# **Carnegie Mellon University**

#### Building Energy Simulations (Part II)

Dr. Miguel Martin

# Learning objectives

- 1. Perform building energy simulations
- 2. Visualize results of simulations
- 3. Co-simulations with a HVAC control system

#### References

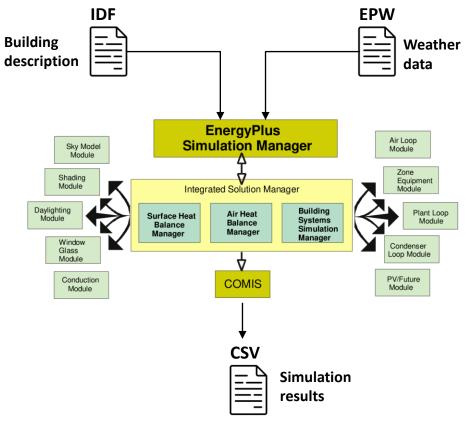
Garg, Vishal, Jyotirmay Mathur, and Aviruch Bhatia. "**Building Energy Simulation : A Workbook Using Designbuilder**". Second edition. Boca Raton, FL ; CRC Press, Taylor & Francis Group, (2021).



# How do we perform building energy simulations?



# **EnergyPlus simulation engine**



#### EP-launch



#### Python code

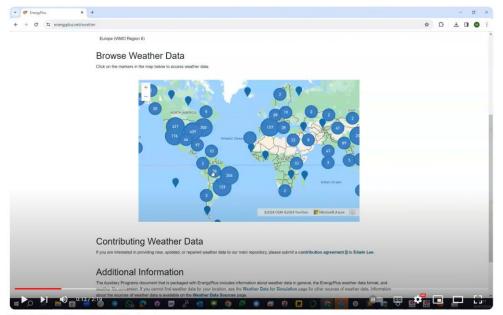
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- + '--readvars' # included to create a .csv file of the results
- + f'--output-directory "{output\_relative\_directory}" '
- + f'--weather "{epw\_relative\_filepath}"
- + f<sup>'''</sup>{idf\_relative\_filepath}<sup>'''</sup>

#### $print(cl_st)$

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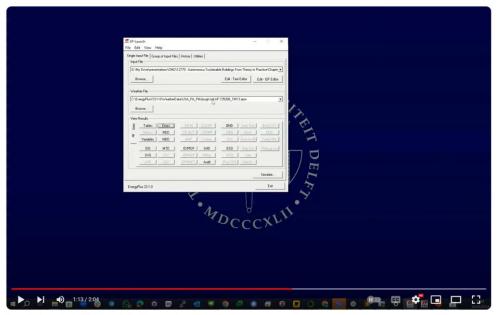
#### **Collect weather data**



**Tutorial EnergyPlus - Collect Weather Data** 

#### https://youtu.be/Cn8vhfg8mBA

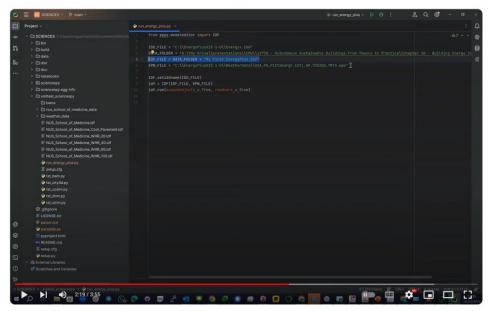
## Perform simulations using EP-launch



Tutorial EnergyPlus - Perform Simultions using EP launch

#### https://youtu.be/sc85BYxloq0

### Perform simulations using Python code



Tutorial EnergyPlus - Perform Simultions using Python

https://youtu.be/X6fFSZGPOxE

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#### How do we visualize results of simulations?



### **Define output variables**

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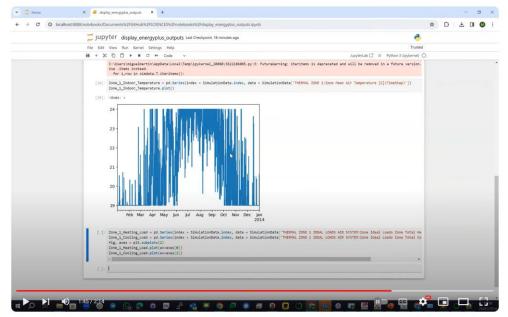
Tutorial EnergyPlus - Define Output Variables

#### https://youtu.be/FhcLGJsvtt4

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### **Plot the results**



Tutorial EnergyPlus - Plot Outputs of EnergyPlus Simulations using Jupyter

https://youtu.be/SAzmLr638Qc

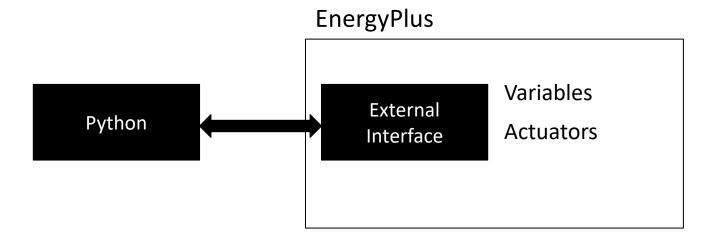
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# How do we co-simulate the building energy model with an HVAC control system?

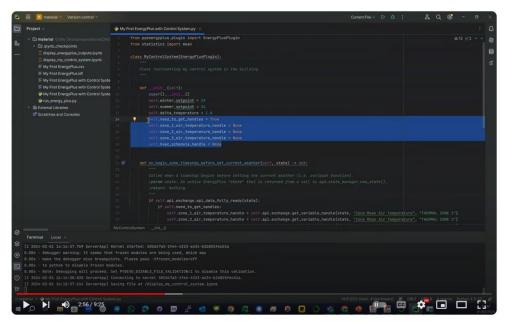


# **Co-simulation with EnergyPlus using Python**





### **Co-simulation with HVAC control system**



Tutorial EnergyPlus - Install Python EnergyPlus Plugin and Co simulate HVAC control system

https://youtu.be/si4sYe9Gktk

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