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UNIVERSITÀ
DEGLI STUDI
DI PADOVA

dii DIPARTIMENTO
DI INGEGNERIA
INDUSTRIALE

ENERGY AND BUILDINGS

2021 – 2022

EnergyPlus

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Practical info

Installation guidelines file

[Google doc](#) for questions

<https://docs.google.com/document/d/1PrbHYNKNaYRuopPOKa5YK-MYZ2CjoabTDx8nm5rcyZY/edit>

Questions and answer meeting on Thursday 14:30, Seminar room (ex Fisica Tecnica)

Information about the report in moodle. After the practical lectures there will an in-depth explanation of the report.

Design of the model

1 - Geometry definition



2 – Input definition



3 - Output definition & Simulation



4 - Analysis of the results



Settings in EnergyPlus: examples

Ground temperature
Outside boundary condition object
Output variables

Warning!

Changes in your *your_model.idf* are not saved in your openstudio!

Be sure your openstudio model is ready before moving to your idf

Every object is described in the documentation:

EnergyPlus Input/Output reference

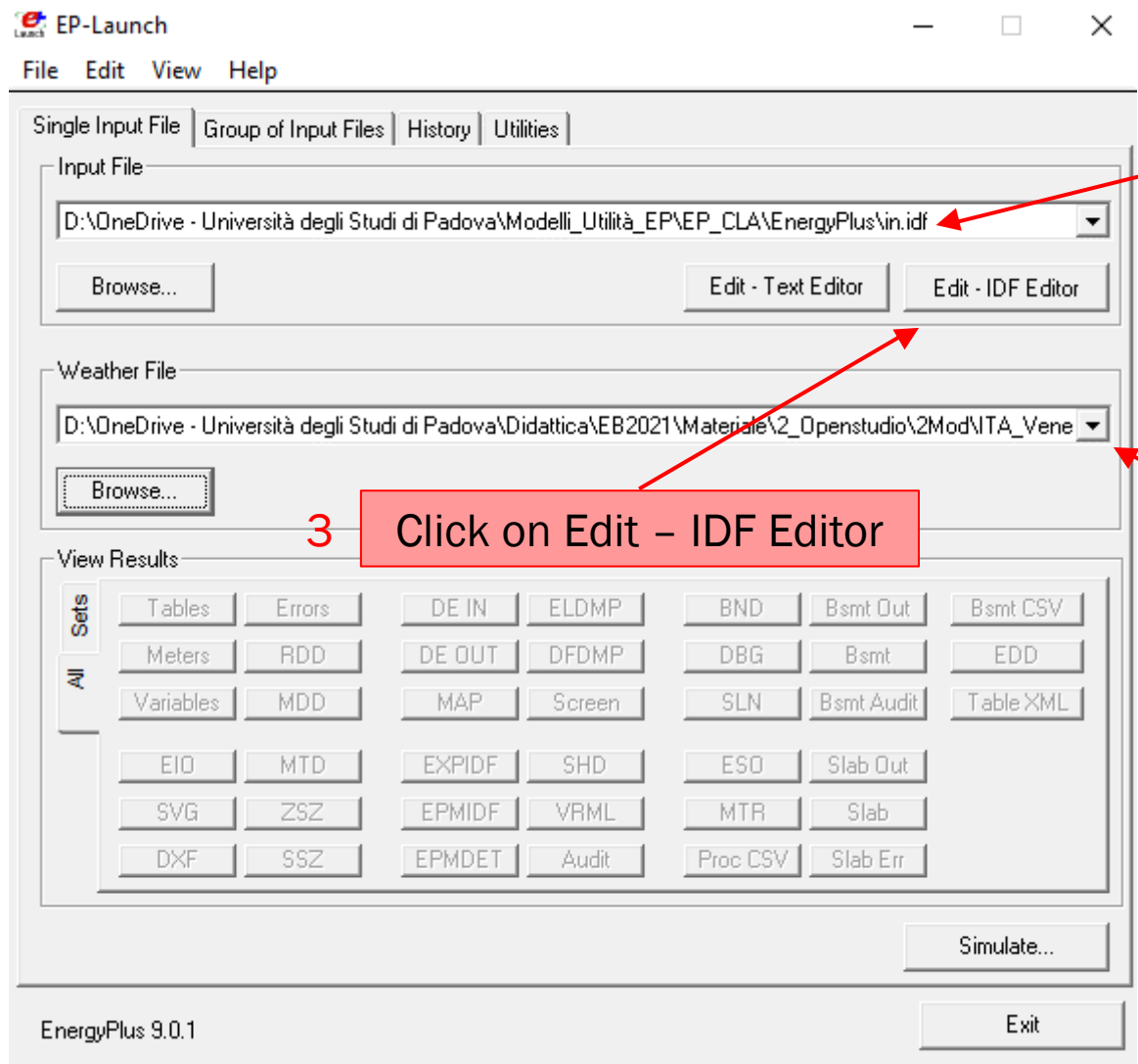
C:\Your_EP_folder\Documentation\InputOutputReference

**Create a new folder *EnergyPlusModel* in the same folder of
*Your_model.osm***

**Copy the file *Your_osm_model\bin\In.idf*
inside the new folder.**

**This is the EnergyPlus Input Data File that has been created by
Openstudio during the first simulation**

Open this file using EnergyPlus launcher



1 Your In.idf file

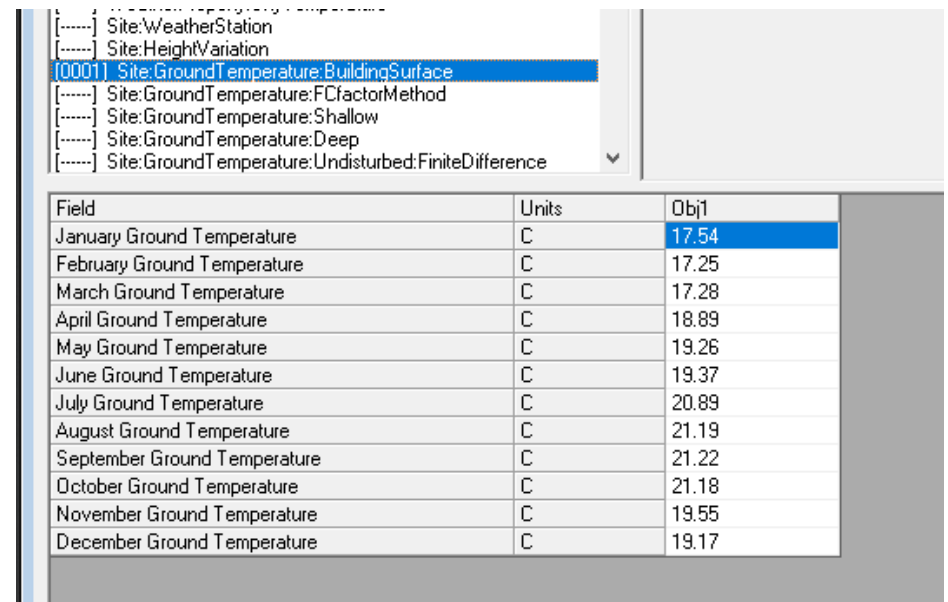
3 Click on Edit - IDF Editor

2 Select your weather file (.epw)

Ground temperature setting

Object

- SiteGroundTemperature:BuildingSurfaces
- You can set 18 - 21 °C for winter - summer months
(see engineering reference manual)



The screenshot shows a software interface with a dropdown menu and a table. The dropdown menu is open, showing several options, with 'Site:GroundTemperature:BuildingSurface' selected. Below the menu is a table with three columns: 'Field', 'Units', and 'Obj1'. The table lists monthly ground temperatures in degrees Celsius.

Field	Units	Obj1
January Ground Temperature	C	17.54
February Ground Temperature	C	17.25
March Ground Temperature	C	17.28
April Ground Temperature	C	18.89
May Ground Temperature	C	19.26
June Ground Temperature	C	19.37
July Ground Temperature	C	20.89
August Ground Temperature	C	21.19
September Ground Temperature	C	21.22
October Ground Temperature	C	21.18
November Ground Temperature	C	19.55
December Ground Temperature	C	19.17

Other side coefficient surface property

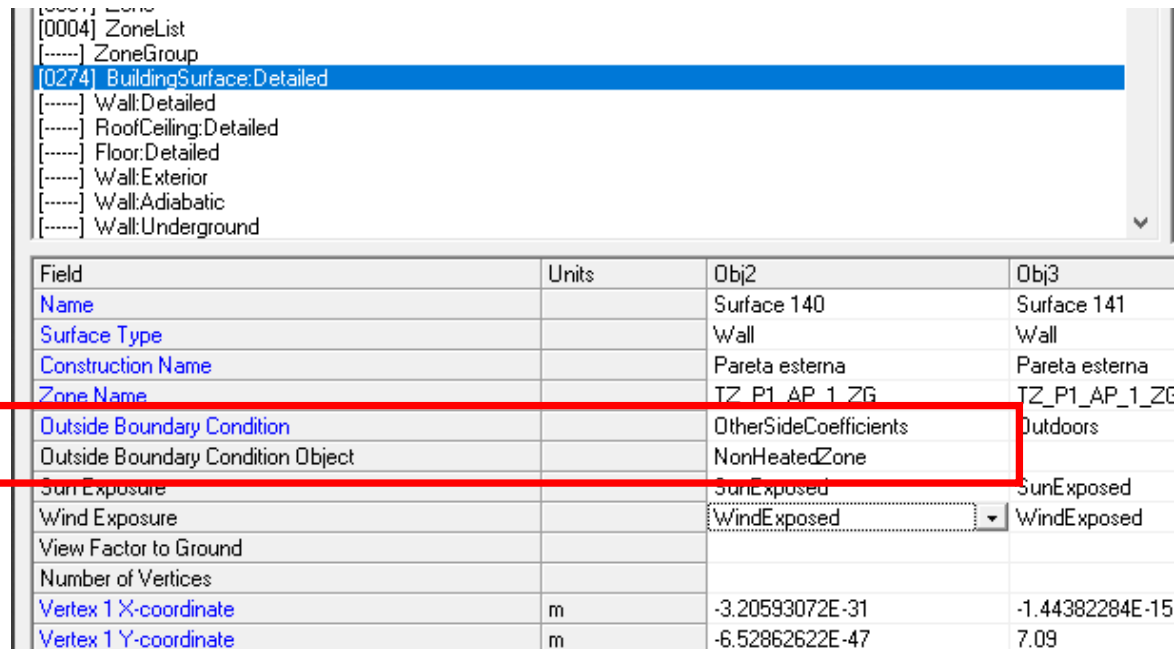
Object

- SurfaceProperty:OtherSideCoefficient
- Set convective/radiative coefficient and constant temperature
- If necessary, include also a schedule in Constant Temperature Schedule Name, to reduce te effect in summer

Field	Units	Obj1
Name		NonHeatedZone
Combined Convective/Radiative Film Coefficient	W/m2-K	8
Constant Temperature	C	15
Constant Temperature Coefficient		1
External Dry-Bulb Temperature Coefficient		
Ground Temperature Coefficient		
Wind Speed Coefficient		
Zone Air Temperature Coefficient		
Constant Temperature Schedule Name		
Sinusoidal Variation of Constant Temperature Coefficient		No
Period of Sinusoidal Variation	hr	24
Previous Other Side Temperature Coefficient		
Minimum Other Side Temperature Limit	C	
Maximum Other Side Temperature Limit	C	

Other side coefficient surface property

- Link the condition to the surface



The screenshot shows a software interface with a list of building surfaces and a table of properties. The list includes:

- [0004] ZoneList
- [-----] ZoneGroup
- [0274] BuildingSurface:Detailed
- [-----] Wall:Detailed
- [-----] RoofCeiling:Detailed
- [-----] Floor:Detailed
- [-----] Wall:Exterior
- [-----] Wall:Adiabatic
- [-----] Wall:Underground

The table below shows properties for two surfaces, Surface 140 and Surface 141. The 'Outside Boundary Condition' and 'Outside Boundary Condition Object' rows are highlighted with a red box.

Field	Units	Obj2	Obj3
Name		Surface 140	Surface 141
Surface Type		Wall	Wall
Construction Name		Pareta esterna	Pareta esterna
Zone Name		TZ_P1_AP_1_ZG	TZ_P1_AP_1_ZG
Outside Boundary Condition		OtherSideCoefficients	Outdoors
Outside Boundary Condition Object		NonHeatedZone	
Sun Exposure		SunExposed	SunExposed
Wind Exposure		WindExposed	WindExposed
View Factor to Ground			
Number of Vertices			
Vertex 1 X-coordinate	m	-3.20593072E-31	-1.44382284E-15
Vertex 1 Y-coordinate	m	-6.52862622E-47	7.09

Output variables

Object

- Output:Variable

Zone Ideal Load Zone Sensible Heating Rate

Zone Ideal Load Zone Sensible Cooling Rate

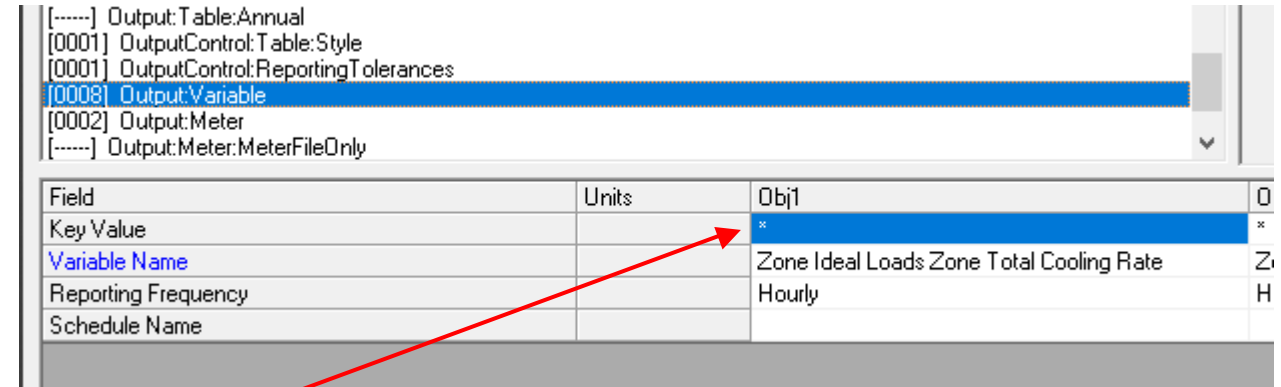
Zone Ideal Load Zone Latent Cooling Rate

If output variables are not listed, you can simulate the model and then open it again with the IDF – Editor

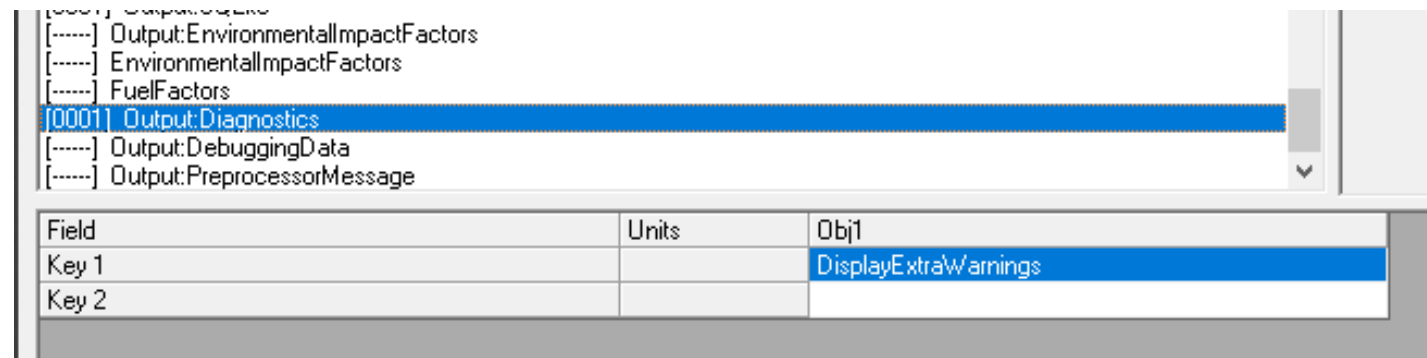
(the variables list is saved in *your_model.rdd*)

- Output:Diagnostics

DisplayExtraWarnings



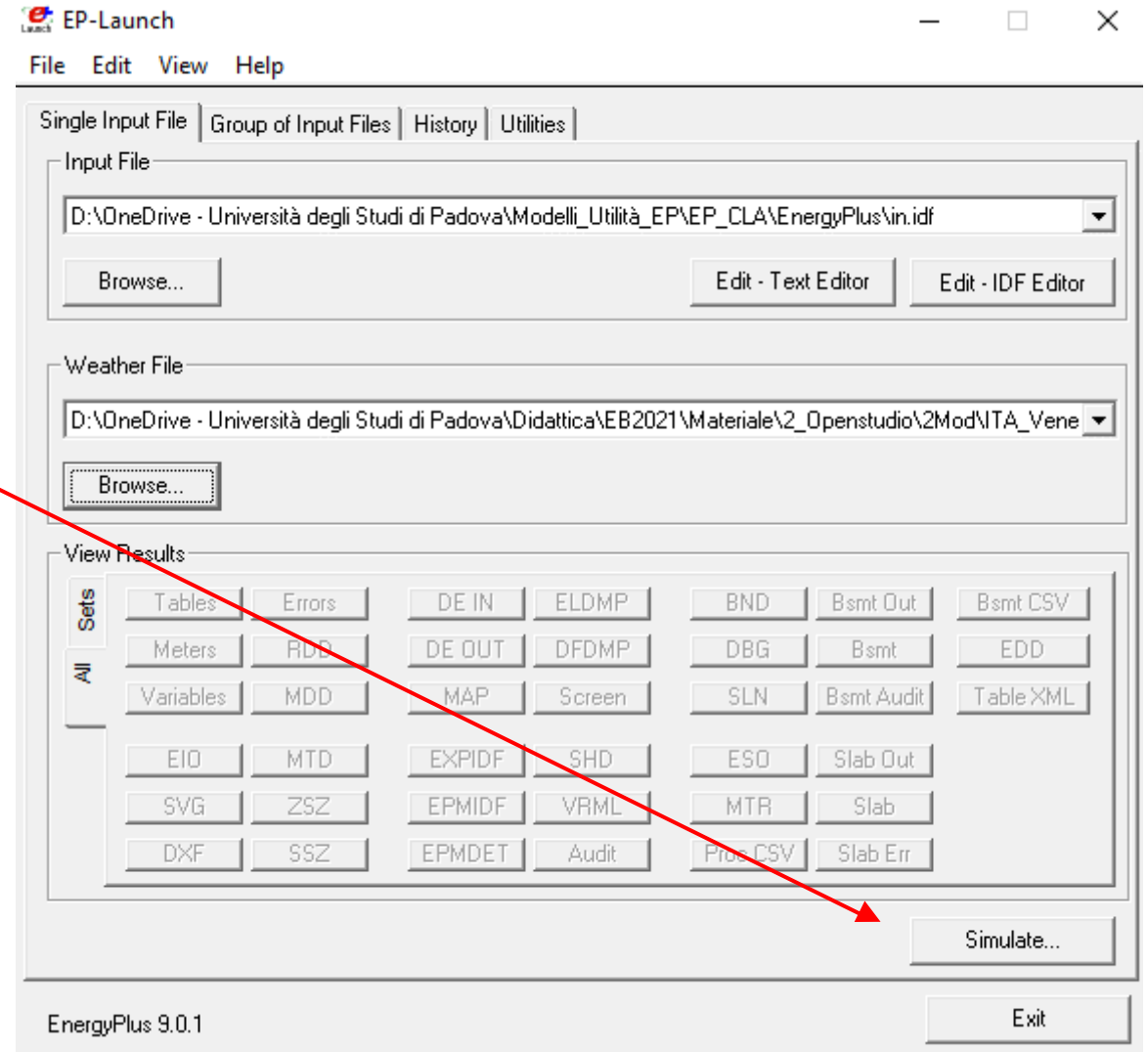
Wildcard



EnergyPlus simulation

Save your In.idf

Close it and simulate your model



Output of the simulation

In *EnergyPlusModel* folder (the one that you created at the beginning)

1. *In.err* file: EnergyPlus simulation must be running without errors (log file as in the openstudio simulation)
2. *In.html* file: the «Tables» file
 - District Heating energy demand [kWh]
 - District Cooling energy demand [kWh]
 - Data about surfaces, zone, ...
3. *In.csv* file: file with hourly values for the output variables. Open it with Excel.

Tips for the report

1. Pay attention to the units: energy and power are different concepts! **Hourly load in kW, monthly energy demand in kWh**
2. Write units correctly! **kWh OK, Kwh WRONG!**
3. **Always** title, captions, axes labels and units in the plots. Same fo tables
4. **Avoid numbers with too many digits!** (26.4629325 °C, or a cooling demand in december of 0,0000005 kWh)
5. **Think about the results that you present!** Unreasonable numbers will be considered as errors!

OpenStudio and EnergyPlus – TIPS and Useful Info

http://nrel.github.io/OpenStudio-user-documentation/getting_started/getting_started/#introductory-tutorial



EnergyPlus InputOutput manual

EnergyPlus Engineering reference manual