International Institute for Sustainable Laboratories

# From Potential to Reality

## How Leading Universities Can Implement a Net Zero Future

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# Learning Objectives

**Connect** life cycle assessment and energy modeling to both operational and embodied emissions.

**Evaluate** where your institution stands and how to scale sustainability within budget limits.

**Establish** clear communication, accountability, and funding structures for implementation.

**Apply** lab energy management and net zero strategies that turn pledges into action.

# The Pledges vs. the Practice

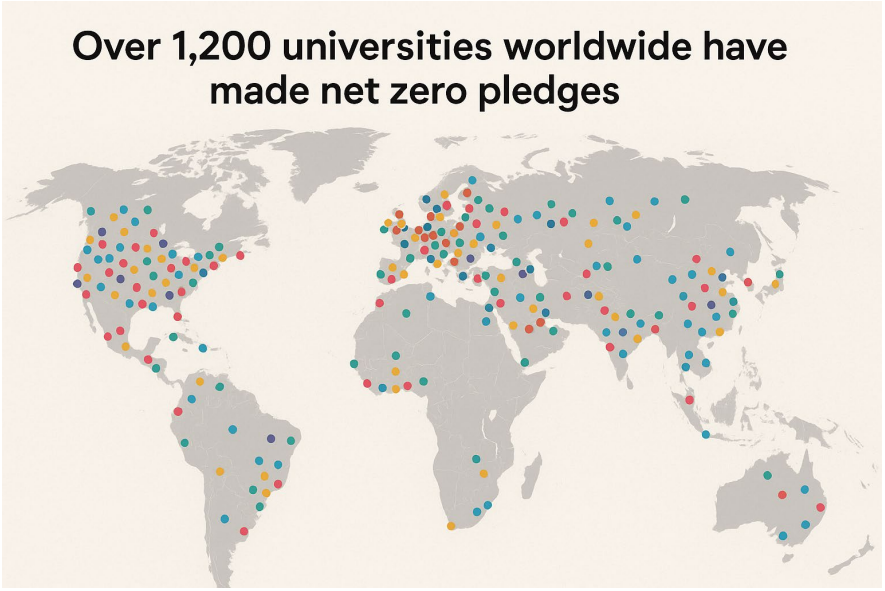
## Global University Commitments

**1,200+** Universities & Colleges worldwide have made net zero pledges

## Common Implementation Hurdles

- Siloed efforts across departments and campus units
- Budget limitations and competing financial priorities
- Gaps in data collection and accountability metrics
- Stakeholder alignment and governance challenges

> **The Implementation Gap**
>
> Many universities have ambitious targets but lack a credible pathway to achieve net zero emissions.




RACE TO Zero
UNIVERSITIES & COLLEGES

# Emissions Profile – Operational vs. Embodied

## Understanding University Emissions

### Operational Emissions

Carbon emissions from day-to-day operations and energy use of campus buildings and facilities.

**Examples:**

- Electricity consumption
- Heating/cooling
- Laboratory equipment
- Campus transportation

### Embodied Emissions

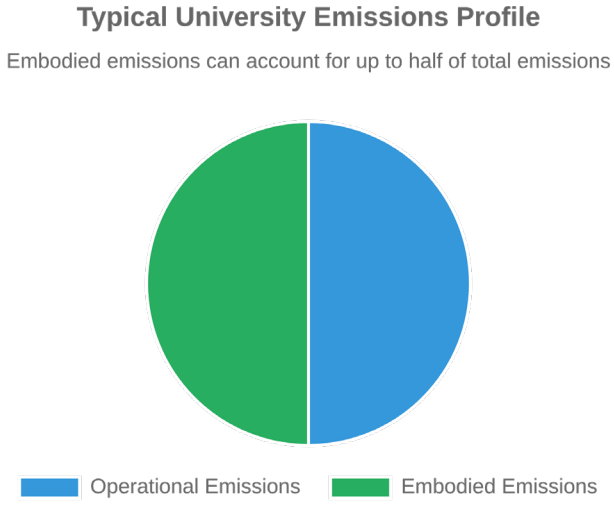
Carbon emissions associated with materials, construction, and the entire lifecycle of campus infrastructure.

**Examples:**

- Building materials
- Construction processes
- Furniture & equipment
- End-of-life disposal

**Key Insight**

Today, campuses are dominated by operational emissions — but embodied carbon is already ~11% of global $CO_2$ and could rise to ~50% of building emissions by 2050 if unchecked.



# Tackling Scope 3 & Embodied Emissions

## Understanding University Emissions

**Key Takeaway**

Scope 3 emissions are complex to track, but they could also make up the largest share of a university's total carbon footprint.

## Why This Matters

Achieving net zero requires tackling both operational and embodied emissions.

Construction and procurement choices today lock in decades of future carbon.

Renovation-first and low-carbon materials reduce embodied impacts immediately.

| Focus Area | High-Level Strategy | Start Here (Quick Wins) |
|---|---|---|
| **Scope 3 Emissions** | Sustainable procurement, travel & commuting, food systems | Travel optimization, sustainable purchasing |
| **Embodied Emissions** | Lifecycle design, low-carbon materials renovation-first policy | Material substitution, prioritize renovation |
| **Crosscutting Tech** | AI tools, carbon-tracking platforms, digital twins | Explore pilot projects with smart materials & digital twins |

# Key Levers for Action

## Strategic Approaches for University Net Zero Implementation

### Life-Cycle Assessment & Energy Modeling

Uncover high-impact opportunities early in planning

- Building performance simulation
- Material carbon accounting
- Data-driven decision making
- Predictive emissions analysis

### Tiered Scaling

Implement in strategic phases for maximum impact

- Quick wins (lighting, controls)
- Strategic retrofits (HVAC, envelope)
- Long-term investments (renewables)
- Campus-wide systems integration

### Labs Focus

Target energy-intensive research facilities

- Fume hood optimization
- Plug load management
- Ventilation right-sizing
- Equipment scheduling & controls

# Stepwise Roadmap

## Implementation Path to Net Zero


1

### Baseline Assessment

Establish comprehensive emissions inventory across Scope 1, 2, and 3.

- Energy audits
- Carbon accounting
- Embodied carbon

2

### Plan & Prioritize

Develop data-driven strategies with clear ROI metrics.

- Energy modeling
- Life-cycle assessment
- Financial analysis

3

### Implement

Execute strategic interventions in phased approach.

- Quick wins
- Retrofits
- Long-term investments

4

### Certify or Validate

Use external frameworks to verify progress.

- LEED certification
- Science-based targets
- Third-party verification

5

### Monitor & Adapt

Continuously track progress and refine strategies.

- Real-time dashboards
- Annual reporting
- Strategy refinement

# External Tools & Structured Frameworks

## The Value of External Expertise

### External Expertise

Consultants and partners with specialized knowledge in campus sustainability and net zero implementation

### Structured Framework

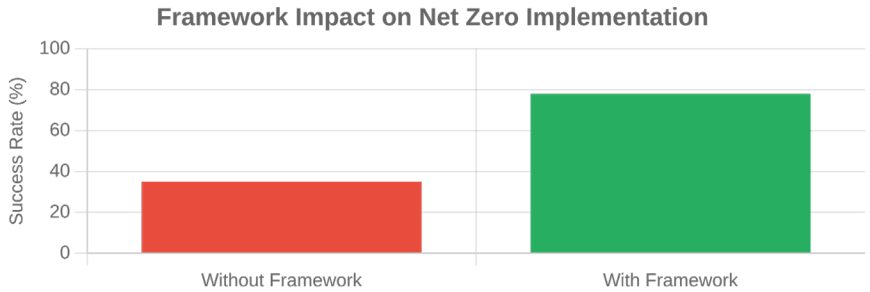
Established methodologies and processes for assessment, planning, and implementation

### Certification & Validation

Third-party verification of progress and achievements toward net zero goals

### Frameworks & Certifications

- LEED
- GNFZ
- ILFI
- I2SL Lab Benchmarking Tool/AIM

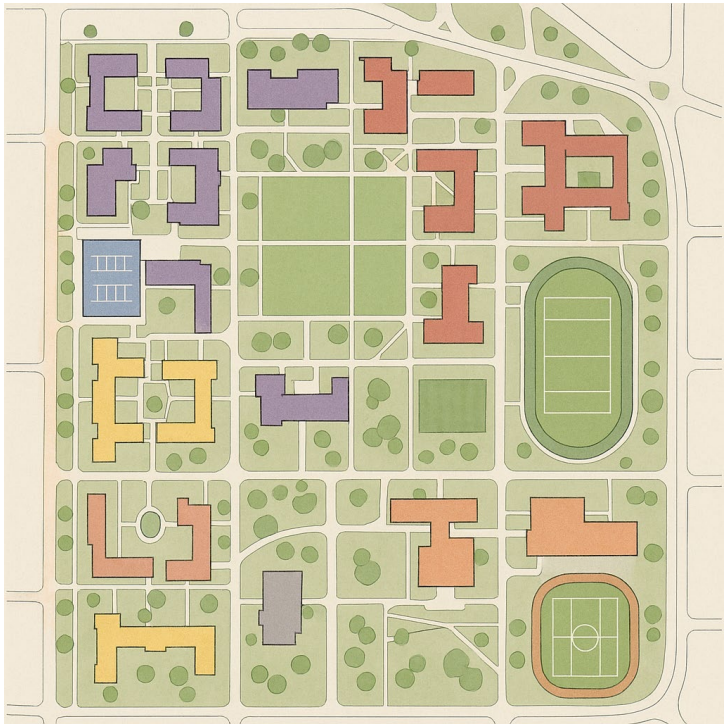



## Key Benefits

- **Data-driven planning** based on validated methodologies and benchmarks
- **Objectivity and credibility** through independent assessment and verification
- **Structured checkpoints** to measure progress and maintain accountability

# Stepwise Roadmap

## Implementation Path to Net Zero



### Success Factors

- Executive leadership commitment and governance
- Cross-departmental collaboration and accountability
- Dedicated funding mechanisms and financial planning
- Stakeholder engagement across campus community

**Implementation Insight**

Universities that follow a structured roadmap are 3x more likely to make meaningful progress toward their net zero goals compared to those with aspirational targets alone.

# Case Example: New Construction Lab/Office Building

**Strategy**

Energy modeling revealed key HVAC efficiencies in a 162,000-sq-ft facility, guiding design and ongoing performance tracking.

## Key Interventions

### Demand-Control Ventilation (Non-Lab Areas)

Implemented occupancy sensors and air quality monitoring to adjust ventilation rates based on actual needs rather than constant maximum flow.

### Lighting Upgrades

Fluorescent fixtures with LED lighting systems and daylight harvesting controls in perimeter zones.

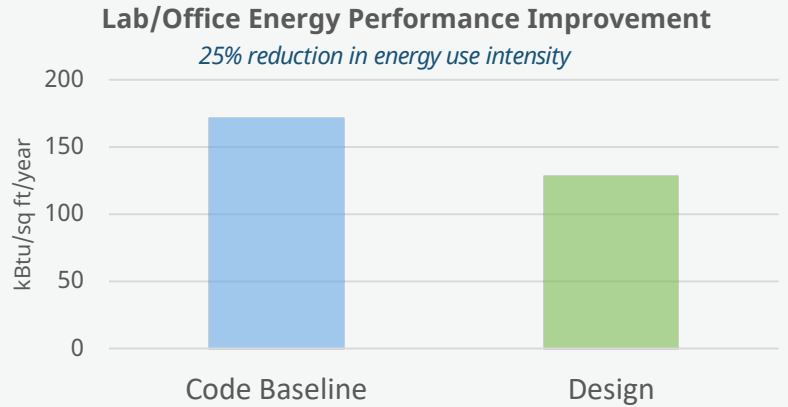
### Fume Hood Management

Implemented sash management program with automatic closers and user education to reduce unnecessary exhaust.

### Plug Load Controls

Installed smart power strips and equipment scheduling systems to reduce standby power consumption.

50% Laboratory, 50% Office building with energy-efficient systems



# Case Example: Addition/Renovation Hospital Building

## Value of Modeling in Design

52% reduction in space heating load

41% reduction in cooling demand

Reduced fan & pump energy

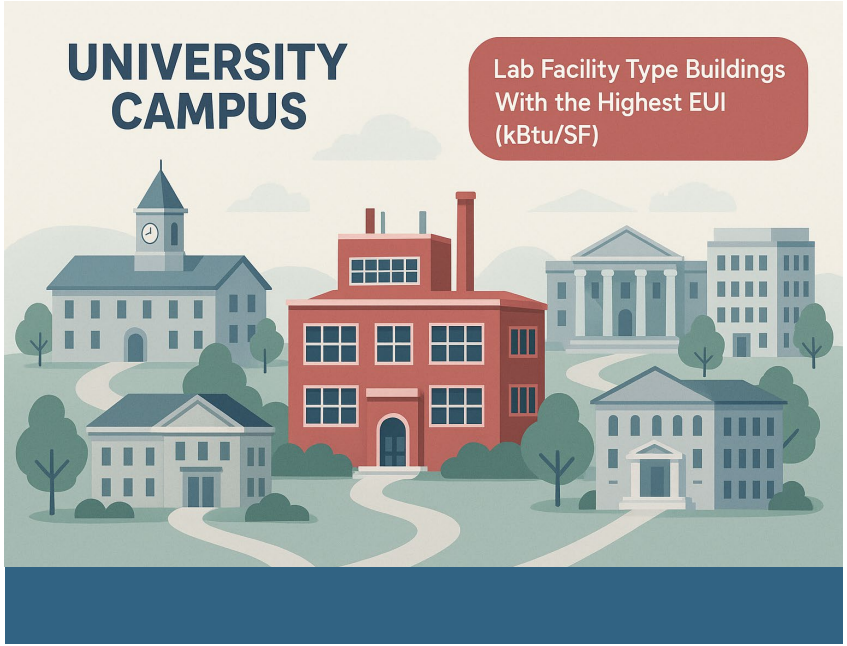
Supply airflow optimized (38,619 → 23,238 CFM)

**Key Outcomes**

| 35% | 22% | 9 |
|---|---|---|
| EUI Reduction (305.6 → 197.8 kBtu/sf/yr) | Annual Cost Savings | LEED Points |

## Benefits

- 35% EUI reduction and 22% cost savings through structured energy modeling
- Improved HVAC performance, comfort, and indoor air quality
- Earned 9 LEED points through verified, framework-based design
- Established a replicable model for future campus healthcare and lab facilities



# Call to Action

## Campus Leaders Should:

### Establish Comprehensive Baseline

Measure both operational and embodied emissions to create a complete carbon inventory across all three scopes.

### Deploy High-ROI Strategies

Implement data-driven interventions that prioritize lab efficiency, building retrofits, and renewable energy integration.

### Use External Frameworks

Leverage certification standards and external expertise to validate progress and ensure accountability.

### From Pledges to Progress

The roadmap exists. What we need now is leadership to make it happen.

# Q&A Discussion

**"What's your greatest obstacle in converting net zero commitments into systemic campus action?"**

*Share your experiences and challenges with implementing net zero strategies*

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