### Project 1 Instructions

The 1951 [Farnsworth House](https://www.loc.gov/resource/hhh.il0323.sheet/?sp=1) by Mies van der Rohe is one of the icons of Modern architecture and was instrumental in disseminating the International Style to the world. The extent of its influence on later architecture would be hard to overstate.

It is a stunningly beautiful building that was built without regard for its energy performance. Located in Plano, Illinois near Chicago, the building envelope is eminently ill-suited to the climate it is set in as will be immediately apparent from perusing the drawings located in the assignment folder. Herein lies your task:

Add a two-bedroom, one bath, two car garage addition(s) to the Farnsworth house while “remodeling” the original to bring the whole building up to Passive House standards.

You may choose to put the house in any North American climate zone for which there are [PHIUS](https://www.phius.org/phius-2015-new-passive-building-standard-summary) standards.

This is an intentionally wicked problem; not unlike many you will likely face in actual practice, though perhaps more acute than most. While this is not a design course, I do expect you to consider the aesthetic ramifications of what you are proposing and be able to speak to the trade-offs necessary in your quest to bring Passive House performance to a building where that was never the original intent.

While the problem is a difficult design challenge, I don’t want you to get hung up on that part of the work. You should quickly arrive at a general approach you’d like to explore, then use the tools iteratively through the various project stages test hypotheses as you proceed and refine your approach.

A Sketchup model of the house downloaded from the Sketchup 3d Warehouse is in the project folder for you to start from.

See the course syllabus for due dates of the individual sections of the project.

## **P1.1**

***Starting from the template I provide***, create your Open Studio model of the existing house as well as the proposed addition. Focus on the building form and envelope at this phase. Apply your initial proposed constructions to the envelope of the proposed building and run a simulation to test that the model is running properly. Set up an Ideal Loads HVAC system to look at heating and cooling loads at this stage.

Then, study how you can improve the building’s performance through parametric analyses related to the form and envelope.

Turn in a one-page summary of your findings.

## **P1.2**

Refine your proposal for the proposed building envelope (consider materials, constructions, fenestration area and shading in particular), using metrics to measure improvement that you have at your disposal. A useful guide for PH thermal envelope performance may be found here:

<https://www.phius.org/what-is-passive-building/passive-house-faqs>

Then, study how you can improve the building’s performance through parametric analyses related to the envelope.

Turn in a one-page summary of your findings.

## **P1.3**

Model internal loads for your building to reflect the proposed use and your likely load conditions. Experiment with different options on use patterns and lighting to evaluate how these affect the overall performance of the building.

Turn in a one-page summary of your findings.

## **P1.4**

Add appropriate ventilation based on ASHRAE 62 and infiltration meeting Passive House requirements (we will use 0.6 ACH50 in conditioned space) to your model. This [video](https://youtu.be/fBNSMuZ_V0I) provides guidance. See [this post](https://energymodeldesignprocess.wordpress.com/2013/09/11/infitration-conversion/) on the class website for instructions on how to convert from pressurized blower door test values to natural air changes.

Create a VRF HVAC system (with COP of 5.0 for both heating and cooling) and a dedicated outdoor air system (DOAS) with ERV for your model. I suggest using the *VRF with DOAS* measure via the “Apply Measure Now” command. Instead of including the ERV that the measure creates add one to the air loop from the library, which will have performance values in line with PH requirements (the one the script creates is far too inefficient). See explanatory video [here](https://youtu.be/tKYYLuo9L40).

~~Add a water-heating system per Dason’s example.~~

Turn in a one-page summary of your findings.

## **P1.5**

Add daylighting to at least one daytime-occupied zone and evaluate the energy savings that can result. Run some parametric studies to test how this performance could be improved and impacts the overall building. This [video](https://www.youtube.com/watch?v=7YuNRDNdYHI&feature=youtu.be) provides guidance.

Add a grid-tied photovoltaic solar system to your project to try to achieve net-zero energy status.

Turn in a one-page summary of your findings.

## **P1 Report**

Compile your findings from each portion of the project updated with any revisions you have since made, and write a brief overall summary critically examining your results and how you might approach it differently if you were to execute the project again with the knowledge and experience you now have. Prepare a presentation for the class of no more than 10 minutes detailing your findings, your Passive House analysis and other interesting aspects of your findings.