EnergyPlus Reference

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Files:

Windows: Program files including data, documentation, examples are in
`This PC / Local Disk (C:) / EnergyPlusV9-#-#`   where ## represent
version number.

Linux: (not recommended)
`/usr/local/EnergyPlus-9-#-#` where ## represent version number.

File Types - Open with Text Editor unless noted

`.idf`	Code file for simulation. Build/edit this to define parameters. Run this file to run simulation. Also for some dataset files such as schedules, materials, etc.
`.err`	Error file, generated upon running a simulation.
`.epw`	Weather file. In `EnergyPlus-9-#-#/WeatherData` or download additional locations from https://energyplus.net/weather. Usually will refer program to this when running simulation.
`.csv`	Opens in Excel, contains data output tables
`.rdd`	Reference of available output/report variable names
`.mdd`	Reference of meter values used?
`.svg`	Some kind of flowchart?
`.dxf`	A 3d model of the building
`.eio`	Written out output as giant text file with lots of parameters
`.mtr`	Very minimally formatted output by timestep

Building & Editing Simulations in .idf Files:

Components are organized into **objects**. Basic syntax rules:
- Use "!" for comments
- Generally use a comment !- after each item as a label, but optional
- Commas after each entry

- Entries must be in the order and format defined in [Input Output Reference](#)
  - Tip: `Ctrl+F` or use Table of Contents because .pdf is >2000 pages
- If an entry is not applicable, leave a blank line with a comma. Do NOT SKIP it.
- Semicolon after LAST entry of object
- Order of vector coordinates matters. CLOCKWISE, start from bottom left.

```
FenestrationSurface:Detailed,
  EAST WINDOW,                  !- Name
  Window,                       !- Surface Type
  DOUBLE PANE WINDOW,           !- Construction name
  ZONE SURFACE EAST,            !- Base Surface Name
  ,                             !- OutsideFaceEnv Obj
  autocalculate,                !- view factor to ground
  ,                             !- WindowFrameAndDivider Name
  1,                            !- multiplier
  4,                            !- num vertices
  8.00, 1.50, 2.35 ,            !- Vector coord 1 - bottom left
  8.00, 1.50, 0.35 ,            !- Vector coord 2 - top left
  8.00, 4.50, 0.35 ,            !- Vector coord 3 - top right
  8.00, 4.50, 2.35 ;            !- Vector coord 4 - bot right
```
*Colors added for emphasis; real code is usually black and white only.

Can copy-paste premade objects from the existing datasets in EnergyPlus9-5-0 folder

Reporting Data:
To get data to be tabulated in .csv
1. See .rdd file for available output names.
   a. Often in format:
      i. `Zone,Sum,PROPERTY NAME [Unit]`
      ii. `Zone,Average,PROPERTY NAME [Unit]`
   Ex: `Zone,Average,Lights Electricity Rate [W]`
2. Then write output in the following format
   a. `Output:Variable,*,PROPERTY NAME,TIMESTEP;`
   Ex: `Output:Variable,*,Lights Electricity Rate,Hourly;`

Other options:
`Output:Meter,PROPERTY NAME,TIMESTEP;` !- Output numbers in .mtr file, not as organized as the csv
`Output:Surfaces:Drawing,DXF;` !- Create 3D model .dxf
`Output:Surfaces:List,Details;` !- List surfaces

```
Output:Constructions,Constructions;
Output:VariableDictionary,Regular;  !- Create .rdd file listing vars
```
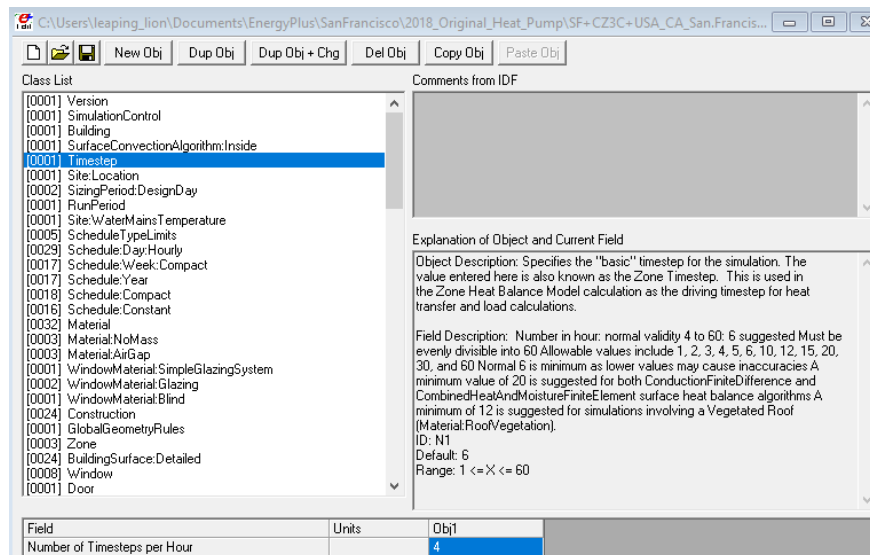
Building & Editing Simulations in IDF Editor

1. CTRL + L to toggle showing unused parameters on left

Showing all   Showing only used
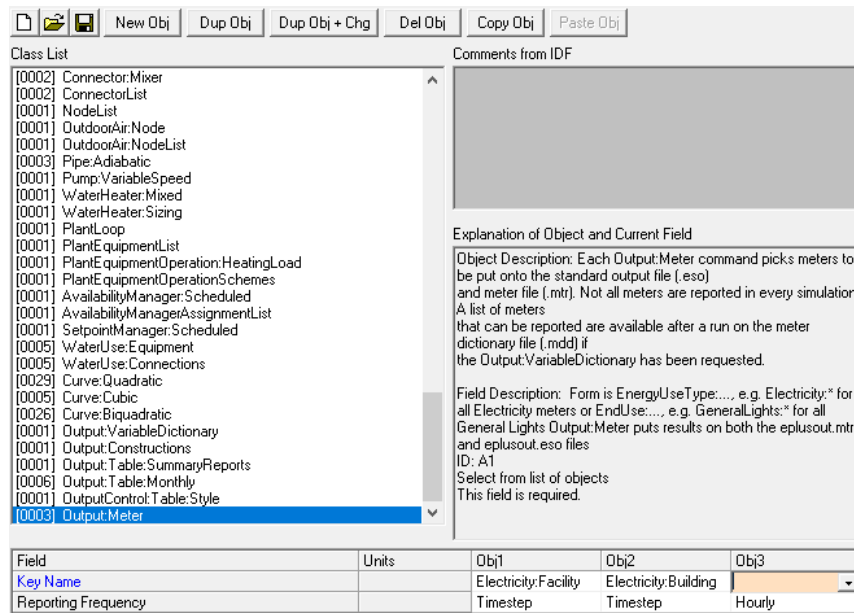
2. Timestep: how often to recompute. 60/TIMESTEP = Num mins. Typically every 5 minutes, or 12 timesteps.


3. Sizing Period: Design Day
4. Output: Meter
   a. [New Obj] to create another thing to report
   b. Use drop down menu to select what parameter
      i. Energy:Facility usually interesting
   c. Set reporting frequency to Timestep

Getting Meter Data: Find the simulation_nameMeter.csv file or select the meter button in EP Launch. Open in Excel or equivalent.

5. The FMU stuff that gets sent to UCEF is located in External Interface
On this page and the To:Schedule one below, it is important to keep note of the numbers when setting up modelConfig.xml in Joe_ep_fmu. The FMU Variable name matters because it is matched with the Python code in UCEF.
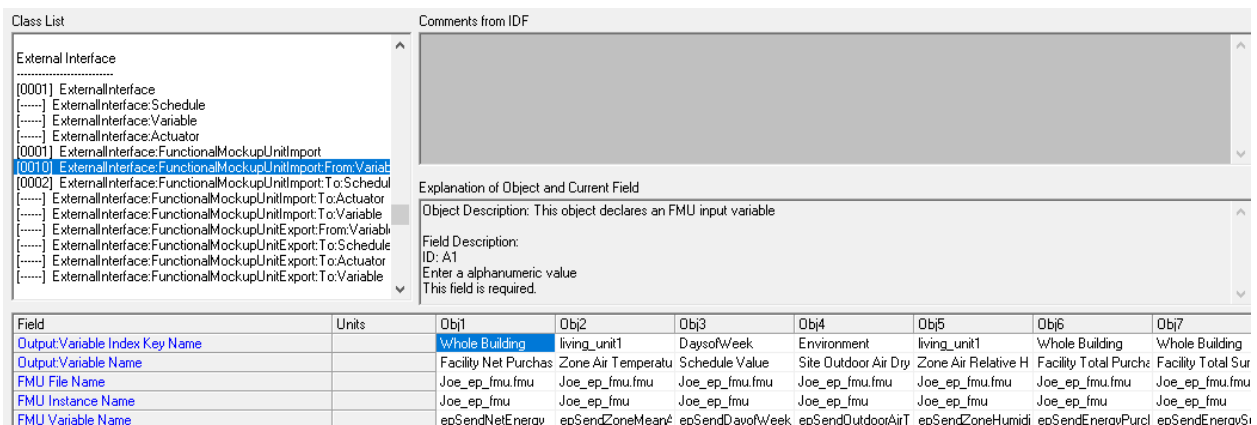
The object numbers on the To:Schedule for heating and cooling are consecutive immediately after the above screen. There are 10 objects in From, so then myStartHeating is 11 and myStartCooling is 12. The line for initial value is the starting temperature in celsius, so the heating setpoint is 20 and the cooling setpoint is 23.

Update/save the file when done!

Running Simulations

A. EP-Launch (Windows only)

1. Open EP-Launch
2. Set input file and weather file

3. If needed, can use IDF Editor from here to check file
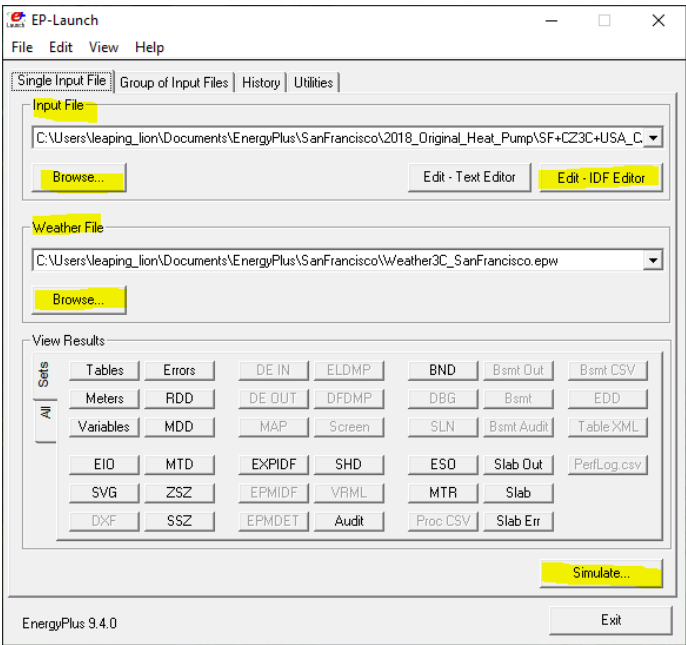4. After simulation, more results are visible

B. Terminal (not recommended)

1. Navigate to folder where the .idf file is located

2. Enter in the following, where WEATHER_FILE_NAME is the weather file, and SIM_NAME is the simulation file name
   a. Only include the weather part (blue) if using a weather database file

```
$ energyplus -i /Energy+.idd -w "WEATHER_FILE_NAME.epw"
SIM_NAME.idf
```

3. Should get the following output

```
EnergyPlus Starting
EnergyPlus, Version 9.4.0-998c4b761e, YMD=2021.03.27 01:49
... Lots of output; ignore except debugging ...
Writing tabular output file results using HTML format.
EnergyPlus Run Time=00hr 00min 11.36sec
EnergyPlus Completed Successfully.
```
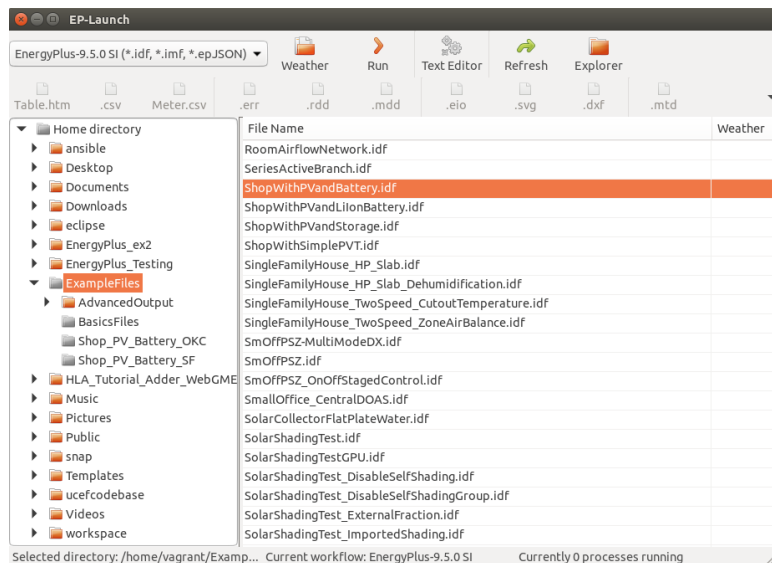
4. The data files will be stored in the directory where the .idf is located
   a. Check the .err file for errors
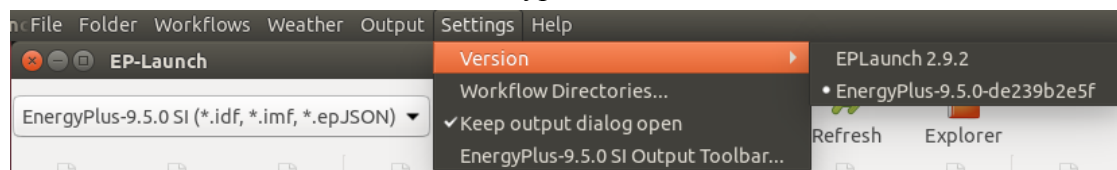
Other terminal tricks:

To list options: `energyplus --help`

C. **EP-Launch 3** (not recommended)
   1. Open EP-Launch 3
   2. Navigate to the folder with the .idf

3. Set the version and workflow unit type

```
AppGPostProcess-9.5.0 (*.html)
CalcSoilSurfTemp-9.5.0 (*.epw)
CoeffCheck-9.5.0 (*.cci)
CoeffConv-9.5.0 (*.coi)
EnergyPlus-9.5.0 IP (*.idf, *.imf, *.epJSON)
EnergyPlus-9.5.0 SI (*.idf, *.imf, *.epJSON)
Transition-9.5.0 (*.idf)
```
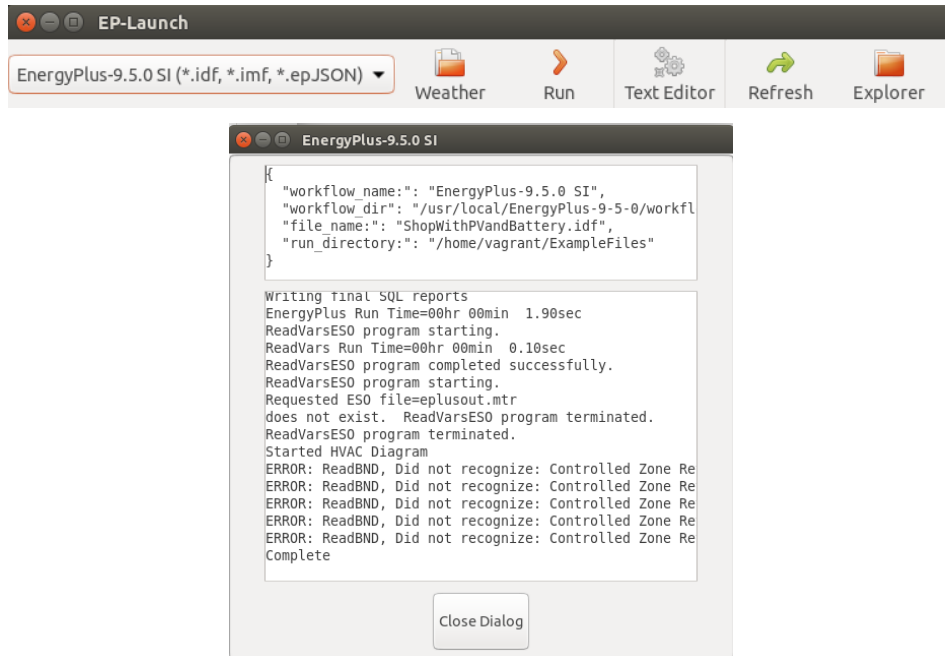
4. Set the weather.
    a. Choose "Design Days" if the weather conditions are predefined in the .idf
    b. Choose "Selected EPW" and navigate to the weather file if using an external weather file.
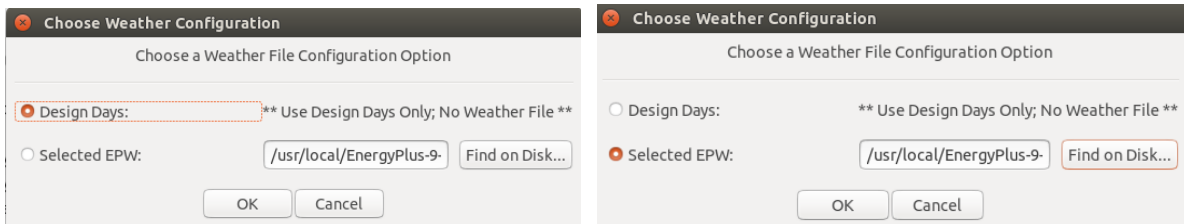
    c. Note that the Weather column next to File Name now shows the weather file name or <No_Weather_File> if Design Days was selected.
5. Select "Run". A pop-up will appear showing the result.

    a. If it says Complete, it worked.
    b. If it failed, check the .err file and try to edit the .idf to fix it
    c. Note that the main EP-Launch window shows Errors, Warnings, and Runtime in the File Name table
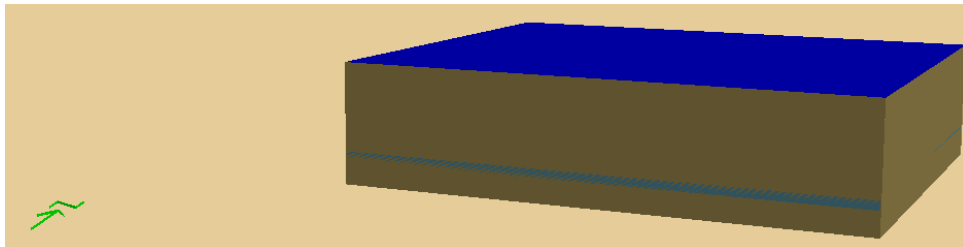
File Name	Weather	Errors	Warnings	Runtime [s]
ShopWithPVandBattery.idf	USA_IL_Chicago-OHare.Intl.AP.725300_TMY3.epw	0	1	1.9

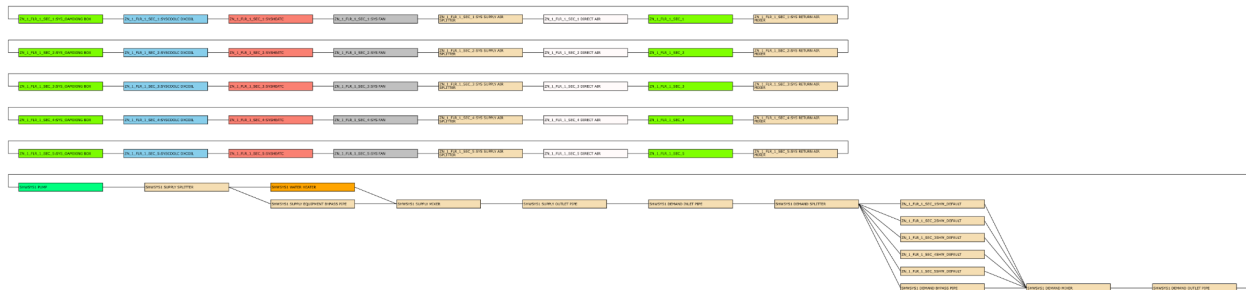6. Result files can be viewed in Output or by going to the folder where the .idf is stored.
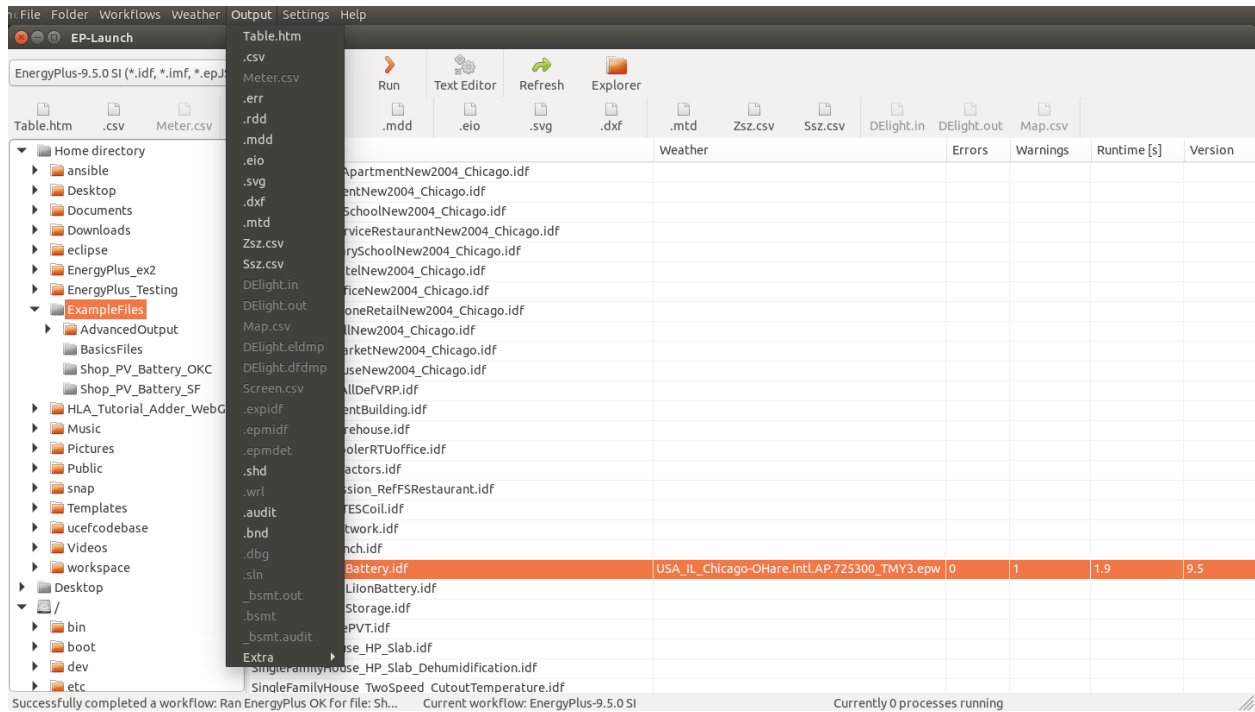
Files in detail

.dxf

.svg

Installing:
EnergyPlus is more or less straightforward
EP Launch 3.0 in Linux requires extensive terminal editing to install dependencies using python3 and pip3 (the "3" is important, without it won't work). Possible but not straightforward in Ubuntu 20.04
Note: Version 9.4.0 is the one used by research team right now. Version 9.5.0 had errors with the version updater

Quick Links
Documentation (particularly useful ones linked below) https://energyplus.net/documentation
Getting Started
Input Output Reference
EnergyPlus Essentials
Engineering Reference
Output Details & Examples
Tips and Tricks

Weather Files https://energyplus.net/weather

Download EnergyPlus https://energyplus.net/downloads
Note: SCU is currently using version 9.4.0 because of bugs in the later versions.
https://github.com/NREL/EnergyPlus/releases/tag/v9.4.0

EP-Launch 3.0 https://github.com/NREL/EP-Launch/releases/tag/v3.0

EP-Launch Documentation https://ep-launch.readthedocs.io/en/latest/