universität innsbruck
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Introduction to OpenStudio/EnergyPlus

Get started

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OpenStudio Application Suite

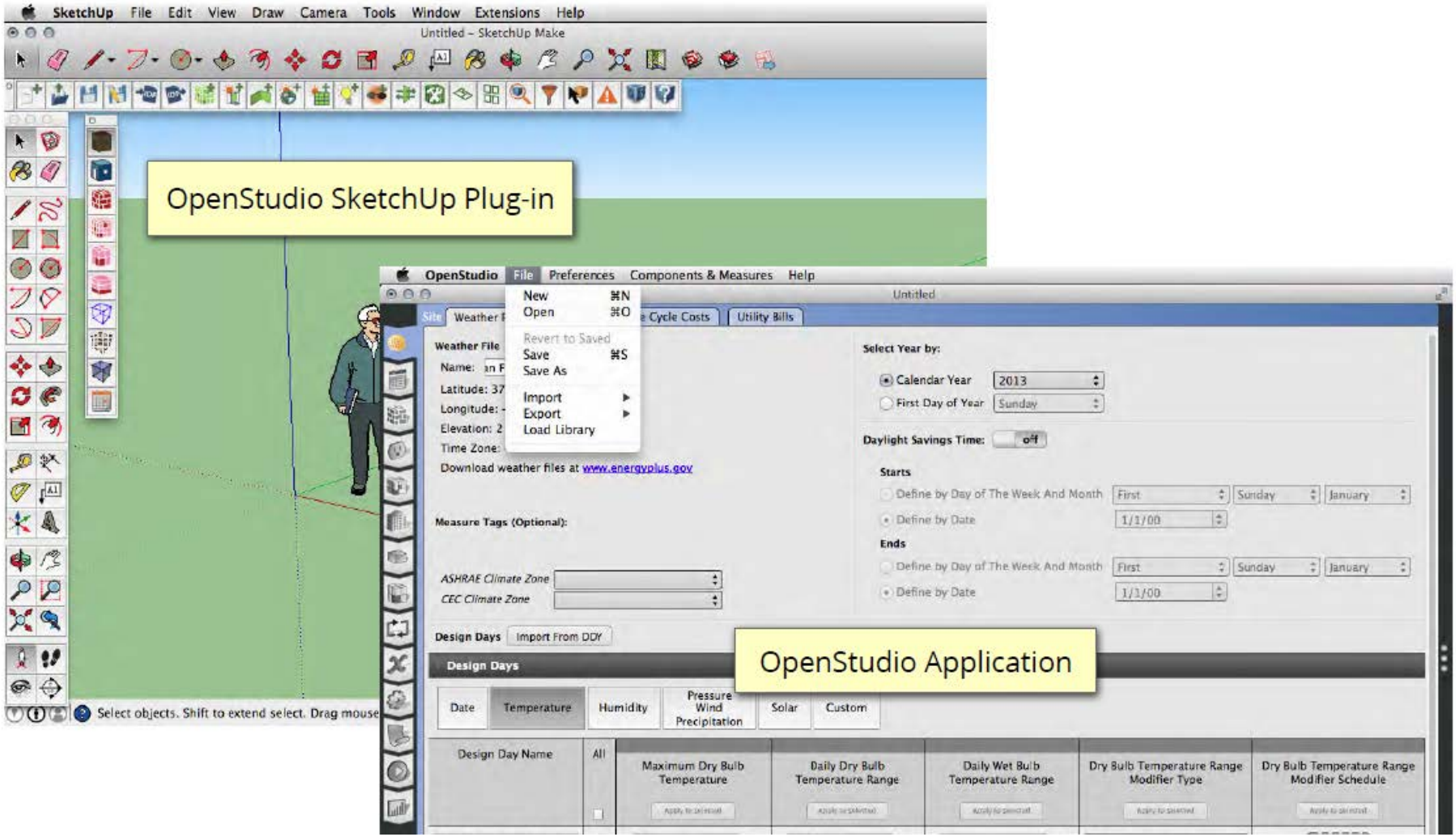
*OpenStudio is a **cross-platform** (Windows, Mac, and Linux) collection of software tools to support **whole building energy modeling using EnergyPlus** and **advanced daylight analysis using Radiance**.*

OpenStudio is an open source project to facilitate community development, extension, and private sector adoption. OpenStudio includes graphical interfaces along with a Software Development Kit (SDK).

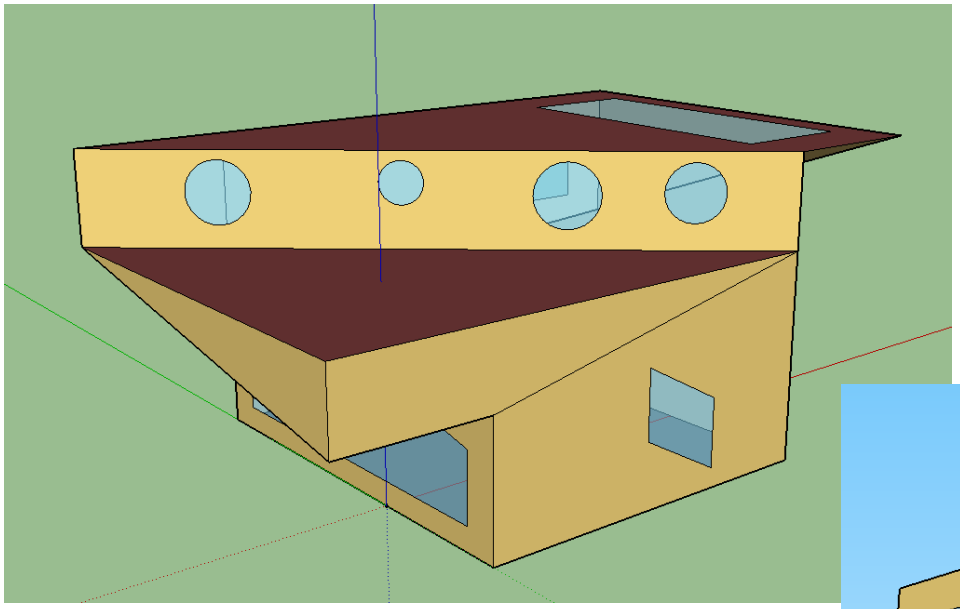
What is OpenStudio?

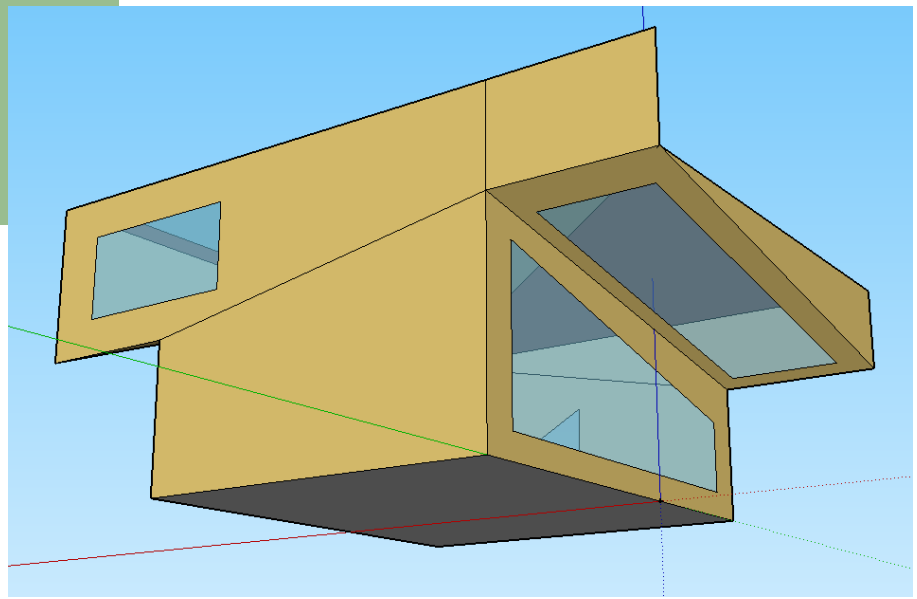
https://www.youtube.com/watch?v=ovLt4-q_UEg#t=96

The working environment



Flexible building geometry is possible…





Open Studio „Ecosystem“

Plug-in for SketchUp

- Create geometry and shading
- Import and apply resource templates
- Cofigure dayligth analysis
- Assign OS spaces and thermal zones
- Assign Ideal Air loads and thermostats

→Complete building form and fabric

OpenStudio Application

- Add detail/ refine inputs in a more granular way
- Import and assign constructions from BCL
- Define and configure HVAC / SHW systems and controls
- Configure simulation run details
- Configure output variables

→ Complete base model description

Open Studio „Ecosystem“

Run Manager

Result Viewer

- Provides graphical views into detailed, sub-hourly results
- Create multivariate time series line plots
- Create single variable 2D flood plots

List of current Features in OpenStudio

- http://nrel.github.io/OpenStudio-user-documentation/getting_started/features/

Connection to powerful engines

EnergyPlus (vers. 8.8)

Radiance (vers. 5.1)

- Same steps as calculation energy demand
- Validated lighting analysis and visualization tool
- Use OpenStudio to generate daylit space configuration
- Specify lighting power, sensor location and control methods
- OS: Run Radiance, calculate lighting schedules, Run E+
- Generate falsecolour and daylight autonomy plots
- NO IES files needed, focus on natural light contribution
- DONT replace detailed lighting design

Building Component Library (https://bcl.nrel.gov)

Cloude ressource (Component/Measures)

External source for re-usable components and measures

Building Component Library - Components

- Statndardized definitions of mnodeling components
- Stored remotely in NREL BCL
- Used by OS App for assigning constructions
- Linked to NREL Technology Performance Exchange

Building Component Library – Measures

- Standardized definitions of a model change
- Stored remotely on NREL BCL
- Used by OS App to extend OS
- Can be user defined/ edited

Measures

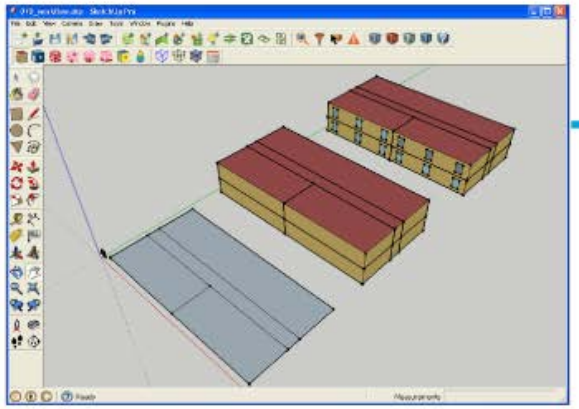
Open Studio Measures

EnergyPlus Measures

Reporting Measures

- Can extend the OS Application by accessing the OS API using Rhuby scripts
- Interacts with users through arguments
- Can be public or private
- Self writeable

OpenStudio Workflow



Quickly develop the building geometry using the **OpenStudio SketchUp Plug-in.**

Envelope

Baseline

Edit and create spaces, thermal zones, HVAC systems, schedules, loads, constructions, and more using the **OpenStudio Application.**

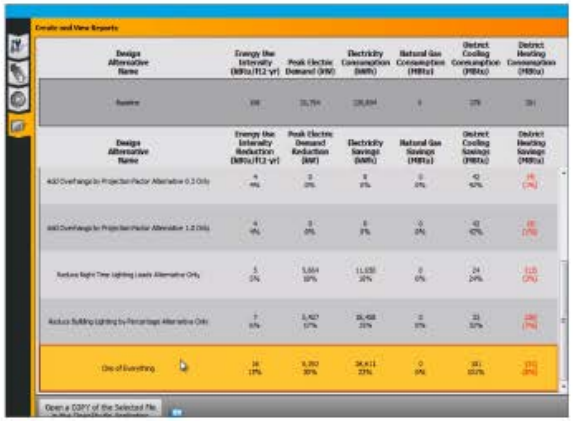
ParametricAnalysisTool (PAT) enables drag-and-drop energy efficiency measures to alter the baseline model and create design alternatives.

Additional Inputs

The **Building Component Library** (BCL) provides an online source for standardized model inputs and energy conservation measures.

Measures

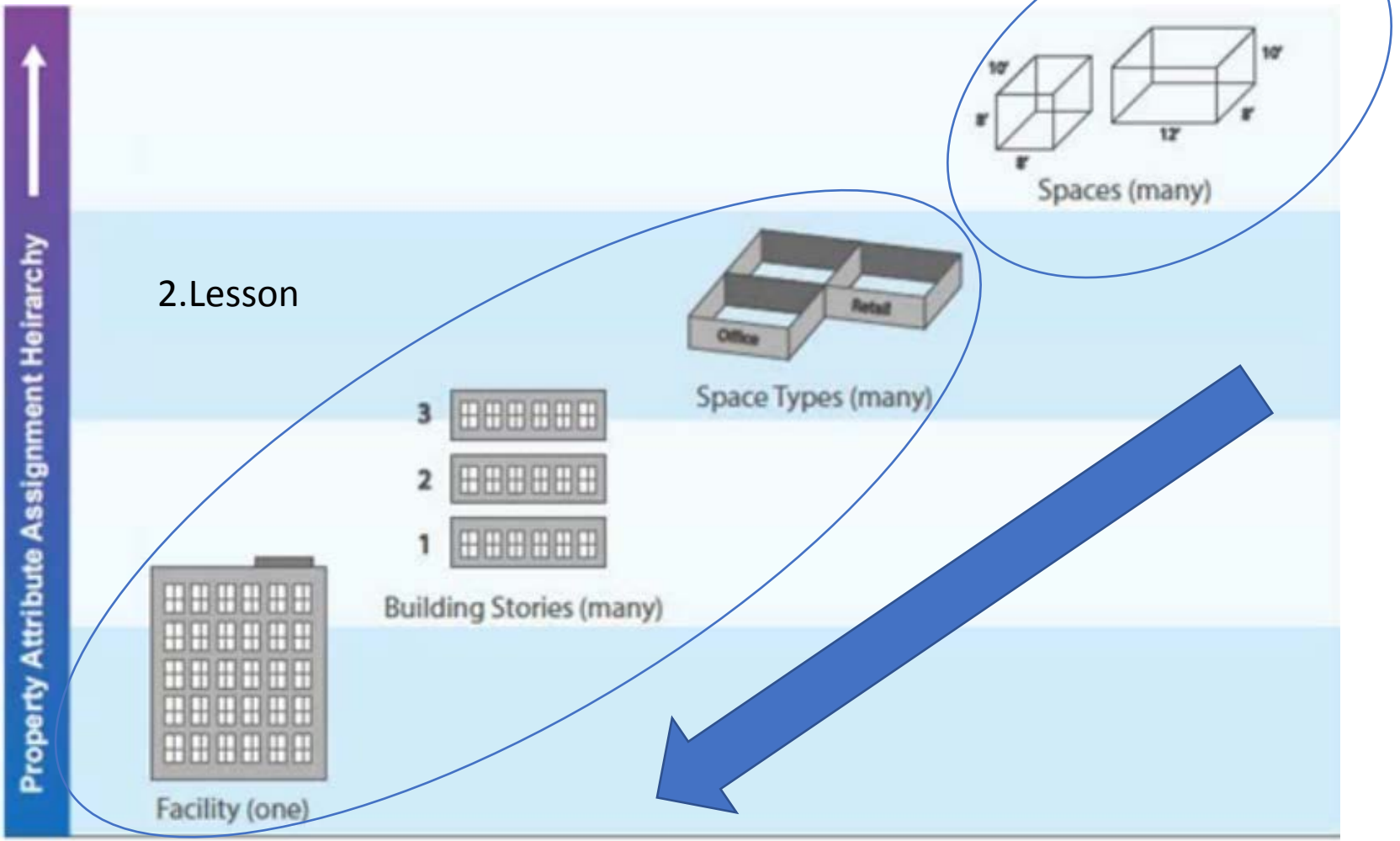
Energy conservation **measures**, reporting measures, and quality control measures are available in the OpenStudio application and in PAT.



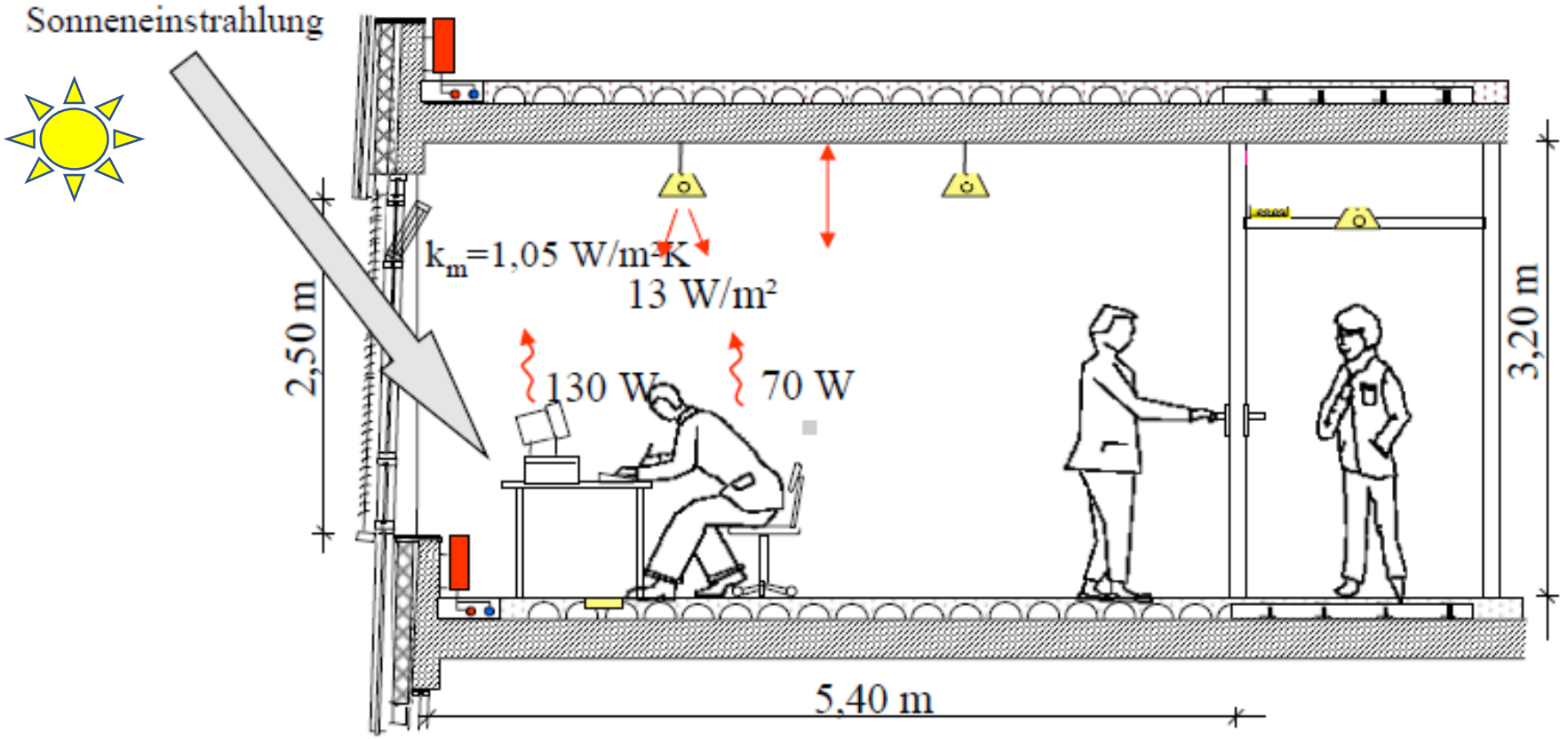
PAT performs life cycle cost analysis of design alternatives, runs automated quality checks, and packages simulation results for upload to EDAPT.

OpenStudio Model hierachy

1.Lesson

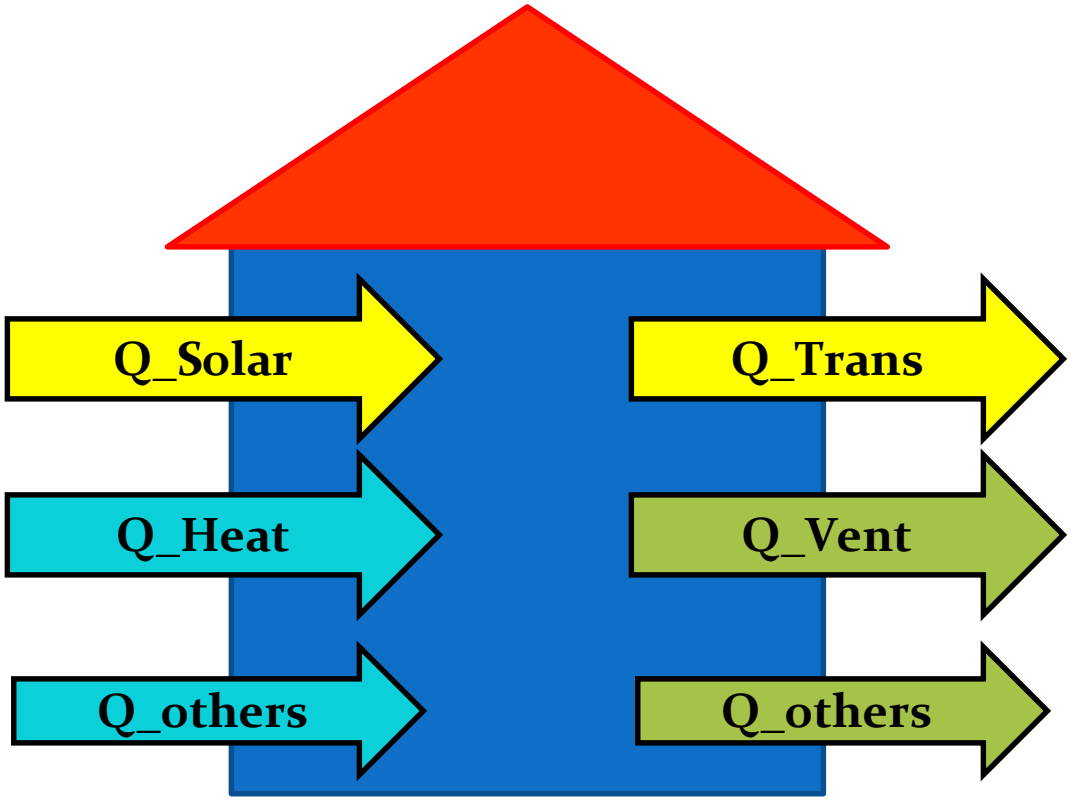


Typical gains in an office space



- Gains by sun radiation
- Gains by persons in the room
- Gains by Equipment (PC,…)
- Gains by artificial lighting

Overall energy balance of a building envelope



Wins:

- solar gains (passive)
- heat gains (active)
- other gains (electricity, persons,...)

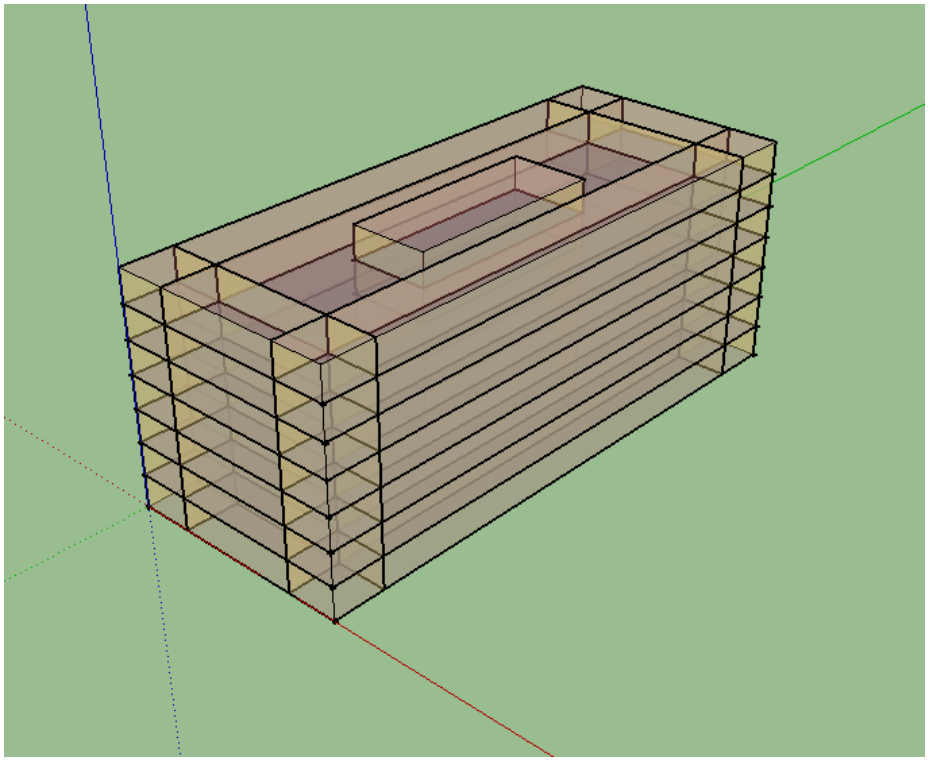
Losses:

- transmission losses
- ventilation losses
- other losses (infiltration,...)

Floor plan GF + UG 1-7

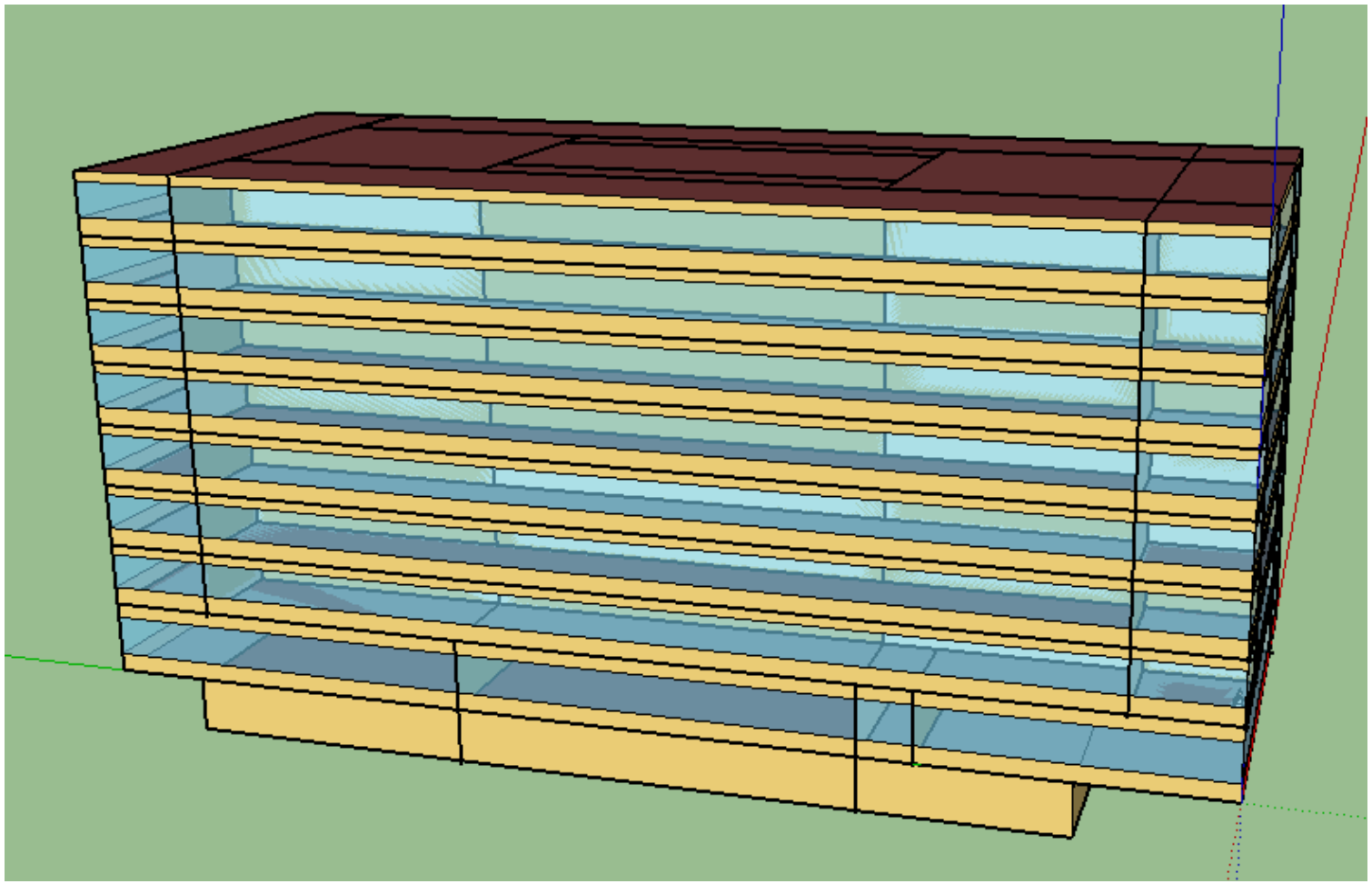
True-to-scale fitting of the floor plan and tracing the space boundaries:

"Pulling up" the solids using the "Create Spaces from Diagram" tool:



Note: To be able to use the function Create Spaces from Diagram, all floors must be identical - later, however, different spaces can be used!

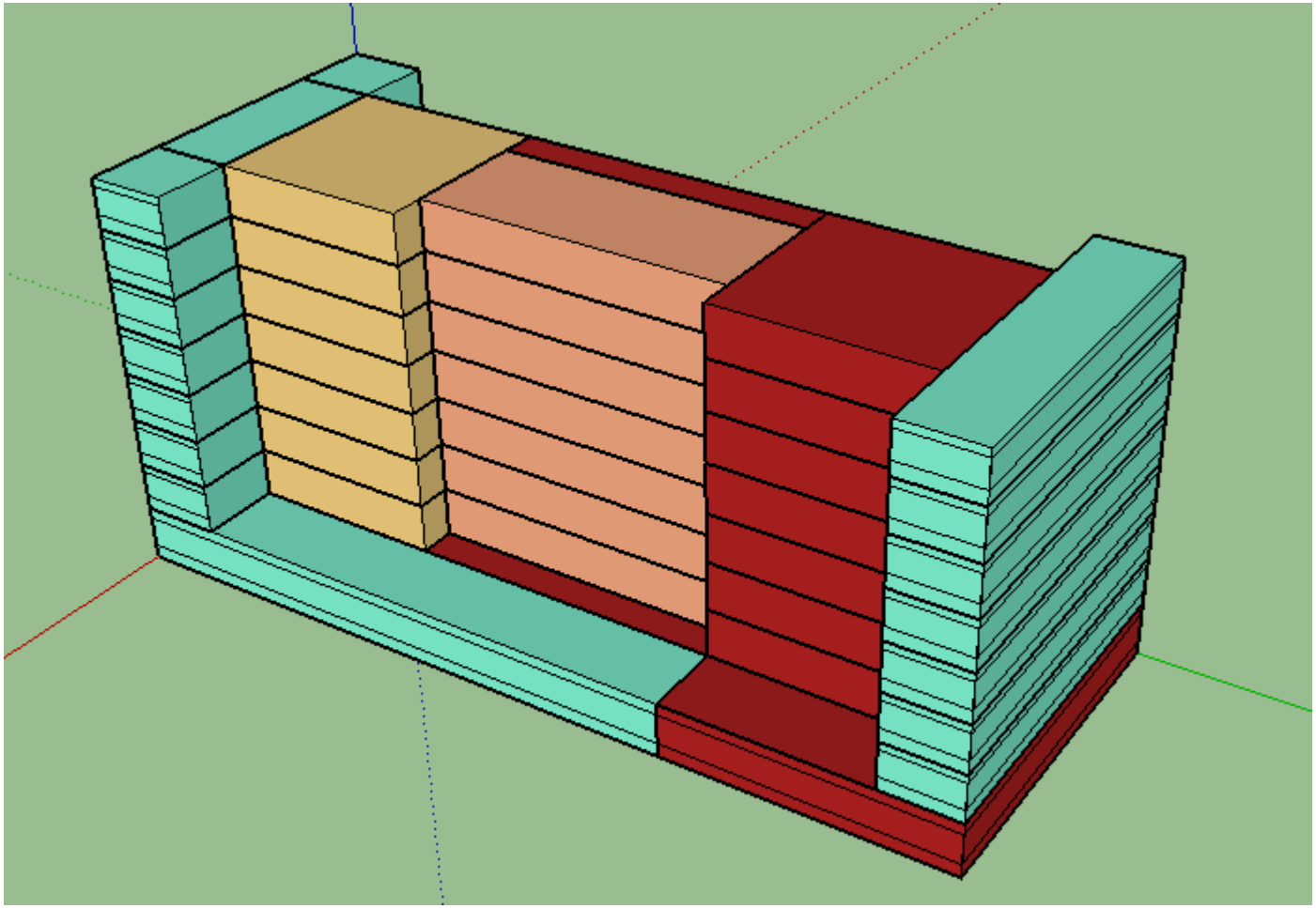
Overall model with windows



Window bands: GF/UF

WWR=0,55
Distance to floor: 1m

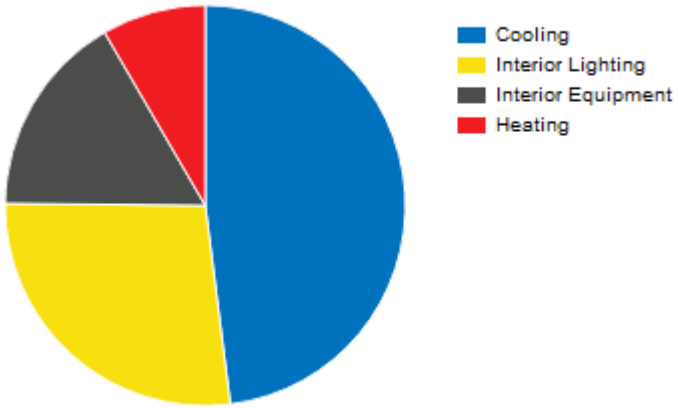
Overall model with Space definitions

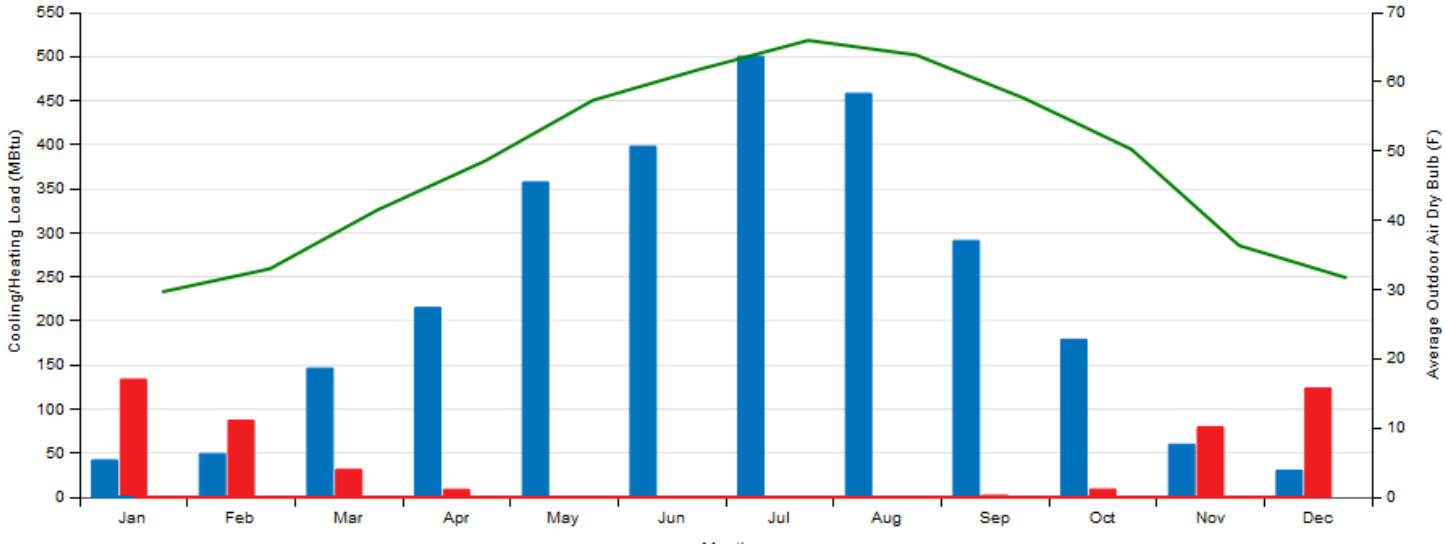


Example:

Rendering by space occupancy

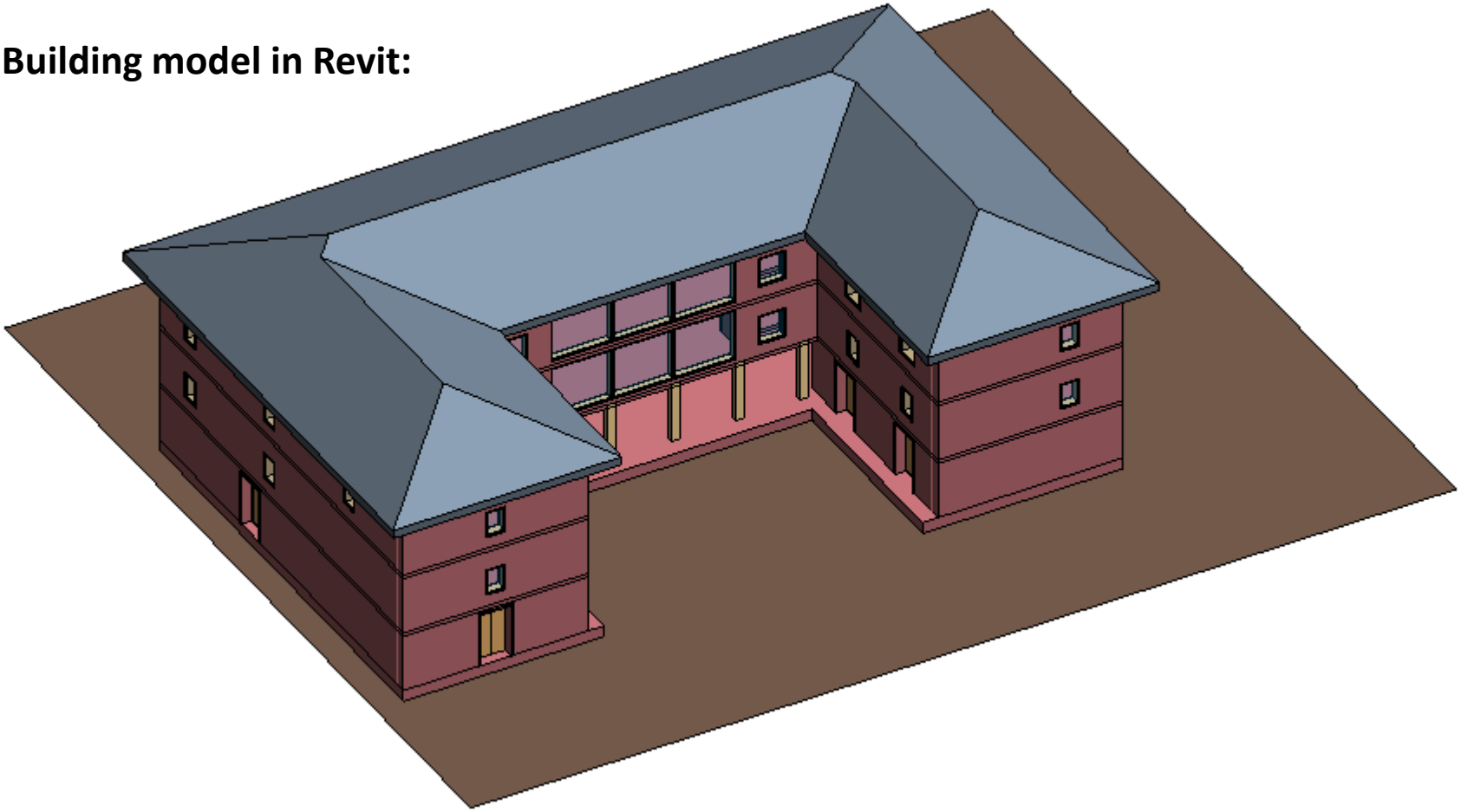
Energy balance: result example





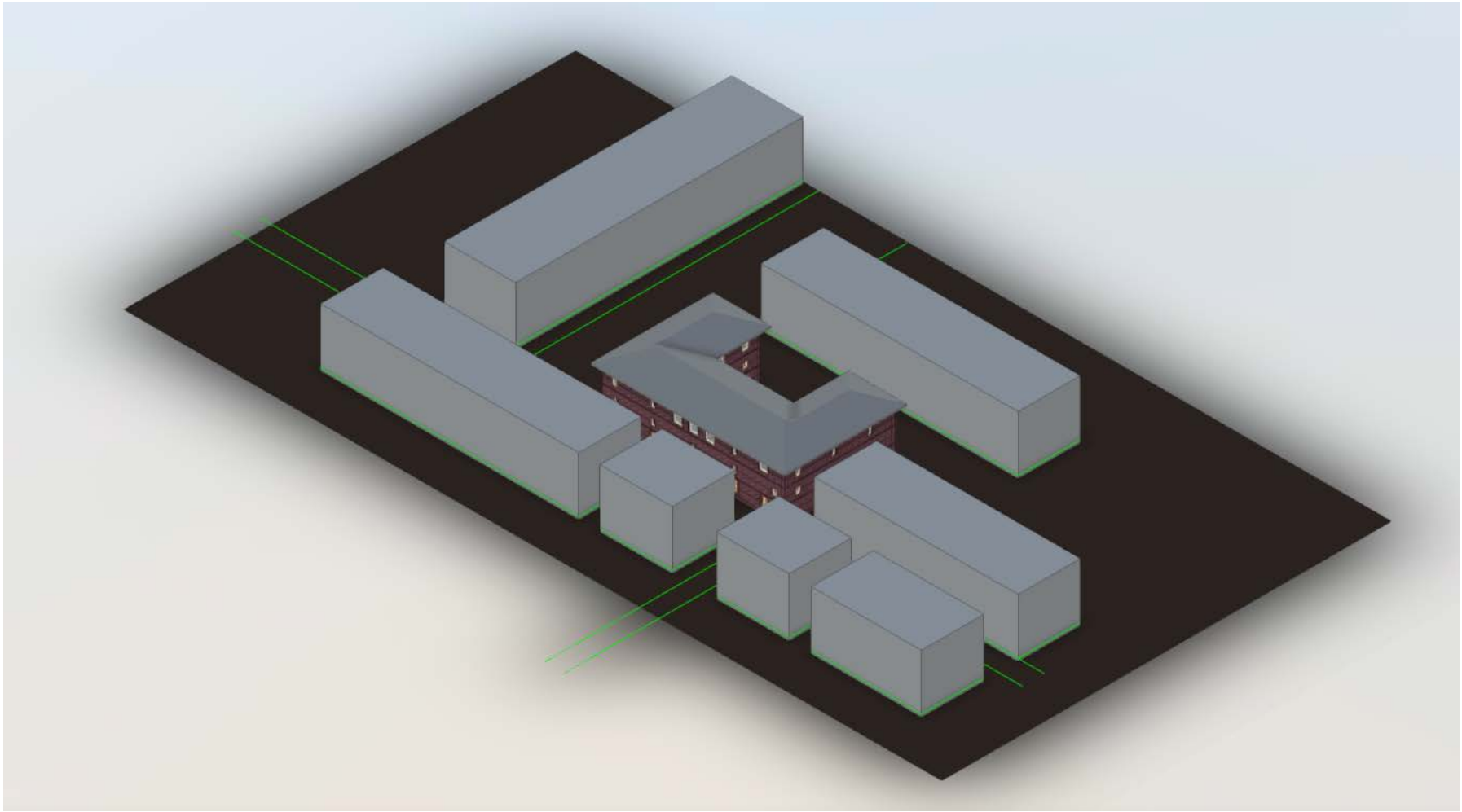
Import an external building model via gbXML

Building model in Revit:



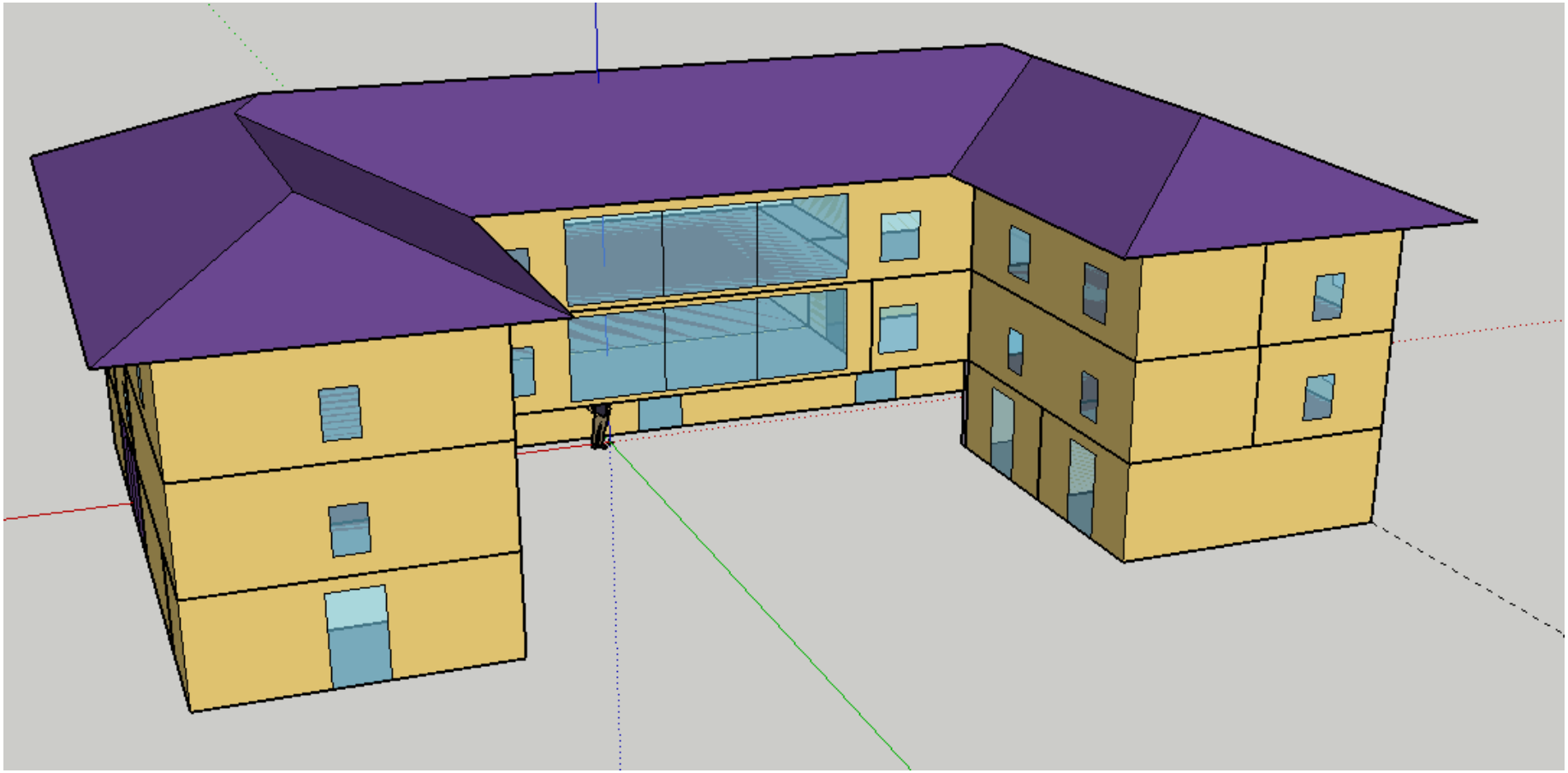
Import an external building model via gbXML

Building model in Revit, including neighbour shading objects:



Import an external building model via gbXML

Transfer model geometry to OS via gbXML data format from Revit:



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