# Fundamentals of EnergyPlus for dynamic Building Energy Simulation (BES)

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Duration: 12h

## Abstract

This course addresses several key questions: How can we approximate the "real" energy consumption of a building? How can we optimize design choices for the building envelope to control the energy balance? How do we assess the effect of thermal inertia under varying internal and external conditions? These questions are central to the work of an Energy Modeller, an emerging figure in the building industry that reflects the growing importance of dynamic simulation for advanced energy design.
The course is intended as a guide to understanding the processes involved in Building Energy Simulation (BES) using the widely recognized EnergyPlus software. Additionally, the simplified tool FREDS, which utilizes EnergyPlus as its core engine, will also be introduced.

## Program

Introduction to dynamic simulation and examples (3h)

- Differences between steady-state, quasi-steady-state, and dynamic approaches
- The dynamic approach and energy balance
- Wall dynamics and the electrical analogy
- Impact of weather files

Modeling the building envelope in EnergyPlus (3h)

- Graphical interface: EnergyPlus-Sketchup
- Defining a workflow

- Modeling a single-zone system and initial dynamic simulations in free-running mode
- Modeling tips & tricks

Windows, schedules, internal gains, Energy Management System (3h)

- Modeling windows and shading devices
- Schedules in EnergyPlus
- Adding internal gains from occupants
- Adding artificial lighting
- Adding additional electrical loads
- Adding infiltration/natural ventilation
- Energy Management System

Simplified simulation with FREDS, data post-processing (3h)

- FREDS
- EnergyPlus outputs
- Tools for post-processing results
- Critical analysis of simulated results