SMMA

Lexington High School

MEP Systems & Sustainable Design Focus Group – Mtg #2

02.12.2024

Setting the benchmark for future projects in the Commonwealth, and across the country, for innovative design, efficiency, sustainability, and positive impact for the community.

DORE + WHITTIER

SMMA

Meeting #2 Agenda

- Givens and Proposed Additional Goals
- Topics of Discussion
  1. Energy
  2. MEP Systems
  3. Healthfulness
- Next Steps

SMMA

Focus Group Objective

Review preferred MEP systems, sustainable design features, healthy materials, environmentally friendly design and renewable opportunities

1	Listen	1/25
2	Review & Respond	2/12
3	Confirm & Recommend	4/3
4	Reconvene	TBD

Givens and Proposed Additional Goals

The Givens and Proposed Additional Goals

Givens

- MA Specialized Energy Stretch Code
- Lexington Integrated Design Policy
- LEEDv4 Gold Certification
- Net Zero Energy (NZE) and EUI 25
- Solar PV Systems/Battery Storage
- SITES Certification - Gold

Proposed Additional Goals

- Net Positive Energy
- Microgrid
- EV Charging for Buses and electric bicycles
- LEED Platinum Certification
- Enhanced Ventilation/Air Quality:
  - 600 PPM (CO_2

Givens – Specialized Energy Stretch Code

Standard Stretch Code Compliance + Electrification Of Heating

Robust Building Enclosure

Window to wall Ratio (WWR) = **25%**

Walls = **R-40**

Roof = **R-60**

Glazing Systems = **R-5 (triple glazing)**

Thermal Bridging Mitigation

Air Infiltration Testing

Air Infiltration Reduction Goal = **0.15 cfm/sf@ 75 PA or better**

Optional Pathway: Passive House

Efficient MEP Systems

Efficient All-Electric Heating and Cooling Systems

- Ground Source HP or ASHP Systems
- Domestic Hot Water Systems (DHW)

Renewable Energy Readiness:

- Solar PV
- Battery Storage

EV Charging Station Readiness

****Net Zero Energy goal include installation of PV/Storage and an All-Electric Kitchen*

Givens – LEEDv4 Gold Certification and Lexington IDP

LEEDv4 Registration Highly Recommended prior to March 2024

Sustainable Sites

Stormwater Management Optimization
Urban Heat Island Reduction
- Light Colored Roof & Paving
- Green Vegetated Roofs
- Trees for Shading

Optimizing green/vegetated areas
Bicycle Storage
Green Vehicles
- Carpooling
- EV Charging Station (2% installed)

Joint Use of Facilities (Community Use)

Water Efficiency

Outdoor Water Reduction
- Low/No Irrigation
- Native Plants

Indoor Water Reduction
- 20% Min. Reduction [MSBA]
- 30-40% Reduction Goal [LEEDv4/IDP]

Water Sub-Metering

Energy and Renewables

EUI 25 Goal or 30% > ASHRAE 90.1
Solar PV/Battery Storage Installation
Advanced Energy Metering
Demand Response Readiness
Enhanced Ozone-Friendly Refrigerants
Commissioning –MEP/BE Cx [MSBA/LEEDv4]

Givens – LEEDv4 Gold Certification and Lexington IDP

Healthy/Low Carbon Materials

Embodied Carbon
- LEEDv4 LCA credit
- ***LEX IDP: TBD % Goal***
- Low Carbon Structure/Enclosure Materials

Sustainable Materials Attributes [Recycled Content, FSC wood, Regional Materials, etc.]
Construction Waste Management [95% goal]
Environmental Product Declaration- EPDs
Health Product Declaration - HPDs
Red List Screening [IDP]
Low-Emitting materials
Recycling Planning and Program

Indoor Environmental Quality

Daylight Optimization
Access to views
Enhanced Indoor Air Quality Strategies
Interior Lighting Design
Acoustical Performance [LEEDv4 pre-requisite]
Thermal Comfort
Construction IAQ Practices, including Flush Out

Resiliency/Healthfulness

Climate Resiliency [IDP]
Emergency Shelter:
- Level 2 – Gym/Field house
- Level 3 – Remainder of Bldg.

Environmental Literacy
Access and Interaction with Nature
Other Considerations:
- Biophilia

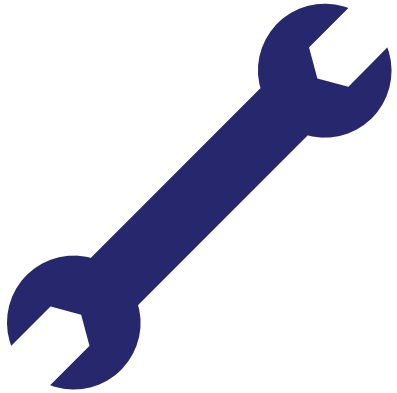
Topics of Discussion

Meeting #1 Priorities

1. Net Zero Energy and Renewable Energy
2. Climate Preparedness and Adaptability
3. MEP Systems
4. Sustainable Transportation and Electrification of Transportation
5. General sustainability and MEP design planning
6. Sustainable Materials and Healthfulness [IAQ/IEQ]
7. Sustainable Sites
8. Environmental Literacy

Topics of Discussion

Energy



MEP Systems

Healthfulness

Topics of Discussion

Energy

MEP Systems

Healthfulness

Energy

- Net Zero Energy
- EUI 25
- Massing and Orientation
- Ground Source and/or Air Source Heat Pumps Systems
- Renewable energy: Solar PV Systems with Battery Storage
- EV Charging Stations (2% LEED/IDP minimums Givens - Bicycle and buses Aspirations)
- Massachusetts Specialized Energy Stretch Code

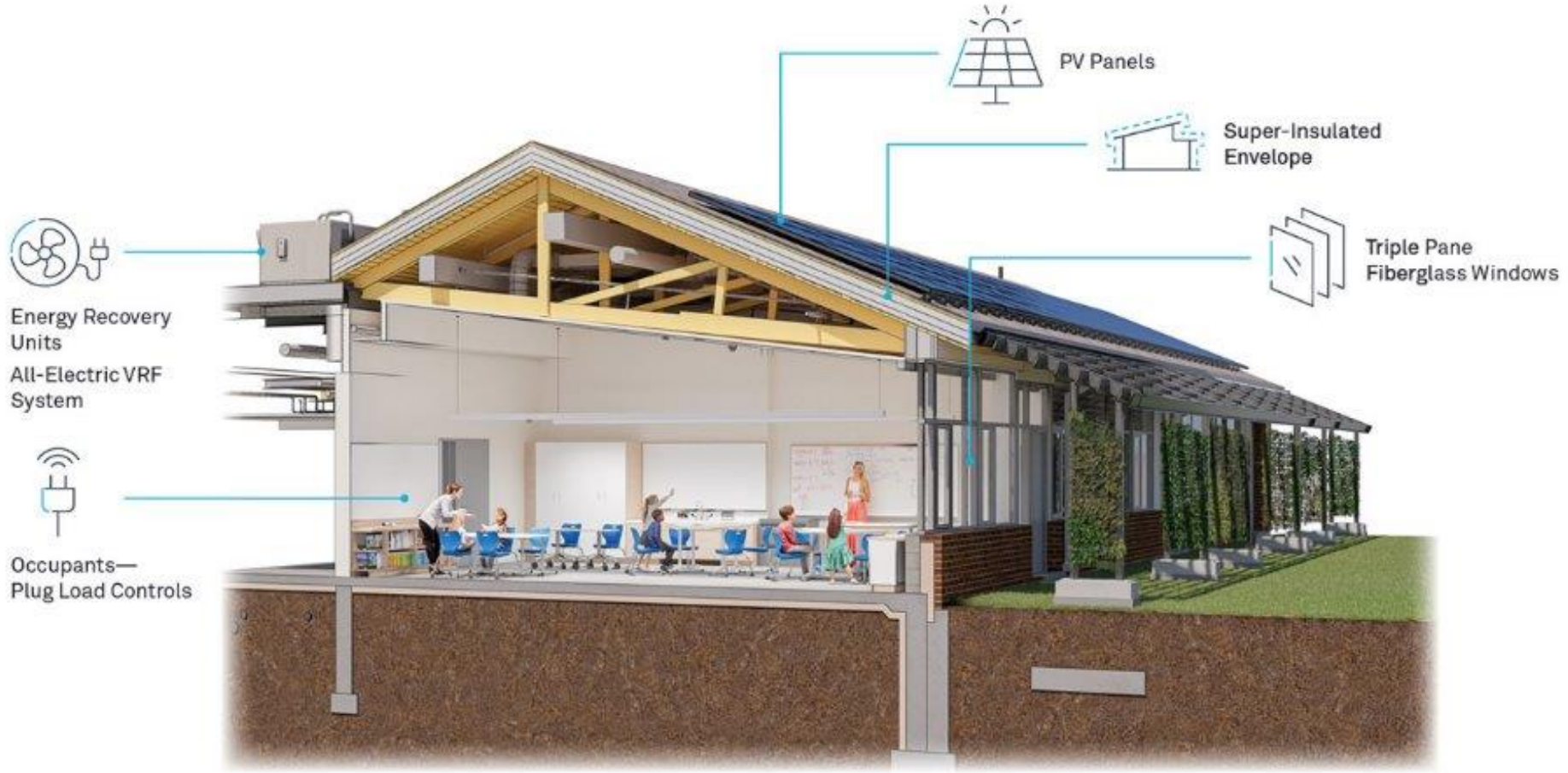
Net Zero Energy Facility

Predicted EUI

25

[kBtu/SF/Yr.]

[Goal]



Net Zero Energy: A Preliminary "Snapshot"

	EUI (kBtu/SF/yr.)	**Energy Usage** (KWH)	**Energy Costs** ($/SF)	**Solar PV Net Metering Benefits**	**Solar PV System**
Proposed School *500,000 SF*** Full AC	25**	~3,700,000	~$1.84	~($0.67/SF)	*3,500-3,700 KW (3.5-3.7 MW)*
% reduction over Existing	70% less energy use per SF				
Existing Facility 369,500 SF Partial AC	104		$1.53	($0.13/SF)	40-50 KW

***Caveats:*
1.Approximately 500,000 SF Building area is subject to flux, based on the Project's design progress and decision process
2. Additional program spaces leading to higher energy use not included may impact EUI 25 goal and Solar PV system sizing

MassSave Incentives Overview: NZE Pathway- $2.00/SF + Heat Pumps Program - $3,500/ ton GSHP or $1,500/ton ASHP

Net Zero Energy:
Solar PV Systems Preliminary Assessment

Potential Solar PV System

3.4 MW

[Does not include EV Charging for Buses and Bikes]

Based on:

Estimated Design Roof Area:	225,000 SF
Existing Parking Area:	167,500 SF

Energy

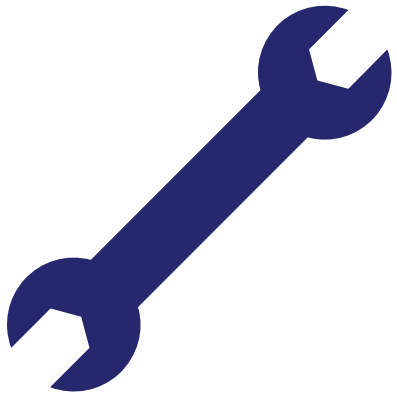
Questions

Comments

Concerns

Topics of Discussion

Energy



MEP Systems

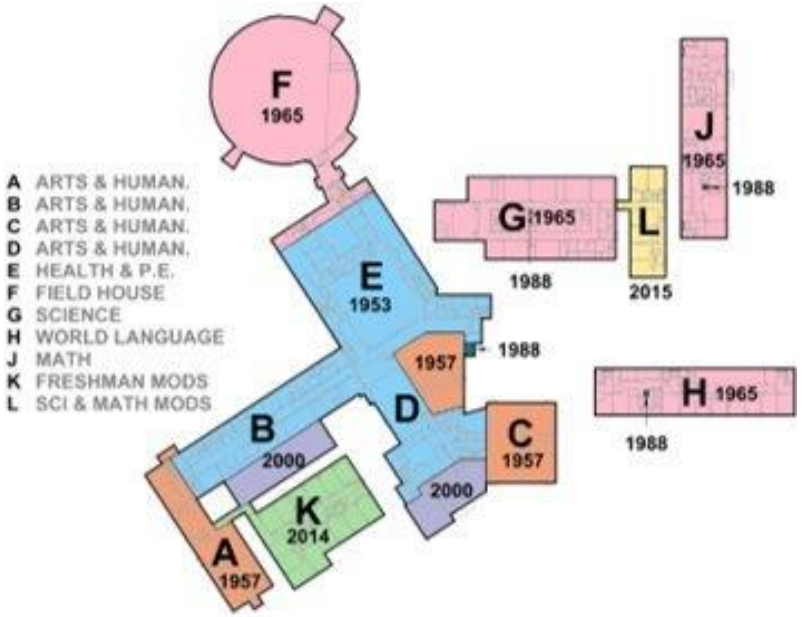
Healthfulness

MEP Systems Overview

- General HVAC
- HVAC Related Comments
- Ventilation Goals
- Geothermal Overview and Comments
- Heat Pump Overview
- Metering and Automation Systems
- Electric Vehicle Charging Stations

General HVAC

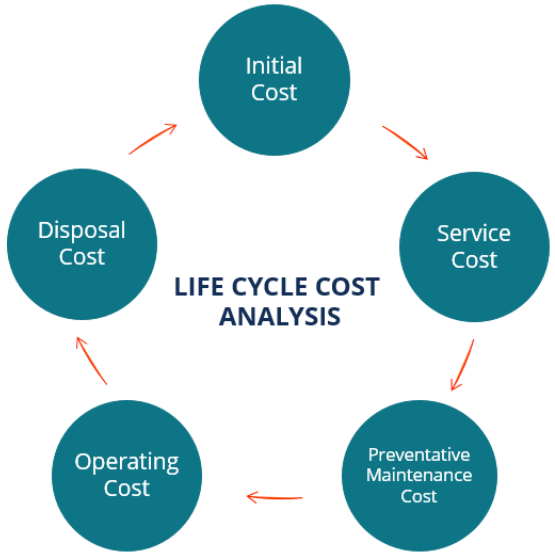
- **System Design Considerations**
  - All-Electric, Utilize the latest MEP technology
  - Select the best system for the intended building use and life cycle cost
  - Cost
    - Upfront, potential incentives
    - Maintenance and repair
  - Serviceability and Maintenance
  - Occupant comfort and health
    - Ventilation
    - Acoustic
  - Room for future expansion



General HVAC

- **Loads Calculations**
  - Preliminary Analysis during PSR phase
  - Critical for understanding potential incentives, and syster options

- **Life Cycle Cost Analysis**
  - Final LCCA of system options during the SD phase
    - Installation cost
    - Operating cost (Energy + Maintenance)
    - Equipment replacement cost – 50 yr life of building



HVAC Comments

- ***System that will last the life of the building***
  - Equipment/equipment components will need to be replaced periodically
  - Much of the distribution can live up to the 50yr life of the building
- ***Best system for a building this size and use it gets***
  - Central systems can leverage diversity of use
  - Local systems must support peak usage
- ***Be cognizant of expansion of systems needed to support the building***
  - The design should consider how building expansion could be accommodated
- ***Heating and cooling is currently inconsistent and inefficient***
  - Yes, steam in main campus, outdated controls, many systems at the end of their useful life.

HVAC Comments

- ***24/7 HVAC and humidity control for critical spaces***
  - *Please clarify*
- ***Leak detection and valve shutoff to mitigate loss***
  - *Use of flow meters to detect off-hour use*
  - *Automatic control valve for shutoff*
- ***Supplemental backup for HVAC***
  - *Heat during loss of normal power*
  - *Emergency shelter space*
  - *Critical Space (IT rooms, Electric Rooms)*
  - *Others?*

HVAC Comments

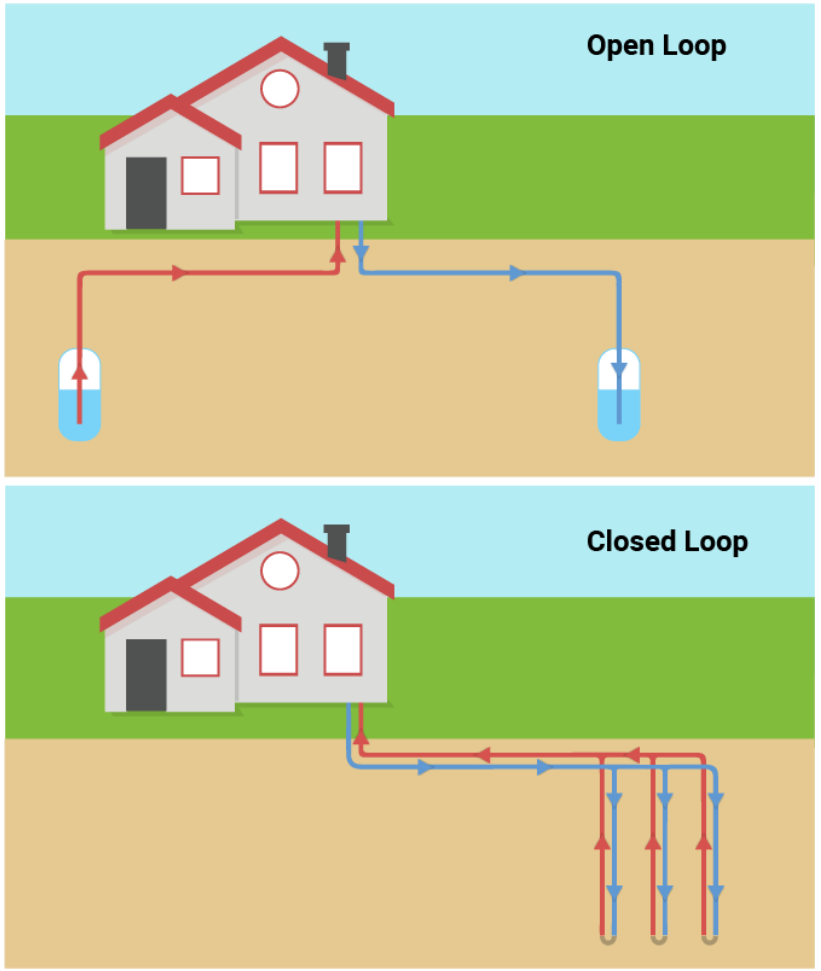
- ***Lessons learned from 2-pipe in the past***
  - Shared piping for hot water and chilled water
  - Cost saving but limits operational flexibility during swing seasons
  - Design Team welcomes lessons learned information
- ***Simultaneous heating and cooling***
  - Each zone will provide either heating or cooling at one time
  - Different zones within the building could have simultaneous heating and cooling
- ***Theater spaces to have larger supply of electricity than other high schools***
  - Power will support full extent of proposed theater program for Auditorium and related program spaces

Ventilation Goals

- **Carbon Dioxide Levels – CO2 PPM**
  - 800 PPM Standard
  - 600 PPM Goal
  - Ambient is ~420 PPM
- **Minimum Air Change Rate**
  - Ventilation = 3 ACH Min
- **VOCs**
  - Discussed in the Healthfulness Section

Geothermal Overview

- **Open Loop vs Closed Loop**
  - Open Loop
    - Up to 1,500 ft deep open wells
    - Up to 30 Tons per well
    - Cons: Water quality, reliability, contamination
  - Closed Loop
    - 500-800 ft deep boreholes
      - some manufacturers are looking into deeper depths
    - 2-4 Tons per borehole
    - Less risk than Open Loop
- **Incentives available**
- **Supports a variety of heating/cooling systems**



Geothermal Comments

- ***How many wells?***
  - Depending on system type and site conditions – will have further information from load calculations and test borehole report
    - Open Loop – Qty = 10s
    - Closed Loop – Qty = 100s

- ***Possible to get exemptions to drill deeper wells?***
  - Typical Closed and Open depths are recommended
  - Will depend on the test borehole, manufacturer, and property

Heat Pumps Overview

- **Air source heat pumps**
  - VRF is efficient and cost effective as a first cost
  - Useful life is ~15 years (Compressor life)
- **Viability of air source heat pumps 5 years out**
  - VRF heat pumps developed in 1980s
  - More prominent in US over last 10-15 years
  - Constantly developing technology
- **Refrigerants**
  - ASHPs hold a higher refrigerant volume than GSHP
  - Design per industry code for refrigerant management and regulations
  - Industry is phasing into lower GWP refrigerants, constantly evolving – we are tracking this closely
- **Heat pump maintenance on cold days**
  - Air source heat pumps go into defrost cycles on cold days (under 40°F)
  - Ventilation units (DOAS) require supplemental electric coils

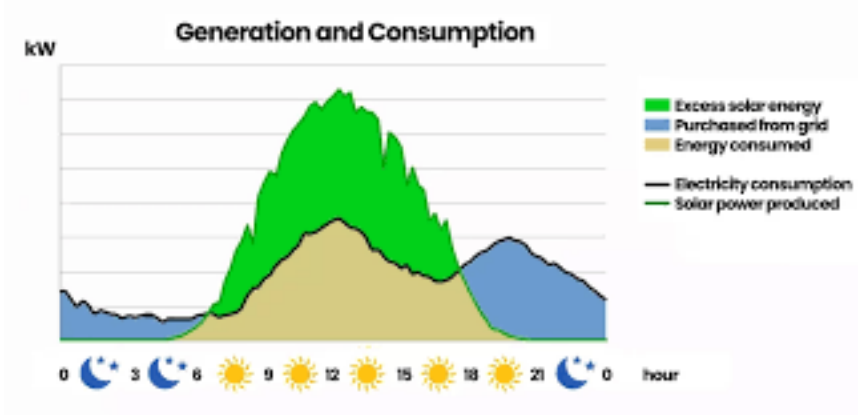
Metering and Automation Systems

» ***Metering of Services***

- Onsite renewables and energy storage
- Electric usage by type
- Water meters by usage type
- Suitable for incentive programs – *revenue grade*

» ***Integration of Automation Systems***

- Security
- HVAC (BMS)
- Lighting
- Fire Alarm
- Other



Electric Vehicle Charging Stations

- **Level 3 Charging**
  - Utility infrastructure required
- **Level 2 Charging**
  - LEED requirement 2%
  - Infrastructure for future installations
- **Level 1 Charging**
  - Flexible charging options

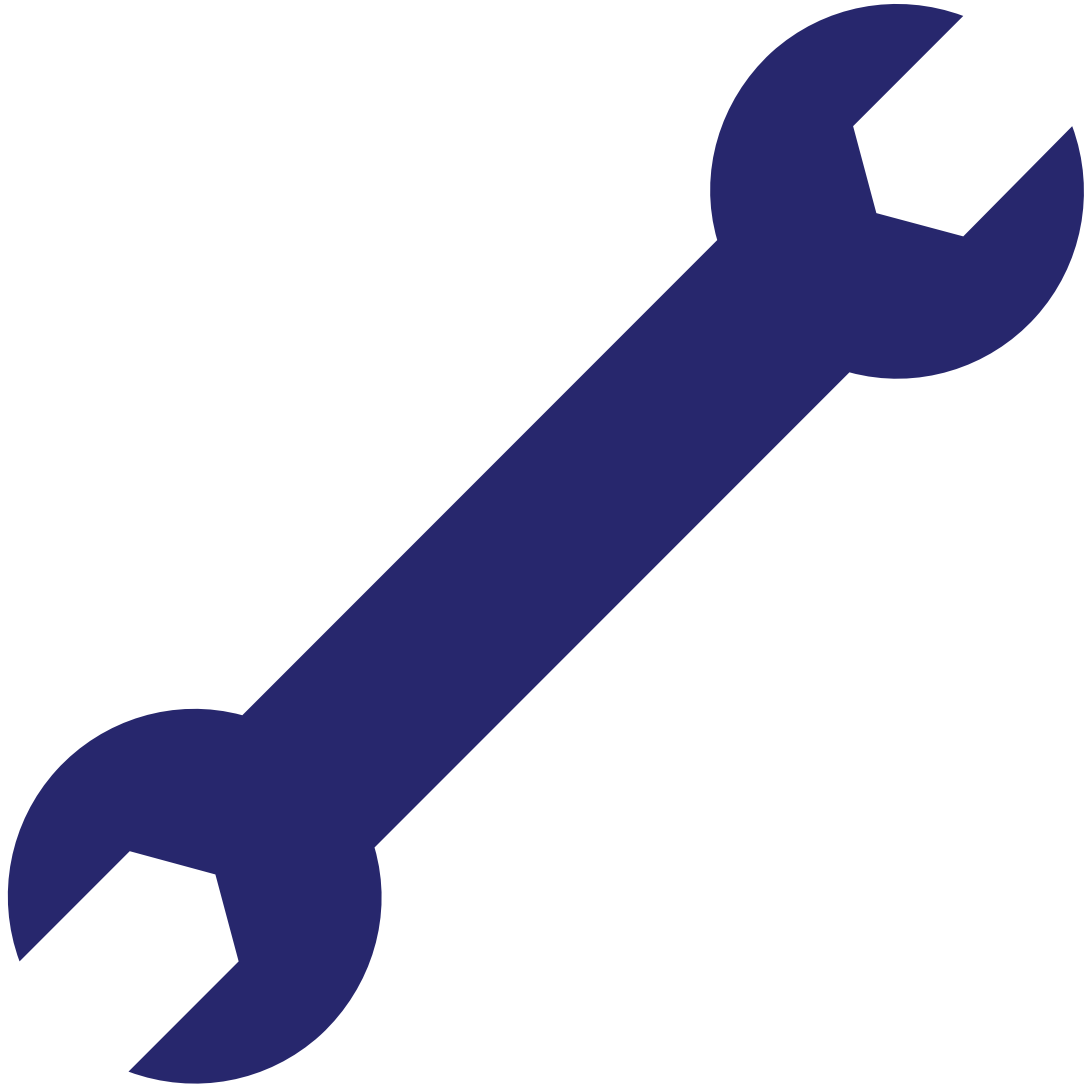
Charging Stations Power Usage		
Electric Bus (Level 3)	**Electric Vehicle** (Level 2)	**Electric Bicycle** (Level 1)
50 - 150 kWatts DC Current	**6.6 kWatts** AC Current	**1.5 kWatts** AC Current

MEP Systems Discussion

Questions

Comments

Concerns



Topics of Discussion

Energy

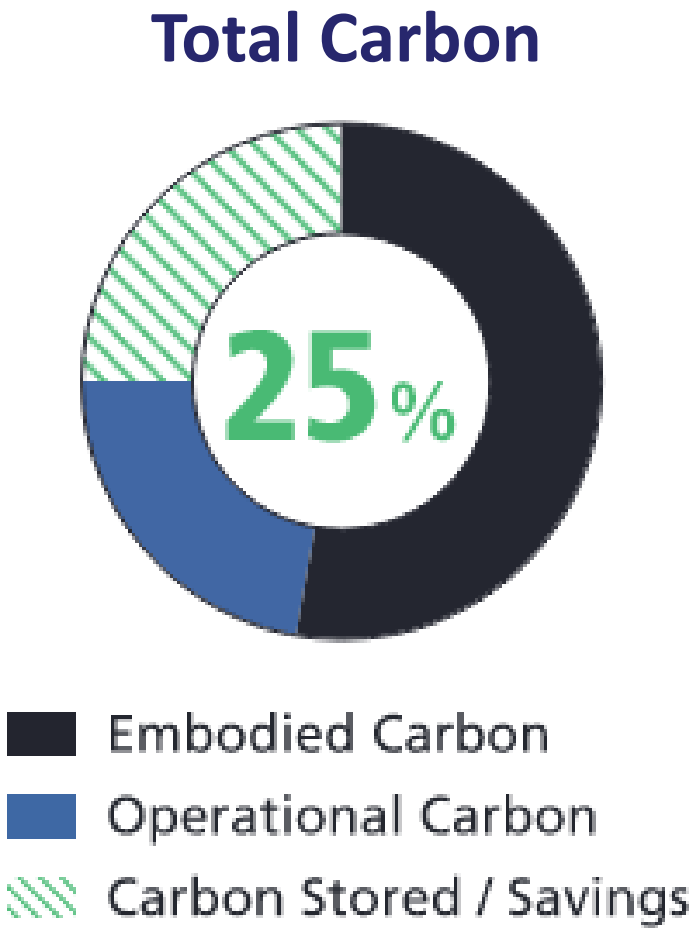
MEP Systems

Healthfulness

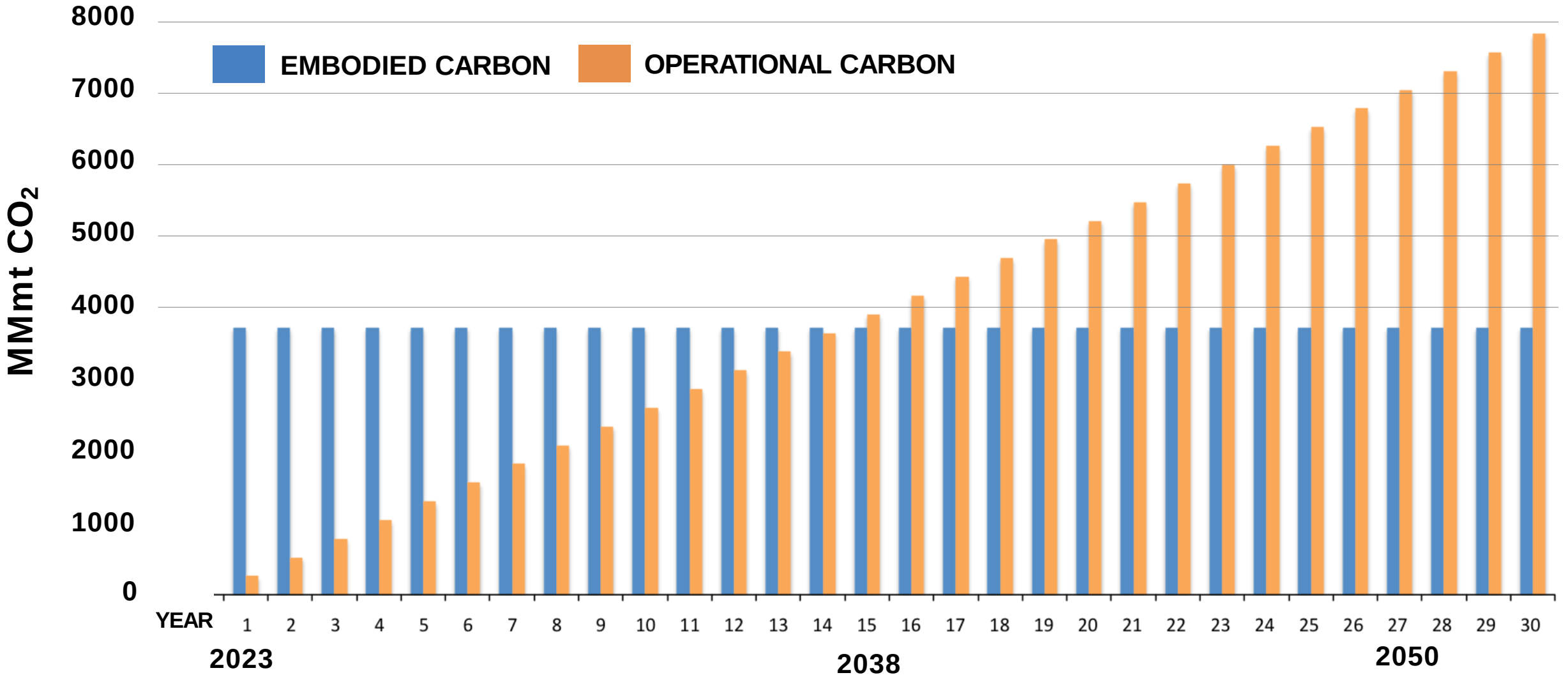
Healthfulness

- Embodied Carbon
- Interior Materials – Red List Materials, Maintainability
- Access to Daylight, Views, Outdoor Classrooms
- Indoor Air Quality
- Sustainable Sites
- Environmental Literacy and Equitable Design Opportunities

Embodied Carbon: Setting a Goal

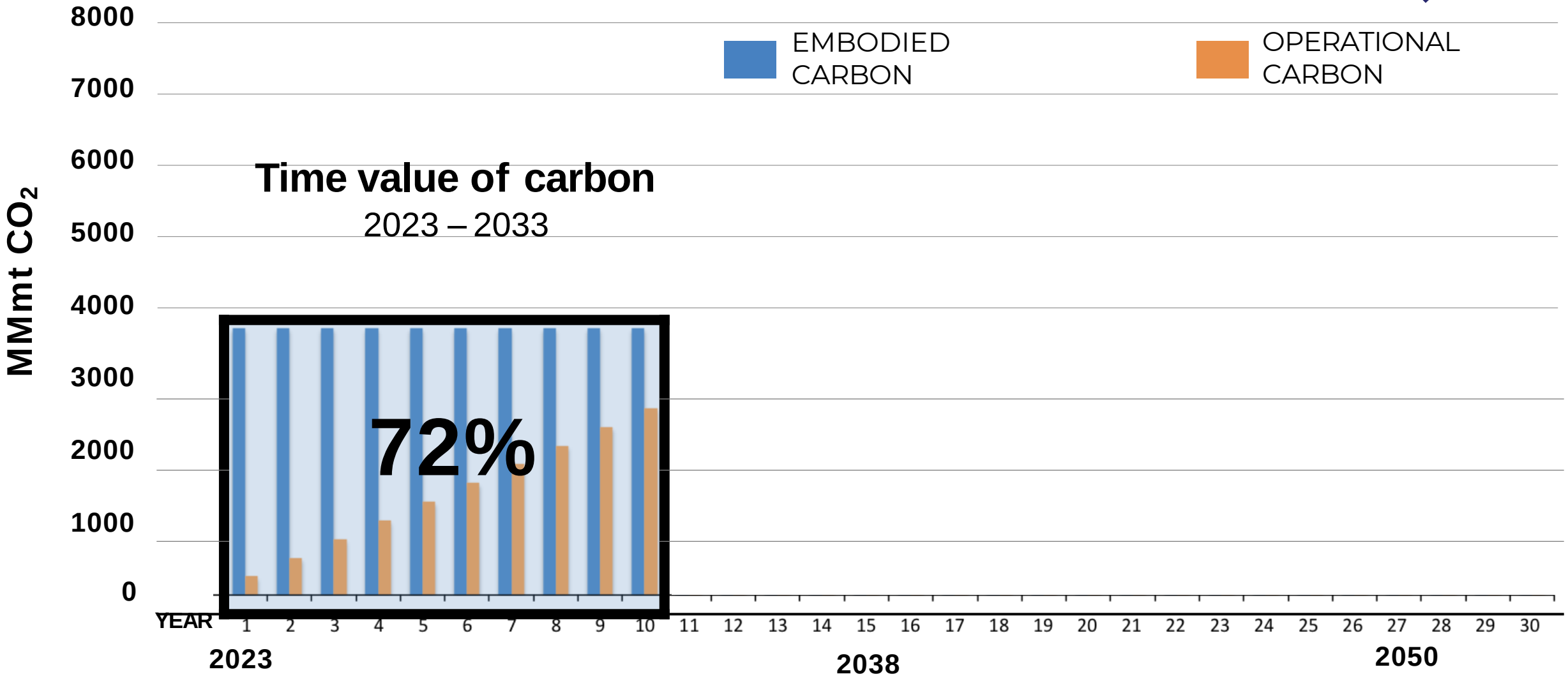


Total Emissions of Global New Construction



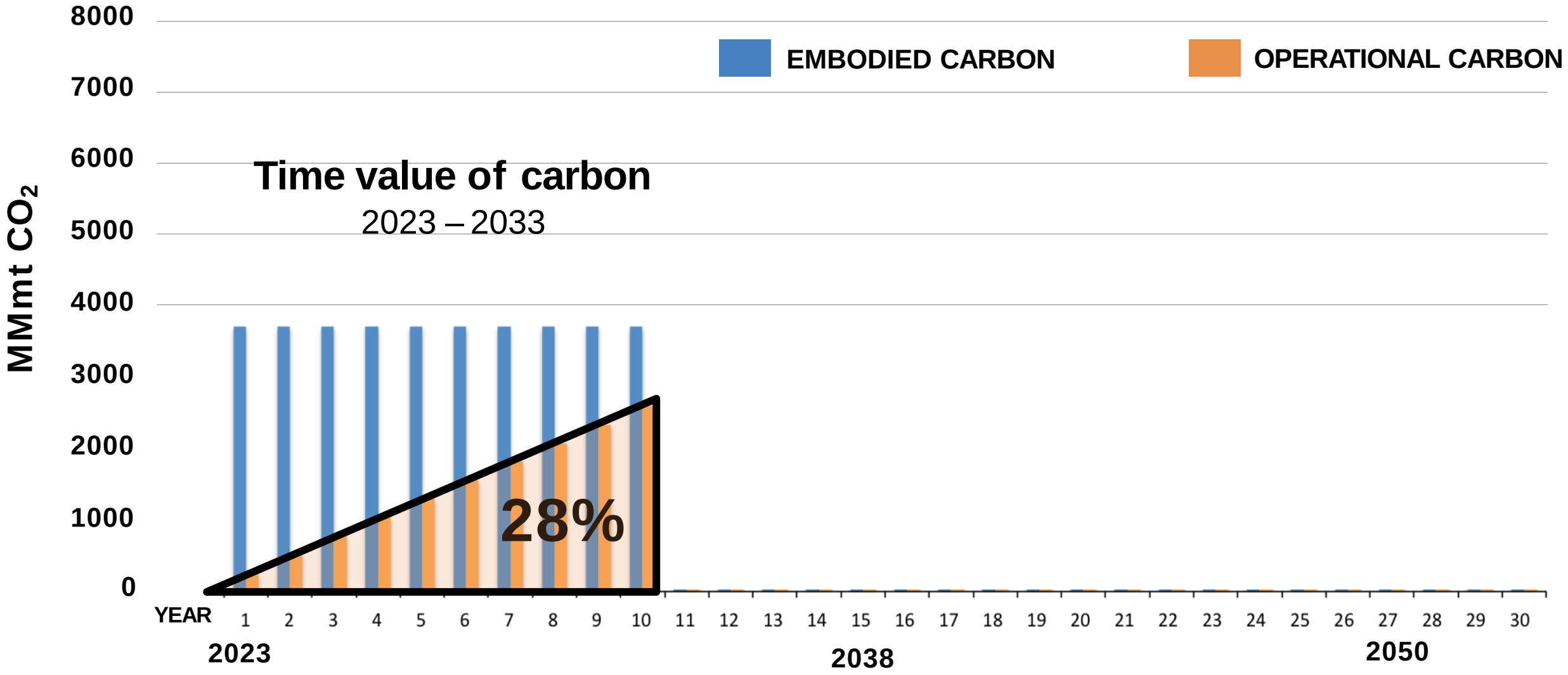
Source: Architecture 2030, Adapted from EIA IEO 2017 and Global ABC, Global Status Report 2017

Total Emissions of Global New Construction



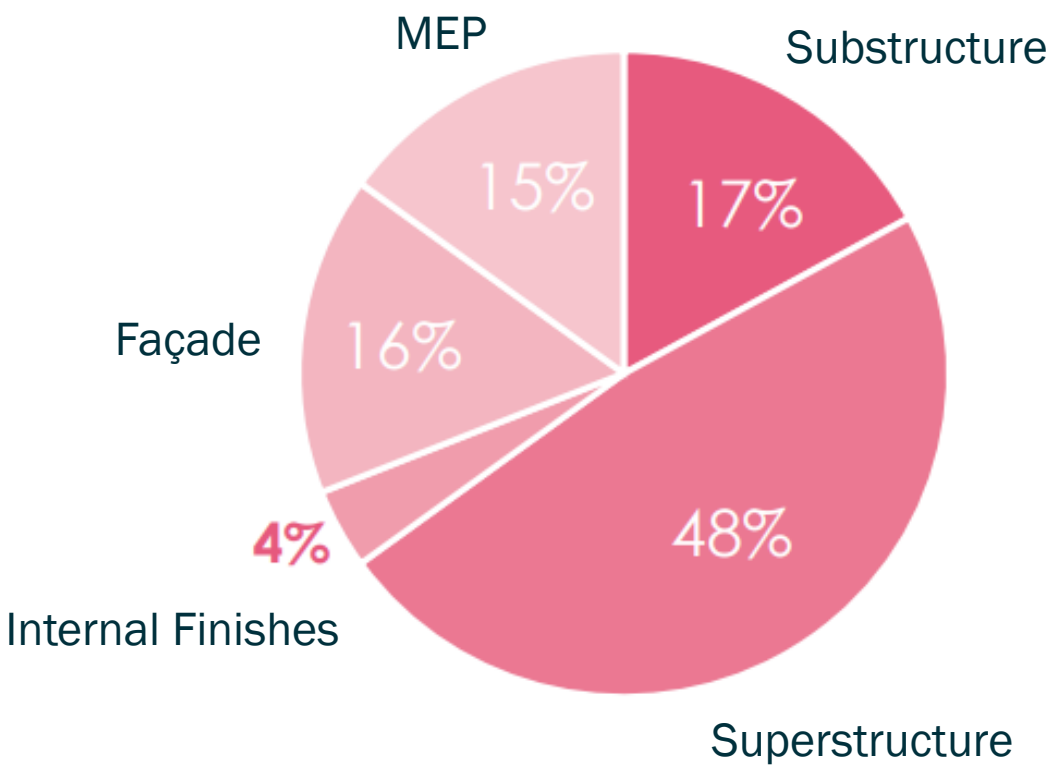
Source: Architecture 2030, Adapted from EIA IEO 2017 and Global ABC, Global Status Report 2017

Total Emissions of Global New Construction



Source: Architecture 2030, Adapted from EIA IEO 2017 and Global ABC, Global Status Report 2017

Where is Embodied Carbon?



65% in the structure
(super + sub)

Sustainability of Mass Timber

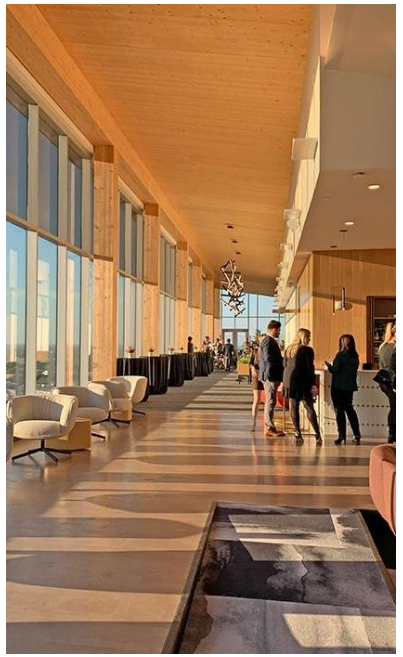
Areas of Impact:

1
Embodied Carbon

2
Construction Efficiency

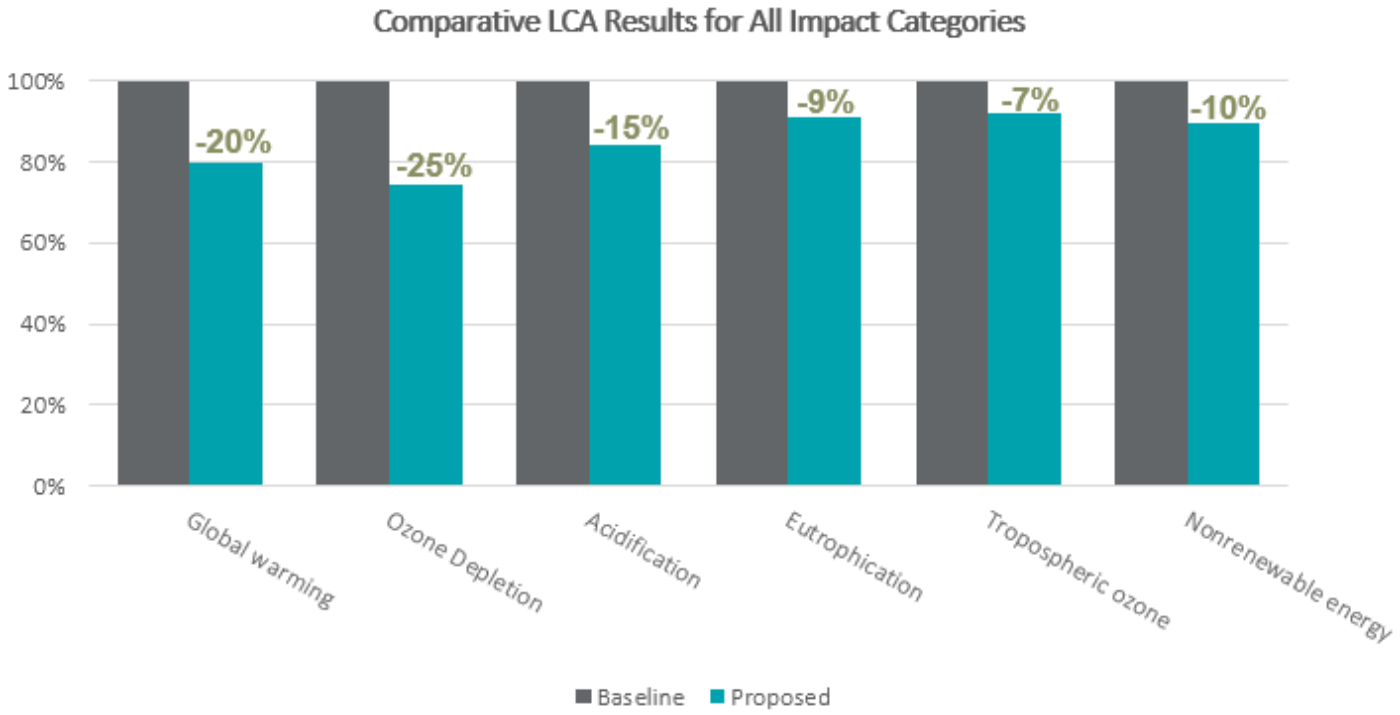
3
Deconstructability & Material Circularity

4
Biophilic Design



5
Occupant Wellbeing

Where is the Impact?



Impact Categories:

- Global Warming Potential (Greenhouse Gases)
- Depletion of the Stratospheric Ozone Layer
- Acidification of Land and Water Sources
- Eutrophication
- Formation of Tropospheric Ozone
- Depletion of Nonrenewable Energy Resources

Healthfulness

1

Optimize comfort & wellbeing

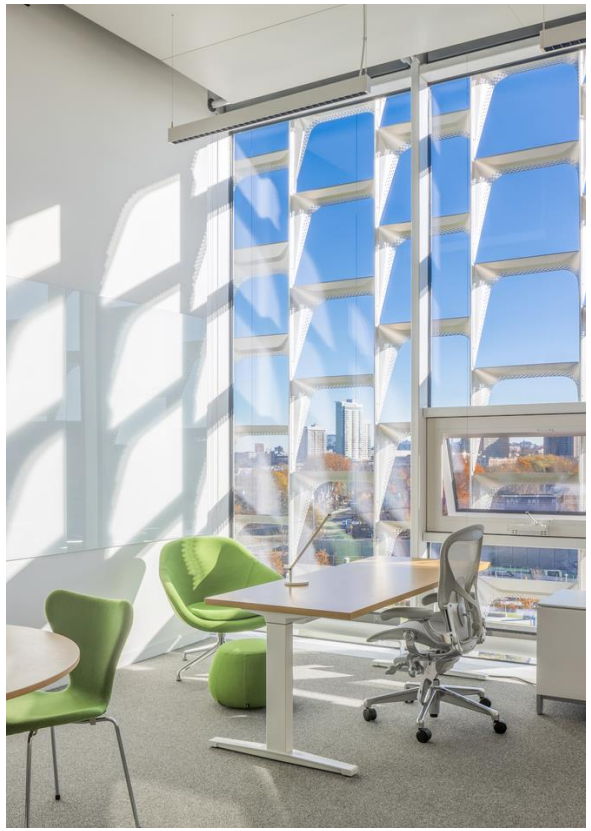
2

Minimize exposure to hazards

3

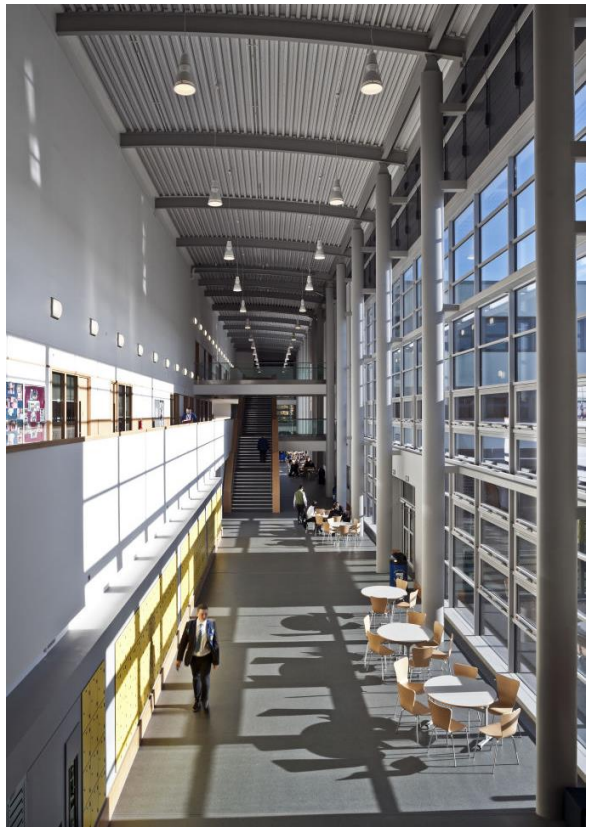
Create equitable & inclusive spaces

Comfort & Wellbeing



Light Quality & Views

Air Quality



Thermal Health

Noise

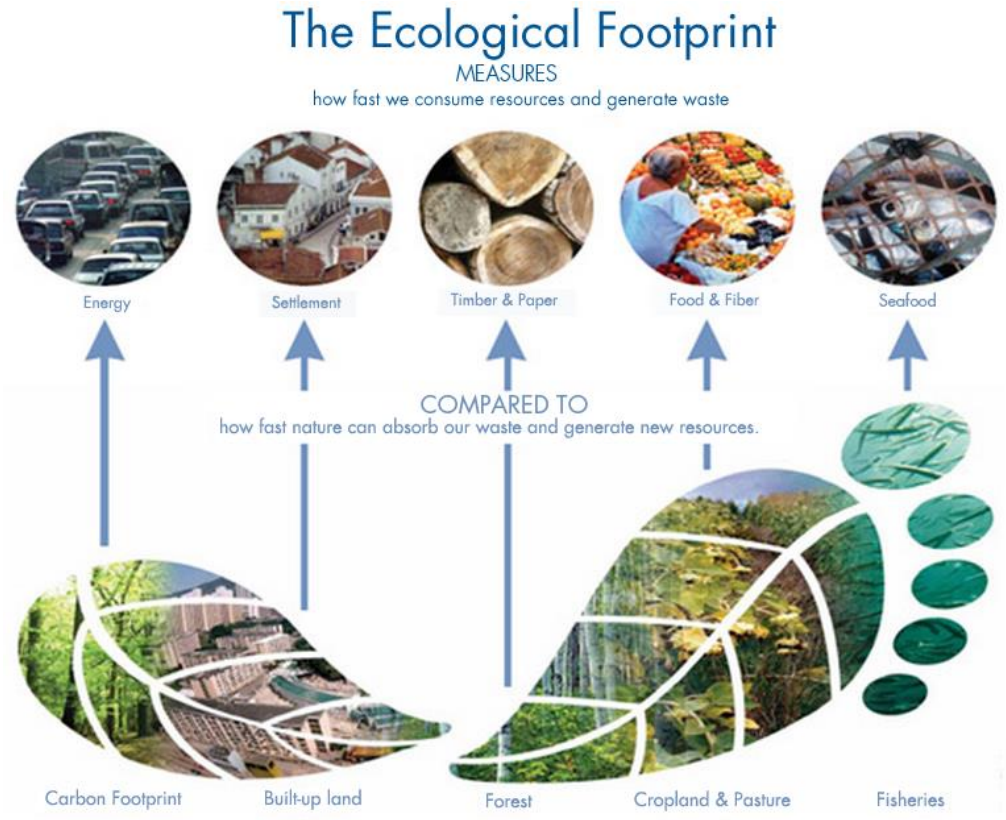
Sustainability Goals: Healthy Materials

New Building:

- Where are the materials from?
- How are they manufactured?
- What are they made of?
- Will they impact our health?
- How are materials maintained?
- What happens at the end of the materials' life?

Existing Building:

- What can be salvaged?
- What needs to be removed?
- Where are our opportunities for positive change?
- Waste diversion

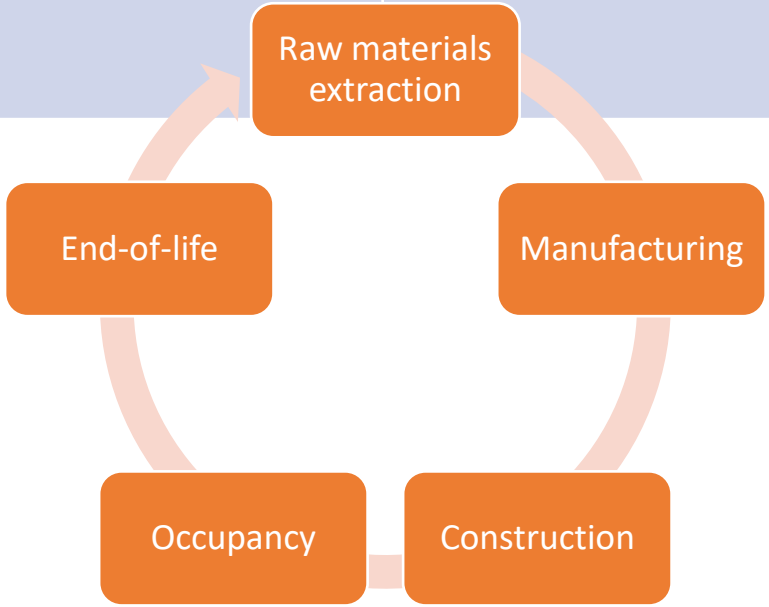


SMMA Red List Analysis Precedent

Material	Manufacturer/ Product	Six Classes of Chemicals Compliance						Red List Compliance
		PFAS	Antimicrobials	Flame Retardants	Bisphenols & Phthalates	Solvents	Metals	
Vinyl Composition Tile	Tarkett VCT II	Yes	Yes	Yes	Yes	Yes	Yes	No
Vinyl Composition Tile	Kahrs Upofloor Quartz	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Resilient Flooring	Kahrs Upofloor Zero	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Epoxy Flooring	Tnemec Powertread	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Carpet Tiles	Interface Net Effect	Yes	Yes	Yes	Yes	Yes	Yes	No
Carpet Tiles	Interface CQuest Bio	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rubber Flooring	Nora by Interface	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gypsum Wall Board (typical)	USG Sheetrock Brand	Yes	Yes	Yes	Yes	Yes	Yes	No
Gypsum Wall Board (Low-Carbon)	USG Sheetrock Brand EcoSmart Firecode	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Healthier Materials Tiered Approach

TIER 1: LEED Equivalency	TIER 2: Targeted Products	TIER 3: Division 9 Focus	TIER 4: Division 9 & Beyond
LEEDv4 equivalency for materials credits (HPDs for all identified product categories)	Identify the Top 10-15 products or product categories to vet using the **Red List** or class-based approach.	Vet all finishes in Division 9 using the Red List or a class-based approach	Vet all finishes in Division 9 & include other targeted categories that have the largest impact on human & environmental health



BIOPHILIA

ROUX CENTER FOR THE ENVIRONMENT, BRUNSWICK ME

COLOR & LIGHT

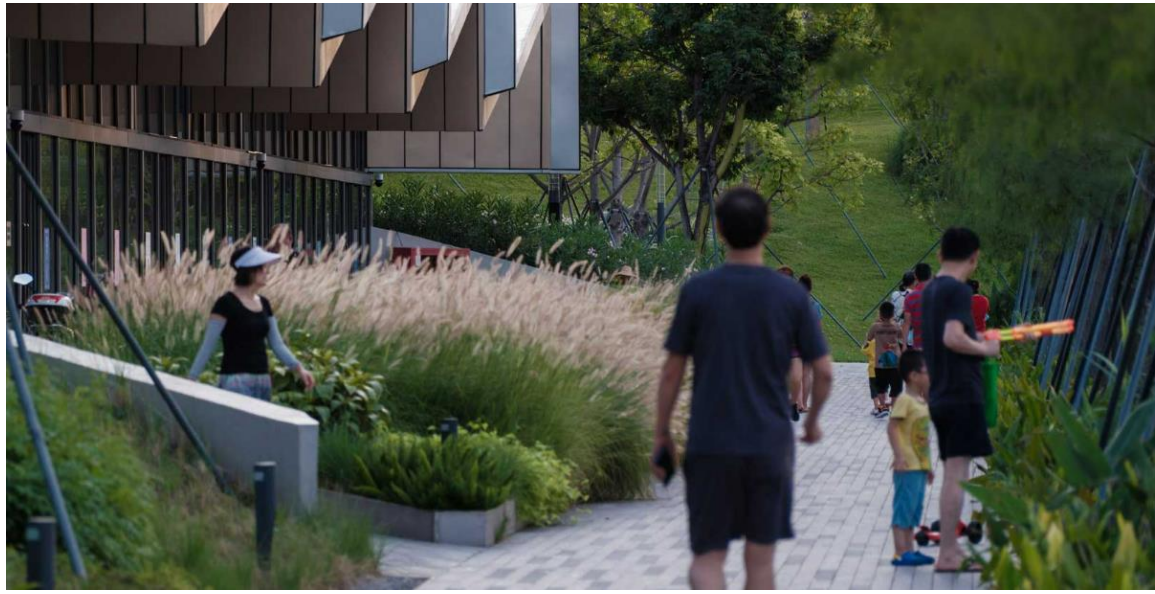
NATURAL MATERIALS

CONNECTION TO PLACE

TRANSITIONAL SPACES

MEP SYSTEMS & SUSTAINABILITY

Active Site Design & Equitable Access



Healthfulness

Questions

Comments

Concerns

Next Steps

What to Expect in Meeting #3

Objective

Based on the discussions in Meetings #1 and #2, the design team will present some draft recommendations for the SBC. The focus group will provide feedback and finalize recommendations so they can be shared with the SBC.

When & Where?

Wednesday, April 3rd, 2024, 3:30-5:30 PM

Estabrook Auditorium, Cary Memorial Building