LabX #4
"Final Design Performance Evaluation"

For this laboratory exercise you will be expected to make a ***Sketch-Up*** or ***Revit*** model of your building and use the appropriate ***Sefaira (only works with Sketch-Up Pro) or Cove Tool*** plug-in to analyze it and inform you of appropriate changes associated with:

- ♣ building skin design,
- ♦ glazing specification and shading device design,
- ♥ ventilation strategies, and
- ♠ daylighting strategies.

Your Lab Exercise presentation will consist of six parts:

(1) Introduction [Group & Building]	**[0 pts]**
(2) Thermal analysis [Question A]	**[5 pts]**
(3) Daylighting analysis [Question B]	**[5 pts]**
(4) Carbon analysis [Question C]	**[5 pts]**
(5) Building redesign [Question D]	**[3 pts]**
(6) Conclusion	**[2 pts]**

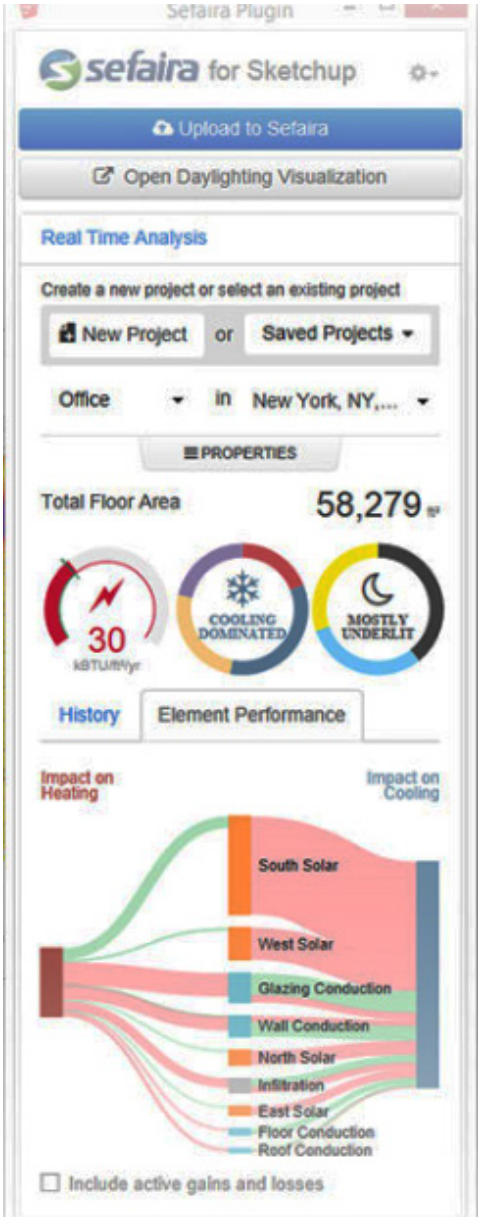
[Up to 5 additional points may be awarded based on the quality and clarity of your presentation.]

Investigation questions:

(A) How well does your building perform thermally?
(B) Have you designed an effective daylighting scheme?
(D) Have you met your carbon goal?
(C) What changes in design can improve performance?

Use appropriate methods to investigate each of these questions.

You will present your Case Study in lab on **November 30** as a digital slide show, limited to 20 slides and 15 minutes. Points [2 pts] are deducted for exceeding these limits.



Sefaira dashboard gives EUI (30kBtu/sqft/yr for the building modeled here) and shows the influence of each building element on heating and cooling performance.

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

Suggested methods (use those appropriate to your Lab Project):

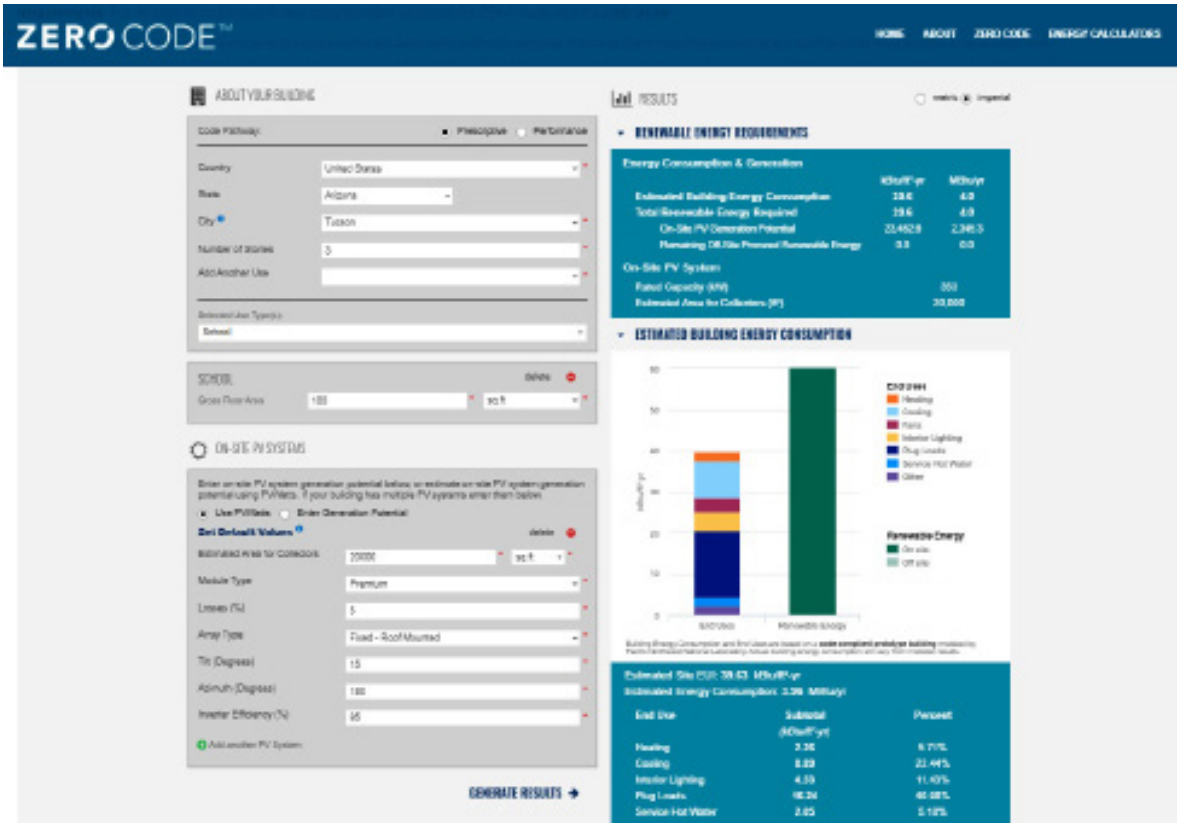
Question A—How well does your building perform thermally?

(1) Use the appropriate ***Sefaira or CoveTool*** plug-in with ***Sketch-Up*** or ***Revit*** to model your entire building's thermal performance.

(2) ***Sefaira or Cove Tool***'s dashboard will give your building's Energy Use Intensity (EUI) in kBtu/sqft/yr. Compare this EUI with Architecture 2030's Zero Tool, a free on-line calculator at <https://zerotool.org/zerotool/> that you used in LabX-2. Compare the baseline and the 80% target for your building type with your ***Sefaira or CoveTool*** calculated EUI.

CoveTool dashboard gives EUI (29.19kBtu/sqft/yr for the building modeled here) and shows the influence of each building element on heating and cooling performance.

(3) Use the free Zero Code Calculator <http://zero-code.org/energy-calculator/ > to determine if on-site or off-site alternative energy generation can make your building net-zero energy. Typical Input and results screen on next page. Tick the Use PV-Watts box as the example indicates to calculate site energy generation using PVs.



Question B—Do you have an effective daylighting scheme?

(1) Use the appropriate ***Sefaira or CoveTool*** plug-in with ***Sketch-Up*** or ***Revit*** to model your entire building's daylighting performance.

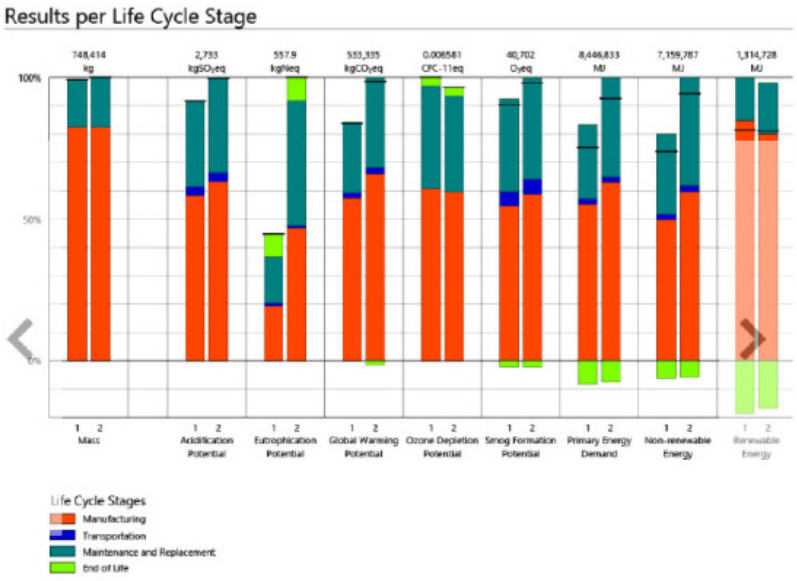
(2) For each room *Sefaira or CoveTool* will construct daylighting visualizations for Daylight Factor (DF), Spatial Daylight Autonomy (sDA), and Annual Sunlight Exposure (ASE).

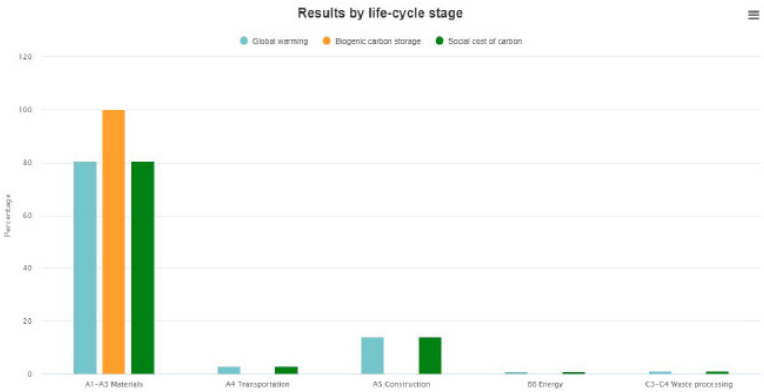
(3) Critique the performance of your design in terms of appropriateness of the daylighting provided for each room. What should you change?

Question C—Have you met the carbon goals you set in Lab-X 2?

(1) Use either ***Tally*** or ***OneClickLCA*** to calculate the embodied carbon in your building. ***Tally*** uses your ***Revit*** model as a graphic interface. Your TA will tell you how to obtain it for free. ***OneClickLCA*** is a cloud-based numeric input program that doesn't require a digital model. A free student licence is available at <https://www.oneclicklca.com/support/faq-and-guidance/get-one-click-lca/student-license/>.

(2) Did you meet your goal? What materials do you need to change in order to meet or exceed your embodied carbon goal?





Tally output (left) vs. OneClick (right) output tabulated by life-cycle stage. The global warming potential gives the embodied and operational carbon for each stage—see Tally's Global Warming column in kgCO2eq and OneClick's Global Warming percentage (the baby blue columns). (below) Woodworks calulator results.

(3) Find out how much carbon is stored in your building structure. Use WoodWorks Carbon Calculator (not the Carbon Estimator) <https://www.woodworks.org/resources/wood-works-carbon-calculator>. How significant is this result?

Question D—What design changes can improve performance?

(1) Make appropriate changes to improve performance in your digital model. Use feedback from ***Sefaira or CoveTool*** to adjust and optimize your design changes.

(2) Report the final thermal and daylighting performance of your building. How green is it?