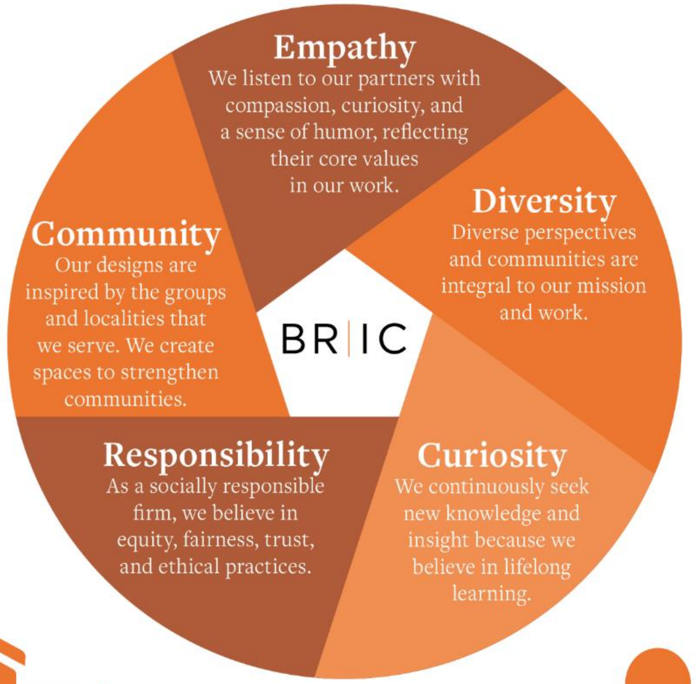
BR|IC

Net Zero Emerging Leaders Internship


BR|IC
Creating Sustainable Buildings and a Sustainable Culture

BRIC Overview

BUILDING RELATIONSHIPS | INSPIRING COMMUNITIES



Educational Design Firm

47 Employees

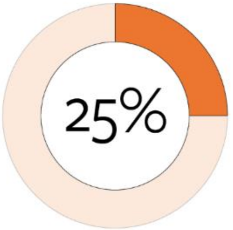
BRIC and Sustainability

BRIC Architecture is a **community-focused** architecture firm. Through value-driven conversations, we collaborate with communities to create spaces that **inspire engagement, exploration, growth, and inclusivity for generations**. We believe the long-term stewardship of the natural environment - both locally and globally - is one of our inherent responsibility as designers. As we renovate and design new buildings, we are recognizing the steps needed to reach a **path to net zero** and look forward to accomplishing these goals.

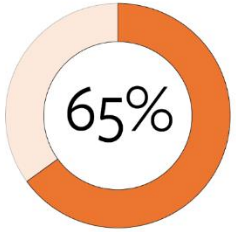
Sustainability and Schools

WHY GREEN SCHOOL DESIGN MATTERS

- Students and faculty spend **85%-90%** of their time indoors, where the indoor air quality can be up to 100 times more harmful than outdoors.
- Over **70%** of executives reported that green schools reduced student absenteeism and improved student performance.[1]



Rate in which the classroom environment can affect a child's academic progress over a year.



Reduction in asthma cases among elementary school students when indoor environment quality improves.

1 Kats, Gregory. (2006). Greening America's Schools: Costs and Benefits.

BRIC's AIA 2030 Commitment

BRIC signs onto the AIA 2030 Commitment Program.

June, 2020

Conduct firm engagement and create a Sustainability Action Plan.

Begin reporting the firm's entire design portfolio to DDx and track how it meets the 2030 goals.

January, 2021

Review how progress and practices are aligning with the Sustainability Action Plan.

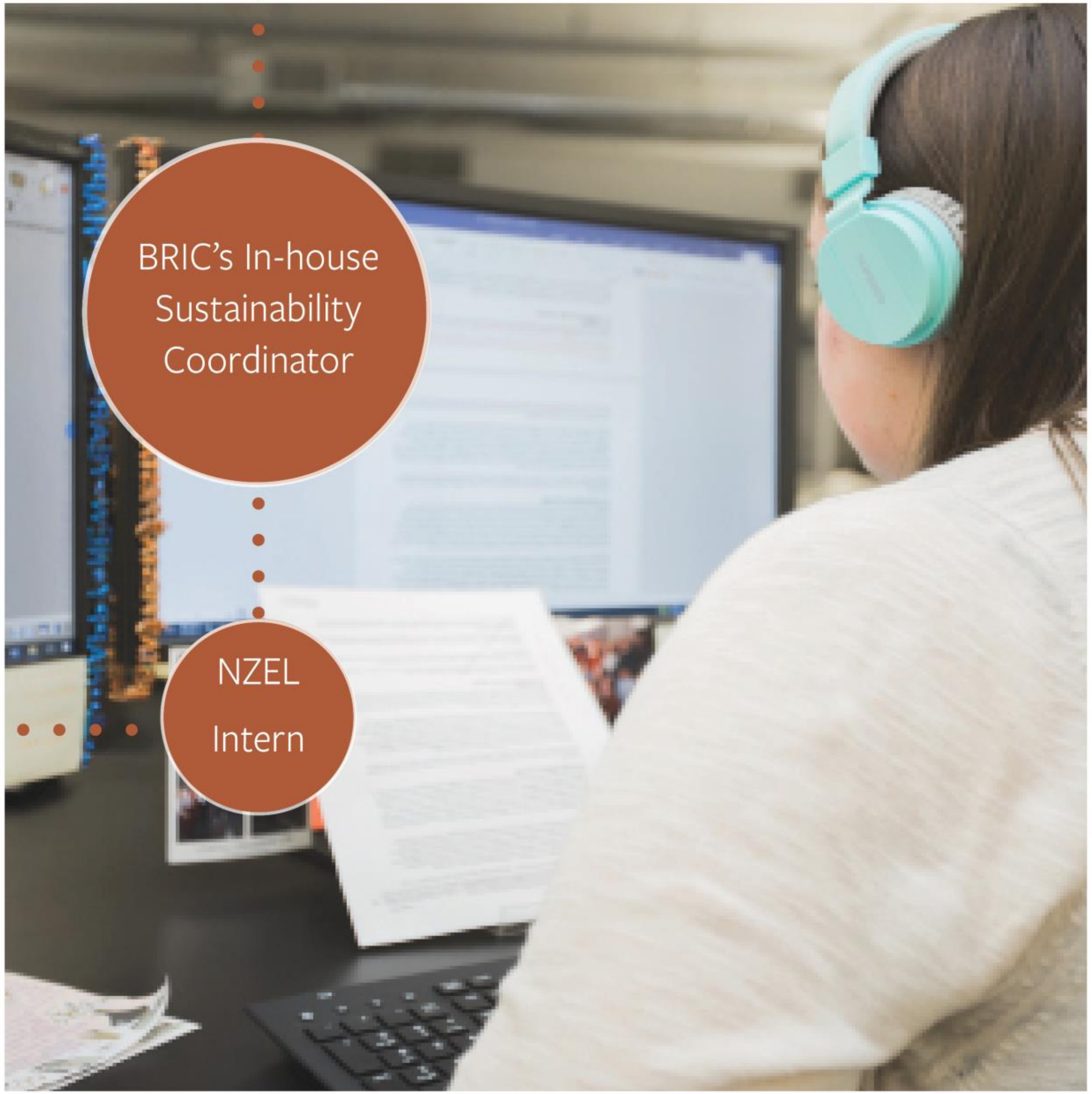
BRIC’s AIA 2030 Commitment

Internship Goals

#1 Establish a method to record project information.

#2 Log all applicable projects into DDx and review results.

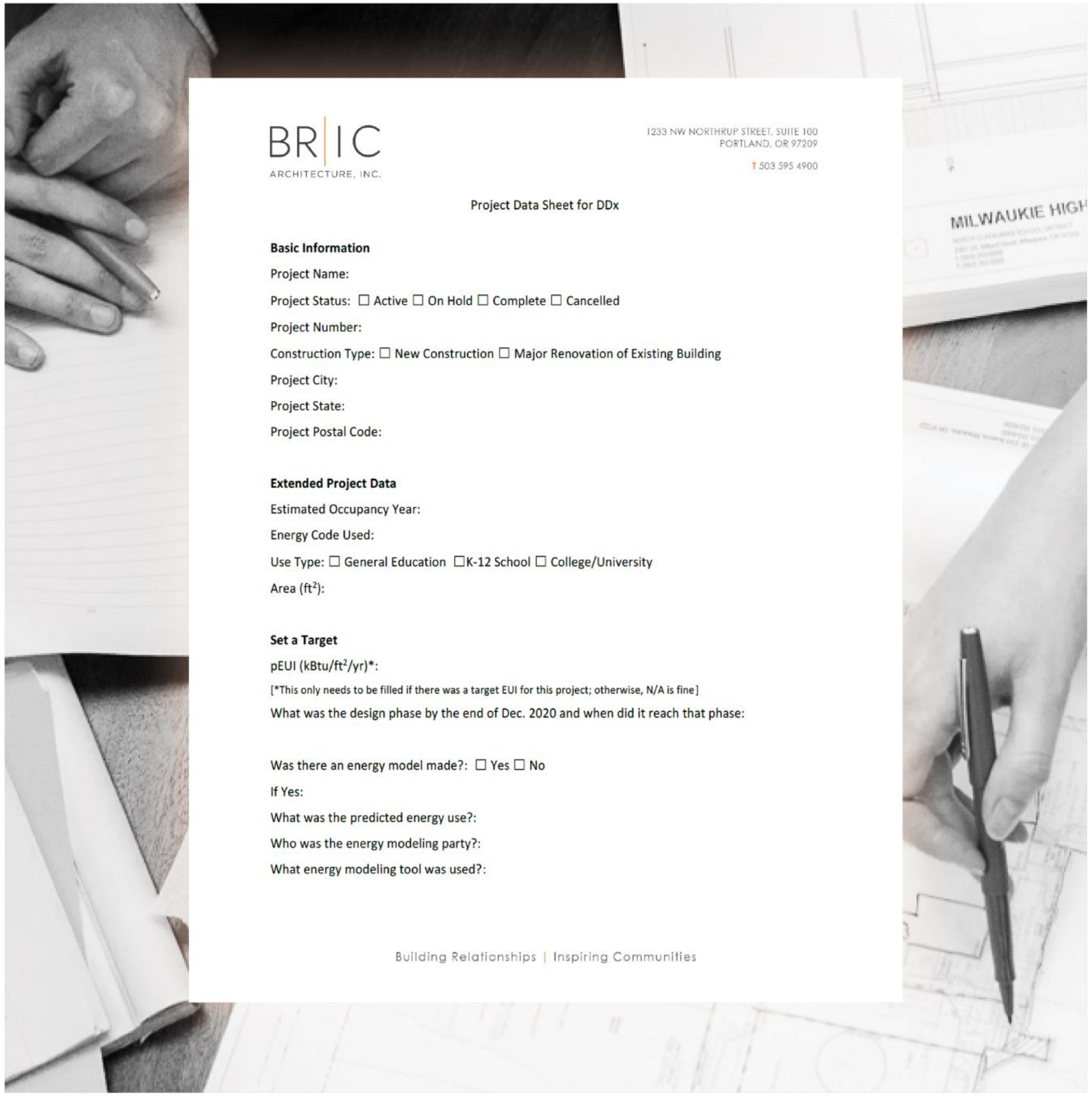
#3 Research performance modeling software.



BRIC 2020 Portfolio

RECORDING PROCESS

- Generated a template that lists the required information from DDx for the firm to use.
- Attended AIA 2030 Open Office Hours to learn how to efficiently use this research tool.
- Recorded projects to DDx and updated whenever new information was provided.



BR|IC
ARCHITECTURE, INC.

1233 NW NORTHRUP STREET, SUITE 100
PORTLAND, OR 97209
T 503 595 4900

Project Data Sheet for DDx

Basic Information

Project Name:

Project Status: ☐ Active ☐ On Hold ☐ Complete ☐ Cancelled

Project Number:

Construction Type: ☐ New Construction ☐ Major Renovation of Existing Building

Project City:

Project State:

Project Postal Code:

Extended Project Data

Estimated Occupancy Year:

Energy Code Used:

Use Type: ☐ General Education ☐K-12 School ☐ College/University

Area (ft^2):

Set a Target

pEUI (kBtu/ft^2/yr)*:

[*This only needs to be filled if there was a target EUI for this project; otherwise, N/A is fine]

What was the design phase by the end of Dec. 2020 and when did it reach that phase:

Was there an energy model made?: ☐ Yes ☐ No

If Yes:

What was the predicted energy use?:

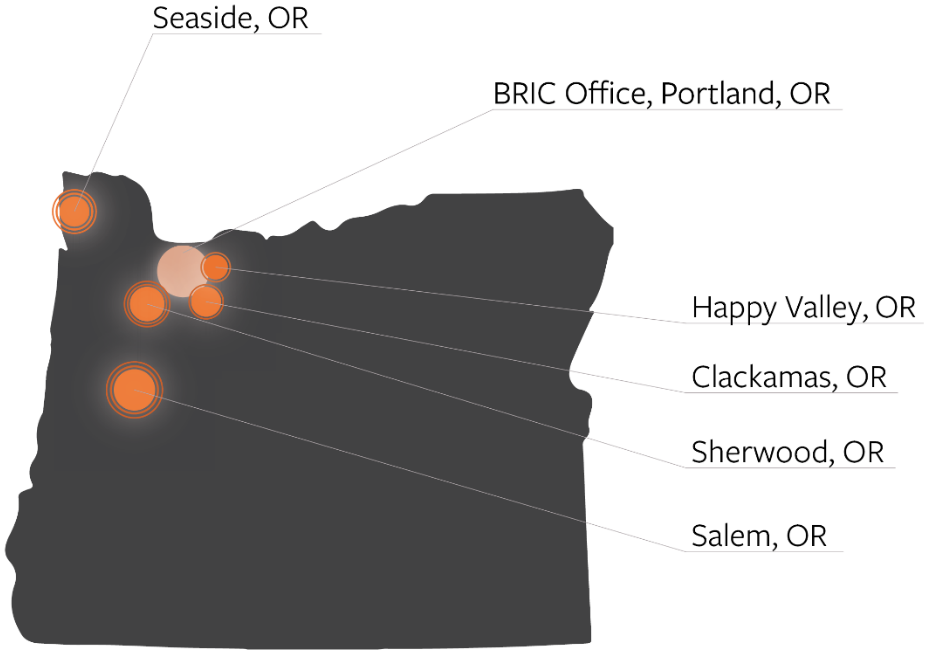
Who was the energy modeling party?:

What energy modeling tool was used?:

Building Relationships | Inspiring Communities

BRIC 2020 Portfolio

PROJECT OVERVIEW



19 Projects Recorded

4 - Elementary

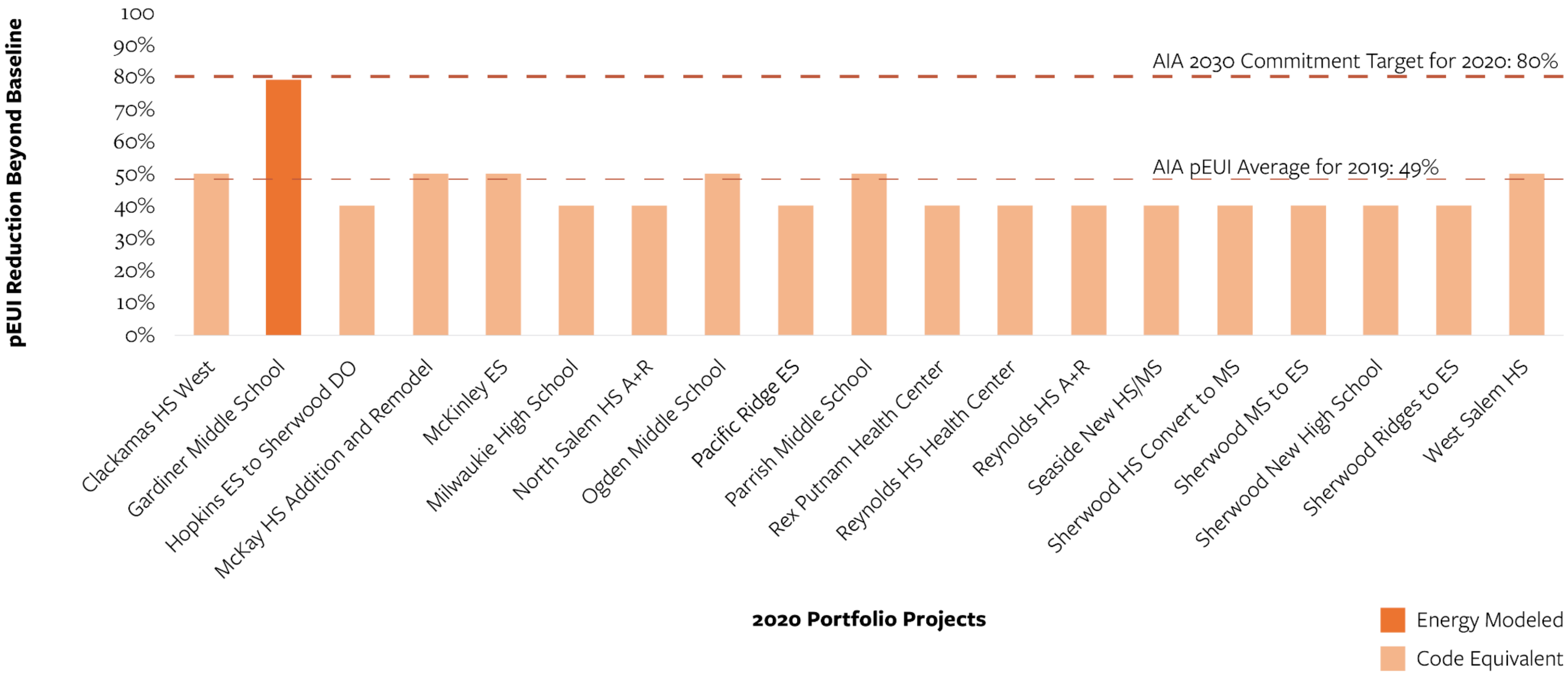
4 - Middle School

8 - High School

3 - Other

BRIC 2020 Portfolio

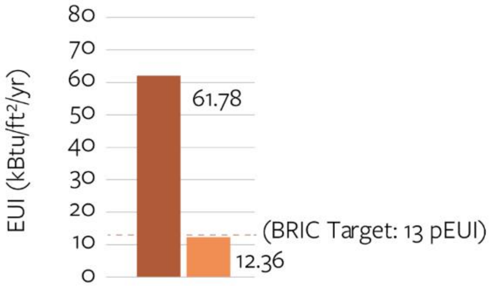
RESULTS

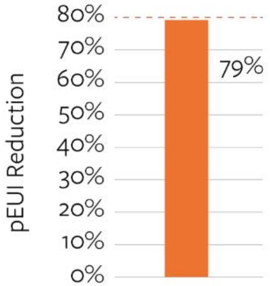


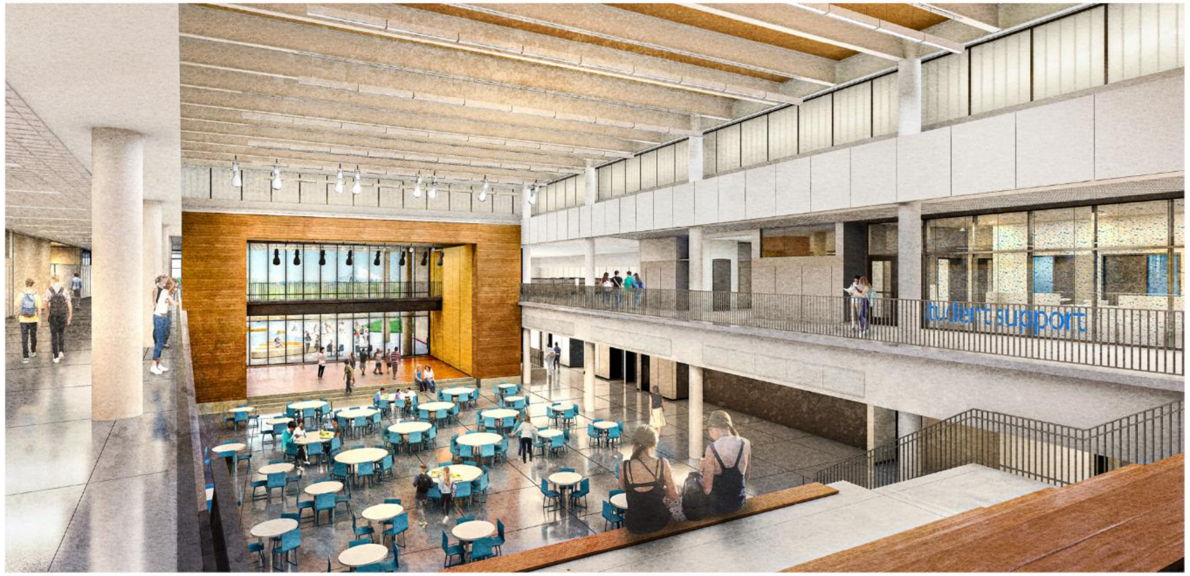
Case Study:

GARDINER MIDDLE SCHOOL

- Oregon City, Oregon
- Area: 150,000 ft²
- Path to net zero project
- Early discussion about EUI and energy modeling
- Focus on energy conservation: water, lighting, electrical, and HVAC
- Renewable energy: solar strategies
- 79% EUI Reduction

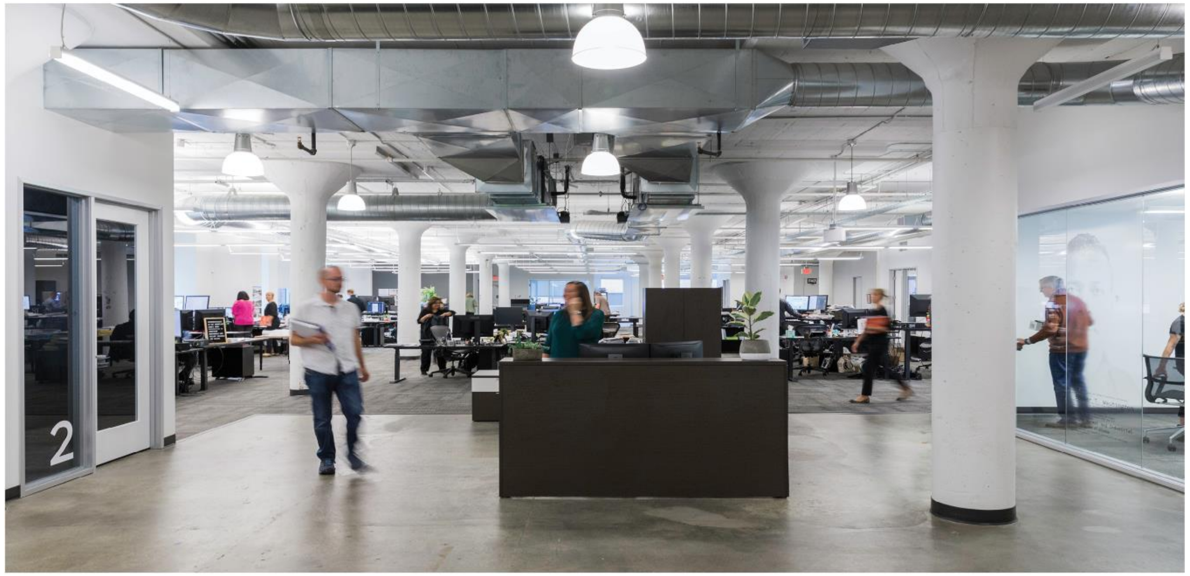




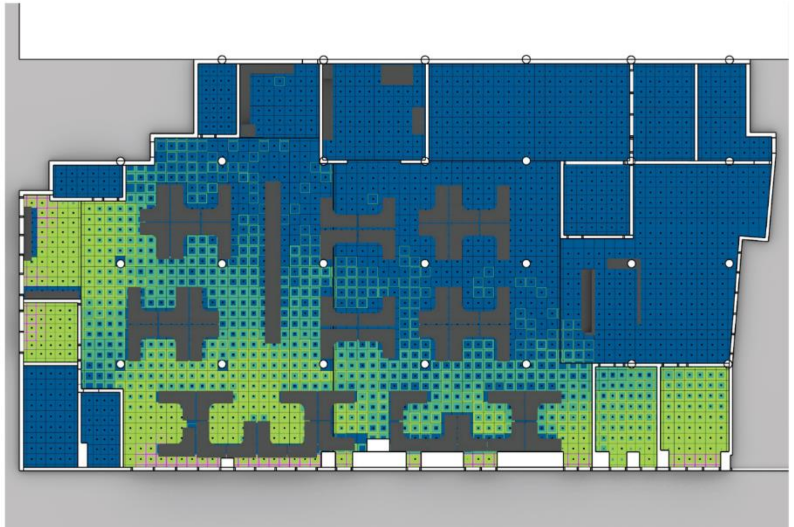


Performance Modeling Comparison

AN ANALYSIS OF THE BRIC OFFICE

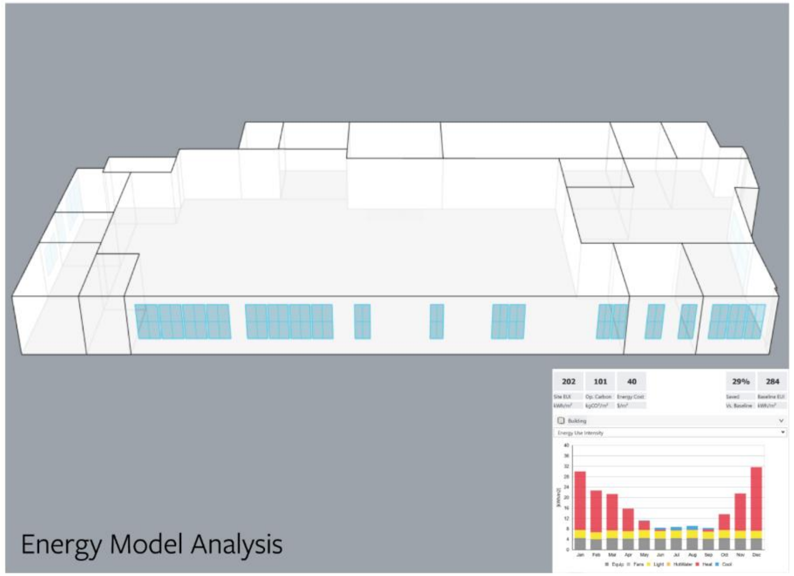


PERFORMANCE MODELING - CLIMATE STUDIO

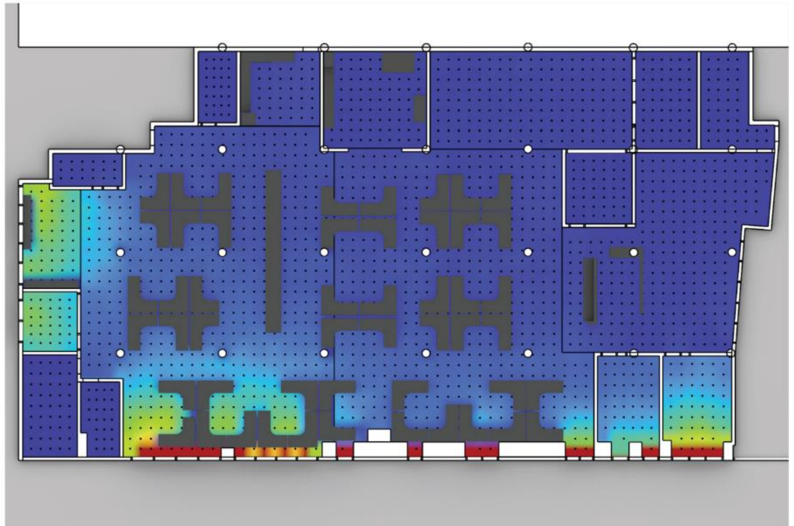


Average Useful Daylight Illuminance

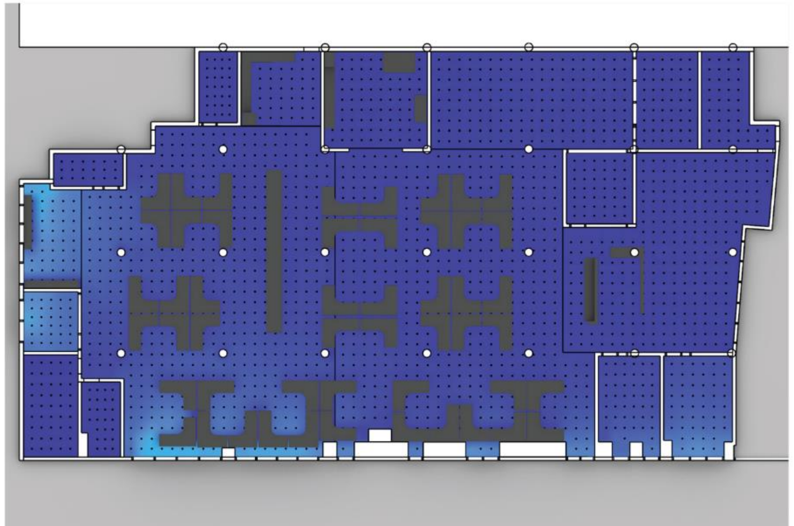
Annual Glare



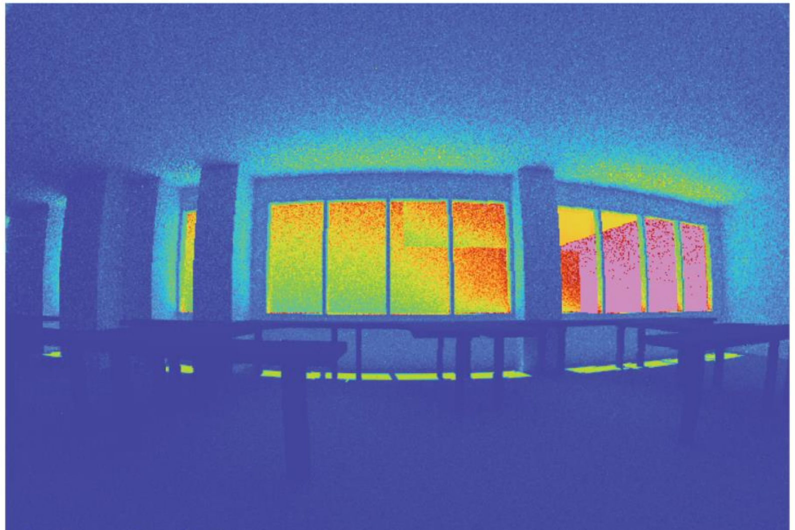
Energy Model Analysis



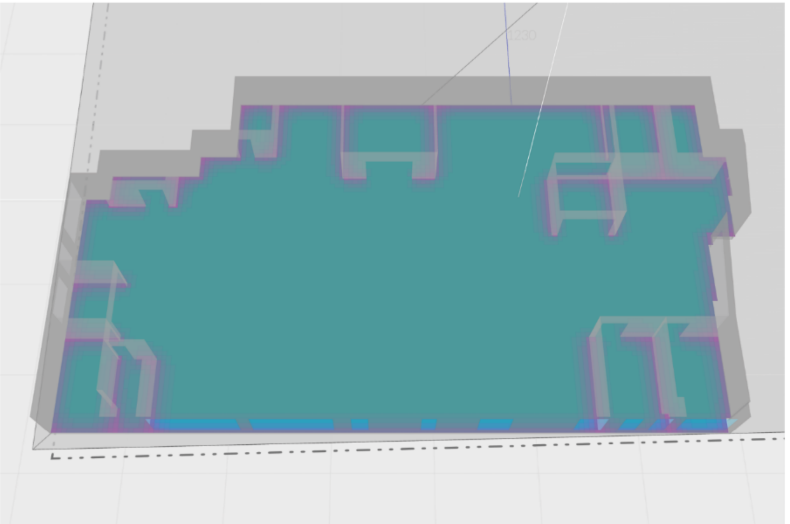
Point-in-Time Illuminance: Summer Solstice

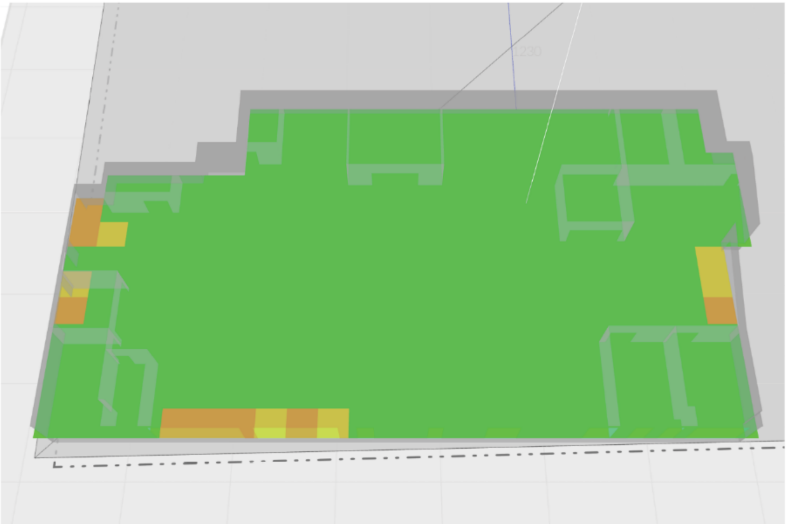


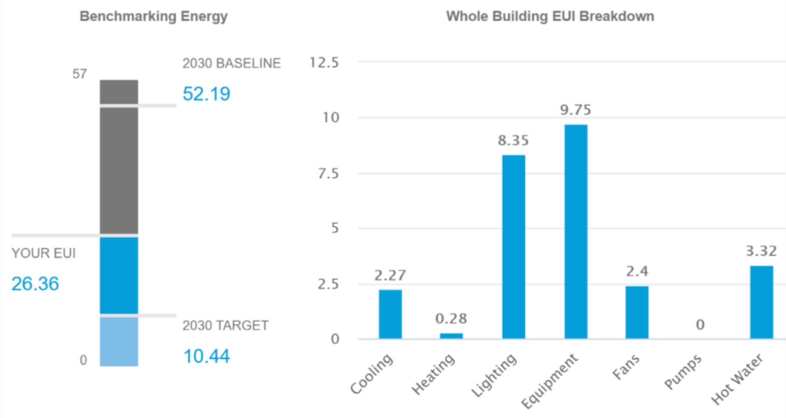
Point-in-Time Illuminance: Winter Solstice



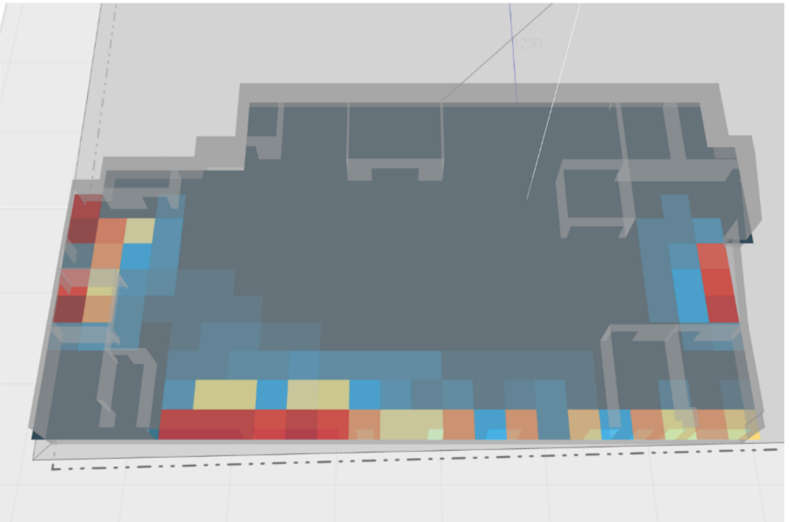
Radiance Rendering

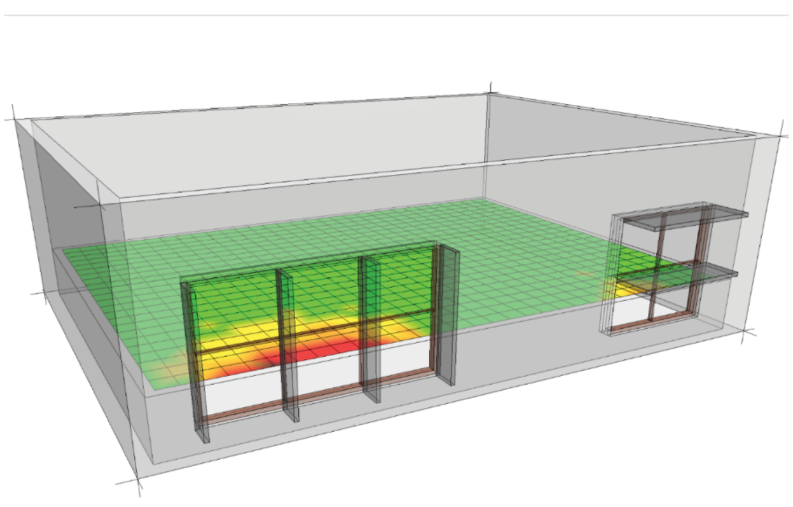

COVID Occupancy Assessment

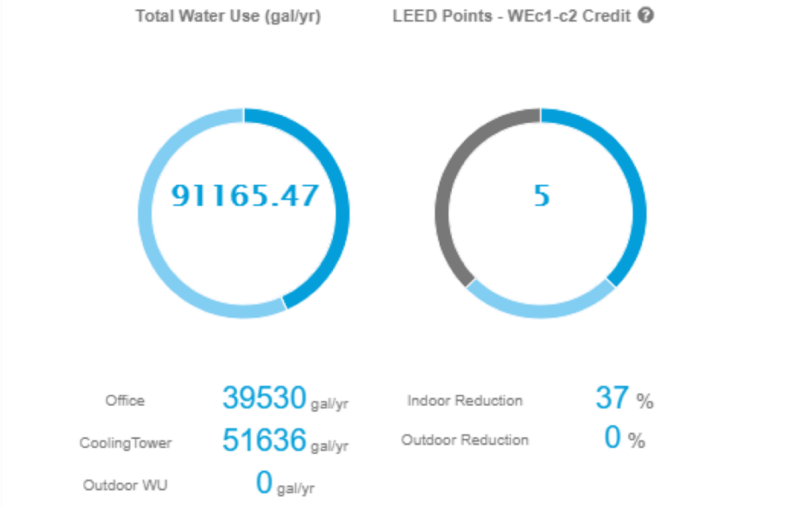

Annual Sun Exposure



EUI Analysis

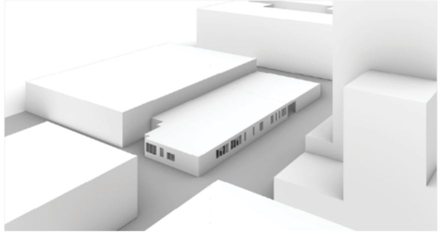

Spatial Daylight Autonomy


Shoe-box Model for Facade Studies

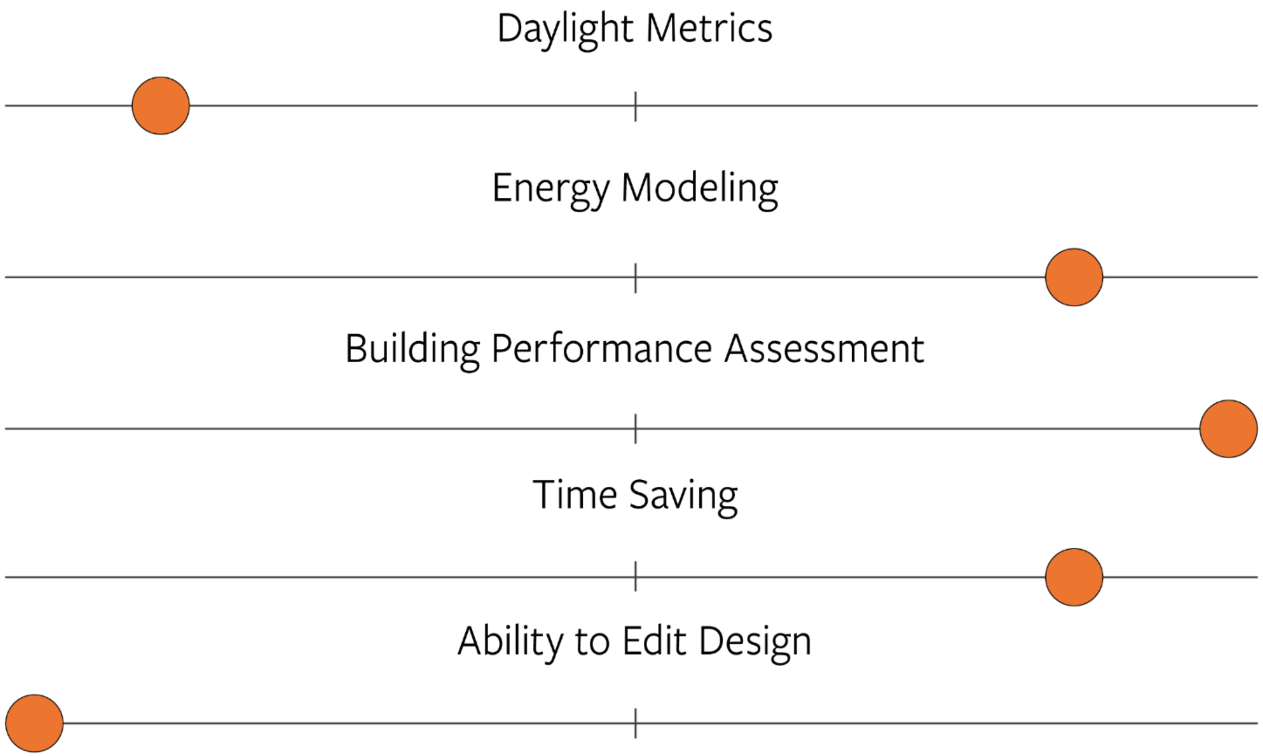


Water Use Analysis

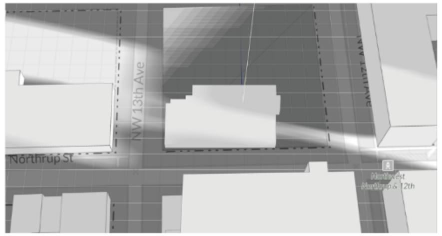
Climate Studio



- Plugin only for Rhino.
- Allows more freedom to alter the design.
- Offers both yearly and specific dates in time analysis.



cove.tool



- Web application and plugin for Rhino, Revit, Sketchup, and other software.
- Offers in depth analysis of results and recommendations.

Next Steps

#1

Standardize energy modeling and EUI tracking throughout the design process.

#2

Develop a method to track renewable energy sources, predicted lighting power density, and embodied carbon.

#3

Maintain progress to the 2030 Challenge.

Thank You

CARLETON HART
ARCHITECTURE

CARLETON HART ARCHITECTURE

NZEL PRESENTATION

BY SUSANA CARRIZAL

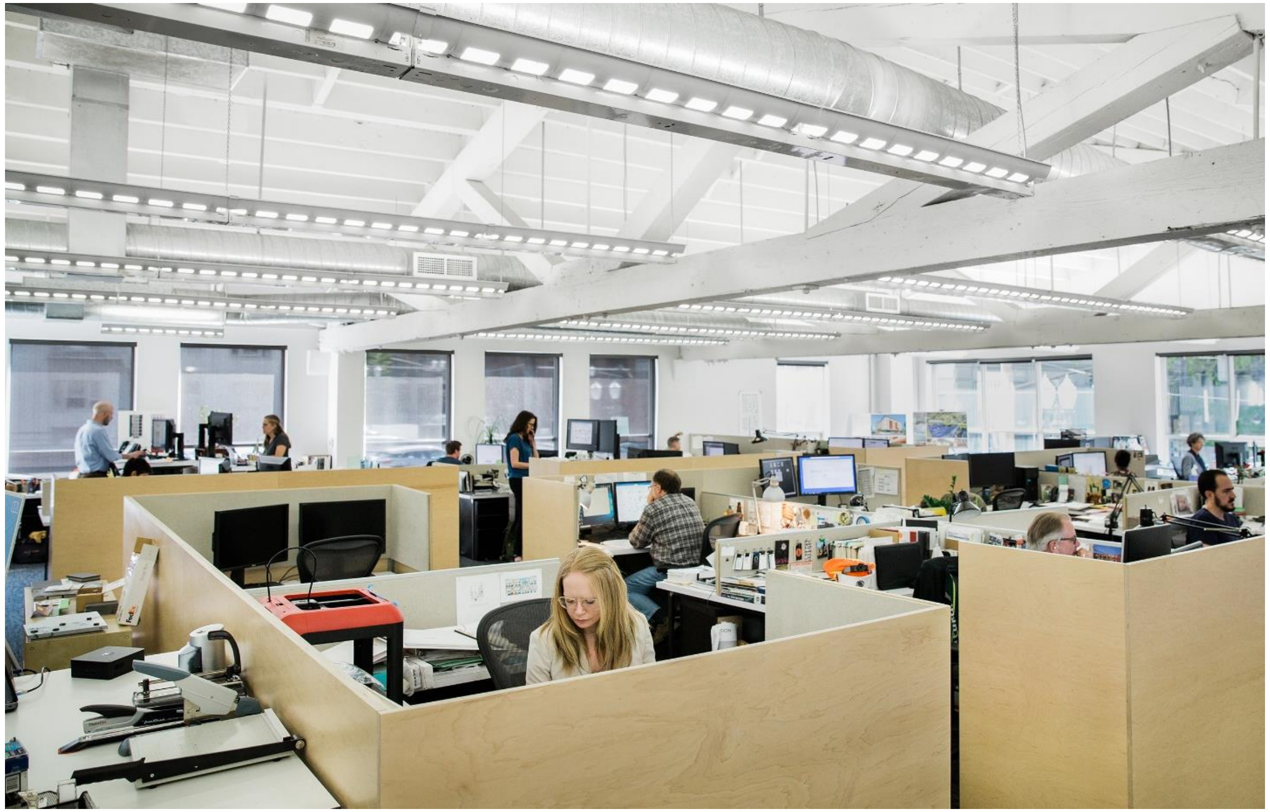
SUSANA CARRIZAL

INTRODUCTION

- Background
  - 3rd year PSU Architecture Student
- NET Zero Emerging Leaders Program
- My experience at Carleton Hart Architecture- 2021
  - Online interning at CHA
  - Discovery
  - Learning
  - Problem Solving
  - Implementing

CARLETON HART ARCHITECTURE

INTRODUCTION



AIA 2030 COMMITMENT

YR 3 REP

Certified B Corporation

Founded in 1994 with a special focus on work that **supports community building.**

Specialize in affordable housing – serving vulnerable and marginalized communities, client – centric, mission driven.

B Corp – A third party certification of social and environmental performance of for-profit companies, that practice a high level of transparency and accountability.

Just - is a transparency platform for organizations to disclose their operations, including how they treat their employees and where they make financial and community investments.

Full-service architecture and interiors – with a special focus on materials health with and equitable design approach.

LEGEND

- LEED CERTIFICATION
- GREEN COMMUNITIES
- EARTH ADVANTAGE

CLARA VISTA TOWNHOMES (SILVER)
Portland, Oregon
65,352 SF
44 Units

IRIS GLEN
Klamath Falls, Oregon
33,065 SF
37 Units

BRIDGE MEADOWS (GOLD)
Portland, Oregon
48,612 SF
36 Units

HOOD RIVER CROSSING
Hood River, Oregon
39,859 SF
40 Units

TIGARD KNOLL
Tigard, Oregon
39,859 SF
40 Units

CHAUCER COURT APTS
(Rehabilitation Project)
Portland, Oregon
61,000 SF
84 Units

MIRACLES CLUB (GOLD)
Portland, Oregon
48,860 SF
40 Units

THE MAGNOLIA (SILVER)
Portland, Oregon
46,382 SF
49 Units

GILMAN COURT (GOLD)
Portland, Oregon
55,800 SF
60 Units

BARCELONA
Location: Beaverton, Oregon
Size: 40,025 SF
Units: 47

LASCALA
Location: Beaverton, Oregon
Size: 47,015 SF
Units: 44

ROSEWOOD PLAZA
Location: Gresham, Oregon
Size: 54,710 SF

SUSTAINABILITY AT WORK CERTIFICATION

HILL PARK
Portland, Oregon
30,209 SF
39 Units

BRIDGE MEADOWS (PLATINUM)
Beaverton, Oregon
49,100 SF
41 Units

NAYA GENERATIONS (GOLD)
Portland, Oregon
30,209 SF
40 Units

BEATRICE MORROW (GOLD)
Portland, Oregon
32,394 SF
80 Units

NEW MEADOWS (GOLD)
Portland, Oregon
14,533 SF
15 Units

COLONIA UNIDAD (GOLD)
Woodburn, Oregon
120,623 SF
44 Units

NESIKA ILLAHEE (PLATINUM)
Portland, Oregon
51,605 SF
59 Units

WOODY GUTHRIE PLACE (PLATINUM)
Portland, Oregon
29,031 SF
64 Units

SUSTAINABILITY AT WORK CERTIFICATION

RED ROCK CREEK COMMONS (PLATINUM)
Tigard, Oregon
38,333 SF
48 Units

CEDAR GROVE (PLATINUM)
Beaverton, Oregon
33,208 SF
44 Units

MAMOOK TOKATEE
Pursuing PLATINUM
Portland, Oregon
54,182 SF
50 Units

WEBSTER ROAD
Pursuing GOLD
Gladstone, Oregon
95,830 SF
48 Units

SUSAN EMMONS
Pursuing GOLD
Portland, Oregon
10,000 SF + 9,992 SF
98 + 48 Units

HAYU TILIXAM
Pursuing PLATINUM
Portland, Oregon
54,182 SF
50 Units

THE JOYCE HOTEL
Pursuing SILVER
Portland, Oregon
5,825 SF
66 Units

BEHAVIORAL HEALTH RESOURCE CENTER
Pursuing GOLD
Portland, Oregon
12,005 SF

COLUMBIA BLVD WASTEWATER TREATMENT PLANT
Pursuing GOLD
Portland, Oregon
10,605 SF

2006 | 2008 | 2010 | 2012 | 2014 | 2016 | 2018 | 2020

2030 CHALLENGE/ ALL PROJECTS

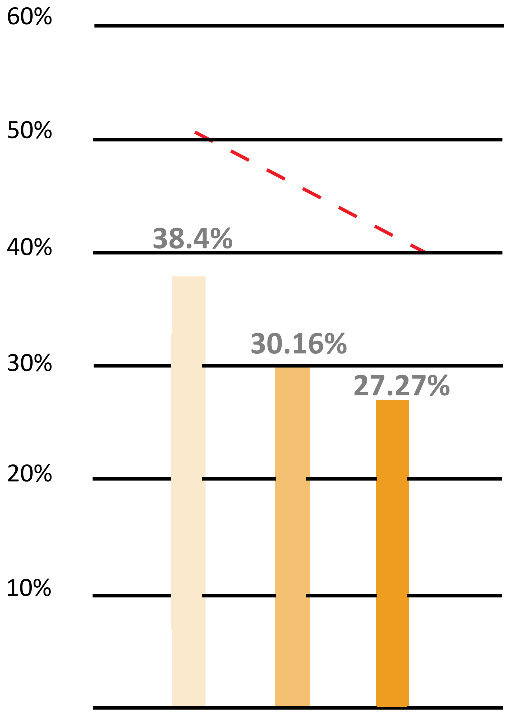
REPORTING YEAR 2020

ARE WE GETTING BETTER OR WORSE?

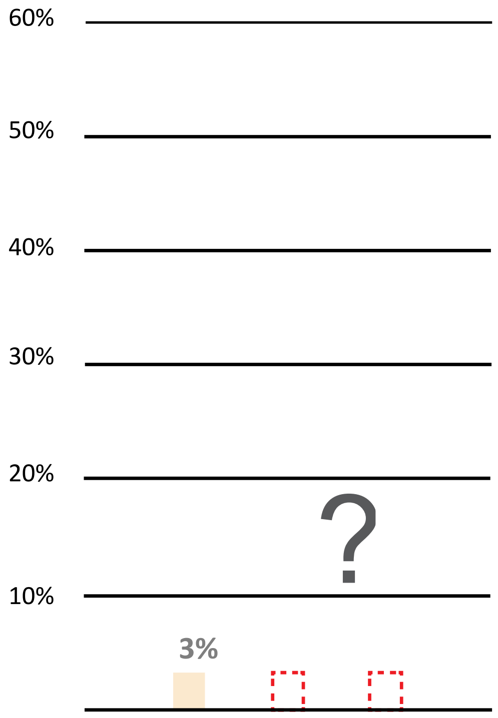
2018-2020 DATA

2018 2019 2020

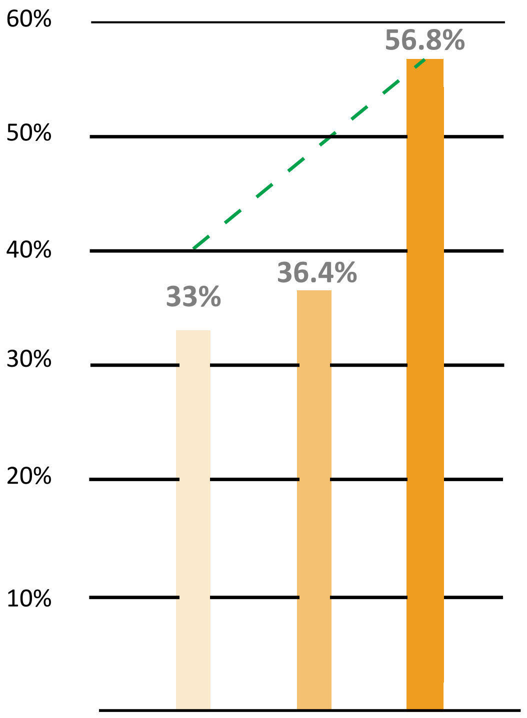
# of projects reported
2018 – 58 projects
2019 – 22 projects
2020 – 17 projects



AVERAGE EUI REDUCTION %



% OF PROJECTS > 60% REDUCTION



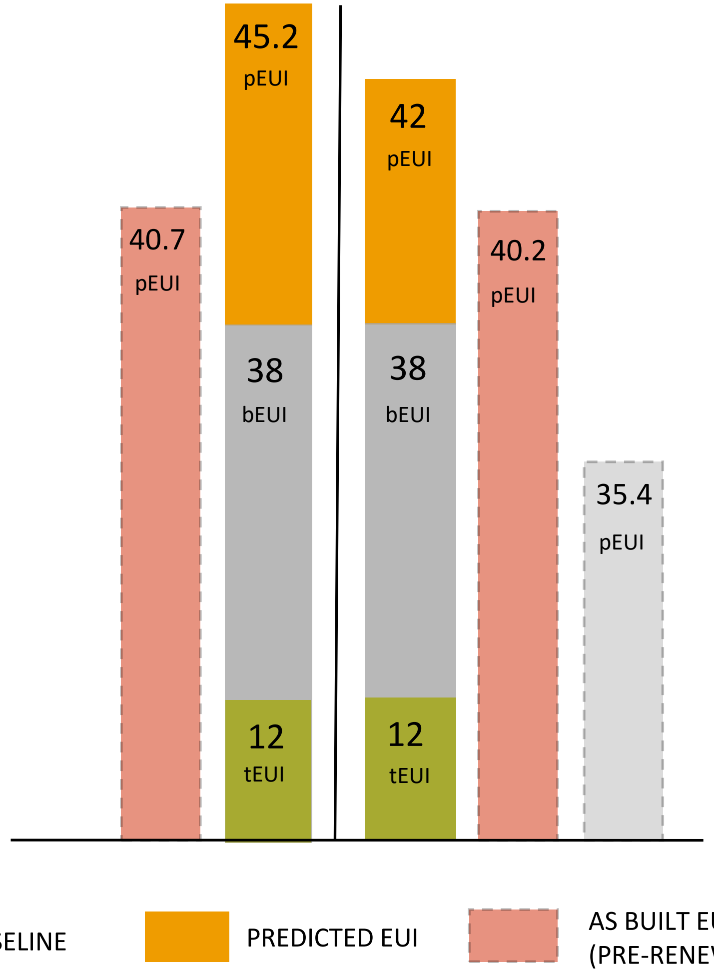
ENERGY MODELED: % OF TOTAL GSF

CASE STUDY

PROJECT A

4 STORY MULTI-FAMILY

39,430 SQFT
NUMBER OF UNITS: 44 **CONSTRUCTION TYPE:** V-A
EARTH ADVANTAGE PLATINUM



PROJECT B

4 STORY MULTI-FAMILY

38,333 SQFT
NUMBER OF UNITS: 48
CONSTRUCTION TYPE: V-A
EARTH ADVANTAGE PLATINUM

CASE STUDY

PROJECT A

Exterior Walls:

R-23, blown-in batt (5 1/2 inches stud bays). R-6, continuous rock wool exterior insulation.

Below Grade Wall:

1. R-10, extruded polystyrene foam board for full height on interior face of wall.

2. R-15, blown-in-batt (3 ½ inches stud bays)

Roof: R-30 (Rigid Insulation)

Windows: Innotech Windows + Doors; Defender 76 DS.

PROJECT B

Exterior Walls:

R-6, exterior continuous mineral wool insulationR-23, blown-in blanket (5 1/2 inches stud bays).

Wood Floors: Overhangs

1. R-38 minimum, Blown-in Batt

Below Grade Wall:

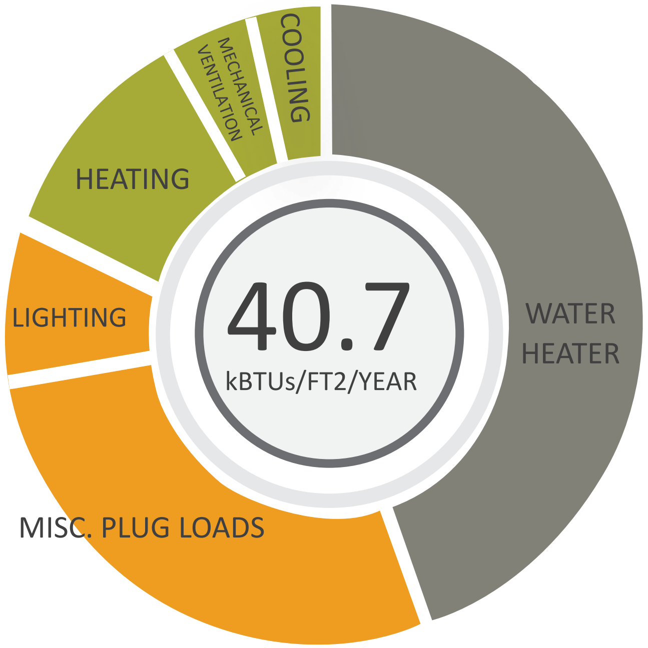
1. R-10, extruded polystyrene foam board for full height on interior face of wall.

2. R-15, blown-in-batt (3 ½ inches stud bays)

Roof: R-30 (Rigid Insulation)

Windows: Innotech Windows + Doors; Defender 76 TS.

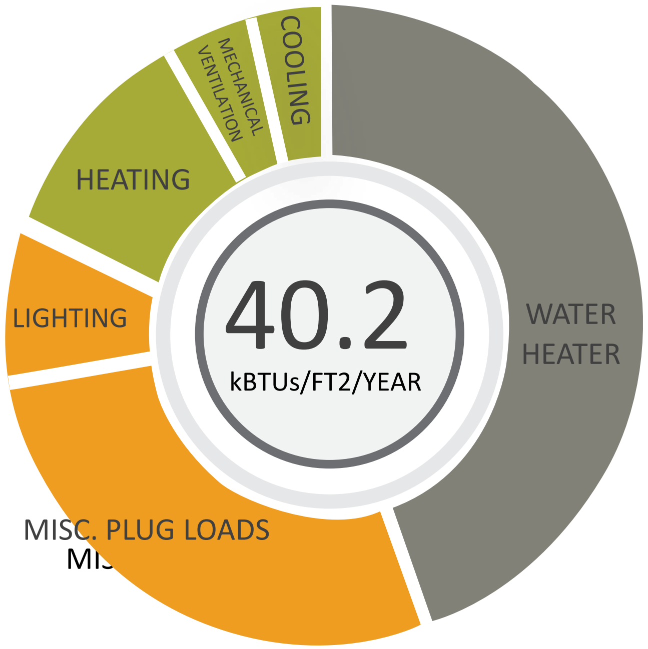
PROJECT A



AS BUILT PERFORMANCE
*SOURCE FROM EARTH ADVANTAGE

20.33% savings over permitted code pre-renewables

PROJECT B



AS BUILT PERFORMANCE
*SOURCE FROM EARTH ADVANTAGE

21.56% savings over permitted code pre-renewables

PLUMBING
ELECTRICAL
MECHANICAL

WATER HEATING (PLUMBING)/MISC PLUG LOAD (ELECTRICAL)/ HEATING (MECHANICAL) **HAVE THE MOST IMPACT** ON A BUILDING'S ENERGY PERFORMANCE

ALTERNATIVES TO VINYL WINDOWS

WHY IS IT IMPORTANT?

RESEARCH

PVC

CREATES AND **RELEASES** ONE OF THE MOST **TOXIC CHEMICALS**

DIFFICULT TO RECYLCE – ENDS UP IN THE LANDFILL

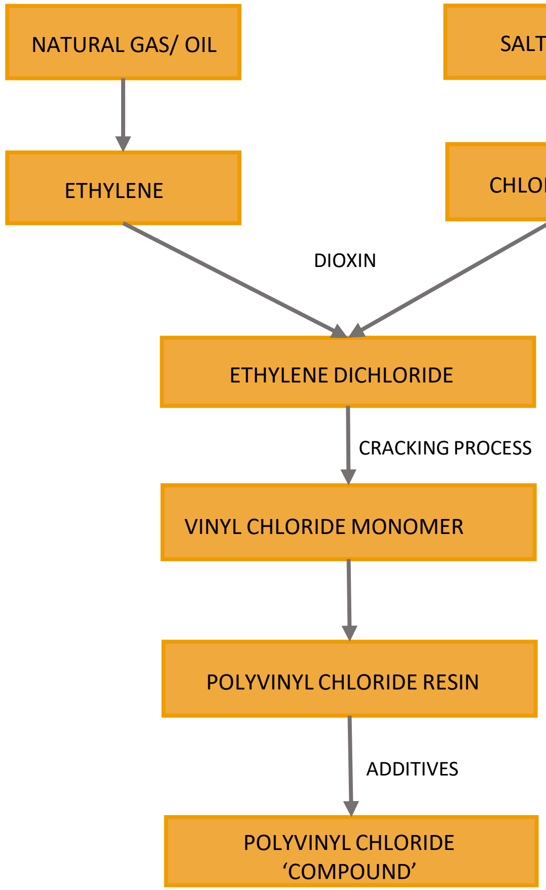
WHY DO WE AS ARCHITECTS NEED TO CARE ABOUT THIS?

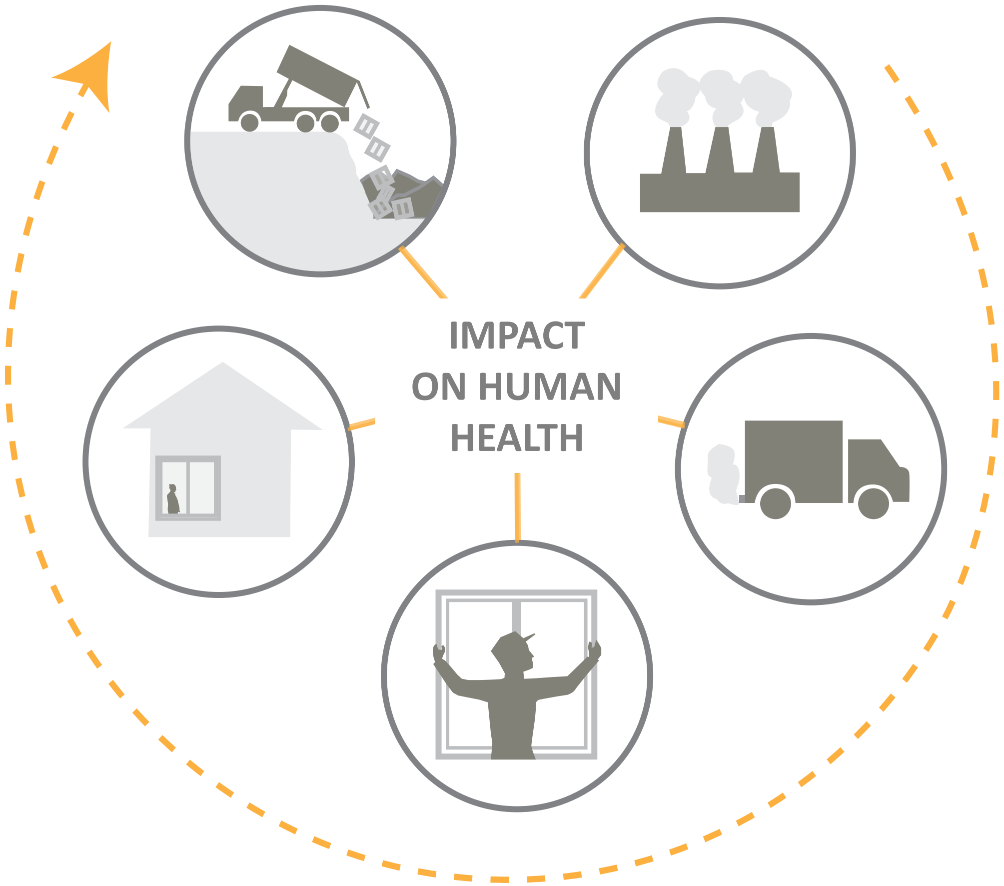
https://earthjustice.org/features/toxic-catastrophes-texas-national-chemical-disaster-rule

CHEMICALS IMPACTING HUMAN HEALTH

RESEARCH

CHEMICAL PROCESS:





LIFE CYCLE OF VINYL WINDOWS

WHAT ARE YOUR CHOICES?

RESEARCH

VINYL

ALUMINUM

FIBERGLASS

WOOD W/
ALUMINUM CLAD

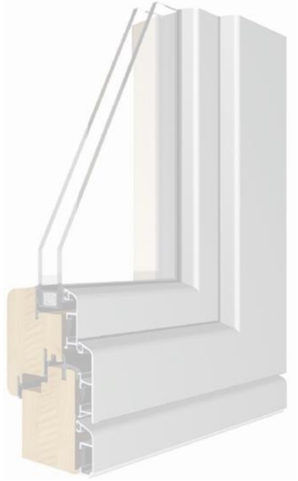
WHAT ARE YOUR CHOICES?

RESEARCH

VINYL

ALUMINUM

FIBERGLASS



WOOD W/
ALUMINUM CLAD

VINYL WINDOWS VS FIBERGLASS

RESEARCH

SAMPLE PROJECT

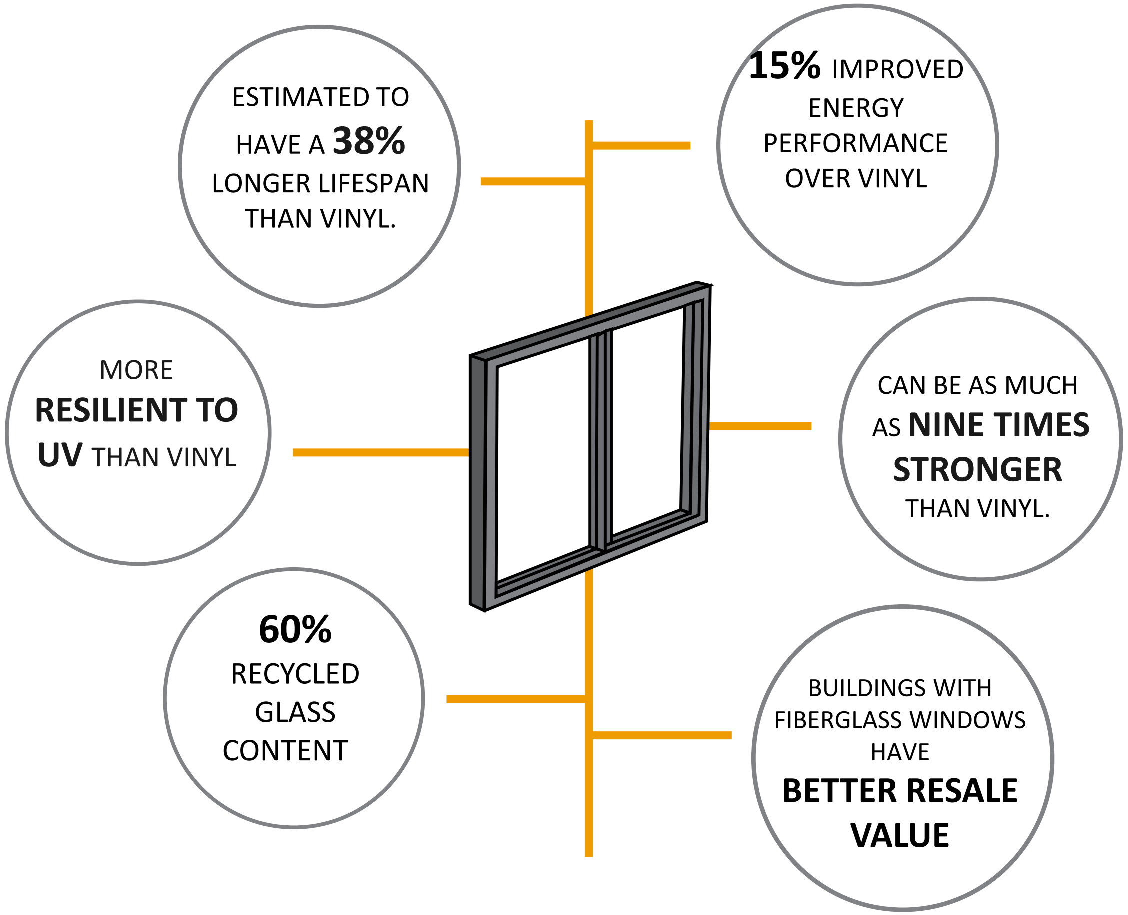
TOTAL NUMBER OF VINYL WINDOWS : **167**

ESTIMATED COST OF VINYL WINDOWS:
$91,850

ESTIMATED COST FOR FIBERGLASS WINDOWS:
$133,600

APROX. 40% PRICE INCREASE

BENEFITS OF FIBERGLASS



WINDOW CHART

RESEARCH

	HARM LVL	PERFORMANCE				OTHER	
TYPE	EMBODIED CARBON	U- VALUE	DURABILITY & ROT	MAINTENANCE	STRENGTH	CUSTOMIZATION OPTION	COST
VINYL	☁☁☁	0.6 – 0.5	★★	★★	★	★	$
ALUMINUM	☁☁	1.0 – 2.2	★★★	★★★	★★	★★★	$$$
FIBERGLASS	☁☁	0.4 – 0.6	★★★	★★★	★★★	★★★	$$$
WOOD W/ ALUMINUM CLAD	☁	0.9 - 1.25	★½	★★	★★	★	$$$$

SOURCES

HTTPS://WWW-BUILDINGGREEN-COM.PROXY.LIB.PDX.EDU/FEATURE/CHOOSING-WINDOWS-LOOKING-THROUGH-OPTIONS

HTTPS://WWW.CASCADIAWINDOWS.COM/DATABASE/FILES/LIBRARY/CASCADIA_WHITE_PAPER_WHY_FIBERGLASS_2020_04(2).PDF

HTTPS://EARTHJUSTICE.ORG/FEATURES/TOXIC-CATASTROPHES-TEXAS-NATIONAL-CHEMICAL-DISASTER-RULE

HTTPS://WWW.ECOHOME.NET/GUIDES/2357/WINDOWS-DOORS/

HTTPS://WWW.ECOWATCH.COM/WHY-YOU-SHOULD-AVOID-PVC-PRODUCTS-1881927242.HTML

HTTP://WWW.HUMMELCROTON.COM/MSDS/PVC.PDF

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SALAZAR, J. “21 - LIFE CYCLE ASSESSMENT (LCA) OF WINDOWS AND WINDOW MATERIALS.” *ECO-EFFICIENT CONSTRUCTION AND BUILDING MATERIALS*, ELSEVIER LTD, 2014, PP. 502–527.

GREEN BUILDINGS AND THE LAW, EDITED BY JULIE ADSHEAD, CRC PRESS LLC, 2011. *PROQUEST EBOOK CENTRAL*, HTTPS://EBOOKCENTRAL-PROQUEST-COM.PROXY.LIB.PDX.EDU/LIB/PSU/DETAIL.ACTION?DOCID=684046.

THANK YOU.

NET ZERO EMERGING LEADER INTERNSHIP

GBD ARCHITECTS | ENERGY TRUST OF OREGON

2021

GBD

GBD NZEL INTERN LINEAGE

2020

BENTLEY RAGER

- DRAFT INTERNAL STANDARDS OF SUSTAINABLE DATA COLLECTION
- CREATE INTERNAL 2019 PROJECT SUSTAINABILITY CATALOGUE
- REPORT 2019 PROJECT DATA TO DDX

47.4% Average predicted EUI reduction for 2019

2021

MASON MARTINEZ

- EXPAND INTERNAL STANDARDS OF SUSTAINABLE DATA COLLECTION
- MERGE PROJECT CATALOGUE WITH POWER-BI INTERFACE/ GENERATE GBD PROJECT DASHBOARDS
- REPORT 2020 PROJECT DATA TO DDX

44.8% Average predicted EUI reduction for 2020

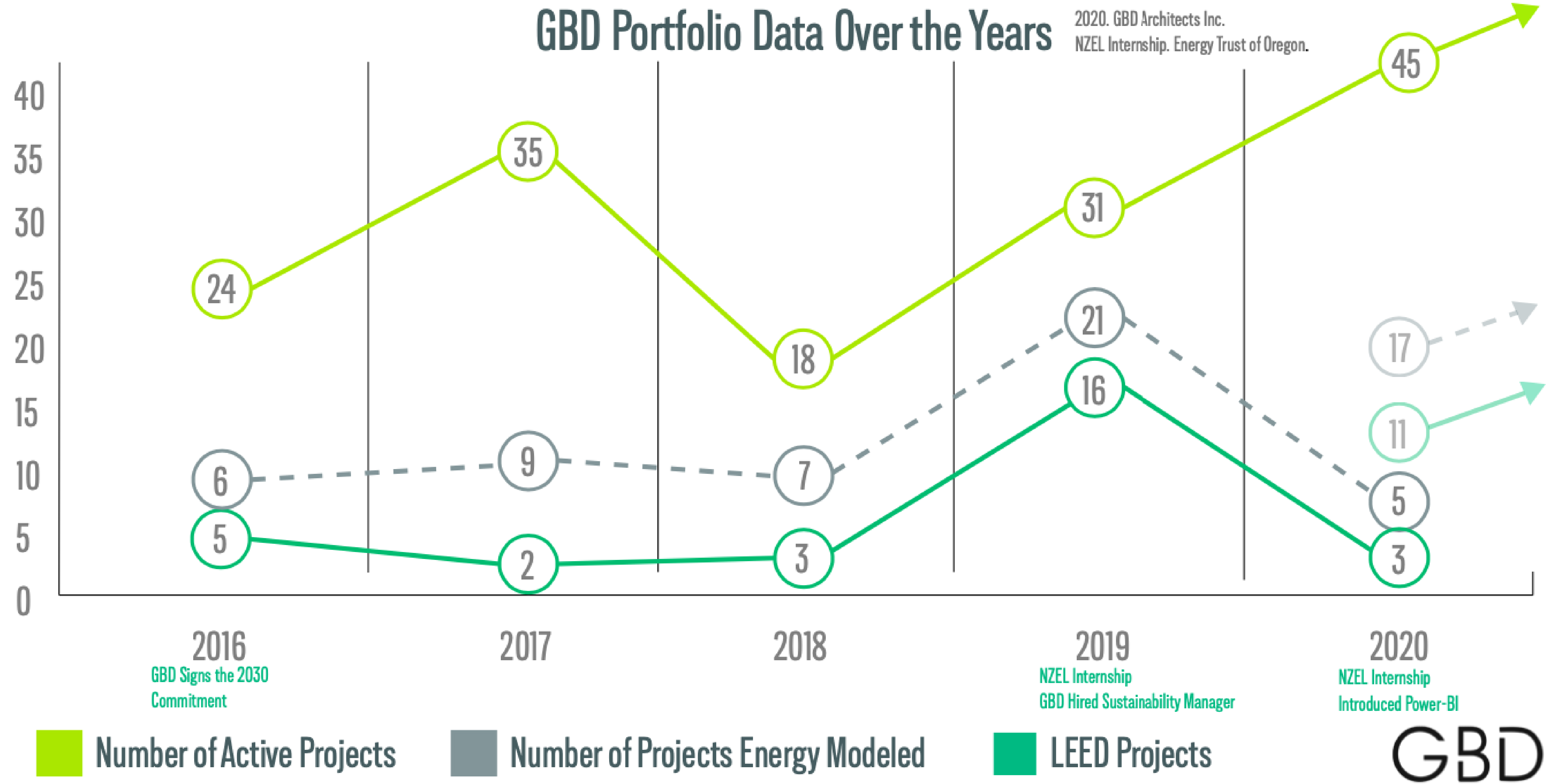
2022

NEXT STEPS

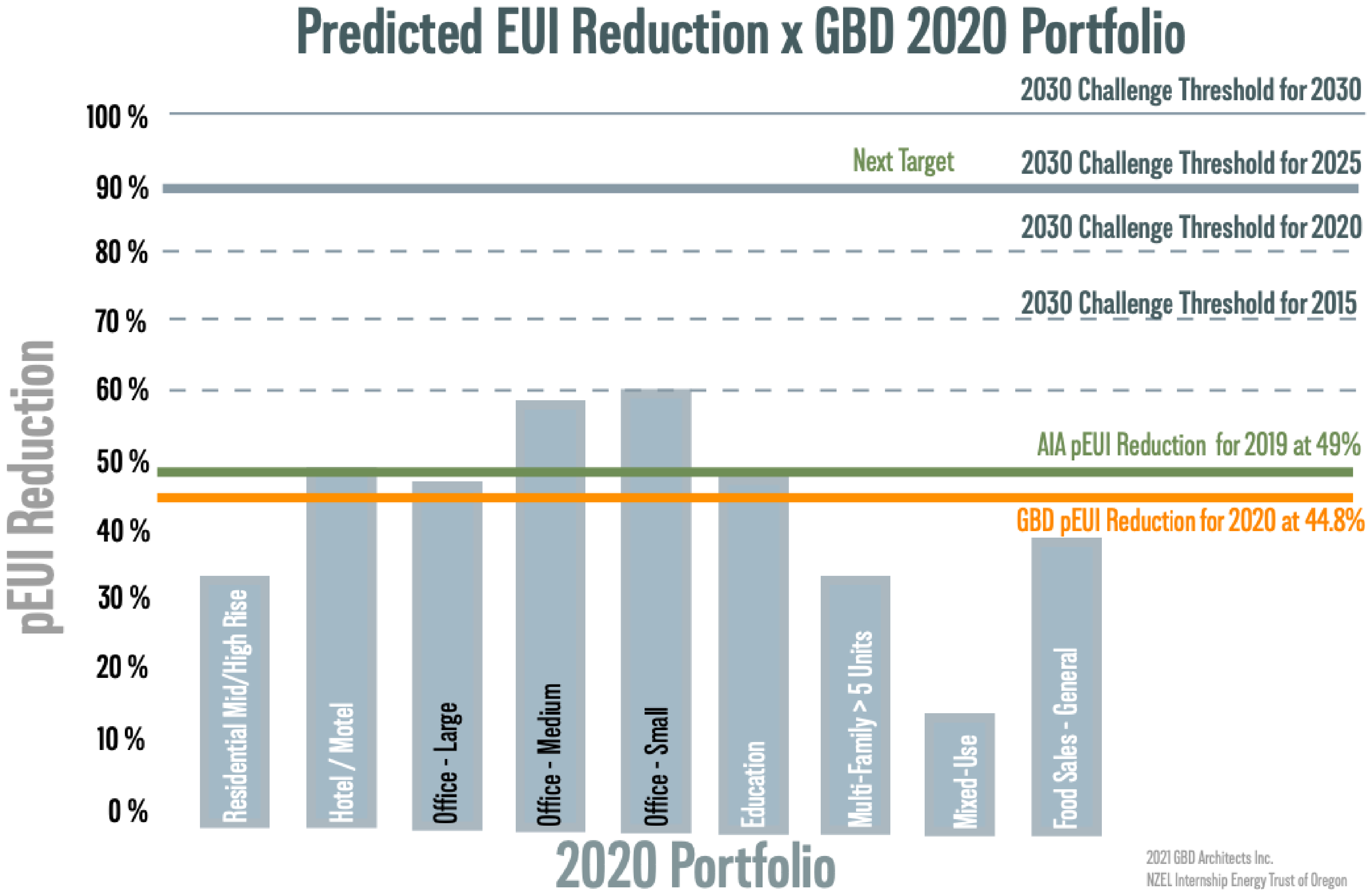
- EXTEND GBD PROJECT DATA WITHIN POWER-BI
- DRAFT PROJECT DATA SUBMISSION PORTAL
- IMPLEMENT PROJECT DASHBOARDS INTO GBD DESIGN WORKFLOW
- UTILIZE ARCHITECT / DESIGNER INPUT TO FINE-TUNE INTERNAL DASHBOARDS
- LEVERAGE PROJECT DASHBOARDS TO MEET AIA 2030 GOALS

GBD

INTERPRETING ANNUAL DATA



WHAT DOES THE DATA TELL US?



2021 GBD Architects Inc.
NZEL Internship Energy Trust of Oregon

GBD

HOW CAN WE MAXIMIZE OUR CURRENT DATA?

THE CURRENT PROBLEM...

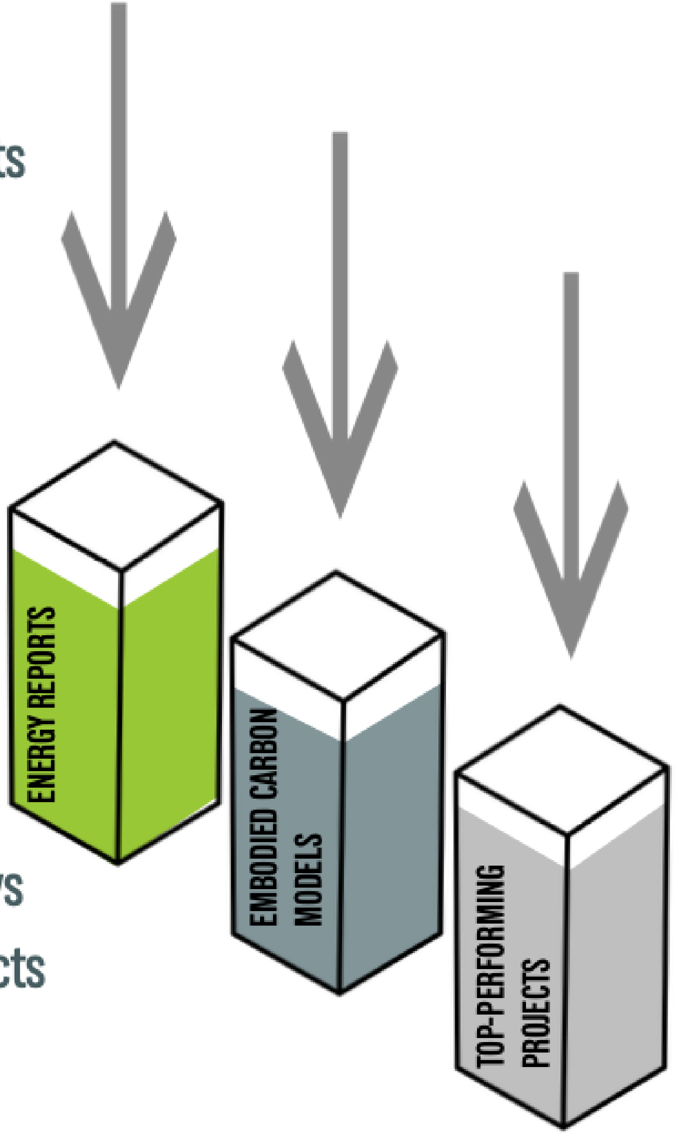
-Project performance reports are siloed in storage

-Reports lay dormant

-Design teams change

-Difficult to find trends

-Archived data typically plays no role in new design projects



OUR NEEDS...

-Generate project performance dashboards

-Cross-reference past project performance

-Pattern recognition of trends through graphics

-Streamline Communication

-Keep a current designer driven project database

HOW CAN WE MAXIMIZE OUR CURRENT DATA?

THE SOLUTION… **Merging current project data with Power-BI Platform**

- Live project dashboards with sustainability measures and modeling results streamline team communication

- Dashboards will facilitate "What if…" scenarios for project teams

- Linking energy conservation with costing models

- Data is translated into customizable info-graphics highlighting trends

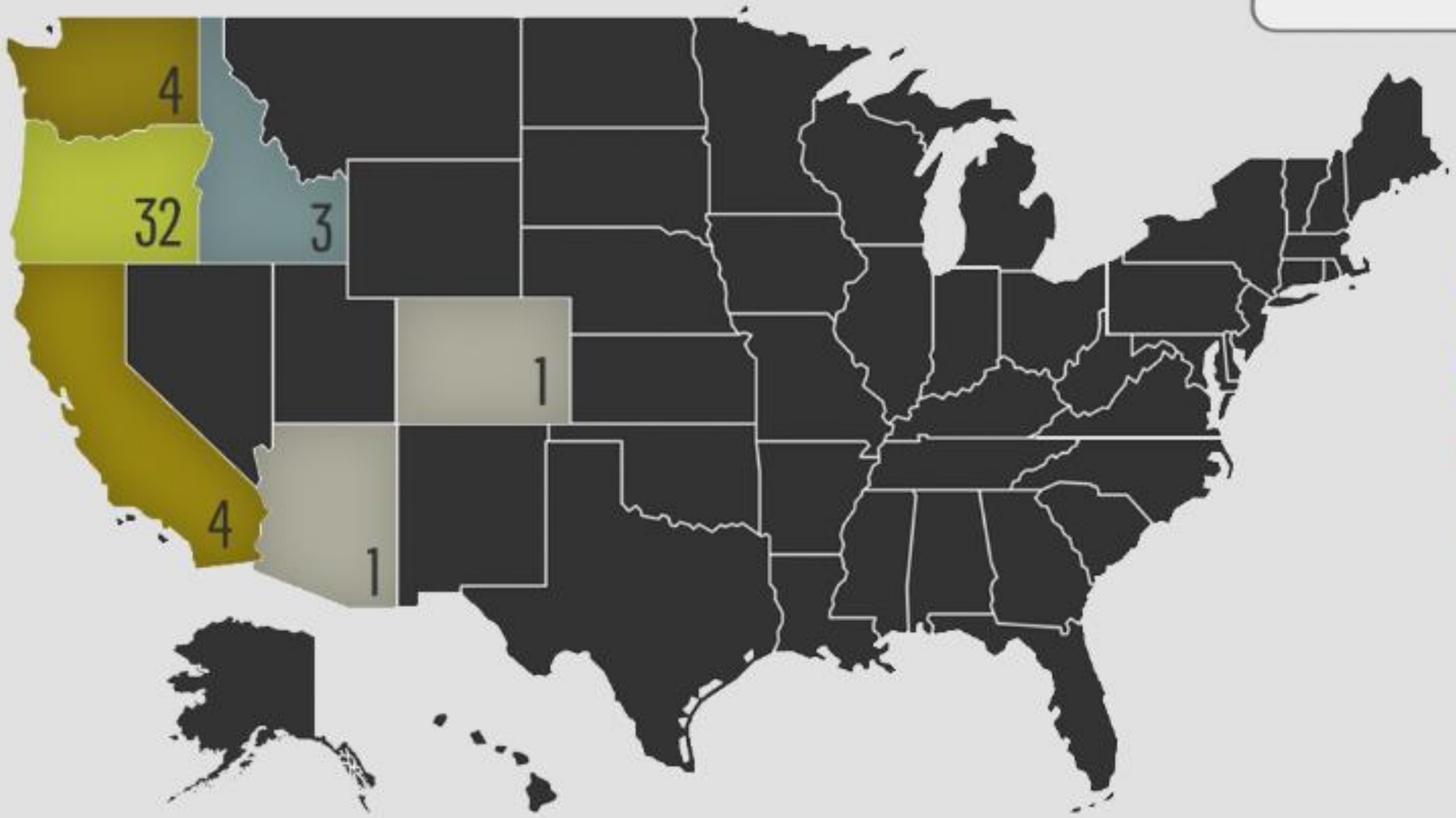
- Used as internal platform to make informed design decisions

- Internal tracking of GBD's progress towards 2030 commitment

GBD ARCHITECTS INC.

All

45 ACTIVE PROJECTS



32 Active
4 Active
3 Active
1 Active
0 Active

GBD TOP-PERFORMERS

PROJECT A	pEUI -0.03
PROJECT B	pEUI 0.00
PROJECT C	pEUI 22.80
PROJECT D	pEUI 29.25

GBD Average pEUI 41.64

pEUI % Reduction 44.8%

pEUI Reduction 2020

NET ZERO	AIA 2030	AIA 2020	GBD	NO REDUCTION
100%	80%	49%	44.8%	0%

DESIGN PHASE

CLIMATE ZONE

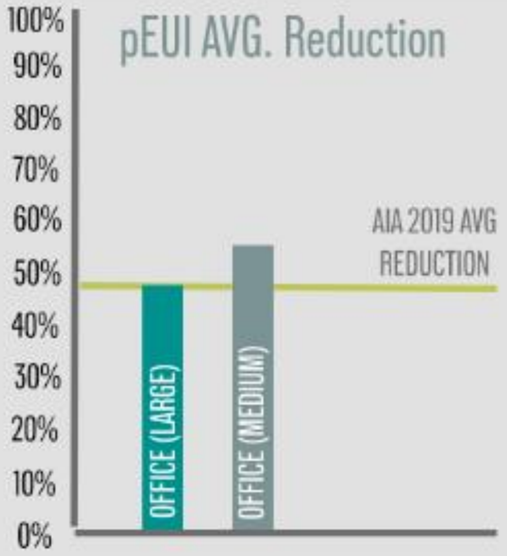
BUILDING TYPE

GBD ARCHITECTS INC.

All

PROJECT RESULTS

PROJECT G	32,000 SQFT	pEUI 0.03
PROJECT K	35,000 SQFT	pEUI 22.8
PROJECT N	32,080 SQFT	pEUI 29.25
PROJECT O	306,079 SQFT	pEUI 30.0
PROJECT S	154,651 SQFT	pEUI 43.19



rojects Modeled 5

otal GSF Modeled 559,810

ffice (Large & Medium) Average pEUI 25.04

nsufficient Amount of data*

Project Type

Office (Large)	Residential Mid/Highris
Office (Medium)	Mulit-Family > 5-Units
Office (Small)	Hotel / Motel
Interiors	Distribution / Shipping
Education	Senior / Assisted Living
Mixed-use	Food Sales / General

Country: U.S

Province/State: Oregon

City

Climate Zone: 4C

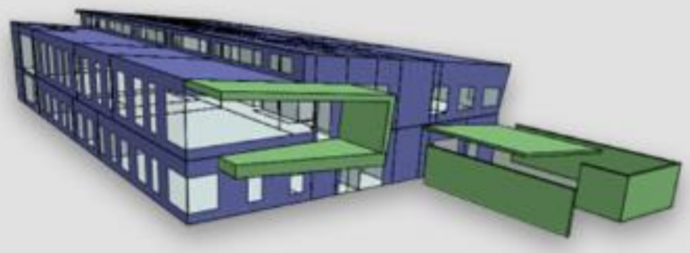
GSF

Design Phase

Project Date

GBD ARCHITECTS INC.

All



GSF 33,770

Office (Medium)

CD Phase

Zone 4C

0.64 LPD

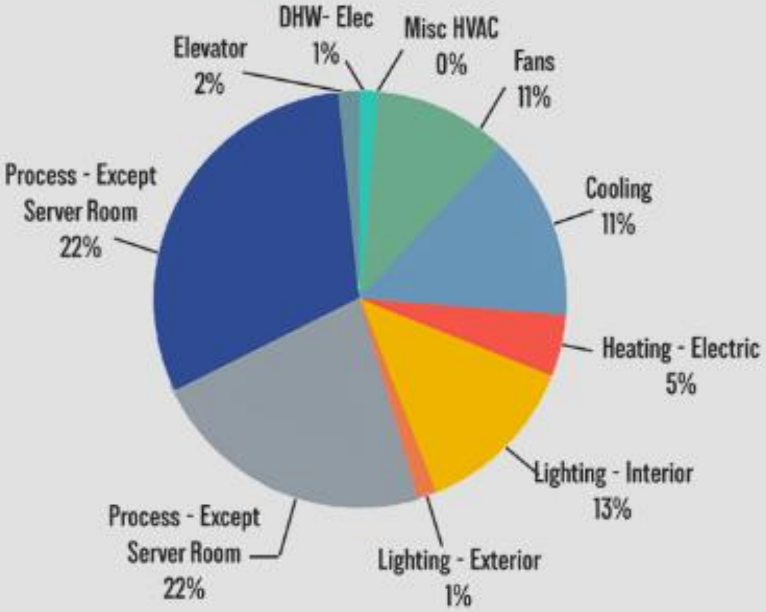
32% Window/Wall

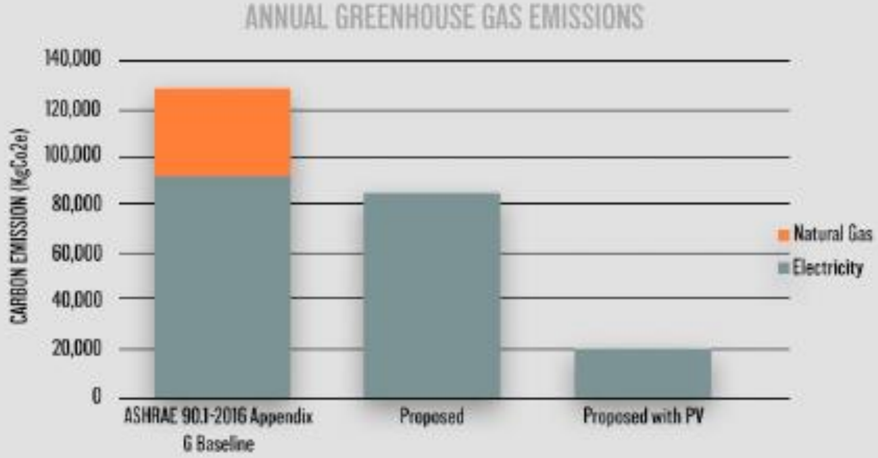
Project G

Pursuing

LEED PLATINUM
NZE

Energy Use Breakdown





System Options

HVAC System

- VRF + DOAS
- Natural Gas 4-pipe FCU
- VRF

PV

- No PV
- 200 kW

Lighting

- Oregon Code-Equivalent
- 20% Reduction

Envelope

- Basis of Design
- Oregon Code-Equivalent

Thank you.

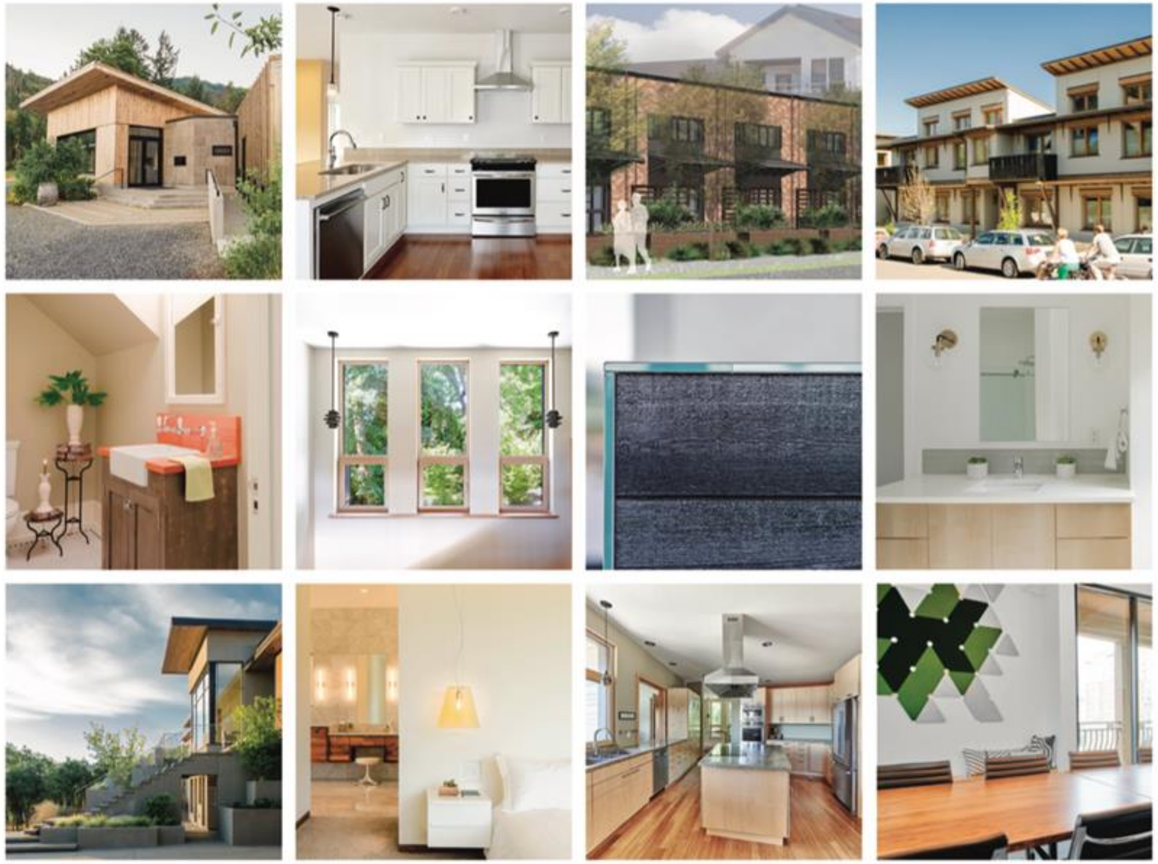
Energy Trust of Oregon

NET ZERO EMERGING LEADERS INTERNSHIP

Green Hammer | Emily Nelson

green hammer

Designed for People. Built for Life.™



Green Hammer is committed to the AIA 2030 commitment towards 70% or greater predicted energy use intensity (pEUI) savings across their building portfolio each year.

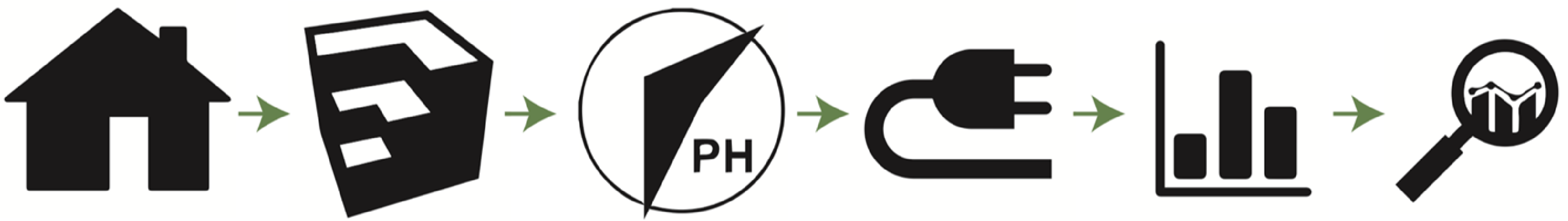
https://www.aia.org/resources/202041-the-2030-commitment https://greenhammer.com/insight/news/green-hammer-aia-2030-commitment/

The Internship Agenda and Goals

- Expand Upon Integrating Energy Modeling into the Workflow
- Simplify the Energy Modeling Process
- Create User-Friendly Guidelines
- Create Easy-to-Use Comprehensive Databases
- Encourage Use of the Systems and Softwares
- Share Gained Knowledge
- Understand the Results

The WUFI Passive Way

START | SKETCHUP | WUFI PASSIVE | PLUG IT IN | RESULTS | REVISE



START

Find a project.

A new construction build?

A retrofit?

A mixed project?

SKETCHUP

Model the projects thermal envelope in SketchUp.

WUFI PASSIVE

Export the SketchUp Model to WUFI Passive.

PLUG IT IN

Plug in all the information.

From location to windows to ventilation, you name it, WUFI Passive needs it!

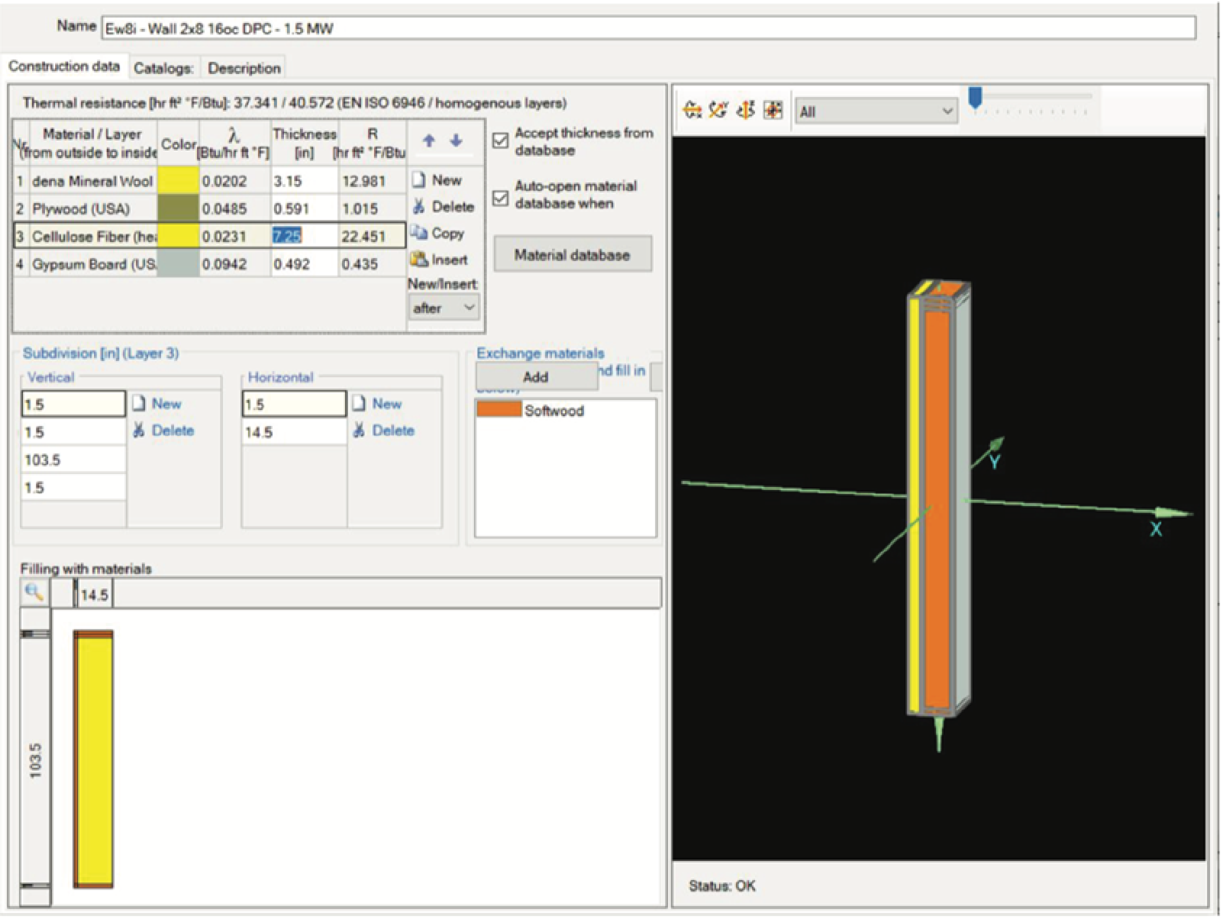
RESULTS

See the results. WUFI gives you all you need to interpret your building.

REVISE

Understand the results and play with the options.

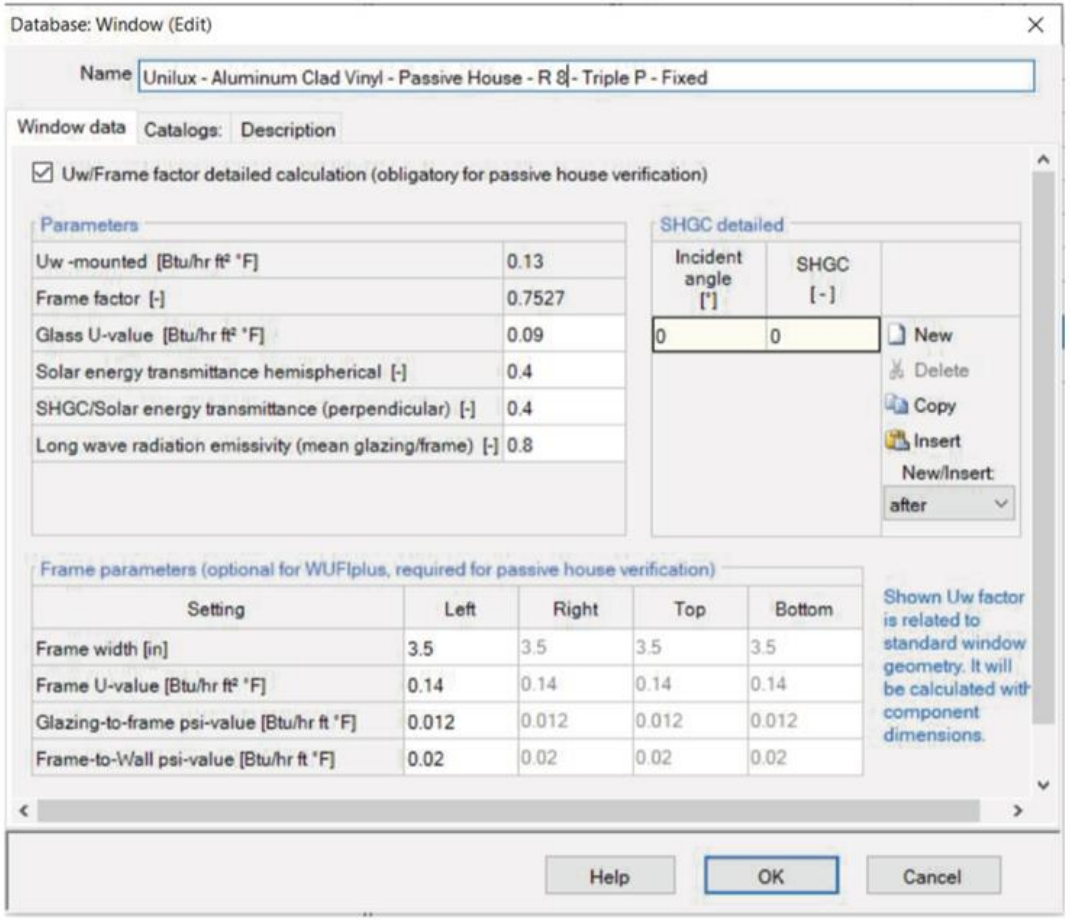
The Assembly Database



Creating a custom database that works for all of Green Hammers' needs:

- Walls
  - Including Green Hammer standards and existing finds
  - Various sizes, insulation types, barrier options, exc.
- Floors
  - Including slab on grade, suspended, basement, exc.
  - Various insulation types, thicknesses, and finishes.
- Roofs
  - Including sloped, flat, ventilated, non ventilated, exc.
  - Various insulation types, structures, barrier options, exc.

The Window Database



Creating a custom database that works for all of Green Hammers' needs:

- Commonly Found Windows
- Different Manufacturers
- Various Materials
- Various R - Values
- Various SHGC
- Exc.

Window Data: Fixed to Operable

Zola - uVPC - Thermo - Triple Pane

Fixed: R - 7	
Uw-Mounted	0.15
Frame Factor	0.7553
Glass U-Value	0.09
Solar Energy Transmittance Hemispherical	0.37
SHGC (Perpendicular)	0.37
Long Wave Radiation Emissivity	0.8
Frame Width	3.46
Frame U-Value	0.144
Glazing-to-Frame Psi-Value	0.040
Frame-to-Wall Psi-Value	0.02

Operable: R - 6	
Uw-Mounted	0.17
Frame Factor	0.7553
Glass U-Value	0.09
Solar Energy Transmittance Hemispherical	0.31
SHGC (Perpendicular)	0.31
Long Wave Radiation Emissivity	0.8
Frame Width	3.46
Frame U-Value	0.144
Glazing-to-Frame Psi-Value	0.060
Frame-to-Wall Psi-Value	0.02

https://www.zolawindows.com/upvc#Slide4

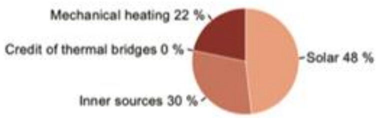
Fixed to Operable in Action

Fixed: R - 7	
Heating Demand	5.22
Cooling Demand	4.55
Heating Load	3.41
Cooling Load	3.01
Source Energy	9,184
Site Energy	13.9

HEAT FLOW - HEATING PERIOD

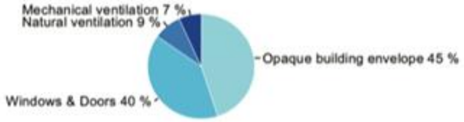
Heat gains

Solar:	12,746 kBtu/yr
Inner sources:	7,963 kBtu/yr
Credit of thermal bridges:	0 kBtu/yr
Mechanical heating:	8,397 kBtu/yr



Heat losses

Opaque building envelope:	12,386 kBtu/yr
Windows & Doors:	10,951 kBtu/yr
Natural ventilation:	2,343 kBtu/yr
Mechanical ventilation:	1,855 kBtu/yr

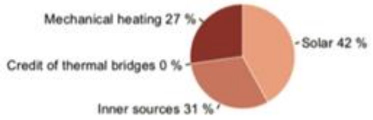


Operable: R - 6	
Heating Demand	6.39
Cooling Demand	3.27
Heating Load	3.77
Cooling Load	2.53
Source Energy	9089
Site Energy	13.76

HEAT FLOW - HEATING PERIOD

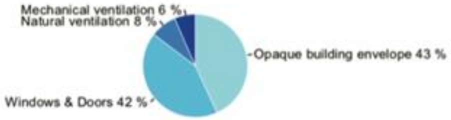
Heat gains

Solar:	11,588 kBtu/yr
Inner sources:	8,505 kBtu/yr
Credit of thermal bridges:	0 kBtu/yr
Mechanical heating:	10,285 kBtu/yr



Heat losses

Opaque building envelope:	12,442 kBtu/yr
Windows & Doors:	12,181 kBtu/yr
Natural ventilation:	2,338 kBtu/yr
Mechanical ventilation:	1,851 kBtu/yr



Window Data: Double to Triple

Double Pane

Zola - uVPC - Classic Clad

Fixed: R - 4	
Uw-Mounted	0.25
Frame Factor	0.7553
Glass U-Value	0.09
Solar Energy Transmittance Hemispherical	0.44
SHGC (Perpendicular)	0.44
Long Wave Radiation Emissivity	0.8
Frame Width	3.46
Frame U-Value	0.60
Glazing-to-Frame Psi-Value	0.023
Frame-to-Wall Psi-Value	0.02

Operable: R - 3.8	
Uw-Mounted	0.26
Frame Factor	0.7553
Glass U-Value	0.09
Solar Energy Transmittance Hemispherical	0.37
SHGC (Perpendicular)	0.37
Long Wave Radiation Emissivity	0.8
Frame Width	3.46
Frame U-Value	0.64
Glazing-to-Frame Psi-Value	0.023
Frame-to-Wall Psi-Value	0.02

https://www.zolawindows.com/upvc#Slide4

Triple Pane

Zola - uVPC - Thermo Clad

Fixed: R - 7	
Uw-Mounted	0.15
Frame Factor	0.7553
Glass U-Value	0.09
Solar Energy Transmittance Hemispherical	0.41
SHGC (Perpendicular)	0.41
Long Wave Radiation Emissivity	0.8
Frame Width	3.46
Frame U-Value	0.25
Glazing-to-Frame Psi-Value	0.007
Frame-to-Wall Psi-Value	0.02

Operable: R - 6	
Uw-Mounted	0.17
Frame Factor	0.7553
Glass U-Value	0.09
Solar Energy Transmittance Hemispherical	0.34
SHGC (Perpendicular)	0.34
Long Wave Radiation Emissivity	0.8
Frame Width	3.46
Frame U-Value	0.32
Glazing-to-Frame Psi-Value	0.007
Frame-to-Wall Psi-Value	0.02

https://www.zolawindows.com/upvc#Slide4

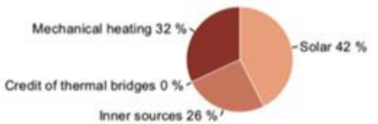
Double to Triple in Action

Double Pane	
Heating Demand	9.06
Cooling Demand	3.98
Heating Load	4.71
Cooling Load	2.98
Source Energy	9,699
Site Energy	14.68

HEAT FLOW - HEATING PERIOD

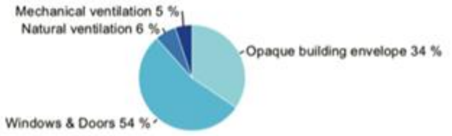
Heat gains

Solar:	**14,230** kBtu/yr
Inner sources:	**8,548** kBtu/yr
Credit of thermal bridges:	**0** kBtu/yr
Mechanical heating:	**14,580** kBtu/yr



Heat losses

Opaque building envelope:	**12,351** kBtu/yr
Windows & Doors:	**19,314** kBtu/yr
Natural ventilation:	**2,313** kBtu/yr
Mechanical ventilation:	**1,831** kBtu/yr

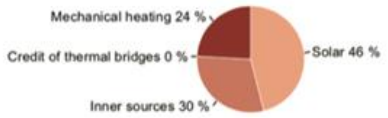


Triple Pane	
Heating Demand	5.85
Cooling Demand	4.17
Heating Load	3.63
Cooling Load	2.9
Source Energy	9,205
Site Energy	13.93

HEAT FLOW - HEATING PERIOD

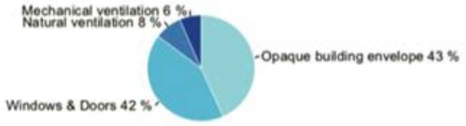
Heat gains

Solar:	**12,587** kBtu/yr
Inner sources:	**8,143** kBtu/yr
Credit of thermal bridges:	**0** kBtu/yr
Mechanical heating:	**9,418** kBtu/yr



Heat losses

Opaque building envelope:	**12,367** kBtu/yr
Windows & Doors:	**12,024** kBtu/yr
Natural ventilation:	**2,338** kBtu/yr
Mechanical ventilation:	**1,851** kBtu/yr



Window Data: Unilux: Wood to EcoWindows: Vinyl

Unilux

Unilux - Wood - Meister - Triple Pane

Window Data	Fixed: R - 6.5	Operable: R - 6
Uw-Mounted	0.16	.17
Frame Factor	0.8544	.8544
Glass U-Value	0.09	.09
Solar Energy Transmittance Hemispherical	0.44	.44
SHGC (Perpendicular)	0.44	.44
Long Wave Radiation Emissivity	0.8	.8
Frame Width	2	2
Frame U-Value	0.4	.43
Glazing-to-Frame Psi-Value	0.0082	.0098
Frame-to-Wall Psi-Value	0.02	.02

https://unilux-windows.com/products

EcoWindows

EcoWindows - Vinyl - Iglo Energy Classic - Triple Pane

Window Data	Fixed: R - 6.5	Operable: R - 6
Uw-Mounted	0.16	0.17
Frame Factor	0.7692	0.7692
Glass U-Value	0.09	0.09
Solar Energy Transmittance Hemispherical	0.17	0.21
SHGC (Perpendicular)	0.17	0.21
Long Wave Radiation Emissivity	0.8	0.8
Frame Width	3.25	3.25
Frame U-Value	0.23	0.245
Glazing-to-Frame Psi-Value	0.025	0.035
Frame-to-Wall Psi-Value	0.02	0.02

http://www.ecowds.com/products/windows/vinyl

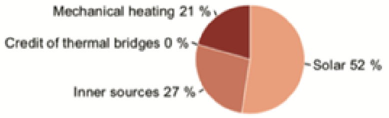
Wood to Vinyl in Action

Wood	
Heating Demand	4.41
Cooling Demand	7.64
Heating Load	3.32
Cooling Load	4.12
Source Energy	9,751
Site Energy	14.76

HEAT FLOW - HEATING PERIOD

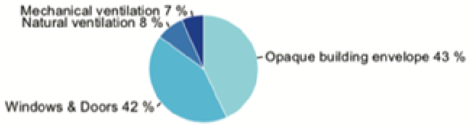
Heat gains

Solar:	13,660 kBtu/yr
Inner sources:	7,027 kBtu/yr
Credit of thermal bridges:	0 kBtu/yr
Mechanical heating:	7,099 kBtu/yr



Heat losses

Opaque building envelope:	11,334 kBtu/yr
Windows & Doors:	11,102 kBtu/yr
Natural ventilation:	2,174 kBtu/yr
Mechanical ventilation:	1,721 kBtu/yr

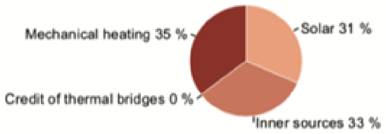


Vinyl	
Heating Demand	7.68
Cooling Demand	1.65
Heating Load	4.06
Cooling Load	1.72
Source Energy	8,931
Site Energy	13.52

HEAT FLOW - HEATING PERIOD

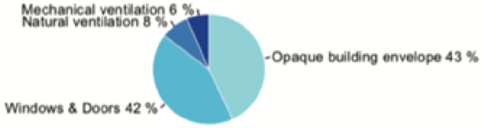
Heat gains

Solar:	8,802 kBtu/yr
Inner sources:	9,279 kBtu/yr
Credit of thermal bridges:	0 kBtu/yr
Mechanical heating:	12,369 kBtu/yr



Heat losses

Opaque building envelope:	12,441 kBtu/yr
Windows & Doors:	12,255 kBtu/yr
Natural ventilation:	2,337 kBtu/yr
Mechanical ventilation:	1,851 kBtu/yr



A Retrofit: After the Remodel

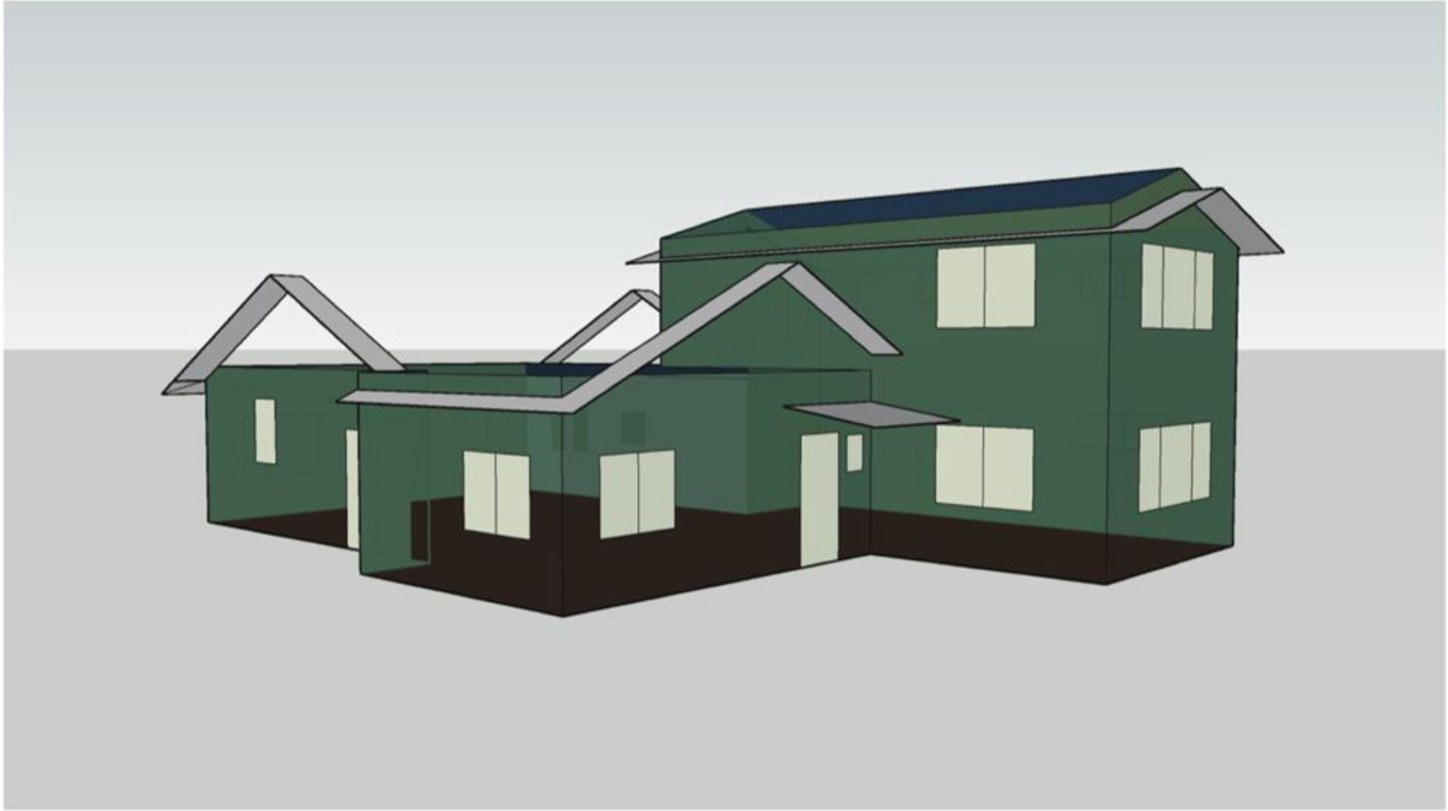
Type: Residential

Status: Under Construction

Net - Volume: 13,522.3 ft^3

Floor Area: 1847.2 ft^2

Envelope Area: 2.866 ft^2



The Results

Data Type	Original Data	Updated Windows	Updated Walls	Updated Roof	Windows, Walls, & Roof	Windows, Walls, Roof, & Systems
Heating Demand	33.86	20.87	31.41	32.92	17.63	9.76
Cooling Demand	0.69	1.49	0.66	0.66	1.51	2.15
Heating Load	15.09	11.77	14.43	14.85	10.88	4.66
Cooling Load	0.85	1.77	0.88	0.83	1.77	1.99
Source Energy	12,288	10,243	11,171	12,124	9,702	7,311
Site Energy	54.19	40.44	51.51	53.15	36.93	19.29

A Retrofit: Before the Remodel

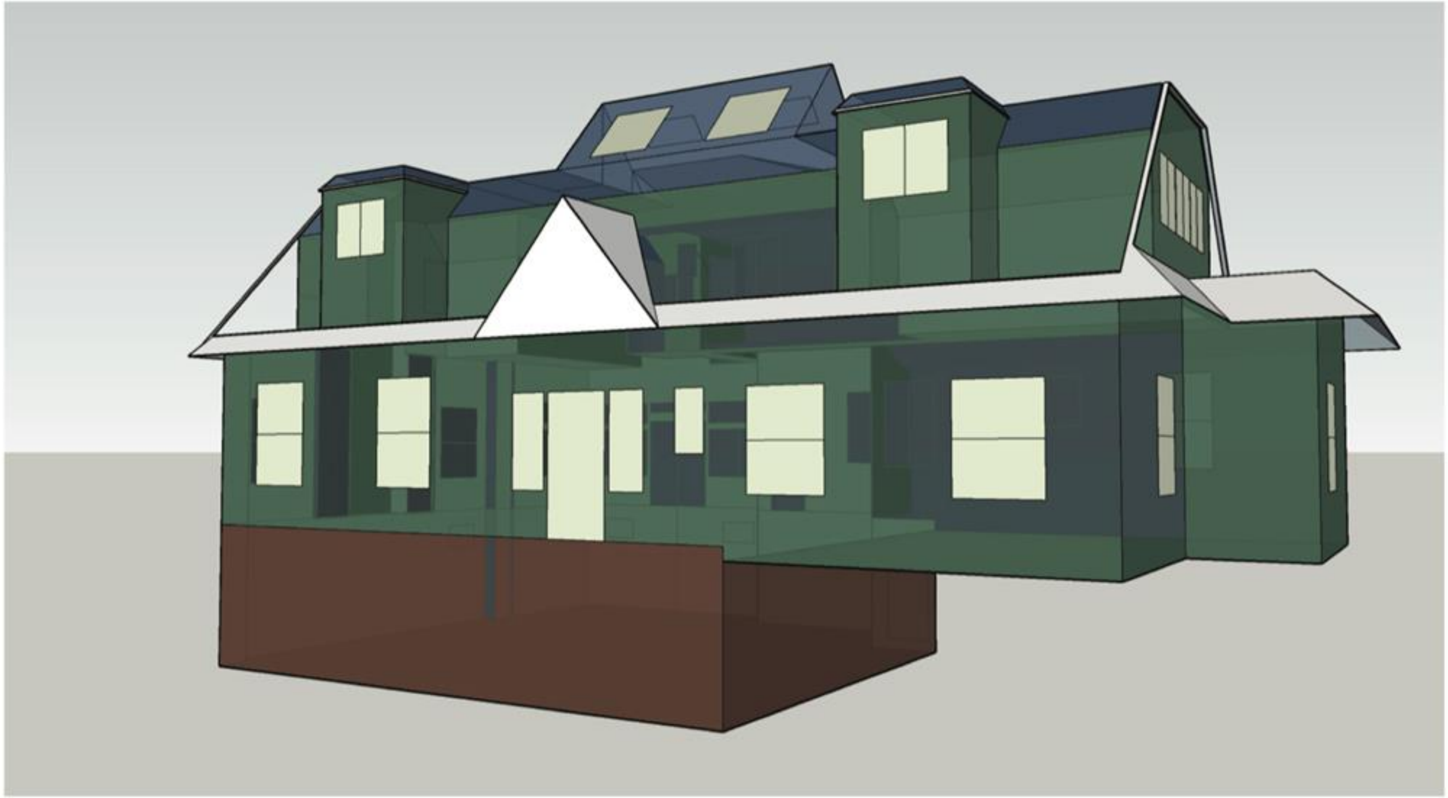
Type: Residential

Status: In Planning

Net - Volume: 25,870.4 ft^3

Floor Area: 3,822.5 ft^2

Envelope Area: 2.103 ft^2



The Results

Data Type	Original Data	Updated Windows	Updated Walls	Updated Roof	Windows, Walls, & Roof	Windows, Walls, Roof, & Systems
Heating Demand	74.59	66.52	58.29	58.46	34.28	17.9
Cooling Demand	1.02	0.85	0.72	0.63	0.27	2.35
Heating Load	27.57	25.37	23.22	23.32	16.76	5.76
Cooling Load	0	0	0	0	0	0.27
Source Energy	60,130	55,006	49,778	49,887	34,527	18,634
Site Energy	87.09	78.77	70.29	70.46	45.54	11.88

Understanding the Results

- Explore Energy Modeling as a Team
- Utilize the Tools Available
- Share Gained Knowledge
- Continue to Revise

Thank You!

EXPANDING THE SCOPE OF CARBON ACCOUNTING FOR PROJECTS

Energy Trust of Oregon
Net Zero Emerging Leaders Internship

Courtney Sigloh

SALAZARCHITECT inc

AN OVERVIEW OF MY EXPERIENCE:

BY THE NUMBERS

12 weeks

3 BIG TASKS

1 team

1. DDx Reporting

cove.tool

AIA

2. LCA Reporting

tally™ ENVIRONMENTAL IMPACT TOOL

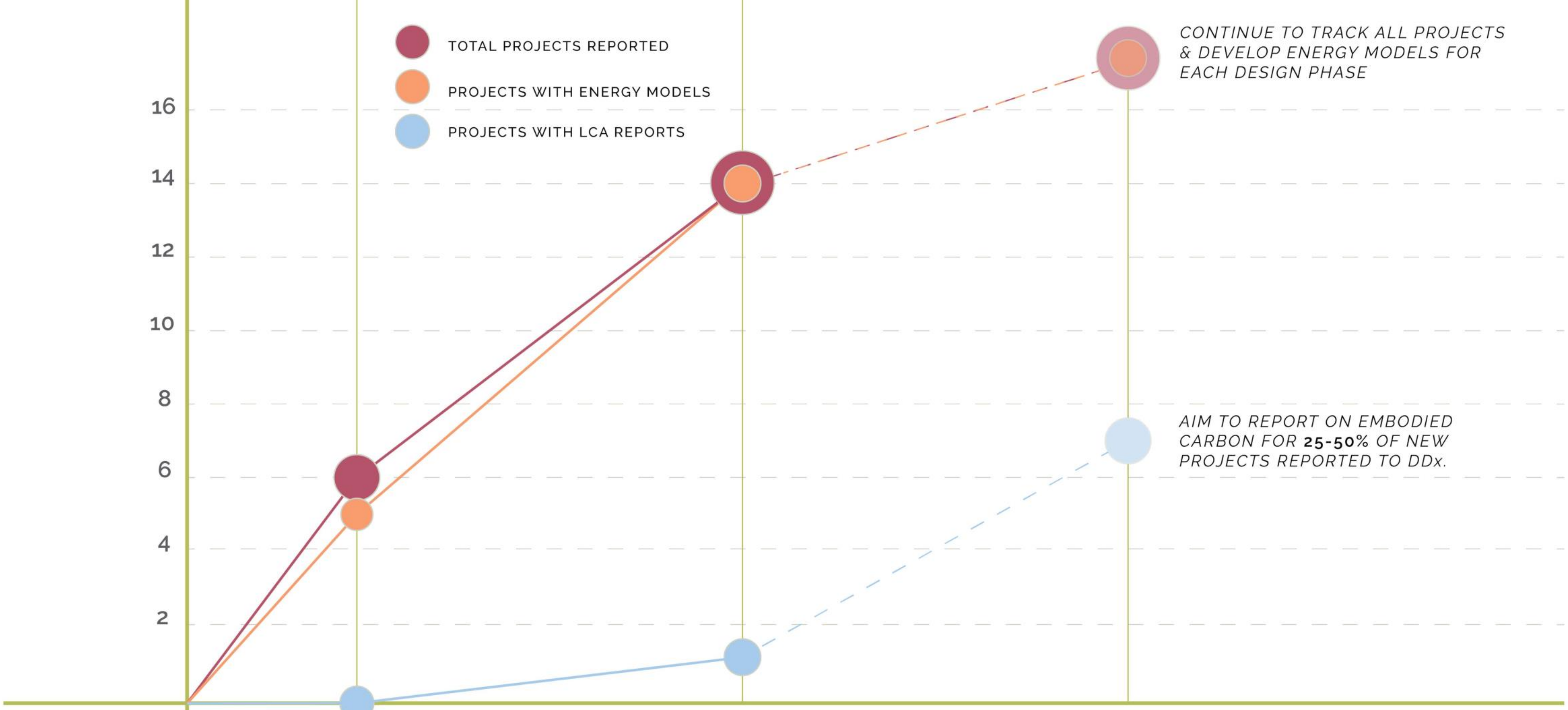
3. Info-graphic

CARBON IMPACT

BY PROJECT COMPONENT

SALAZARCHITECT inc

1. DDx Reporting & Cove.Tool Energy Modeling



AIA DDx REPORTING

2019

SIGNATORY for 2030 CHALLENGE

FIRST REPORTING YEAR

2020

IMPROVED ENERGY MODELING PROCESS

1st EMBODIED CARBON PROJECT REPORT

2021

EXPAND REPORTING ON EXISTING / RENOVATED PROJECTS

CONTINUE TO GROW ENERGY MODELING & CARBON ACCOUNTING PROCESS

SALAZARCHITECT inc

A FOCUSED APPROACH

TRACKING & REPORTING 4 PROJECTS

Goldcrest Apartments	Williams Plaza Apartments	Aldercrest Apartments	Maple Lane Apartments
»New Construction »82,000 sqft / 75 Units »**Embodied Carbon WBLCA**	»Renovation of Existing 1972 Building »Redesigned Site & Interiors »**Tracking Reduction in EUI & Reporting for Renos**	»Renovation of Existing 1970 Buildings »New Community Building & Landscaping »**Community Building Design Strategies (Passive Design)**	»New Construction »Net Zero Ready »**Using Cove.Tool for Comparisons & Optimization**

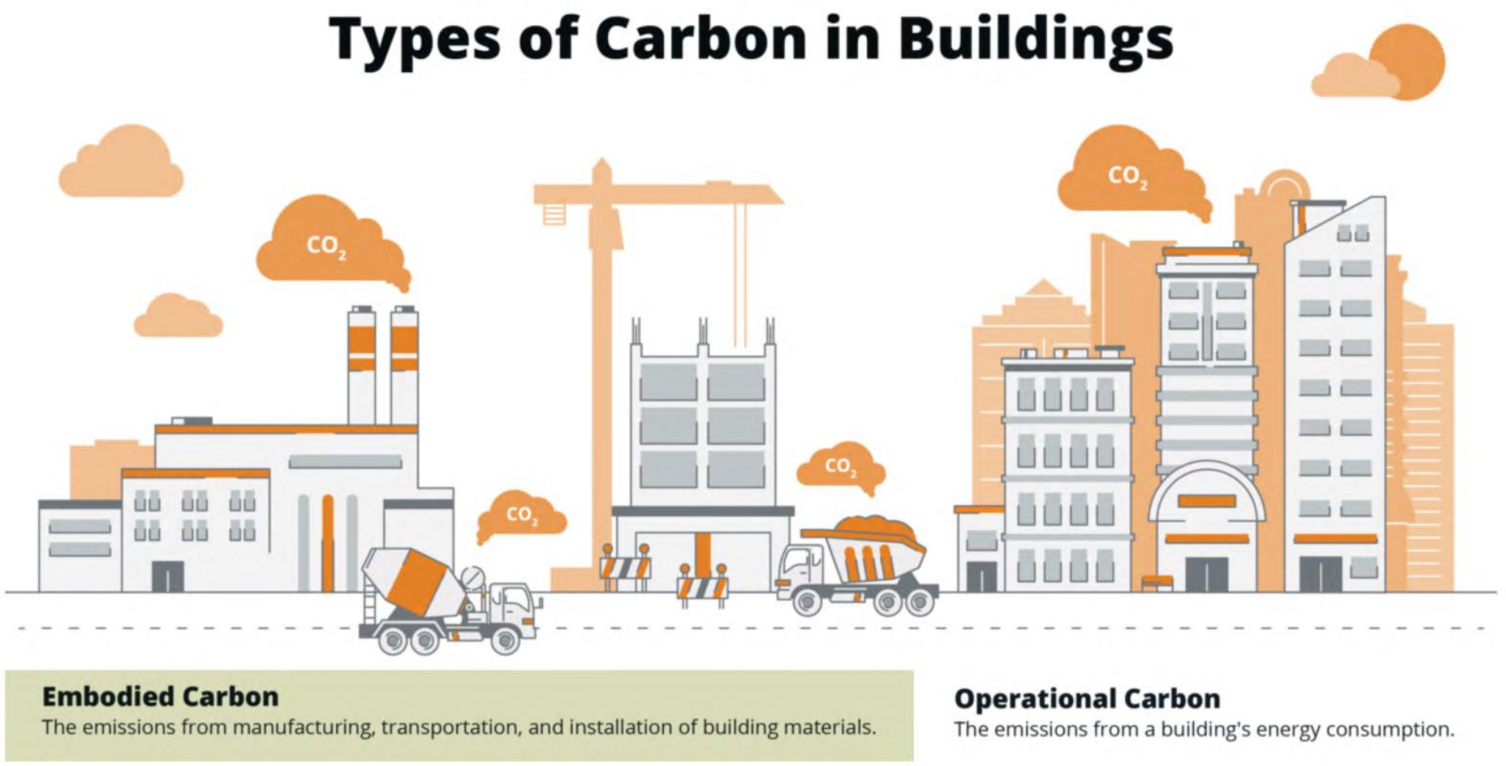



2. Investigating Embodied Carbon: Research, Tools, Process

EMBODIED CARBON ACCOUNTING:

WHAT IS IT?

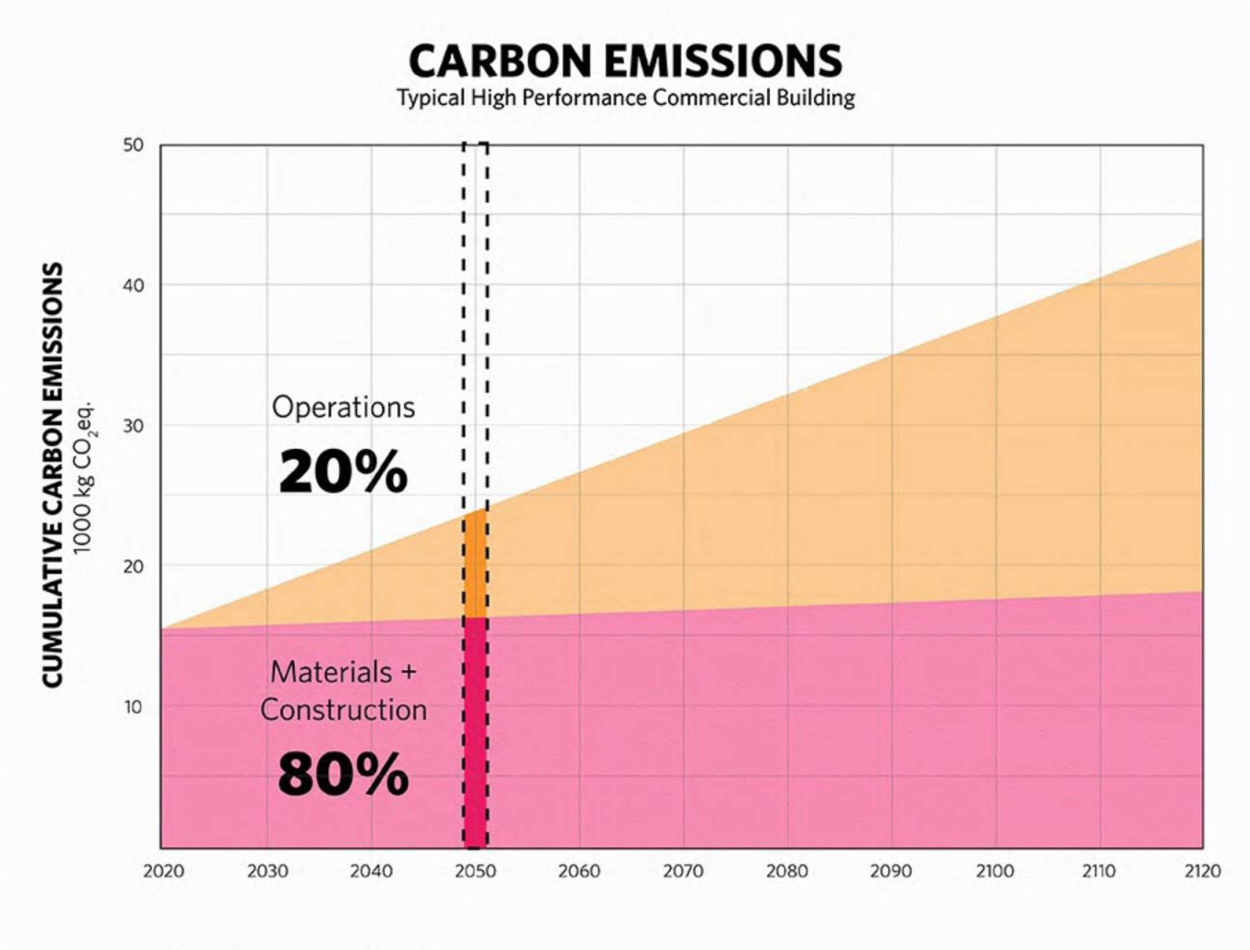
EMBODIED CARBON IS THE TOTAL CARBON EMISSIONS FROM BUILDINGS' PRODUCTS - THEIR TRANSPORT, MAINTENANCE, & END OF LIFE.



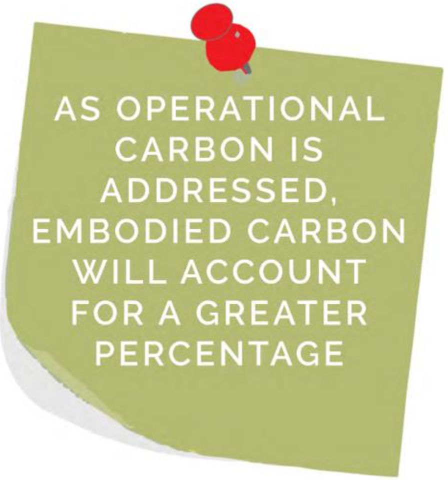
EMBODIED CARBON IS THE FIRST STEP IN REDUCING A BUILDING'S CARBON FOOTPRINT

EMBODIED CARBON ACCOUNTING:

WHY IS IT IMPORTANT?



Kieran Timberlake - Carbon Accounting
https://kierantimberlake.com/files/pages/631/embodied-c.gif?1619060464544



IT IS ANTICIPATED THAT IT WILL BE RESPONSIBLE FOR **72%** OF THE CARBON EMISSIONS ASSOCIATED WITH NEW BUILDING CONSTRUCTION

SELECTING AN LCA TOOL:

TALLY TOOL (BY KIERAN TIMBERLAKE)

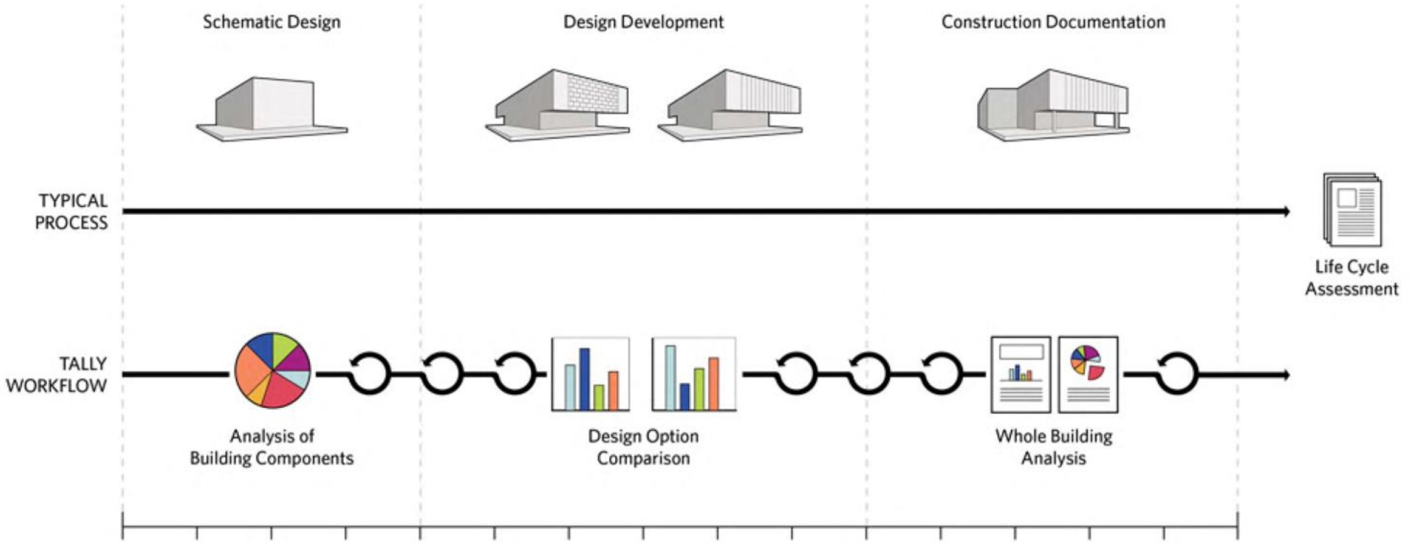
Athena
Impact Estimator
for Buildings

One Click LCA

Product of Bionova Ltd

tally™
ENVIRONMENTAL
IMPACT TOOL

tally™
ENVIRONMENTAL
IMPACT TOOL

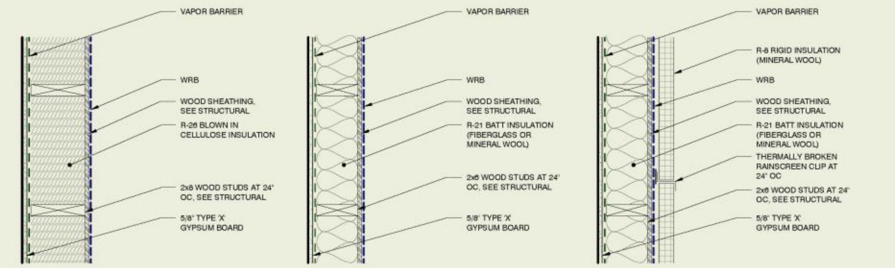


ASSEMBLY COMPARISONS:

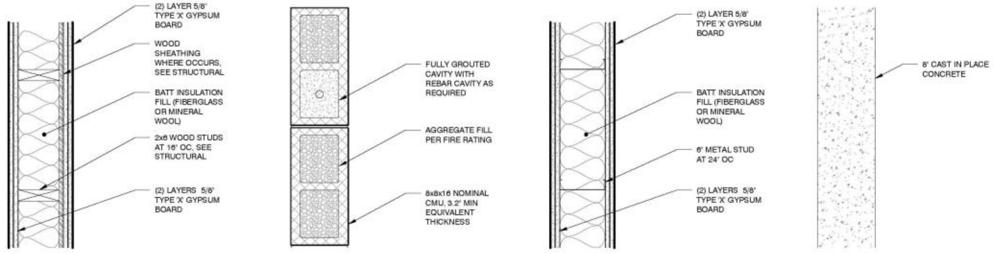
EMBODIED CARBON ANALYSIS

PRIORITIZED GLOBAL WARMING POTENTIAL (GWP) kgCO2eq

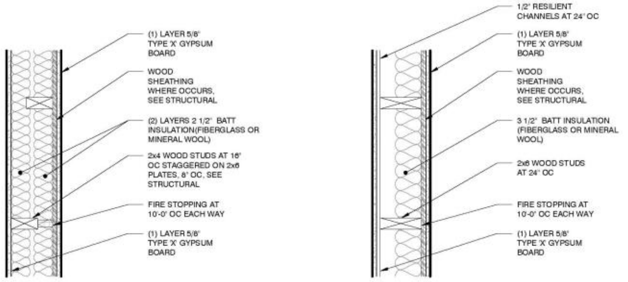
UTILIZED THE TALLY DESIGN OPTION COMPARISON TOOL WITH REVIT



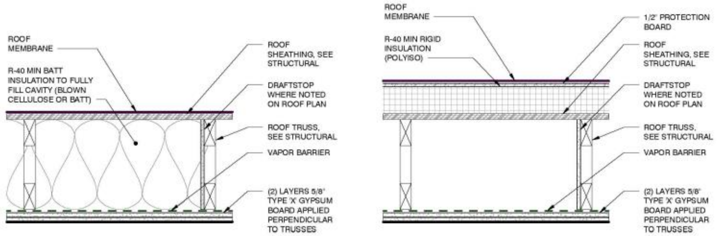
4 COMPARISON 4



3 COMPARISON 3



2 COMPARISON 2



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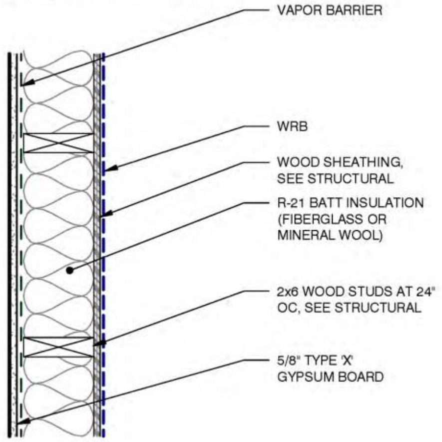
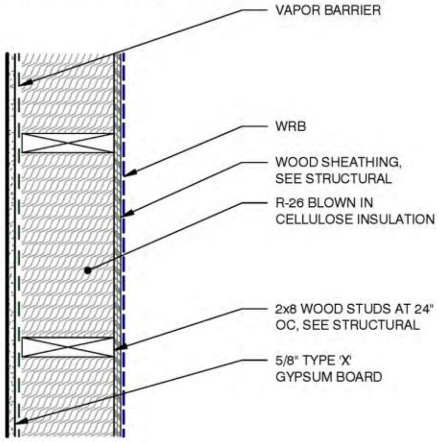
COMPARISON:

Typical Exterior Wall Assemblies

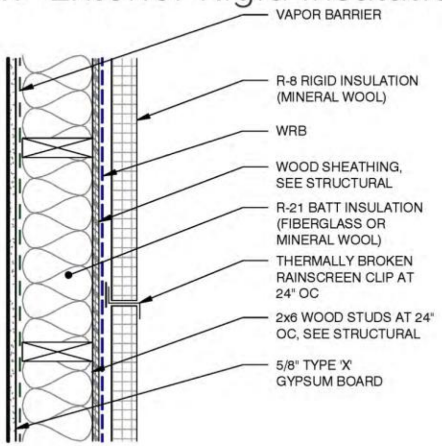
OPTION 1: 2x6 Wood Studs w/ Mineral Wool



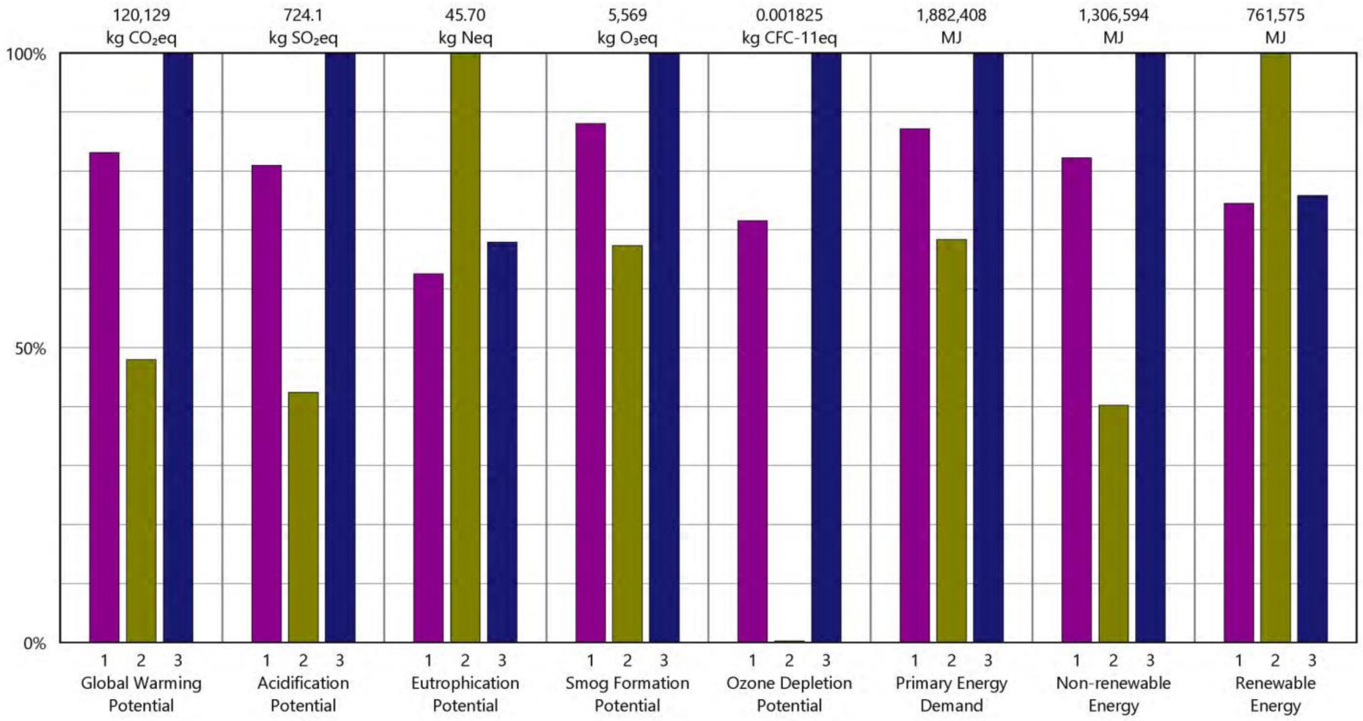
OPTION 2: 2x8 Wood Studs w/ Blown Cellulose



OPTION 3: 2x6 Wood Studs w/ Exterior Rigid Insulation



OPTION 2 SHOWS 35-50% DECREASE IN GWP BUT DOES IT HAVE THE BEST THERMAL PERFORMANCE?



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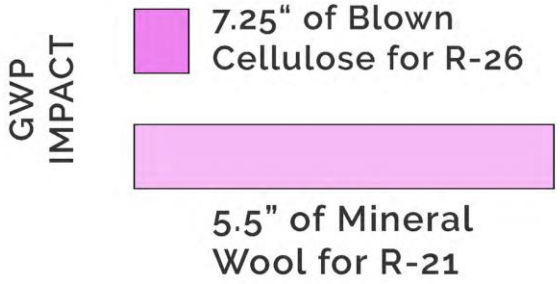
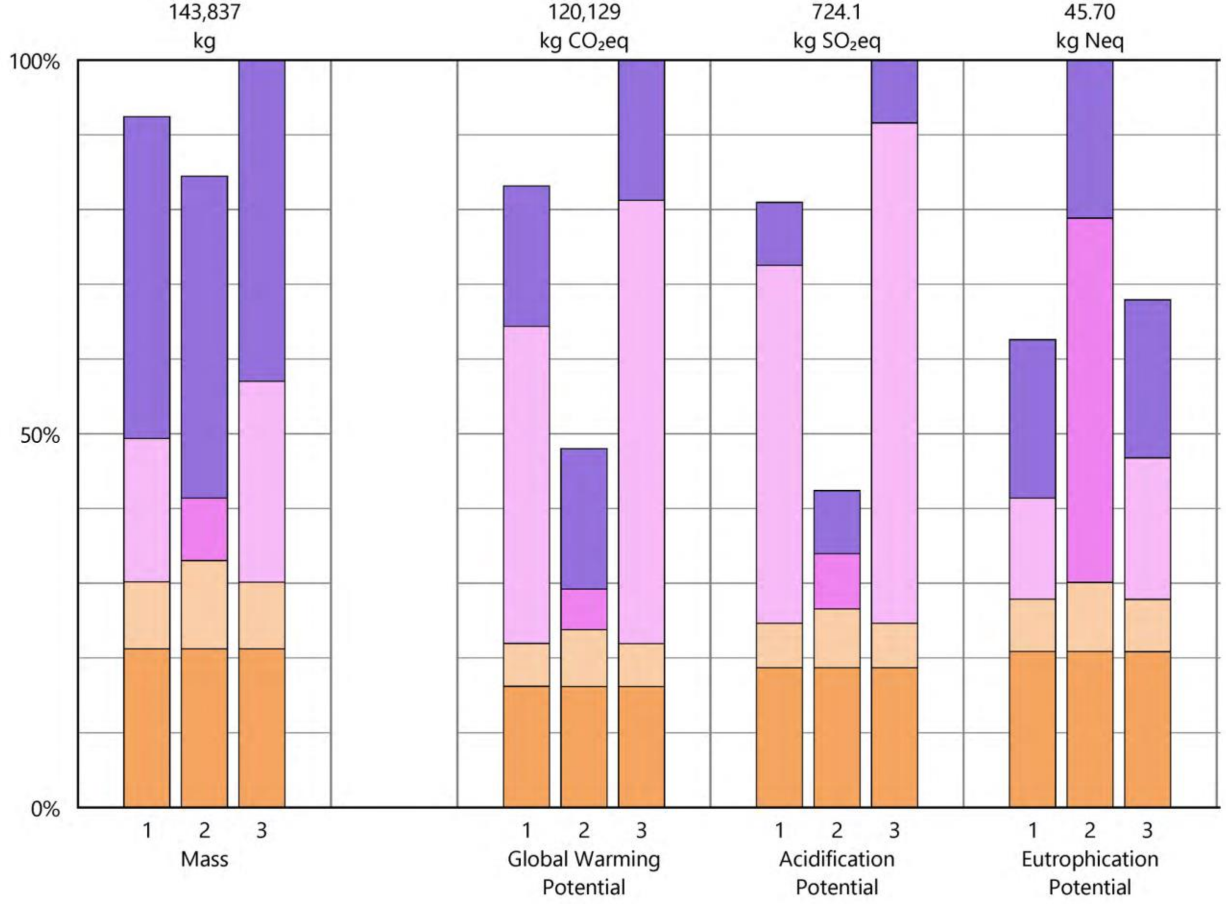
COMPARISON:

Typical Exterior Wall Assemblies





06 - Wood/Plastics/Composites
- Plywood, interior grade
- Wood framing

07 - Thermal and Moisture Protection
- Cellulose insulation, blown
- Mineral wool, board, generic

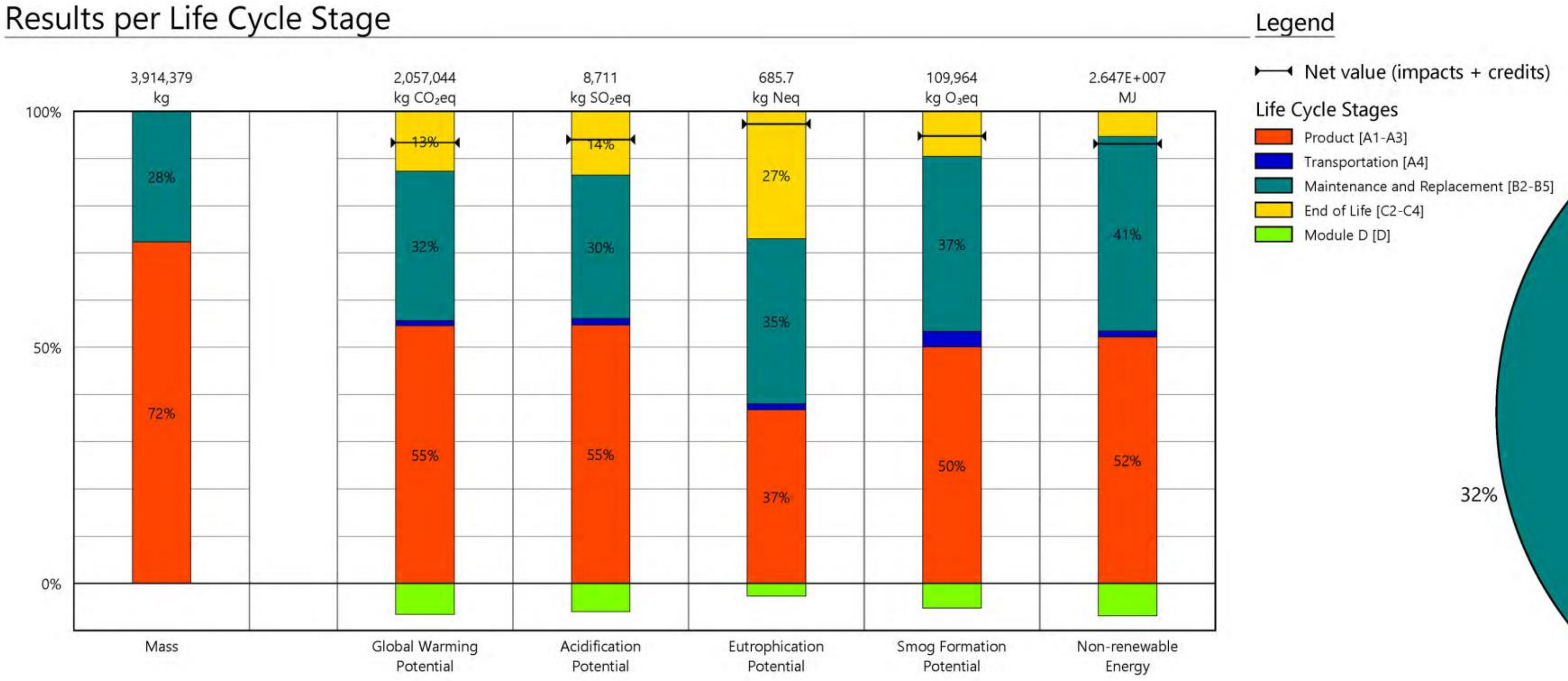
09 - Finishes
- Wall board, gypsum

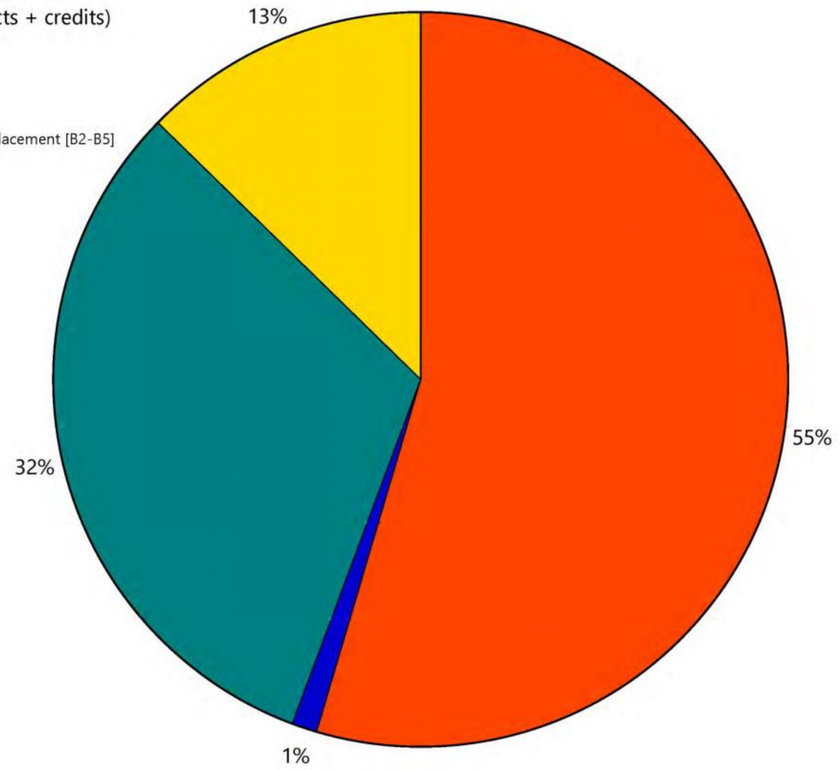
OPTION 2 consistently performed better in each of the Environmental Impact Categories - with the exception of Eutrophication Potential. This reminds us to consider the trade-offs of each decision and how performance changes based on categories being assessed.

FUTURE EXPLORATION OF CELLULOSE WITH BEST BLOWING AGENT FOR ENVIRONMENT

WHOLE BUILDING LCA:

Embodied Carbon Impact for Goldcrest by Life Cycle Stage





Global Warming Potential

1,920,874 (kg CO_2eq)

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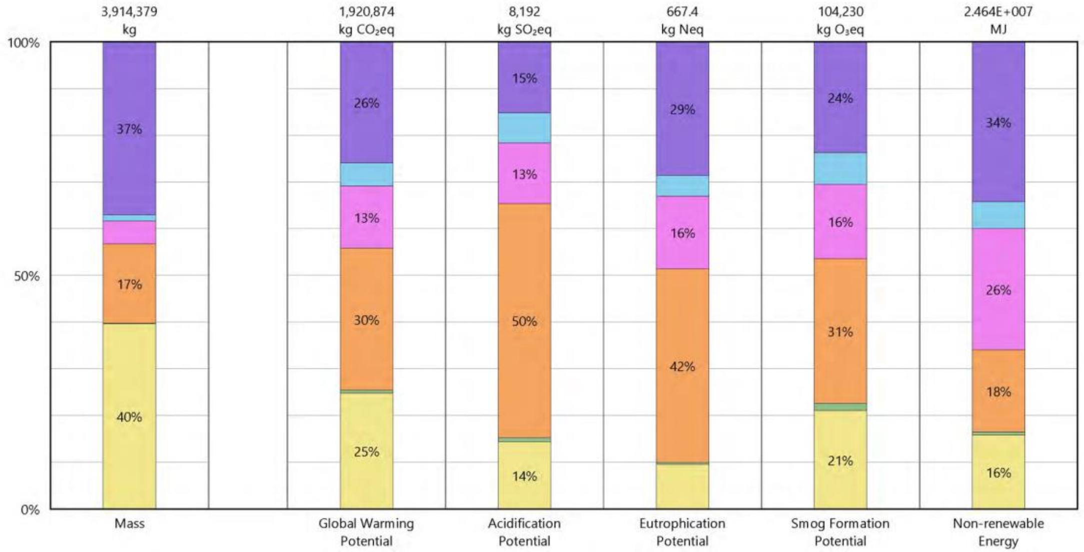
WHOLE BUILDING LCA:

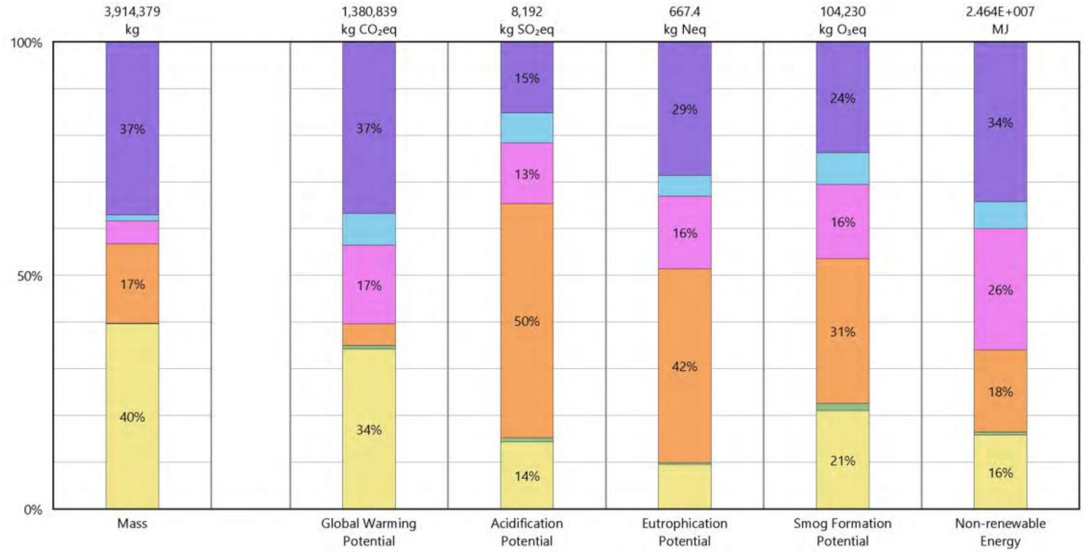
Results per Division -- Not accounting for Biogenic Carbon



Divisions

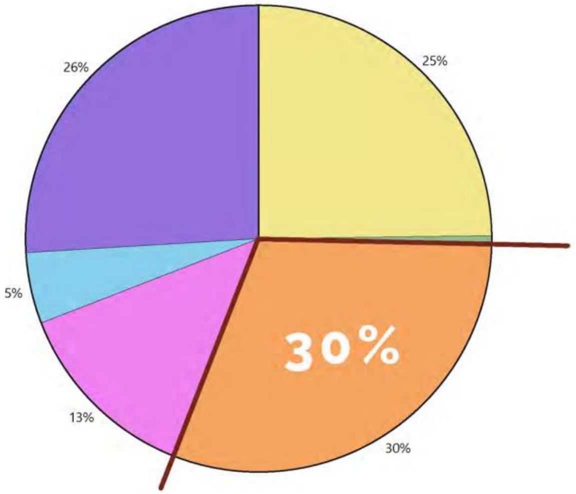
- 03 - Concrete
- 05 - Metals
- 06 - Wood/Plastics/Composites
- 07 - Thermal and Moisture Protection
- 08 - Openings and Glazing
- 09 - Finishes

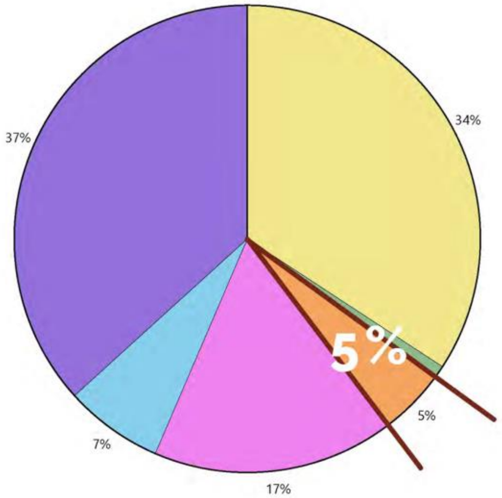
Results per Division -- Includes Biogenic Carbon



Again the question arises:
<u>accounting for biogenic carbon??</u>

When it is not included the wood stud walls account for 30% of the total carbon count - the greatest impact of any division of GWP.





GWP DECREASES FROM 1,920,874 to 1,380,839

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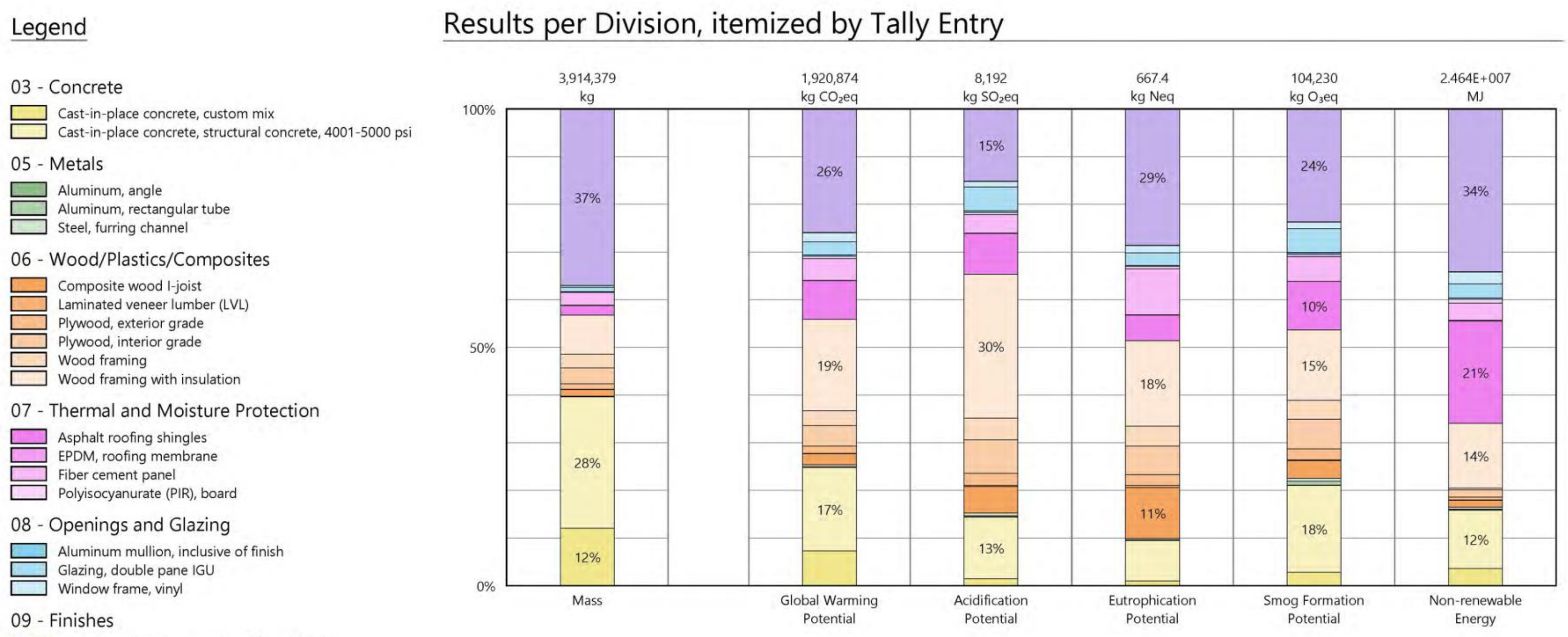
WHOLE BUILDING LCA:

Embodied Carbon Impact for Goldcrest Based on Materials



***Footings and foundations (concrete totals) are an estimate in this analysis; in subsequent Tally results this value may change.*

Gypsum Wall Board accounts for 26% of the total embodied carbon in the project!

Gypsum has a huge impact and appears all throughout a multi-family project - with double layers for demising walls.

Lightweight gypsum products with less water in the mix can be used to reduce energy intensity.

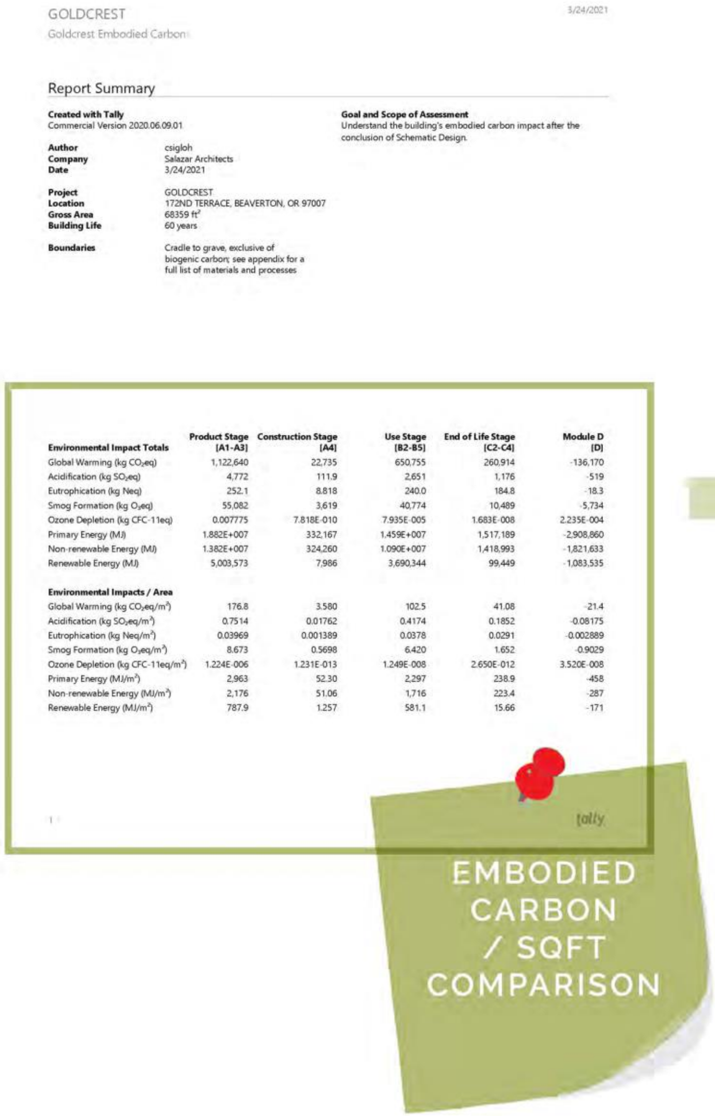
Optimize the thickness of gypsum being drawn - get it as thin as possible.

Optimize the interior elevations and carefully dimension relative to gypsum sheet size to limit the amount of wasted material.

WHAT'S UP WITH GYPSUM? IS THERE AN ALTERNATIVE COMING?

WHOLE BUILDING LCA:

Embodied Carbon Impact Comparison Across Future Projects



Environmental Impact Totals	Product Stage [A1-A3]	Construction Stage [A4]	Use Stage [B2-B5]	End of Life Stage [C2-C4]	Module D [D]
Global Warming (kg CO_2eq)	1,122,640	22,735	650,755	260,914	-136,170
Acidification (kg SO_2eq)	4,772	111.9	2,651	1,176	-519
Eutrophication (kg Neq)	252.1	8.818	240.0	184.8	-18.3
Smog Formation (kg O_3eq)	55,082	3,619	40,774	10,489	-5,734
Ozone Depletion (kg CFC-11eq)	0.007775	7.818E-010	7.935E-005	1.683E-008	2.235E-004
Primary Energy (MJ)	1.882E+007	332,167	1.459E+007	1,517,189	-2,908,860
Non-renewable Energy (MJ)	1.382E+007	324,260	1.090E+007	1,418,993	-1,821,633
Renewable Energy (MJ)	5,003,573	7,986	3,690,344	99,449	-1,083,535
Environmental Impacts / Area					
Global Warming (kg CO_2eq/m²)	176.8	3.580	102.5	41.08	-21.4
Acidification (kg SO_2eq/m²)	0.7514	0.01762	0.4174	0.1852	-0.08175
Eutrophication (kg Neq/m²)	0.03969	0.001389	0.0378	0.0291	-0.002889
Smog Formation (kg O_3eq/m²)	8.673	0.5698	6.420	1.652	-0.9029
Ozone Depletion (kg CFC-11eq/m²)	1.224E-006	1.231E-013	1.249E-008	2.650E-012	3.520E-008
Primary Energy (MJ/m²)	2,963	52.30	2,297	238.9	-458
Non-renewable Energy (MJ/m²)	2,176	51.06	1,716	223.4	-287
Renewable Energy (MJ/m²)	787.9	1.257	581.1	15.66	-171

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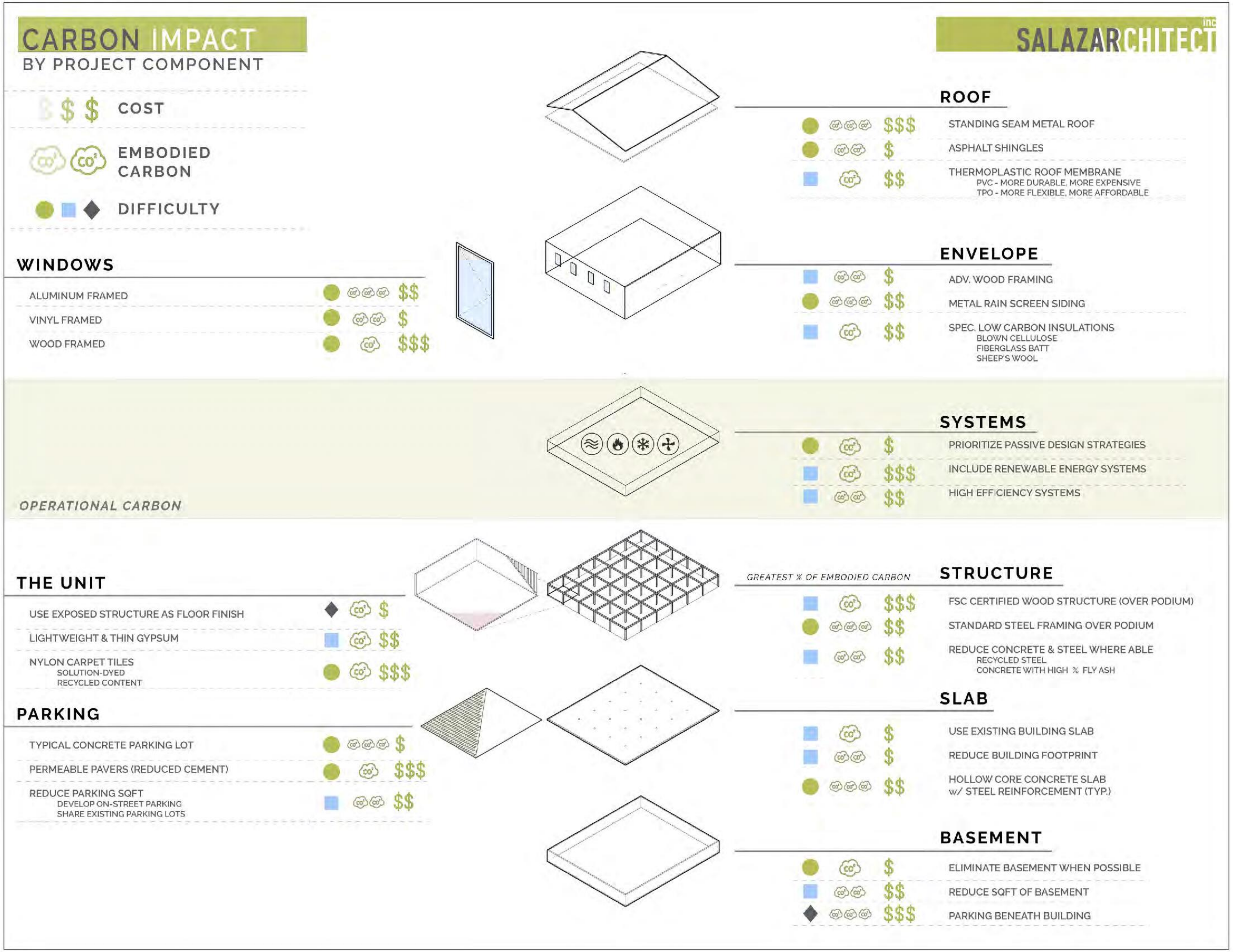
3. Developing an Info-graphic for Client Communication

COMPARISON FOR CLIENTS

A BREAKDOWN OF DESIGN DECISIONS WITH RESPECT TO EMBODIED CARBON, COST, AND DIFFICULTLY.

BALANCING SUSTAINABLE DESIGN WITH BUDGET & SCHEDULE RESTRAINTS ASSOCIATED WITH MULTI-FAMILY HOUSING.

DISCUSS SUSTAINABLE DESIGN OPTIONS EARLY ON



Looking Back to Move Forward: Reflections & Next Steps

OPERATIONAL CARBON vs EMBODIED CARBON:

HOW TO QUANTIFY AND TRACK?

Dana Fradon, *The New Yorker* May 17, 1976
Credit: Dana Fradon/The New Yorker Collection/The Cartoon Bank

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REFLECTIONS:

MAJOR TAKE AWAYS & LESSONS LEARNED

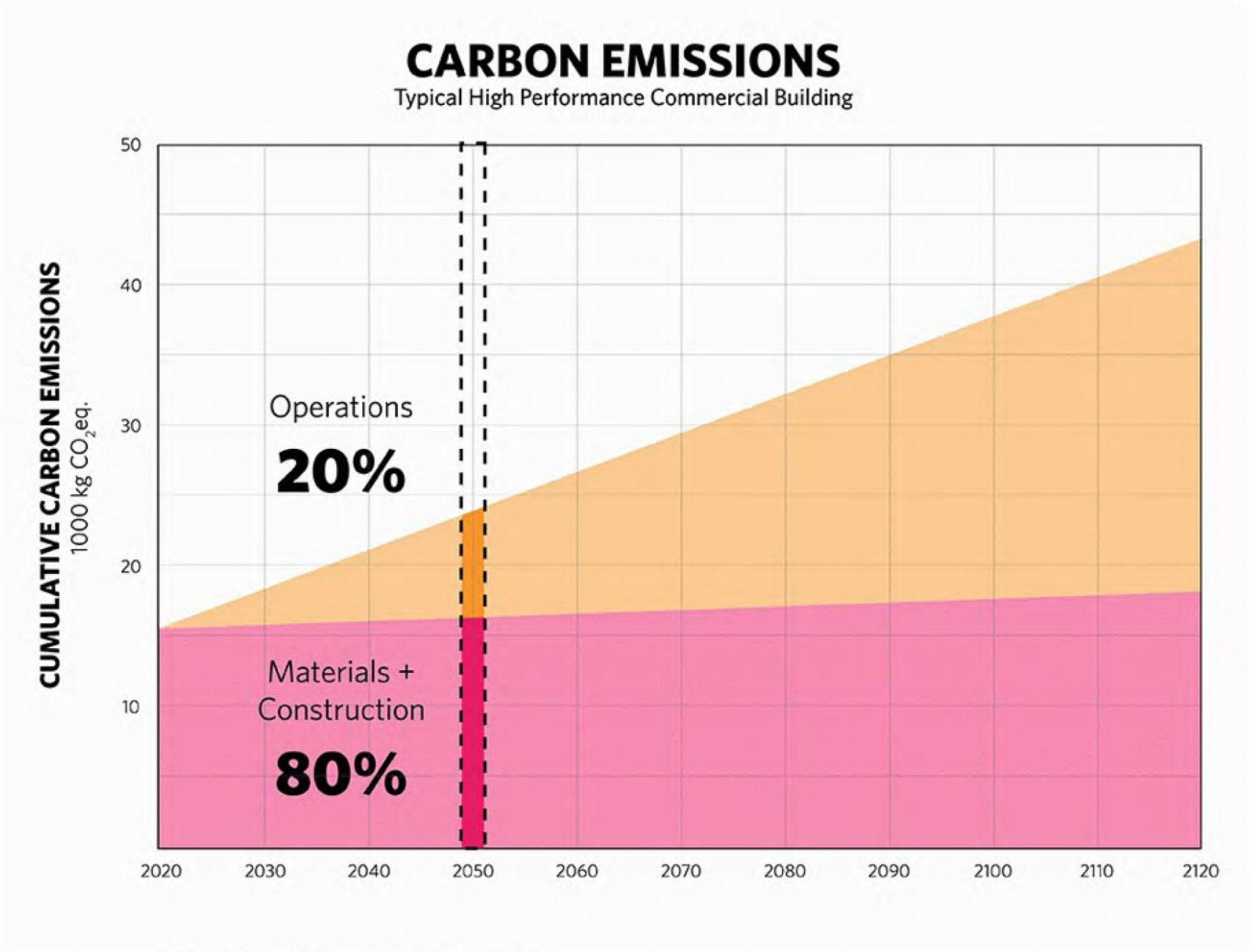
» UP UNTIL THIS POINT, **OPERATIONAL CARBON** HAS BEEN **PRIORITIZED IN BUILDING SUSTAINABILITY**

» **EMBODIED CARBON** NEEDS TO BE AN **EQUAL OR GREATER FACTOR** IN BUILDING DECISIONS

» EMBODIED CARBON IS A **DIRECT RESPONSIBILITY FOR ARCHITECTS - MATERIALS!**

» ONCE EMBODIED CARBON HAS BEEN POURED INTO OUR PROJECTS - **THERE IS NO GOING BACK**

» **POLICY & ENERGY CODES** NEED TO EXPAND TO INCLUDE EMBODIED CARBON DECISIONS



Kieran Timberlake - Carbon Accounting
https://kierantimberlake.com/files/pages/631/embodied-c.gif?1619060464544

LOOKING AHEAD:

NEXT STEPS FOR CARBON ACCOUNTING...

IS THE BEST BUILDING NO BUILDING?

IS OUR BEST FOOT FORWARD USING AN EXISTING BUILDING?

HOW DO YOU QUANTIFY THE TRADE OFF BETWEEN A LESS OPERATIONALLY EFFICIENT “OLD” BUILDING AND A NEW, NET ZERO BUILDING?

HOW MUCH CARBON IS SPARED BY USING AN EXISTING BUILDING?

Williams Plaza Apartments - Portland, Oregon
Renovated Project by Salazar Architects

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THANK YOU!

Expanding the Scope of Carbon Accounting for Projects
Net Zero Emerging Leaders Internship

Courtney Sigloh - cysigloh5k@gmail.com

April 29th, 2021