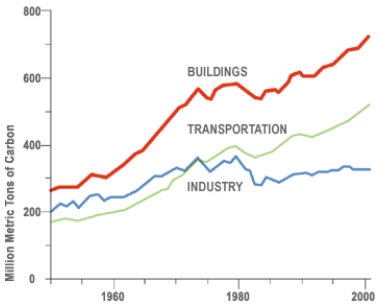
PROGRAM BRIEF: Meeting the "2030 °Challenge" at CDes

The Minnesota Zero Energy Design Lab

mn-ZED Lab

Unknowingly, the architecture and building community is responsible for almost half of all U.S. greenhouse gas emissions annually. Globally the percentage is even higher.

-- Ed Mazria, Architecture 2030



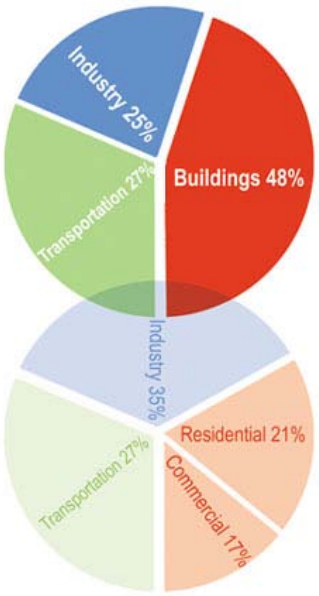
U.S. CO2 Emissions by Sector

1. U.S. Energy Information Administration Statistics

The Design Challenge: mnZED Lab

This semester you are asked to consider how the design community can respond to the growing ecological challenges of global climate change. Your challenge is to design a "Minnesota Zero-Energy Design Lab" (mnZED Lab) for the College of Design. The lab is proposed as an addition to Rapson Hall. While there are many issues related to carbon neutral and zero energy design, this investigation will focus on the roles of daylighting, thermal, and bioclimatic considerations to meaningfully inform architectural design while also reducing fossil fuel consumption and carbon emissions.

The course will explore the architectural design opportunities of the **"Architecture 2030 °Challenge,"** recently adopted by the American Institute of Architects the **"2030 °Challenge"** provides an ambitious plan for carbon. *The "2030 Challenge" proposes that the fossil fuel use and associated carbon emissions be reduced net-ZERO by 2030.*



U.S. Energy Consumption by Sector
U.S. Energy Information Administration Statistics
Metropolis Magazine, October 2003
Architecture 2030, www.architecture 2030.org

Design Requirements for the mnZED Laboratory

The **mnZED Laboratory** will bring together the design and building communities to investigate and promote the **"2030 °Challenge"** and to achieve zero energy and zero carbon emissions through design in Minnesota. This partnership embraces all aspects of the designed environment, from landscapes to architecture, interior design, materials and components, and product design. The **mnZED Lab** will include design facilities for:

- ***Education:*** The lab will provide teaching resources and laboratory spaces for ZED education and outreach programs; it will provide access to computational, virtual, and simulation tools; it will house sustainable design and building technology resources, publications, and archive materials.
- ***Research:*** The lab will provide resources for ZED research, testing, assessment, and monitoring (e.g. physical and computer modeling for landscape, structural, construction, interior, and product design, as well as analytical tools to evaluate daylighting, thermal, and solar design); it will have network connections with other research centers; it will house research materials and publications.
- ***Design Assistance:*** The lab will provide design assistance to evaluate and integrate ZED strategies and methods into landscape, architecture, interior, and product designs in Minnesota.
- ***Demonstration:*** The lab will provide resources for demonstrating ZED and sustainable design principles, construction methods, products, and technologies; it will enable demonstration of sustainable assessment and evaluation methods; it will provide facilities for hands-on explorations, testing, mock-ups, and fabrications.
- ***Collaboration:*** The lab will provide a forum for design practitioners, educators, researchers, and the building industries; it will provide facilities for video-conferencing, workshops, and seminars; it will create a physical center for ZED education and research partnership and dissemination; it will bring together multiple disciplines, interest groups, and perspectives to achieve zero emission design and sustainability in Minnesota.

The mnZED Laboratory Space Requirements: 3rd Floor Addition to "old" Rapson Hall

You are asked to develop a design concept and proposal for a third floor addition to "old Rapson Hall" to house the mnZED Lab. The design should be shaped and deeply informed by daylighting, thermal, and bioclimatic design. The existing footprint for old Rapson Hall is 183'x183' (with the courtyard at 93'x93') . The total footprint of the roof is 33,489 (with 8,649 over the courtyard and 24,840 sf (a rough estimate of 24,000 sf) over existing studios. An overview of the program includes:

1. *Interior spaces: The scheme for your third floor addition over "old" Rapson Hall may range in scale from 15,000 sf (minimum) to 18,000 sf (maximum).*
2. *Exterior spaces: Outside meeting and/or demonstration is required.*
3. *Hours of operation: 6:00 a.m. until 7:00 p.m., Monday-Sunday throughout the year.*

Recommended Space requirements

Dept.	Room/Space	Occ	NSF	GSF*	Notes
CSBR Offices				4,500	
	Lobby/Reception	1	500		Adjacent to Elevator Lobby
	Director	1	150		
	Assistant Director	1	150		
	Researchers	8	1000		Open Office Layout
	Conference	9	500		Video conferencing
	Storage/copy		200		
Labs				7,500	
	Energy and Indoor Air Quality	5	1000		South facing exposure preferred.
	Materials	5	1000		Option to combine w/Site&water L.
	Site & Water	5	1000		Adjacent to Outdoor Demo
	Daylight Lab	5	1000		Blackout curtains
	Demonstration	5	1000		Adjacent to all labs
Classrooms				2,500	
	Classroom 1	25	500		Classrooms can be opened up to be one large flexible space; daylighting required for all but black-out capabilities also needed.
	Classroom 2	25	500		
	Classroom 3	25	500		
	Classroom Storage		150		
Restrooms				900	
	Men		300		
	Women		300		
Circulation/Services				2,100	
	Elevator		150		Align with existing
	Stair 1		350		Align with existing
	Stair 2		350		Align with existing
	Janitor/Storage		50		Adjacent Restrooms
	Mechanical (AHUs)		200		Align with vertical shaft
	Mechanical Equip		150		
	Electrical		80		
	LAN/Computer		60		Central Location
Total Conditioned Building Gross SF				17,500	
Outdoor Classroom/Demonstration				6,500	Adjacent to CSBR and Site & Water Lab
Total Indoor and Outdoor Gross Area				24,000	
Total Occupant Load		120			

* Includes columns, partitions and Circulation (at 1.5 multiplier)

Additional mnZED Laboratory Considerations

Circulation and Life Safety

All vertical circulation should align with existing elevator and stairs and meet all life safety codes. Corridors should be 10' wide minimum, but consider allowing for project reviews in appropriate areas. All normal fire protection systems will be provided. Corridors without access to an exit in both directions ("dead-end corridors") must not be longer than 20' by code and should be avoided entirely. All spaces with occupant loads of over 25 must have 2 points of egress. Distance between exists must be a minimum of half the diagonal distance of the space. A code compliant elevator lobby shall be provided on each level.

Structural

Although Old Rapson Hall was originally designed for an additional floor level, all added structural loads should bear on the double ring of columns at the perimeter of the structure in a non-eccentric fashion. No loads should be added to the inverted hyper-paraboloid structure supporting the courtyard roof. It can be assumed that the courtyard roof can be raised if desired to maintain consistency of natural lighting and access to interior of courtyard space. Although a one-level approach may be preferable in many aspects a two-level scheme is not precluded provided that a minimum of 2 stairs are provided aligning with existing stairs and the existing elevator can be accessed.

HVAC and Lighting Systems

Several options are available for provision of heating and cooling energy for the new mnZED Lab. Option 1 involves connecting to the University district heating and cooling systems. The existing Rapson Hall facilities get heating and cooling energy by this means and services enter the building on the lower level. Option 2 would be provision of new stand-alone heating and cooling systems such as a Ground Source Heat Pump. Ventilation systems will be new and most likely separate from the existing Air Handling Units. Lighting systems should include optimal integration of natural daylight wherever possible. Electric lighting should be compatible with and respond to the availability of natural daylight and be the most energy efficient technologies available while still providing the best possible indoor lighting quality and aesthetic considerations. Avoid Design solutions that have a negative impact on access to daylight in the existing courtyard and seek solutions that have a positive impact on courtyard lighting and acoustics. Illuminance levels shall conform to IES recommended standards depending upon activity and indirect lighting methods shall be preferred for ambient lighting conditions (dependent on qualitative issues related to the luminous activities and program needs).

Security and hours of operation

For purposes of security, spaces should be configured so that the CSBR Offices and Labs can be zoned and secured separately from the classrooms, restrooms and vertical circulation which will be accessed from and controlled similarly to the main portion of the building. The normal hours of operation shall be considered to be from 6:00 A.M to 7:00 P.M. Monday through Sunday.

Sustainable Site and Landscape Considerations

The Green Roof Lab and Sustainable Landscape Demonstration Area(s) may be one contiguous or 2 separate areas and shall provide amenities to the mnZED Lab such as meeting and teaching areas, green roof and living wall demonstration and investigation and performance monitoring as well as recreational, permaculture, and organic gardening opportunities. Water features and rainwater harvesting demonstration can also be considered. Although not central to the project, opportunities exist for a more sustainable site overall (e.g., reconsider site amenities, water, vegetation, habitat, materials, paving, parking, bike racks, etc.)