DARTMOUTH COLLEGE

ARTHUR L. IRVING INSTITUTE FOR ENERGY AND SOCIETY

Project Description

This 51,000 GSF project, scheduled for completion in 2021, will be the first permanent home for the Irving Institute for Energy and Society. Its design demonstrates and expresses the building's high performance while creating a space for interdisciplinary research that focuses on advancing an affordable, sustainable, and reliable energy future for the benefit of society.

The institute is a hub of collaboration that brings together multiple different users: institute researchers, the Thayer School of Engineering and Tuck School of Business, the Campus Sustainability Office, the Feldberg Library, and students moving to and from Murdough Center, to which it connects. The main atrium acts as a public living room that provides opportunities for users to formally and informally coalesce.

Design Objectives

- Design a building that is a global benchmark for innovation and high performance design
- Express the energy/sustainability theme in creative and appropriate ways
- Respond to the site context and respect the aesthetic of other campus buildings
- Provide places of transparency to place learning and activity on display
- Integrate landscape and building to improve and promote accessibility through the campus
- Optimize building efficiency and reduce energy consumption to achieve an Energy Use Intensity (EUI) of 20 or below.

Integrative Design

Dartmouth College and the Irving Institute are committed to creating a sustainable building that promotes and facilitates the research of energy science. The building embodies these goals through its integration of active and passive systems for managing thermal, daylight, and ventilation comfort while also adhering to a strict list of healthy and environmentally friendly materials.

LEED and the 2030 Commitment

The project is aiming to achieve LEED Platinum Certification. Currently the project is tracking 83 points. Many of these points are derived from the reduction of indoor and outdoor water use, optimized energy performance via the double-skin facade, radiant ceilings, and natural ventilation systems, and renewable energy generated from PV panels.

Goody Clancy is signatory to The AIA 2030 Commitment, and this project is tracking ahead of the 2030 target through 2025 at 90% reduction from the baseline.

Embodied Carbon

The architectural team is conducting Life Cycle Assessment using Tally and also pursuing LEED credits for reductions to the building's embodied carbon and other environmental impacts.

Embodied carbon will be reduced through concrete mix design, use of recycled steel, and careful selection of architectural materials such as insulation.

Projected Building Performance

- **LEED Target:** Platinum (current LEED score 83)
- **Energy Target:** 20 kBTU/sf/yr
- **Projected Energy Use Intensity:** 26.9kBTU/sf/yr (not including PV)
- **Projected Energy Generation:** 125,105 kWh/yr
- **Net Projected Energy Use Intensity:** 18.6 kBTU/sf/yr

LEED Facts

LEED BD+C for New Construction (v4)

Projected: LEED Platinum	**83/110**
Integrative Process	1/1
Location & Transportation	5/16
Sustainable Sites	8/10
Water Efficiency	8/11
Energy & Atmosphere	**33/33**
Materials & Resources	8/13
Indoor Environmental Quality	10/16
Innovation	6/6
Regional Priority	4/4

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Net projected energy use of proposed building

88% Reduction
in overall energy use of proposed building from 2030 baseline

700,000kg CO_2
Global warming potential offset from the structural system and interior materials

83% of work areas are served by natural ventilation

91% of work areas receive natural daylight ($sDA_{300/50\%}$)

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- **A** Air enters through south and east facades
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- **1** Atrium Skylight provides natural daylight throughout building and provides views to the sky above and hosts PV arrays
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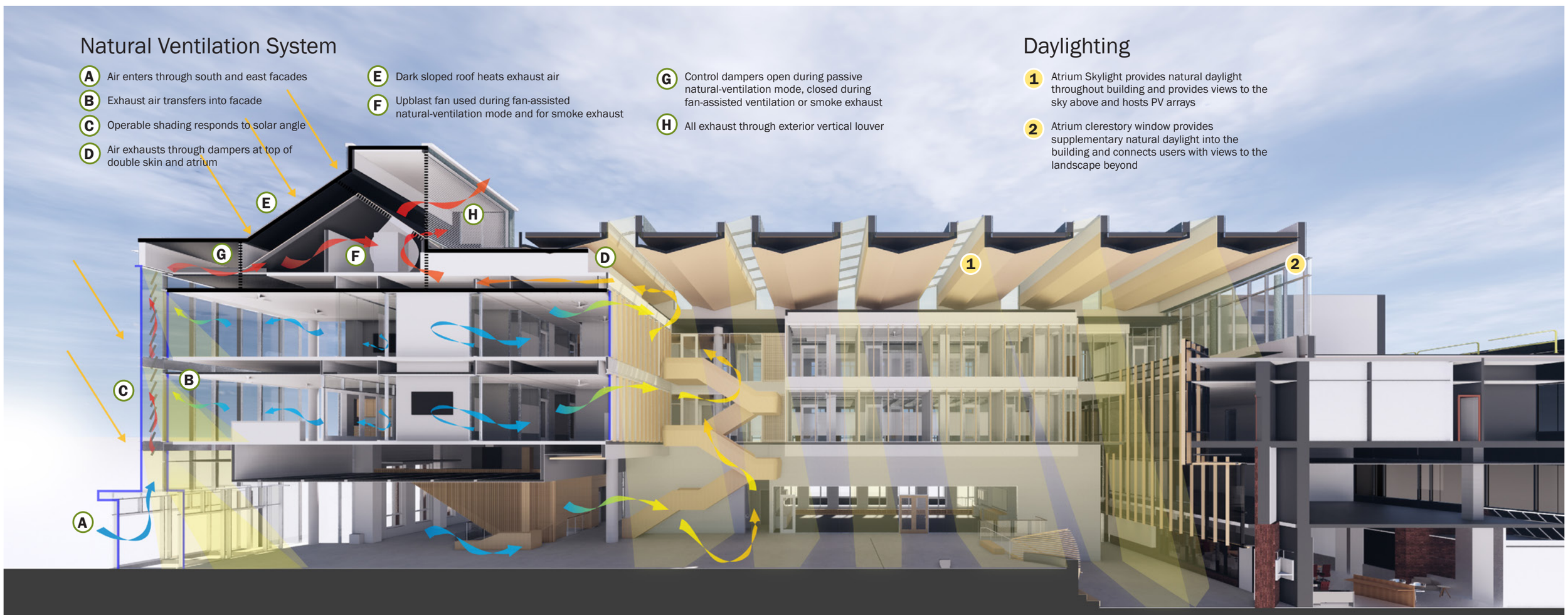

ARCHITECT Goody Clancy
MEP/FP ENGINEER van Zelm Engineers
STRUCTURAL ENGINEER LeMessurier
CIVIL ENGINEER Engineering Ventures
EXTERIOR ENVELOPE 3iVE
SUSTAINABILITY TransSolar
LEED Steven Winter Associates
LANDSCAPE ARCHITECT Michael Van Valkenburgh
LIGHTING HLB Lighting Design
ACOUSTIC/AV/VIBRATION Acentech
CODE Jensen Hughes
COST ESTIMATOR Faithful + Gould

GOODYCLANCY
ARCHITECTURE / PLANNING / PRESERVATION

DARTMOUTH

ARTHUR L. IRVING INSTITUTE FOR ENERGY AND SOCIETY

Design Team

Architect: Goody Clancy

Acoustic: Acentech

Civil Engineer: Engineering Ventures

Cost Estimator: Faithful + Gould

Fire Protection + Code: Jensen Hughes

Landscape Architect: Michael Van Valkenburgh

Specifications: Long Green Specs

MEP/FP Engineer: VanZelm

Structural Engineer: LeMessurier

Sustainability Consultant: TransSolar

LEED: Steven Winter Associates

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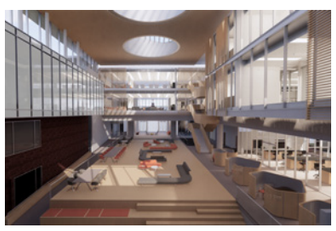
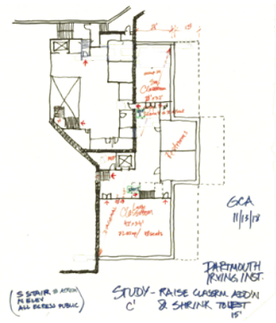
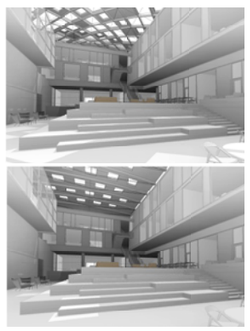
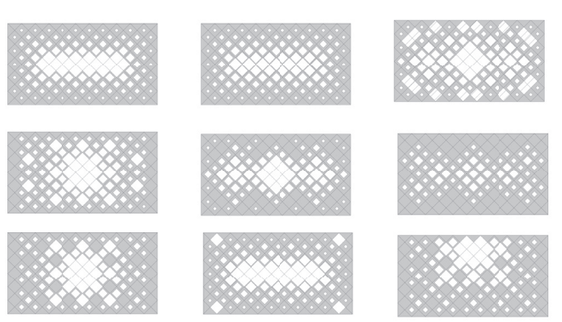
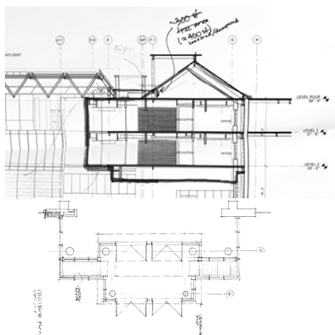
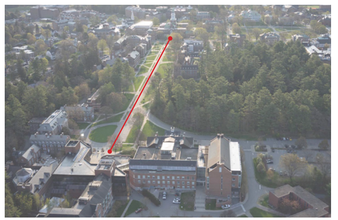






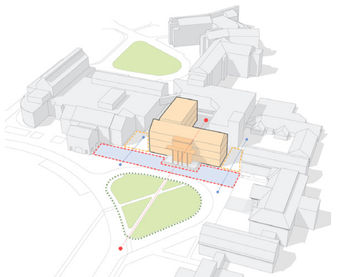






Aligning with Tuck Mall

The existing building, Murdough, retreats from Tuck Mall and sinks down into the ground. The proposed building rises up and creates a welcoming anchor to the West Campus



Site and Massing Development

Recognizing the strong axial alignment with Tuck Mall, across from Baker Hall, was an important design decision in establishing a strong presence on the campus. The proposed design addresses this relationship and stands as a new landmark on Dartmouth's Campus.

Understanding the Site

The relationship of our site to Dartmouth's greater campus is in a unique position at the western terminus of Tuck Mall. This was an opportunity to complete the axis with a building that has a strong presence that welcomes students and faculty to the West End.

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LEED Platinum

The project is aiming to achieve LEED Platinum Certification. Currently the project is tracking 84 points. Many of these points are derived from the reduction of indoor and outdoor water use, optimized energy performance via the double skin facade and natural ventilation systems, and renewable energy collected from PV panels.

2030 Commitment

Goody Clancy is signatory to The AIA 2030 Commitment. The mission of The AIA 2030 Commitment is to transform the practice of architecture in a way that is holistic, firm-wide, project-based, and data-driven, so that the AIA and the participating firms can prioritize energy performance and carbon reductions in the design toward carbon neutral buildings, developments and major renovations by 2030.

This project is tracking ahead of the 2030 target through 2025 at 90% reduction from the baseline.

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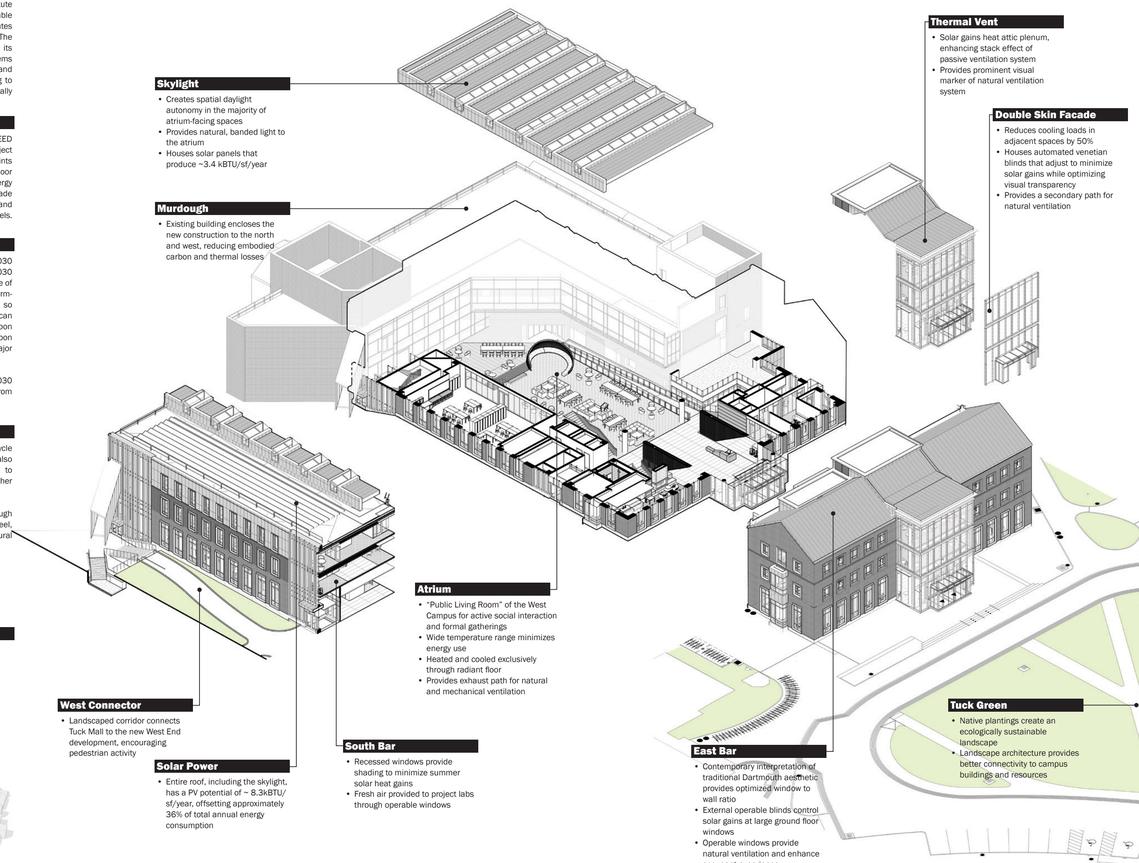
Building Placement

- Building placement and alignment to surrounding context
- Tuck Green
- Irving Plaza
- West Connector



Skylight

- Creates spatial daylight autonomy in the majority of atrium-facing spaces
- Provides natural, banded light to the atrium
- Houses solar panels that produce ~3.4 kBTU/sf/year

Murdough

- Existing building encloses the new construction to the north and west, reducing embodied carbon and thermal losses

Thermal Vent

- Solar gains heat attic plenum, enhancing stack effect of passive ventilation system
- Provides prominent visual marker of natural ventilation system

Double Skin Facade

- Reduces cooling loads in adjacent spaces by 50%
- Houses automated venetian blinds that adjust to minimize solar gains while optimizing visual transparency
- Provides a secondary path for natural ventilation

Atrium

- "Public Living Room" of the West Campus for active social interaction and formal gatherings
- Wide temperature range minimizes energy use
- Heated and cooled exclusively through radiant floor
- Provides exhaust path for natural and mechanical ventilation

West Connector

- Landscaped corridor connects Tuck Mall to the new West End development, encouraging pedestrian activity

Solar Power

- Entire roof, including the skylight, has a PV potential of ~ 8.3kBTU/sf/year, offsetting approximately 36% of total annual energy consumption

South Bar

- Recessed windows provide shading to minimize summer solar heat gains
- Fresh air provided to project labs through operable windows

East Bar

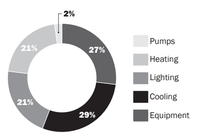
- Contemporary interpretation of traditional Dartmouth aesthetic provides optimized window to wall ratio
- External operable blinds control solar gains at large ground floor windows
- Operable windows provide natural ventilation and enhance occupant experience

Tuck Green

- Native plantings create an ecologically sustainable landscape
- Landscape architecture provides better connectivity to campus buildings and resources

Energy Model Preliminary Results

Conducting energy model assessments alongside our iterative design process is integral to designing a building that excels in energy efficiency and reduces overall energy consumption:



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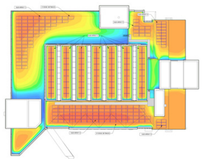
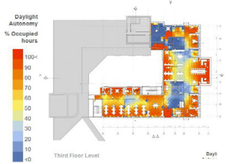
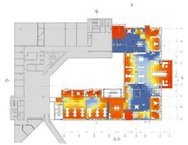
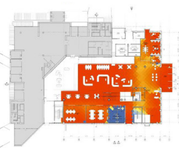
Daylight and Solar Analysis

- Spatial Daylight Autonomy (sDA) and photo-voltaic potential are key drivers for the atrium skylight geometry.
- Analysis ensures occupants receive comfortable levels of daylight throughout the year.



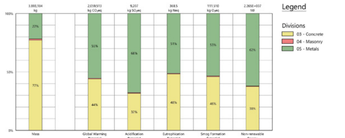






Structural System - Life Cycle Assessment

- Initial LCA of structural system performed through Tally showing the relative impacts of each material across five environmental impact categories: **Global Warming Potential, Acidification Potential, Eutrophication Potential, Smog Formation Potential, Non-renewable Resource Depletion**



Local Materials

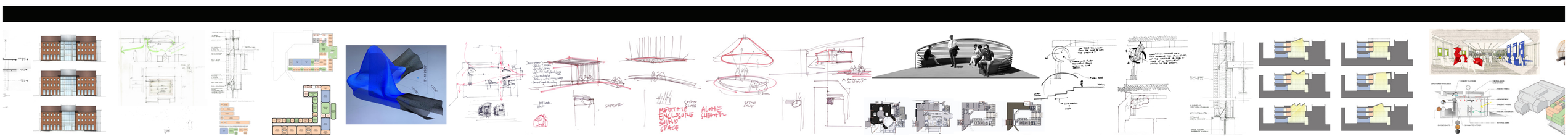
Raw material for the manufacturing of select pieces of furniture in the atrium will be sourced from The Grant, a sustainably managed forest maintained by Dartmouth's Woodlands Office.

27,000 acres
of woodland forests managed for timber harvesting and recreation

200,000 bdft
produced and harvested from The Grant annually

Thermal Envelope

Developing the design for the thermal envelope facade the design encompassed multiple elements of our energy goals for the building, namely the thermal performance, natural ventilation, and natural daylighting for the comfort of the users.



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Lobby + Cafe

Upper Atrium

Lower Atrium

*View QR panoramas in portrait mode