Leveraging the campus as a test bed for sustainability: *Catalyzing innovation, Imagination, and Impact.*

Julie Newman, Ph.D.
Director of Sustainability

Lecturer, Dept. Urban Studies and Planning

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"I've heard an intense desire to see the people of MIT come together, in meaningful ways, to meet all the great challenges of our time. Above all, and most urgently: to marshal a bold, tenacious response to the run-away crisis of climate change."

–Sally Kornbluth, MIT President

168 acres	**14,508** offices	**4,657** undergrads	**40** MW power plant
190 buildings	**5,551** labs	**7,201** graduates	**17** miles of utilities
43,000 spaces	**1,319** restrooms	**1,080** faculty	**400** active projects
13 million square feet	**528** classrooms	**15,247** staff	**70,000** work orders / yr.

Strategic sustainability leadership

Strategic Sustainability Leadership

Inquiry & design via burning questions

1. Work from common scientific models
2. Plan across scales
3. Foster city-university partnerships
4. Lead through collaboration & accountability
5. Leverage campus as test bed
6. Center equity and justice
7. Implement solutions

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Inquiry & design via
driving questions

What is the organizational structure and behavior that is responsive to, alters, informs, and influences the climate trajectory we are on?

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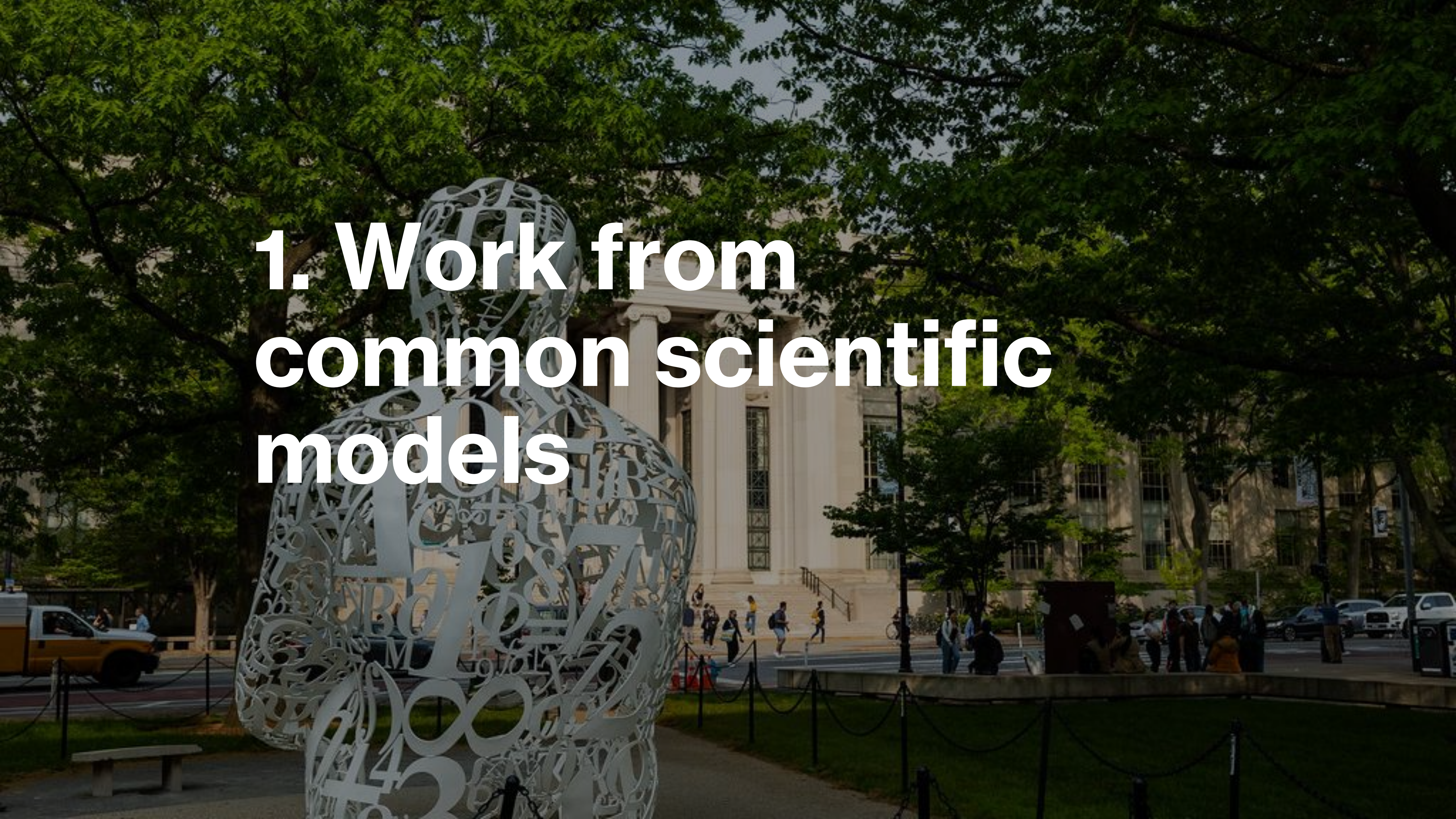
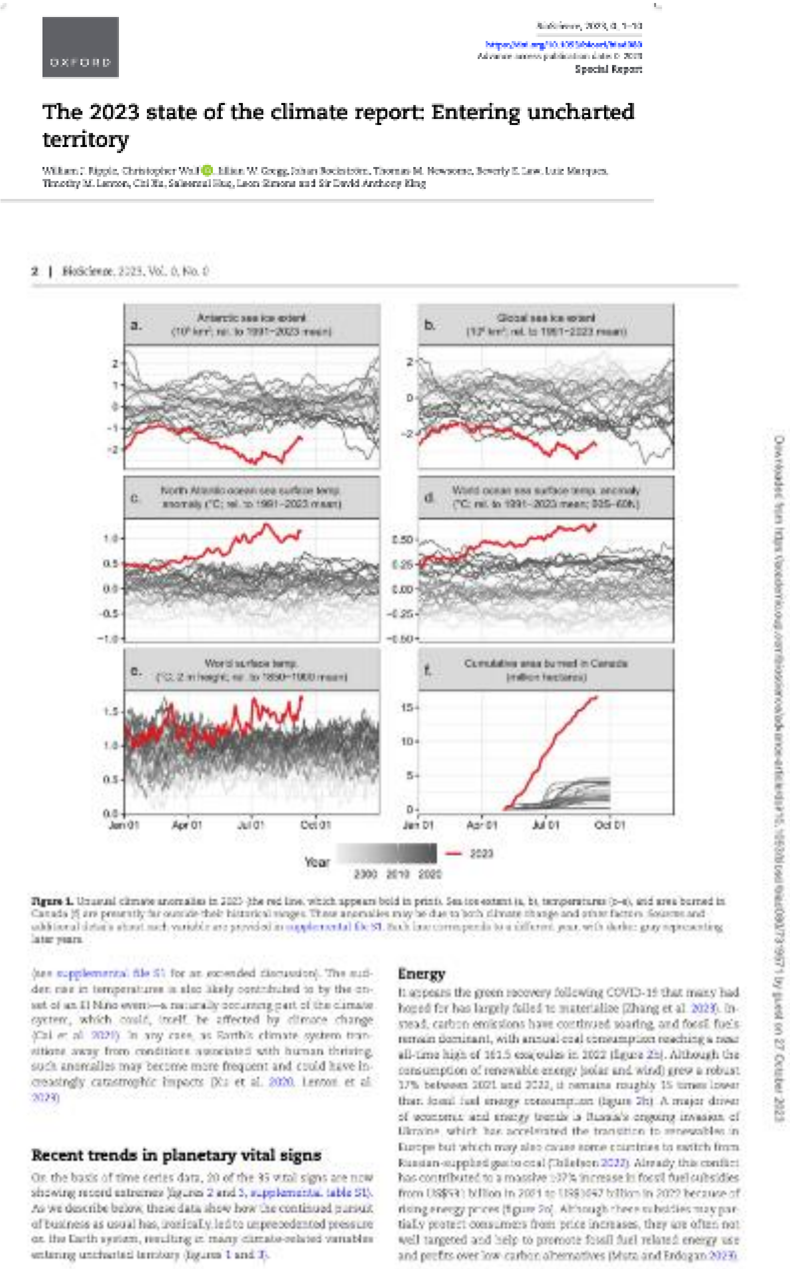
1. Work from common scientific models

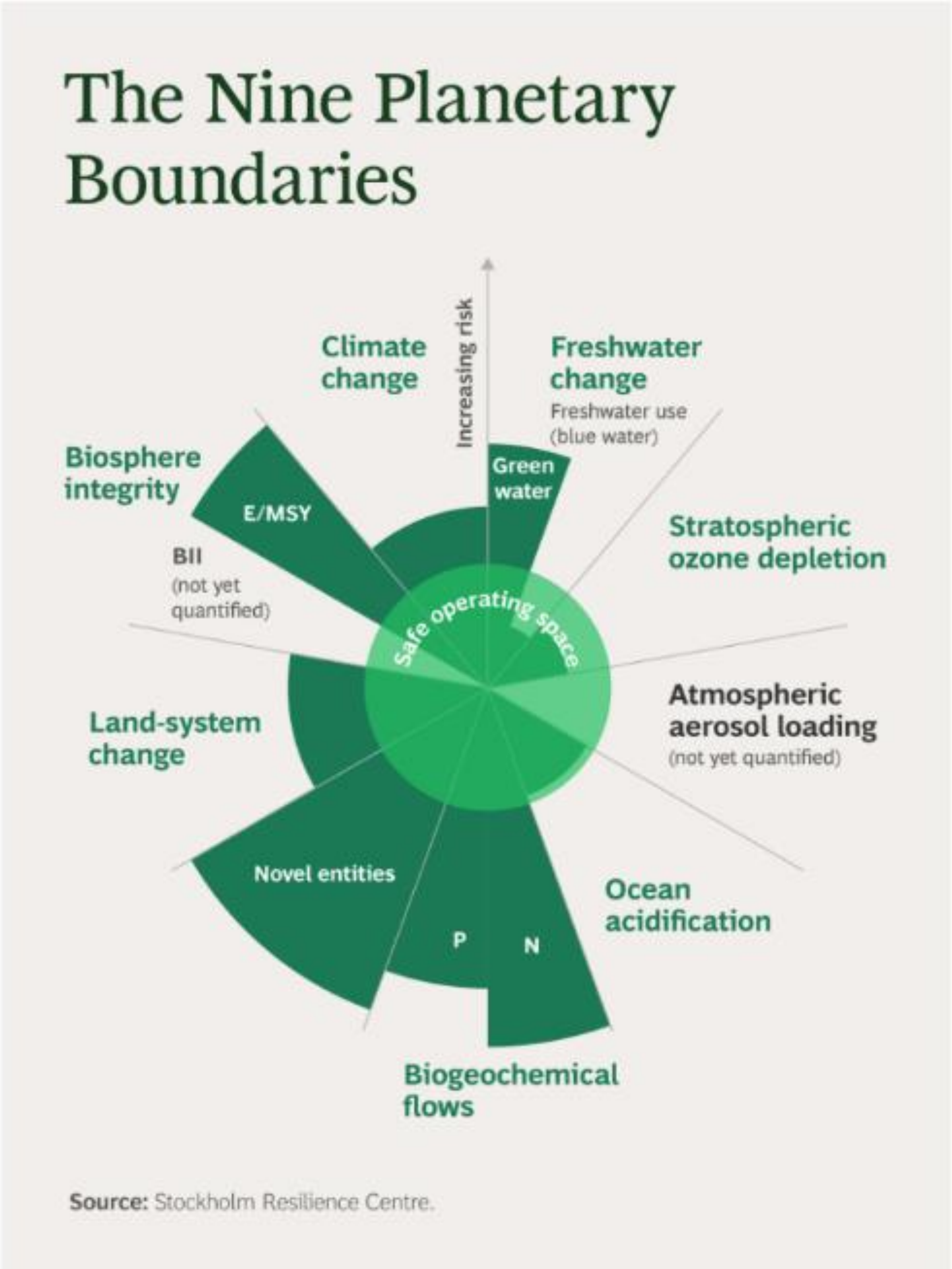



BioScience, 2023, 0, 1–10
Special Report

The 2023 state of the climate report: Entering uncharted territory

Energy

Recent trends in planetary vital signs



Source: Bioscience, 2023

Entering uncharted territory: 2023 anomalies across the Earth System compared to 2000-2020.

2. Plan across scales

Scales of Impact

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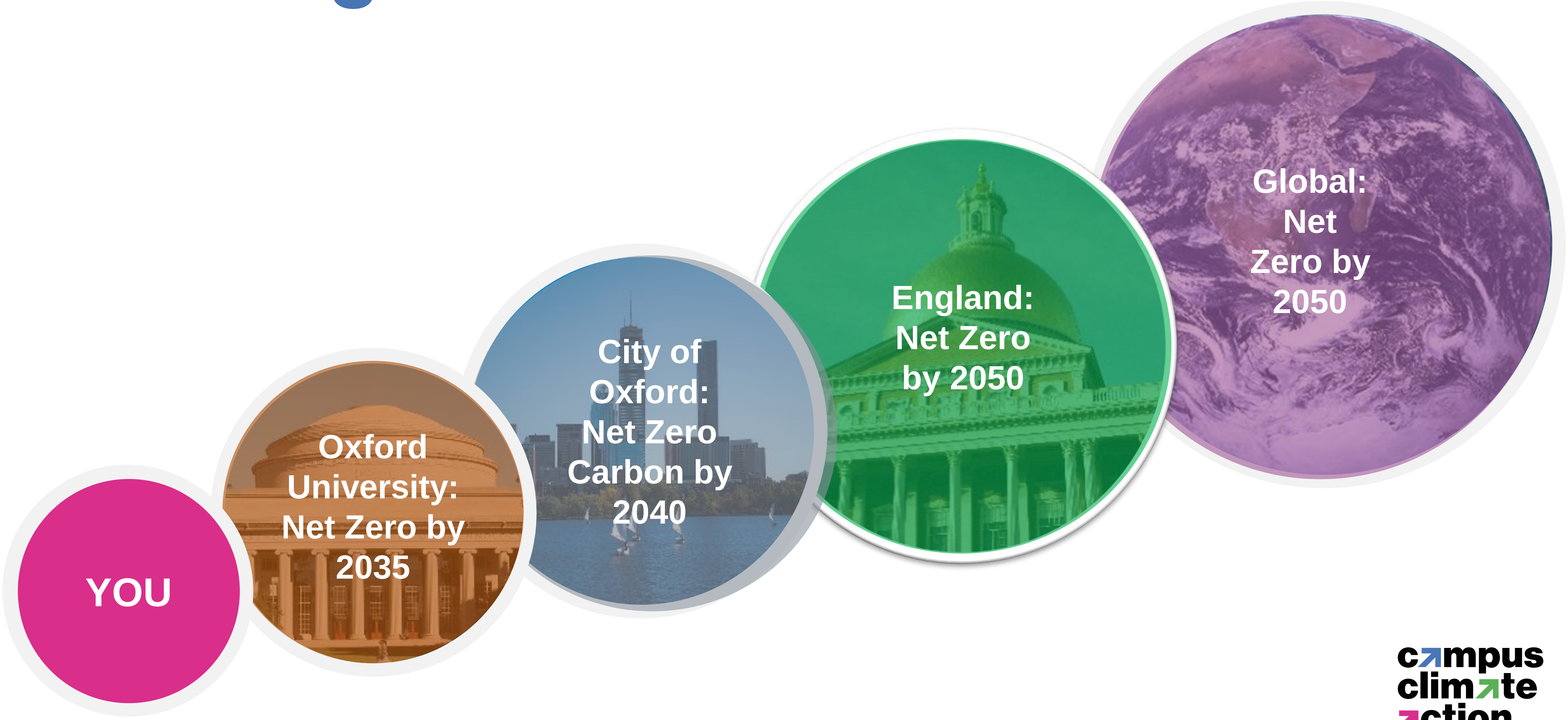
Planning across scales: Oxford



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3. Foster & strengthen university-city-community partnerships

Climate Community Collaborative

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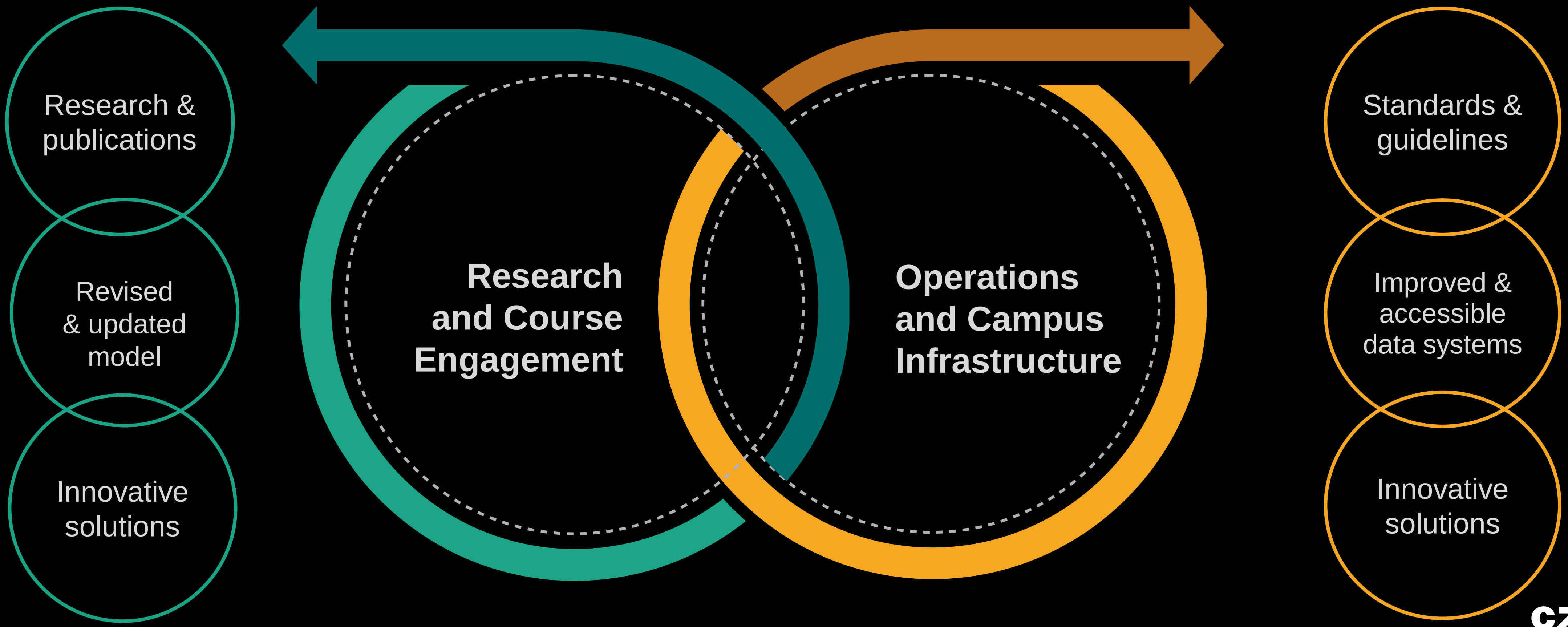
4. Activate the campus as test bed

How do we solve for sustainability at MIT?



CAMPUS AS TEST BED

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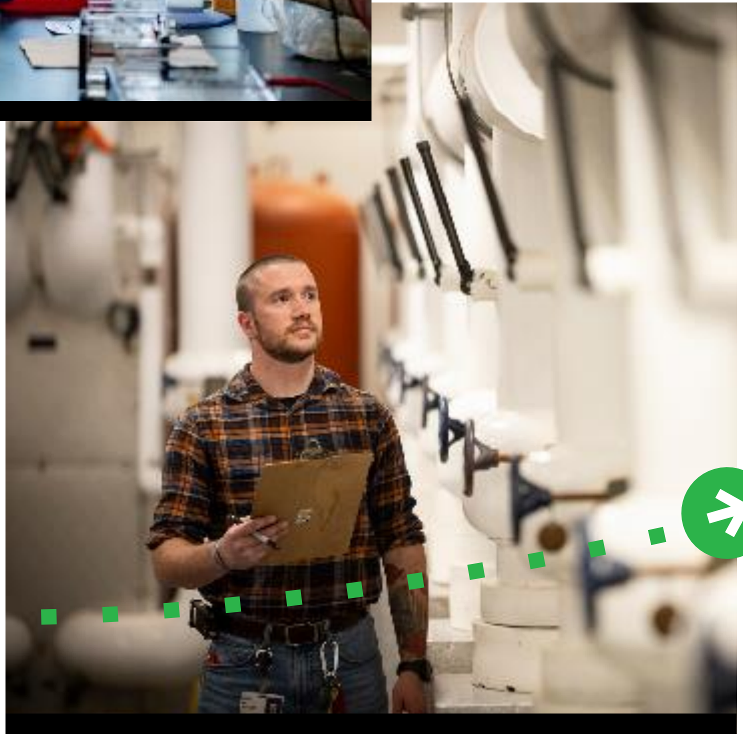
Could MIT's buildings become just as "smart" as the people who work in them?

CONNECTING THE DOTS:

USING MIT'S CAMPUS AS A "TEST BED" FOR SUSTAINABILITY



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If you have a "smart" thermostat in your home, you know how they work to keep your surroundings comfortable and efficient. But what if your house was really big? Say... 13.9 million square feet?

Discover how an AI algorithm pilot is using data from campus spaces to help MIT reduce consumption, increase efficiency, and move closer to decarbonization.

How did they do it?

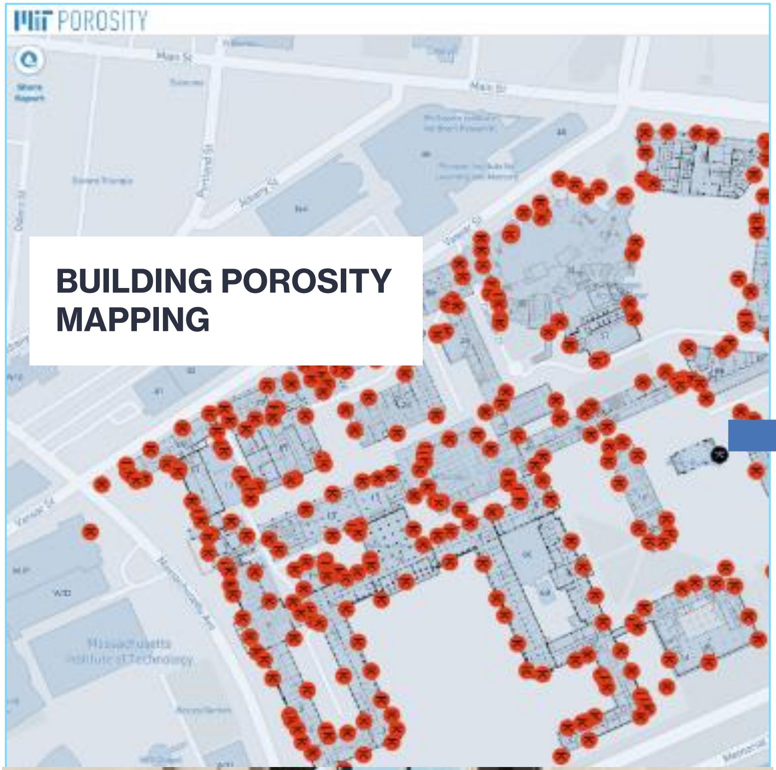
Resilience to extreme weather events

Ken Stryzpek,
Researcher, EAPS

Katya Boukin,'24
PhD student, CEE

- Incorporating flood-resilient design in all new construction projects
- Advancing campus flood models
- Evaluating campus systems and locations most vulnerable to flooding and prioritizing protection measures

Climate Resiliency & Adaptation: Basement Flood Risk Model



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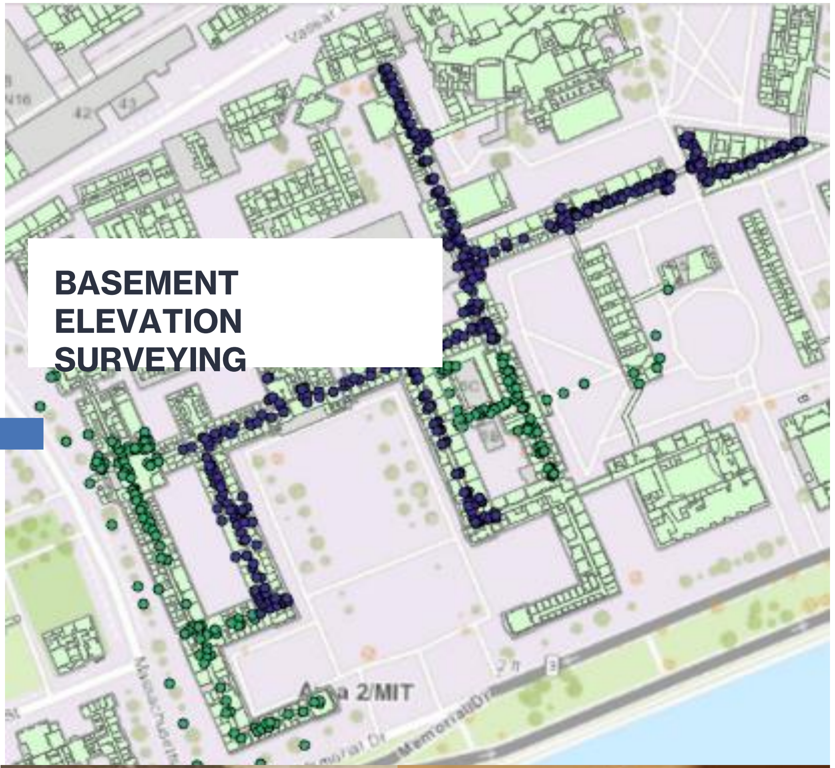

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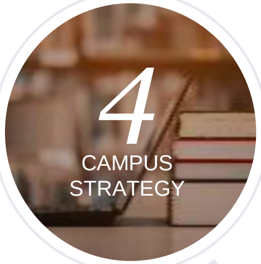
5. Lead through collaboration & accountabiilty

Reducing MIT’s Climate Impact

Distributed Leadership



Fast Forward Workstream status update:

Climate Mitigation + Resiliency

&

GHG scope expansion

Fast Forward: Climate Action Plan Winter 2024 Overview

January 14, 2024

Category: Mitigation & Resilience

General				Progress			Timeline				
Commitment Name	Status	Recent Accomplishments	Next Steps	Discovery	Implementation	Deliverable	2022	2023	2024	2025	2026+
1. Zero Emissions Plan by 2050		• AE/ALE completed 20 Level 1 ASHRAE energy audits and reviewed the Level 2 audits for campus wide analysis • BEUDO analysis with respect to buildings attached to the CUP - ongoing • Beginning to screen technologies for Decarb strategies	• Workshop for framework for decarbonization • Financial modeling for baseline or reference case	[illegible]	0%	0%					2050>>
2. Building Efficiency		• Bldg. 46 is approx. 90% complete including: Room level ECM implementation on all floors 1-7; equipment related ECMs (VFDs, blower coils, cross-connect, steam traps, etc.), and BMS Transition	• Completion of Bldg. 46: Building level ECM implementation (static pressure reset, etc.) targeting end of January and start of M&V period • 76 Construction Phase funding approval • E25: Design & construction funding approval	[illegible]	[illegible]	0%					2030>>
3. Resilience & Adaptation Roadmap		• Completion of Draft Roadmap • Collection of 100 new spot elevation data points for Outfinite/Nano Courtyard • Completion of draft resilient landscape planning tool	• Launch of Stormwater v3.0 model • Visualization of campus heat risk findings	[illegible]	[illegible]	[illegible]					
4. Rooftop Solar		• Design/Build contract approved • W20 roof construction complete • Design funding approved	• January: Execute contracts • January: Submit Eversource Interconnection Agreement - W46, W97, E53, W20 • February – March 2024: Design for 4 solar installations • March / April 2024: Construction funding request • Winter / Spring 2024: O+M planning for existing installations • Spring / Summer 2024: PV installation - W46, E53, W97	[illegible]	[illegible]	0%					2026
5. Net Zero 2026		• Completed negotiations and executed contract for 208MW Bowman Wind project in ND, MIT taking 21% • Construction started on 200MW Big Elm solar project	• Coordinated press release and communications plan of PPA accomplishments and net-zero progress – Q3 FY24 • Initiation of additional PPA project procurement process – Q3 FY24	[illegible]	[illegible]	75%					2026
6. AI to Reduce Energy Use		• Improvements made to machine learning platform • Pilot testing expanded to additional rooms and types of spaces on campus, in collaboration with MIT facilities and building management systems vendor	• Completion of initial version of machine learning platform • Expansion of pilot testing on campus	[illegible]	[illegible]	[illegible]					2030>>

Category: GHG Scope Expansion

General				Progress			Timeline				
Commitment Name	Status	Recent Accomplishments	Next Steps	Discovery	Implementation	Deliverable	2022	2023	2024	2025	2026+
7. Travel Offset		• Socialized program with Elizabeth Lennox, ADeans, and with AACII • Climate Vault catalog live for pilot participants in Coupa	• Communicate program to fac/staff in pilot areas	[illegible]	[illegible]	[illegible]					
8. Add in Scope 3 Emissions		• Completed update of business travel dashboard through FY2023 • Established agreement with Audit Division for consulting on data and reporting processes	• Deployment of new back-end data processing systems • Socialization of GHG impact from Construction, Purchased Goods + Services, Commuting	[illegible]	[illegible]	[illegible]					2026
9. Add in Off Campus Emissions		• Completed energy data collection from Bates, Wallace/Haystack, Endicott House facilities for FY2023 • Calculated equivalent GHG emissions for each site	• Will publish additional emissions in our FY2023 GHG reporting in Q3 FY24 • Will institutionalize data collection and reporting processes in Q3 and Q4 FY24	[illegible]	[illegible]	75%					2026

Staff / Faculty research teams

Technology	Description (working version)	Faculty / Staff point of contacts
1 Building Baseline Model	Build an hourly load profile model for MIT campus buildings and apply a series of off-the-shelf retrofits to predict future load profiles for electricity, heating and cooling. The other technology packages will be evaluated based on these evolving load profiles.	Christoph Reinhart / Siobhan Carr/ Steve Lanou/
2 District Geothermal	A review of how the existing campus district energy system can be electrified and evolve over time to meet evolving load profiles [1].	Pablo Martinez / Carlo Fanone
3 Avoided Costs	Quantify costs that would occur to MIT from inaction such as a carbon tax or reputational costs.	Siqi Zheng / Steve Lanou
4 Future grid emissions and capacity; Resiliency	Predict how the New England grid might decarbonize between now and 2050 and what excess capacity the grid might have during key times in the year based on [2].	Andy Sun / Jon Sepich
5 High resolution building controls (AI)	Survey of next generation sensor, actuator and control technologies for room-level HVAC control. Quantify savings based on [3].	Joe Paradiso / Wade Burner
6 Energy efficient lab	Identify safe transition pathways to reduce operational energy use in MIT lab based on [3].	Brad Olsen / Jim Doughty
7 Deep geothermal	In this activity we will investigate the readiness of deep geothermal wells [>5,000ft] for heating and electricity generation based on [2].	Christoph Reinhart / Joe Higgins
8 Micro-reactors	Evaluate emerging small (5-20MW) nuclear reactor technologies and adoption potential by MIT based on [3]	Jacopo Buongiorno / Janine Helwig
9 Energy storage including EV and PV	Study potential use of large electric and thermal storage for campus resiliency based on [2].	Jessika Trancik / Randa Ghattas
10 Local carbon capture	Evaluate various carbon capture opportunities that could be deployed on or near the MIT campus to balance residue on campus emissions.	Betar Galant / Jessica Parks

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6. Center Equity and Justice

Reducing MIT's Own Climate Impacts, Advancing Justice

How can MIT reduce its carbon emissions while promoting equity, benefiting local economies and communities, and improving public health?

Carbon

- Net-zero by 2026
- Zero direct emissions by 2050
- Zero emissions campus vehicles
- Reduce food, water, & waste impacts

+ Wealth generation opportunities
+ Community climate resilience
+ Workforce dev't
+ Healthy people & ecosystems
+ Food security
+ Environmental justice

Justice

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7. Implementation

18 Climate and sustainability commitments in action

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Strategic Sustainability Leadership

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On the horizon: A call for collaborative climate leadership models

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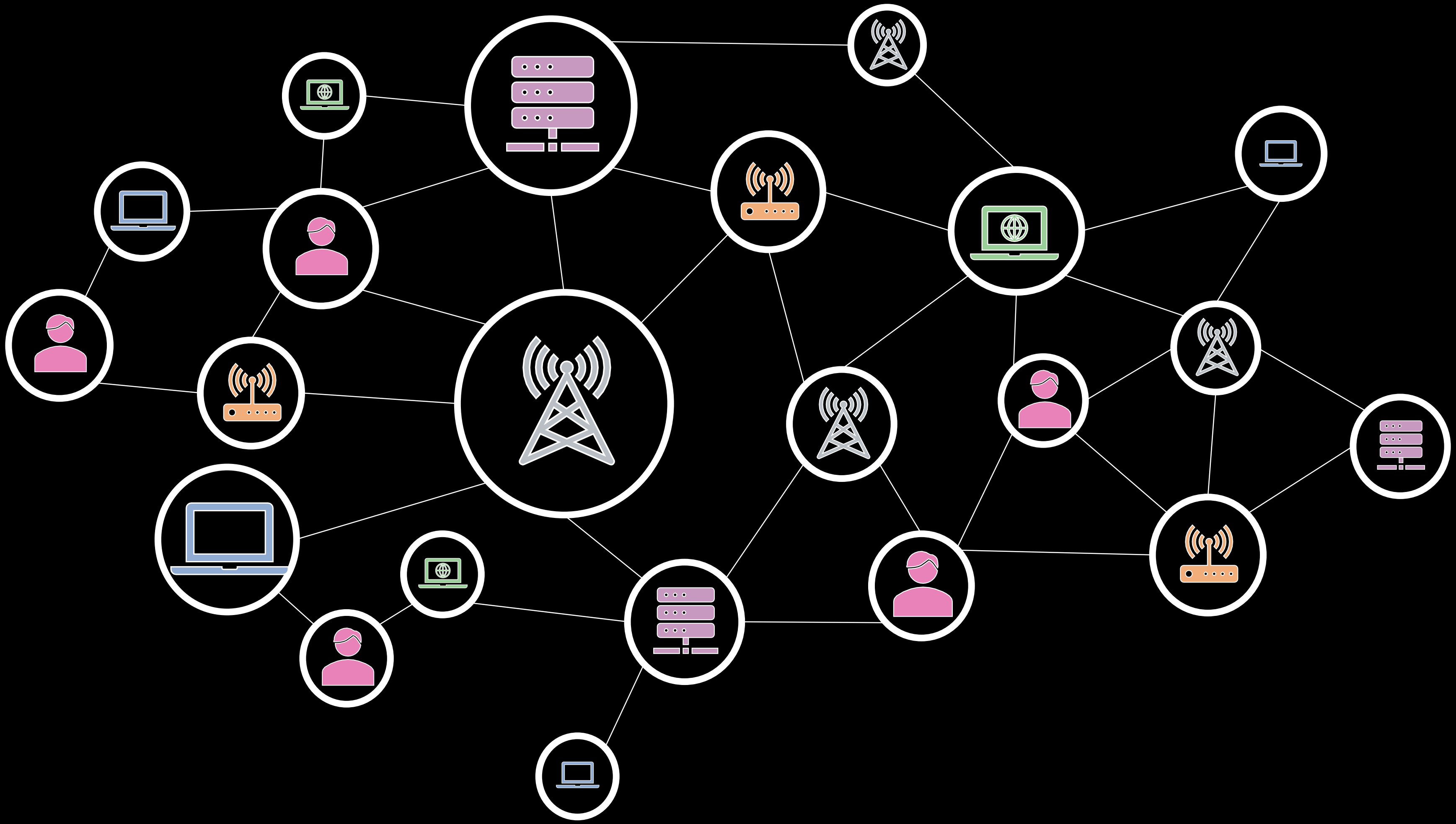
Collaborative disciplinary structures:

Generalists bridging specialists?



Engineering

Humanities

Biology

Law & Policy

Architecture & Planning

Collaborative Climate Leadership

ACADEMIC LEADERSHIP ROLE

Research & teaching missions
Global scale application, impact and accelerated solution development
Research platform oversight

INETGRATOR ROLE

State/Fed liaison on climate
Climate regs/IRA funding/higher ed coor
Higher education leadership
Test bed – campus/community
Industry/Campus sustainability liaison Alumni engagement

ADMINISTRATIVE OPERATIONS & INFRASTRUCTURE ROLE

Office of Sustainability
Decarbonization of the campus
City Compliance
EHS/Utilities/Cap.
Construction/Facilities/Repair
Maintenance/Grounds