

Lab Exercise #2

“Designing for Site, Climate, and Performance”

For this lab exercise assignment you will design a passively heated and cooled building for your assigned site and climate. In order to successfully accomplish your design goals you will complete exercises associated with:

- ◆ finding an appropriate precedent,
- ♣ setting performance goals,
- ◆ schematic building design process, and
- ♥ critique and evaluation of your building's design.

Your Lab Exercise presentation will consist of six parts:

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|--|---------|
| (1) Introduction—climate, site, building type, group members | [0 pts] |
| (2) Precedent analysis [Question A] | [5 pts] |
| (3) Setting energy and carbon goals [Question B] | [4 pts] |
| (4) Building design and redesign [Question C] | [8 pts] |
| (5) Design critique [Question D] | [1 pt] |
| (6) Conclusion | [2 pts] |

[Up to 5 additional points may be awarded based on the quality and clarity of your presentation.]

Investigation questions:

- (A) Is there a low-energy building with a similar program and climate as yours?
- (B) What are the energy and carbon goals for your building?
- (C) What is an appropriate passive design for your site and climate?
- (D) How successful is your design?

Use appropriate methods to investigate each of these questions.

You will present your Case Study in lab on **October 12** as a digital slide show, limited to 20 slides and 15 minutes. Points [2 pts] are deducted for exceeding these limits.

Annotate all your digital slides to make your presentation clear to all readers.

Suggested methods (use those appropriate to your Case Study):

Question A—Is there a low energy building with program and climate similar to yours?

(1) Use the filters in the *COTE Top Ten Data Map* <<https://network.aia.org/blogs/april-ovens1/2020/04/15/cote-top-ten-design-datamap>> to search for a climate/program match for your building. An alternate source is *High Performing Buildings* magazine <<https://www.hpbmagazine.org/case-studies/>>.

(2) Critique the selected precedent building based on the **top three heating** strategies and **top three cooling** strategies for your assigned climate as suggested by the *Climate Consultant* Psychrometric Chart.

Question B—What are the energy and carbon goals for your building?

(1) Use *Zero Tool Baseline and Target Setter*, a free on-line calculator at <<http://www.zerotool.org/zerotool/>> to determine your building's EUI (Energy Use Intensity) goal for complying with Architecture 2030's goal of 80% reduction in 2020. **[80% is minimum, 100% is ideal]**

(2) Critique the performance of your design in terms of energy use and associated greenhouse gas (GHG) emissions. What should you change?

(3) Demonstrate how much electricity can be generated on your site by using the PV-Watts calculator <<https://pvwatts.nrel.gov/>>. Show how many windturbines (and what size) it would take to generate an equal amount of electricity? Use Axowind's calculator <<https://www.axowind.com/energy-calculator/>> or similar. Can you generate sufficient electricity on-site to meet the EUI target (Annual energy = EUI x bldg sqft)?

(4) Map the sources of building materials for your building. The energy use during extraction, processing, construction, and transportation causes carbon emissions that comprise the embodied carbon for your building.

(5) Consider local and carbon smart materials as alternatives. See <<https://materialspalette.org/palette/>> for choices. How have you changed your design?

Question C—What is an appropriate passive design for your site and climate?

(1) Use the lessons you learned from LabX-1 to create a climate-responsive schematic design **[HINT: use a 4'x4' floor planning grid for your schematic design which will make using SBEED in LabX-3 more satisfying.]** for your assigned building according to the instructions in *InsideOut* exercises D1.0 & D1.1 and guidance from the *Climate Consultant* Psychrometric Chart.

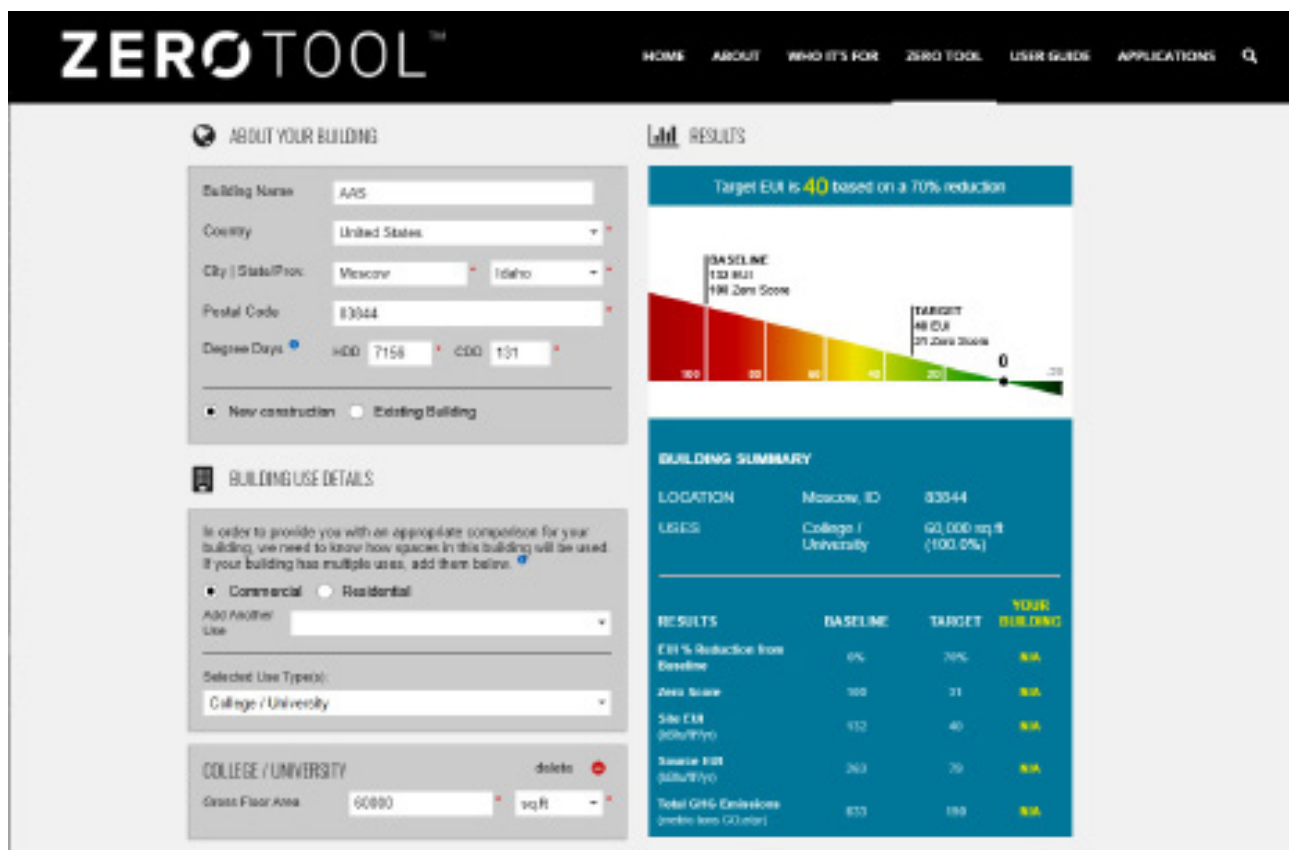
(2) Do *InsideOut* exercises D1.2-D1.4. Document your site model with its solar envelope constructed on your site model or in SketchUp.

(3) Do *InsideOut* exercises D1.5-D1.9 for your proposed design to determine performance for components of your schematic design. Adjust the component designs as needed.

Question D—How successful is your design?

(1) Do *InsideOut* exercise D1.10 to critique your schematic design efforts.

***InsideOut* exercises C1 through D1 are available as references .**



Typical report of results from Zero Tool. The energy use goal for your building is reported as site EUI. It compares your Zero Tool target and the baseline (average) energy use of your building type. The reported EUIs are annual number, therefore kBtu/sqft/yr. The target EUI set above is 40 kbtu/sqft/yr.