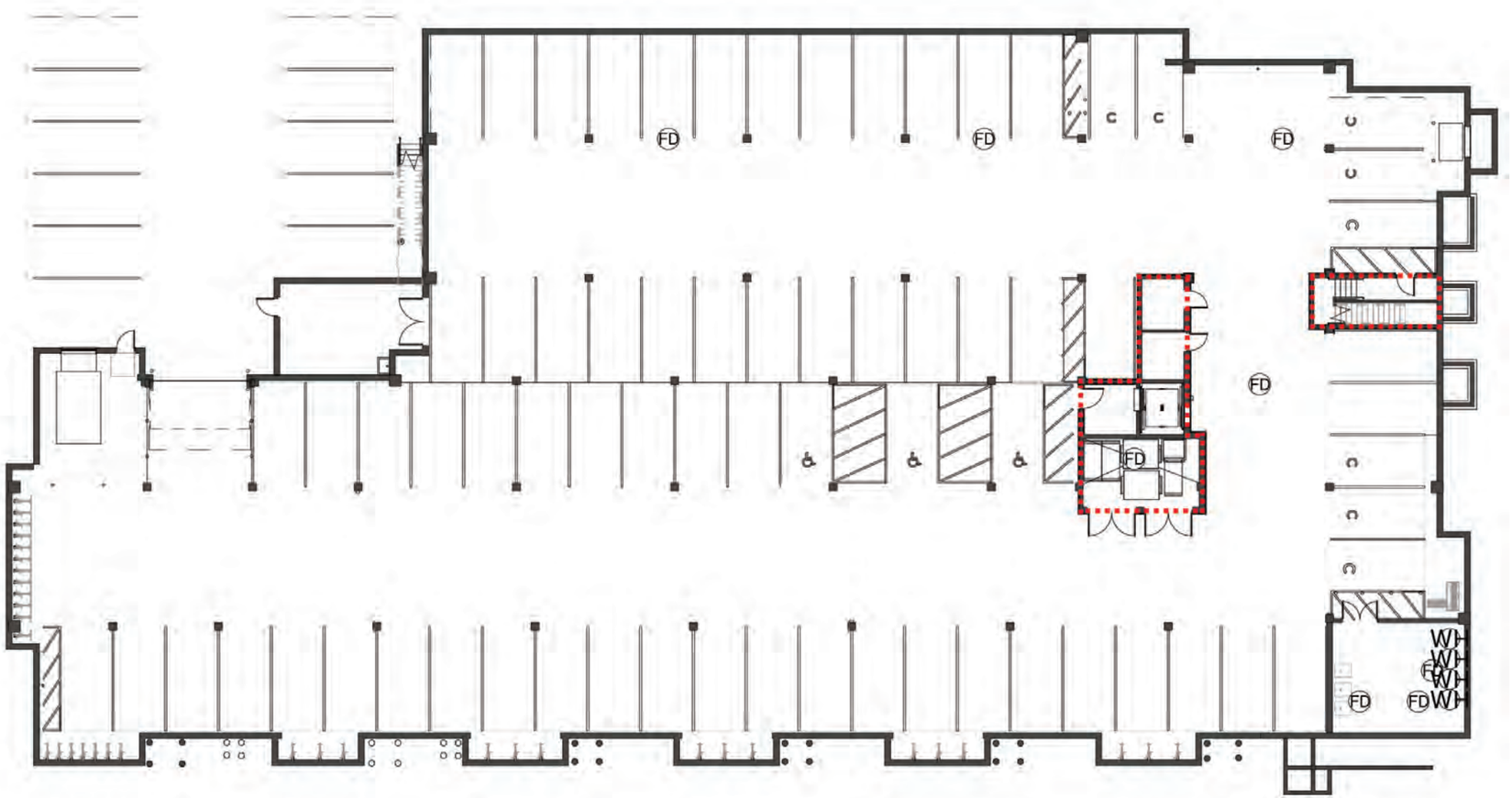
passive house envelope: first floor



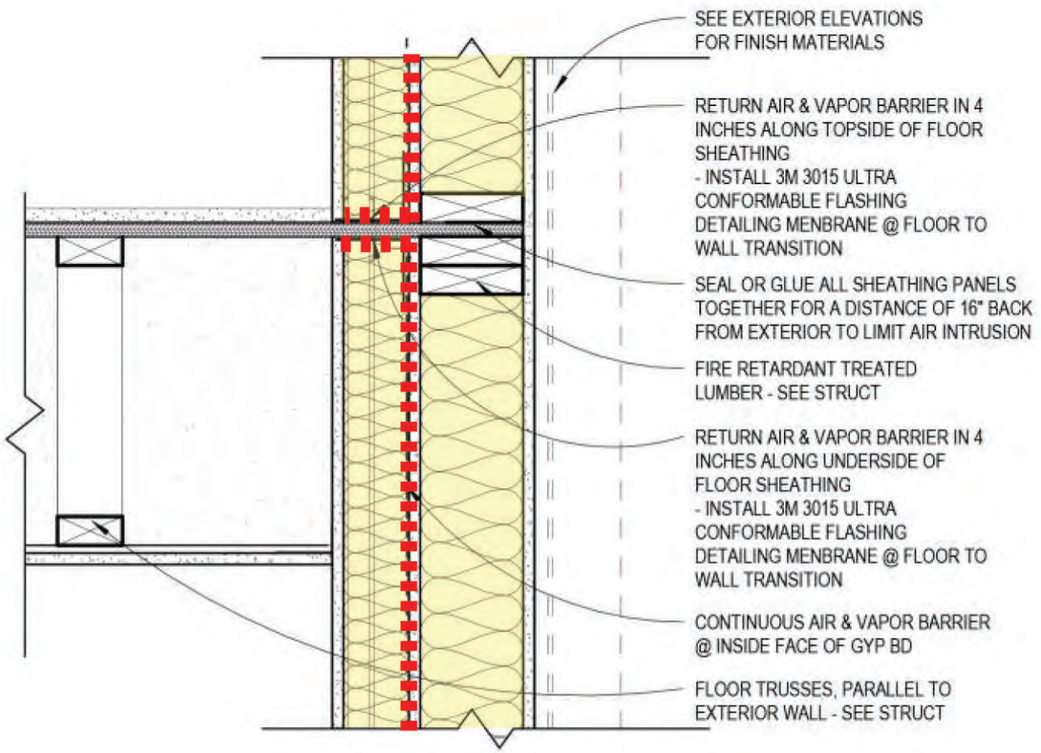
passive house envelope: section



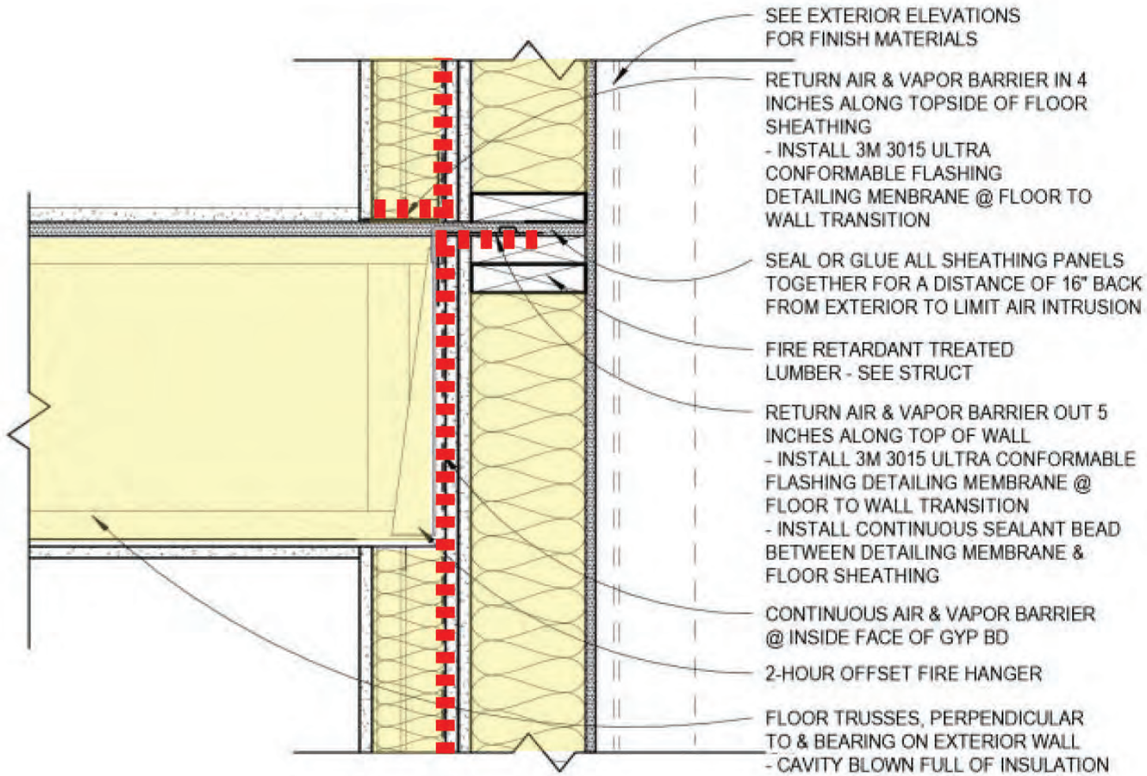
passive house envelope: garage



passive house envelope



17 Exterior Wall - Floor Truss @ Ext. Wall
Section - 1HR WALL1
1 1/2" = 1'-0"



15 Exterior Wall - Floor Truss @ Ext. Wall
Section - 2HR WALL1
1 1/2" = 1'-0"

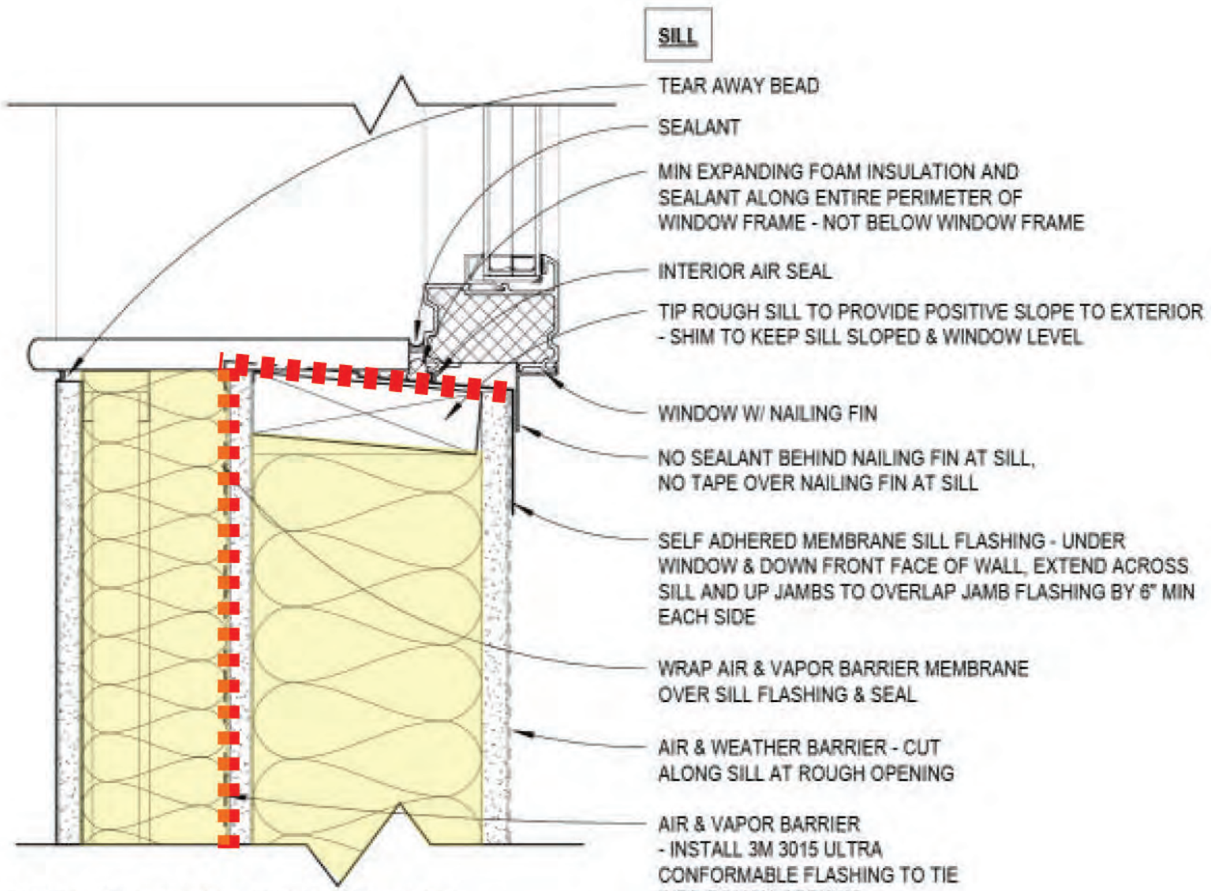

RH
RH
FRANA


Tyvek
DURASTRAND

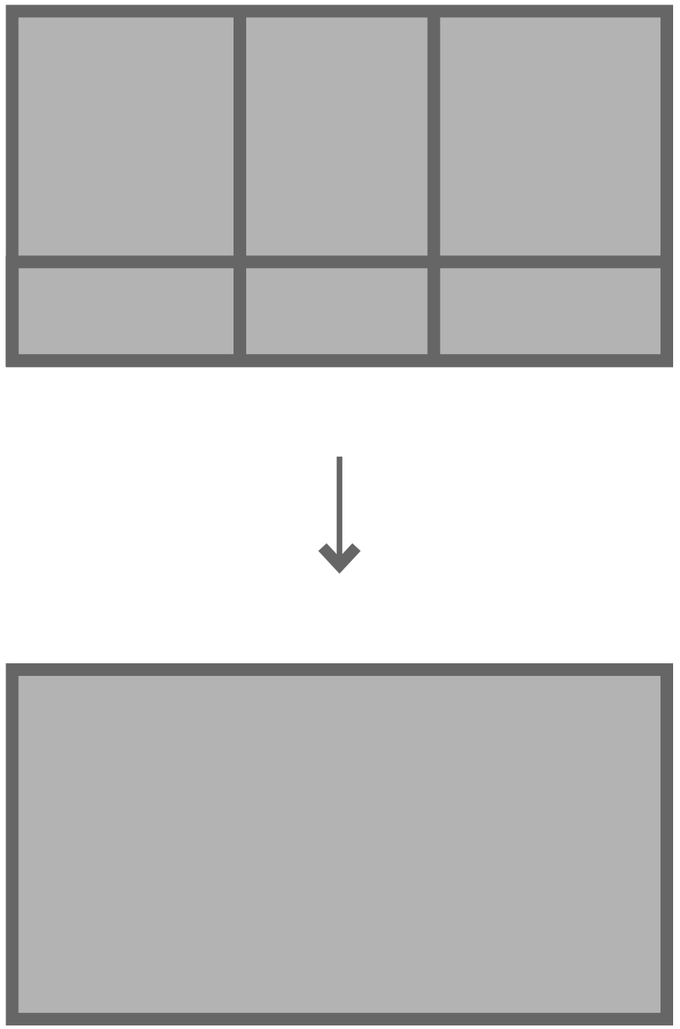

exp


Tyvek
235

window details



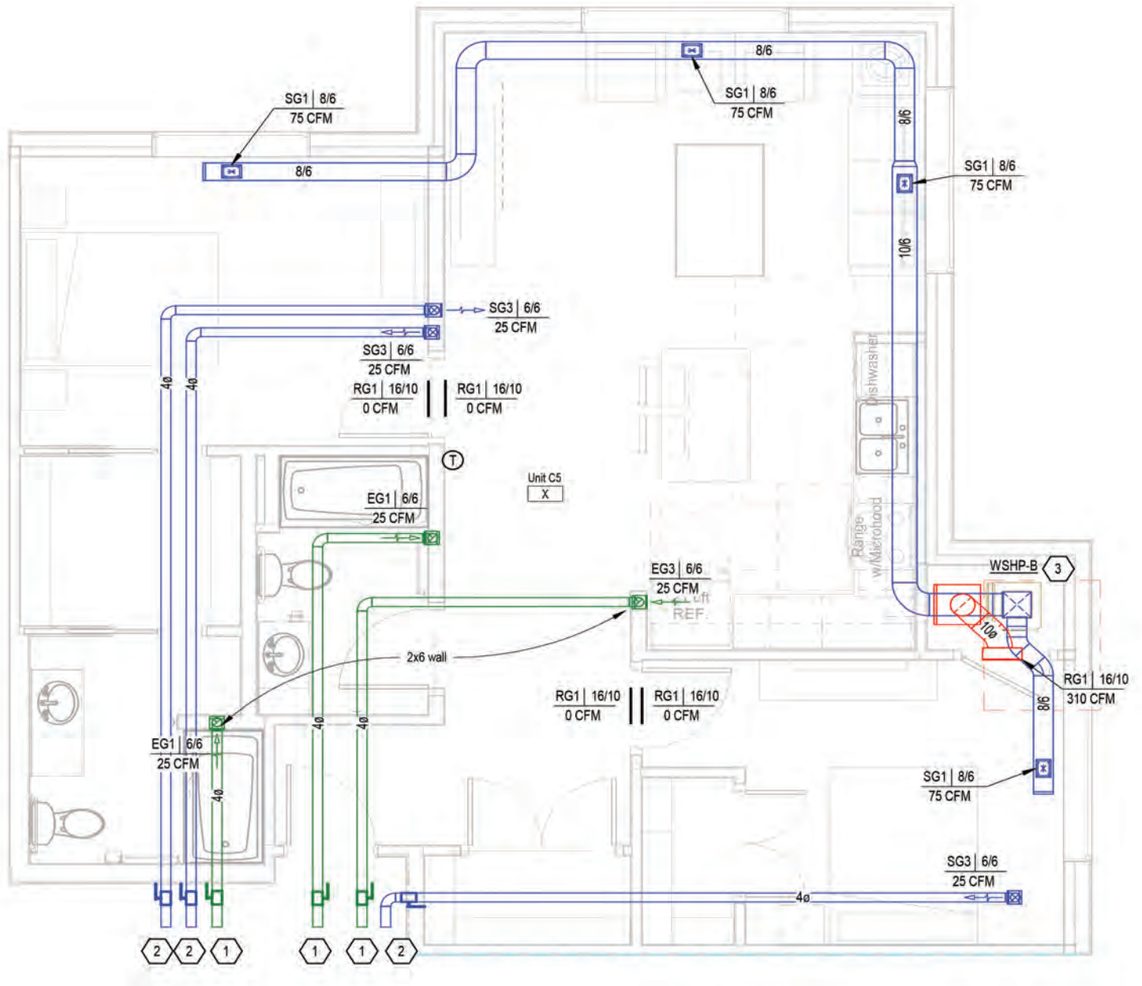
8800 - Fiberglass Window Flashing
Head/Jamb/Sill
1 3" = 1'-0"




3M
GP
Sheathing
CAN/ULC-S741

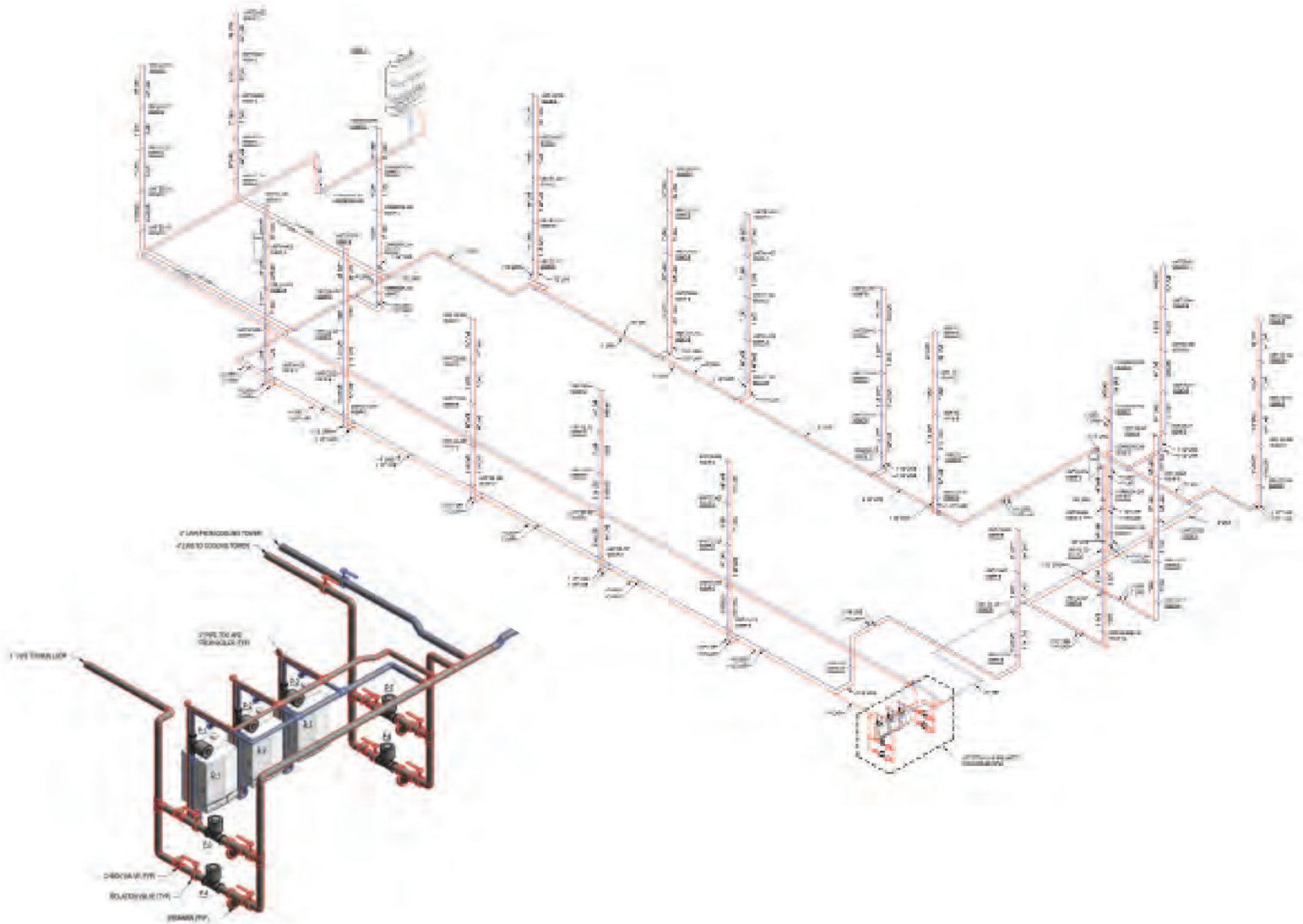

GP
OSB

typical unit hvac plan



water source heat pump

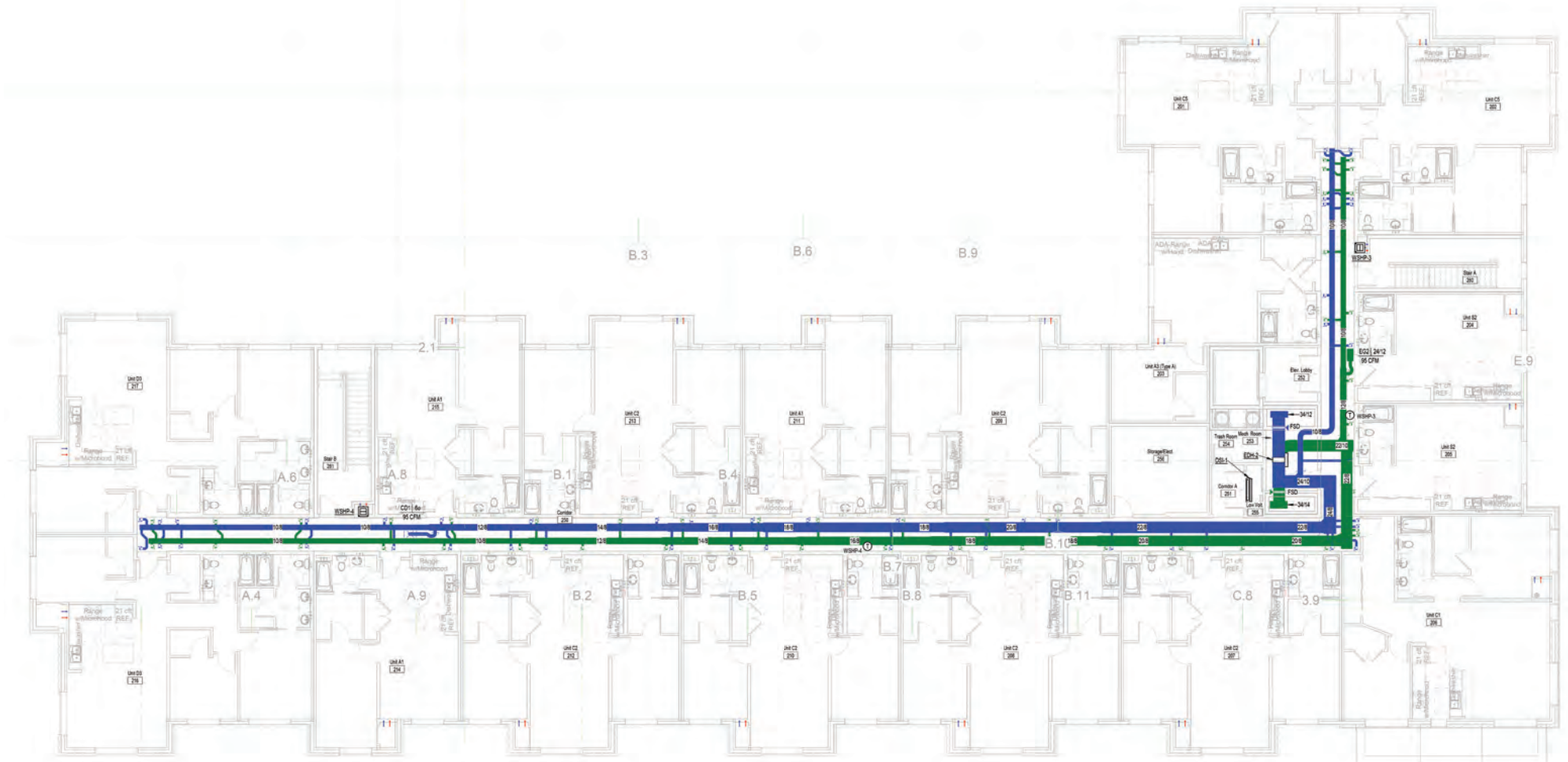
loop water system

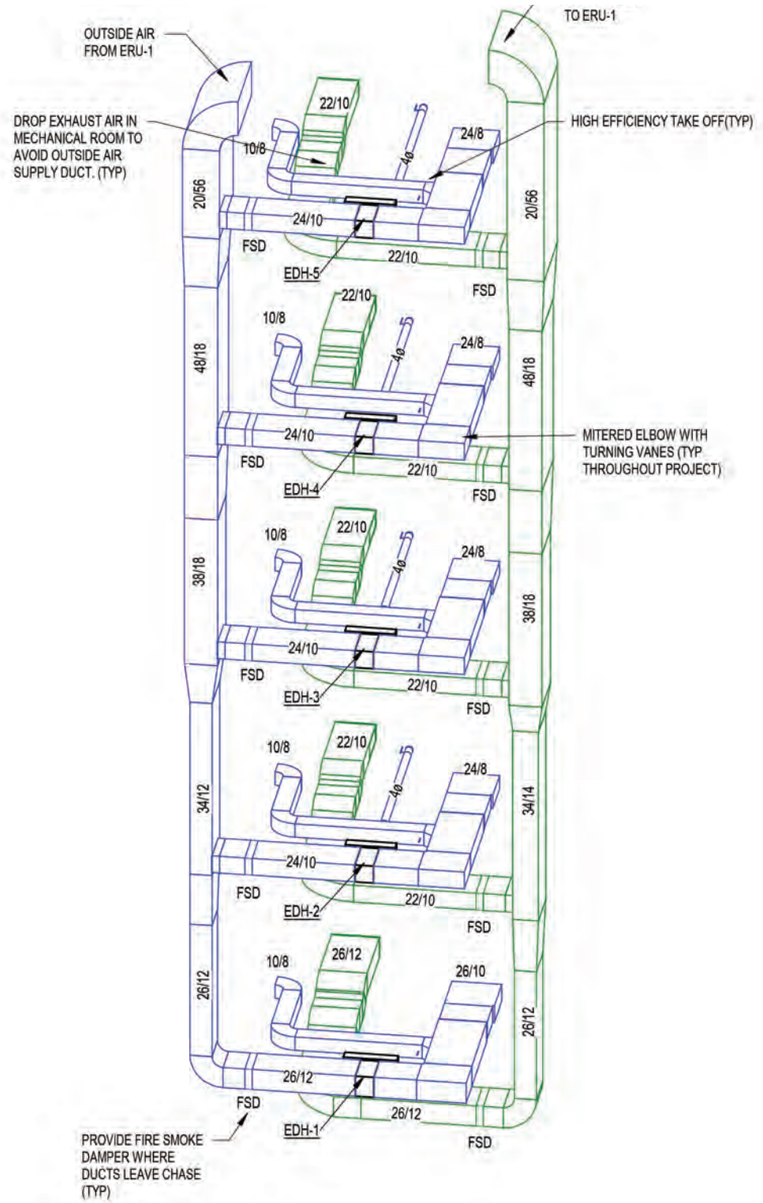


a'21mn conference november 2021

PATHWAYS TO SB2030: LESSONS FROM WEST SIDE FLATS

energy recovery system (erv)






GOLD
GOLD
Swegon


GOLD
FRANA
companies
Swegon