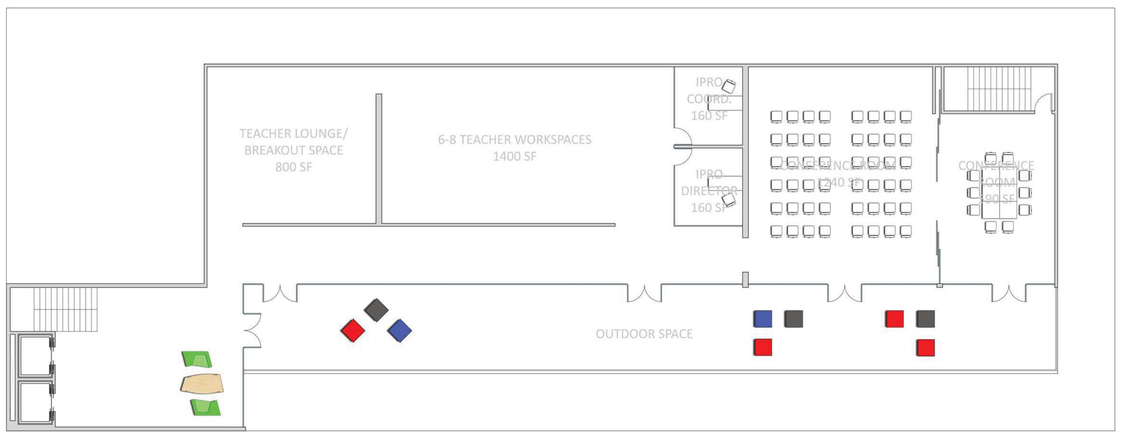
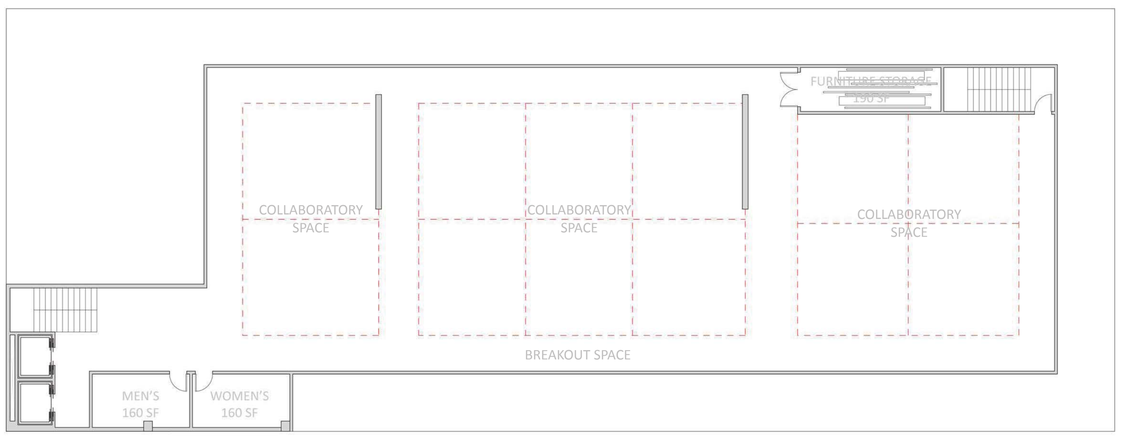
IPRO 337: Zero Energy Lab and Designing the IPRO Team Collaboratory Space

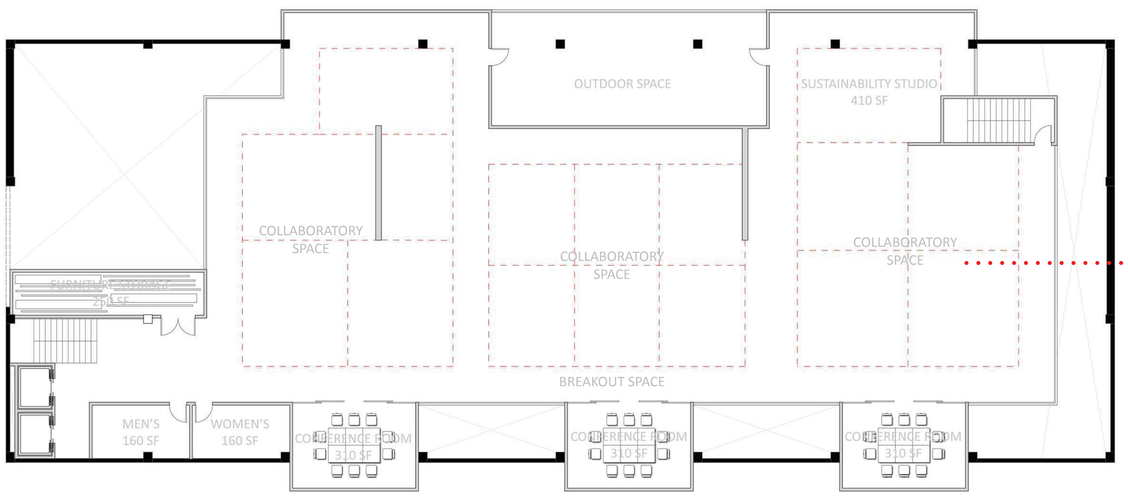
IPRO 337 is investigating the conversion of the existing CTA building on campus to serve as a dedicated IPRO facility. These boards summarize the results of our design efforts. In performing this work the team tapped a menu of sustainable energy ideas that have been researched by prior IPRO teams under the Zero Energy Lab banner. To symbolize IIT's commitment to sustainability, a number of these ideas have been considered in the proposed design. In particular, a vertical wind turbine developed by a dedicated sub-team of our IPRO will be highlighted in this presentation to demonstrate how such ideas can be showcased in a building's design.



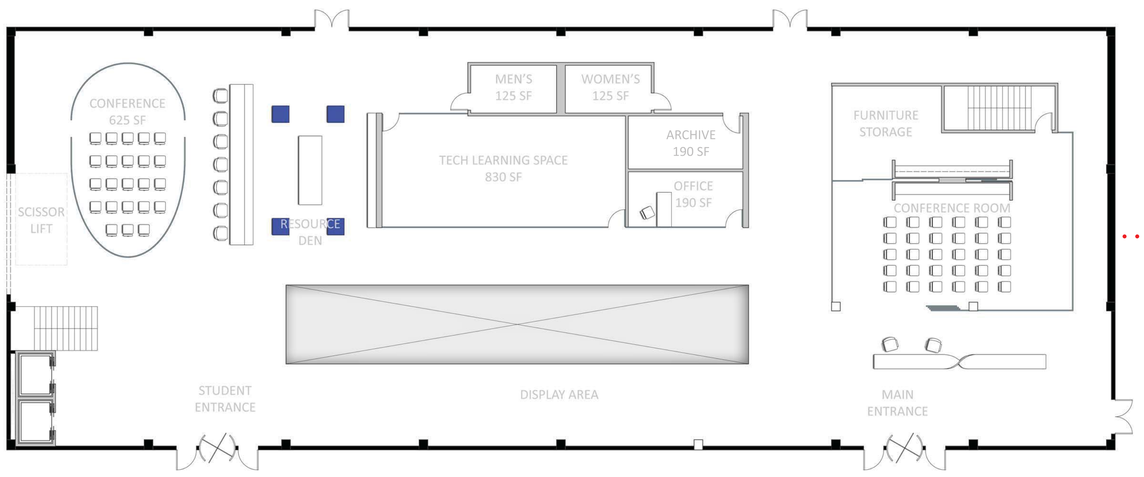
FOURTH FLOOR
1"=150'



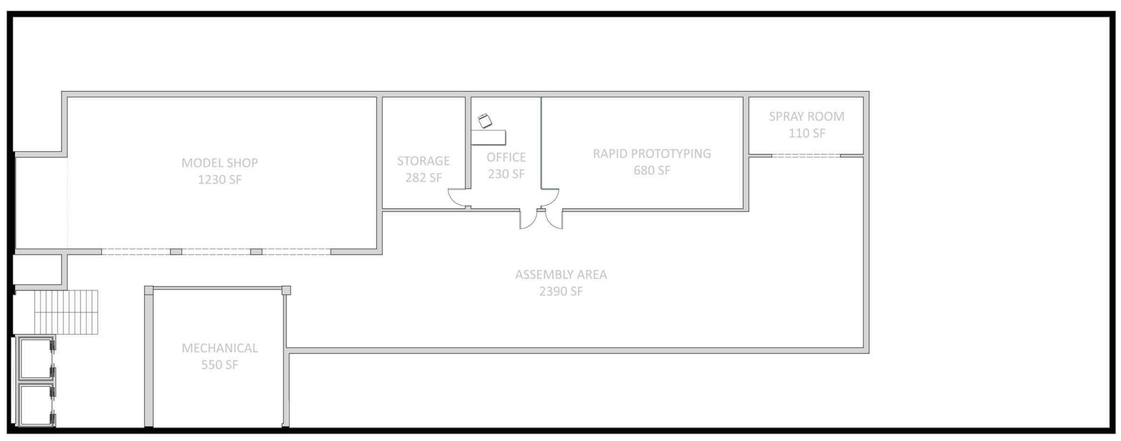
THIRD FLOOR
1"=150'



SECOND FLOOR
1"=150'



GROUND FLOOR
1"=150'



SUBLEVEL
1"=150'

The location of the CTA building is at the north east corner of the IIT campus. Its location at this corner makes it an ideal entrance to 'Innovation Alley,' a collection of facilities at IIT that foster creation.

The existing facility is a steel structure with a brick and glass enclosure. It currently holds maintenance and landscaping equipment.

PRELIMINARY RESEARCH

SURVEY

After reviewing the 'IPRO Space' survey, which brought results from 95% of current fall IPROs, our group reached 5 major conclusions that would be most influential in the designing process:

1) IIT needs a dedicated IPRO facility that reinforces its importance to the university.

2) IPROs need open, flexible workspaces to foster a productive environment.

3) IPROs need small, comfortable breakout areas with ready access to computers, whiteboards, and modeling/ prototyping and assembly spaces.

4) The IPRO program needs dedicated equipment and assembly space in its new facility.

5) The IPRO program needs assigned, secure storage for each IPRO team in the new facility.

INTERVIEWS

Our team conducted interviews with Thomas Jacobius, the Director of the IPRO program, and Robert Krawczyk, Architecture and Digital Design Professor, to learn more about the future of the IPRO program and prototyping. After these interviews, our design can better cater to the IPRO program as it changes, and can provide a good environment for creative design and fabrication.

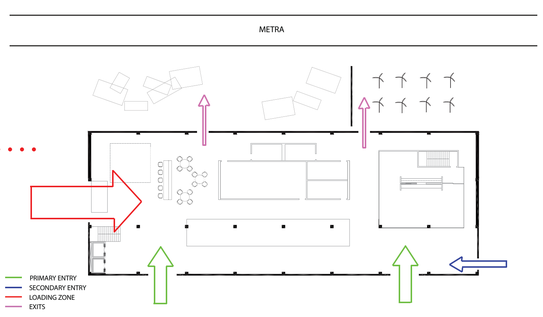
SITE VISIT

Our team also visited the new Innovation Center at the University of Illinois Chicago, to see how a collaboratory space might look. The Center had multifunctional spaces surrounded by breakout rooms and conference rooms, and included a small prototyping shop and offices. The connection and visibility between the large and small meeting spaces inspired our design to be able to create both large and small spaces based on IPRO need.

Program For IPRO Facility

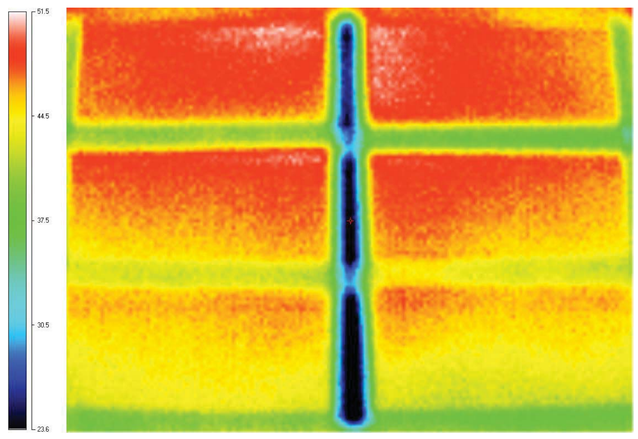
	Units (SF)	Quantity	Extended SF	Remarks/Description
1. Mess Space				
1.1 Prototype Shop	3000	1	3000	Separate Rapid Prototyping and Model shop
1.2 Prototype Shop Staff	100	1	100	
1.3 Staging/Assembling Areas	300	7	2100	One Per Track
1.4 Storage	125	7	875	One Per Track
1.5 Spray room	300	1	300	Glue, Mounting, Drying, Closed for Separate Ventilation
2. Wet Space				
2.1 Wet Lab - General Purpose	600	1	600	For General Clean up and Experiments / Non hazardous liquids
2.2 Wet Storage	200	1	200	
3. Collaboratory Space				
3.1 Collaborative Space				
CS1	400	16	6400	Divided between 7 tracks: Applied Research and Dev, Information Tech + Solutions, Process Improvement, Sustainability 1 +2, Service Learning 2, Venture
CS2	550	2	1100	
CS3	700	2	1400	
3.2 Flex studio	500	1	500	Mock up room for variable projects
3.3 Conference Rooms	550	6	3300	IPRO day, daily meetings, presentations, teleconference
3.4 Break out space	250	5	1250	Distributed Lounge
3.5 Sustainability Studio	800	1	800	Development of new sustainable techniques
4. Clean Space				
4.1 Main entry	400	1	400	Weather Guard, Seating, Maybe desk
4.2 Display Space	300	1	300	Strategic to entrance
4.3 Gallery	500	1	500	Exhibits, Prefunction
5. Supporting Space				
5.1 Restrooms	500	2	1000	Based on occupancy
5.2 Pantry/Prep	200	1	200	Near gallery and/or Gathering Area
5.3 Furniture Storage 1	500	1	500	Flexibility for Varying Functions + Large Gatherings / Knock
5.4 Furniture Storage 2	200	1	200	Down
5.5 Archival Storage	500	1	500	Past IPRO projects
5.7 Resource Lounge/Den	400	1	400	"Libraryesque"
5.8 Main Print Area	250	1	250	Staffed, can share staff with Multimedia Equipment Room
5.9 Supply Room	200	1	200	Main supplies
6. Tech Space				
6.1 Design-Learning Spaces	400	1	400	Misc electronics or assembling
6.2 Multimedia Equipment Room	400	1	400	Sound and Video Equipment
6.3 Multimedia Equipment Staff	100	1	100	Sign-out and Technician
6.4 Computer Area	500	1	500	Support IPRO work
7. IPRO Staff Space				
7.1 IPRO Director Office	180	1	180	
7.2 IPRO Coordinator Office	150	1	150	
7.3 Assistant Workspace	200	1	200	2 assistants shared workspace
7.4 Printing Space	150	1	150	
7.5 Workspace	600	1	600	6-8 Permanent IPRO teachers open work space
7.6 Faculty Meeting room	250	1	250	
7.7 Faculty Lounge	250	1	250	
Square Feet Subtotal			29555	
Circulation Factor		40%	11822	
Estimated Total Square Feet (subtotal + circulation factor)			41377	

The building has both a main entry for guests and for students, with secondary entrances at the back of the building and 31st street.

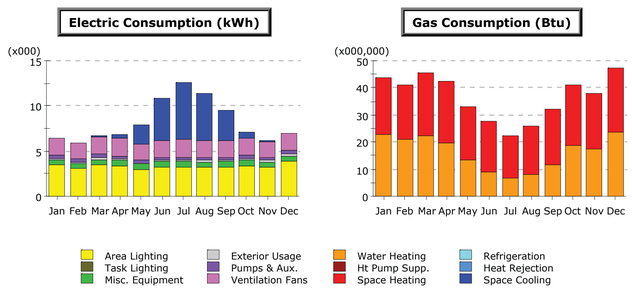


In order to help IIT in its endeavor to become the most Sustainable Urban Campus our team was tasked with making a Zero Energy Facility by adding Renewable Energy Technology and increasing the Efficiency of the existing building.

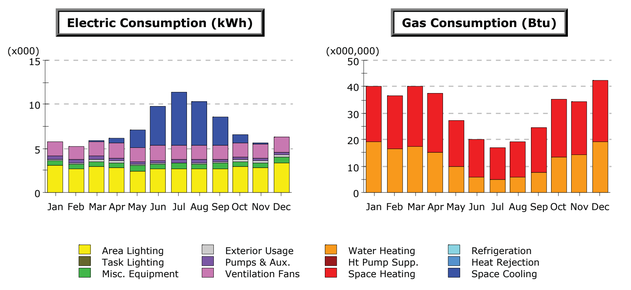
One sub-team of IPRO 337 was dedicated to analyzing the energy consumption of the CTA building. They produced an energy model of the building as it exists and as it will exist based on the team's designs, and were able to determine what energy improvements are possible.



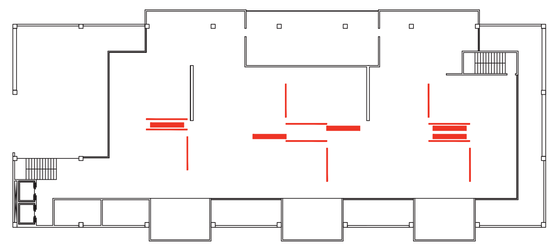
A thermal reading of the building shows where heat is gained and lost through the existing building windows.



An analysis of the existing electric and gas consumption for the CTA building, based on records.



An analysis of the projected electric and gas consumption for the dedicated IPRO facility, based on the new building and incorporating sustainable techniques.



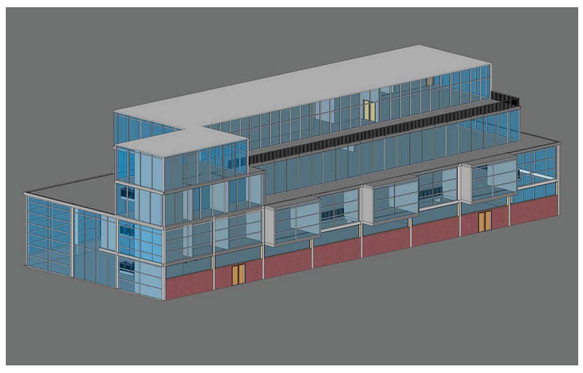
Moveable panel with mounted white board and pin-up space

Blank moveable panel for a projection background or pin-up space

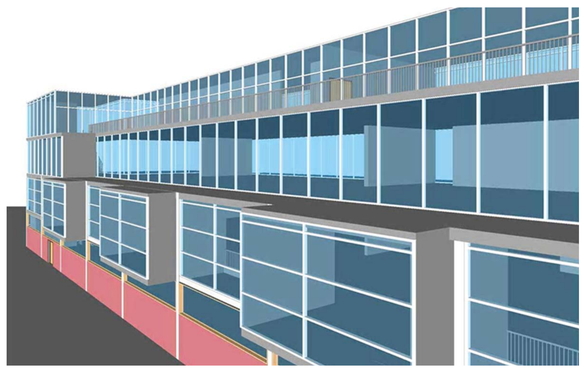
Moveable dividers with various sized storage spaces
'Ad Hoc' storage wall by Vitra.

Moveable panels and storage units provide IPRO tracks and individual IPROs with the option to work in a large group space or smaller 'break out' spaces.

IPRO 337: Zero Energy Lab and Designing the IPRO Team Collaboratory Space

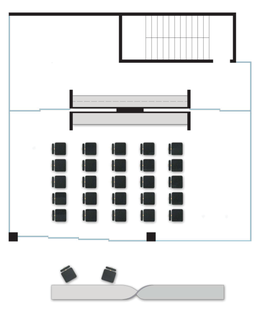


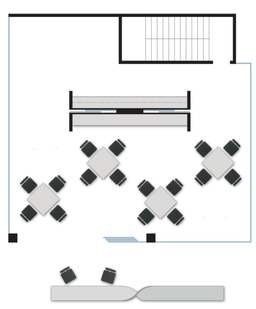
View of dedicated IPRO facility facing northwest. The glass facade allows clear sightlines into the collaboratory spaces.



View of dedicated IPRO facility facing southwest. The program of the building is pulled away from the facade, so the circulation is located on the exterior edges of the building.

The well lit circulation space around the building doubles as 'break out' space for the IPRO groups.

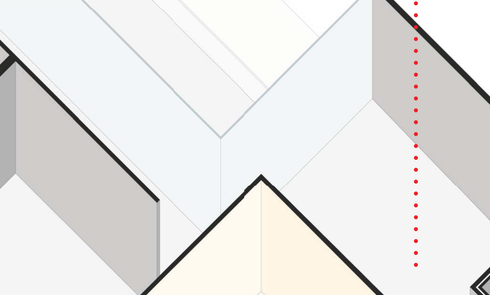




An arrangement of wind turbines developed by the ZEL add visual interest and help to power the building.

ELEVATOR SHAFT
ADMIN
COLLABORATORY SPACES
TECHNOLOGY LAB
PROTOTYPE SHOP

on-site-00: programmatic furniture example of front desk/ bench



Large conference/ reception space can be divided into two conference rooms for IPRO day.

Combined teacher workspace and meeting space.

Outdoor space provides access to direct daylight and views of the campus.

Faculty reception area with views onto balcony and campus.

Fourth Floor 'Staff Level'
Scale: 1" = 100'

A felt ceiling treatment provides an environmentally friendly way to insulate the sound in the open spaces.

Plan of felt ceiling treatment with lighting arrangment

Secti on through felt ceiling treatment with lighting arrangment

Ground floor gallery has views into prototyping shop below.

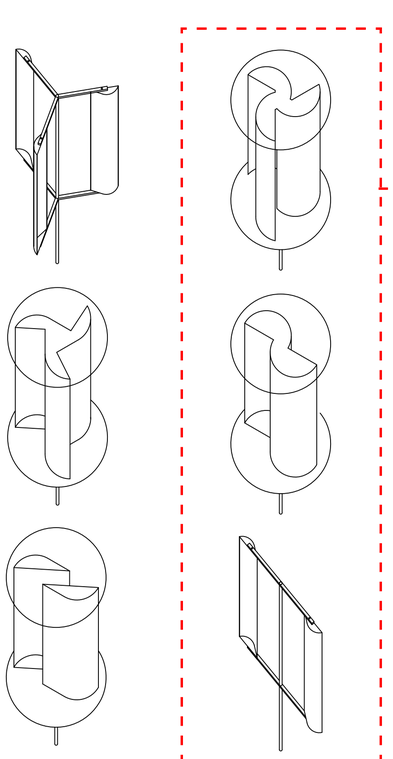
Conference/ performance space.

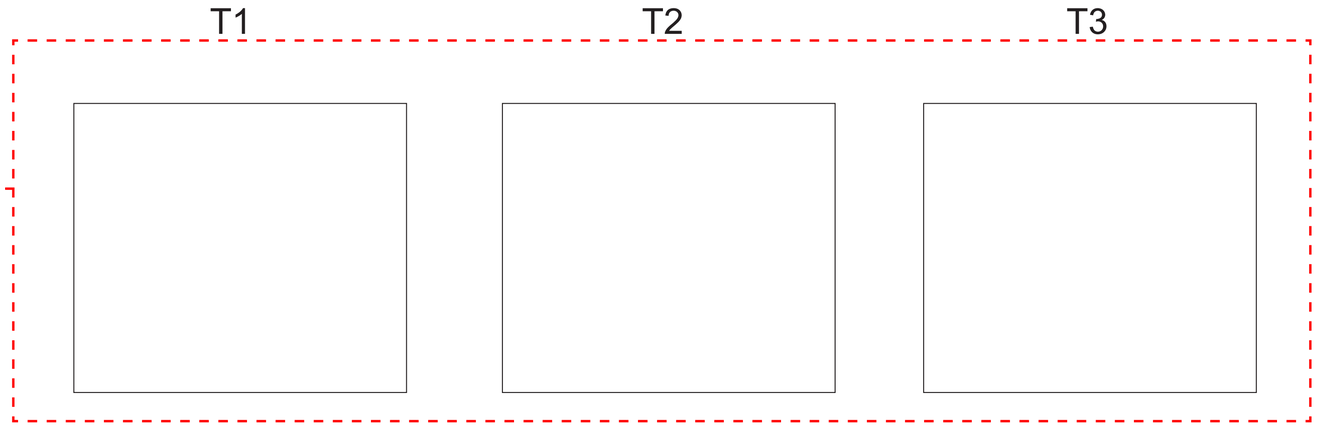
Ground Floor 'Reception'
Scale: 1" = 100'

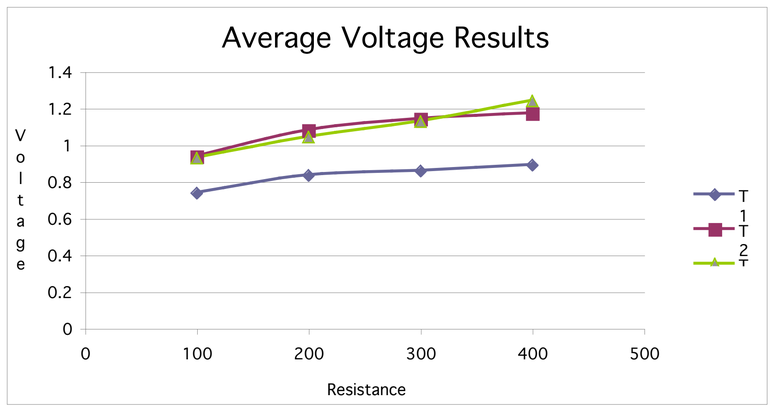
IPRO 337: Zero Energy Lab and Designing the IPRO Team Collaboratory Space

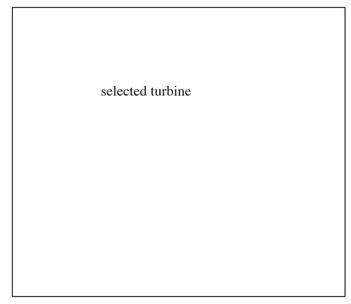
Turbine Design Development

Our turbine design began at the beginning of the semester when we began our research on vertical axis wind turbines. We looked into the various types of turbines and sketched out a few designs. Of the 6 shown here, we chose 3 to further develop, construct, and test for efficiency. Once we constructed the 3 mock-ups, we ran the test and the results are shown below. We then selected the most efficient wind turbine for further development and full-scale construction.



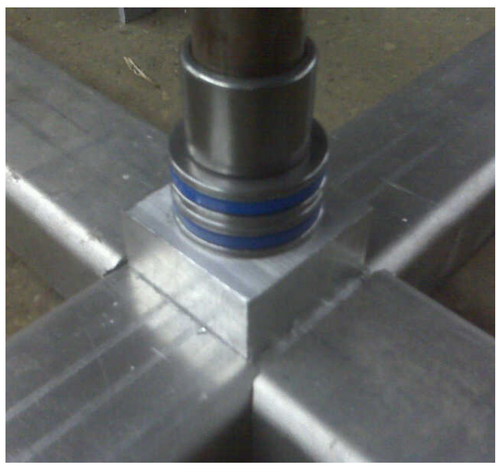


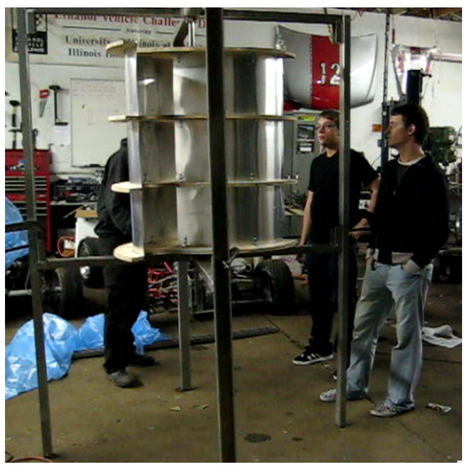




Turbine Construction

Once we selected the turbine for construction, we immediately developed the connection details and ordered the necessary parts. When the parts came in, we began the construction and followed through until completion as shown below.





Future Turbine Implementation

Although still at a conceptual stage, we began to think about creating a sort of icon for the CTA building while implementing the wind turbines. By constructing the frame work as we have, the turbines are easily “stackable”, allowing for more energy production while using the same footprint. This also could create a visual effect that can then teach others about the processes and technologies that are implemented into the CTA building.