BUILDINGENERGY BOSTON

Goals That Stick: Rallying Project Teams around Building Performance

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Northeast Sustainable Energy Association (NESEA)
March 1, 2022

AGENDA

1. Intro: examining goal-setting as a tool in high-performance design
2. Case Studies: stories of goal-setting and follow-through in service of design excellence
3. Your Feedback: performance goals survey
4. Moderated Discussion: industry feedback on how to set goals that lead to highly successful outcomes
5. Audience Q+A

Icebreaker

Go to **www.menti.com** and use the code **6657 1454**

Mentimeter

In a few words, what are you most excited about at BuildingEnergy Boston 2022?

Intro: examining goal-setting as a tool in high-performance design

Why We are Here

The problem:

Many building industry professionals are experiencing a plateau in the journey to minimize the negative impact of our work on the planet

The hypothesis:

Clearly communicated, quantifiable performance goals with buy-in from across the team boost projects to realize their maximum potential for high-performance design.

Common Barriers

- Inadequately ambitious goals or missed opportunities leveraging the full capacity of the team in goal setting.
- Overly ambitious goals; it is taken for granted that they are “reach” goals, and it is assumed they won’t be met.
- Too many goals results in no clear, shared team target
- Lack of sustained commitment. Goals erode over time due to inadequate buy-in and belief that there is a real intention to achieve them.
- Project team members frequently don’t buy into the goals of other team members, may be singularly focused on their individual goals

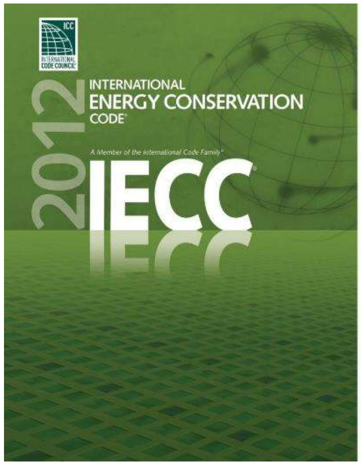
Proliferation of Goal Drivers

CLIMATE ACTION PLAN

LIVING BUILDING CHALLENGE SM

U.S. GREEN BUILDING COUNCIL
LEED CERTIFIED
USGBC ®

NYC LOCAL LAW 97



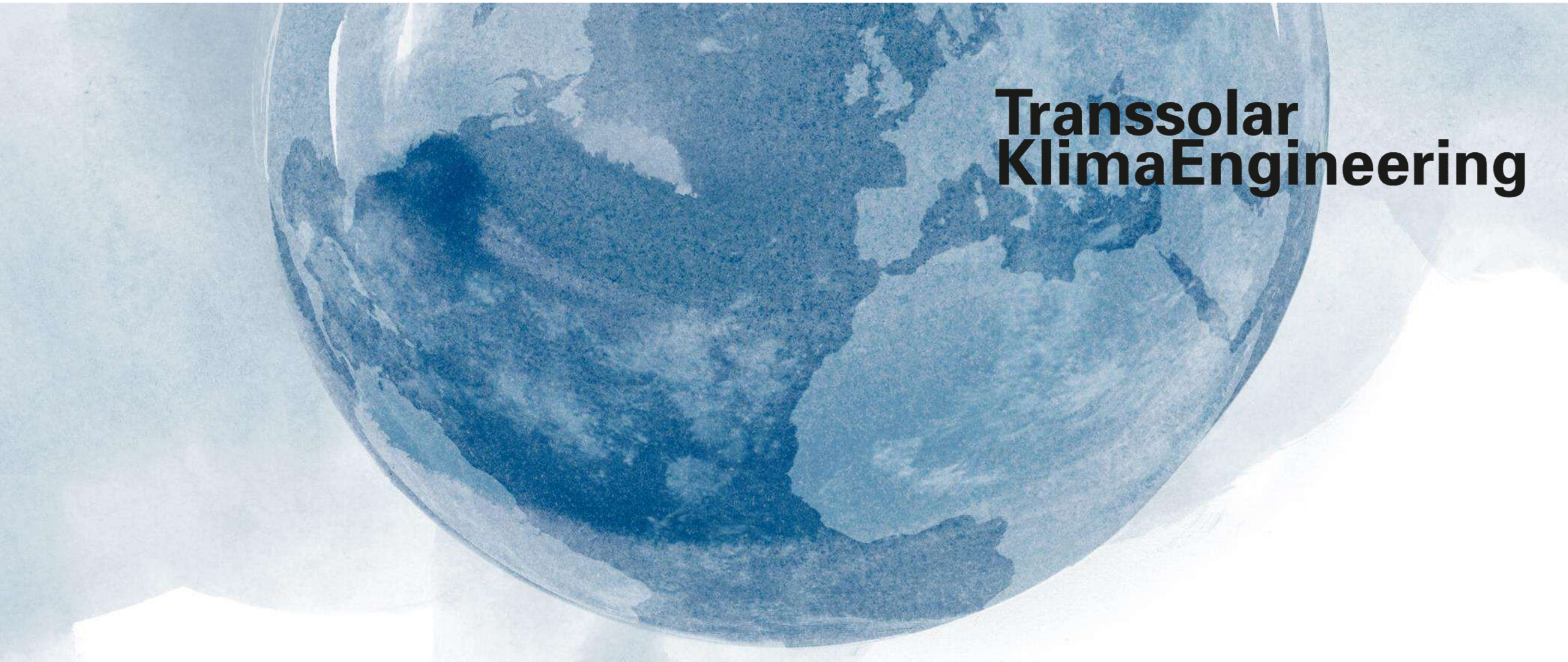
AIA 2030™

CLIMATE COMMITMENT
CLIMATE LEADERSHIP

The Question

How can we as design and construction industry professionals become better at **setting goals** that are **ambitious, achievable, design drivers** that lead to the highest possible performance outcomes?

Case Studies



Goals That Stick: Rallying Project Teams around Building Performance

NESEA Building Energy Boston 2022
1 March 2022
Erik Olsen, PE

School of Design and Environment – National University of Singapore

Architect: Serie, London + Multiply, Singapore

MEP and Architect of Record: Surbana

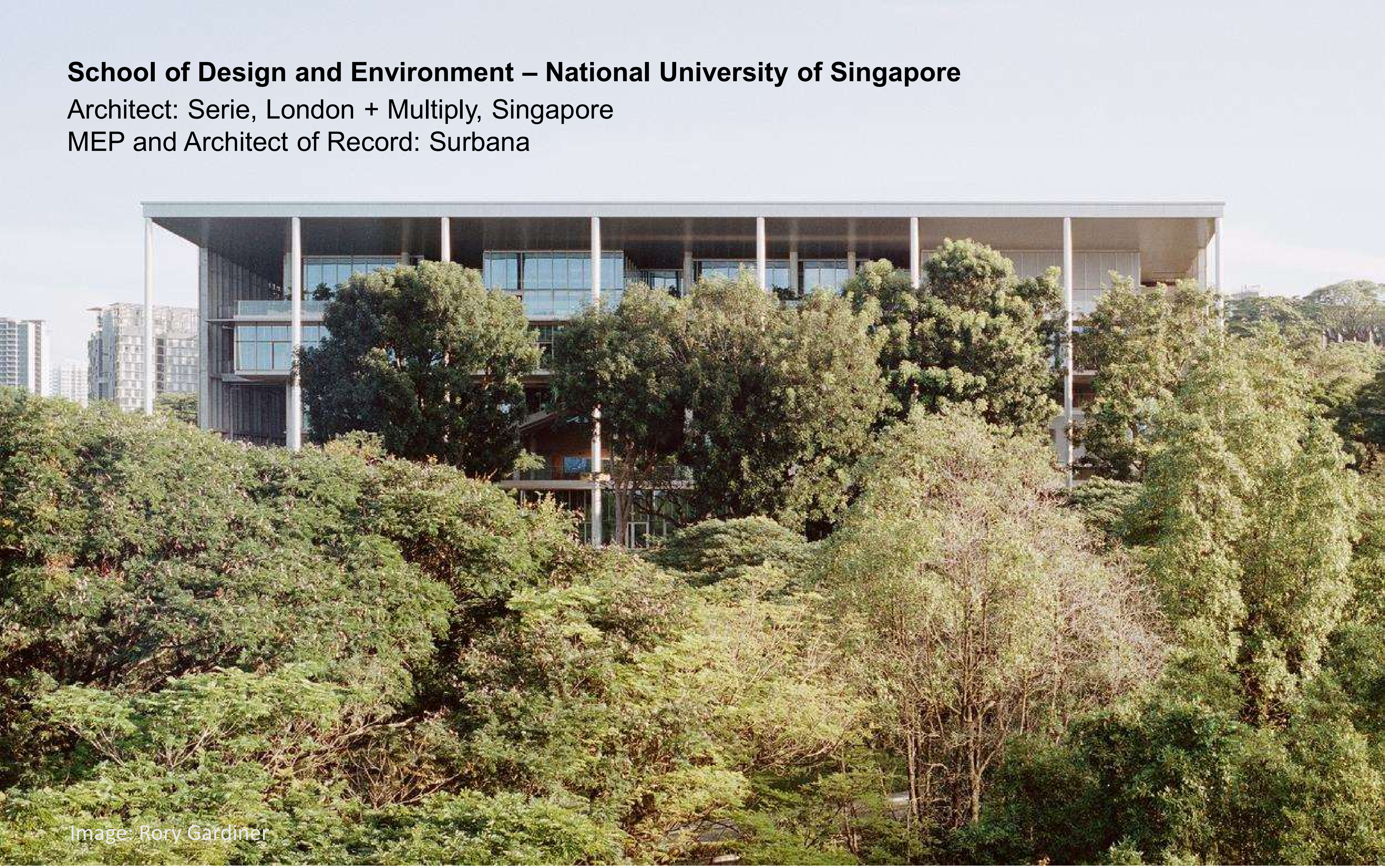


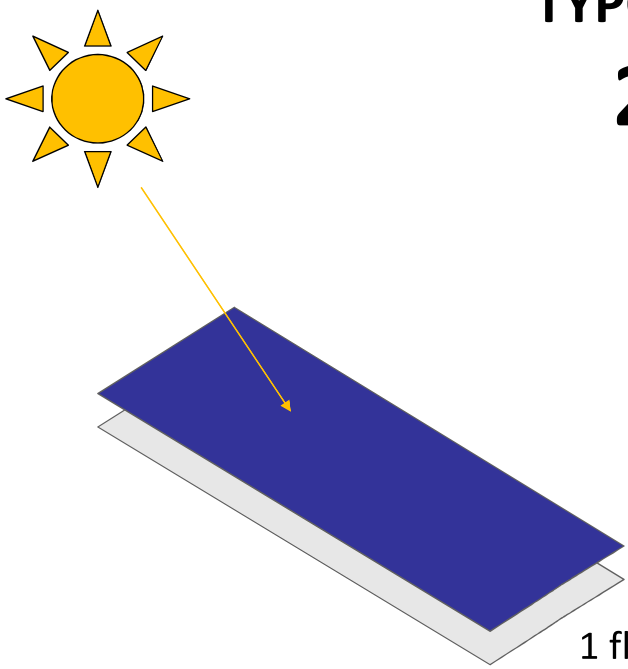
Image: Rory Gardiner

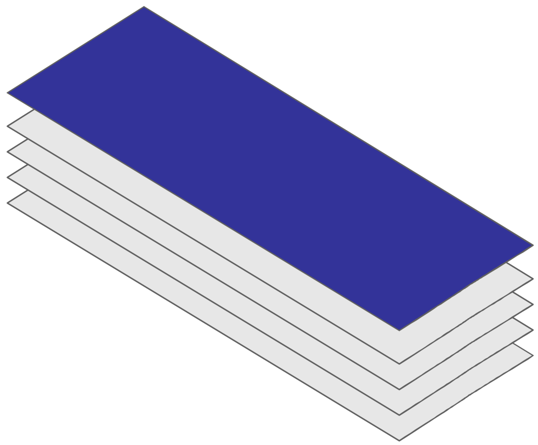
Client Mandate

Net Zero Energy

TYPCIAL PRODUCTION ROOF

260 kWh/m²a





OFFICE, AVERAGE EUI

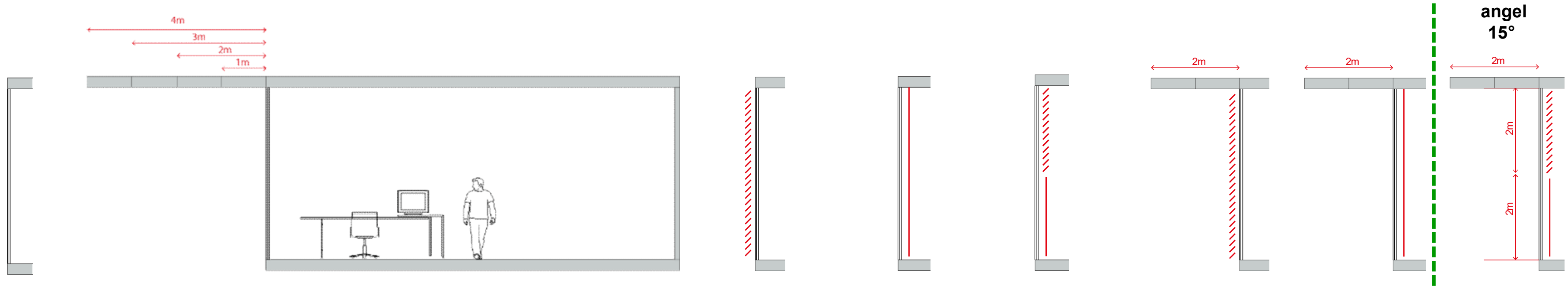
252 kWh/m²a

OPTIMIZED BUILDING

70 kWh/m²a

Design Studio 4th floor

lamella angel 15°



overhang	**no**	**1m**	**2m**	**3m**	**4m**	**no**	**no**	**no**	**2m**	**2m**	**2m**
shading	**no**	**no**	**no**	**no**	**no**	**ext. shading operable**	**int. screen operable**	**int. screen low operable**	**ext. shading operable**	**int. screen operable**	**int. scrren low operable**

50/25	**51%**	**34%**	**18%**	**7%**	**3%**	**0%**	**24%**	**37%**	**0%**	**9%**	**6%**

% of operation hours operative temperature exceeding 29 °C (hybrid system)

50/25	**85%**	**84%**	**83%**	**83%**	**82%**	**67%**	**1%**	**0%**	**65%**	**0%**	**4%**

glare potential (over 1000 lx; @3m); hours of exceeding in relation to operation hours

50/25	**100%**	**100%**	**100%**	**99%**	**92%**	**81%**	**3%**	**57%**	**78%**	**0%**	**76%**

spatial Daylight Autonomy ($sDA_{300lx/50\%}$)

Comfortable Comfort

Full AC

operative temperature
75°F

Comfortable Comfort

operative temperature
84°F

tempered air + elevated air speed


6-3


Hybrid
AC

Reaching Net-Zero

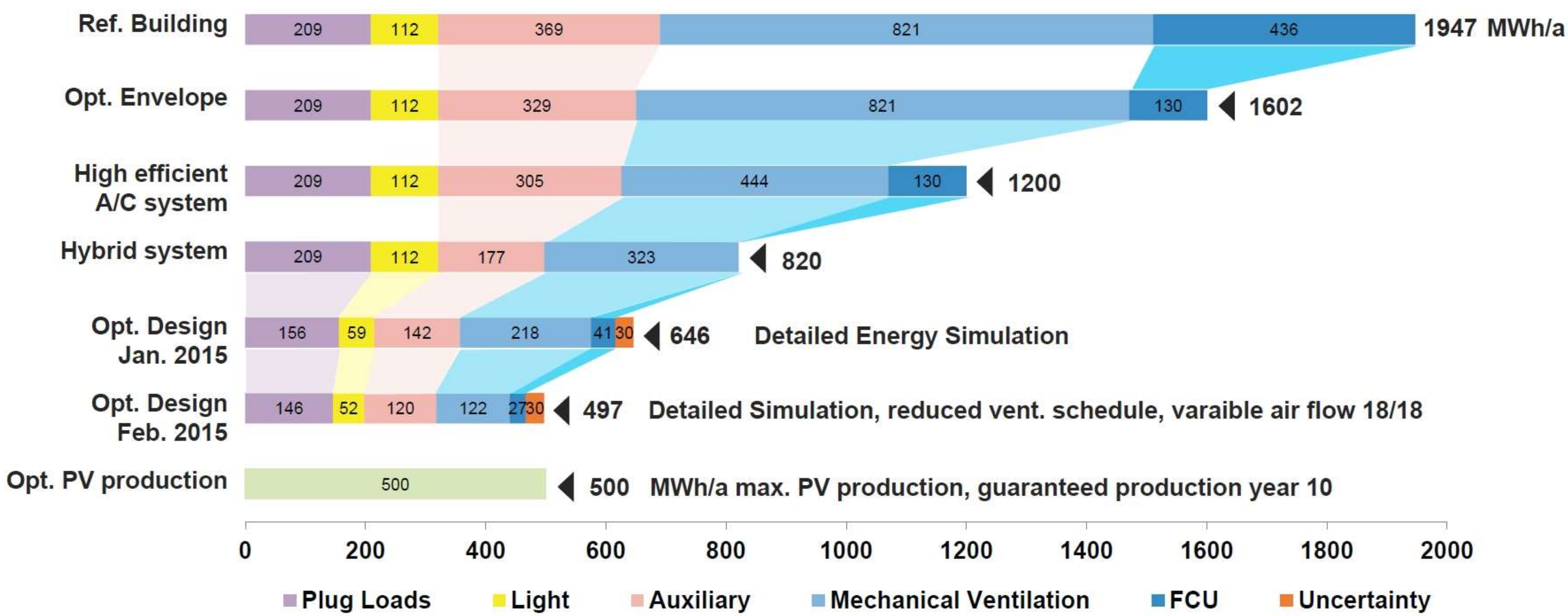



Image: Rory Gardiner


Image: Rory Gardiner


Toronto and Region Conservation Authority
Bucholz McEvoy Architects + ZAS Architects

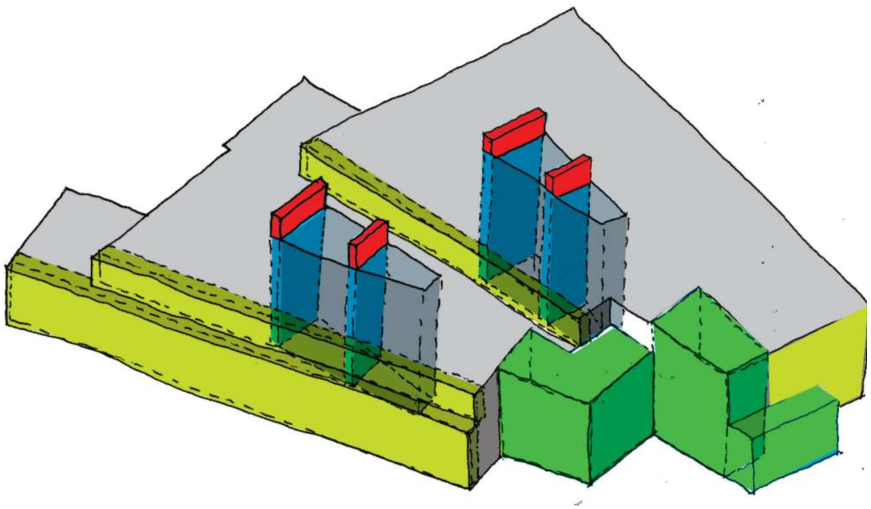
Client Mandate

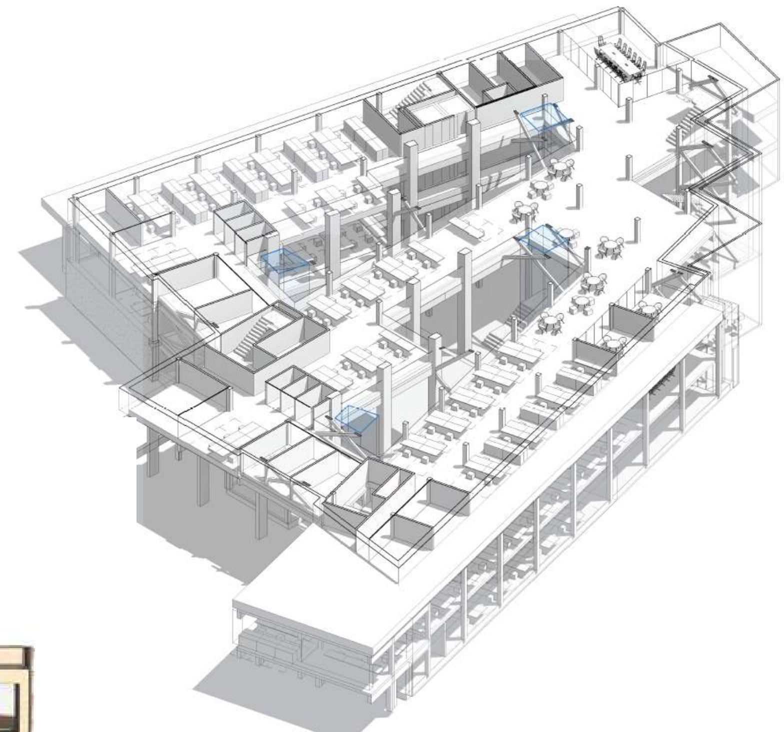
LEED Platinum
WELL Silver
CaGBC Net Zero Carbon Pilot
Net Zero Energy?

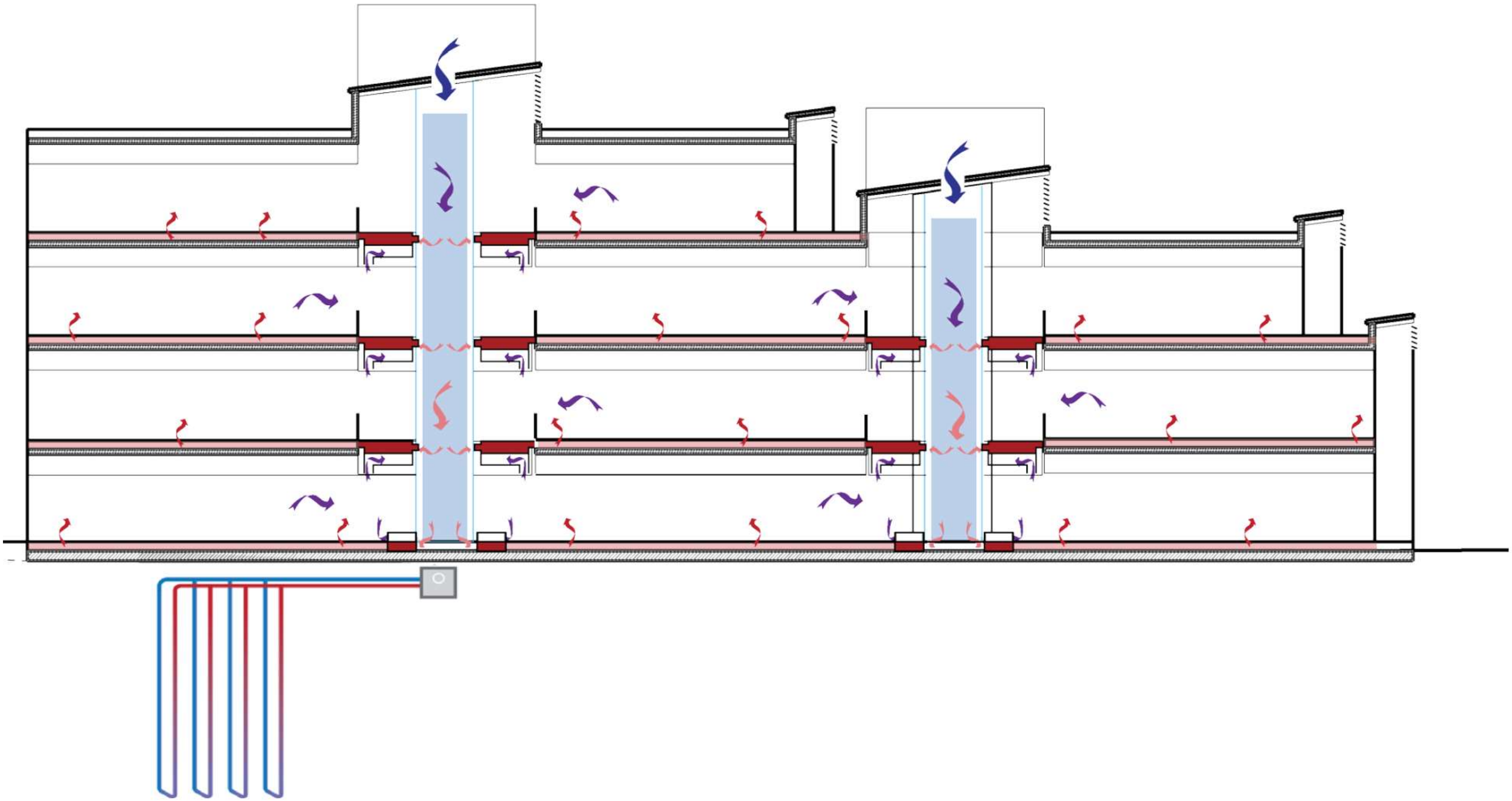
Site Section

Client Mandate + Team Suggestions

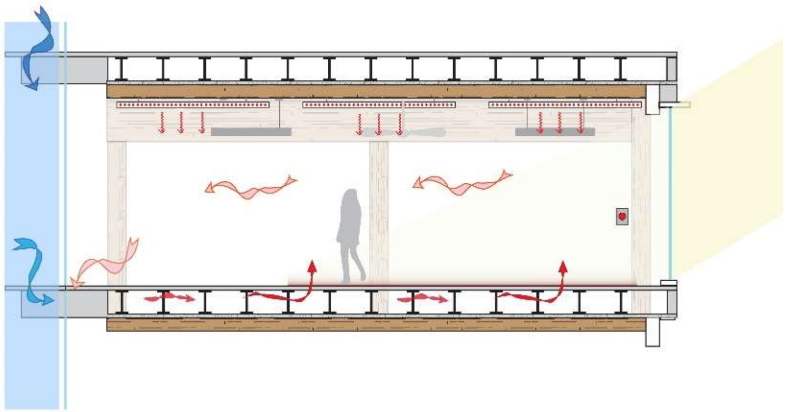
Client Mandate	Team Suggestions
LEED Platinum	Respond to the Ravine
WELL Silver	Intuitive and Human-Focused
CaGBC Net Zero Carbon Pilot	47-63 kWh/m² (15-20 kBtu/sf)
~~Net Zero Energy~~	



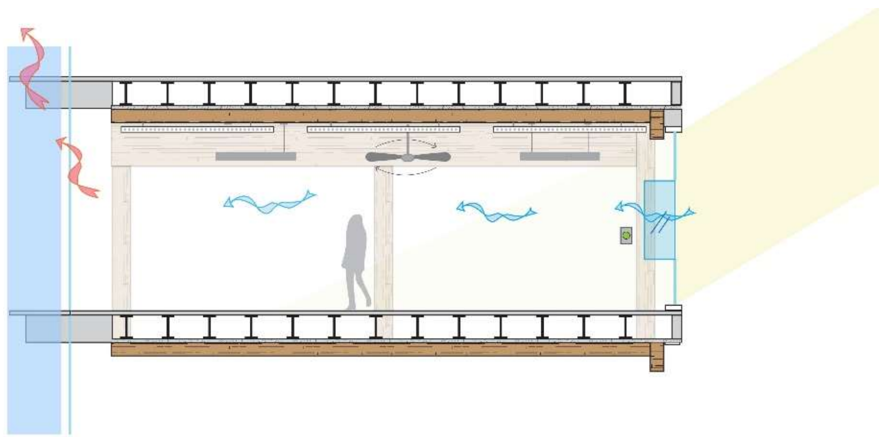




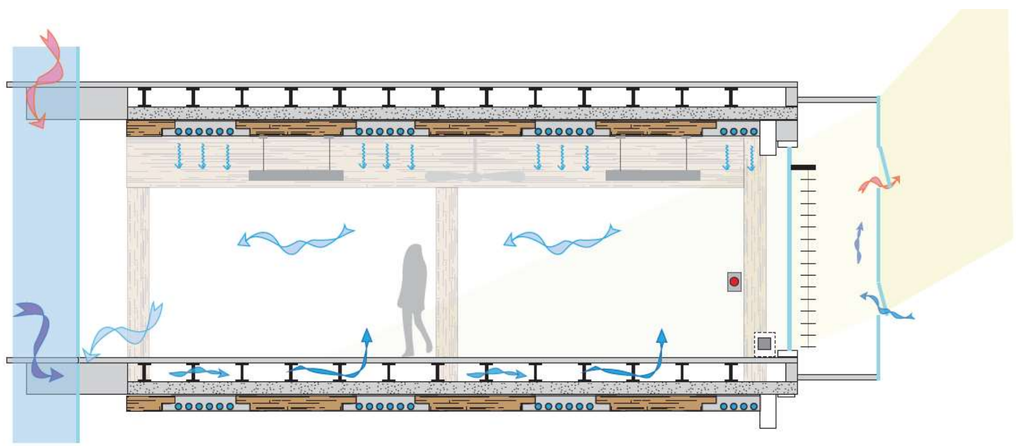
Operation Modes



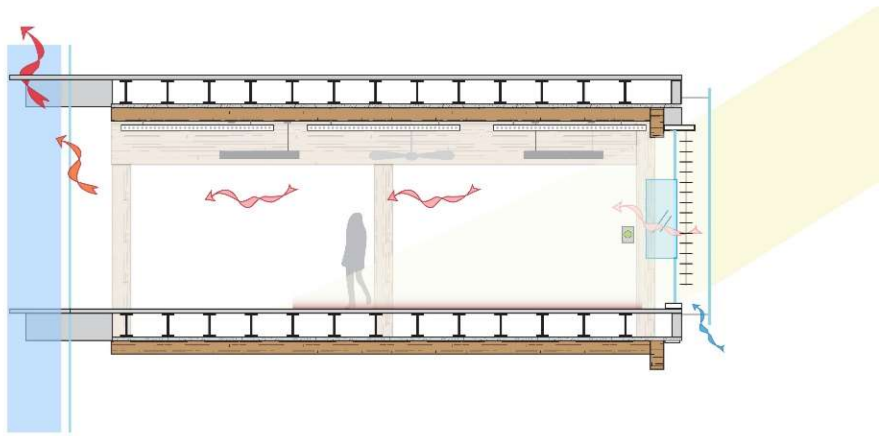
Winter heating



Natural ventilation



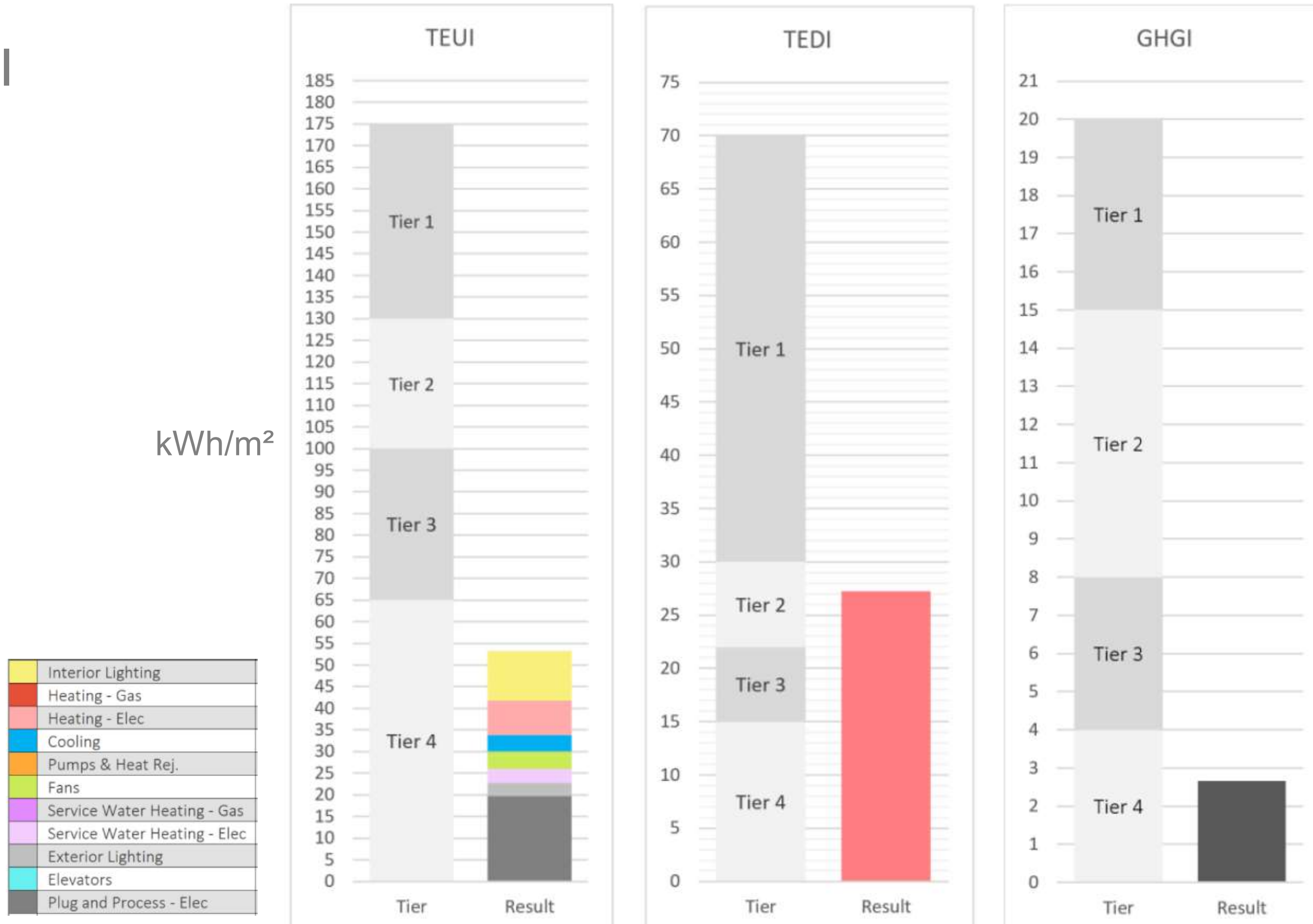
Summer cooling



Extended natural ventilation

Energy Performance

Predicted Total Site EUI
53 kWh/m² / 17 kBtu/sf



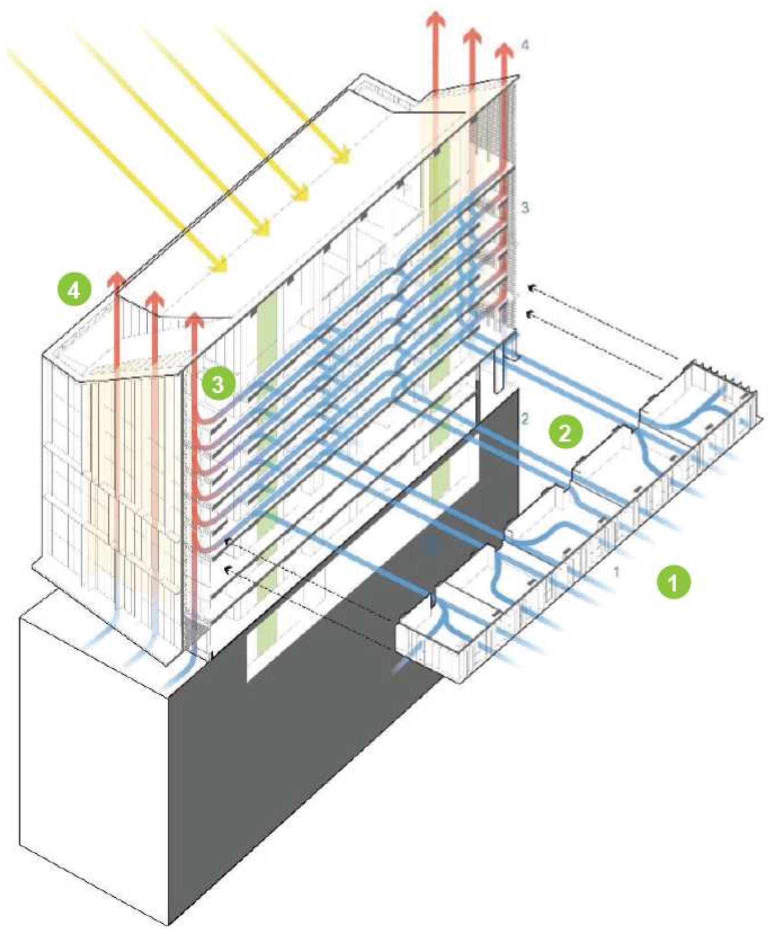

"THE ARBOUR"
Schematic Design DRP
July 25TH, 2018
Moriyama & Teshima
+ Acton & Ostry

Client Mandate

Low carbon: Mass timber + LEED Gold
Future Proof and Resilient
Net positive energy
Smart building

Building Level

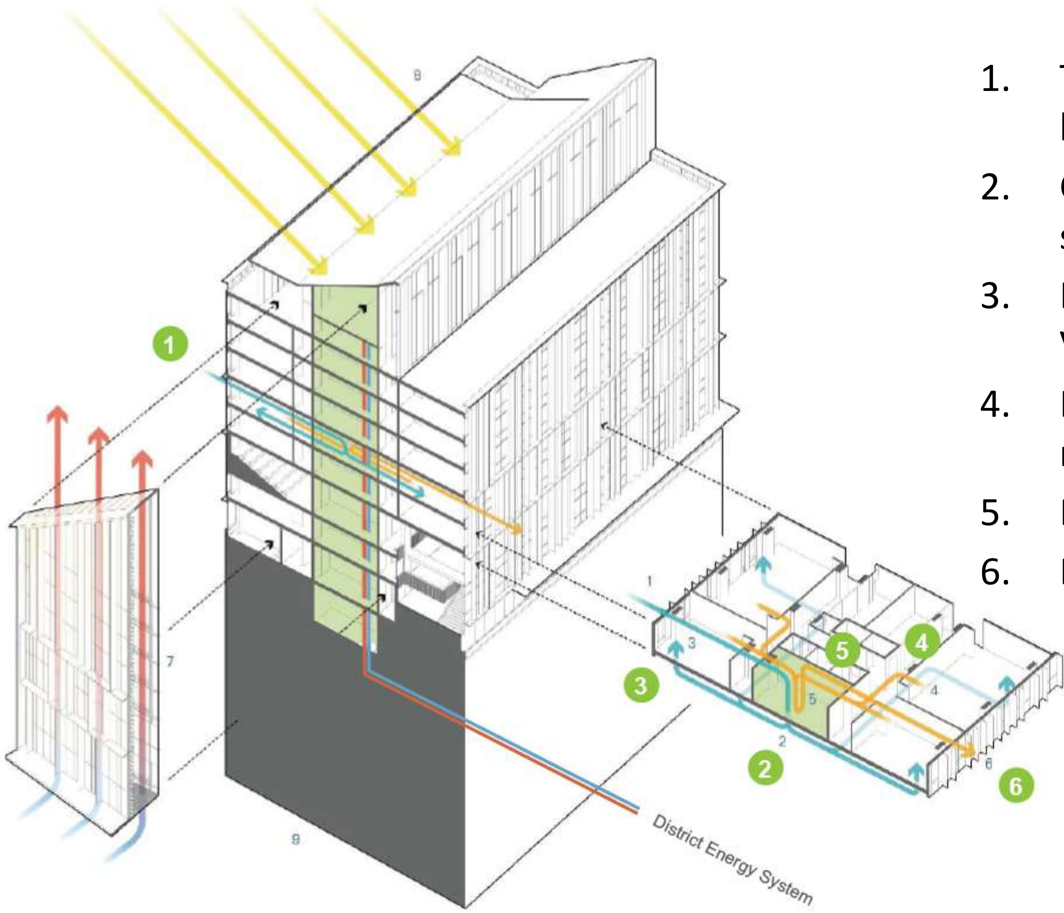
Passive Systems



1. Fresh air enters classrooms, labs and offices from naturally operated windows.
2. Air transfers to corridors via acoustically protected transfer vent.
3. Air moves into double-height student interaction spaces (breathing rooms).
4. Air is exhausted by the solar chimney via operable openings.

Building Level

Active Systems

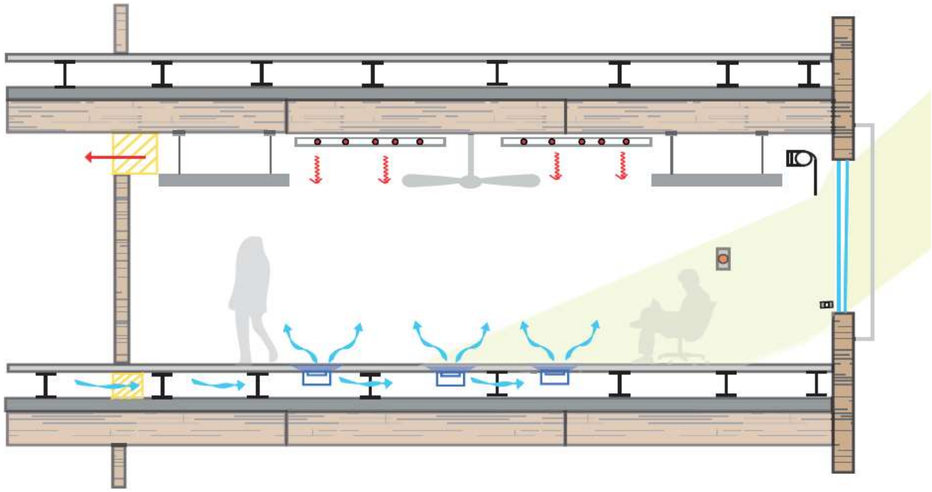


1. The outdoor air is supplied to air handling units located in mechanical rooms at every floor.
2. Conditioned outside air is supplied to all occupied spaces via underfloor plenum.
3. Displacement air is supplied at low velocity from VAV diffusers in the floor.
4. Return air is transferred to the corridor and returned to mechanical rooms at each floor.
5. Energy recover of return air in the AHU.
6. Exhaust air at each floor.

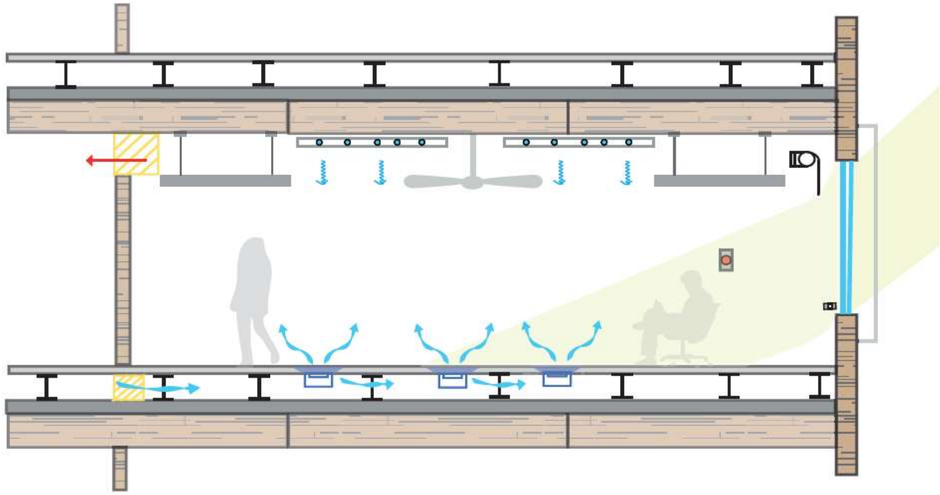
Client Mandate + Team Suggestions

Client Mandate	Team Suggestions
Low carbon: Mass timber + LEED Gold	Intuitive and Human-Focused
Future Proof and Resilient	55-60 kWh/m² (17-19 kBtu/sf)
~~Net positive energy~~	Smart operations
~~Smart building~~	Toronto Green Standard Tier 4

Space Level
Operation Modes



Winter heating mode



Summer cooling mode

Breathing Room

Whole Building Energy Estimate Summary

Predicted Energy Consumption Model

Arthur L. Irving Institute for Energy and Society, Dartmouth College

Goody Clancy

Client Mandate

LEED Platinum

Dartmouth GHG Goals + Irving Institute Mission

A 50% greenhouse gas (GHG) emissions reduction by 2025 with no offsets, using a 2010 baseline

An 80% GHG reduction by 2050 with no offsets, using a 2010 baseline

The mission of the Arthur L. Irving Institute for Energy and Society at Dartmouth is to advance an affordable, sustainable, and reliable energy future for the benefit of society.

We seek to achieve this mission by developing the next generation of energy experts, leaders, and citizens and by transforming humankind's understanding of energy systems across technological, environmental, economic, geopolitical, and cultural perspectives.

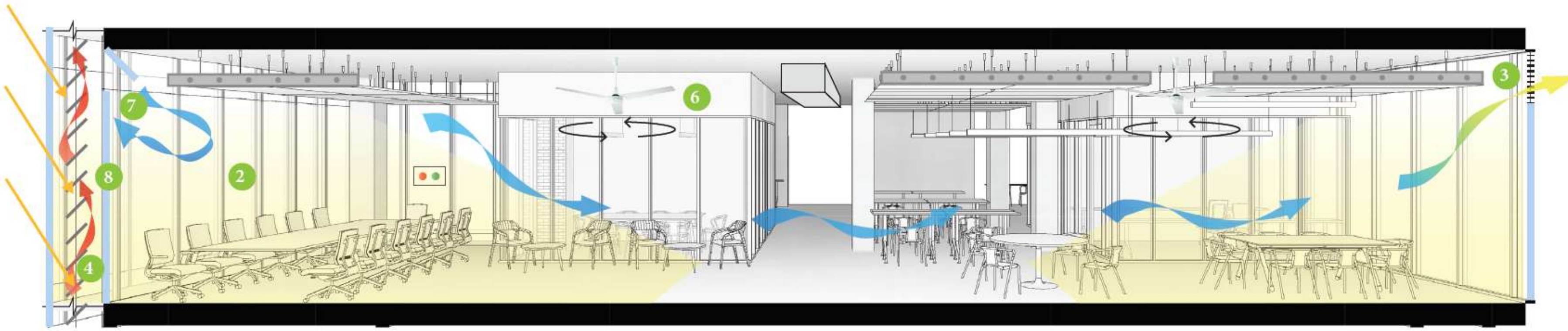
Client Mandate + Team Suggestions

LEED Platinum
80% GHG reduction by 2050 with no offsets, using a 2010 baseline

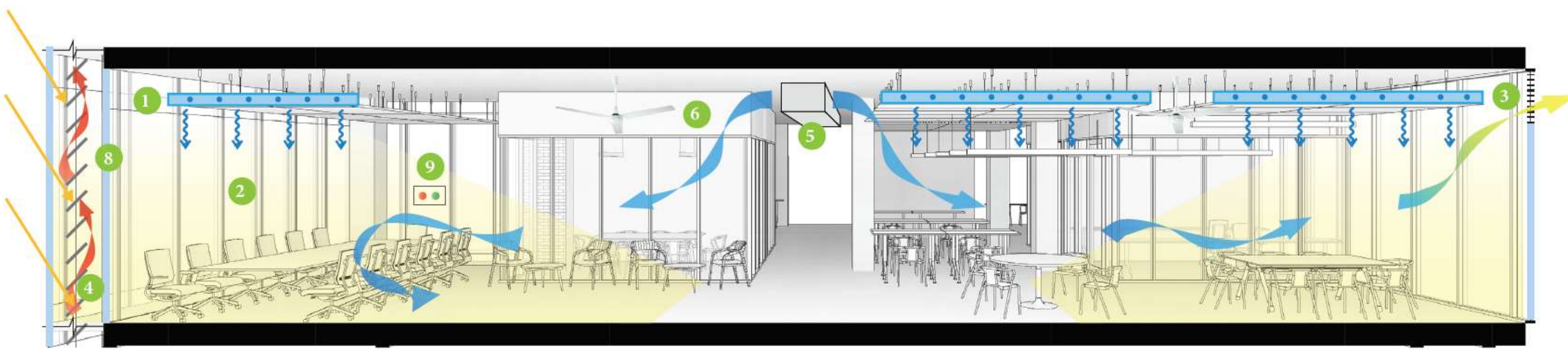
Unparalleled Energy Performance
Humane Spaces
Expression of Performance
Building as a Research Tool

Open Office Climate Concept

Transsolar
KlimaEngineering



Natural Ventilation Mode



Mechanical Cooling/Heating Mode

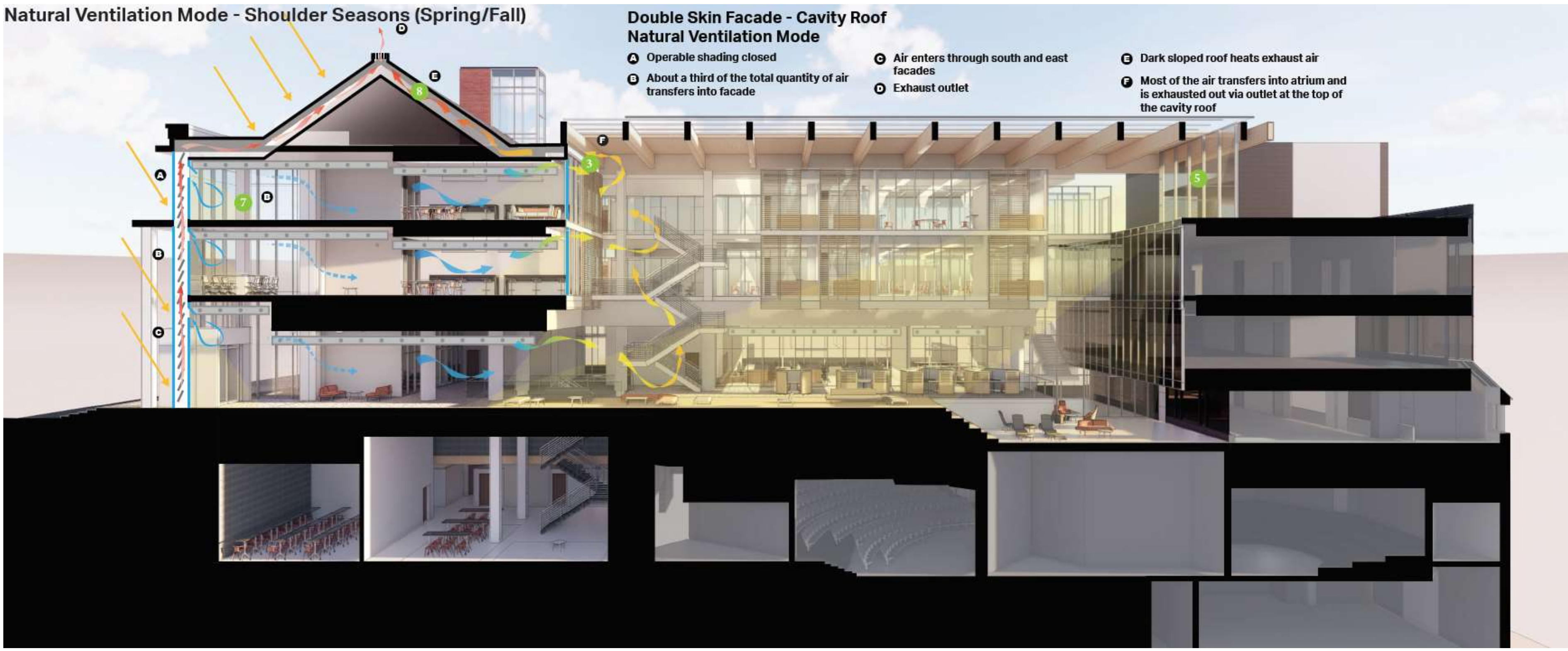
Whole Building Climate Concept

Cooling

Whole Building Climate Concept

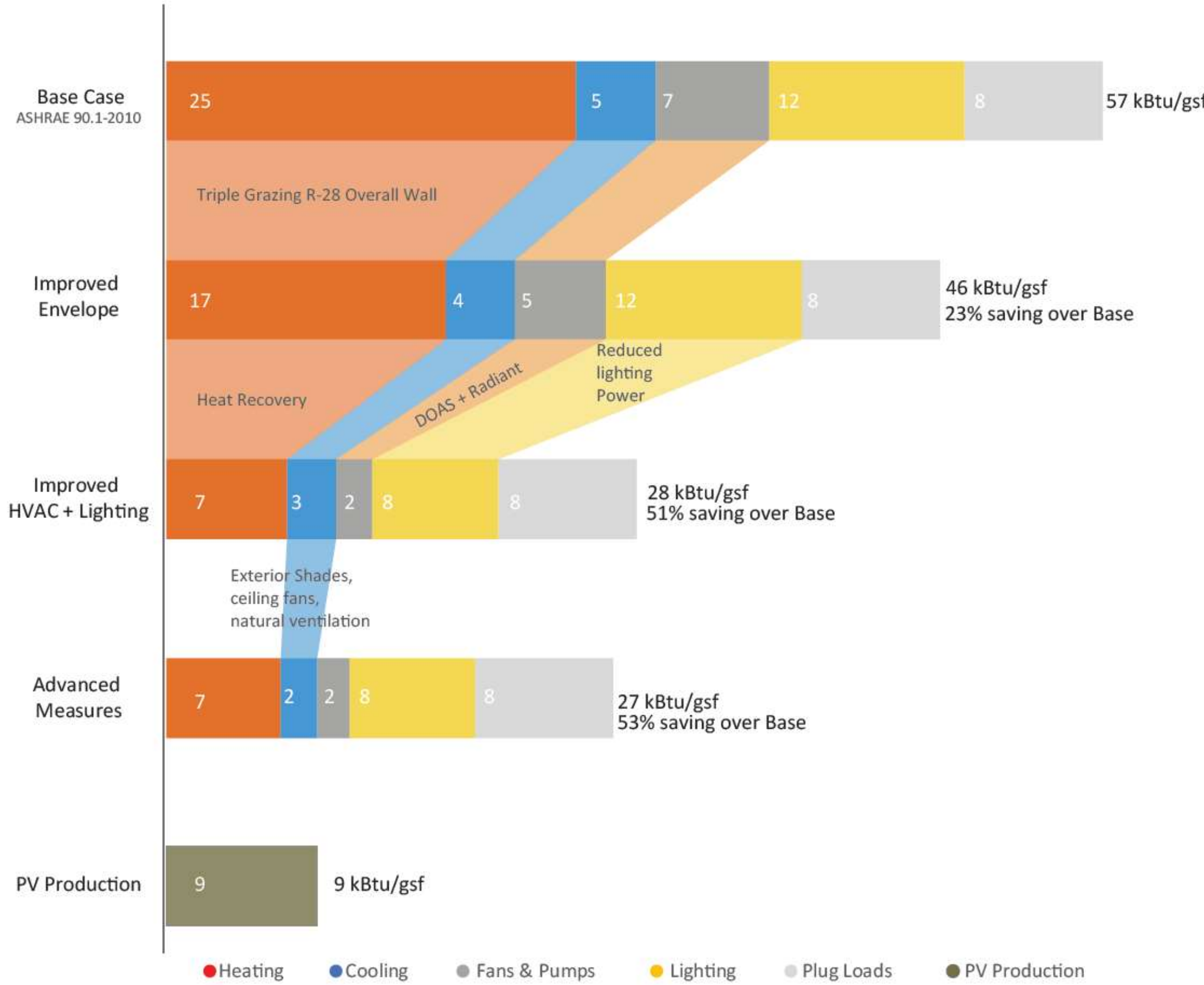
Natural Ventilation

Transsolar
KlimaEngineering



Energy Performance

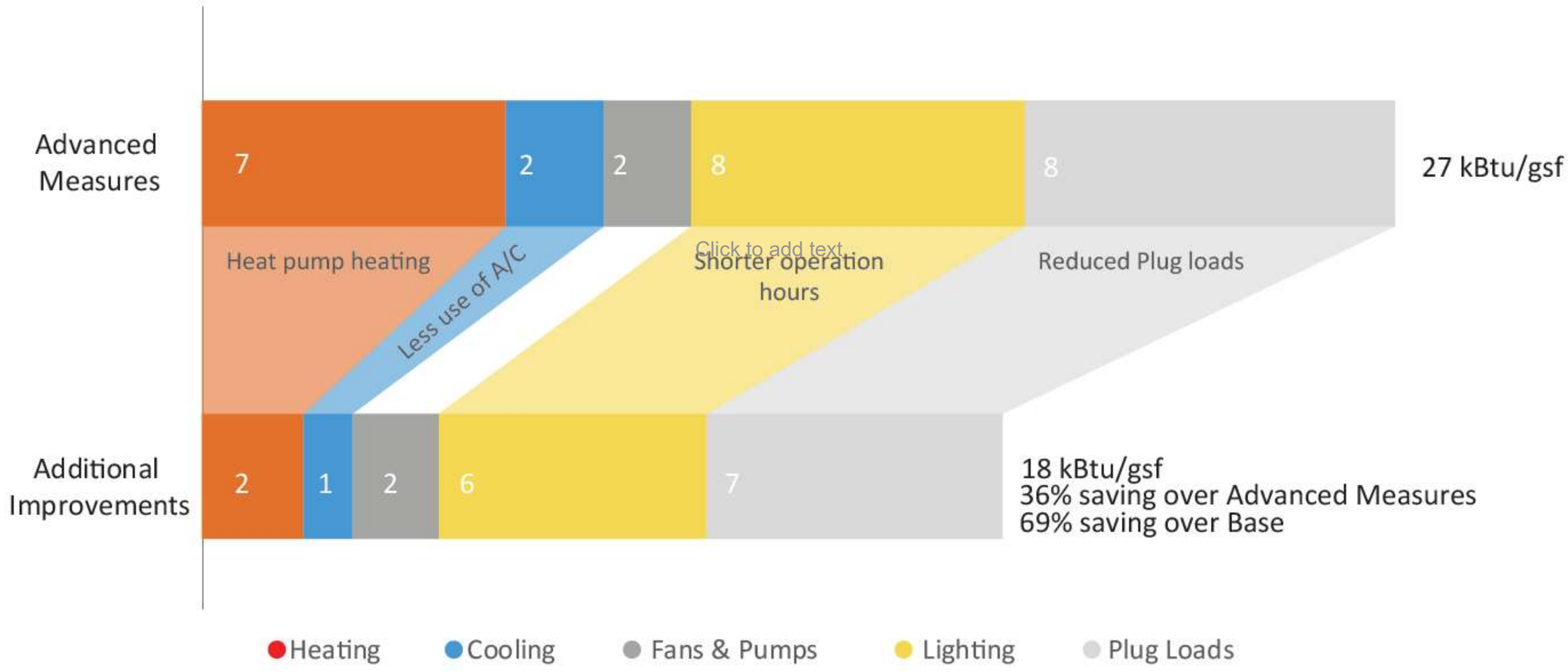
Transsolar KlimaEngineering



Energy Performance

Getting to 18 kBtu/sf

Transsolar KlimaEngineering



A closer look: How teamwide buy-in to performance goals impacted project execution

Case Study: Arthur L. Irving Institute of Energy and Society at Dartmouth College

Project Stakeholders

DESIGN TEAM

- Acoustical Consultant
- Architect
- Civil Engineer
- Code Consultant
- Energy Modeler
- Envelope Consultant
- FFE Consultant
- High-performance Consultant
- Landscape Consultant
- Lighting Designer
- MEPFP Engineers
- Spec Writer
- Structural Engineer
- PV Designer

CLIENT TEAM

- Design Review Committee
- Donor Group
- Facilities Group
- Institute User Group
- Project Management

CONSTRUCTION TEAM

- Construction Manager
- Product Engineers
- Subcontractors

Case Study: Arthur L. Irving Institute of Energy and Society at Dartmouth College

OPPORTUNITIES	VISION	GOALS	PRIORITIES	STRATEGIES	COMPONENTS
Program	A global benchmark for high-performance design	Energy Use Intensity EUI<20			
Site		Optimize occupant comfort			
Team		Minimize mechanical cooling need			
		Express energy performance through design			

Case Study: Arthur L. Irving Institute of Energy and Society at Dartmouth College

OPPORTUNITIES	VISION	GOALS	PRIORITIES	STRATEGIES	COMPONENTS
Program	A global benchmark for high-performance design	Energy Use Intensity EUI<20	Reduce heating & cooling loads		
Site		Optimize occupant comfort	Maximize use of passive systems		
Team		Minimize mechanical cooling need	Find renewable energy sources		
		Express energy performance through design	Streamline building operations		

Case Study: Arthur L. Irving Institute of Energy and Society at Dartmouth College

OPPORTUNITIES

- Program
- Site
- Team

VISION

- A global benchmark for high-performance design

GOALS

- Energy Use Intensity EUI<20
- Optimize occupant comfort
- Minimize mechanical cooling need
- Express energy performance through design

PRIORITIES

- Reduce heating & cooling loads
- Maximize use of passive systems
- Find renewable energy sources
- Streamline building operations

STRATEGIES

- Robust thermal envelope
- Natural ventilation system
- Radiant heating & cooling
- Daylighting
- Photovoltaic (PV) array

COMPONENTS

Case Study: Arthur L. Irving Institute of Energy and Society at Dartmouth College

OPPORTUNITIES
- Program
- Site
- Team

VISION
- A global benchmark for high-performance design

GOALS
- Energy Use Intensity EUI<20
- Optimize occupant comfort
- Minimize mechanical cooling need
- Express energy performance through design

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- Reduce heating & cooling loads
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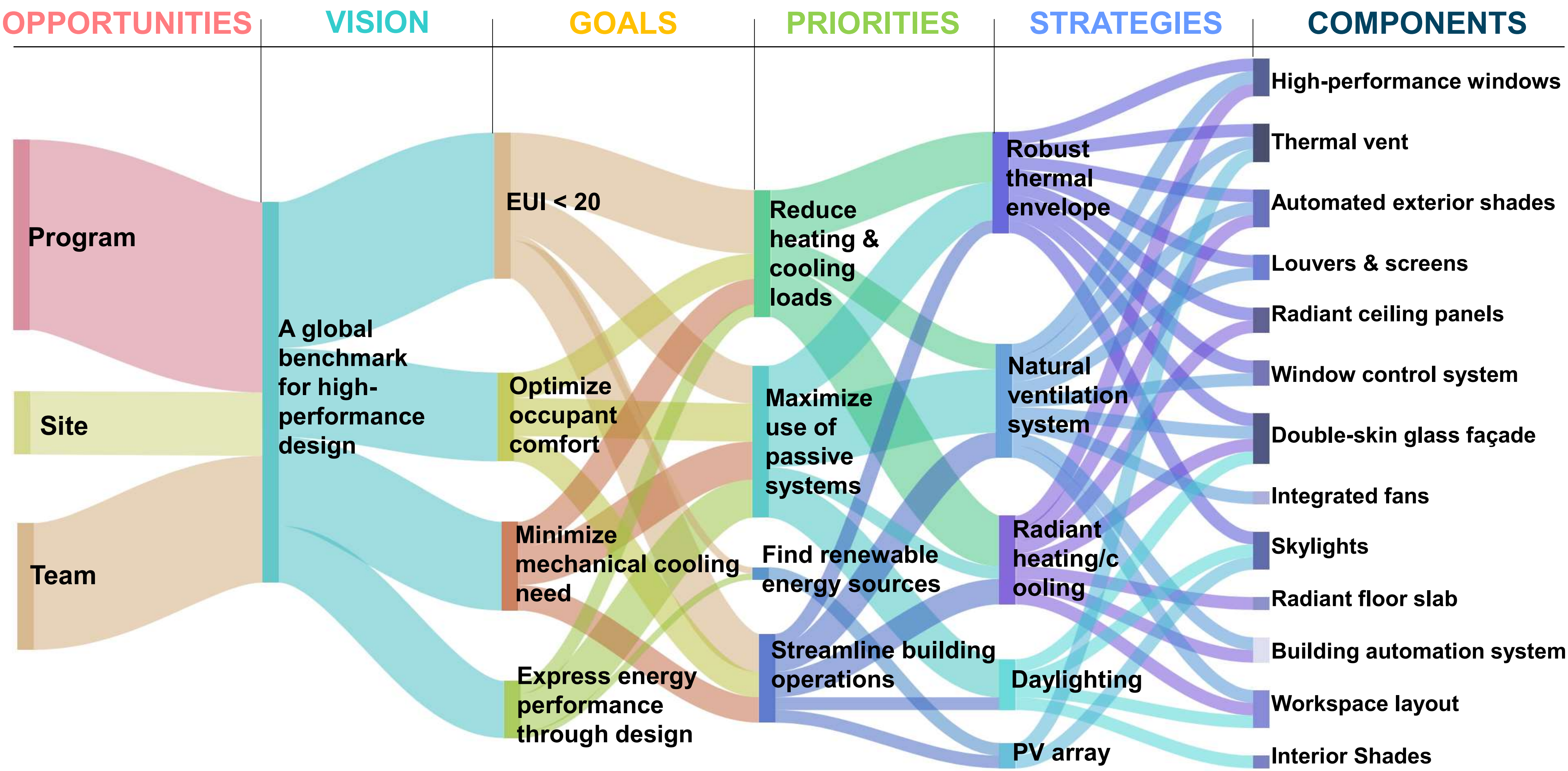
- Find renewable energy sources
- Streamline building operations

STRATEGIES
- Robust thermal envelope
- Natural ventilation system
- Radiant heating & cooling
- Daylighting
- Photovoltaic (PV) array

COMPONENTS
- High-performance windows
- Thermal vent
- Automated exterior shades
- Louvers & screens
- Radiant ceiling panels
- Window control system
- Double-skin façade
- Integrated fans
- Skylights
- Radiant floor slab
- Building automation system
- Workspace layout
- Interior Shades

Case Study: Arthur L. Irving Institute of Energy and Society at Dartmouth College



Team Members by Design Decision

PROJECT DESIGN PHASES	SELECTED COLLABORATIVE DECISIONS BY PHASE	CLIENT TEAM					DESIGN TEAM							CONSTRUCTION TEAM		
		DESIGN REVIEW COMMITTEE	DONOR GROUP	FACILITIES GROUP	INSTITUTE USER GROUP	PROJECT MANAGEMENT	ACOUSTICAL CONSULTANT	ARCHITECT	CODE CONSULTANT	ENERGY MODELER	ENVELOPE CONSULTANT	HIGH-PERFORMANCE CONSULTANT	MECHANICAL ENGINEER	CONSTRUCTION MANAGER	PRODUCT ENGINEERS	WINDOW SUBCONTRACTOR
CD	DEVELOP PERFORMANCE GOALS & NV CONCEPT	●	●	●	●	●		●				●	●			
CD	SELECT DOUBLE-SKIN GLASS PAVILION SCHEME	●	●			●		●				●				
CD	ESTABLISH NV DESIGN REQUIREMENTS			●	●	●		●				●	●			
SD	CONFIGURE WORKSPACES TO SUPPORT NV				●	●		●	●			●	●			
SD	DEFINE NV OPERATING MODES & REQUIREMENTS			●	●	●		●		●		●	●			
SD	INTRODUCE ROOFTOP THERMAL VENT	●	●			●		●			●	●	●			
SD	INTEGRATE EXHAUST PATHWAYS			●		●	●	●	●			●	●		●	
DD	ADJUST GLASS PAVILION SCOPE					●		●				●	●	●		
DD	COMPARTMENTALIZE WORKSPACE AREAS				●	●	●	●				●				
DD	INCORPORATE CEILING FANS				●	●		●				●	●			
CDs	REFINE AUTOMATION AND CONTROL SEQUENCE			●	●	●		●		●		●	●		●	
CDs	EXPRESS ATRIUM TRANSFER POINTS VISUALLY	●	●			●		●								
CDs	FINALIZE DETAILS AT EACH TRANSFER POINT						●	●	●		●	●	●		●	
CDs	RECONCILE AUTOMATED WINDOW AND SHADES					●		●			●	●	●	●	●	●

Example: Preserving performance goals through value management

Concepts	SD	DD	CDs

Challenge: Balancing budget and design priorities

Opportunity: Create better and more efficient design

- Design Review Committee
- Donor Group
- Facilities Group
- Project Management
- Architect
- Civil Engineer
- Code Consultant
- Energy Modeler
- Envelope Consultant
- High-performance Consultant
- Landscape Consultant
- Lighting Designer
- Mechanical Engineer
- Structural Engineer
- Construction Manager

Example: Assess impact of each potential item against performance goals

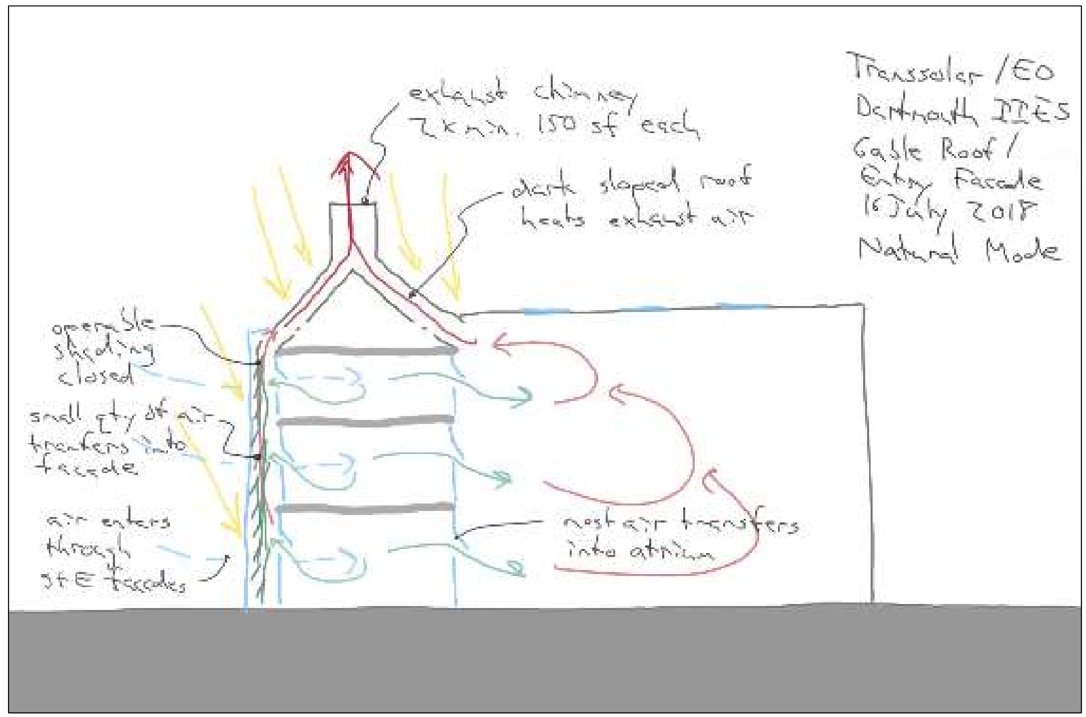
IMPACT		
Performance	Design	Program
1	Little or No Impact	
2	Moderate Impact	
3	Higher Impact	
IMPACT		
Performance	**Design**	**Program**
NA	1	2

			1	Little or No Impact		
			2	Moderate Impact		
			3	Higher Impact		
VE#		**DESCRIPTION**	**IMPACT**			**COST**
TCC0	**GCA**		**Performance**	**Design**	**Program**	**TCCO**
	GENERAL					
1	1	Eliminate classroom level space under east b	NA	1	2	$$$$
2	2	Deletion of SE Utility Room	NA	1	1	$$$
3	3	Lower east bar roof by 6'; windows become dormers	NA	3	1	$$$
4	4	Reduce attic floor area by 70%. *(Lower attic slab by 2')*	NA	2	1	$$$
5	5	Reduce area in north wing/east wing 2000 sf.	NA	3	3	$$$
6	6	Eliminate doors and partitions at 6 enclosed offices	1	1	2	$$
7	7	Chute: move stair to west to avoid change to mechanical rooms below	NA	1	1	$
	8	*eliminate murdough balcony*	NA	1	1	

Natural Ventilation – Initial Sketch

The three goals for this system were to:

1) Maximize the building area served by natural ventilation,
2) Increase time in natural ventilation mode, and
3) Improve system visibility to promote energy awareness.



Natural Mode (Sketch by Transsolar)

Case Study: Arthur L. Irving Institute of Energy and Society at Dartmouth College

Goal: Minimize need for mechanical cooling

Case Study: Arthur L. Irving Institute of Energy and Society at Dartmouth College

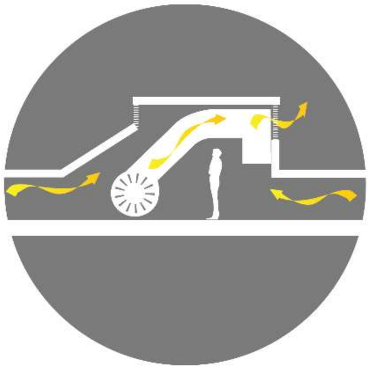
Goal: Express performance through design

Case Study: Arthur L. Irving Institute of Energy and Society at Dartmouth College

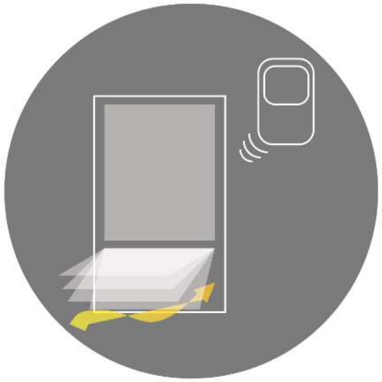
Goal: Express performance through design

Case Study: Arthur L. Irving Institute of Energy and Society at Dartmouth College

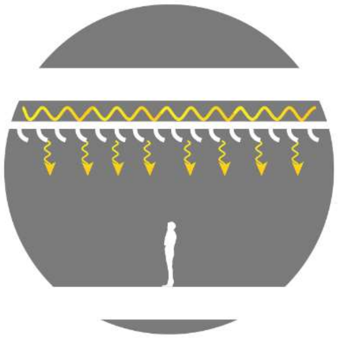
Innovative Components (1st on Dartmouth Campus)



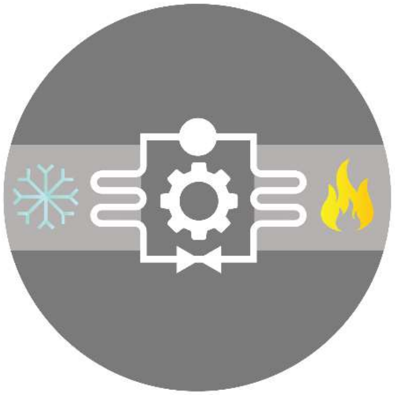
Rooftop fanroom for natural ventilation exhaust



Modulated control system for automated windows



Radiant sail ceiling panels in labs



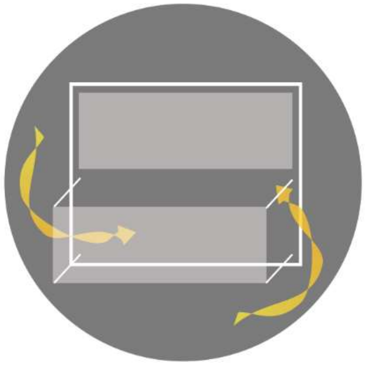
Heat Pump Chiller

Case Study: Arthur L. Irving Institute of Energy and Society at Dartmouth College

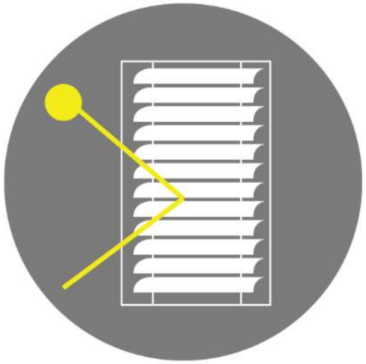
Innovative Components (1st on Dartmouth Campus)

Double-skin glass façade

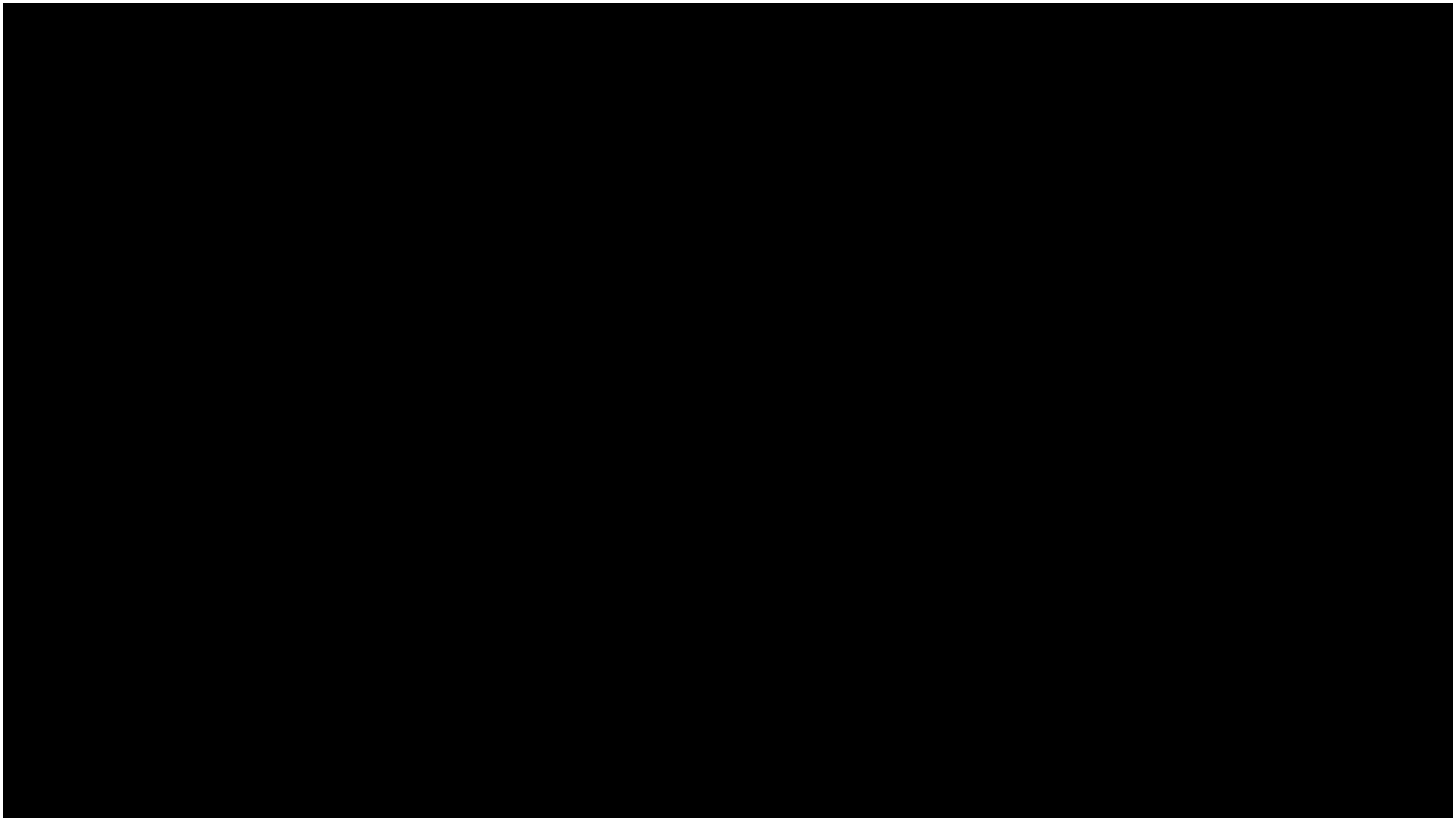
Integrated ceiling fans in all work & collaboration spaces



Parallel project window openings at double-skin



Exterior automated venetian blinds



Survey

Go to **www.menti.com** and use the code **6657 1454**

For sustainability attributes that are quantifiable (carbon emissions, energy use, human health indicators, etc.), how effective are numerical targets

Go to **www.menti.com** and use the code **6657 1454**

How often do quantitative goals for the following categories drive design decisions on your projects?

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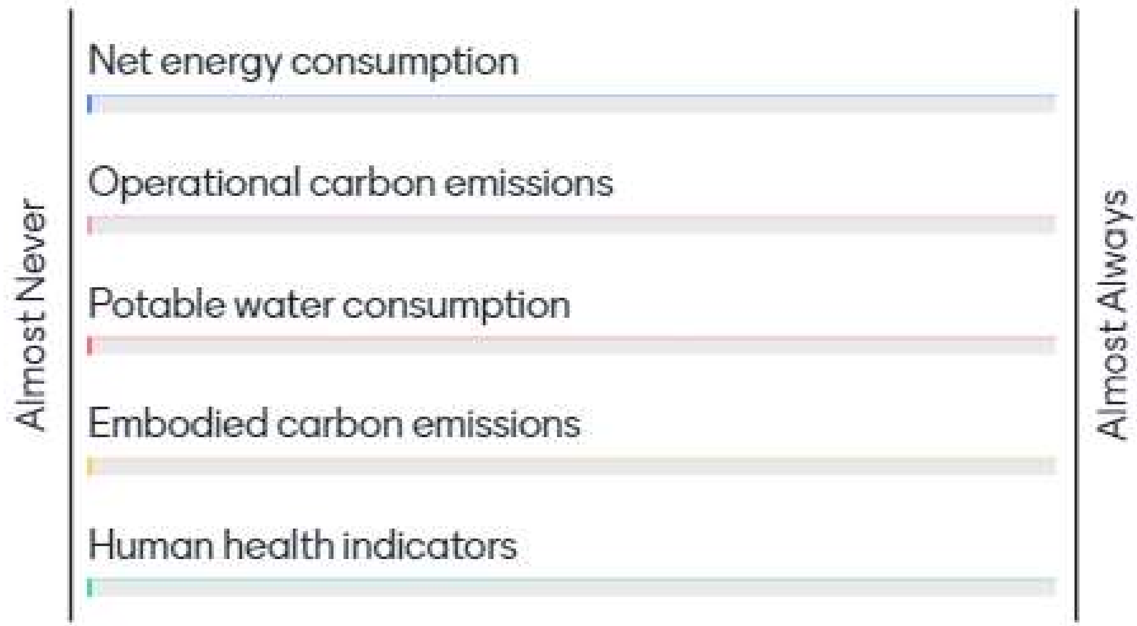

Go to **www.menti.com** and use the code **6657 1454**

How effective are each of these strategies in helping teams in achieving project goals?

Mentimeter

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What are the greatest barriers that prevent projects from reaching their goals?

Mentimeter

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Mentimeter

Achieving high performance and meeting goals requires sustained effort throughout a project. In your most successful projects, who was the driving for

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What is the most important marker of achieving a project's goals?

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What is your typical role?

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Moderated Discussion

Audience Q+A

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What one strategy will you implement on your next project to set aspirational performance goals that stick?

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