



# Enhanced Sustainability Webinar

October 24<sup>th</sup>, 2023

# Our Mission: The Core Purpose

Housing is foundational to a full life and a thriving state, so we equitably collaborate with individuals, communities and partners to create, preserve and finance housing that is affordable.

# Agenda

- |                    |   |
|--------------------|---|
| 9:00 - 9:10 a.m.   | Overview of Enhanced Sustainability, Katherine Teiken |
| 9:10 - 9:30 a.m.   | SB 2030, Pat Smith and Rolf Jacobson                  |
| 9:30 - 9:50 a.m.   | DOE Net Zero Energy Ready, Phil Anderson              |
| 9:50 – 10:10 a.m.  | Passive House, Elizabeth Turner                       |
| 10:10 - 10:30 a.m. | Questions and Conversation                            |



# Overview of Enhanced Sustainability

Katherine Teiken | Minnesota Housing

# Current Enhanced Sustainability Language

1.  **Tier 1:** The project will include at least two times the minimum number of Optional Criteria points, in addition to the Required Mandatory Criteria, as outlined within the applicable year's Minnesota Overlay to Enterprise Green Communities Criteria (EGCC) and as claimed in the Multifamily Intended Methods Worksheet **(1 point)**
2.  **Tier 2:** The project will include at least three times the minimum number of Optional Criteria points, in addition to the Required Mandatory Criteria, as outlined within the applicable year's Minnesota Overlay to EGCC and as claimed in the Multifamily Intended Methods Worksheet **(2 points)**

# Current Enhanced Sustainability Language

3.  **Tier 3:** The project will conform to at least one of the following alternative building performance pathways as claimed in the Multifamily Intended Methods Worksheet **(3 points)**
- a. Pathway 1<sup>15</sup> (applicable to new construction and rehabilitation (rehab) projects): The project meets Minnesota B3 Sustainable Building 2030 (SB 2030) Energy Standard
  - b. Pathway 2<sup>16</sup> (applicable to new construction projects only): Certify the project with the Department of Energy (DOE) Zero Energy Ready Home (ZERH) program
  - c. Pathway 3 (applicable to rehabilitation (rehab) projects only): The project meets the 2020EGCC – Criterion 5.1b Building Performance Standard

To receive points for Pathway 3, the project must follow the Performance Pathway as described in the applicable year's Minnesota Overlay to EGCC – Criterion 5.1b by providing an Energy Rater Index (ERI) Pathway by achieving one of the following Home Energy Rating System (HERS) Index thresholds:

- i. A HERS Index score of 80 or less for properties built in or after 1980
- ii. A HERS Index score of 100 or less for properties built before 1980
- iii. A post-rehab HERS Index score at least 15% less than the pre-rehab HERS Index score

# Current Enhanced Sustainability Language

4.  **Tier 4:** The project will be certified by one of the following alternative building performance pathways as claimed in the Multifamily Intended Methods Worksheet **(4 points):**
- a. Passive House Institute (PHI) Classic
  - b. Passive House Institute United States (PHIUS)
  - c. One of the following 2020 Enterprise Green Communities Criteria, Criterion 5.4 Achieving Zero Energy, Option 2 programs:
    - i. PHIUS + Source Zero
    - ii. PHI Plus
    - iii. PHI Premium
    - iv. International Living Future Institute's Zero Energy Petal
    - v. Zero Carbon Petal
    - vi. Living Building Challenge

# Energy Star Certification

- As of April 2022, all requirements of ENERGYSTAR must be included for new construction. However, the certification was not required.
- Starting in April 2023, all new construction project applications must be certified by ENERGYSTAR. This includes all projects regardless of whether they are receiving Enhanced Sustainability selection points.
- ENERGYSTAR Multifamily New Construction requires continuous underground garage ceiling insulation and continuous insulation (CI) at exterior walls. (CI not required at walls of three-story or less with efficiency framing)



# Questions we've been hearing

- How can a project buy renewable energy credits for SB2030?
- What are the design requirements for garages in each of the building standards?
- Can a project change between building standards?
- How much time does pursuing one of these building standards add to the project timeline?
- What documentation can be used to prove compliance both pre-construction and post-construction?



# Previewing the 2026-2027 QAP and Minnesota Overlay

## Planning for the 2027-2026 QAP and Minnesota Overlay has begun

- Will convene Minnesota Overlay TAG Spring 2024
- QAP Public Comment likely Summer/Fall 2024
- Will be required for Summer 2025 Consolidated RFP Application Period

## Potential TAG Topics

- Enhanced Sustainability
- Solar
- Electrification
- Climate Resiliency



# Minnesota Sustainability Building 2030 Energy Standards

Pat Smith and Rolf Jacobson | Center for Sustainable Building Research

®



# **SB 2030 OVERVIEW**

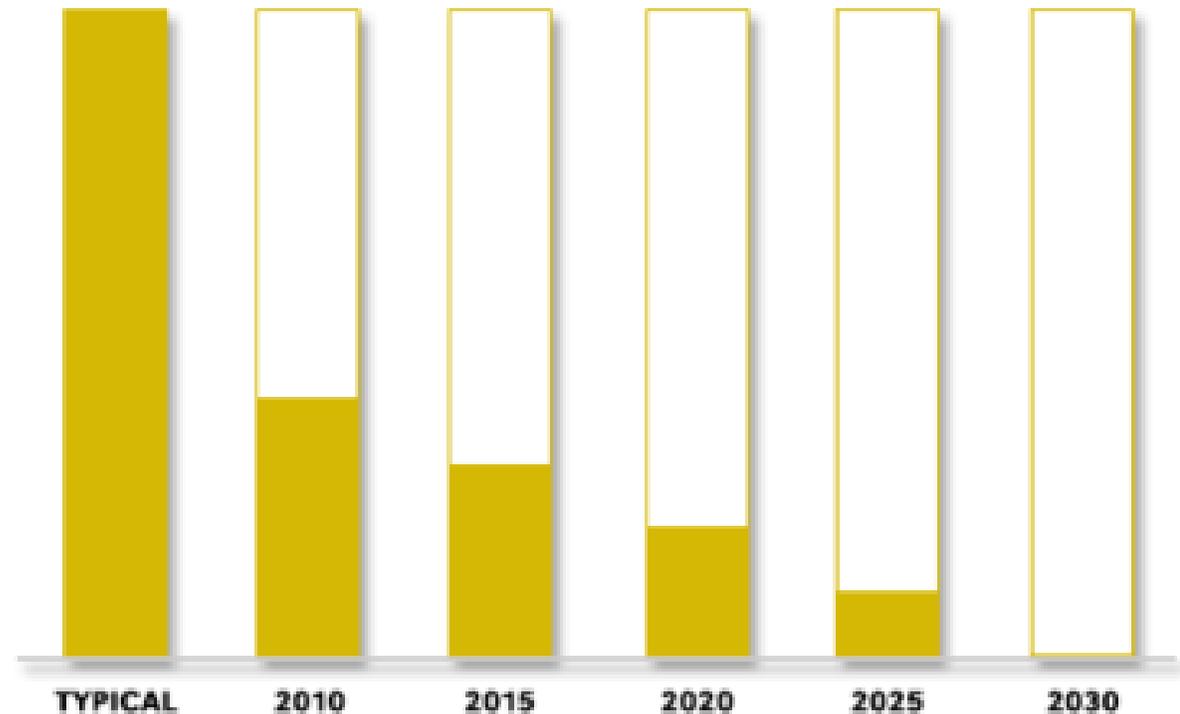
Pat Smith, Rolf Jacobson

Center for Sustainable Building Research, Univ. of Minnesota

# SB 2030

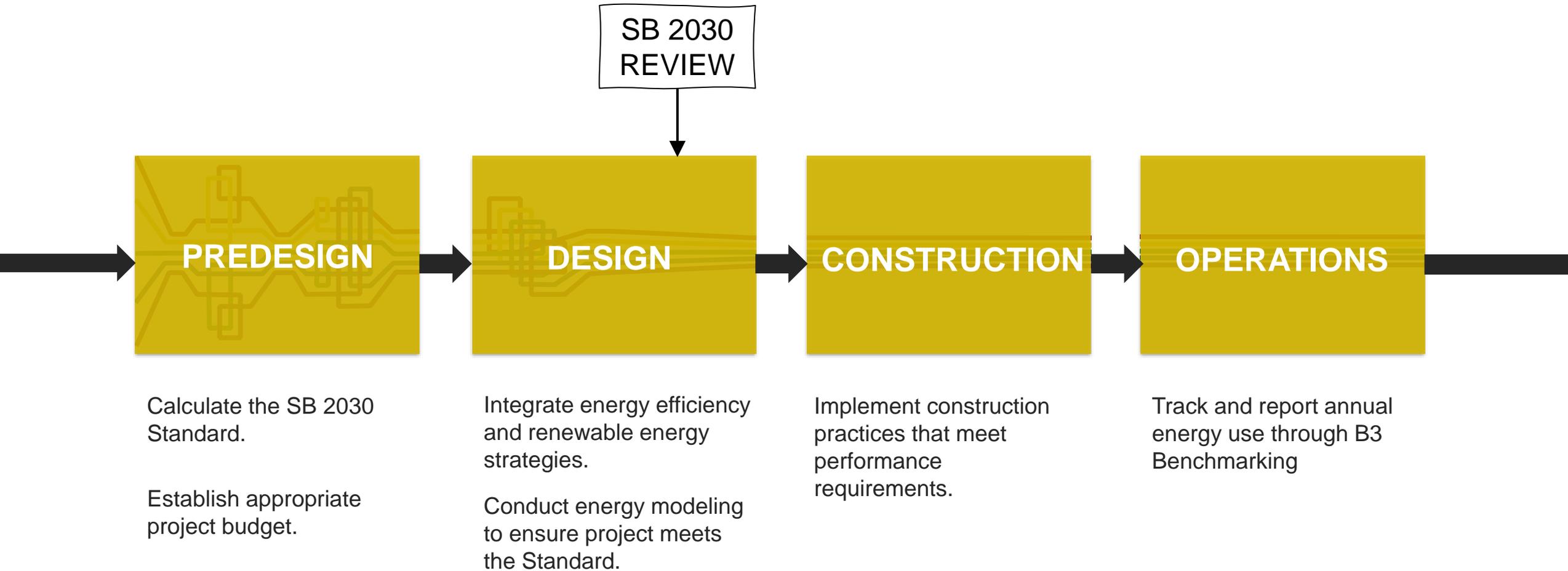
SB 2030 is a progressive energy and carbon reduction program

- modeled on the Architecture 2030 program
- customized to better fit Minnesota's buildings, climate, and policies
- expanded to allow the inclusion of more building types.



## SB 2030 Energy Standard

Building Energy Consumption from Carbon Producing Fuel



**MINNESOTA 3 GUIDELINES TRACKING TOOL** Welcome **Becky Alexander**  
My Account | Sign Out

Home Projects Reports About Administrator

### B3 Guidelines Sample Project

123 Fake Street, Minneapolis, MN 55406

General Team Roles Actions Schedule Notes Admin

**Predesign Phase**  
Ready For Guideline Leader

**You have 1 open action item(s)**

Guideline	Responsible Role	Person	Action	PD	D	FD	CO
Phase Summary Reports:							
<b>PERFORMANCE MANAGEMENT</b>				PD	D	FD	CO
<b>SITE AND WATER</b>				PD	D	FD	CO
<b>ENERGY AND ATMOSPHERE</b>				PD	D	FD	CO
E.0. Energy and Atmosphere Strategies							<a href="#">Read the Guideline</a>
E.1. Energy Use							<a href="#">Read the Guideline</a>
E.2. Renewable Energy							<a href="#">Read the Guideline</a>
E.3. Efficient Equipment and Appliances							<a href="#">Read the Guideline</a>
E.4. Atmospheric Protection							<a href="#">Read the Guideline</a>
E.5. EV-Ready							<a href="#">Read the Guideline</a>
<b>INDOOR ENVIRONMENTAL QUALITY</b>				PD	D	FD	CO
<b>MATERIALS AND WASTE</b>				PD	D	FD	CO

**OCCUPANCY**  
This project is not defined for occupancy. [Click here to set an occupancy date](#)

**FILTER**  
Expand the grid to display:  
My Action Items

**LEGEND**

- Action Item
- Completed
- Variance
- Not applicable
- Current Phase
- Required
- Actual Phase

B3 Guidelines Tracking Tool

NEO Analysis - Google Chrome  
app.netenergyoptimizer.com/v390/analysis?id=2c13b55f-2e93-444f-870b-4f3da95868ef&licenseId=ca8090d3-632d-4e18-a89b-e6554b5e...

**MINNESOTA 3 SB 2030** Phase PD - B3 Guideli... Building HVAC Rating MENU

First, define your new building.

**Building Definition** [Unlock](#)

Building Type:  Total Area:  ft<sup>2</sup>

[Modify Details](#)

**Space Asset Areas** [+ Add Area](#) [Scale All to Fit](#) [Summary](#)

**Stacks and Reading**

Type: **Stacks and Reading**

Area: **11,250 ft<sup>2</sup> (75%)**

Floors: 1

Arrangement: **Adjacent**

[Edit](#)

**Computer Center**

Type: **Computer Center**

Area: **3,750 ft<sup>2</sup> (25%)**

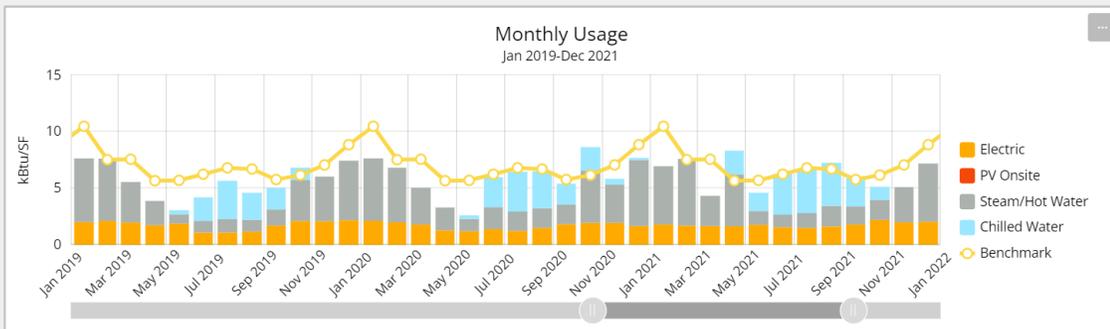
Floors: 1

Arrangement: **Adjacent**

[Edit](#)

[Help](#) [HVAC >](#)

SB 2030 Energy Standard Tool



B3 Benchmarking



# COST-EFFECTIVENESS

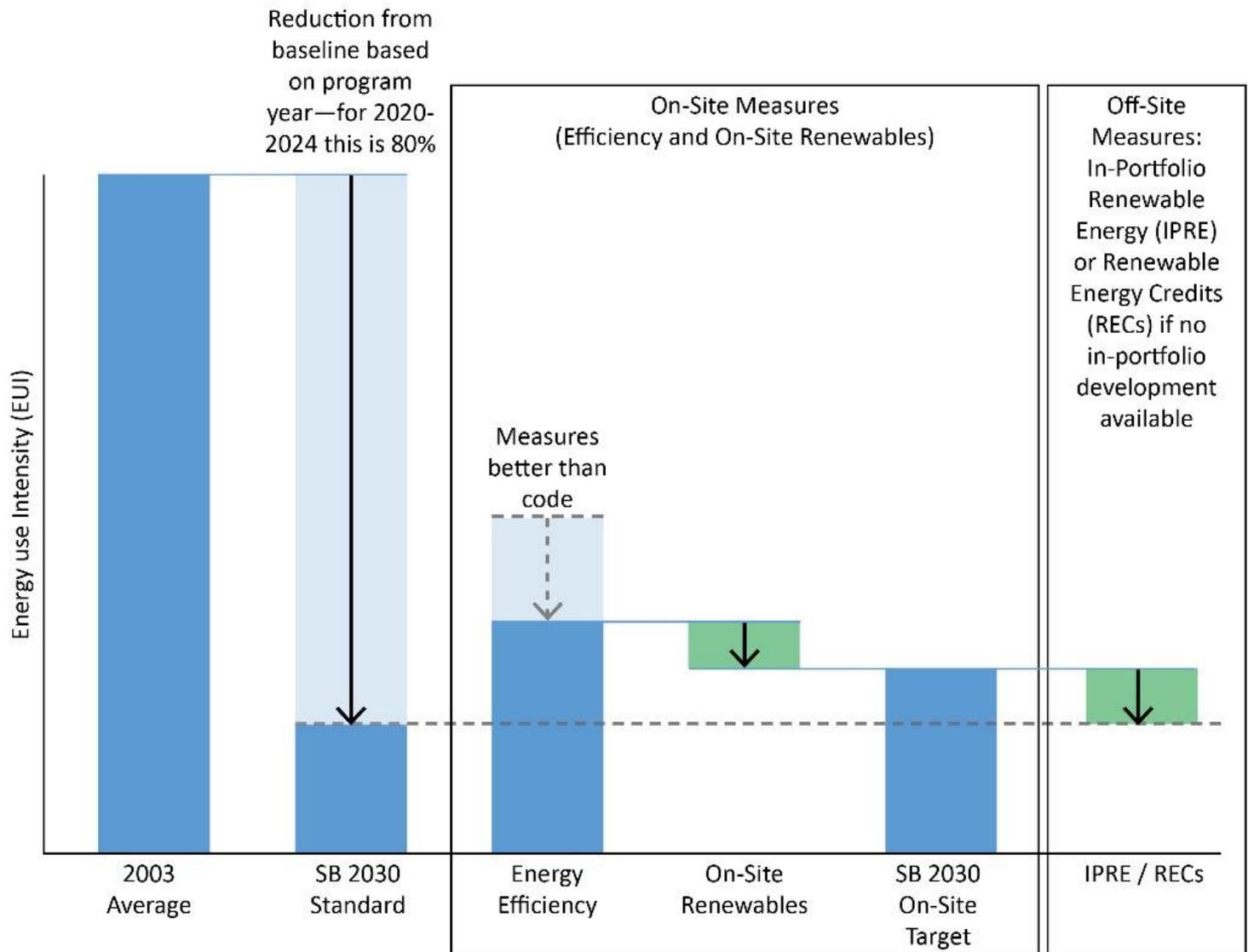
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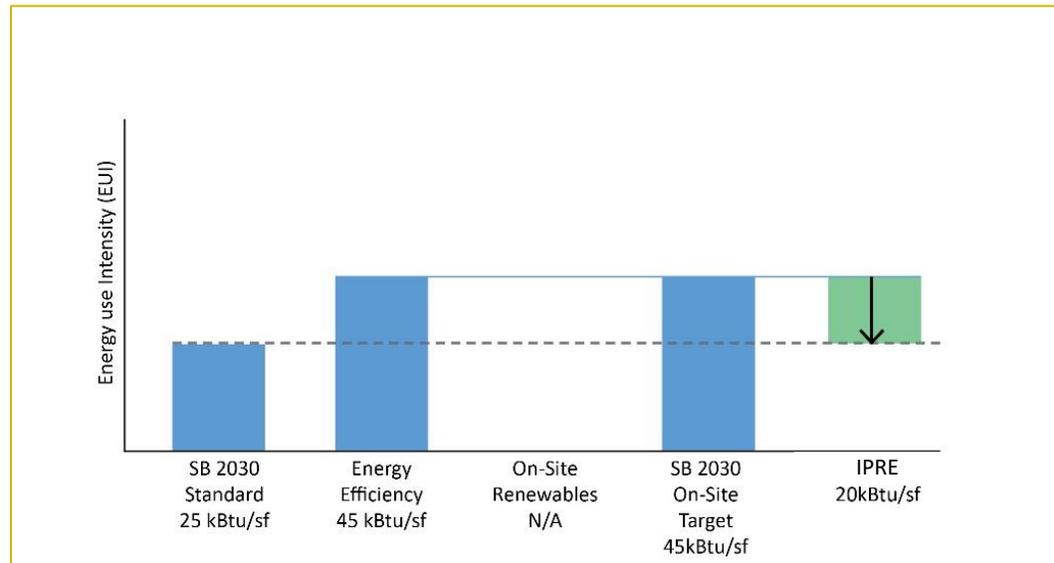
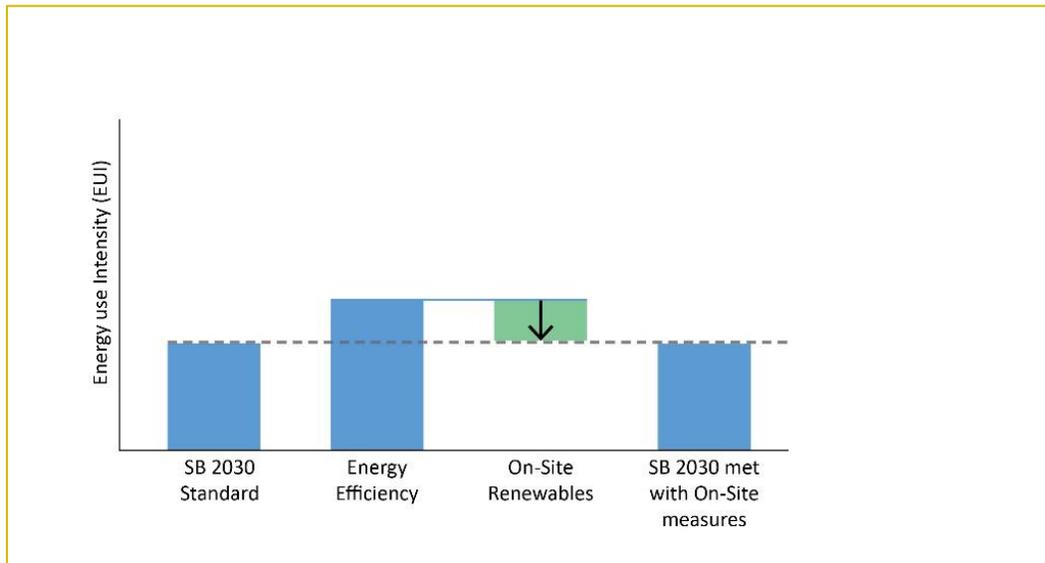
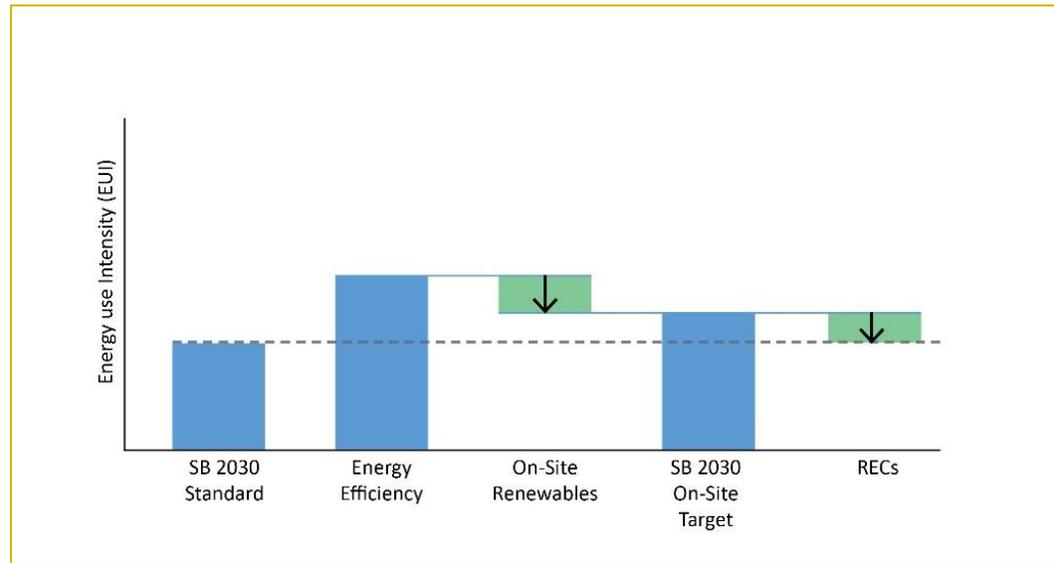
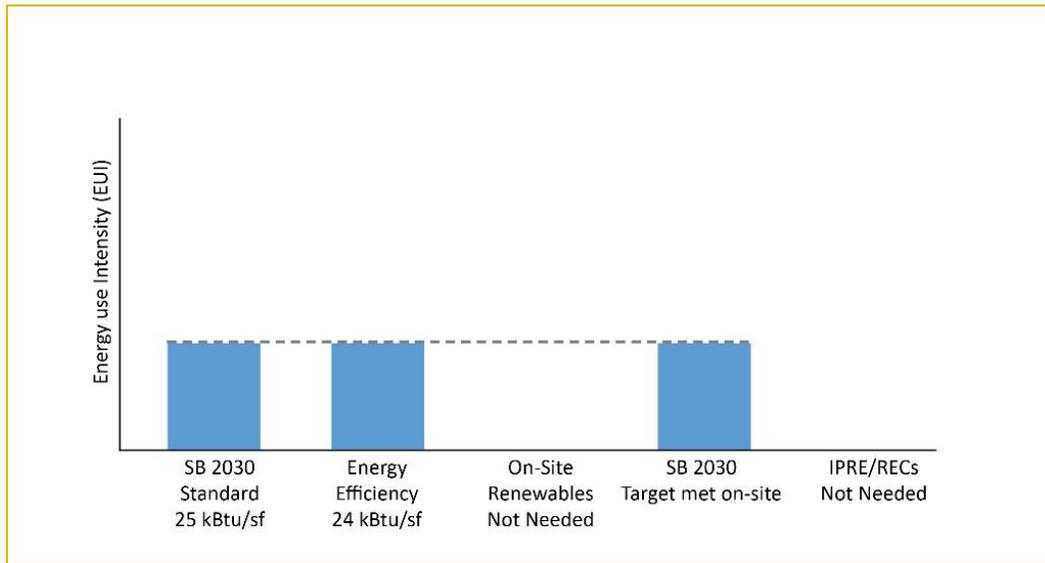
SB 2030 cannot require performance standards that are not cost-effective.

Cost effectiveness limits are based on:

- Societal test
- Participant test
- Utility test

The current cost-effectiveness threshold is a simple payback period of **12 years** or less.





# DIFFERENT PATHS TO SB 2030

# PROGRAM GUIDE: THE PARTS

## PART 1: ESTABLISH AN SB 2030 ENERGY STANDARD

## PART 2: ON-SITE MEASURES

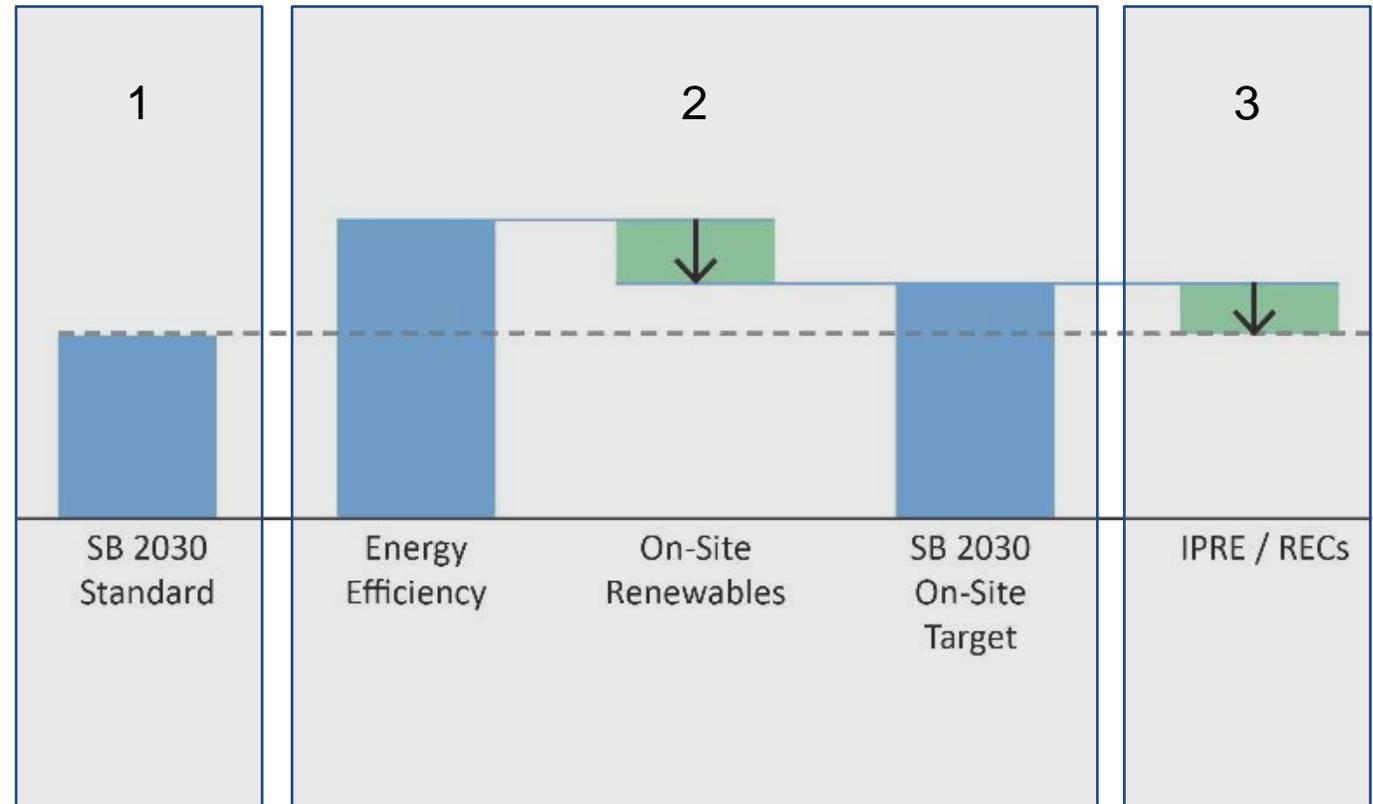
Energy Efficiency

On-Site Renewable Energy

On-Site Target\*

## PART 3: OFF-SITE RENEWABLE ENERGY\*

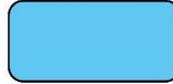
\*if needed



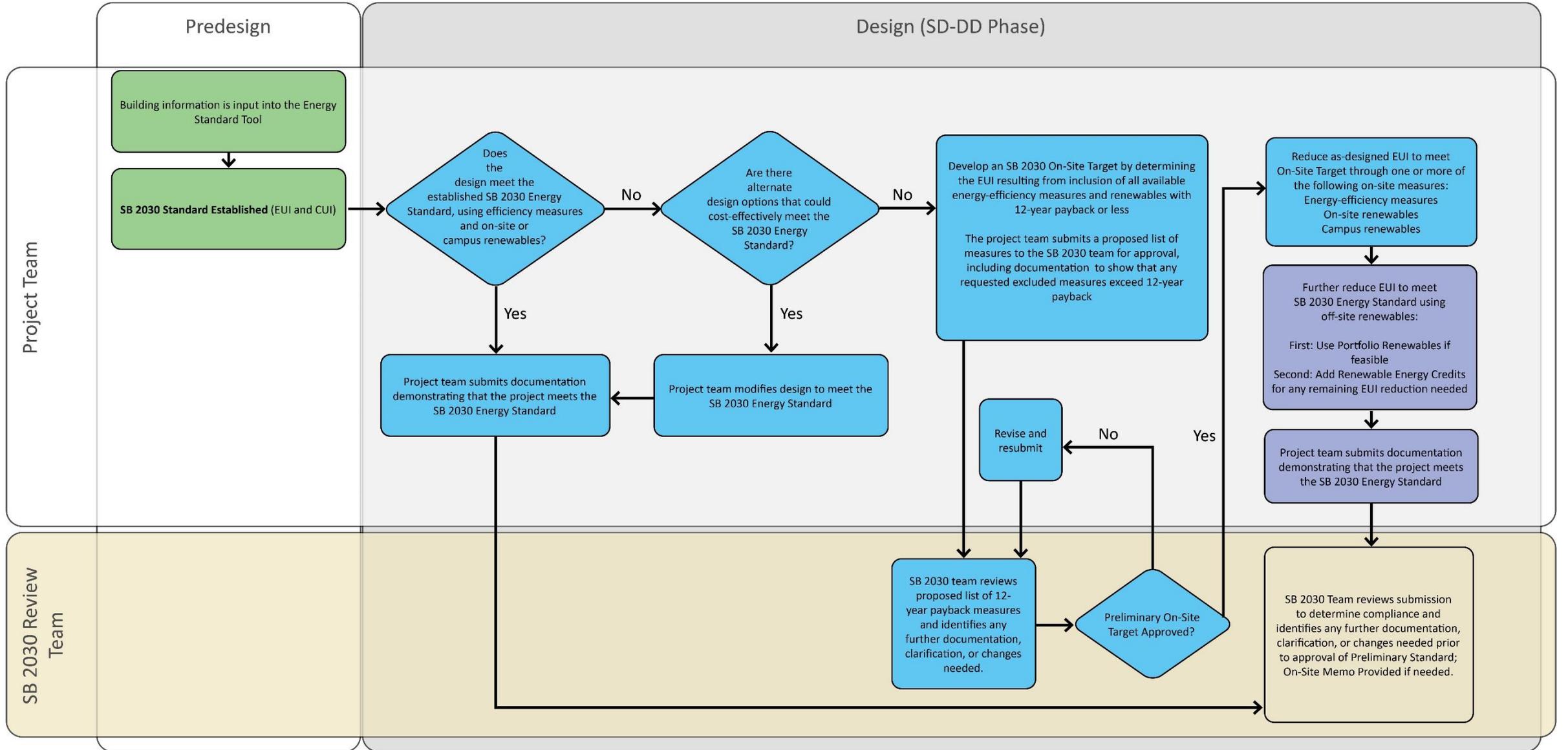
Part 1: Establish a SB 2030 Standard



Part 2: Estimate Design Efficiency, On-Site Renewable Energy, and Establish On-Site Target if needed



Part 3: Off-Site Renewable Energy and Renewable Energy Credits



**MINNESOTA 3 GUIDELINES TRACKING TOOL**

Welcome **Becky Alexander** [Sign Out](#)

E1A Meet SB 2030 Energy Standards - Google Chrome

NEO Analysis - Google Chrome

app.netenergyoptimizer.com/v390/analysis?id=2c13b55f-2e93-444f-870b-4f3da95868ef&licenseId=ca8090d3-632d-4e18-a89b-e6554b5ec499#!/strategies

**MINNESOTA 3 SB 2030** Phase PD - B3 Guidelines ... Building HVAC Rating Save MENU

Calculate ✕ 📊 ⚙️

**2030 Energy Standard**

Energy Use Intensity (kBTU/ft<sup>2</sup>/yr)

**D**

Energy Use Intensity (kBTU/ft<sup>2</sup>/yr)

**64.5**

**2030 Energy Standard**

CO2e Intensity (lbm/ft<sup>2</sup>/yr)

**D**

CO2e Intensity (lbm/ft<sup>2</sup>/yr)

**17.1**

[Help](#)

I agree that the above information is correct and complete. Signed by Claire Winters on 10/21/2021 2:50 PM

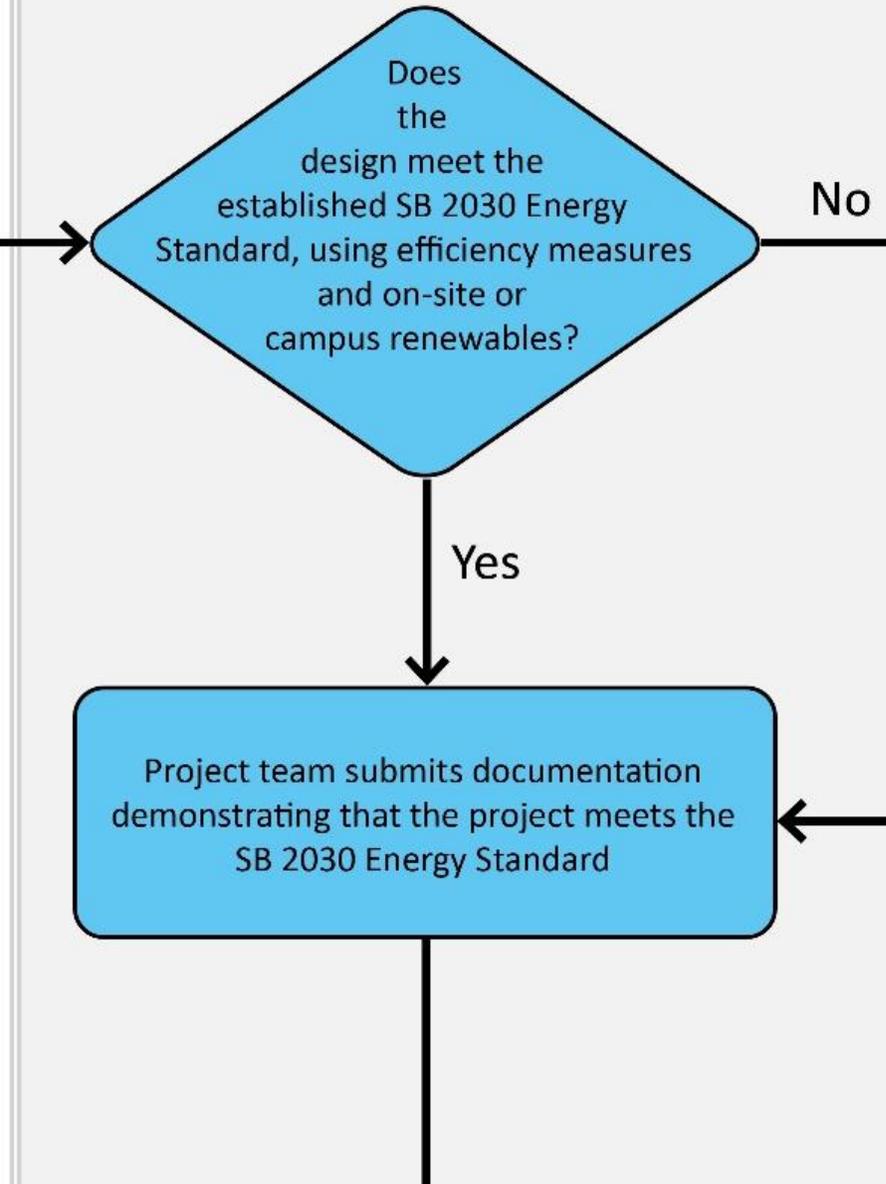
[E.2. Renewable Energy](#) [Read the Guideline](#)

[E.2. Efficient Equipment and Appliances](#) [Read the Guideline](#)



# PART 1: ESTABLISH AN SB 2030 ENERGY STANDARD

## PART 2: ON-SITE MEASURES



- Predicted energy use can be modeled in SB 2030 Energy Standard Tool or another approved tool
- If SB 2030 Standard can be met through on-site measures, a separate On-Site Target is not needed.
- Projects may choose to use measures outside of the 12-year payback to meet the SB 2030 Energy Standard.
- RECs for on-site renewable energy used to meet SB 2030 must be retained or replaced.

SB 2030 On-Site Standard Approval (Preliminary)—[PROJECT NAME]

After a follow up review and discussion of the modeling performed—[Description of referenced modeling]—the SB 2030 Review Team approves the proposed preliminary values for the key SB 2030 metrics for this project noted below.

Note that these simulations may need to be updated to better reflect the final design if actual design measures or other items vary notably from the measure list used and assumptions. For example, if the design outdoor air flows or HVAC unit fan powers are significantly different than what was assumed in the modeling referenced here, the 12 year payback bundle and as-designed simulation may need to be updated. Updates are generally expected to lead to very little relative change in how the two EUIs compare, as both will shift with adjustments in building characterizations unless the actual design for energy efficiency measures differs significantly from the measure definitions used in this analysis. These updated simulations may be critical when comparing the actual energy use to the design stage simulations.

The project team has not yet provided the extent of on-site renewable energy development achievable for this project, and as such several key metrics are yet to be determined.

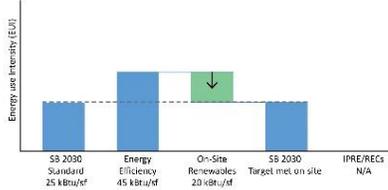
Listed below are the current key SB 2030 Standard Metrics for this project:

**SB 2030 Targets:**  
 SB 2030 Energy Standard: 25.0 kBtu/sf/yr  
 SB 2030 Carbon Standard: 7.0 lbs CO<sub>2</sub>/sf/yr

**Efficiency Measures:**  
 Cost-effective efficiency measures: 45.0 kBtu/sf/yr, 12.0 lbs CO<sub>2</sub>/sf/yr  
 Design simulation: 41.0 kBtu/sf/yr, 10 lbs CO<sub>2</sub>/sf/yr

**On-Site Renewables:**  
 Solar PV (on campus): 20kBtu/sf

**Off-site measures pursued:**  
 Not applicable



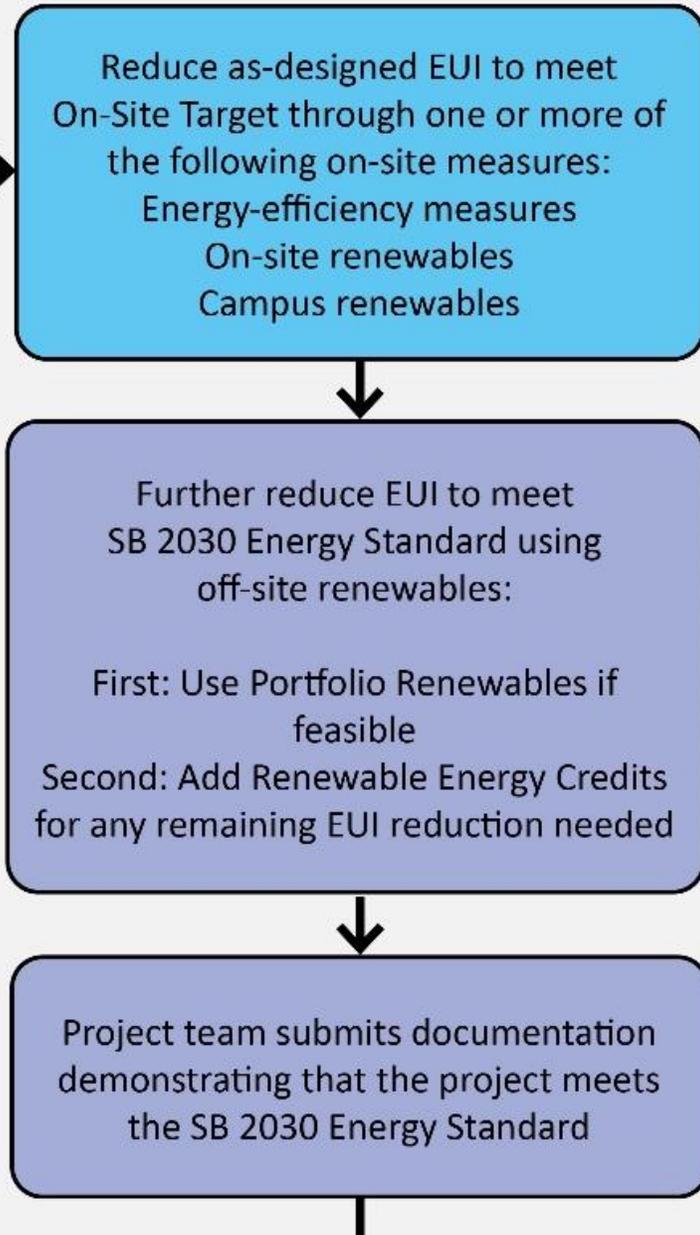
# PART 2: ON-SITE TARGET

- The On-Site Target is the energy use intensity resulting from all energy efficiency measures and renewables with a 12-year payback or less.
- All reasonable efficiency and renewable energy strategies must be included in this calculation.
- Work with the SB 2030 Review Team early in design to establish the On-Site Target.
- The On-Site Target memo documents key metrics.
- The project team can decide how best to meet the on-site target.

# PART 3: OFF-SITE RENEWABLES

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- In portfolio opportunities should be used before
- RECs should be assigned to the building project for the duration of a 10-year period.
  - This can be done with a 10-year term or an upfront purchase based on estimated need.
  - The offsite renewable energy producer must maintain transparent accounting that clearly assigns production to the building.
- Eligible technologies: solar, wind, hydroelectric (<100MW), biomass (with limitations), or hydrogen derived from these sources (M.S. 216B.1691)



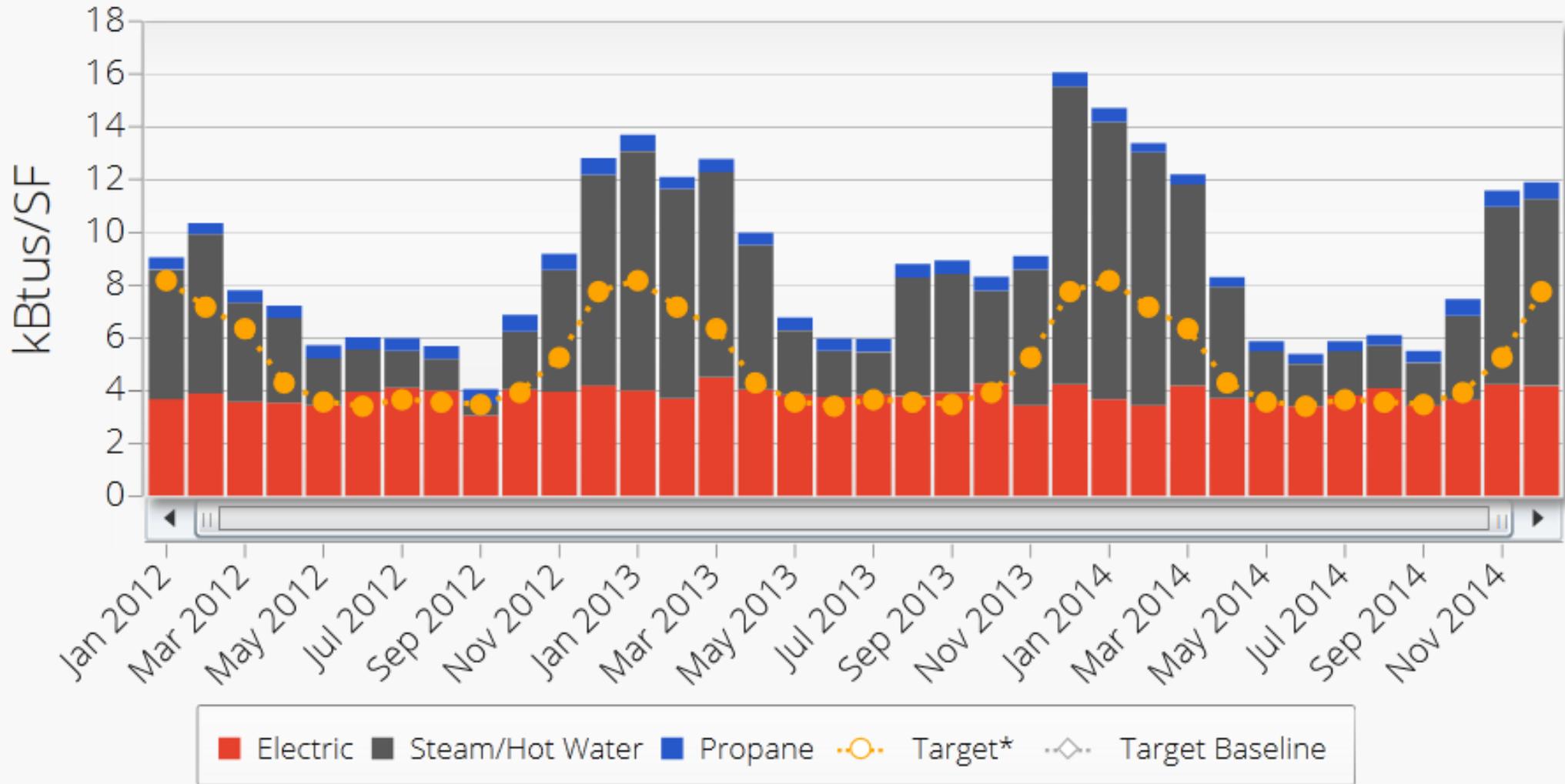
# PART 3: OFF-SITE RENEWABLES

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## POTENTIAL APPROACHES:

1. Investing in a new off-site renewable energy system in exchange for the RECs generated
  - Community solar subscriptions typically do not include RECs.
2. Purchasing RECs
  - Green-e program
3. Subscribing to Green Power/Green Tariff programs
  - Examples: Renewable Connect (Xcel), Wellspring (GRE), Renewable Source (MN Power), Tailwinds (Otter Tail)





**USING B3 BENCHMARKING TO TRACK OPERATIONAL ENERGY USE**

# BENCHMARKING AUTOMATION ASSISTANCE

- Automation assistance in utility data transfer, including whole building consumption—into Energy Star Portfolio Manager (and into B3 Benchmarking for SB 2030 projects)
- Note that this is only for Xcel and Centerpoint territories
- Assistance available for public entities and for non-profits
- Automation can assist in whole-building data (both Xcel and Centerpoint tools allow aggregation of tenant meters).
- Level of support dependent on demand
- Support for this (most likely) closes Summer 2024



# PROGRAM DEVELOPMENTS: UPCOMING AND OTHER

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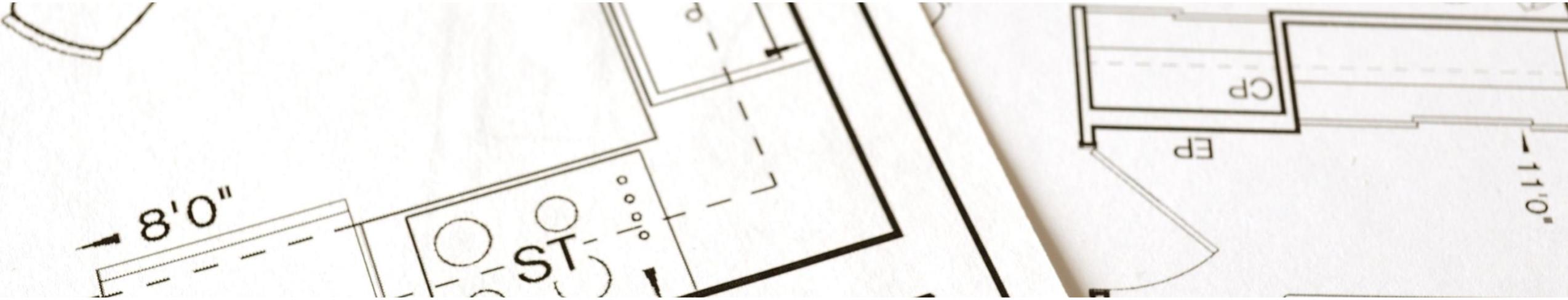
- Current cost effectiveness test is 12-years, note that this gets updated periodically
- Current ability to offset some natural gas use with renewable energy (electricity) procurement, likely to change with transition to 90% better in 2025
- Have moved to a fee-supported model for projects outside of the State General Obligation Bond funded work
- Continual toolkit improvements
- Investigating alternatives to RECs



**QUESTIONS?**

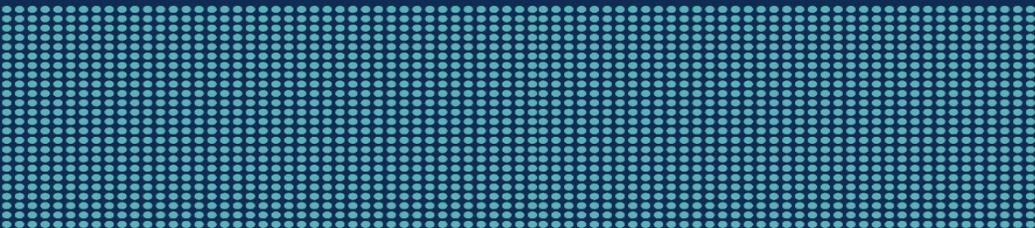
guidelines@b3mn.org





# DOE Zero Energy Ready Homes

Phil Anderson | Center for Energy and Environment



# DOE ZERO ENERGY READY HOMES

**Phil Anderson**

October 24, 2023



Center for Energy and Environment



# DOE ZERH Certification

- Single-Family
  - Version 1, Revision 8 – 2023
  - SF Version 2, January 1, 2024
- Multifamily
  - Version 1, Revision 8 – 2023-?
    - Up to 5 stories
  - Multifamily Version 2 – TBD?
    - Any Height

	HVAC QI w/WHV	HVAC QI w/WHV	HVAC QI w/WHV	Micro-load HVAC QI	Micro-load HVAC QI
	Water Management				
	Independent HERS Verification				
IECC 2012 Enclosure	IECC 2012 Enclosure	IECC 2012 Enclosure	IECC 2015/18 Encl./ES Win.	Ultra-Efficient Enclosure	Ultra-Efficient Enclosure
HERS 70-80	HERS 60-70	HERS 50-60	HERS 35-45	HERS 30-40	HERS < 0
IECC 2012	ENERGY STAR v3	ENERGY STAR v3.1	ZERH	phius CORE	phius ZERO

SOLAR READY  
Depends on climate

Eff. Comps. & H2O Distrib

EPA Indoor airPLUS VI

Ducts in Condit. Space

Electrification Readiness	Renewable Energy to Get to Zero
Electric Vehicle Readiness	No Fossil-Fuel Combustion On-Site
Balanced Ventilation HRV/ERV	Electric Vehicle Readiness
SOLAR READY ALWAYS	Balanced Ventilation HRV/ERV
Eff. Comps. & H2O Distrib	SOLAR READY ALWAYS
EPA Indoor airPLUS VI	Eff. Comps. & H2O Distrib
Ducts in Condit. Space	EPA Indoor airPLUS VI
Water Management	Ducts in Condit. Space
Independent HERS Verification	Water Management
Ultra-Efficient Enclosure	Independent HERS Verification
HERS 30-40	Ultra-Efficient Enclosure
phius CORE	HERS < 0
phius ZERO	phius ZERO

# ZERH Eligibility

## ZERH Single Family, Version 2

Single family



Duplexes



Townhomes



## ZERH Multifamily, Version 2

Multifamily, any height



(Townhomes using ERI Path)

## ZERH Manufactured Housing Pilot Program

Manufactured Homes



# Prerequisites

IECC is the minimum energy code



DOE's Zero Energy Ready Home Program establishes the highest performance levels of federal programs to advance the housing industry. **Requires ENERGY STAR and Indoor airPLUS as prerequisites.**

# Program Requirements



## Step One: Optimized Efficiency

**Enclosure**  
  
 Advanced thermal envelope  
 Airtightness  
 Ducts in conditioned space

**Equipment**  
  
 Advanced heating and cooling  
 Advanced water heating

**Appliances and Lighting**  
  
 LED lighting  
 ENERGY STAR appliances

## Step Two: High Performance

**Water Protection**  
  
 Foundation drainage  
 Flashing  
 Dehumidification  
 Vapor barriers

**Ensured Comfort**  
  
 Ventilation  
 Filtration  
 Pest protections

**Indoor Air Quality**  
  
 Combustion safety  
 Low emission products  
 Radon control

## Step Three: Future Ready

**Photovoltaic Ready**  
  
 Electrical infrastructure to facilitate future PV installation

**Electric Vehicle Ready**  
  
 Electrical infrastructure to support EV charging

**Electric Ready Space and Water Heating**  
  
 Electrical infrastructure to facilitate use of heat pump technology

# Elements of ZERH Program Compliance

## Mandatory Requirements

- Prerequisites (i.e., ENERGY STAR certification)
- “Must-haves” (i.e., thermal envelope, PV Readiness, etc.)

## Performance Threshold

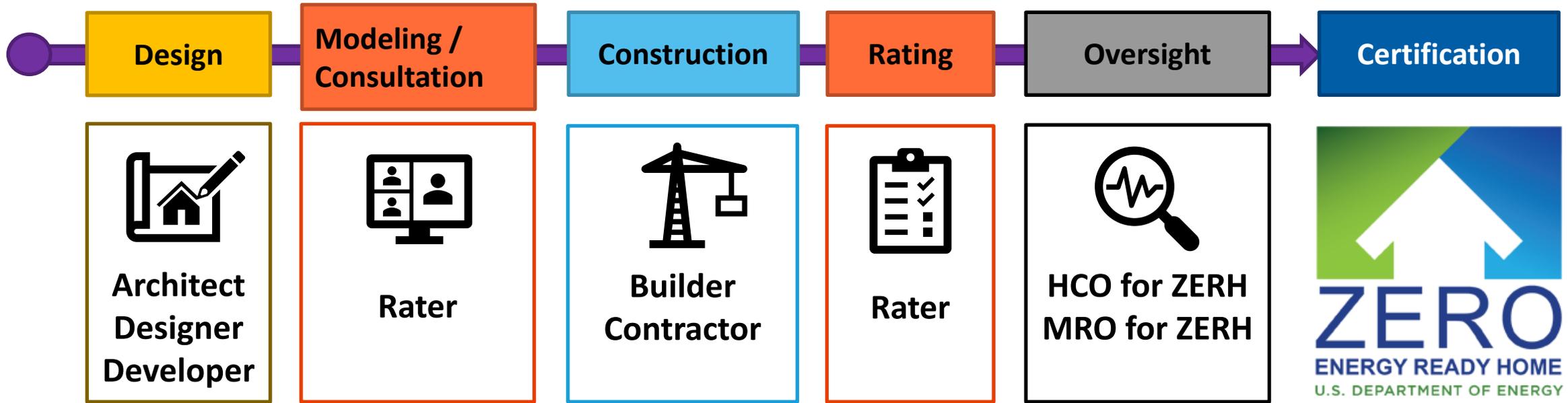
- Each program has a minimum energy efficiency performance levels
- Compliance may be prescriptive or involve energy modeling

## Checklists for Verification

- Rater checklists are the main verification document
- Document minimum specifications and field verified items



# ZERH Certification Process



# Which Program Requirements Do I Use?

## DOE Zero Energy Ready Home (ZERH) Program Requirements

<https://www.energy.gov/eere/buildings/doe-zero-energy-ready-home-zerh-program-requirements>

### Version and Revision Timeline



#### DOE ZERH · Program Versions and Implementation Timelines

##### National (except California)

Program Version and Revision Number	Required for Use, if Home's Permit Date is on/after this Date	Project Type
Version 1, Rev. 06	7/20/2017	Single family, multifamily up to 5 stories
Version 1, Rev. 07	6/1/2019	
Version 1, Rev. 08	1/1/2023	
Single Family Version 2	1/1/2024	Single Family
Multifamily Version 2	TBD (may be optionally used after publication)	Multifamily, any height

##### California Only

Program Version and Revision Number	Required for Use, if Home's Permit/Plan Approval Date is on/after this Date	Project Type
CA Version 1, Rev.07	10/1/2018	Single family, multifamily up to 5 stories
CA Version 1, Rev.08	1/1/2023	
CA Single Family Version 2	TBD (may be optionally used after publication)	Single family
CA Multifamily Version 2		Multifamily, any number of stories

##### Manufactured Homes

Program Version and Revision Number	Required for Use, if Home's Production Date is on/after this Date	Project Type
Manufactured Homes Version 1 (Pilot)	1/1/2023	Manufactured homes (specifications apply nationally, including California)
Manufactured Homes Version 2	TBD (may be optionally used after publication)	

## Need to Know:

- Project Location
- Project Permit Date
- Project Type

# Program Implementation – 45L Tax Credits



<https://www.irs.gov/credits-deductions/credit-for-builders-of-energy-efficient-homes>



<https://www.energy.gov/eere/buildings/45l-tax-credits-zero-energy-ready-homes>



## Credits Available:

Certified Single-Family Homes, Duplexes, and Townhomes **\$5,000** each

Certified Units in Multifamily Buildings **\$1,000** each

Certified Units in Multifamily Buildings when prevailing wages are met **\$5,000** each

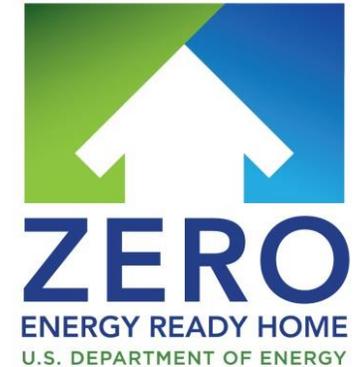
## Need to Know:

- Project Type
- Project Location
- Project Permit Date



# Key Changes for Version 2 – Single Family

- Required Items
  - 2021 IECC Insulation
  - Windows U-factor 0.25
  - HRV or ERV whole home ventilation
  - PV Ready
  - Electric Vehicle Ready
  - Heat Pump Water Heater Ready
  - Heat Pump Space Heater Ready
  - Target home energy efficiency increased





# Key Changes for Version 2 – Multi-Family (Draft)

- Required Items:
  - ENERGY STAR Multifamily New Construction Version 1.2
  - 2021 IECC Insulation Requirements (Residential or Commercial chapters)
  - Windows U-factor 0.25
  - HRV or ERV whole home ventilation
  - PV Ready
  - Electric Vehicle Ready
  - Heat Pump Water Heater Ready
  - Heat Pump Space Heater Ready
  - Target home energy efficiency increased
- Other changes
  - Version 2 has no height limits on multifamily buildings (V1 up to 5 stories)
  - ASHRAE 90.1 compliance path added





# DOE Zero Energy Ready – Paperwork



- Initial submission to MHFA
  - Projected/Draft energy rating reports:
    - ENERGY STAR
    - Indoor airPLUS
    - DOE Zero Energy Ready
- Final submission to MHFA
  - Certified energy rating reports:
    - ENERGY STAR
    - Indoor airPLUS
    - DOE Zero Energy Ready

Normalized, Modified End-Use Loads (MBtu/year)		ENERGY STAR	As Designed
Heating	30.1	4.1	28.7
Cooling	4.1	11.6	3.0
Water Heating	11.6	20.8	5.6
Lights and Appliances	20.8	96.7	19.1
<b>Total</b>	<b>66.7</b>		<b>56.4</b>

Pollution Prevented		Reduction	Energy Cost Savings	\$/yr
Type of Emissions Carbon Dioxide (CO <sub>2</sub> ) - tons/yr	Heating	0.5	Heating	23
	Cooling		Cooling	22
	Water Heating		Water Heating	45
	Lights & Appliances		Lights & Appliances	9
	Generation Savings		Generation Savings	8
<b>Total</b>		<b>Total</b>	<b>53</b>	



# DOE Zero Energy Ready – Key Takeaway's



- Review DOE ZERH requirements for building type during design
  - ENERGY STAR, Indoor airPLUS, and DOE ZERH
- Recruit energy rater early on to model and assist with relevant requirements and provide projected certification documents
- Incorporate requirements into plans and spec's for bidding and construction
- Builders/developers, and raters/verifiers sign up as partners and take relevant trainings
- Hold meetings with developer, architect, builder, rater, and relevant tradespeople to ensure requirements are followed and site visits happen
- Provide necessary documents to rater/verifier for final certification
- Submit final certified reports to MHFA for compliance



# DOE Zero Energy Ready - Resources



- DOE Zero Energy Ready Homes
  - Website
    - <https://www.energy.gov/eere/buildings/zero-energy-ready-home-program>
  - Partner Central
    - <https://www.energy.gov/eere/buildings/partner-central>
  - Program Resources
    - <https://www.energy.gov/eere/buildings/program-resources>
  - Section 45L Tax Credits for DOE Zero Energy Ready Homes
    - <https://www.energy.gov/eere/buildings/section-45l-tax-credits-zero-energy-ready-homes>
- ENERGY STAR
  - [https://www.energystar.gov/partner\\_resources/residential\\_new](https://www.energystar.gov/partner_resources/residential_new)
- Indoor airPLUS
  - <https://www.epa.gov/indoorairplus>



# Passive House

Elizabeth Turner | Precipitate

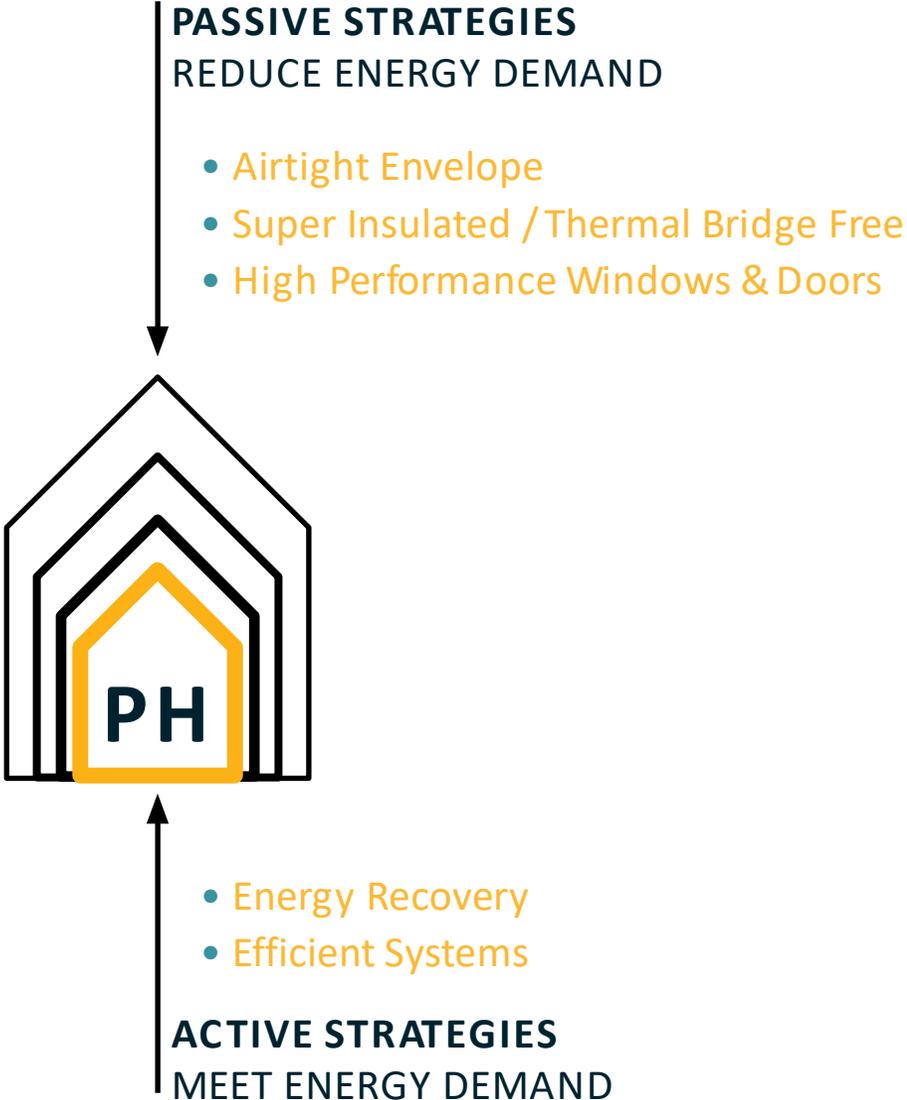
# PHIUS CERTIFICATION

*principles & process*

# passive building principles



Photo by Darrell Cassell on Unsplash



# performance targets

## SPACE CONDITIONING CRITERIA

calculated based on:

- interior conditioned floor area (iCFA)
- envelope area
- number of occupants (bedrooms +1)
- climate data

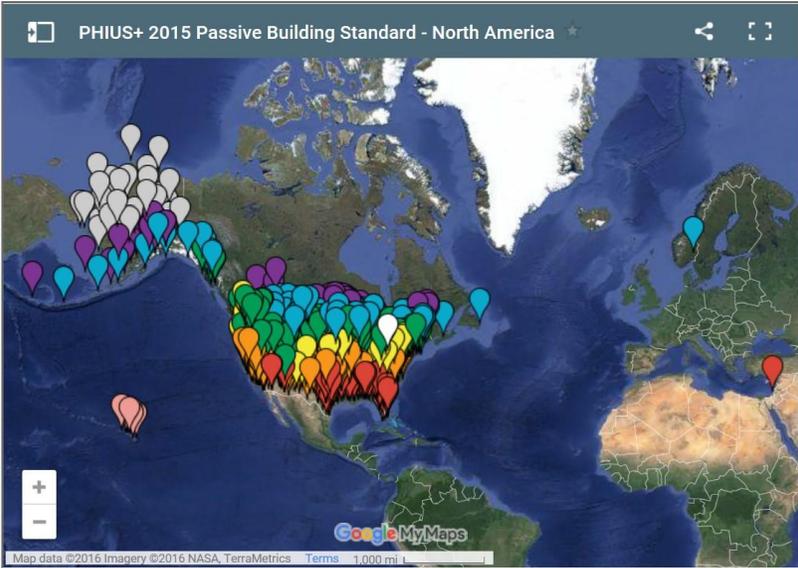


Image credit PHIUS

Phius 2021 Performance Criteria Calculator v3.3		
UNITS:	IMPERIAL (IP) ▾	
BUILDING FUNCTION:	RESIDENTIAL ▾	
PROJECT TYPE:	NEW CONSTRUCTION ▾	
STATE/ PROVINCE	MINNESOTA ▾	
CITY	ROCHESTER INTERNATI ▾	
Envelope Area (ft <sup>2</sup> )	68,400.0	
iCFA (ft <sup>2</sup> )	62,718.0	
Dwelling Units (Count)	48	
Total Bedrooms (Count)	102	
Space Conditioning Criteria		
Annual Heating Demand	6.8	kBtu/ft <sup>2</sup> yr
Annual Cooling Demand	6.0	kBtu/ft <sup>2</sup> yr
Peak Heating Load	6.6	Btu/ft <sup>2</sup> hr
Peak Cooling Load	2.4	Btu/ft <sup>2</sup> hr
Source Energy Criteria		
Phius CORE	4375	kWh/person.yr
Phius ZERO	0	kWh/person.yr

# *phius certification team*



# building off existing rating systems

						Renewable Energy to Get to Zero
						No Fossil-Fuel Combustion On-Site
						Electric Vehicle Readiness
						Balanced Ventilation ERV/ERV
						SOLAR READY ALWAYS
						Eff. Comps. & H <sub>2</sub> O Disc'd
						EPA Indoor airPLUS
						Ducts in Condit. Space
						Micro-load HVAC CI
						Water Management
						Independent Verification
						Ultra-Efficient Enclosure
						HERS < 0
IECC 2009	IECC 2012	ENERGY STAR v3	ENERGY STAR v3.1	ZERH	PHIUS CORE	PHIUS ZERO

image from phius

# growing local examples

## VERDANT

Saint Paul, MN (2019) - Kaas Wilson & Sherman Associates



## HOOK & LADDER

Minneapolis, MN (2017) - LHB & Newport Midwest



## SOLSTICE APARTMENTS

Minneapolis, MN (2024) - Precipitate & Footprint Development



## BAYVIEW TOWNHOMES

Madison, WI (2020) - TKWA & Bayview Foundation



## NORTHSIDE PASSIVE

Minneapolis, MN (2021) - Precipitate & Urban Homeworks / PPL



## HILLCREST VILLAGE

Northfield, MN (2021) - Sweetgrass Design Studio & Northfield CDC



# *parking*

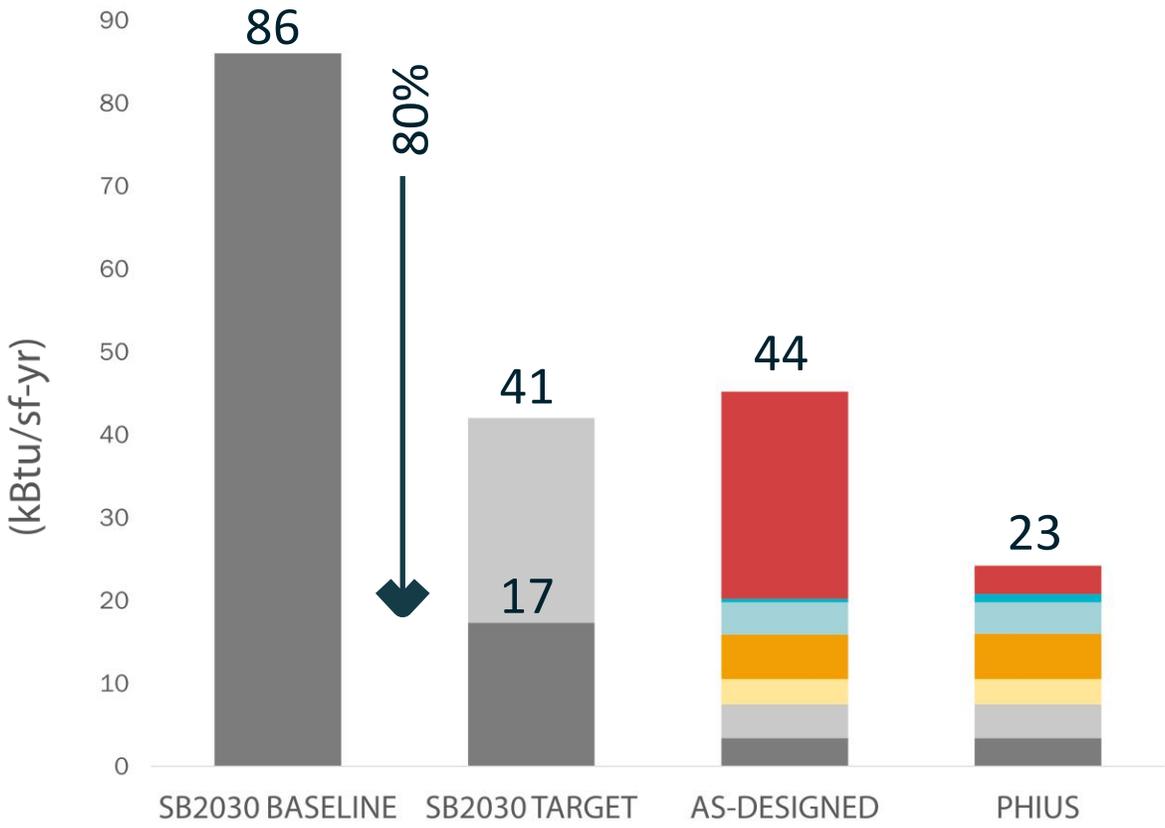


**VERDANT ENCLOSED & TEMPERED**



**HOOK & LADDER TUCK-UNDER**

# comparison with sb2030 - edge apartments



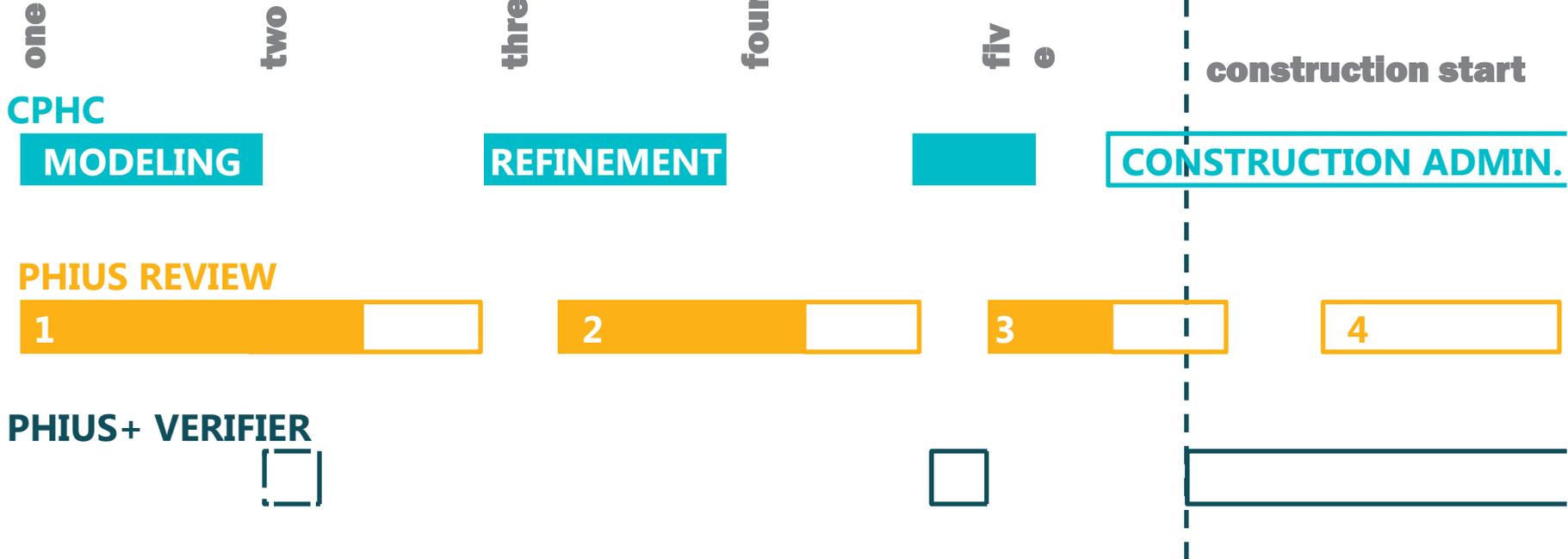
- SPACE HEATING
- SPACE COOLING
- AUXILIARY ENERGY/FANS
- HOT WATER
- LIGHTING
- LARGE APPLIANCES
- MISCELLANEOUS LOADS

# improvements from energy star

	ENERGY STAR ENTERPRISE GREEN COMMUNITIES	PASSIVE HOUSE
	AS-DESIGNED	PHIUS+ 2021
Roof	R49	R49
(whole wall) Wall	R19 + 6.6 ci	R19 + 12.6 ci
Slab	R0.42 (slab on grade)	R14.8 (slab + 4" EPS)
Windows	U-0.27, SHGC .392 no interior blinds	U-0.16 (operable), U-0.14 (fixed) no interior blinds
Doors	R8.7	R8.7
Air Sealing	0.13 cfm/SF @50 Pa	.06 cfm/SF @50 Pa
Heating	95 AFUE Gas Furnace 20 - 31 kBTU/h	Water Source Heat Pump (Gas Heated Water Loop) Combined COP 5.09
Cooling	Electric AC 13 SEER / 11.38 EER 12 - 17 kBTU/h	Water Source Heat Pump (Chilled Water Loop) Combined

# phius certification process

month



# *phius certification process*

**CHPC - MODELING**

**PRECERTIFICATION DESIGN  
REVIEW - PHIUS**

*design certification*

**TESTING BY PHIUS+ VERIFIER**

- Detailed on-site inspection
  - Slab + Foundation insulation
  - Site shading
  - Insulation
  - Air barrier details
- Blower door test
- HVAC + DHW commissioning
- Infrared imaging (optional)

*certification*

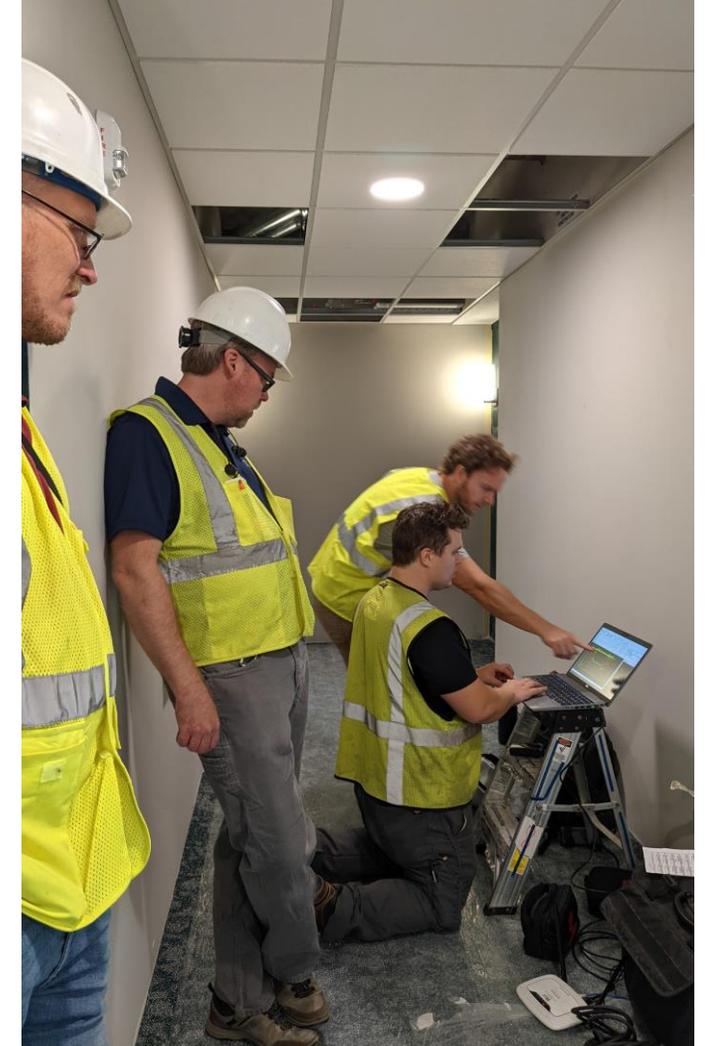
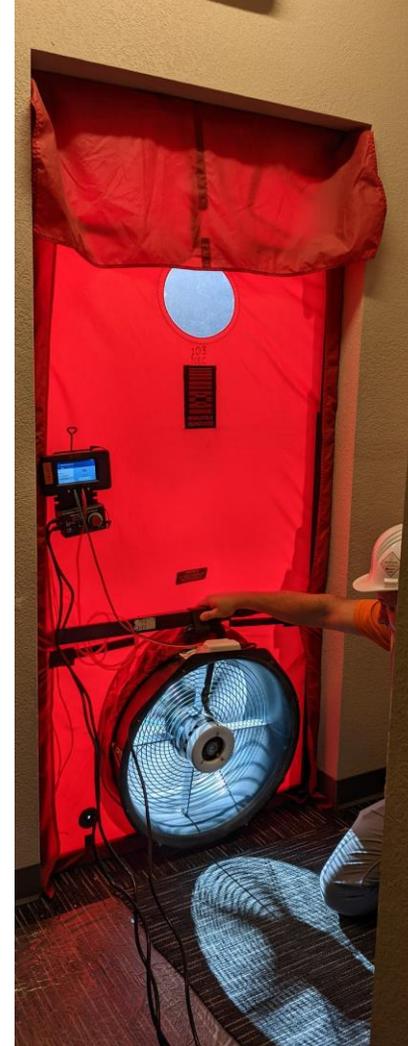


image credit: Elizabeth Turner

# *tips for success*

- Consider schedule & team impacts
  - Engage CPHC early & often
  - Engage mechanical engineers in Schematic Design stage
  - Allow appropriate time for energy modeling & Phius reviews
- Location matters: choose site in southern range of climate zone for reduced insulation differences
- Optimize massing & orientation when possible
  - Allow for general east-west orientation with plenty of southern light
  - Minimize SF/occupant
- Consider which rooms are 'inside building envelope'



**THANK YOU!**

# the “perfect wall”

concept by Building Science Corporation / Joe Lstiburek

## VAPOR

- mid-wall so can dry to both sides
- may have ‘smart’ permeable vapor retarder on interior

## THERMAL

- ideally on either side of air barrier / vapor retarder
- >50% on exterior of thermal bridges (structure)

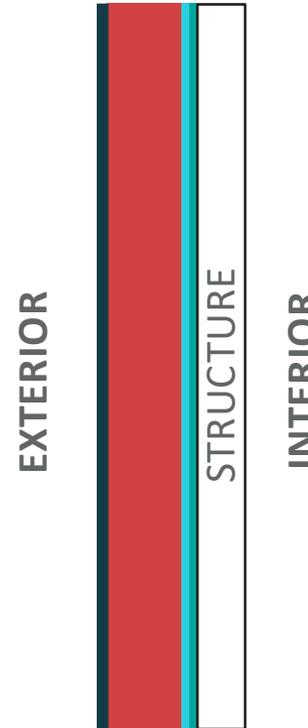
## AIR

- mid-wall so can dry to both sides
- continuous (taped / sealed)

## WATER

- standard methods work, may be paired with other barriers

concept by Building Science Corporation / Joe Lstiburek



*Keep in mind the “perfect wall” concept - structure to the inside, insulation to the outside.*

*Diffusion open or exterior rigid foam, both versions can work*

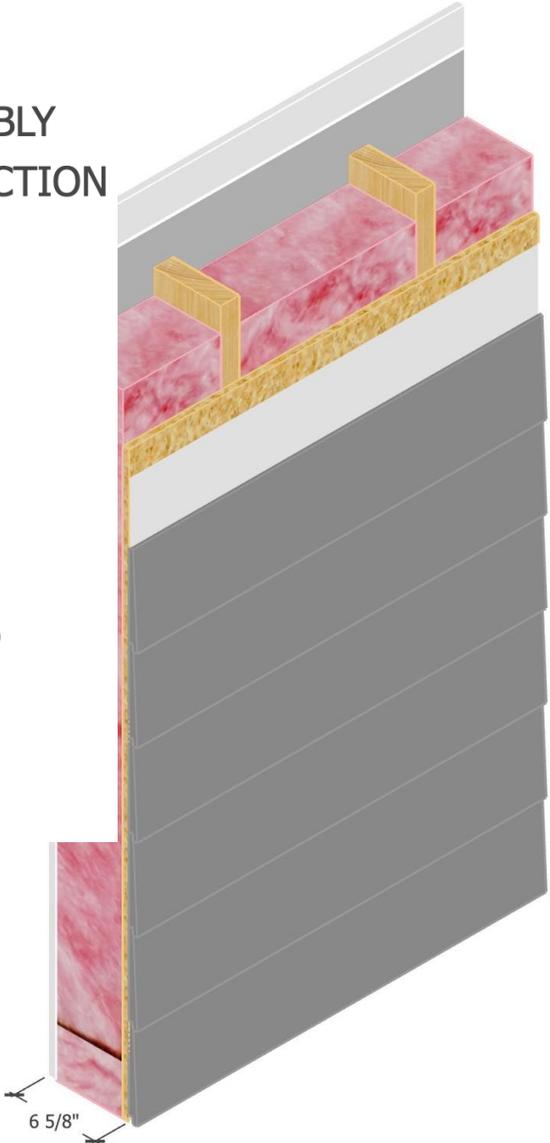
PHIUS CERTIFICATION GUIDEBOOK

*Mid-wall is the best place for the air barrier. Exterior/interior placement is more vulnerable.*

# example wall assembly

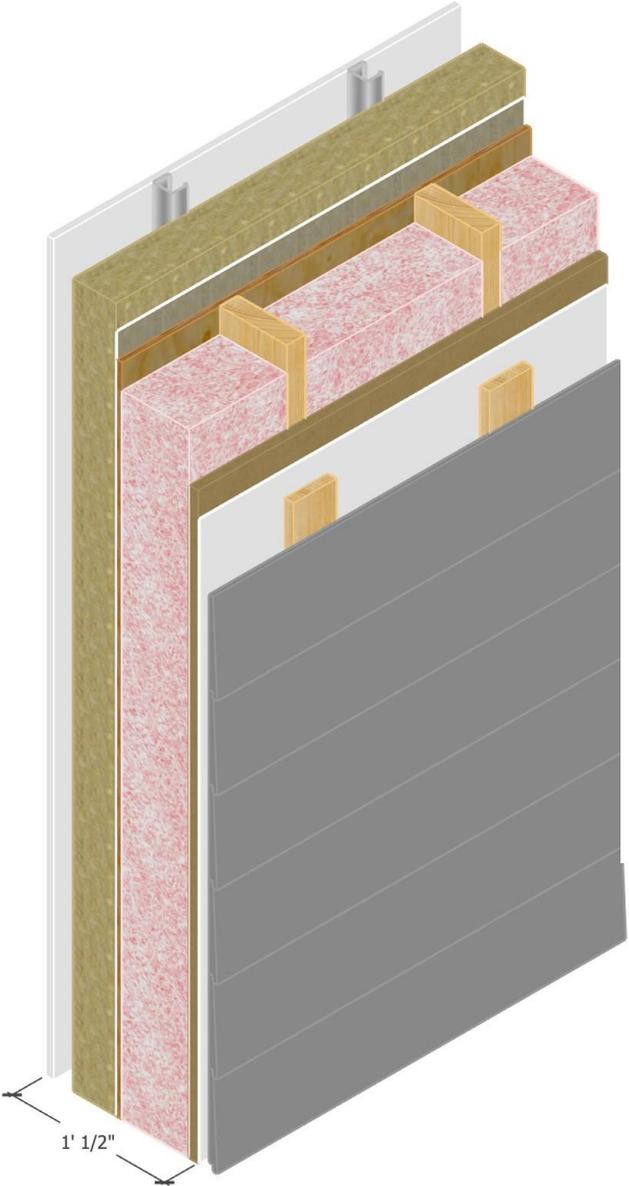
## "GOOD" WALL ASSEMBLY STANDARD CONSTRUCTION

- INTERIOR SHEATHING
- \*VAPOR BARRIER\*  
POLYETHYLENE MEMBRANE
- STRUCTURAL FRAMING  
2X6 WOOD STUD  
R21 FIBERGLASS BATT INSULATION  
1/2" OSB SHEATHING
- \*WATER BARRIER\*  
WRB (WEATHER RESISTIVE BARRIER)
- EXTERIOR CLADDING  
LP SMARTSIDE

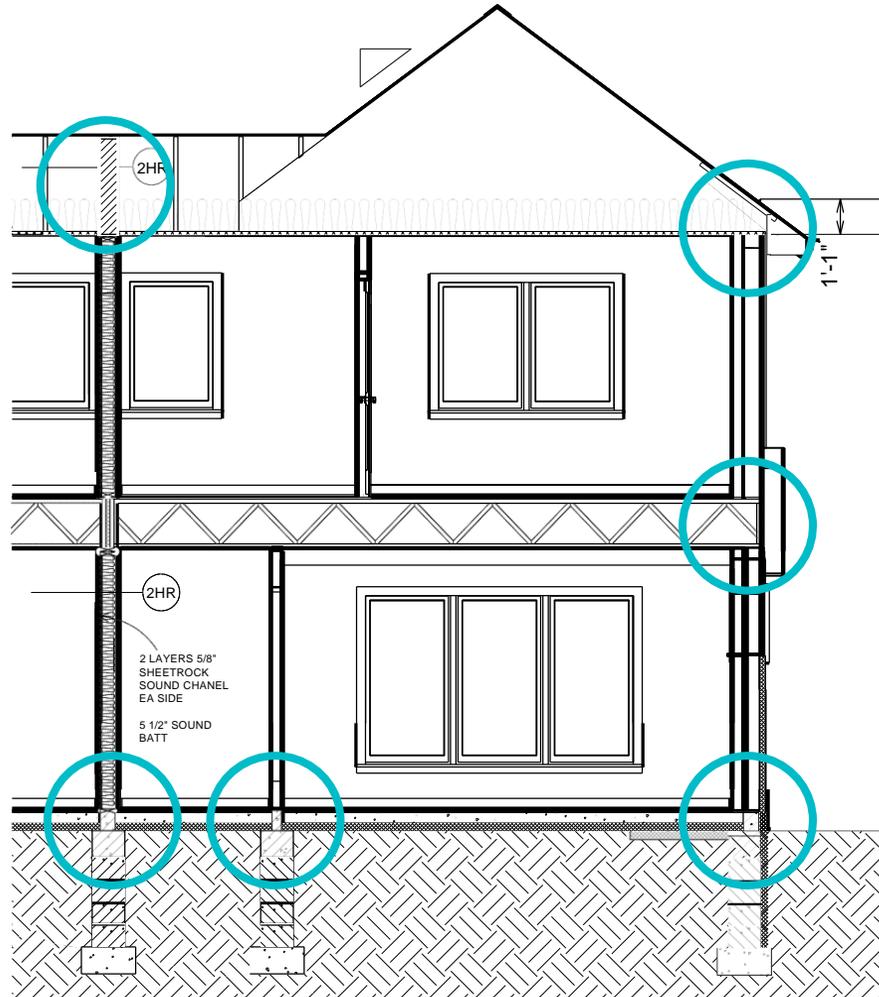


## "BEST" WALL ASSEMBLY - B PHIUS+ 2018 CONSTRUCTION

- INTERIOR SHEATHING
- FURRED SERVICE WALL  
1 5/8" METAL STUD  
CONTINUOUS R15 ROCKWOOL COMFORTBATT
- \*AIR + VAPOR BARRIER\*  
3M 3015 SELF-ADHERED MEMBRANE  
1/2" PLYWOOD SUBSTRATE
- STRUCTURAL FRAMING  
2X6 WOOD STUD  
R24 BIBS (FIBERGLASS BLOW-IN-BLANKET SYSTEM)  
3/4" FIBERBOARD STRUCTURAL SHEATHING \*VAPOR OPE
- \*WATER BARRIER\*  
WRB (WEATHER RESISTIVE BARRIER)
- \*DRAINAGE PLANE + VENTED CAVITY\*  
VERTICAL 1x4 WOOD STRAPPING



# thermal bridging

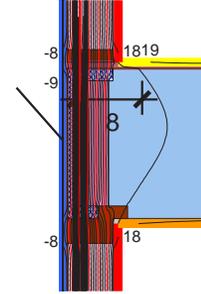


Drawings copyright SWEETGRASS DESIGN STUDIO

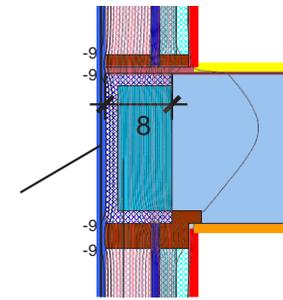
6091 KBTU/YEAR VS 468 KBTU/YEAR

## EXAMPLE RIM JOIST DETAIL

TB (>0.006) 0.018 BTU/hr-ft-F

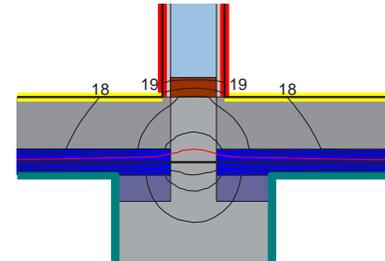


TB-FREE (<0.006) 0.003 BTU/hr-ft-F



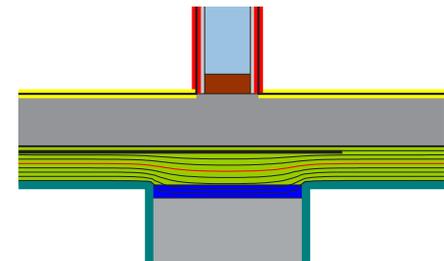
## EXAMPLE BEARING WALL DETAIL

TB 0.0341 BTU/hr-ft-F



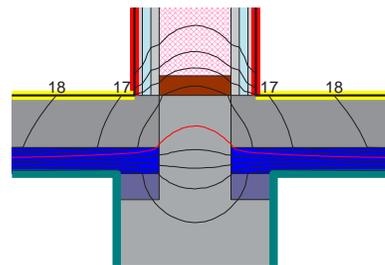
TB-FREE

-0.018 BTU/hr-ft-F



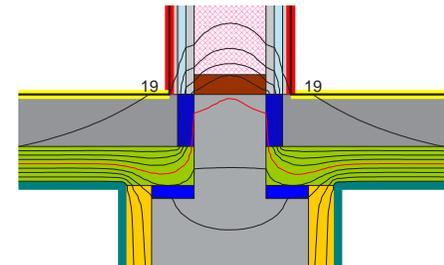
## EXAMPLE DEMISING WALL DETAIL

TB 0.380 BTU/hr-ft-F



ADEQUATE

0.062 BTU/hr-ft-F



# window mullions matter

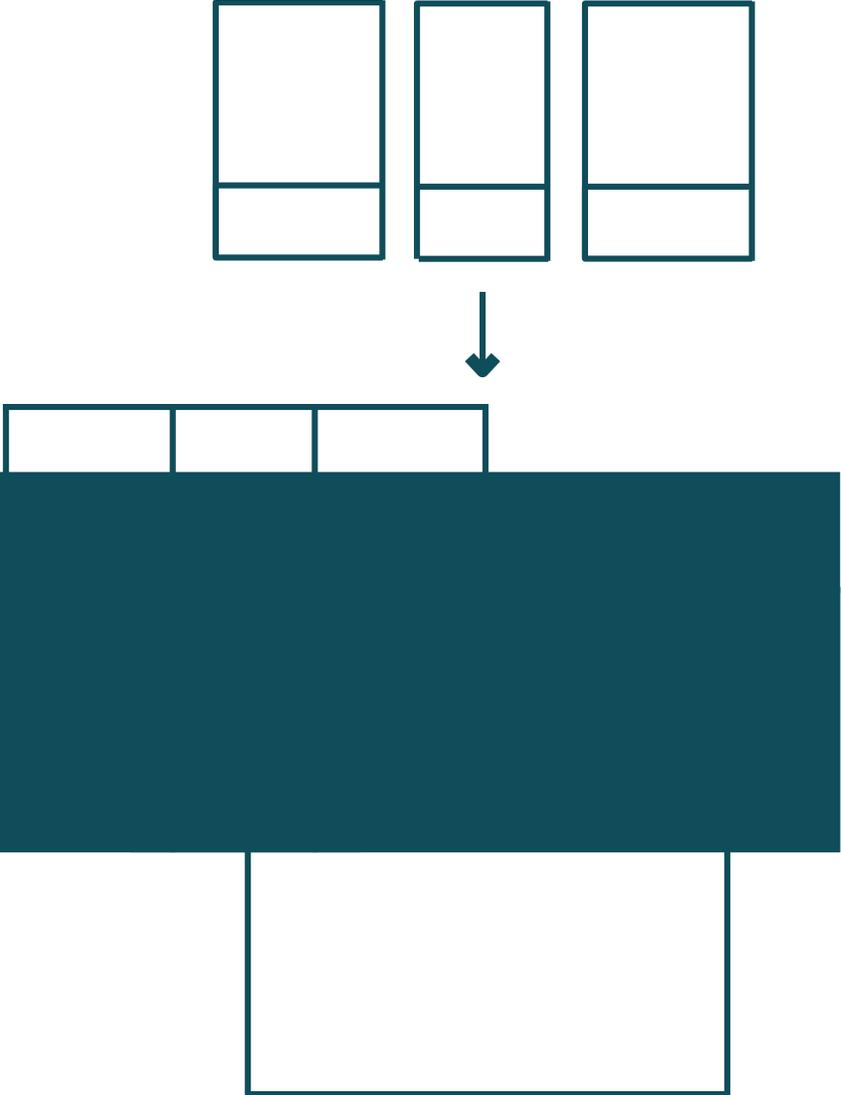
Frame/glazing data

Uw -mounted [Btu/hr ft <sup>2</sup> °F]	0.1794
Frame factor [-]	0.7953
U-value frame [Btu/hr ft <sup>2</sup> °F]	0.2009
Glass U-value [Btu/hr ft <sup>2</sup> °F]	0.123

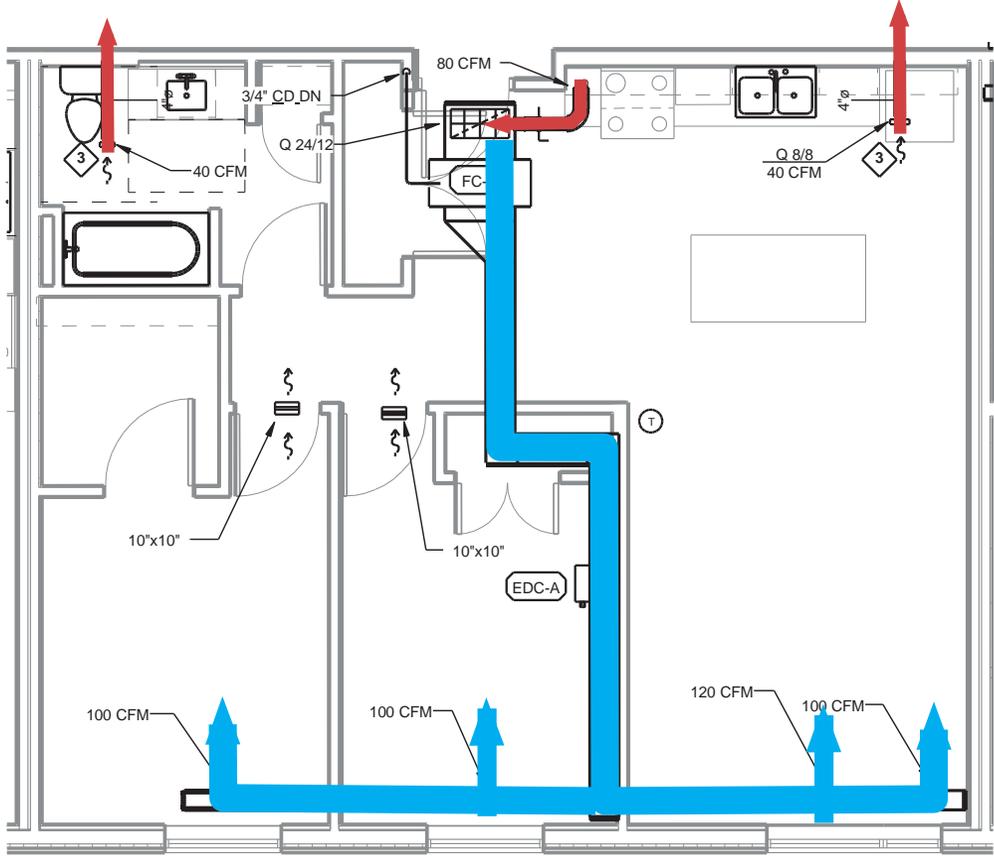
Frame parameters

Setting	Left	Right	Top	Bottom
Frame width [in]	2.86	2.86	2.86	2.86
Frame U-value [Btu/hr ft <sup>2</sup> °F]	0.15	0.15	0.15	0.15
Glazing-to-frame psi-value [Btu/hr ft <sup>2</sup> °F]	0.018	0.018	0.018	0.018
Frame-to-Wall psi-value [Btu/hr ft <sup>2</sup> °F]	0.04	0.04	0.04	0.04

Shown Uw/Frame factor are related to standard window geometry. It will be calculated with component dimensions.



# continuous ventilation



Drawing credit LHB



Image credit Peter Schmelzer



Image credit Elizabeth Turner



Heat or Energy Recovery Core  
Image credit fieldcontrols.com



Image credit Zehnder USA

*minimal space conditioning - typically centralized*



# design process

## PREDESIGN

### PASSIVE SYSTEMS

#### *conceptual design strategies*

- Site selection
- Programming
- Spatial relationships & adjacencies

## SCHEMATIC DESIGN

- Massing & orientation
- Window to wall ratio (WWR)
- Facade articulation & shading

## DESIGN DEVELOPMENT

#### *technical design strategies*

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

## CONSTRUCTION DOCUMENTATION

## CONSTRUCTION ADMINISTRATION

## OCCUPANCY

- Verification

### ACTIVE SYSTEMS

- Energy Recovery Ventilation
- Low-load high-efficiency equipment
- Automated controls
  
- Commissioning



## Questions and Conversation